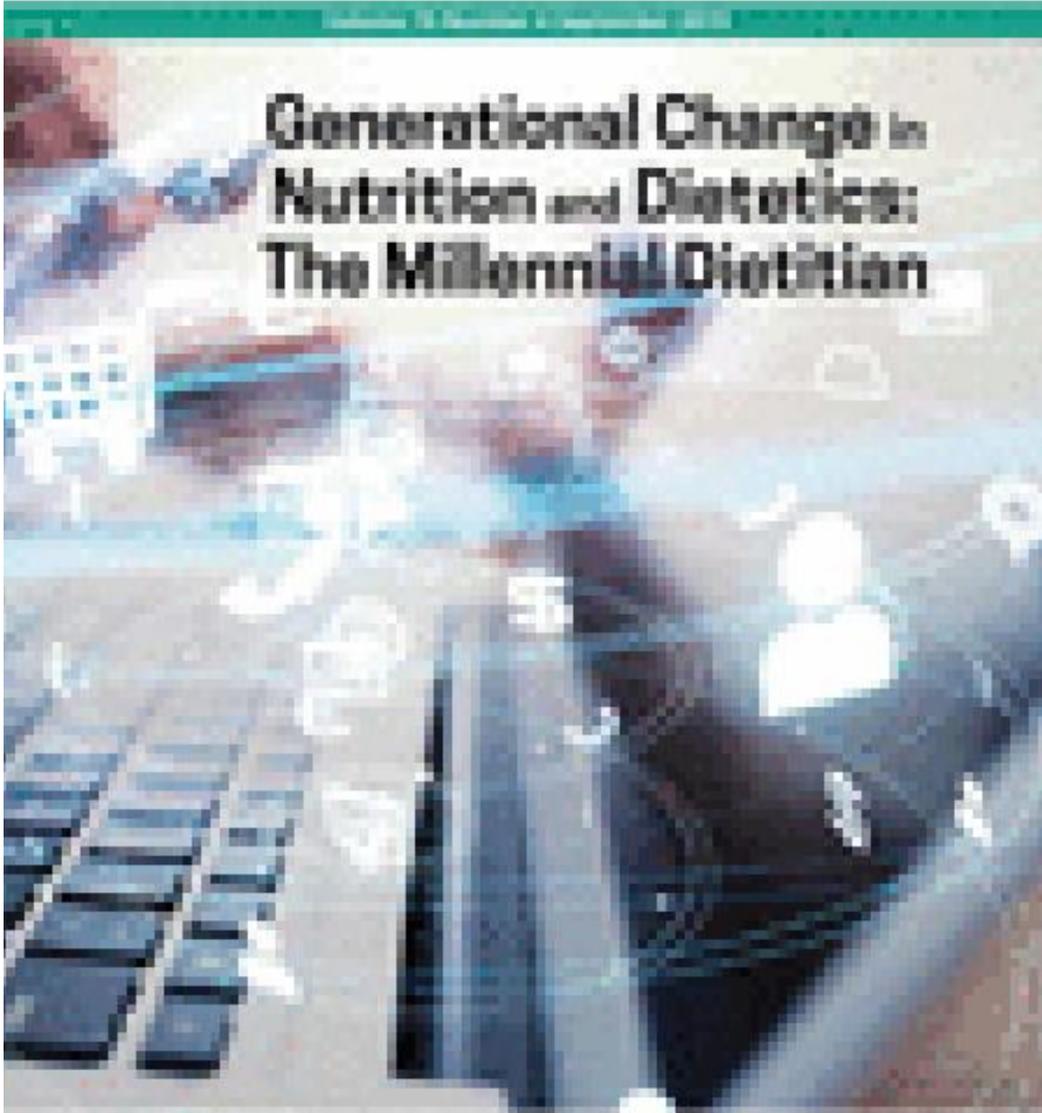


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Generational Change in Nutrition and Dietetics: The Millennial Dietitian



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EDITORIAL

Generational change in nutrition and dietetics: The millennial dietitian

Narcissistic, lazy, entitled, stunted and self-involved. Earnest, optimistic, accepting and pragmatic. These were the terms used to describe me and my millennial generation in the front page issue of *Time*, May 2013.¹ Millennials, a term coined by Howe and Strauss, are people born between 1982 and 2004.² That makes them aged between 15 and 37 years today. A survey of over 15,000 respondents from across the world found that my generation ranks travelling the world and earning high salaries higher in their list of priorities than making positive impacts on society and having children.³ Climate change and the environment is our number one concern, and we have a bleak outlook on the economy, business, political and religious leaders and traditional media.³ This should not be surprising given each generation is characterised by qualities and traits that are shaped by their exposure to global events and their interactions and experiences in their homes, education settings, work places and communities.

Millennials form the largest segment both of the Australian population and the nutrition and dietetics profession in Australia. We make up 28% of the population, exceeding Generation X (born between 1965 and 1984) and Baby Boomers (born between 1946 and 1964).⁴ Two thirds of the members of the Dietitians Association of Australia (DAA) are millennials (personal correspondence, DAA). We are the young adults and adults in society today – university students, new graduates and job seekers, young professionals and parents of small children. Just over half of millennial DAA members are Accredited Practising Dietitians (APDs) (57%), followed by provisional APDs (21%), students (19%) and Advanced APDs/fellows (<1%). DAA Engagement and Development (ie, branch) committee members are aged, on average, in their late 20s to early 30s (personal correspondence, DAA).

The large size and position of the millennial generation in society and in the nutrition and dietetics profession means that we have, or should have, significant influence. Our preferences and patterns of communication, consumer behaviour, learning and working matter. At the same time, although the “me, me, me” millennial generation may think it is all about us, undoubtedly, the needs and preferences of other generations must be taken into account. This issue of *Nutrition & Dietetics* explores the challenges and

opportunities that our modern world presents for the profession and how we can appreciate and respond to generational differences. It includes papers that report on research about technology in health-care,⁵⁻⁷ communicating health information,⁸⁻¹¹ health and nutrition interventions¹²⁻¹⁶ and education.^{17,18} In addition, other reports in this issue from the international context add to the discussion.^{19,20}

1 | TECHNOLOGY IN HEALTH CARE

The evolution of technology is a factor distinguishing periods in time and one generation from another. Although technology now pervades all aspects of personal and professional life, older millennials and the generations before us recall when the internet, mobile phones, automation and social media did not exist. Unlike the “digital natives” of Generation Z (born in the 2000s) who know no different, many millennials have adopted and led technological changes in the work place.

In the health-care setting, technological change has seen the introduction of electronic health records, mobile health apps, mobile computing, telehealth consultations and electronic systems such as medication prescribing and bedside meal ordering. Although eHealth is rapidly being implemented across the world, an umbrella review of systematic reviews suggests that overall eHealth technologies used by health professionals do not actually provide the quality and safety benefits we expected.²¹ However, there was some evidence that electronic health records do save time and improve data quality.²¹ McCamley et al add to this evidence base in their study which found that implementation of an electronic medical record increased quality, availability and accessibility of data for nutrition assessments, and time efficiency.⁵

The lack of uptake of eHealth by health professionals or issues with the fidelity of eHealth implementation may help explain how overall outcomes appear to have fallen short of expectations. In this issue, Maunder et al report that nutrition informatics experts believe Australian dietitians are not ready for eHealth.⁶ They call for leadership, collaboration and representation, training and mentoring to enhance dietitians' awareness and capacity.⁶ The importance of leadership

for supporting change in health-care is echoed in the study by O'Sullivan et al, who explored factors associated with use and perceptions of Nutrition Care Process and Terminology among Asia Pacific dietitians.⁷

2 | THE INTERNET, SOCIAL MEDIA AND PRINT MEDIA FOR ACCESSING HEALTH INFORMATION

The internet and social media have remarkably transformed the way consumers access health information. They provide quick and easy access to large volumes of information. In addition, social media allows for interaction and give users the power to generate and share content. In the 1980s, when the Baby Boomers were the age of the current millennials, health-related questions were answered by visiting a doctor or health professional or by consulting books or print media. Times have changed; nowadays 58% of people use search engines such as Google to seek health information precisely in order to *avoid* seeing a health professional face to face.²² More people report obtaining nutrition information from social media than from a nutritionist.²³ Evidence indicates that younger age is significantly associated with using the internet as the first source of health information, blogging about health and using social media for health reasons.²⁴

Several studies in this issue explore how the internet and social media are used in nutrition and dietetics with a largely millennial sample. Boswell et al. report that a mixture of online methods (website, email and/or Facebook group) is most preferred for receiving information and intervention for fussy eating by parents, with face to face being the least preferred.¹² Crino et al. also describe that women favour online methods for advertising and recruitment for weight management trials.¹³ Athletes equally prefer the internet and dietitians as their nutrition information source.⁸ With this in mind, the findings by Probst and Peng that only a third of Australian dietitians use social media professionally demonstrate a disconnect between what consumers want and what professionals are providing.⁹ The 2019 Decadal Plan for nutrition science in Australia identifies the opportunities that exist for nutrition professionals to harness the communication power of social media and the internet.²⁵

The risks and limitations of using social media and the internet for communicating health information and delivering interventions are established in the literature²⁶ and are reiterated throughout this issue. These include concerns about privacy and data security,^{12,13} copyright infringements and loss of professional image when used for work purposes.⁹ Quality, reliability and trustworthiness of information are other issues.^{23,26} Guidance and codes of practice set out by professional associations serve to support and protect both the creator and audience.²⁷

Despite the focus on online communication in this digital age, traditional methods such as print media still have a place. A range of approaches are needed to suit a diverse range of clients, professionals, work settings and communication intentions. The *Letter to the Editor* in this issue provides three key recommendations for developing printed education materials to ensure they achieve their purpose and are a worthwhile investment of time, money and space.¹⁰

3 | NUTRITION AND DIETETICS EMPLOYMENT IN THE FUTURE

Millennial dietitians in Australia work predominately in private practice (24%) and public hospitals (23%) (personal correspondence, DAA). 10 years from now, when millennials and Generation Z make up the majority of the labour force, what will employment as a nutrition professional look like? The future is uncertain. The type, location and hours of work will be influenced by the needs of society, evidence and technology and roles of our colleagues and competitors.

Less than 5% of millennial dietitians in Australia work in aged care, mental health and disability services combined (personal correspondence, DAA). New opportunities for employment in this area may occur as a result of our ageing population, the Royal Commission into Aged Care Quality and Safety, the Royal Commission into Victoria's Mental Health System and the National Disability Insurance Scheme. With climate change and the environment consistently rated by millennials as the most important issue facing our world today,³ we should see more dietitians and nutritionists working in roles to support sustainable and healthy food systems.²⁸ Personalised nutrition based on genetic information is another future direction for the profession.²⁵

There is crowded space of qualified nutrition professionals alongside celebrities and "influencers" from the wellness, fitness and food/cooking industry. Previous research has found that dietitians, nutritionists and doctors are the most preferred and most trusted sources of nutrition information.²³ This may be changing. In this issue, Barnes et al report that personal trainers discussing nutrition and providing nutrition care is the norm.¹¹ The Decadal Plan for nutrition science in Australia calls for a common title, competency-based training and a shared code of conduct to create a "trusted voice".²⁵ This may help to protect the scope of practice and work opportunities for future generations.

Millennials' approach to employment will also influence workplaces in the future. Four of five millennials would consider joining the "gig economy", with financial rewards, flexible work hours and better work-life balance cited as the top three attractions.³ Millennials are more likely to value work-life balance than previous generations.²⁹ Baby Boomers are described as being loyal to their employer and Generation X to

their profession.³⁰ On the other hand, half of millennials say they would leave their job in the next 2 years.³ Recruitment and retention strategies of dietitians now and in the future should consider these factors.

4 | TEACHING MILLENNIALS

Our current and future tertiary students expect educational institutions, rather than business or employers, to prepare workers for future employment opportunities.³ Millennials are consumers in higher education, expecting more and more from their investment of money and time. The qualitative exploration by Morgan et al. of dietetic educators' experiences suggests they are suffering from the pressure to deliver this high-quality service amidst professional constraints and uncertainties about graduate employability.¹⁷ As a millennial myself and an educator of millennial nutrition and dietetics students, my classroom may inadvertently be a millennial's delight. It features technology, simulation and gamification, teamwork and collaboration, story telling and activity-based learning. Students expect detailed instructions, explanations of the relevance of tasks and content to practice, lots of feedback and reassurance, extra assistance, connection on a personal level and a high standard of professionalism. Reassuringly, these observations align with the literature.³¹ The success of the clinical educator model for dietetic placement described by Weber et al. may be because of its ability to cater to these needs.¹⁸

Generational differences create diversity that may currently be undervalued. Understanding the perspectives, ideologies, concerns and motivators that characterise each generation may help us to engage more productively and authentically with others. Although the millennial generation may be young (comparatively to Baby Boomers and Generation X), we are the future of the nutrition and dietetics profession. Millennials must engage with professional associations, organisations and the media to give our generation a voice and ensure we are appropriately represented.

AUTHOR CONTRIBUTIONS

J.C. is the sole author of this manuscript. The content has not been published elsewhere. The author acknowledges the Dietitians Association of Australia for supplying aggregate data on the characteristics of members as of July 2019. The author would like to extend thanks to Dr Simone Gibson for her feedback on the draft manuscript.

CONFLICT OF INTEREST

J.C. is a millennial, a daughter of Baby Boomers and works with individuals from all generations. No other conflict of interest is declared.

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ORIGINAL RESEARCH

Strategic leadership will be essential for dietitian eHealth readiness: A qualitative study exploring dietitian perspectives of eHealth readiness

Kirsty MAUNDER ¹, Karen WALTON,¹ Peter WILLIAMS,² Maree FERGUSON³ and Eleanor BECK¹¹School of Medicine, University of Wollongong, Wollongong, New South Wales, ²Faculty of Health, University of Canberra, Canberra, Australian Capital Territory and ³Dietitian Connection, Mt Gravatt, Queensland, Australia**Abstract****Aim:** To explore dietitians' perspectives on the eHealth readiness of Australian dietitians, and to identify strategies to improve eHealth readiness of the profession.**Methods:** Dietitians who met the criteria for nutrition informatics experts participated in semi-structured interviews between June 2016 and March 2017. The interviews were recorded and transcribed verbatim. Thematic analysis using coding was undertaken until consensus was reached by the researchers regarding key themes, topics and exemplar quotes.**Results:** Interviews with 10 nutrition informatics experts revealed 25 discussion topics grouped into four main themes: benefits of eHealth for dietitians; risks of dietitians not being involved in eHealth; dietitians are not ready for eHealth; and strategies to improve eHealth readiness. The strategies identified for improving eHealth readiness included: collaboration and representation, education, offering of incentives and mentoring, as well as development of a national strategy, organisational leaders, nutrition informatics champions and a supportive environment.**Conclusions:** These findings suggest that dietitians may not be ready for eHealth. Strategic leadership and the actioning of other identified strategies will be imperative to preparing dietitians for eHealth to ensure the profession can practice effectively in the digital age, optimise nutrition care and support research for eHealth. If dietitians do not engage in eHealth, others may take their place, or dietitians may be forced to use eHealth in ways that are not the most effective for practice or maximising patient outcomes.**Key words:** dietitian, eHealth, health information technology, nutrition informatics.**Introduction**

The complexity of modern health care, combined with the growing legislative requirements of healthcare organisations and the increasing demands of client expectations, make the delivery of health services to patients difficult without the support of technology.^{1–3} The sheer volume of information and medical knowledge within a healthcare environment can no longer be safely or efficiently contained within the minds of staff and paper records.^{1,4} eHealth is an umbrella term referring to all electronic processes and communication that support or enable healthcare practices,⁵

and is now accepted as integral in improving healthcare delivery, patient safety, efficiency, clinical decision-making, curtailing increasing healthcare costs, supporting research and ultimately enhancing patient care.^{2,3,6–9} eHealth encompasses (but is not limited to) electronic health records (EHR), telehealth, mobile health applications (mHealth), clinical information systems and standardised terminology (e.g. Nutrition Care Process Terminology (NCPT)).^{10–12}

Realising the benefits of eHealth, however, is complex and requires professional readiness to successfully guide the development, selection and implementation of eHealth solutions.^{1,13,14} eHealth solutions are not without risk, and without the right solution and clinical engagement, the costs (both financially and patient-related) can be significant, marginalising quality and safety.^{2,3,7,15,16} eHealth readiness means the preparedness of healthcare organisations, societies or a profession, for the expected change caused by plans associated with an eHealth solution.^{17,18} The assessment of readiness for a healthcare innovation, and the readiness for change, has been demonstrated to reduce the risk of failure after introduction.^{19–21}

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Nutrition informatics, as a subsection of eHealth, is defined as 'The effective retrieval, organisation, storage and optimum use of information, data and knowledge for food and nutrition-related problem solving and decision-making. Informatics is supported by the use of information standards, processes and technology'.²² The integration of eHealth, and specifically nutrition informatics, will inevitably impact dietetic practice, but the level and quality of dietitian engagement will determine whether the outcomes for both dietitians and their patients are positive in relation to improving nutrition care. However, there is a paucity of literature on the eHealth readiness of allied health professionals (including dietitians), as well frameworks or tools on how to measure eHealth readiness.^{23,24}

In order to investigate eHealth readiness of dietitians, our team has used a mixed-methods approach across three phases, investigating from several perspectives. The first phase involved the development of a framework for assessing eHealth readiness through a systematic literature review and semi-structured interviews (using both a quantitative and qualitative approach).²⁵ The second phase was the analysis of Australian dietitian eHealth readiness through national surveys and a cross-sectional analysis (using a quantitative approach).^{23,24} The final phase reported here used a qualitative approach to explore dietitian perspectives on eHealth readiness and to identify strategies for improving the readiness of the profession.

The first phase revealed that there were no guiding theories or frameworks to determine the eHealth readiness of dietitians within the literature. Therefore we utilised an inductive approach to develop a *Framework for eHealth Readiness of Dietitians (FeRD)*, which encompasses five key eHealth readiness dimensions: *access, standards, attitude, aptitude* and *advocacy*.²⁵ The FeRD builds on existing theories and models, and provides a conceptual model for developing eHealth readiness evaluation tools to examine, measure and drive strategies to better prepare dietitians for eHealth. In addition, it provided a framework to analyse and report on the next phase of the research.

The national surveys, forming the second phase, provided baseline data and an indicative trend of dietitian eHealth readiness. The findings demonstrated a moderate level of eHealth readiness by Australian dietitians, with minimal improvement between 2013 and 2016 (survey periods).^{23,24} The key dimensions identified for improvement were attitude (awareness of the broader benefits of eHealth, such as improving patient safety and quality of care and reducing medical errors); aptitude (in terms of low levels of experience with eHealth initiatives); and advocacy (area requiring the most improvement, with minimal involvement with eHealth initiatives). The barriers remained consistent over time, with the top three (employer issues, technology issues and training issues) being reported by respondents.^{23,24}

Given the limited improvements in eHealth readiness of dietitians, we endeavoured to investigate the perspectives of dietitians to determine if they could provide specific direction on strategies to assist further progression. Specifically, this research (phase 3), aimed to explore the areas identified

for improvement in the national surveys. We used in-depth interviews to investigate nutrition informatics experts' perspectives of eHealth and eHealth readiness, and identify strategies to strengthen the capacity of all dietitians to lead eHealth initiatives and effectively drive successful nutrition-related eHealth implementations.

Methods

A post-positivist approach was adopted for this qualitative study to elaborate on the key areas for development identified in the national surveys,^{23,24} through semi-structured interviews with nutrition informatics experts. A purposive and 'snowballing' sampling technique was used to select participants with expertise in the field of nutrition informatics and to ensure representation across a variety of practice areas.²⁶ The selection of dietitian nutrition informatics expert participants was based on meeting at least one of four inclusion criteria: (i) experience with an eHealth implementation; (ii) research and publication on eHealth solutions for dietitians; (iii) role at a national level as an advocate for eHealth for dietitians; or (iv) holding the credential of Certified Health Informatician Australasia (CHIA). The interviews were conducted between June 2016 and March 2017 by the primary researcher, face-to-face or over the phone, and were digitally recorded. The interviews were transcribed verbatim by the same researcher. Ethics approval was granted (HE16/202) by the University of Wollongong Human Research Ethics Committee.

The interview questions were developed based on the gaps identified in the surveys. Namely, to specifically address the lack of awareness of the broader eHealth benefits, low levels of experience, and minimal involvement in eHealth initiatives by dietitians, in order to generate practical strategies to improve dietitian eHealth readiness. Ten questions were developed relating to the nutrition informatics expert's perceptions on the benefits of eHealth; risks of not being involved; dietitian eHealth readiness; reasons for lack of dietetic engagement in eHealth projects; the impact dietitian involvement has on eHealth projects; and ways dietitian engagement could be improved. The questions were piloted with two dietitians, with some minor modifications made to reduce duplication in responses.

Initial coding of the data was performed with the assistance of QSR NVivo 11 Pro (v11.0.0.317) qualitative analysis software. The transcripts were read and reread to gain a comprehensive overview of the opinions and perceptions expressed by the participants. Thematic analysis²⁷ was conducted and two researchers (including the primary researcher) independently reviewed each line of data to identify key words and phrases to describe the opinions of participants. The text was labelled as an open code and then once the transcript was coded, all codes were grouped into categories of similar concepts. Whilst a 'bottom-up' approach to the thematic analysis was adopted, the concepts from the first two research phases guided the development of the interview questions, and therefore the resulting codes could be considered to have been a

combination of an inductive and deductive approach.²⁸ The codes and concepts were then discussed by the researchers until consensus was reached on the topics and key themes emerging from the data. The data coding was reviewed with the agreed themes and a selection of exemplar quotes identified to illustrate these themes and topics.²⁹

Results

Ten dietitians who met the criteria of a nutrition informatics expert participated in the present study. Practice areas represented included: hospital (management, clinical and foodservices) (n = 5), university or research (n = 2), government (n = 1), private practice (n = 1) and industry (n = 1). Females represented 80% (n = 8) of the respondents and is reflective of the gender ratios within the profession.³⁰ The interviews lasted up to 50 minutes, with eight face-to-face and two telephone interviews. Although common themes were emerging after five interviews, additional interviews were conducted to gather nuances associated with the themes, and to ensure we revealed topics and themes across all practice areas and individual perspectives.

The data analysis identified 25 topics which formed four key themes, namely: benefits of eHealth for dietitians; risks of dietitians not being involved in eHealth; dietitians are not ready for eHealth; and improving eHealth readiness strategies (Table 1). Exemplar quotes were identified for each of the topics (Table 1).

Theme 1: Benefits of eHealth for dietitians: The benefits of eHealth to dietitians were clearly articulated. The responses identified the same topics outlined in the eHealth readiness survey relating to the benefits of eHealth for dietitians, including access to information, accuracy and safety, consumer access to health care, data analytics and efficiency.^{23,24} One quote encompassed several of the benefits in one response:

‘By using the data you can get out of an eHealth system to actually drive decision making processes around models of care. So I would be saying we are collecting a lot of data through eHealth, all sorts of dietitian specific and health specific, you could bring it together to inform how we deploy the workforce, looking for where our best bang for the buck is in terms of patient outcomes, because there is little health dollar...and I think we need to be smart about how and where we deploy staff, and so eHealth is a way that we can start to make those decisions. For example, we did this particular model of care and this was the outcome for the patient’ (Interview 6, Hospital setting).

Theme 2: Risks of dietitians not being involved in eHealth: The risks to dietitians not being involved in eHealth extend beyond just missing the benefits. The topics identified during the interviews also outlined the potential for clinical risk, which is a possibility if solutions for dietitians are developed by those without the nutrition expertise. The management of diet restrictions and allergies in hospital

patients, for example, need to be accurately linked to the corresponding codes in order for hospital interfaces to be safe and reliable (Interview 9, Private Practice setting). A similar topic identified was systems not suited to the professions’ requirements, meaning if dietitians are not involved in the development of an eHealth solution, it may not end up including the key fields and processes required to support dietetic practice, and consequently will not be adopted by dietitians. The ultimate risk, however, is dietitians ‘will become obsolete’ (Interview 5, Government setting), with others claiming authority in the nutrition space.

Theme 3: Dietitians are not ready for eHealth: Dietitians are not ready for eHealth was a consistent theme arising from the interviews with eight topics revealed contributing to this belief. The topics identify barriers to dietitian eHealth readiness, including dietitians’ lack of knowledge, awareness, confidence and informatics expertise in relation to eHealth that was most often discussed. It was identified that eHealth projects are often challenging and difficult to engage in, with the terminology and processes foreign to a dietitian, so they are ‘getting dragged along with what the organisation is doing’ (Interview 4, Hospital setting) because of their lack of informatics expertise, rather than confidently driving clear nutrition-related solutions. In addition, the importance of a fine balance was highlighted, ‘balance between collecting data for research purposes and having a system that promotes good workflow and good communication... because it’s very easy to create for example a progress note that is a blank page and that’s the electronic equivalent to the patient paper note, but that does not give you any of the added benefit that eHealth provides’ (Interview 6, Hospital setting). This quote provides a clear example supporting the need for someone with informatics skills and experience.

There was frustration with the current lack of progress across the profession, passive engagement and lack of national support and strategy for moving the profession forward. A quote from one of the participants: ‘We need to move forward as a group and we need to move forward with I guess a united idea of what this concept is and clearly that’s not happening’ (Interview 7, University/Research setting).

Theme 4: Improving eHealth readiness strategies: Eight strategies were identified to improve eHealth readiness: collaboration, incentives, education, mentoring, national strategy, leaders, champions and supportive environment. Many of these strategies were related to leadership: collaboration and representation; organisational leaders and nutrition informatics champions. Collaboration and representation recommendations were reported on a multitude of levels, starting from individual organisations, to state-wide, to national and international opportunities, whereas the other two topics related more to individual leadership attributes. For the strategy of organisational leadership, it was suggested that this could be fulfilled by those already in a position of leadership, or alternatively it may require a dedicated position. ‘It may need a dedicated project type role, where it would be a key strategy of the organisation to

Table 1 Key themes, topics and exemplar quotes for the interview transcripts

<i>Themes</i>	<i>Topics</i>	<i>Quotes (interviewee, practice area/setting)</i>
1. Benefits of eHealth to dietitians	Access to information	‘So eHealth makes it easy to access information that is going to help you inform your care plan. The benefit of that is you have more co-ordinated integrated care for the patient which would drive better patient outcomes’ (Interview 6, Hospital).
	Accuracy and safety	‘I think there is a lot of potential for safety built into it in a much more effective way than what happens in a paper record for example’ (Interview 3, University/Research).
	Consumer access to healthcare	‘Keeping up-to-date with what consumers are accessing and what patients (our consumers) are accessing, and providing services to patients in different forms other than traditional face-to-face form to enable a broader reach and I guess meeting patients and consumer needs and ultimately satisfaction’ (Interview 4, Hospital).
	Data analytics	‘It can help us target our service because it can provide information that will change your service delivery as a result of analysing larger pieces of data’ (Interview 1, Hospital).
	Efficiency	‘The immediacy of access, so not just the waiting time, but no matter where you are you can find them, access them, many people can be using it at the same time’ (Interview 3, University/Research).
2. Risks of dietitians not being involved in eHealth	Clinical risk	‘I think you can have some clinical risks and you know we have seen that in some of our hospitals’ (Interview 8, Hospital).
	Lose professional domain	‘I think dietitians risk being left behind, becoming out of touch, and being seen as redundant. A rise in other nutrition professionals, or professionals claiming to have nutrition qualifications and training, and being better at using certain aspects of eHealth and promoting themselves’ (Interview 9, Private Practice).
	Miss the benefits	‘Well, as a profession we won’t get the benefits, we won’t get the initiatives, we won’t get innovation. We would possibly be lost and swamped by a multiple other professions who will ultimately leverage off that data and leverage off the opportunities to change and grow and capture that patient interest in the sense of healthcare...’ (Interview 1, Hospital).
	Systems not suited to professions’ requirements	‘I think that’s the biggest risk, decisions are going to be made without them, systems are going to be built that don’t require a dietitian, and some EMRs [electronic medical records] can be completely setup to not require dietitian involvement’ (Interview 2, Industry).
3. Dietitians are not ready for eHealth	Disconnect between IT and clinical departments	‘So, I think that lack of a link, or lack of communication with IT departments, or lack of connection, has resulted in dietitians being very disengaged from the process’ (Interview 9, Private Practice).
	Focused on role and not seeing the bigger picture	‘And that may be for any number of reasons, we are all busy people and we are focused on patient care and we don’t see the immediate benefit of our time and effort’ (Interview 6, Hospital).
	Frustration	‘I feel there is a huge amount of frustration that we were unable to move things forward and have real meaningful headway into getting and attracting interest within the profession, even though as an industry health informatics has not stopped, in fact it has escalated exponentially, but as a profession our interest has not followed that vein’ (Interview 1, Hospital).
	Generational	‘The younger generation has grown up with technology; they expect it to be in their daily lives, so when you suggest ideas that involve electronic systems they are much more ready to use that’ (Interview 2, Industry).
	Lack of enthusiasm or interest	‘I do think that because there is very little current interest in the dietetics field about nutrition informatics or not so much current interest, but certainly a lack of enthusiasm’ (Interview 1, Hospital).

Table 1 Continued

Themes	Topics	Quotes (interviewee, practice area/setting)
4. Improving eHealth readiness strategies	Lack of informatics expertise	'Part of the frustration is, that once this thing has been designed is that you can't go back and redesign, and there are all sorts of rules and barriers. We've had a very frustrating time going back and asking can we start again, and they say sure you can start again, but they aren't making the changes we put forward' (Interview 6, Hospital).
	Lack of knowledge, awareness and confidence	'I think the fear, lack of understanding, so there is a lot out there; it's not just one thing.' (Interview 7, University/Research)
	Lack of progress	'I feel we are a pretty passive workforce, that we will adopt technology when it is given to us, or we will critique it when it's handed to us. But on a whole I don't think we are well engaged as a profession in this sort of stuff' (Interview 6, Hospital).
	Collaboration and representation	'I think that if we got involved in some of those key organisations that are involved in nutrition informatics or health informatics that it puts us on the map, it creates a skill level for us that keeps the conversation going. It probably embeds us as a profession within that whole health network, and if we don't do it we'll miss the opportunity altogether or someone will come in and provide it for us, but it will be with their perspective of dietetics which may not be within our profession' (Interview 1, Hospital).
	Education	'I think that we need to provide more education about what eHealth is; that it's more than just the EHR [electronic health record], which is how eHealth is widely seen by clinical dietitians in hospitals. We need to provide education about existing systems and how they fit in, how they are existing eHealth systems I guess, and also future possibilities' (Interview 9, Private Practice).
	Offer incentives	'I do think that because there is very little current interest in the dietetics field about nutrition informatics or not so much not current interest, but certainly a lack of enthusiasm that perhaps we might need some sort of impetus to get us over the hurdle to help bring an awareness or create a profile or create a structure for us as a profession to move forward' (Interview 1, Hospital).
	Mentoring	'So I suppose it's a matter of supporting, encouraging, mentoring and building confidence from a professional perspective about a field that was not our primary area of study' (Interview 1, Hospital).
	National strategy	'I think DAA [Dietitians Association of Australia] have a role to play here to actually educate, promote and assist dietitians to become better informed about eHealth, what eHealth is, how it impacts us and what the risks are of not embracing it as a profession' (Interview 9, Private Practice).
	Organisational leaders	'Obviously for individual dietitians it is very difficult for them to change a whole system or whole approach, but those in positions of leadership are the ones who can help guide, help reassure, help put stepping stones in place to have it all happen' (Interview 3, University/Research).
	Nutrition informatics champions	'I do think you need big picture people, holistic people, visionary people in place to get some of the big overarching stepping stones in place, and we need the right people in the right place at the right time' (Interview 3, University/Research).
	Supportive environment	'But how do we manage to keep those people together, those people with the view, the vision, the insight and the big picture, how do we connect all of these pieces of a massive spider web together and again I think the professional organisation is one means by which we can do that' (Interview 3, University/Research).

further develop and once that interest is created I suspect a higher uptake of interested parties can then have a snowball effect and move the profession forward' (Interview 1, Hospital setting). Supporting the suggestion of nutrition informatics champions were the following quotes: 'Have some sort of group or a group that can show leadership and start to drive the process and upskill people and start to really inspire people who don't necessarily don't want to lead, but who are interested in the area and that tiny bit of interest is all we need to start the ball rolling and get others on board' (Interview 7, University/Research setting). 'I do think champions are helpful, the thing I think are helpful about champions is almost a pure sales approach if I can say, so the champions themselves have been upskilled, but after a couple of years need a rest, but I think they can be a buddy or guide to the next generation of champions. So if any one of them could then be a support for several other newer people coming on board, then 10 becomes 100 becomes 1000 in no time at all if we use that type of approach. I think that supportive model could be very strong and very valuable' (Interview 3, University/Research setting).

Education and mentoring were highlighted in regard to creating opportunities for eHealth awareness raising and exposure. The need for a national strategy with 'simple messages, and consistent hammering of those key areas' (Interview 5, Government setting) to members, and an action plan to 'influence at a national commonwealth level' (Interview 5, Government setting) eHealth standards and policies. Also raised was the need to create an 'impetus to get over the hurdle for the profession to move forward' (Interview 1, Hospital setting), and an 'incentive' (Interview 8, Hospital setting) for individuals to get involved. A supportive or enabling environment to enable the coordination of the effort required for the profession in this space, 'with everyone working together to achieve these goals' (Interview 3, University/Research setting).

The participants suggested many strategies for improving eHealth readiness. However, when prompted they found it difficult to identify who, and how these strategies could be coordinated and actioned. Primarily, the Dietitians Association of Australia (DAA) and universities were identified as having key roles in assisting with providing education to increase awareness of eHealth, to provide incentives, develop a national strategy, and to provide a supportive environment. To quote: 'I think that Universities certainly have a role for the future graduates – talk about eHealth, what it is, how it fits in, and it's more than just EMR or nutrition support software that you might use in your workplace. I think DAA have a role to play here to actually educate, promote and assist dietitians to become better informed about eHealth, what eHealth is, how it impacts us and what the risks are of not embracing it as a profession' (Interview 9, Private Practice setting).

Discussion

This research explored the perceived eHealth readiness of dietitians through interviews with nutrition informatics

expert. Twenty-five topics were identified, forming four key themes, with similar responses and perspectives being reported by all the participants. There was agreement that there were benefits to dietitians in using eHealth, as well as risks of dietitians not being involved. However, there was frustration with the current lack of progress across the profession, and overwhelming consensus that dietitians were not yet ready for eHealth. This supports the findings of the eHealth readiness study.^{23,24} Eight key strategies on how to improve dietitian readiness for eHealth were also identified.

The benefits identified during the interviews were comprehensive and reflect commonly reported key eHealth benefits, all of which contribute to the ultimate goal of eHealth: to improve the quality of health-care delivery.^{31–33} The achievement of this goal in dietetics has demonstrated improvements in the consolidation and reconciliation of patient information (including the incorporation of data standards),^{34–36} accuracy and safety,²⁴ efficiencies,^{34,36–38} and patient nutrition outcomes.^{35,39} Nutrition focused studies have also demonstrated efficiencies gained through eHealth, which can contribute to cost savings,^{34,35} or allow for increased time to be devoted to direct patient care and enhancing the care experience for patients and health-care providers.⁴⁰ Telehealth and mobile health apps (mHealth) can support dietitians to provide patient access to nutrition care, enabling healthcare information to be obtained at the right place and right time, irrespective of socioeconomic status and physical location.^{31,41}

The risks of dietitians not being involved in eHealth became the second theme, which like benefits, are an important part of this discussion.⁴² Whilst the benefits can form positive messages to promote the importance of eHealth readiness to the profession, presenting the risks has the potential to create a strong incentive to the profession to become more aware and involved. It was reported that dietitians will miss out on the benefits eHealth offers, potentially introducing or fostering clinical risk, and ultimately becoming irrelevant; even losing their professional domain. This is an issue in social media, which has recently been flagged anecdotally as a significant risk to the profession; the uprising of the non-nutrition professionals providing nutrition information and advice to the general public. The DAA and other dietetic professional groups and individuals, in response to the rise of the non-nutrition professionals, have actively campaigned to promote the role of the professional nutrition expert throughout social media.

There were strong opinions relating to the theme that dietitians are not ready for eHealth, and several potential barriers for this identified. These reasons should be taken into consideration and targeted when developing the strategies to address dietitian eHealth readiness. For example, how can we leverage the younger generations' knowledge and confidence with technology to improve the professions interest and enthusiasm for eHealth? Dietitians are not aware of the benefits of these solutions, the risks of not being involved,^{23,24} and consequently are not confident to lead opportunities related to nutrition eHealth initiatives.

The fourth and final theme encompassed the strategies for improving eHealth readiness amongst the profession. This area is challenging, with no previous framework to guide the profession and insufficient investment in reflecting on our limited experiences, to identify how we can do better moving forward.²⁵ The need for strong and active leadership is clearly an essential ingredient for eHealth advancement and one key area where the profession is lagging,^{23,24} and several ideas on the types of leadership required were discussed. A systematic literature review by Ingebrigtsen *et al.* in 2014 revealed a moderate level of evidence that clinical leaders who have technical skills and experience with eHealth project management are instrumental in the successful adoption of eHealth.¹³ The attributes of these clinical leaders suggest that they are likely to develop a long-term vision, motivate and foster the necessary IT competencies, establish partnerships with IT representatives, can maintain confidence and stability through the adversities that these projects often entail, and are consequently associated with successful organisational and clinical outcomes through eHealth initiatives.¹³

The importance of greater collaboration and engagement by dietitians as part of the development and implementation process of eHealth solutions has also been identified in research studies, and in particular in several with nutrition focus.^{38,41,43} Chen *et al.*'s research in 2017 on designing mHealth apps to support dietetic practice concluded that it was critical for dietitians and the app developer to collaborate in order to achieve dietitian and patient-centred app designs.⁴¹ During the development of an eHealth solution for dietitians, Mirtallo *et al.* in 2009 reported that dietitians were consulted, and ultimately ensured optimised nutrition care functionality.⁴³

Some topics related to strategies that did not arise in the interviews included competency standards for dietitians and health (or specifically nutrition) informatics certifications. Ayres *et al.* in 2012 from the Academy of Nutrition and Dietetics identified that whilst other professions had addressed informatics competencies at different levels of practice, the dietetics profession had not.⁴⁴ The Academy defined informatics competencies of dietitians, and determined the assignment of each competency to the appropriate level of practice (based on the six levels of practice from the Academy's Career Development Guide).⁴⁴ In addition, within the topic of 'collaboration and representation', no key eHealth organisations were mentioned, such as HL7, HIMSS or the Digital Health Agency. Similarly, none of the respondents identified the importance of ensuring dietitian involvement in national eHealth policy and standards; ensuring nutrition is incorporated as part of regulation and policy and to ensure interoperability. Another possible strategy that was not identified during the interviews is the support and encouragement of research contributing to the evidence of nutrition informatics benefits for patient nutrition care, as well as the development of best practice criteria for nutrition eHealth selection and use as a potential important focus for the coming years.^{45,46}

As with any semi-structured interviews, a limitation is the risk that participants may not reveal all of their true

opinions as they may wish to please the interviewer. This method was specifically chosen over focus groups, for example, as there is the risk that the responses may be influenced by a dominant view, and alternate views may be less accepted or possibly not externalised.⁴⁷ In addition, the participants represented experienced practitioners and experts in this field, so were more likely to feel confident and comfortable with their opinions and responses than the general dietetics population. It should also be noted, as there were a limited number of interviewees, the comments cannot be taken to represent the views of all practitioners in each of these practice areas, and so consideration should focus on the common themes that emerged from the participants.

When the three phases of this research were considered as a whole using triangulation methodology, a significant finding was the complexity of eHealth readiness, and the lack of understanding of what readiness entails by the profession. This may be the key issue and the first place for the profession to focus eHealth awareness efforts. It appears that understanding of readiness is limited to personal experience (and unfortunately dietetic experience in eHealth is very low), and therefore is often assumed to be made up only of attitude and aptitude. Dietitians' high confidence and experience in using computers may be creating their belief that they are ready for eHealth, when in fact they are not (when all FeRD dimensions of readiness are assessed).²⁵ It is this belief and the idea that simply raising awareness will be sufficient to prepare those that are not ready, that is, placing the profession in danger of being complacent and missing the opportunities eHealth will facilitate. Additional implications of dietitians not being prepared for eHealth are that others may take their place, or dietitians may be forced to use eHealth in ways that are not the most effective for practice or maximising patient outcomes.

There is an opportunity to embrace this knowledge, and for dietitians to demonstrate they are the clinical leaders for nutrition, and ensure they are driving the eHealth solutions for nutrition care, rather than financiers or technologists. Whilst achieving the benefits of eHealth will be complex, collaboration across the profession is key, with a number of strategies imperative to prepare dietitians for eHealth and ensure the profession can practice effectively in the digital age, optimise nutrition care and support research for eHealth. These strategies include developing a national strategic plan; enhancing university training and graduate competency; engaging and collaborating with external organisations to ensure inclusion and interoperability (incorporated into standards and policy); utilising the skills and expertise across the practice areas to identify champions and leaders; embracing those with experience; and drawing on the varying expertise demonstrated by the different generations.

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Conflict of interest

KM acknowledges the nonfinancial support of her employer The CBORD Group. MF, Director of Dietitian Connection, receives sponsorship from The CBORD Group.

Authorship

KM determined the key concepts for the paper, prepared the interview questions, conducted and transcribed the interviews, conducted thematic analysis and drafted the manuscript. KW assisted in the interview questions, conducted thematic analysis and assisted in the development of the manuscript. PW assisted in the interview questions and in the development of the manuscript. MF assisted in the interview questions and in the development of the manuscript. EB assisted in the interview questions and in the development of the manuscript. All authors approved of the final version of the manuscript.

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ORIGINAL RESEARCH

Challenges in preparing the dietetics workforce of the future: An exploration of dietetics educators' experiences

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Abstract

Aim: Dietetics educators represent a small but influential workforce group that has experienced significant change in recent years. The workforce development challenges faced by this group have been largely unexplored. The present study aimed to explore the experiences of, and challenges faced by, academic dietetics educators in preparing dietitians for the workforce.

Methods: The approach taken in the present study was informed by qualitative description. Fifteen dietetics educators employed by 13 universities across Australia were purposively sampled. In-depth, semi-structured interviews conducted via telephone ($n = 12$) or face-to-face ($n = 3$) were digitally recorded then transcribed verbatim. Data were managed with NVivo and inductively analysed using open coding. Codes were condensed into themes through an iterative process involving multiple researchers.

Results: The overarching theme of 'aiming for a moving target' was underpinned by the themes of: (i) striving for betterment; (ii) bridging dissonance and (iii) distressing impossibilities. Interviewees described how they were driven to enhance the preparation of dietitians but acknowledged disparity between what graduates are being prepared for and what they need to be prepared for. Heightened expectations of others, professional constraints and a lack of collegiality among the profession were among the challenges that manifested in a sense of frustration, concern and isolation.

Conclusions: Dietetics educators are motivated to shape and enhance the future profession. However, they face numerous challenges in their efforts to prepare graduates who are well-equipped for increasingly diverse dietetics practice. Strong leadership, academic collaboration and greater engagement of the broader workforce are required for the benefit of the entire profession.

Key words: dietetics educators, education, qualitative research, students, university, workforce.

Introduction

Health professional educators in higher education settings are operating in increasingly challenging and changing environments. Health systems for which educators are preparing graduates are under tremendous pressure to perform.^{1,2} Health workforce preparation is further pressurised by the

expectations and demands of the higher education sector.³ The urgent need to support the health workforce into the future by transforming how the health and education systems work together has been recognised in Australia,² with similar calls for reform emerging from the USA⁴ and the UK.⁵ As contributors to the broader health workforce and more specifically the dietetics workforce, dietetics educators are likely to experience these challenges.

An academic dietetics educator (herein referred to as dietetics educators) has been defined as a dietitian employed by a university to educate and prepare entry-level dietitians for the workforce predominately within the university setting.⁶ Dietetics educators are well-positioned to have a considerable influence on the professional development of dietetics students/graduates and therefore, to shape the future dietetics workforce. They, along with other key stakeholders, can lay the foundation for a dietetics graduate's independent practice as a dietitian, and are critical to providing quality learning experiences for students.^{7–9}

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Conducting research is a requirement for most dietetics educators in academic roles.⁶ However, research regarding dietetics educators themselves appears to be lacking. Internationally, it is suggested that academia and research is one of the greatest growth areas in which dietitians work,¹⁰ yet it remains a relatively small workforce sector. In 2014, the core workforce of dietetics educators in Australia was estimated to comprise just 2% (n = 147) of a dietetics workforce that was growing at around 10% annually.⁶ The proportion of dietitians working as dietetics educators in other countries with an established dietetics workforce is yet to be published. However, with 7% or less of dietitians in the USA and Canada reporting education and research as their practice area,^{11,12} it is likely to be similarly small. While establishing a profile of the dietetics educator workforce is useful to inform workforce planning and development, it is the experiences of these stakeholders that present a source of intelligence which could help inform the preparation of future dietetics workforces.

Exploring dietetics workforce preparation from the perspectives of other stakeholders including dietetics practice educators (preceptors/placement supervisors),^{13,14} students,^{15,16} graduates^{17,18} and employers of graduates^{19,20} has, to some extent, been investigated. Existing research has generally taken a piecemeal approach and focused on specific elements of workforce preparation (e.g. assessment) with participants being mostly from a single location (i.e. one university).^{14–16,21–24} In the absence of empirical evidence exploring the perspectives of dietetics educators, it has been speculated that their challenges may include: sourcing suitable student placements; equipping graduates to practice internationally; having valid and consistent assessment tools;²⁵ a more diverse and demanding student population;²⁶ and teaching using relevant technology.²⁷

Recent research commissioned by national dietetics bodies in the USA,^{26,28,29} the UK³⁰ and Canada^{12,31} has attempted to inform dietetics workforce development and hypothesise on the future direction of the profession. However, to the authors' knowledge, no national approaches to date have broadly explored dietetics workforce preparation and the impact of associated challenges from the perspective of dietetics educators. As key stakeholders in preparing future dietetics professionals, dietetics educators can provide valuable insights into workforce preparation. Understanding the experiences and challenges faced by dietetics educators may be critical to informing strategic and effective workforce planning and development into the future. The present study aimed to explore the experiences of, and challenges faced by, academic dietetics educators in preparing dietitians for the workforce.

Methods

The approach taken in the present study was informed by qualitative description whereby researchers sought to describe dietetics educators' perspectives on their experience of preparing dietitians for the workforce.³² The researchers adopted a social constructionist epistemological position

(that realities are socially constructed by the research participants and their interactions with the world) and an interpretivist theoretical perspective (that those realities come from how the research participants interpret and make sense of their experiences).^{33–35} Inclusion criteria required participants to be dietitians employed, either part-time or full-time, by an Australian university offering a dietetics program. They also needed to contribute to the education and/or preparation of dietitians for the workforce. Participants were purposively sampled due to their experience of the phenomenon being investigated and their potential to provide substantial insights.³⁶ Individuals identified as dietetics educators from a previous study (n = 91)⁶ were stratified based on professional attributes and demographics including: (i) years of experience in dietetics education; (ii) area of specialisation as a dietetics educator and (iii) geographical locations across Australia. To capture a diverse range of perspectives, maximum variation sampling^{35,37} combined with random selection was employed across each of the stratified sub-samples.

The Bond University Human Research Ethics Committee provided ethical approval for the present study. Recruitment commenced February 2015 and ceased July 2015. Dietetics educators were invited to participate by the primary researcher (KM) via email and were followed up with a telephone call. An explanatory statement with details of the study, including assurance of confidentiality, informed consent and example question topics, was emailed to potential participants. Reminder emails were sent at approximately two weeks and four weeks after the initial invitation to those who had not responded. Respondents were asked to indicate a suitable interview time and were provided with the interview guide.

Interviews were the chosen enquiry method and the interview guide included 10 open-ended questions designed to elicit in-depth participant responses about their experiences of and challenges faced in the phenomenon of interest (Table 1). Interview questions were guided by the study's aim and informed by a review of published literature which revealed a paucity of evidence related to dietetics educators' experiences. Furthermore, questions were shaped by the researchers' experiences in health workforce preparation and their awareness of extant challenges in the higher education sector. Demographic and professional attributes were also requested from each participant. Prior to recruitment, interviews were piloted with two dietetics educators who were not part of the research team, with minor modifications made to the interview guide (e.g. re-ordering of questions to enhance conversational style) based on researcher and pilot feedback.

The research team's experience in, and familiarity with, either dietetics education and related research (KM, KC and DR) or medical education and related research (SS and LC), informed their position that educators were important informants on the phenomenon of interest and that they would likely experience challenges in dietetics workforce preparation. As all authors were experienced health professional educators familiar with the challenges faced across a range of disciplines, this influenced the focus of the research. The

Table 1 Questions used to guide in-depth, semi-structured interviews with dietetics educators

	<i>Question</i>	<i>Enquiry logic</i>
1.	Can you describe your own experience of being prepared as a dietitian for the workforce?	Own experience of workforce preparation
2.	How prepared did you feel as a dietitian entering the workforce?	Own experience of preparedness
3.	How did you come to be working in dietetics workforce preparation?	Pathway into and motivations for work
4.	Can you describe your experience of preparing dietitians for the workforce?	Experience of workforce preparation
5.	Do you have a philosophy or approach that guides your work in preparing dietitians for the workforce, and if so, can you describe it?	Pedagogical approach and influences on workforce preparation
6.	Can you describe the learning and teaching methods you use to prepare dietitians for the workforce?	Pedagogical practices and influences on workforce preparation
7.	What challenges do you face in your work to prepare dietitians for the workforce?	Own challenges faced in workforce preparation
8.	What challenges are faced by the dietetics educator workforce in preparing dietitians for the workforce?	Views on challenges faced by others in workforce preparation
9.	How prepared for the workforce do you believe graduate dietitians are today?	Views on preparedness of current graduates
10.	What are the challenges faced by dietitians entering the workforce today?	Views on challenges faced by graduates

primary researcher—a female dietetics educator with qualitative research experience—conducted the interviews. Interviews were conducted either face-to-face or via telephone (depending on participant preference and proximity to the primary researcher) at a suitable time for participants and were digitally recorded with the participants' written informed consent. Interview recordings were transcribed verbatim by the primary researcher and field notes were kept for subsequent reflection and data validation. To describe the sample, participant demographic and professional attribute data were collated and frequency distributions generated using SPSS (Version 20.0. Armonk, NY: IBM Corp.).

Each transcript was read multiple times by the primary researcher to develop familiarity with the data and to generate initial notes. Transcripts were imported into NVivo, version 10 software³⁸ and systematically analysed using open coding.³⁹ Each piece of data was assigned an initial note, with initial notes then being grouped into initial codes to enable subsequent organisation of preliminary themes.^{39,40} Codes were handwritten and visually mapped to illustrate the developing themes and sub-themes. This was an iterative process whereby codes and themes were revisited multiple times by multiple researchers (KM, DR and SS) to develop final themes. Inductive analysis continued until theoretical sufficiency was reached, whereby researchers were satisfied that the study's aim had been sufficiently addressed.⁴¹ Once themes were agreed, an overarching theme was developed by the researchers to capture the essence of the main themes and the collective meaning of the dataset. Two researchers (DR and SS) reviewed a sample of interview transcripts and codes to ensure: that the data were examined from multiple perspectives; that data were

comprehensively translated by the primary researcher; and that the synthesised themes reflected participant perspectives.⁴¹ Reflective memos were kept to acknowledge subjectivity and interpretive analysis.⁴²

Results

Twenty-one dietetics educators were invited to participate, with 15 providing written informed consent. Two did not respond to the invitation, two declined to participate (citing a lack of time) and another two responded but were not required due to theoretical sufficiency being reached. Dietetics educators from 13 universities from across the six Australian states/territories where dietetics education programs were offered were interviewed. Most interviews were conducted via telephone ($n = 12$) with three being conducted face-to-face due to the preference and proximity of the participant. Interviews lasted an average of 64 minutes (range: 38–100 minutes). Participants represented a range of experience levels in dietetics education with the majority (53%; $n = 8/15$) having greater than 10 years of experience. Most participants were female (87%; $n = 13/15$), aged between 40 and 49 years (47%; $n = 7/15$) who reported individual case management or community and/or public health nutrition (both 27%; $n = 4/15$) as their main area of specialisation as a dietetics educator (Table S1).

A total of 197 initial codes assigned to the data were grouped into nine provisional themes and 30 sub-themes. These were revised and condensed until one final overarching theme, three main themes and nine sub-themes relating to the challenges faced by dietetics educators were identified from the data (Figure 1). The overarching theme of 'aiming

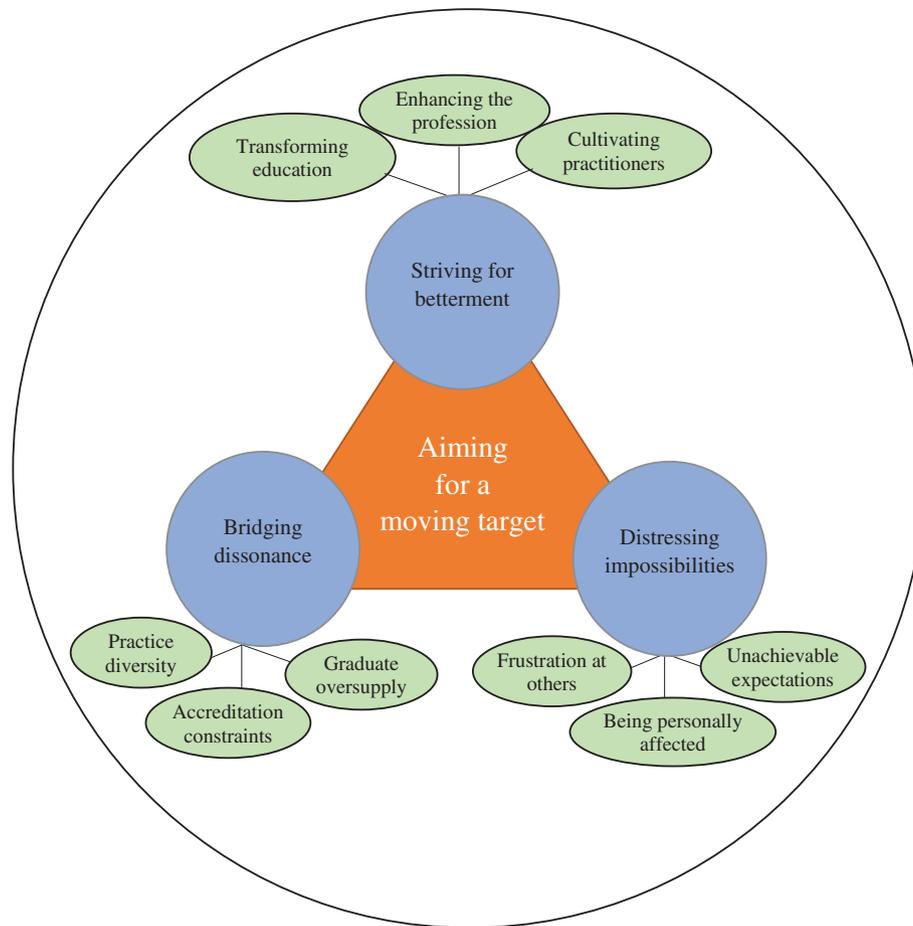


Figure 1 Thematic map showing overarching theme (orange triangle), themes (blue circles) and sub-themes (green ovals) relating to challenges faced by dietetics educators.

for a moving target' was underpinned by the main themes of: (i) striving for betterment; (ii) bridging dissonance; and (iii) distressing impossibilities. The themes presented below are supported by verbatim quotes with participant identification codes used to maintain anonymity.

Overarching theme—Aiming for a moving target: The overarching theme reflected dietetics educators' attempts to aim for a moving target. Despite participants' inner drive to deliver a well-equipped workforce, they were challenged to reach elusive goals while being constrained by external forces. Dietetics educators were motivated by their perceived contribution in shaping the future workforce yet described frustration in their work to deliver relevant graduates. The experience of preparing dietitians for the workforce was summarised by one participant as being battered by a storm.

'(We're) in the eye of the perfect storm. We're being pushed from below by the university...we've got our stakeholders, the employers, all the stuff that's happening in the health care sector, that drives things around placement...and then you've got accreditation...there are a lot of pushes and pulls'. (DE030)

Participants felt that incoming pressures from multiple sources hindered their efforts in dietetics workforce

preparation. The following three themes and nine sub-themes further illustrate the challenges experienced by dietetics educators.

Theme 1—Striving for betterment: Within this theme, dietetics educators expressed a sense of altruism and their motivation to 'make things better'. They used their experiences as past students and supervisors as a point of comparison and described how they wanted students to be better prepared for practice than they felt they had been. This striving for betterment in student preparation was seen as a mechanism by which the profession may be enhanced.

Sub-theme—Transforming education: Participants reflected that their own experiences as students were not optimal and that they were driven to transform dietetics education into a positive experience for students today. Some participants had unpleasant and uninspiring encounters with their own educators when they were students (both practice- and university-based) which had a lasting impact on them.

'I had such a terrible dietetic education experience, I thought 'surely I can do better than that.' That experience greatly influenced my work in preparing dietitians for the workforce today...going in the opposite direction of what I got exposed to'. (DE055)

Sub-theme—Enhancing the profession: Many participants saw themselves as being in a position where they could, and wanted to, enhance the emerging workforce. One dietetics educator viewed themselves as a guardian of students, helping to maintain and further inspire student's interest in nutrition. The honour of helping to shape future practitioners and the profession, was shared by another participant when they expressed:

'to be involved in education and to have a role in influencing the future profession, I see as a real privilege and something that I take really seriously'. (DE117)

Sub-theme—Cultivating practitioners: It was widely reported by participants that their drive to make things better was perpetuated by seeing students develop. When dietetics educators observed professional growth in students and when they received positive feedback from others (e.g. graduates, supervisors), it reinforced their motivation to keep preparing future dietitians as best they can.

'when you see students really get something and are passionate about it and (they) go on working in the area, that sort of thing is inspiring and it keeps you passionate'. (DE079)

Participants were motivated by the long-lasting impact that their educational experience had on them and by witnessing their own students develop from novices into professionals. Their desire to help others and contribute to the 'greater good' shaped the experience they were trying to provide for their students.

Theme 2—Bridging dissonance: In this theme, dietetics educators looked to the 'real world' to affirm their view that disparities existed between graduates' preparation needs and graduates' preparation experiences. Participants described their continual efforts to bridge that gap by providing students with meaningful preparatory experiences to help them to secure work upon graduation. The dietetics educators expressed their concern at how this incongruity could impact graduates and the profession.

Sub-theme—Practice diversity: Reflection on the past and how 'times had changed' was again apparent in this sub-theme. Participants recognised that the areas in which dietitians now practised were very diverse, compared to many years ago when there were fewer practice domains. They also recognised that not all areas of practice were, or could be, taught during a university program due to constraints and already full curricula.

'the other thing that has changed is just the diversity of roles for dietitians...when I first started out it was really all about preparing people to be clinical dietitians'. (DE030)

Sub-theme—Accreditation constraints: While the majority of dietetics educators believed that graduates were 'as well prepared as possible' for the workforce, this was mostly in regard to the traditional domains of practice (e.g. clinical dietetics). Participants described how professional

accreditation requirements had resulted in programs that were not able to dynamically respond to changing workforce needs, and in graduates that were not well-equipped to pursue work in non-traditional or emerging areas of practice.

'We have a dietetics course that's focused around three different domains (of practice) but many of our graduates are going into private practice, they're not as prepared under the traditional training model'. (DE103)

Sub-theme—Graduate oversupply: The struggle of dietetics educators to bridge the preparation-practice divide was further exacerbated by the increasing number of graduates being produced from university programs. While some participants thought there had always been competition for dietetics jobs, it was a commonly shared view that the supply of dietetics graduates far outweighed the apparent demand. One participant expressed their concern for how this posed a risk to the broader profession.

'The ability to walk into your perfect job within a few weeks of graduating now (is) not particularly realistic, and I think that that does pose a big challenge, because word gets out, students decide that 'I'm not going to do dietetics, I'm going to do something else', we'll lose the brightest leaders of the future'. (DE085)

Attempting to bridge the gap between dietetics preparation and practice was a source of frustration for the participants in the present study. Curricula that were bound by program accreditation requirements were seen to have contributed to an apparent surplus of traditionally prepared dietetics graduates that outweighed the existing demand.

Theme 3—Distressing impossibilities: The multiple expectations that dietetics educators felt were placed on them created a sense of impossibility, which manifested into frustration at others and the dietetics educators themselves being affected personally. Within this theme, participants were increasingly required to 'do more with less'. Participants recognised that this issue was broader than just dietetics and was due, in part, to increased pressure on governments, health care institutions and universities to be more efficient. The lack of apparent support to help address these challenges left many educators feeling isolated in their efforts to shape the future workforce.

Sub-theme—Unachievable expectations: Some participants felt that practice educators had heightened expectations for students to arrive at placements better prepared than what students had been previously. This was due, in part, to practice educators having to take more students on placements while already struggling with heavy workloads. Students' increasingly high expectations that they should receive a quality educational experience was an additional source of pressure on dietetics educators. For example, one participant highlighted students' expectations to be taught with the most current technology:

'Technology related to learning and teaching, every year there's a new platform and if you don't learn it and keep up with it you're behind everybody else, so students look at you and think 'well this is a bit of an average subject because they're not using all these new interface things that I enjoy seeing in other subjects''. (DE103)

Organisational constraints and efficiency drives of higher education institutions were also seen as unrealistic and unreachable, adding to the sense of impossibility. University policies, such as those in relation to teaching and assessment, were not seen as conducive to providing quality student experiences.

'You know the marking, the marking is just diabolical. At our uni we're meant to be spending half an hour per student per semester which is just ridiculous, you just can't do that'. (DE200)

Sub-theme—Frustration at others: The sense of impossibility appeared to result in frustration at others, specifically other stakeholders and organisations. Animosity towards the professional association for its ambiguity and inflexibility around program accreditation was expressed by a number of participants. Some also lamented the lack of involvement from the wider dietetics profession, whom participants thought should help share the load of preparing the workforce of the future. Frustration was also directed towards the dietetics educator workforce itself for its lack of collegiality and collaboration. As one participant reflected:

'I mean, people have friends they can call up but I don't really think that it's a nice support network, and I think part of the problem is that (dietetics educators) do view (sharing knowledge and resources) as competition or a conflict of interest rather than genuinely helping people and working to improve the profession'. (DE077)

Sub-theme—Being personally affected: The impact of trying to reach apparently unattainable outcomes was internalised by some participants who felt personally affected. While some dietetics educators acknowledged that academia had always been demanding, others felt that they were constantly having to work outside standard hours and were juggling increasing workloads with less support. This was reflected by some participants who reported feeling exhausted, tired and isolated. A personal concern shared by several participants was in relation to students—either not getting work upon graduation or by performing poorly on placement.

'I'm very worried, I worry about the student, I worry about the supervisor and our relationships with the sites and the patients and the community and you just feel very responsible without a lot of support behind you'. (DE049)

Conversely, some participants viewed such challenges with a more pragmatic approach and did not internalise them as a personal responsibility. One dietetics educator

saw their perceived challenges as surmountable and 'part of the job'.

'I think I overcome them (challenges) all. You could say the constraints of university administrative systems (are a challenge), but I don't see it as a challenge, I just see it as part of my job'. (DE116)

Meeting the expectations of others including students, universities and other healthcare stakeholders was seen by some participants as an unattainable feat. The sense of impossibility resulted in feelings of frustration, concern and isolation, due in part, to a lack of support and a lack of collegiality within both dietetics education and the wider profession.

Discussion

The present study describes the challenges faced by academic dietetics educators in dietetics workforce preparation—an experience illustrated by the overarching theme of 'aiming for a moving target'. The three themes (striving for betterment; bridging dissonance; and distressing impossibilities) and nine sub-themes that were constructed from the data suggest that dietetics educators face numerous challenges in their efforts to prepare graduates who are well-equipped to meet increasingly diverse areas of dietetics practice. Despite heightened expectations of others, professional constraints and a perceived lack of collegiality among the profession, dietetics educators remain driven to enhance the preparation and preparedness of dietetics graduates.

Dietetics educators in the present study were altruistic in their desire to make things better—both the educational experience of their students and the future profession. Their acknowledgement of being in a position to influence and shape the profession echoes the perspective previously shared by dietetics students^{9,43,44} and students in other health professions.^{45,46} Understanding dietetics educators' drivers could be used to enhance their performance and productivity in workforce preparation and subsequently, that of the future workforce. Harnessing the collective motivation of dietetics educators nationally, could facilitate collaborative problem-solving, sharing of innovations and championing of common causes. The success of a recent community of practice for dietetics educators in Australia⁴⁷ (established after these interviews took place) may provide a blueprint and impetus for all stakeholders in dietetics education to work together to address shared issues.

The findings of the present study highlight the need for curricula reform if dietetics graduates are to be relevant in an increasingly diverse and dynamic practice environment. Rigid program accreditation requirements were seen to have exacerbated the perceived issue of an oversupply of dietetics graduates who were under-equipped for embracing contemporary opportunities. This was anticipated by a 2012 dietetics workforce demand study which warned that without adaptability, there would be too few dietitians equipped

for emerging areas and too many for declining areas.²⁶ Despite pleas to prepare dietetics professionals who can respond to the rapidly changing practice environment^{48–50} and calls for greater flexibility in dietetics education programs,^{25,51} it is not surprising that dietetics educators recognise a chasm between workforce preparation and practice. The present study adds to recent calls by other educators to provide students with more diverse experiences across non-traditional dietetics domains.⁵² Placing students in non-traditional settings,⁵³ in underserved areas⁵⁴ and in role-emerging placements⁵⁵ have demonstrated benefits for key stakeholders and may help to pioneer new professional pathways.

The perception of dietetics educators in the present study that incongruity exists between the supply and demand of dietetics graduates echoes the views of dietetics employers, practitioners and the professional association.⁵⁶ Incongruities have also been witnessed in other countries with workforce shortages in Canada^{12,31} and internship shortages in the USA.^{57,58} These issues could be due in part to the significant changes seen within the dietetics profession and dietetics education in recent years.¹⁰ Furthermore, the lack of available data on workforce trends in Australia,⁵⁶ limits dietetics educators' efforts to produce a workforce that can anticipate and meet market demands. National approaches to analysing how dietetics practice areas are changing and proposing how the future workforce may look have been conducted in the USA¹¹ and the UK,³⁰ respectively. If workforce preparation is to be matched to future practice needs, similar strategies which are led by the professional association in conjunction with the dietetics profession are urgently required in Australia. Moreover, a broad, comprehensive review of existing dietetics workforce preparation scholarship in Australia would help to identify evidence gaps and to guide dietetics educators in conducting future research.

Meeting heightened expectations while managing a demanding workload, as expressed by participants here, confirms suggestions made in earlier literature^{26,27} and is a challenge shared by dietetics practice educators.¹³ Dietetics educators' view that they need to 'do more with less' will likely continue given that they are operating in a field that straddles both the health and higher education sectors. This may be further amplified by the non-collegial culture described by the dietetics educators in the present study. There is a need for broad engagement across the entire profession to share the responsibility of cultivating future dietitians. Professional associations must incentivise and facilitate engagement of more practitioners in dietetics workforce preparation while leaders in dietetics education need to advocate for and illustrate examples of how this can be achieved. Bringing together groups of dietitians with shared concerns and interests, such as through communities of practice,^{59,60} may be effective in enhancing collegiality among the workforce.

The views expressed by the dietetics educators in the present study are consistent with the three innate needs that influence motivation as described in self-determination theory⁶¹ which has previously been used as a framework to

understand learning and teaching processes in medical education.⁶² The need for autonomy (a desire to feel in control of one's own destiny) is reflected in how the educators felt constrained by rigid accreditation standards. The educators' perceptions that they were in a position to influence future dietitians and the existence of a non-collegial professional culture signals their need for relatedness (a desire to feel accepted, valued and connected to others). The perceived need of educators to meet heightened expectations and 'do more with less' aligns with their need for competence (a desire to feel effective by seeking out challenges that can enhance skills). This theoretical framework could be used in future studies to further explore the motivations of dietetics educators and other stakeholders involved in dietetics education.

Future research that explores the perspectives of other key stakeholders in dietetics workforce preparation, including dietetics practice educators and dietetics graduates, would be valuable. These perspectives may either corroborate or challenge the views expressed by the educators in the present study and could further inform dietetics workforce development by contributing additional insights into the challenges that need to be addressed. Furthermore, exploring potential solutions to the challenges faced by these key stakeholders could be a useful catalyst to enhance efforts towards dietetics workforce preparation quality improvement. The exploration of challenges experienced by dietetics educators in other countries is also needed to advance dietetics education, and workforces, internationally.

This is the first study to take a national approach to broadly explore the experiences of academic dietetics educators in Australia and has revealed challenges faced within this important workforce group. Throughout the study, steps were taken to ensure rigour was demonstrated. The primary researcher conducted all interviews to ensure consistency and reliability while verbatim transcripts enhanced confirmability.⁴² Reflexivity was employed during data collection and analysis to acknowledge the researchers' positions and their potential impact on the findings.^{33,63} The involvement of multiple researchers in coding and analysis was used to enhance dependability, credibility⁴² and interpretive validity.³² Furthermore, the reporting of this research was guided by the relevancy, appropriateness, transparency and soundness (RATS) qualitative research review guidelines.⁶⁴

The small sample size of the present study is consistent with qualitative research aimed at obtaining in-depth insights of the phenomenon being investigated from well-placed informants. Transferability of the present study's findings was enhanced by purposively selecting a diverse sample of participants from across Australia. The challenges faced by the educators in the present study may or may not be experienced by other dietetics educators. Non-respondents were not followed up. However, given that two respondents declined the invitation due to a lack of time, it is plausible that this may have prevented their participation. A potential limitation of the present study was that participants may have been affected by social

acceptance or desirability bias due to the interviewer being a dietetics educator.⁶⁵ Care was taken to ensure that questions were open-ended and not leading in order to minimise researcher influence on participants. It is not known if or how revised competency and accreditation standards for dietetics programs in Australia implemented since the present study took place^{66,67} will impact dietetics educators' perceptions. However, ongoing engagement with and exploration of dietetics educators' experiences regarding the phenomenon of interest is warranted.

The present study has provided an opportunity for one group of influential stakeholders in dietetics education to share substantial insights into the phenomenon of dietetics workforce preparation. Dietetics educators believe they have the capacity and drive to shape the dietetics profession—a profession which is ideally placed to help address the growing burden of nutrition-related health conditions. The present study reveals that dietetics educators are motivated to optimise how dietitians of the future are prepared and are attempting to match preparation efforts with practice but are impacted by and faced with numerous challenges. For dietetics workforce preparation to be optimised, strong leadership, academic collaboration, meaningful scholarship and greater engagement is required for the benefit of the entire profession.

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Conflict of interest

The authors KM, DR and KC are associated with university dietetics programs which contribute to the academic dietetics educator workforce in Australia.

Authorship

KM conceptualised and implemented the study, analysed the data and took the lead role in manuscript preparation. DR and SS contributed to data analysis, and DR, KC and LC contributed to data interpretation and peer-review. All authors contributed to manuscript preparation and approved the final version of the manuscript submitted for publication.

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Supporting information

Additional Supporting Information may be found in the online version of this article at the publisher's web-site:

Table S1 Demographic and professional attributes of dietetics educators (n = 15) who participated in interviews regarding dietetics workforce preparation

ORIGINAL RESEARCH

Recruiting young women to weight management programs: Barriers and enablers

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Abstract

Aim: Recruiting young women to weight management research programs is difficult. The purpose of this study was to gain insights into the barriers and motivators that influence participation and to explore effective methods of recruitment from the perspective of young women with obesity living in both urban and regional areas.

Methods: Semi-structured interviews were used to elicit information from focus groups. The interviews were transcribed, coded and analysed qualitatively. Eight focus groups, which included a total of 27 women, were conducted. Participants had a mean age of 29.1 (± 5.1) years and a mean body mass index of 35.8 (± 2.9) kg/m².

Results: The barriers to participation were multifaceted and largely similar across urban and regional participants. Fear of judgement and uncertainty about the process were major psychosocial barriers. A lack of tailoring of program content was an important program-related barrier. Physical barriers such as time commitment, cost and access were discussed extensively, particularly in urban groups. The provision of incentives and the use of positive language that focusses on the benefits of the intervention were viewed positively. Physical and virtual methods of recruitment were identified as potentially effective provided they were presented in media that this group is likely to use and can access in a private location.

Conclusions: The results of this study provide a greater understanding of the challenges faced by young women in relation to participation in weight management programs and some of the potential methods that could be utilised to facilitate participation.

Key words: recruitment barriers, weight-management, young women.

Introduction

The prevalence of obesity in young Australian women has more than doubled from 1995 to 2011.^{1,2} Young women are gaining weight more rapidly than older women or men³ and this appears to be more pronounced for women

living outside major cities as they are more likely to be above a healthy weight range and engage in less leisure-time physical activity compared to women living in urban areas.^{1,4} There are significant physical consequences for young women with obesity (e.g. hypertension, polycystic ovaries, infertility, obstetric complications, back pain, sleep-disturbance) as well as longer term effects on their health (e.g. degenerative joint disease, increased risk of diabetes, cardiovascular disease and cancer).^{5–7} Psychologically, young women with obesity typically experience intense body dissatisfaction, low self-esteem, depression, social withdrawal, and interpersonal difficulties⁸ as well as distress associated with engaging in popular diets that are often extreme and difficult to follow in the longer term.^{9–11} Furthermore, young women with obesity experience the negative effects of weight stigma; a social phenomenon referring to the 'negative social meanings' attached to being overweight¹² such as the perception that being overweight is associated with moral failings,

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poor willpower, gluttony, lack of motivation and noncompliance.^{11–13}

Recruiting young women in the 18 to 35 year age range to weight loss research involves unique challenges. This is a developmental stage marked by rapid life transitions and balancing multiple priorities, such as tertiary education or work, moving out of home, entering relationships, living with others and becoming parents.^{3,14,15} It is at this time that dietary habits tend to change and include an increased consumption of sugar sweetened beverages, poor vegetable intake, social activities that involve drinking alcohol and eating out, coupled with limited experience preparing meals.^{3,16} These life-transitions and lifestyle factors can have a negative impact on weight and physical activity and are likely to influence the decision to participate and complete health interventions.^{3,14,16,17}

Despite the need for effective weight management interventions, younger women are underrepresented in weight management research generally.^{18–20} Recruitment tends to be slow, failing to meet targets within a planned time frame, and there is substantial attrition leading to studies being terminated prematurely and being inadequately powered.^{17,18} Little is known about the barriers and enablers associated with recruiting this age group¹⁸ and research on interventions targeting obesity do not typically detail how to engage them.³ Some of the barriers reported by emerging adults (males and females between 18 and 25 years) include a lack of time, motivation and tailoring of program content.²¹ In contrast, adolescents and their parents identified weight stigma, lack of services, and cost as barriers to participating in behavioural weight loss programs.²² Women living in regional communities (i.e. towns and areas that lie outside beyond major cities with populations less than 50 000 persons)²³ are likely to face additional barriers such as having to travel further distances to access health-related interventions.²⁴

The known characteristics of behavioural weight loss programs that encourage participation include a focus on lifestyle, including messages about healthy living^{21,22} and offering them free of charge.²² The use of digital health interventions has also been found to encourage participation in health interventions (not specifically weight management), as these can assist with maintaining motivation, and reduce anxiety about participation.²⁵

The purpose of the study was to gain further insights into the barriers and motivators that influence participation in weight management programs, specifically in the young adult female cohort (between 18 and 35 years), and in both urban and regional communities. This study aimed to highlight important issues to consider in the design of future weight management research studies which could be translated into clinical practice.

Methods

The conduct and reporting of this paper adheres to the guidelines outlined in the Consolidates Criteria for Reporting of Qualitative Research (COREQ).²⁶

Participant recruitment and inclusion criteria: Women were recruited to the study in several ways: through flyers distributed at two universities; via a university E-newsletter; and using a database comprising previous participants. A \$100 gift card was provided for participation as a means of reimbursement for expenses incurred attending the focus groups (e.g. travel, parking). Participants were required to be female, have a body mass index (BMI; kg/m²) between 30 and 40, have undertaken at least three serious weight loss attempts in the past and be fluent in English. They were excluded if they had previous bariatric surgery or were pregnant or breastfeeding.

Focus Groups: The participants were recruited to 90-minute focus groups (2–6 participants/group). The groups were audio-recorded and held in a private meeting room on a university campus. A semi-structured interview protocol developed by the research team was used to elicit information from members of the focus groups.^{27,28} The questions probed the following three major themes: the barriers for young women participating in studies involving weight loss interventions and how could those barriers be overcome; the best ways to recruit young women to such programs; and the most effective forms of media to target young women (See Appendix). Experienced facilitators, who were not known to participants, conducted all focus groups. Two members of the research team were present during the focus groups.

Interviews were recorded and uploaded to a secure commercial transcription website and transcribed verbatim. Any sections of the transcripts that were inconsistent with context were rechecked by one research team member who listened to the audio-recordings and corrected the transcript. Field notes reflecting non-verbal cues and discussions outside of the recording were used as an additional confirmation of the transcription. Participants were asked to review a copy of their own transcript to ensure content accuracy. Comments and amendments returned by participants were compiled into a single document per focus group. Amended transcripts were then imported into NVivo (v. 12.0),²⁹ qualitative data analysis software, for initial coding. Qualitative content analysis was initially conducted by two of the researchers. The coding was then checked by another researcher, and amendments and refinements to the coding tree were discussed. The themes identified across the focus groups were then reviewed by other members of the research team.

Ethical approval was provided by the Ethics Review Committees of the University of Sydney (Project No: 2014/1018) and Charles Sturt University (Project No: 2014/050). All participants provided formal voluntary informed consent prior to commencement.

Results

Participant Characteristics: Fifty-two women expressed interest in participating. Twenty-four participants did not participate because they were either ineligible due to a low BMI (n = 4), not contactable for screening (n = 9) or

there were scheduling difficulties (n = 11). One participant who agreed to participate did not attend (reason unknown). The remaining 27 women participated in the study. Participants were aged between 18 and 35 years, with Class I and II obesity (BMI between 30 and 40). They had a mean age of 29.1 (± 5.1) years and a BMI of 35.8 (± 2.9) kg/m². There were eight focus groups with similar participant characteristics in terms of demographics and BMI, five groups from an urban area (16 participants) and three from a regional area (11 participants). Participants were not known to each other and had engaged in a variety of weight loss experiences including commercial weight loss programs, personal training/exercise, diet book/magazine approaches, meal replacements or dietitian supervised.

Barriers influencing participation in weight management programs: The participants' description of the barriers suggested that multiple factors are involved across three domains: psychosocial, physical and program-related. The psychosocial domain was discussed extensively across both urban and regional participants, referencing four main themes: fear of judgement by health professionals/researchers or other participants; discomfort associated with talking about weight; fear and the need to feel safe participating; and the challenge of overcoming the denial about the need to address weight. The following excerpts reflect these psychosocial themes:

'Some things you don't wanna share with a group, 'cause you might feel like you're the only one, or you've failed. You don't know what other people are thinking about you.' (ID7Urban)

'If you're not comfortable within yourself talking about weight, you've got no chance enrolling in a study, but if you're happy talking about it, well, you've got every chance, but there are some people out there that I'm just not gonna tell I'm fat. Oh, no! I can't talk about how big I am. There's people out there that they really need help, but in their heads, they're like "I am not admitting that".' (ID6Urban)

'I think for me personally, the weight loss issues haven't been physical, but psychological. So, admitting to it can be quite hard compared to maybe other illnesses where the psychological part of it is not as important. So, I think it would be harder sometimes to get people who have weight loss issues-compared to other things.' (ID1Urban)

The need to feel safe participating is highlighted in the following exchange:

'One thing that I think might be deterring some women in the larger higher weight category for weight studies is because you actually take measurements and waist measurements and I think a lot of times, larger women actually just don't like that. I think it's a very embarrassing experience for a lot of women and also not knowing who is gonna be

there, who is gonna be watching, is it public? Just thinking about these things can be really intimidating.' (ID10Urban)

'I was thinking about the idea of risk management from the participant point of view 'cause if they don't quite know what they're in for, then they might not participate, but if they know they're gonna be safe the whole way, that it's not pushing your body to limits in any way, shape or form, then I think it makes it much more appealing for people to participate.' (ID3Urban)

The second category of barriers was physical and related to location and access (whether they could commute, availability of parking and public transport); time commitment; and other participation costs and registration. Physical barriers were discussed to a greater extent in urban groups.

'I think the time is probably a big barrier, being time poor. Yeah, and also, where it is. I think you'd be more likely to get people that are based around [the city] if that's what you're prepared to do. So, how willing you are to travel is important.' (ID9Urban)

'A lot of women in this age group don't have a lot of time. They're getting their career sorted, they're socializing. At the end of the day, how they look and what they eat especially, comes last.' (ID14Regional)

'I'm so pressed for time. There is definitely no time inside work hours, and outside work hours, I've even got to organize my husband, make sure he picks up the kids and those sorts of things. Before kids, I loved to walk, I grew up on a farm, I was always walking.' (ID18Regional)

The third category of barriers discussed was program-related. A lack of tailoring of programs to younger women was identified as a major program-related barrier.

'I like something that's tailored. I want someone who has sort of looked at my entire being, not just my BMI and says 'okay, this is what's best for you whether it's exercise, food'. All these programs that are bulk-built are rolled out for people in all different stages of their lives- someone that looks at what my work life looks like, what my children look like, what my time looks like and says, okay, for you- this environment, these are the optimal ways to get your exercise in. This is the best way to find something that is sustainable because it is not sustainable for me to go to the gym every night.' (ID18Regional)

Factors enabling participation to weight management programs: The participants' description of the factors enabling participation were varied and were discussed to a greater extent by urban women. A recurring theme across groups was that participants disliked the use of descriptor words such as 'obesity' and 'weight loss' as they were seen to have a negative and judgemental undertone. Participants reported being more comfortable with the use of words such 'fitness', 'health', and 'well-being' as they do not engender weight stigma connotations.

‘When I decided to participate in this study, I thought—was this going to be uncomfortable or not? And I sort of looked at the wording again and I felt like—it was just really professional and it felt like it was respectful, so I felt pretty confident that it would be a positive experience, and it was a professional communication with you and I think if it hadn’t been, maybe I would have said: You know what? There’s a chance that people will say some sort of comment that won’t be respectful, and it will just be an unpleasant experience.’ (ID10Urban)

‘Sometimes it’s as simple as wording, like I read the word obesity and I go, “Oh, I’m not doing that.” Even though like probably technically, I am obese. I still will read and go, “Oh, I’m not doing that”, whereas if it is says—with a BMI over this, or if you fit these criteria, I would consider it.’ (ID12Urban)

‘I think the word obesity somehow, it just feels really ugly and it’s not a nice word- yeah. And even though BMI is-yeah- like flawed for its own reasons and I don’t love that either- I find that there’s like less emotional attachment. I think using words like health, fitness or mood and those kind of things helps counterbalance some of the negative stereotypes, so being someone who’s interested in health, fitness and being a young woman, these all seem like really nice things to identify with’ (ID10Urban)

Incentives were considered to be a strong enabler for young women considering participation in health programs. Tangible rewards such as payment, gift cards, discounts, purchase of items, and travel compensation were the most popular incentives. The provision of medical and psychological feedback, developing self-understanding, becoming fit and healthy, and enjoyment were also considered to enable participation.

‘I was thinking maybe if somehow in the ad, it could-or maybe somehow the study could slightly somehow be changed so that not only are you doing the study but you’re getting something back in return, like you’ll know your iron levels and you’ll get cognitive feedback. Just something like making you feel you’re getting something back out of it. It’s then not just about putting themselves out there, being vulnerable, sharing about their struggles with weight and then walking away without.’ (ID18Regional)

Methods of recruitment to intervention studies: The preferred methods of recruitment identified by the participants were broadly categorised as physical and virtual. Both categories were highlighted as potentially effective by participants. Physical methods consisted of subcategories related to format and location of the recruitment advertisement and included traditional recruitment methods (e.g. pull-off-tags, newspapers and flyers, as well as the more recent advent of the Quick Response codes), and informal recruitment methods (e.g. word of mouth).

Word of mouth via doctors, personal trainers and friends were viewed as acceptable methods of recruitment while

newspaper and magazine advertising was often overlooked and not a medium that younger participants engaged with.

The use of noticeboards and pull-off-tags was not viewed positively as there would be discomfort looking at such a poster or pulling off a tag in public. However, pull-off-tags were viewed positively if they could be accessed in a private location. The need for privacy is reflected in the following excerpts:

‘A women’s-only area is another area to post flyers as it is private- even in a public part of a women’s change room as opposed to the library at uni where I could run into my students or my supervisors. I think less super public areas would help.’ (ID10Urban)

‘Whatever online method it would be, I think privacy is still important. So, for example, I wouldn’t want to “like” a page about a weight loss study and I wouldn’t “re-tweet” a study about obesity ‘cause yeah, I think privacy is such a big part of it.’ (ID21Regional)

‘I think also a lot of people would steer away from face-to-face interaction. So, if there’s a way to put things into a different aspect so that they complete the first section where they don’t have to face somebody because they are dealing with anxieties around that area. Then they go, “Oh that’s not too bad”.’ (ID20Regional)

Advertising weight management programs in doctor’s surgeries, dietitian’s rooms, medical centres, hospitals, community health centres, gyms and fitness/weight loss centres was viewed favourably. The acknowledgement of the need to address weight issues at these locations was raised several times (refer to the following text):

‘If you have someone with weight loss issues that doesn’t wanna face the fact that they’ve got an issue, then a newspaper would be hard to reach this person, but if someone that’s already going to see a dietitian or doctor because of their problem, then that person is already aware of it and it is not as scary talking about the issue.’ (ID1Urban)

Virtual methods consisted of e-mail, e-newsletters, social media and websites. These were reported as favourable and have the added benefit of being able to be accessed in private. Urban women made more references to virtual methods than regional women. All the references to recruitment via social media by the regional women were associated with Facebook, whereas urban women also mentioned Twitter and social media in general. Potential problems associated with these methods included privacy, malware and trustworthiness/legitimacy.

Discussion

The purpose of this study was to gain insights into the barriers and motivators that influence participation in weight management programs and to explore effective methods of

recruitment from the perspective of young women with obesity living in urban and regional areas.

A principle finding from the study was that fear of judgement is a major barrier to participation across both urban and regional participants, which has been reported previously by adolescents.²² While this fear of judgement is not unique to young women, as a group they likely attract more weight stigma than older age groups. Weight stigma can lead to an intense fear of being judged by health professionals/researchers or other participants. This fear is not unfounded as health care professionals may hold negative judgements and biased thinking about individuals with obesity.^{30,31} Potential participants may also interpret the invitation to participate in a weight management program as intrinsically stigmatising³² in that such programs are designed for change, indicating that their current body weight must be considered inappropriate. Weight stigma may also make it difficult for the target group to even admit that there is a problem that needs to be addressed as this requires identifying with a stigmatised group which can feel threatening.³³ Moreover, when individuals personally endorse negative social judgements about body shape, they come to perceive that the traits they must embody because they are overweight (such as poor will power and gluttony) are stable and unable to be changed.^{11,13,15} This leads to low motivation, low-self-efficacy³⁴ and ultimately avoidance; known as the 'why try' effect.³³ Recruitment methods that convey positive health messages about body image, promote a positive group identity and are focussed on the benefits of the intervention, were endorsed by focus groups.

Concerns about the process of participation also emerged as a major psychosocial barrier for both urban and regional participants. Participants in this study identified the potential to feel discomfort and vulnerable across many aspects of the weight management process such as talking about weight, having measurements taken, physical limitations, using gym equipment and even meeting a new group of people. This barrier has not been reported in previous research but is more easily resolved than some of the more entrenched barriers such as weight stigma. Providing clear information about the program, the research environment and details about what will be expected of participants might assist with reducing fear and feelings of vulnerability.

Physical barriers related to location, access, time commitment and cost were discussed significantly in all focus groups but to a greater extent amongst urban participants. While time commitment has been previously reported as a major barrier to participation for the young adult cohort as a whole,^{21,35} access to health-related interventions is generally considered to be more problematic for regional participants.²⁴ It may be that regional participants did not discuss location as much as urban participants because they simply assume a lack of services are available.²⁴ Alternatively, the results may reflect the fact that location is a major barrier for urban participants as well, as they have to contend with traffic, transport, and limited (costly) parking in metropolitan areas. Given these barriers, it would therefore help to deliver programs at flexible times and in locations that can

be easily accessed by public transport or where parking is available. Adding an online component with less face-to-face intervention may also assist with keeping this time-poor cohort engaged,¹⁸ and may provide an alternative to travelling to appointments.

An important program-related barrier across urban and regional participants was a lack of tailoring of programs to the needs of young people. Unfortunately, weight management programs tend to be designed for middle- and older-aged cohorts managing obesity-related comorbidities^{15,18} and are not necessarily relevant to young adults³⁶ in that they do not typically address issues such as eating out and cooking, childcare and relationships.^{3,37} Weight management programs that incorporate interventions relevant to developmental age and life circumstances, as well as individual needs based on a pre-assessment, appealed to this group.

As reported in previous research, the use of incentives were thought to encourage participation.^{21,36} The incentives identified by participants in this study included intrinsic motivations such as getting healthier, as well as tangible rewards such as payment or gifts. Previous research has shown that small financial incentives promote weight loss and weight loss behaviours such as self-monitoring, but only in the short-term.^{38,39} Further research is needed to establish their longer-term cost effectiveness and their effectiveness at eliciting weight loss and/or program adherence over the long term.

Finally and with particular relevance to this digitally engaged age group, both physical and virtual recruitment methods were viewed favourably by urban and regional participants, provided they can be accessed in a private location. The importance of privacy has been reported anecdotally in other studies.^{8,18} The physical and virtual recruitment methods described by participants consisted of both active (face-to-face) and passive modes (print methods and mass media).³⁶ Regarding active modes, there was an acknowledgement amongst participants in this study that advertising weight management research studies in primary care settings was appropriate. However pressures on clinicians may hinder recruitment efforts.^{18,40} Passive methods, such as Facebook, tend to be more cost effective, encourage self-referral, and are considered helpful for accessing those in more remote settings.^{36,40} However, in this particular study, urban participants made more references to virtual methods of recruitment. Methods such as Facebook are limited in other ways. For instance, because Facebook uses peer network structures to circulate advertisements, members of stigmatised groups may be reluctant to endorse the content publicly, limiting the circulation of the recruitment advertisement through social channels.⁴⁰ As both active and passive modes were viewed favourably amongst participants and both approaches have limitations, a recruitment strategy that integrates a combination of both modes, may have greater yield.³⁶

The use of qualitative methods and focus groups is a strength of this study. This method has been found to identify more barriers related to participation in clinical trials compared to quantitative methods⁴¹ and it allows for a rich contextual analysis of experiences that are of a sensitive nature.²⁶ There are, however, some limitations. A large

number of participants (21%) declined to participate in this study due to scheduling issues. This is similar to the rate reported by Griffin *et al.*¹⁸ Participants who decided not to proceed may be a qualitatively different group from those who elected to participate. Indeed, some of the sample had participated in a previous study, perhaps indicating they had fewer barriers or they were able to overcome any barriers to participation. The current sample is also likely to be from a higher sociodemographic population as many were recruited from university networks, therefore limiting the generalisability of the findings.

The results of this study provide a greater understanding of the challenges faced by young women in relation to participation in weight management programs/studies, and some of the potential methods that could be utilised to facilitate participation. The study highlights the need to consider weight stigma, concerns about the process, language, incentives, tailoring program content, location, time commitment, and utilising recruitment methods that are engaging and provide anonymity. These issues were relevant to both urban and regional participants. Future research could investigate whether addressing these issues enhances participation rates.

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Conflict of interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

Authorship

HTO, KSS and NJO conceived the study. HMP, JAG, CED, HTO and EMG assisted with data collection. KYL, EMG, JAG performed the analysis of data. NDC, KYL, EMG, JAG, HTO interpreted the data. NDC, HMP, HTO drafted the paper, then all authors proof read and edited the paper.

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Appendix

Interview Guide

Hello, my name is (insert investigator name) from the University of Sydney. We are conducting research in young women. As discussed with you, and as you have provided your informed consent, we are now conducting this interview to help us understand better ways to recruit young women to programs weight management programs/research studies.

Your responses will be confidential to the research team.

I need to go through a few housekeeping items before we start.

- I just want to remind you that the interview is being recorded. Other members of the research team may also listen to the recordings at a later date.
- You may decline to answer any question or section of questions, and can finish the interview at any time.

For the purposes of the audio recording, today's focus group interview was conducted on [insert date] at [time] am/pm.

Barriers associated with recruiting young women to weight management programs/research studies: There is evidence that

recruiting young women to weight management programs/research studies is challenging. We seek to understand why.

- What might the barriers be to participation in such programs/studies?
- How could we potentially overcome these barriers?
- Are there specific factors which influence engagement?

Ways of engaging women in weight management programs/research studies: We seek to understand the best ways to engage and recruit young women to weight management programs/research studies.

- What would be the best way to engage and recruit young women to weight management programs/research studies?

Ideal forms of media to use for recruitment: We are currently planning an intervention on weight management and want to use the best forms of media to recruit young adult women.

- What are the best forms of media to use for young adult women?

ORIGINAL RESEARCH

‘Back to Life’—Using knowledge exchange processes to enhance lifestyle interventions for liver transplant recipients: A qualitative study

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Abstract

Aim: Interventions to prevent excessive weight gain after liver transplant are needed. The purpose of the present study was to enhance a specialist post-transplant well-being program through knowledge exchange with end-users.

Methods: The study used an interactive process of knowledge exchange between researchers, clinicians and health system users. Data were collected as focus groups or telephone interviews and underwent applied thematic analysis.

Results: There were 28 participants (age 24–68 years; 64% male). The results identified experiences that may influence decisions around health behaviours during the course of transplant recovery. Three over-arching themes were identified that impact on liver transplant recipients post-transplant health behaviours. These include (i) *Finding a coping mechanism* which highlighted the need to acknowledge the significant emotional burden of transplant prior to addressing long-term physical wellness; (ii) *Back to Life* encompassing the desire to return to employment and prioritise family, while co-ordinating the burden of ongoing medical monitoring and self-management and (iii) *Tailored, Personalised Care* with a preference for health care delivery by transplant specialists via a range of flexible eHealth modalities.

Conclusions: This person-centred process of knowledge exchange incorporated experiences of recipients into service design and identified life priorities most likely to influence health behaviours post-transplant. Patient co-creation of services has the potential to improve the integration of knowledge into health systems and future directions will require evaluation of effectiveness and sustainability of patient-centred multidisciplinary service development.

Key words: focus groups, health service design, liver disease, obesity, patient engagement, quality of life.

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Introduction

Rapid weight gain after liver transplant is a worldwide phenomenon with 16–46% of liver transplant recipients (LTRs) becoming obese in the first year after transplant.^{1–8} There is a higher prevalence of metabolic syndrome in LTRs compared with the general adult population and this appears to predispose to increasing cardiovascular disease risk, graft rejection, infection and other complications.⁹

Adjusting to a liver transplant is a complex process which incorporates both physical and mental components of recovery. LTRs endure significant physical and psychological stress awaiting surgery¹⁰ and group-based psycho-educational strategies appear effective at improving coping strategies and social support pre-transplant.¹¹ There is, however, a paucity of data addressing how best to deliver diet and exercise prescription for post-transplant recovery



and how lifestyle interventions may prevent obesity and cardiometabolic complications post-liver transplant. The development of targeted lifestyle interventions to prevent excessive weight gain and manage cardiovascular risk requires a process of knowledge exchange between service providers and patients, in order to meet the unique needs and life priorities of this cohort.

The purpose of the present study was to use a process of knowledge exchange to involve knowledge users in research and explore the everyday experience of LTRs to co-create a specialist health and well-being program aimed at reducing cardio-metabolic risk factors post-transplant. The study aimed to engage with LTRs to define life needs and priorities, and capture the emergence of factors that influence health behaviours across the spectrum of pre- and post-liver transplant health services.

Methods

A stakeholder group of five liver transplant specialists, including physicians, nutrition and exercise experts from a single Australian transplant centre (40–55 transplants per year) developed a framework of key factors (enablers and barriers) that could impact on the long-term health of LTR, which informed the development of the present study. In preparation for a process of knowledge exchange, for example, imparting meaningful knowledge between knowledge users (LTR) and producers (investigators and health practitioners), this framework drew from components of implementation science, such as level of evidence (determined by literature review), context of health service delivery system (determined by extensive clinical experience working within the system) and unique needs of LTR (determined by both published evidence and clinical experience).^{12–14} This framework was further refined with clinical consultation and reference to individual, institutional and systemic factors that impact on health behaviours including patient perceptions of weight gain and ‘healthy lifestyle’ post-transplant, life priorities, timing of service delivery and acceptance and feasibility of technology-assisted service models (Table S1). The framework then informed the development of semistructured interview questions designed to promote knowledge exchange and capture LTR live experience of transplant and perceptions of health priorities in relation to long-term well-being (Table S1). Data saturation determined when to cease recruitment and was defined as no new information being offered either through the knowledge exchange or prioritisation processes.

Interviews were conducted with LTRs through either focus groups or telephone interviews. Participants were offered opportunities to share experience and knowledge during early (within 6 months of transplant) and long-term (>6 months post-transplant) health service follow-up. Participants were asked to prioritise factors that they considered most influenced their health behaviours post-transplant.

The study was approved by the Metro South Hospital and Health Service Human Research Ethics Committee

(HREC/15/QPAH/804). All participants provided written informed consent (received by post for those undertaking telephone interviews).

The study population included adults who had undergone a liver transplant and had ongoing medical review as an outpatient of the service. Transplant registry lists were screened for eligibility with inclusion criteria of ≥ 18 years of age, undergone a liver transplant ≥ 12 months ago and English-speaking. Participants were opportunistically sampled to identify those already scheduled for outpatient visits during the recruitment period (January–June 2015), and purposively recruited to achieve broad demographic diversity including gender and geographical location. Eligible patients were not previously known to the investigators (although were known to the transplant clinic) and contacted via telephone, had the purpose of the study described and invited to participate in the study. Those who agreed to participate were scheduled for a face-to-face focus group (1–1.5 hours) or a telephone interview (30 minutes) based on their preference.

Four focus groups (total participants $n = 17$) were conducted by investigators DC (APD, female, research student) and IJH (PhD, research fellow, female, experienced researcher) over the study period and consisted of seven prepared questions. There were no non-participants present. Each group also developed a list of life priorities to identify the most important influencing factors in their lives at three different time-points across the transplant continuum: pre-transplant; early post-transplant (within 6 months); and ≥ 12 months post-transplant. Participants were encouraged as a group to name life priorities at each of the three time-points until no new priorities were identified. These were listed in order of mention on a whiteboard for all to see. When all participants had considered the group list, they were asked to anonymously write down the top five most relevant issues to them personally for each time-point, in order of priority for them as an individual. This could include priorities that had not been discussed by the group. The participant’s priority list was given to the investigator without sharing with the group.

All discussions were audio-recorded and transcribed for data analysis. Certificates of appreciation were presented to participants on completion.

The option of a telephone interview was offered to participants who could not attend face-to-face due to geographical distance or personal commitments and was chosen by 11 participants. The choice to use both focus groups and interviews in this way was to ensure broad participant diversity, and to offer opportunities to voice issues that the participants may have been uncomfortable to discuss in a group setting. Due to lack of group dynamics, the priority listing exercise was modified for individualised interviews.

Data analysis: Data were reported according to the COnsolidated criteria for REporting Qualitative research (COREQ).¹⁵ Interviews and focus groups continued until saturation of themes was reached. Audio-recorded data from focus groups and telephone interviews were transcribed

verbatim, and entered into NVivo11 (Qualitative Software for Research (QSR) International 2017). Applied thematic analysis was used as an exploratory approach to code broad emergent themes (DC).¹⁶ Subthemes that emerged were augmented using both an inductive approach (developed after consultative interpretation of the analysis) and a deductive approach (bound by the intent of informing the development of a health promotion program). Coding was cross-checked by secondary analysts (IH) and triangulated (DG) to validate interpretations and consistency. Illustrative quotes are from participants in focus groups (FG) and telephone interviews (TI) with multiple options proposed by analysts (DC and IH) and chosen with consensus by all authors.

The prioritisation exercise whereby patients listed their top five life priorities at pre- early post- and post-transplant was analysed using content analysis to determine the greatest frequency of stated life priorities clustered across the three pre-determined time-points.¹⁷ Similar meaning words were collapsed into themes and triangulated by an independent researcher. Frequency of word clusters were matched with identified themes to estimate when sub-themes were most likely to emerge or change over the course of recovery.

Results

Figure 1 illustrates the recruitment flow diagram with $n = 28$ agreeing to participate. Participants were 24–68 years old (mean: 53 ± 13 years) and 18 (64%) were male. Median time since most recent transplant was 4 years (range: 2–5 years). Both focus groups and telephone interviews consisted of participants from local, regional and interstate locations. Geographical residence of participants ranged from 13 (46%) being located within the tertiary hospital catchment area, 6 (21%) within 100 km of the hospital and 9 (33%) >100 km from the hospital. Average time

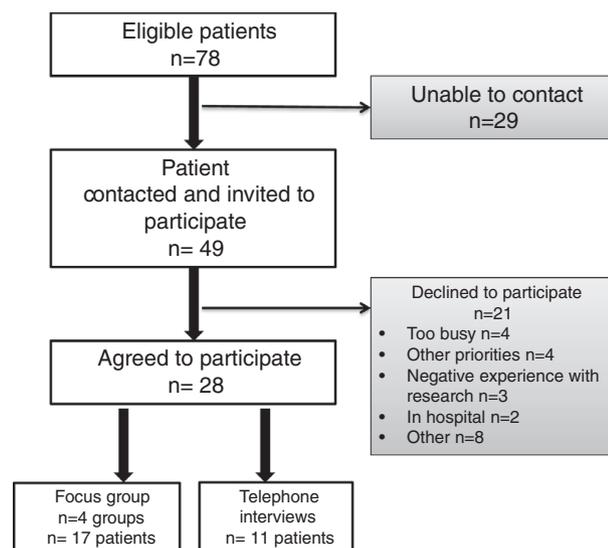


Figure 1 Study participant recruitment flow diagram.

for focus groups was 82 minutes (range: 70–90 minutes) and individual interviews was 27 minutes (range: 15–48 minutes).

Thematic analysis identified three over-arching themes and multiple subthemes (Figure 2). The timing of when each subtheme emerged across the transplant journey was estimated by matching with the frequency of life priorities listed by participants at each of the three pre-defined time-points and was determined by consensus among investigators (DC, IJH, DG and AB) (Figure 2).

Finding a coping mechanism

At every stage of transplant (from pre-surgery to many years post-transplant) participants stated that finding a way to cope emotionally and physically with the transplant experience was a high priority and infiltrated most decisions regarding health behaviours.

Facing an unknown future after near-death: The fear of an unknown future ruminated constantly prior to transplant and left a strong legacy of uncertainty well after transplant that continued to impact on future life plans.

‘The foremost thing was getting a transplant, but not knowing what was ahead of me though, so you don’t really know, it’s one of those things that you think... .. is it going to be good or is it going to be bad’ (TI, 16)
 ‘For me every blood test was Russian roulette... there was always someone who was in some degree of rejection... so every blood test was you know, is it my turn to find I’m in rejection. That was all the way through that first 12 months... that weighs very heavy on your mind... only stuff that sticks in your mind is the bad stuff all of a sudden when you’re lying in bed at 2 am’ (FG4, 32)

Emotional and psychological support networks: Participants expressed the need for emotional and psychological support networks to cope with feelings of guilt and uncertainty at all stages of transplant. Family and social influences could significantly impact adherence to health behaviours in either a positive or negative way depending on the degree of perceived emotional and psychological support received. A common topic that emerged was the importance placed on mentoring or peer support from other LTRs, in the form of social and emotional support.

‘People that had had transplants and they used to come up and give a talk too and they’d talk to you about um you know what they went through and how they handled it and you got to actually talk to them face to face and you could ask them whatever questions you wanted to... That’s the best way if there’s someone [another LTR] close that can organise to meet and just have a talk yeah that’s all they need, a bit of support’. (TI, 16)

However, participants also desired greater psychological support from the hospital clinic to develop coping strategies for stress and anxiety, which they perceived to impact on physical wellness even years after transplant.

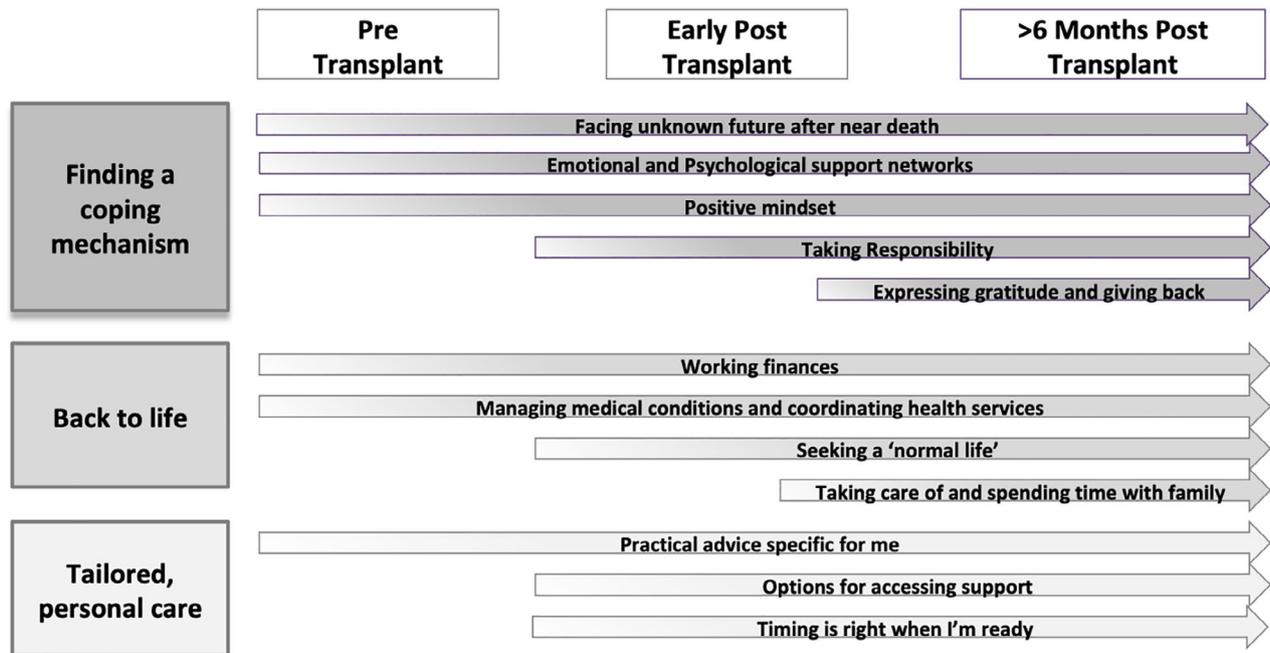


Figure 2 Three overarching themes with subthemes emerging across the liver transplant journey, which have potential to impact the design of diet and exercise wellness programs.

'The psychological aspect as well I'm a big advocate for that I don't think we do enough in that area as well simply because you know, the transplant friends I have, none of us have ever had any sort of support or anything like that. I think that it's a big factor that's sort of overlooked'. (FG, 31)

'So it was really, also the questions of how to actually maintain a balance in terms of your thinking, you're sort of in a healing process, yes the physical stuff but also your sort of spiritual healing shall we say'. (FG1, 3)

Keeping a positive mindset: Participants placed a high importance on optimism and maintaining a positive mindset as a strategy for coping before and after transplant.

'I've got a second chance. I've still got these underlying issues; I've really got to keep on top of it so you can't really do that unless you stay positive'. (FG, 10)

Expressing gratitude and giving back: After the early post-transplant recovery, participants had a strong emotional connection related to a deep gratitude for the 'gift of life' and expressed need to 'give back'. This was nuanced by personal expression that may have been inward looking such as motivation to look after the new liver through a healthy diet or outward looking such as adhering to prescribed hospital advice or offering reciprocal support for others.

'I'm guessing that most of us go through stages where we feel like you know why us, and you know we're like eternally grateful for what was sort of given to us so I started to think that what I could do to give something back you know... How could I show that I was just being grateful you know'. (TI, 12)

Taking responsibility: By later stages of recovery (>6 months post-transplant), participants predominantly wanted to take responsibility for their actions, and take ownership of their own health. This was a coping strategy that made them feel in control of their health.

'I think maybe just people having, needing, to take the responsibility themselves and owning what's going on in their life. You know what I mean you can have all these people tracking you and following you and advising you but if you don't take that responsibility and own it, it doesn't work'. (FG, 20)

Back to Life

Participants described a renewed outlook on life and expressed their desire to return to 'normality' and 'stability'. The word 'life' was used in the context of rebuilding life, getting back to 'normal' life, 'making the most of life' and social life. Seeking a 'normal life' included recovering physically and emotionally, gaining back independence and returning to their ordinary day-to-day activities and way of living.

Work and finances: Returning to employment post-transplant was of critical importance. It was a prominent thought well before transplant and greatly influenced the prioritisation of health behaviours that impact on employment or managing finances after transplant.

'It was just trying to get back to work yeah cos you know being sick and being away from work and being in hospital quite a lot yeah it puts quite a lot of pressure on the family for bills and stuff like that' (TI, 15)

Taking care of and spending time with family: Participants valued family and social connections, and expressed a desire to take care of and spend time with their family after transplant.

'Yeah it's the best thing that ever happened to me you know, one yes I'm still alive but the lifestyle choices that I've made now whereas before we were um driven by material things now we're not. It's more about family and lifestyle and you know doing what we actually enjoy rather than you know keeping up with the Jones's'. (FG, 31)

Managing medical conditions and coordinating health service interactions: From an early stage, participants placed a high priority on their long-term wellness and linked that to living a 'normal life'. The management of ongoing medical issues, medications and side effects was a significant burden for participants, and outside what most people would consider 'normal'. Participants accepted the need for regular follow-up post-transplant, however, expressed a desire for receiving care outside of the hospital/clinic environment. They wanted integration of a wider range of support services such as general practitioners, dietitians and exercise specialists into their post-transplant care schedule.

'Probably educate the GPs a little bit better... the regime as to what the recipient should be doing so that the GP becomes effectively a part of your team. On exactly the same wave length of what recipients should be doing as you. Even down to little things like the GP should be getting you to get your blood tests done, should know the frequency of that'. (TI, 8)

'A long-term issue for me to deal with is staying well in regards to having a to keep on top of all the other medical stuff that's going on as well'. (FG3, 20)

Hospitalisations and outpatient appointments are burdensome, and participants described eagerly anticipating a decrease in frequency of hospital appointments, which was a common metric that they used to gauge their progress.

'I started off like you monthly and then 3 monthly and then 6 monthly for a couple of years and now its yearly. Yeah its great it's a good feeling'. (FG, 20)

Tailored, Personalised Care

Participants acknowledged their uniqueness in the community due to their specific requirements relating to long-term health advice and diet and exercise information specific for LTR.

Practical advice specific for me: The need for diet and exercise advice to be tailored to the specific needs of liver transplantation and personalised to the individual's circumstances became evident throughout the data. Participants identified a wide variety of preferences for long-term health care and support but always with a focus on practical advice for approaches to diet and exercise.

'The information that they give you is just like, it needs to be more tailored to individuals... What information that suits one person probably doesn't suit everyone. It depends [on] the circumstances you had your transplant under'. (TI, 21)

Options for accessing support: Participants' preferences varied for how they thought diet and exercise support post-transplant should be provided. Some had a preference for group-based education; while others wanted one-on-one interactions with health professionals. Participants valued in-person interactions with health professionals and suggested video conferencing for LTR who are not located close to the hospital. There were contrasting views on engaging with technology for diet and exercise support with some LTRs open to innovative technologies, while others objected strongly to this strategy and would prefer telephone follow-up or written resources.

'I love the electronics but it's not the same as a personal discussion... You've got to use a whole range of things and you know... a website where some generic information goes and then there's more personalised one-on-one contact and whether that one-on-one is actually sitting here face to face or whether its though skype or something like that because of distance factors'. (FG, 13)

Timing is right when I'm ready: Preferences for the timing of receiving post-transplant diet and exercise education ranged considerably. Some participants emphasised the importance of receiving post-transplant diet and exercise information prior to transplantation, while most reported being best placed to receive support within 6 months of receiving their transplant. There was an agreement that if the presentation of a post-transplant well-being program is mistimed, unintended consequences could occur, with patients disregarding information or resenting health professionals.

'You need that [lifestyle related] info pretty much straight away after the transplant to get yourself on the right track. That first 12 months is a real transitional phase for you because you are going through all the healing and stuff. And you don't really have your head in the place of planning your new life. You have your head in getting through day to day whereas 12 months down the track your mindset has changed by then and you're starting to focus on what you are going to do with your new life.....' (TI, 8)

Based on a translation of the thematic analysis, key factors informing the development of a post-transplant well-being program are identified in Table 1. These include practical recommendations for clinicians to consider when implementing post-liver transplant health services.

Discussion

This qualitative study used a process of knowledge exchange between researchers, clinicians and health system

users and highlights the value of using implementation science for the design of new health services. It identified experiences that may influence decisions around health behaviours and informed elements of a post-transplant wellness program for LTR.

While quality of life improves after transplant, participants of the present study described ongoing issues associated with mental health and emotional resilience that may impact on health-related decision making.¹⁸ Unique emotional stressors such as survivor guilt and post-traumatic stress are recognised in organ transplant recipients.^{19–22} Study participants indicated that before they could address their diet and exercise needs, they needed better strategies to cope with the insecurity and uncertainty associated with survival; and also needed the physical and emotional resources to deal with their current medical issues. Regular exercise and improving diet quality are effective strategies for fostering good mental health and cognitive function after significant health events such as cardiac arrest.^{23–25} However, participants in the present study did not identify such health behaviours as coping mechanisms *per se*. This finding has significant implications for transplant services that may not typically offer psychological support or peer mentoring programs as standard care. The desire for professional emotional support emphasises the need for multi-disciplinary teams before and after transplant. The provision of group psychotherapy to patients awaiting liver transplant has uncovered some reluctance to engage with

these strategies but warrants further investigation due to the potential benefits such as reduced anxiety and sharing experiences with others.²⁶

Based on the responses from this cohort of LTRs it seems important at the outset of a health promotion program to formally recognise the emotional burden of receiving a transplant and the influence of post-traumatic growth on well-being and health behaviours post-transplant.²⁷ Incorporating LTR peers into the delivery of the program will offer another vehicle for emotional support and also serve as a mechanism to develop partnerships with knowledgeable users who acknowledge a responsibility to live a healthy life.^{19,28}

Participants placed a high priority on getting back to 'normal life' despite reconciling their reality that interacting with health services and self-monitoring will be a life-long burden that others do not bear. The importance of regaining independence, such as being able to drive and travel, and returning to work, are common themes post-organ transplant.²⁹ The experience of this cohort was that re-entering the workforce was a high priority, contributed to financial recovery, social functioning and establishing a work-life balance that reflects emerging wellness. These results can inform the structure of program delivery whereby the need for recipients to prioritise and balance work commitments with recommended health behaviours are acknowledged and accommodated.

Participants in the present study desired tailored, personalised health care, with practical guidance to help them self-manage diet and exercise. Rather than a lack of understanding around the benefits of exercise, participants expressed uncertainty around how best to commence strenuous physical activities due to feeling ill-equipped to judge the safety of exercise. Fear associated with physical capabilities post-transplant has been recognised in other organ transplant groups.²⁸ Guided, tailored prescription of exercise pre- and early post-transplant may overcome this barrier.

A tension exists between participants' preference to maintain relationships and monitoring by specialist health professionals with the desire for a life free from hospital appointments. While the LTRs wanted expert advice for key aspects of care such as emotional needs and exercise prescription, there was a commitment to take responsibility for the long-term self-management of their well-being. This paradox may be addressed with flexible telehealth access to specialist care within the context of predominantly home-based, self-directed support programs.

Considering the stated financial concerns of LTR, and the geographical dispersion of a state-wide transplant service; utilising telehealth platforms and technology to offer hospital-to-home group support for long-term health behaviour change may improve effectiveness and equitable access.^{30–33}

The present study highlighted the need for some degree of patient-led process for how and when post-transplant health services are engaged by LTR. Recipients desire an awareness of available resources at early stages of the transplant experience, however, the readiness to engage differs for each LTR. In

Table 1 Key insights from liver transplant recipients (LTRs) to inform the design of a post-transplant diet and exercise program

Key insights

- Consider the psychological and emotional health of the patient at entry to the program, and the influence of mental health status on decision-making related to health behaviours
 - Include mentoring and networking with other LTR to share experiences and facilitate group interactions with people at different stages of recovery
 - Potential recipients should be made aware of available post-transplant diet and exercise resources prior to transplant, but be able to choose when and how to engage with these resources
 - Service delivery options that include telehealth and video connections for face to face contact should be included, with flexible access times to suit employment and family commitments
 - Program to be delivered by health professionals with expertise in liver transplant
 - Program information to be pitched with positivity regarding maintaining health and well-being rather than reminding patients of links with illness and chronic disease
-

addition, it was identified that life priorities change over the course of recovery, which may impact on readiness to engage with wellness programs. There is likely to be greater uptake and effectiveness if the health system can support an inherently flexible user-led approach to uptake of service delivery and potentially screening LTR and their carers for readiness to engage may be worthwhile to improve uptake.

The results of the present study contribute to person-centred health care design by creating partnerships between researchers and the people for whom the research is ultimately meant to be of use.³⁴ This challenges assumptions of experts and values the consideration of LTR life priorities during the course of recovery.

The study has used robust qualitative methods to involve knowledge users in research. Many aspects of the present study decreased barriers to inclusion such as giving participants options for data collection methods (phone interviews or focus groups) including regional and metropolitan residents, and increased face validity by secondary analysts performing data triangulation. Question development involved a multidisciplinary team, which increased internal consistency. Due to the voluntary nature of the study, it is possible that the participants were over-represented by those who have had a positive transplant and/or healthcare experience. In addition, all participants were asked to recall their pre-transplant experiences and perceptions which may have been more than 12 months prior for some participants and introduces recall bias for pre- and early post-transplant time-points. The results are contextual to an Australian, English-speaking transplant population and may not be generalisable to other countries and cultures.

In conclusion, this interactive qualitative process of knowledge exchange focused on the experiences of LTRs and identified life priorities most likely to influence decision-making related to health behaviours post-transplant. Users' co-creation of services has the potential to improve the integration of knowledge into health systems and improve patient outcomes. The future direction of this patient engagement process will involve the implementation and evaluation of technology-assisted lifestyle intervention for LTRs.

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Conflict of interest

The authors declare no conflict of interest.

Authorship

All authors were involved in the project design. DC and IJH were responsible for data collection and interpretation, and manuscript development. All authors critically reviewed the manuscript prior to submission for publication. All authors are in agreement with the final manuscript and declare that the content has not been published elsewhere. The authors

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Supporting information

Additional Supporting Information may be found in the online version of this article at the publisher's web-site:

Table S1. Focus group questions.

ORIGINAL RESEARCH

Australian dietitians' beliefs and attitudes towards weight loss counselling and health at every size counselling for larger-bodied clients

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Abstract

Aim: Research suggests that dietitians now employ weight-neutral (WN) approaches (Health at Every Size (HAES), Intuitive Eating and non-diet) as well as more traditional weight-centric (WC) approaches (weight loss counselling) to address adult weight concerns. This study aimed to compare the knowledge of and attitudes towards WN practice compared with WC practice in Australian dietitians who work with larger-bodied clients as delineated by practice approach.

Methods: A cross-sectional web-based knowledge, attitudes and practices survey was conducted with Australian dietitians who counsel adults with a body mass index >25 kg/m². Based on their responses, dietitians were categorised into WC (preferring weight loss counselling), WN (preferring HAES counselling) or mixed approach (MA). Between-group comparisons were conducted using Pearson's chi-squared tests for knowledge and practice and independent t-tests for attitudes.

Results: Of the 317 respondents, 18.3% fulfilled the criteria for WN practitioners, 30.3% for WC practitioners and the remainder were classified as providing a MA. Weight-neutral approaches were more positively regarded generally than WC approaches (84.5% vs 53.9%) as well as considered professionally responsible (86% vs 58.7%) and perceived as more helpful for clients (61.2% vs 35%). Knowledge of WN practice goals was poor with only 36.9% (n = 117) of the participants indicating correctly that this mode of treatment is incompatible with a weight loss goal.

Conclusions: Weight-neutral practice was considered acceptable by Australian dietetics professionals who counsel larger-bodied people regardless of their personal practice preference although many displayed inaccurate knowledge of WN approaches.

Key words: attitude of health personnel, dietetics, healthy lifestyle, obesity management.

Introduction

Dietitians counsel a high proportion of clients classified as 'overweight' and 'obese'^{1–3} by body mass index (BMI), particularly in private practice settings.² Although dietitians provide individualised dietary advice,⁴ dietetic counselling for this population has traditionally taken a weight-centric (WC) perspective,⁵ in which weight loss is an important primary or ancillary goal. While a preference for more flexible lifestyle approaches for weight management as opposed to strict dieting has been evident in dietetics for at least the last two decades,^{6,7} an emerging practice variant is that of

overtly weight-neutral (WN) approaches.^{8,9} Weight-neutral approaches focus on helping clients to accept their current body weight and adopt lifestyle behaviours to manage chronic disease and reduce chronic disease risk without a weight management focus or celebration of weight loss. Understanding the preferred practices of Australian dietitians and attitudes towards these emerging dietetic practice approaches for clients with a higher BMI is important both for the planning of dietetic training curricula and for understanding the diversity of dietetic practice in the field.

Weight-neutral lifestyle approaches encourage the enhancement of dietary quality, physical fitness and self-acceptance without the intention of weight loss. Approaches which meet this definition include Intuitive Eating (IE),¹⁰ those informed by the Health at Every Size (HAES) principles,^{11–13} and weight-inclusive, non-diet approaches.^{8,9,14} These approaches were initially regarded as problematic by some,¹⁵ with the core dispute being about the existence of 'healthy obesity'.¹⁶ More recently acceptance for them has grown due to mounting evidence

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of the improvements in morbidity, mortality and quality of life of lifestyle behaviours regardless of BMI^{17,18} and poor likelihood of long-term maintenance of behavioural weight losses.^{18,19} Weight bias and stigma driven by a cultural and medical 'thin ideal' have also received research attention for their negative effects on health outcomes and widespread occurrence in society and healthcare settings,²⁰ problems that WN approaches strive to address directly.¹⁸ Indeed, the Royal Australasian College of Physicians (RACP) has, for these reasons, recently recommended a shift to 'optimising health and managing treatable risk factors at any weight'.²¹

Dietetics as a profession continues to strongly endorse WC approaches in lockstep with national medical clinical practice guidelines^{19,22} even while many dietitians report that they have adopted what they consider to be WN practice.^{6,7,23–25} Weight-neutral approach training content is now also being included in a limited number of dietitian accreditation programs^{26,27} alongside traditional perspectives. However, due to its emergent nature and philosophical conflict with traditional practice, the dissemination of WN practice into the profession, and attitudes towards WC and WN practice approaches in Australia is unclear.

The aim of this study was to investigate and compare the knowledge of and attitudes towards weight loss counselling and HAES/non-diet approach counselling of Australian WN and WC dietitians who counsel larger-bodied people. Higher body weight is a frequent reason for engaging in dietetic counselling so canvassing the knowledge and sentiments of current practitioners who report offering these divergent approaches may assist in planning dietetics training curriculum to ensure real-world practice needs are met. Furthermore, consumers and organisations that represent and employ dietitians may deem our findings useful to better understand the views and services of these two types of practitioners.

Methods

This cross-sectional study used purposive sampling to capture self-reported knowledge, attitudes and practice preferences of dietitians in Australia across the spectrum of weight-related practice approaches using an anonymous, novel, electronic web-based survey (DWC-KAPS) hosted by Key Survey.²⁸ The findings presented here are part of a larger study measuring the psychological characteristics of WC and WN dietitians in Australia and their preferred practice strategies. The Queensland University of Technology Research Ethics and Integrity approved the study protocol (approval 1500000577). Participants were first provided with written information about the study and consent was assumed by survey submission. Statistical analysis was conducted using SPSS version 22.0.²⁹

The Dietitians Weight Counselling Knowledge, Attitudes and Practices Survey (DWC-KAPS) items were developed following a review of WN practice literature and previous surveys of Australian dietitians and general practitioners regarding their attitudes to the treatment of 'overweight'

and 'obesity'.^{7,30} Four knowledge items, six attitude items and four items relating to own practice were included. The items were reviewed by senior faculty members before being tested separately with five experienced dietitians to ensure readability and confirm face validity before deployment. Attitude and practice items were worded positively, items alternated between WC and WN subjects and participants were unidentifiable to minimise social desirability bias. The terms 'HAES counselling' and 'weight loss counselling' were used in the items with a statement at the top of each page of the survey to clarify their meaning. The survey items and statement can be found in the Appendix S1, Supporting Information.

Participants were categorised into one of three groups across a weight focus spectrum based on their responses to key knowledge, preference and practice items. These items were included in the categorisation process because it was anticipated that some practitioners would be limited to practising the approach endorsed by their workplace and may not be consistent with their personal preferences, and some practitioners may mistakenly believe that HAES counselling is an approach for weight control. A 'weight-centric' (WC) classification was based on two items: if they selected *strongly agree* or *somewhat agree* to preferring to use weight loss counselling approaches (individual preference) and *always* or *frequently* using a weight loss counselling approach (individual practice) with clients of BMI >25 kg/m². For classification as 'weight-neutral' (WN) participants had to correctly indicate that weight loss goals are not compatible with HAES counselling, *strongly agree* or *somewhat agree* to preferring to use HAES counselling (individual preference) and *always* or *frequently* using HAES counselling (individual practice) with clients of BMI >25 kg/m². The remaining participants were categorised as 'mixed approach' (MA). Thus, the categories provide a nominal categorisation for practice approach, WC–MA–WN, from most weight focused to least weight focused.

In addition to the items used to categorise practice approach, six items explored three more general attitudes; if HAES counselling and weight loss counselling were 'professionally responsible' types of practice for dietitians, if the respondent had a 'positive attitude' towards the practice modes and whether they believed the approach was the 'most helpful' for larger clients. Item responses were considered 'positive' if they returned the results of *somewhat agree* or *strongly agree*, 'neutral' if they answered *neither agree or disagree*, and 'negative' if *somewhat disagree* or *strongly disagree* was selected. For consolidating the relationships between preferred practice approach and attitudes towards the practice approaches, the six attitude questions were summed into two scales, one for overall attitude towards weight loss counselling by dietitians and the other for overall attitude towards HAES counselling by dietitians (range of 5–15 with higher scores indicating a more positive attitude).

The study was advertised to all Accredited Practising Dietitians (APDs) nationally in the Dietitians Association of Australia (DAA) weekly newsletter (to approximately 6000

recipients) and via an alert to the DAA 'Obesity Special Interest Group' email listserv (to approximately 2000 recipients) to recruit dietitians working within the mainstream weight management approach paradigm. The invitation to the study was also disseminated in WN dietitian networks, via specialised email listservs and Facebook groups to capture dietitians who use a WN practice approach. Participant recruitment goals were purposive and determined by the requirements of the instruments used in the larger study. Data were collected during 2 months in late 2015.

Comparison of category demographic characteristics and responses to knowledge items was achieved using Pearson's chi-squared tests and pairwise independent *t*-tests were used to compare attitude scores between practice preference categories. The internal consistency of the categorisation items was assessed by calculating the Cronbach's α scores for each category. Only responses with complete data were used. The reporting of this study conforms to the STROBE statement for cross-sectional studies.³¹

Results

There were 342 valid submissions from Australian dietitians, with 317 completing the items to allow categorisation for preferred practice approach. The demographics of the respondents and responses to the categorisation items are outlined in Table 1. The purposive sampling method was successful in recruiting participants eligible for each of the practice approach categories; WC ($n = 96$, 30.3%), MA ($n = 158$, 49.8%), WN ($n = 58$, 18.3%). Only five (4.3%) met the criteria for classification as both WC and WN and were subsequently categorised as MA practitioners ($n = 163$, 51.4%). This small proportion of category overlap suggests that the categorisation method was successfully discriminant for practice approach.

Demographic characteristics did not differ statistically between the three practice categories, except for level of engagement in HAES/non-diet professional development, self-assessed adequacy of weight loss counselling skills and self-assessed adequacy of HAES/non-diet approach skills. The preference and practice items used to categorise participants had strong internal consistency (weight loss counselling items, $n = 2$, Cronbach's $\alpha = 0.826$, HAES counselling items $n = 2$, Cronbach's $\alpha = 0.774$). In the categorisation items, there was a stronger swing away from preference and practice of weight loss counselling by WN dietitians than away from preference and practice of HAES counselling by WC dietitians, with 50% WC versus 3.4% WN dietitians preferring to use the opposing practice type, and 29.2% WC versus 3.4% WN using the opposing practice type frequently or always.

Most (84.5%) respondents, regardless of category, had a positive attitude towards the use of HAES counselling for people with a BMI >25 kg/m² by dietitians (1.5% had a negative attitude) compared with 53.9% having a positive attitude towards weight loss counselling by dietitians (27.8% had negative attitude). Eighty-six percent of respondents considered HAES counselling to be professionally

responsible dietetic practice (1.8% disagreed), while 58.7% thought that weight loss counselling was a responsible approach (27.8% disagreed). Finally, 61.2% of respondents reported that they consider HAES counselling to be the most helpful way to help people with a BMI > 25 kg/m² (7.6% disagreed) contrasted with 35% who believed weight loss counselling to be the most helpful approach (32.5% disagreed).

The three items used to assess overall attitudes towards practice approach displayed a high degree of internal consistency (weight loss counselling Cronbach's $\alpha = 0.880$, HAES/non-diet approach items $\alpha = 0.795$) suggesting that in this sample of dietitians, these concepts were related. Overall attitudes scores towards HAES counselling and weight loss counselling varied across groups. These findings and pairwise independent *t*-test results are reported in Table 2. Respondents' degree of positive attitude towards weight loss counselling by dietitians was moderately negatively correlated with the degree of positive attitude towards HAES counselling using Pearson's correlation ($r = -0.364$, $n = 318$, $P = <0.001$).

Despite reporting largely positive attitudes towards HAES counselling, respondents demonstrated a considerable degree of uncertainty about the intentions of HAES counselling with only 36.9% ($n = 117$) indicating correctly that this mode of treatment is incompatible with weight loss goals. Of the remainder, 33.8% incorrectly believed that HAES counselling could be used for weight loss, and 29.3% were unsure of the compatibility of the approaches. Of those who correctly noted that HAES counselling is incompatible with intentional weight loss, 74 (63.2%) indicated that they *sometimes*, *frequently* or *always* use both weight loss counselling and HAES counselling in their practice. Beliefs about the effectiveness of dietetic weight loss counselling on long-term weight loss maintenance, and on the effectiveness of both approaches on long-term lifestyle behaviour change also varied between groups and favoured their preferred practice type (Table 3).

Discussion

The WN literature often presents WN and WC approaches as oppositional,^{9,32} giving the impression that practitioners firmly ascribe to one or the other. While this is philosophically true (one cannot simultaneously have weight loss as a goal while not having weight loss as a goal), it was not known to what extent dietitians can reconcile these two viewpoints to apply both paradigms in practice (e.g. client A receives HAES counselling, client B receives weight loss counselling). The research here shows that while some dietitians do appear to ascribe to an exclusively WC or WN approach, others report using both approaches in practice. However, most in the MA group (74.2%) demonstrated a crucial WN practice knowledge gap (the rejection of weight control goals) so it is likely that in this sample, the MA group skewed towards providing WC counselling in the field despite their perceptions of the contrary. These findings are corroborated by the work of Schaefer *et al.*³³ whose

Table 1 Background characteristics of dietitian participants categorised by practice approach

	Weight centric, WC (n = 96)	Mixed approach, MA (n = 163)	Weight neutral, WN (n = 58)	Total (n = 317)
Gender identity (female %)	96.8	97.5	100	97.7
Age (mean, SD)	33.26, 10.465	34.91, 10.366	33.78, 8.609	34.21, 10.093
Years in practice Mean (SD)	7.96, 8.735	8.94, 8.866	9.19, 8.127	8.69, 8.682
BMI status (%)				
BMI < 18	2.1	2.5	1.7	2.2
BMI 18–25	84.4	84.7	72.4	82.3
BMI 25–30	11.5	9.8	17.2	11.7
BMI 30+	0	1.2	3.4	1.3
Do not know	0	1.2	3.4	1.3
Prefer not to answer	2.1	0.6	1.7	1.3
Self-reported adequacy of weight loss counselling skills (%)*	88.5	73.6	77.6	78.9
Self-reported adequacy of HAES counselling skills (%)**	43.8	55.8	98.3	59.9
Engagement in weight loss counselling professional development (%)	95.8	95.7	96.6	95.9
Engagement in HAES counselling professional development (%)**	66.7	79.8	100	79.5
Categorisation items				
HAES treatment is compatible with intentional weight loss (% correct: 'false')**	17.7	25.8	100	36.9
I prefer to use HAES counselling with my clients (% somewhat/strongly agree)**	50	52.8	100	60.6
I use HAES counselling with my clients (% frequently/always)**	29.2	38	100	46.7
I prefer to use weight loss counselling approaches with my clients (% somewhat/strongly agree)**	100	19	3.4	40.7
I use weight loss counselling approaches with my clients (% frequently/always)**	100	23.3	3.4	42.9

Pearson's chi-squared test results for between-group comparisons WC versus WN, * $P = <0.05$, ** $P = <0.001$.
HAES, Health at Every Size.

2016 study to validate a measure of IE in dietitians also found overlap in perspectives.

Two surveys of U.S. dietitians' attitudes towards IE^{25,34} found attitudes towards professional use of IE principles differed by personal level of IE endorsement. Simon³⁴ found low versus high IE practice endorsement resulted in scores of 9.50 versus 11.37 for knowledge and 24.00 versus 26.53 for attitude respectively (both $p < 0.01$). A large study of 22, 542 USA-based dietitians by Schaefer *et al.*²⁵ found a mostly positive attitude towards WN practice, with 37% of respondents indicating they 'support', and 36.7% indicating they 'strongly support' an IE approach. This is broadly similar to the current findings although they did not investigate attitude scores based on preferred practice approach or outcome beliefs. Our study adds to this literature by revealing that dietitians appear to display confirmation bias given the strong relationship between practice

approach preference and favourable outcomes beliefs, even though only one of the outcome statements we used is currently supported by Level A evidence (that behavioural weight losses are regained within 2–5 years for most adults).¹⁹

The term 'non-diet' has been used previously in both WC and WN settings. Zinn *et al.*² note in their 2013 study of private practice dietitians in New Zealand that 70% of respondents often or always used a 'small changes approach' which they describe as being aligned with non-dieting or size acceptance, similar to the WN group captured here, as they were reluctant to issue meal plans, focusing more on health outcomes than weight. In Australia, Collins³ in 2003 found that 35% of dietitians nominated that they used a 'non-diet approach with eating behaviour goals' although 41.1% reported using a 'non-diet approach but identifying specific ways to reduce energy

Table 2 Weight centric, weight neutral and mixed approach dietitians' attitudes towards Health at Every Size (HAES) counselling and weight loss counselling for people with BMI > 25 kg/m²

Practice approach category Items, mean (SD)	Weight centric, WC (n = 96)	Mixed approach, MA (n = 163)	Weight inclusive, WI (n = 58)	Total (n = 317)
<i>I have a positive attitude towards HAES counselling by dietitians for treating overweight/obese clients with weight concern^a</i>	3.97 (0.732) (3)***	4.13 (0.750) (2)***	4.74 (0.515) (2)***, (3)***	4.2 (0.754)
<i>I believe that HAES counselling is the most helpful way to address overweight or obese clients' weight concern^a</i>	3.34 (0.831) (1)**, (3)***	3.68 (0.844) (1)**, (2)***	4.5, (0.755) (2)***, (3)***	3.73 (0.912)
<i>I think HAES counselling is a responsible way for dietitians to help overweight or obese clients with weight concern^a</i>	4.01 (0.733) (1)*, (3)***	4.25 (0.767) (1)*, (2)***	4.67 (0.685) (2)***, (3)***	4.26 (0.773)
Overall HAES counselling attitude score ^b	11.32 (1.861)	12.07 (1.999)	13.91 (1.442)	12.18 (2.060)
<i>I have a positive attitude towards weight loss counselling by dietitians for treating overweight/obese clients with weight concern^a</i>	4.18 (0.615) (1)***, (3)***	3.18 (1.112) (1)***, (2)***	2.14 (0.999) (2)***, (3)***	3.29 (1.190)
<i>I believe that weight loss counselling is the most helpful way to address overweight or obese clients' weight concern^a</i>	3.65 (0.781) (1)***, (3)***	2.97 (0.965) (1)***, (2)***	1.74 (0.849) (2)***, (3)***	2.95 (1.098)
<i>I think weight loss counselling is a responsible way for dietitians to help overweight or obese clients with weight concern^a</i>	4.3 (0.651) (1)***, (3)***	3.36 (1.175) (1)***, (2)***	2.03 (1.092) (2)***, (3)***	3.4 (1.281)
Overall weight loss counselling attitude score ^c	12.13 (1.517)	9.54 (2.767)	5.91 (2.644)	9.66 (3.212)

Within-item pairings independent *t*-tests: (1) = WC versus MA, (2) = MA versus WN, (3) = WN versus WC, **P* = <0.05, ***P* = <0.01, ****P* = <0.001.

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^a Scores range 1–5, 1 = strongly disagree to 5 = strongly agree. Higher scores indicate a more positive attitude.

^b Sum of three HAES counselling attitude questions, scores range 3–15, 1 = strongly disagree to 5 = strongly agree. Higher scores indicate a more positive attitude.

^c Sum of three weight loss counselling attitude items, scores range 3–15, 1 = strongly disagree to 5 = strongly agree. Higher scores indicate a more positive attitude.

BMI, body mass index.

intake'. These findings suggest that dietitians may interpret the meaning of 'non-diet' as being synonymous with 'flexible' while maintaining an implicit goal of weight reduction rather than being indicative of true weight neutrality. Similarly, in the current study, 99 (37.8%) of the 262 respondents who indicated that they used HAES counselling *sometimes, frequently or always* in practice incorrectly believed that weight loss goals could be consistent with HAES counselling.

A recent study of weight bias in Australian dietitians found a clear tendency towards WC practice, although attitudes about WN practice were not investigated. Diversi *et al.*³⁵ used both a measure of 'fat phobia' and a case study activity where a non-weight-related nutrition issue was randomised to display either an image of the client with an approximate BMI of 32 kg/m² versus a matched image

reflecting a BMI of approximately 22 kg/m² to investigate the weight bias of dietitians in practice. They found that while the respondents scores indicated only mild 'fat phobia', those who received the case study of the client with the larger body tended to rate the client as less healthy, deem the energy intake as excessive (despite the provision of a relatively low-energy diet history), provide unsolicited weight loss advice using a wide range of strategies and be less optimistic about the client following the advice. Taken together, these Australian findings appear to point to a widespread acceptance of the *idea* of WN practice while in *practice* WC philosophies may be enacted most readily.

The purposive sampling strategy used to capture practice approach subgroups precludes the generalisability of our findings, although the robust number of dietitians in each group gives some confidence in understanding the pattern

Table 3 Dietitians' beliefs regarding long-term weight and behaviour change outcomes of weight loss counselling and Health at Every Size (HAES) counselling

Item	Response	Weight centric (WC) N = 96 (%)	Mixed approach (MA) N = 163 (%)	Weight neutral (WN) N = 58 (%)	Total	WC versus WN, X ² (df) sig
Weight loss counselling from a dietitian is effective at inducing long-term (more than 5 years) weight loss for most overweight or obese clients.	True	38.5	16.0	0.0	19.9	50.23 (2), P = <0.001
	False	32.3	47.9	89.7	50.8	
	Unsure	29.2	36.2	10.3	29.3	
Weight loss counselling is effective at improving dietary quality and physical activity levels for most people with weight concern in the long term (more than 5 years).	True	49	26.4	5.2	29.3	63.38 (2), P = <0.001
	False	14.6	35.6	77.6	36.9	
	Unsure	36.5	38	17.2	33.8	
HAES counselling is effective at improving dietary quality and physical activity levels for most people with weight concern in the long term (more than 5 years).	True	49.0	59.9	87.9	61.7	23.94 (2), P = <0.001
	False	3.1	3.1	0.0	2.5	
	Unsure	47.9	37	12.1	35.8	

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of knowledge and attitudes of these two types of dietitians in Australia. Though efforts were made to reduce response bias, it is possible that some participants felt compelled to conform with traditional practice expectations and/or demonstrate competency in newer practice approaches. This may have resulted in inflated reporting of WN practice approach use rather than a misapplication of the approach in practice as might be inferred from the demonstrated WN knowledge deficits. Testing the fidelity of practitioners to WC and WN approaches by direct observation was beyond the scope of this research but remains a limitation of self-report methods such as this. Another limitation is that the current study did not use an experimentally validated tool to survey knowledge, attitude and practice because no such measure existed at the time. However, statistical analysis indicated acceptable internal consistency and the marked differences in attitudes between those categorised as WC and WN suggest criterion validity.

To the authors' knowledge, this is the first study to describe the attitudes of Australian dietitians towards weight loss counselling and HAES counselling for people with a BMI >25 kg/m² as delineated by the practice approach they prefer to use with this population. It appears that HAES counselling is a generally familiar and accepted (although somewhat misunderstood) practice and has been adopted as the sole practice philosophy by some Australian dietitians. Attitudes were found to be generally more positive towards HAES counselling than weight loss counselling irrespective of actual practice. However, improved understanding of WN approaches, particularly about their incompatibility with weight loss goals, may influence the attitudes of dietitians towards WN practice in the future. Given that

HAES counselling appears to be widely accepted amongst Australian dietetics professionals who work with larger-bodied clients, inclusion of this practice approach may be prudent in forthcoming dietetic practice guidelines and training. Future research should focus on determining the acceptability and effectiveness of these two practice approaches for clients with weight concerns.

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Conflict of interest

ES and MHJ declare no conflicts of interest. FW provides professional development materials and workshops for health professionals in weight-inclusive practice derived from research activities. FW served (elected, unpaid) on the Board of Directors of the Association for Size Diversity and Health (2016–2018), the holders of the 'Health at Every Size' and 'HAES' Trademarks (ASDAH www.sizeandhealth.org) and is a founding member of HAES Australia Inc. (www.HAESAustralia.org.au).

Authorship

FW and ES designed the study. FW collected and analysed the data and wrote the manuscript. ES and MHJ provided comprehensive feedback and direction to the research and the

manuscript. All authors are in agreement with the manuscript and declare that the content has not been published elsewhere.

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Supporting information

Additional Supporting Information may be found in the online version of this article at the publisher's web-site:

Appendix S1 Dietitians Weight Counselling Knowledge, Attitudes and Practices Survey (DWC-KAPS).

ORIGINAL RESEARCH

Social media in dietetics: Insights into use and user networks

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Aim: Social media has transformed the interaction between healthcare professionals and consumers, yet research of its use in dietetics is limited. The aim of this study was to investigate the influence of dietetic user networks on use of social media and test the applicability of a social media metrics tool to determine influential users.

Methods: An online survey about social media use and practices based on the scientific literature was developed and implemented online with dietitians. Feasibility of a social media metrics analysis was conducted via Twitter using the NodeXL metrics tool to determine influential dietetic networks based on four measures of network centrality (betweenness, eigenvector, closeness and degree).

Results: The survey (n = 340) revealed social networking sites were the most widely used (by user) (n = 282) and micro-blogging was the most regularly used (by frequency of use). Among respondents who used social media in a professional capacity (n = 130), the greatest benefit was communicating internationally and remotely while the delivery of health care was of least benefit. The majority of respondents (87.3%) indicated their primary efforts were to maintain e-professionalism. Time restraints (18.6%) and not knowing where to start (18.6%) were common barriers to use. Highly influential connections between users were observed from network visualisations of dietitians in Australia and the United States.

Conclusions: Professional use of social media among dietitians needs to be monitored over time for shifts of influential networks. Influential users from key networks can be identified from metrics analyses and should be engaged via professional bodies to upskill new users.

Key words: dietitian, health communication, internet, nutrition, social media, survey.

Introduction

Social media is a form of participative Internet use that allows users to create and share content via social networking services (Twitter, Instagram and Facebook), collaborative content development (wikis, blogs) and advanced networking (Second Life, podcasts). Unlike read-only Internet, social media allows for exchange of information which offers a platform for healthcare professional and consumer interactions.^{1,2} Social media platforms are the predominant lenses through which disease treatment and prevention communications are viewed.³ Early studies suggest that the growing use of social media⁴ had a strong impact on dietitians with reduced demand for dietetic services.⁵ Thus, it is imperative for dietitians to understand the opportunities for

social media and ways to overcome related challenges for this method of communication.

Studies of health professionals' use of social media have been conducted evaluating its use in facilitating communication.^{6,7} In the medical profession the concept of e-professionalism the 'attitudes and behaviours that reflect traditional professionalism paradigms... manifested through digital media'⁸ emerged from these evaluations with the rise of social media. Concern was raised with regard to the impact of messages to the public and patients, the application of professional medical practice to an online environment and reflection of unprofessional content on the profession overall.⁹ These concerns have been echoed in the field of dietetics although compared with other health professions, there are few studies related to dietetic use of social media.^{10,11}

Social media research methods in dietetics are limited to the exploration of education messages using surveys or content analysis methods. Used correctly, qualitative analyses can provide valuable insights. For example, content analyses of Facebook breast cancer support groups revealed a significant role for awareness-raising and support-seeking and the related focus groups identified social media

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influence on the eating behaviours of these patients.¹² While such outcomes are valuable for engaging a group of social media users they often target patient groups and cannot measure changes over time. Further, they do not directly target the dietitians use of social media.

Objective reporting of social media in dietetics may be limited due to the complex methods of analysis that are required. For example in public health, Twitter streams were tracked to measure public concern during the Influenza AH1N1 pandemic. Public sentiment was related to the outbreak while also tracking and measuring disease activity.¹³ This approach used time stamped Twitter posts clustered by the regions of the users as well as Influenza like symptom posts and Centre for Disease Control Influenza Reporting Regions applied to a Support Vector Regression model. The research was deemed accurate for tracking Influenza spread using social media symptom posts. Similarly, social media metric analyses can create an objective measure for a topic of discussion or person of influence allowing for a picture of the current situation to be created.

Originating from the marketing discipline, social media metrics can be used in health promotion evaluation to measure marketing-related indicators such as exposure, reach, and engagement.¹⁴ Metrics analyses focus on *how* individuals in a network connect to each other¹⁵ and have not been widely used in health, despite the popularity and rapid growth of social networking platforms. Thus, NodeXL, a social networking metrics analysis tool, will be used in the present study to demonstrate its feasibility. The aim of this study was to explore dietetic use and practice with social media and to determine influential dietetic users based on four measures of network centrality (betweenness, eigenvector, closeness and degree) in Twitter.

Methods

This mixed methods study consists of two components, a cross-sectional online survey of dietitian social media use and practices as well as a social media metric analysis of dietitian networks to determine influential users. This study followed the Checklist for Reporting Results of Internet E-Surveys (CHERRIES) statement.¹⁶

Online survey: An 18-item stagnant question-style survey was developed based on the scientific literature by identifying potential issues or concerns. The literature was used to determine known uses, benefits, challenges and barriers from other health professions. The survey was tested for face validity with dietitians (n = 5) and nutrition students (n = 5) by convenience sample. The exploratory, open, voluntary survey investigated the dietetic use of social media and was administered online via Survey Monkey (SurveyMonkey Inc., San Mateo, CA, www.surveymonkey.com) for a 1 month period to a targeted convenience sample. Question styles included dichotomous, multiple choice, likert scale and rank order questions. Question response options were created based on common areas extracted from the scientific literature as outlined above. An 'other' open-response option was added for the personal and professional use,

technologies used, benefits, challenges, concerns and barriers to use questions allowing for unique responses that differed from other professions. Demographic data and personal use of social media data were collected from all participants. IP address was used to avoid duplicate entries during the period the survey was open. Participants who used social media in a professional capacity were asked about their professional use while those did not use social media in a professional capacity were asked about their barriers to social media use in a professional capacity. Questions were displayed two to four to a screen to minimise the completion time and no questions beyond the consent and use of social media in a professional capacity were deemed mandatory. Respondents could move between questions as required. All members of the Dietitians Association of Australia (DAA) currently working in Australia were considered eligible, regardless of whether they had used a social media platform. An advertisement was distributed via the weekly email newsletter including a link to the survey. A gift card prize draw incentive was offered to all participants.

De-identified demographic and personal use of social media data were collected from all consenting participants. The survey assessed professional use of social media, including the frequency, benefits, problems, journalistic practices, and perceptions related to e-professionalism. The University of Wollongong Human Research Ethics Committee approved the study (HE11/141) and tacit informed consent about all elements of the survey was obtained by completion of the first question.

Social media metrics: NodeXL, an open-source social media network analysis and visualisation tool provided as an add-in to Microsoft Excel.¹⁷ NodeXL provides network graphs referred to as network visualisations and computes a range of graph metrics: degree centrality, betweenness centrality, closeness centrality and eigenvector centrality. Degree centrality measures the total number of connections linked to a vertex (a social media user); betweenness centrality captures the disruption of connections between other vertices in a network caused by removing the user from the network; closeness centrality measures the average distance between a user and every other user in the network and eigenvector centrality is a measure of influence. Figure 1 shows the different types of centrality with each ring indicating a user and users A, B and C linked via different measures of centrality.¹⁸ An increased degree centrality of a vertex, is represented by an increasingly opaque vertex.

For this study, NodeXL was applied to Twitter data via Excel for dietitians who were using the networks of two Twitter public lists: 'Dietitians-down-under' (Australian dietitian Twitter users) 'Dietitians' (American dietitian Twitter users). Twitter data were obtained on the same day for both lists.

Data analysis: All respondent survey data were analysed using SPSS 22.0 for Windows (SPSS, Inc., Chicago, IL). To compare the proportion of demographic subgroups in the use of social media, cross-tabulations were created between use of social media in a professional/personal capacity and age groups, gender, geographic areas and work settings,

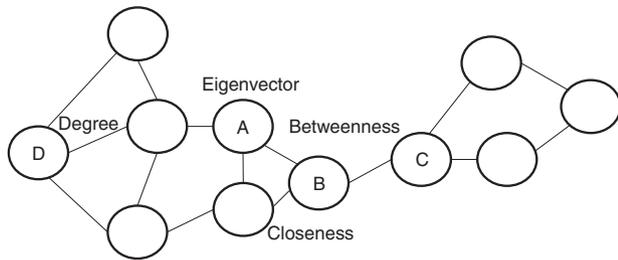


Figure 1 Representation of the network visualisation measures of centrality identified via metric analyses. Users A, B and C are represented as circles linked via different centrality measures. Betweenness centrality is the shortest path between users shown via user B when measured for users A and C. Closeness centrality is the mean distance of a user from other users. Eigenvector centrality is a measure of influence with user A having more influence. Degree centrality relates to the number of direct links a user has to other users.

with Pearson’s chi square analyses as appropriate. Alpha was set at 0.05 and no statistical corrections were applied. Some demographic variables were collapsed to avoid statistical test violations. Age groups 46–55 years and >55 years were grouped into ≥ 45 years; geographic areas remote and very remote were grouped into remote; work settings community and government were grouped into public health, and education and research were grouped into academic. The responses to the frequency of use were condensed into dichotomous variables. Responses of, ‘never’ were considered as ‘not used’ and all the other responses grouped as ‘used’. Likert scale questions for perceived benefits of using social media were coded and mean \pm SD scores calculated and ranked. The barriers to use question responses were analysed using content analysis¹⁹ whereby common topics were extracted and grouped to aligned with each area.

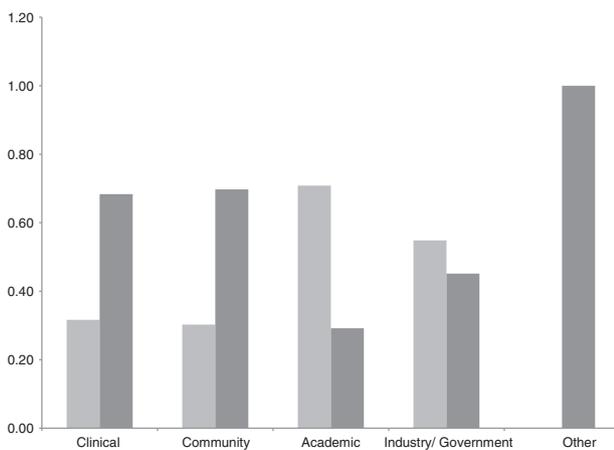


Figure 2 Comparison between the demographic characteristics of survey respondents and their use of social media in a professional capacity. Footnote: Among respondents selecting other, n = 26 indicated their primary work setting as private care. * Pearsons χ^2 , $P < 0.05$. (■) Yes and (□) no.

For the NodeXL analyses, measures of centrality were interpreted for each network from the public Twitter lists. The degree centrality to opacity was mapped for visualisations of network metrics. Clusters were identified and mapped based on connectedness between vertexes (social media users) and key users identified.¹⁸

Results

A total of 342 respondents (approximately 7.1% DAA membership), determined by IP address, attempted the online survey with two respondents’ not progressing (99.5% response rate, 73.8% completion rate). All responses were within the expected time stamp for survey completion. Unique site visitor information was not available. Of the respondents, 37.5% used social media in a professional capacity. The majority of professional social media users were in the 26–35 year age group (44.8%) while 51% of those aged 36–45 years were more likely to use social media for professional purposes. The largest proportion (70%) of non-professional users were those aged <26 years. Respondents were primarily (75.3%) from a metropolitan location with only 4.8% located in a rural/remote area. Professional users were primarily (71%) employed in an academic field while the majority (68%) of non-professional users were employed in a community setting (70%) followed closely by a clinical role (68%). Only 3% of respondents were male.

Professional use of social media was significantly related to the work setting (χ^2 30.430, $P = 0.00$), with dietitians employed in academic and industry/government settings more likely to use social media in a professional capacity (Figure 2). Among the 130 respondents who used social media in a professional capacity, discussion forums were the most widely used (66.4%, n = 87), whereas wikis and micro-blogging sites were used by only 28.2% (n = 37) and 33.6% (n = 44) of respondents, respectively. Dietitians reported using Twitter regularly showing, there was a clear preference for micro-blogging tools. Facebook was only used in a professional capacity by 76 respondents, whereas it was the most popular (n = 282) social media platform in a personal capacity with 97 respondents reportedly using it regularly.

Chi square analyses showed significant relationships between the proportion of user work settings and using blogs, and between proportion of the age groups and the use of podcasts ($P = 0.002$). Blogs were more widely reported by respondents employed in non-hospital clinical settings, and podcasts were more common in respondents aged over 36 years.

Challenges to the professional use of social media were addressed based on concern and occurrence across the four content areas (Figure 3). Among them, loss of professional image and copyright issues were the most concerning problems, and the most frequently occurring problems were loss of professional image, and financial interests or conflicts. The majority of respondents (87.3%, n = 110) indicated

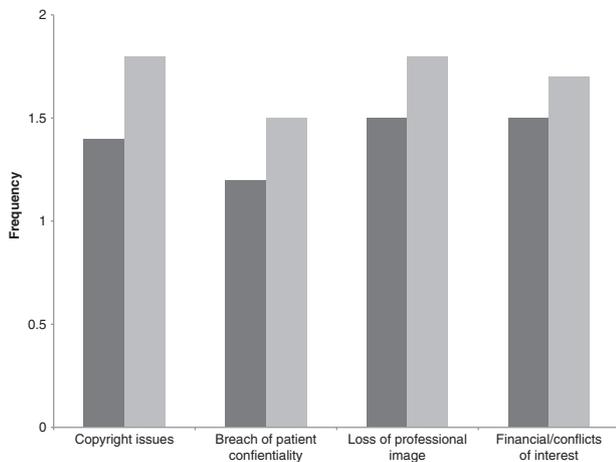


Figure 3 The occurrence of and concerns for issues in the professional use of social media. Footnote: data expressed as mean frequency of use scores (1 = never, 2 = sometimes and 3 = often). (■) Occurrence and (□) concerned.

they had taken efforts to minimise problems associated with unprofessional online behaviours.

With regard to the main barriers to using social media for professional purposes, the most common responses were not knowing where to start (18.6%, $n = 52$), and a lack of time (18.6%, $n = 52$). Another common barrier was a lack of necessity in using social media in a professional capacity. Of users, 29 respondents indicated that social media did not provide additional benefit compared to traditional tools, and 15 respondents stated that they did not see it as a requirement for work.

The highest perceived benefits were communicating internationally or remotely (mean \pm SD; 1.3 ± 0.1), keeping abreast of current information (1.3 ± 0.1), followed by disseminating health messages (1.1 ± 0.1). On the contrary, delivery of health care was ranked lowest (0.3 ± 0.1) followed by greater esteem through higher visibility (0.6 ± 0.1) and attracting potential clients (0.6 ± 0.1).

Network visualisations using NodeXL were created for US data from the 'Dietitians' network, with three clusters clearly shown based on the connection between users and opacity based on degree centrality (Figure 4). From the metrics for user connections, it was found that user A had a degree centrality of 114, betweenness centrality of 41.729, closeness centrality of 0.002 and eigenvector centrality of 0.003. User B, in the centre of the upper cluster, had a degree centrality of 254, betweenness centrality of 638.02, closeness centrality of 0.003 and eigenvector centrality of 0.006. One could infer from these measures that user A had quicker access to other users (lower closeness centrality compared to user B) whereas user B had connections to more users (higher degree centrality). The higher eigenvector centrality of user B higher also demonstrated that he/she is more influential as a member of the network. Furthermore, the higher betweenness centrality of user B indicates

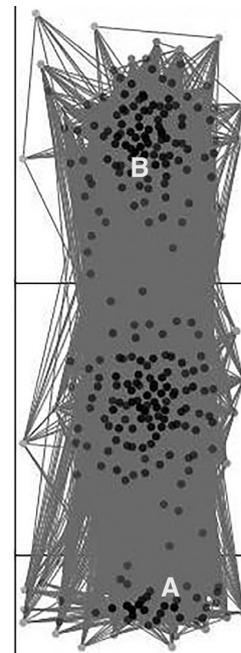


Figure 4 The network visualisation of Twitter 'Dietitians' public list. Footnote: Cluster output mapped from NodeXL metrics analysis tool based on connectedness between individuals. Degree centrality is mapped to opacity for visualisation of network metrics. A and B indicate key users of influence within the networks.

that this user had an important 'bridging' role of controlling information flow between otherwise unlinked constituents, possibly through re-tweeting of information.

From the 'Dietitians-down-under' network, most of users were clustered in the middle of the network visualisation, with a few at the edges. User A was connected to five users in the larger cluster. They had degree centrality of 5, betweenness centrality of 0, closeness centrality of 0.004 and eigenvector centrality of 0.001. Another user, user B, in the middle of the network, had degree centrality of 227, betweenness centrality of 2202, closeness centrality of 0.008 and eigenvector centrality of 0.017 which can be seen by their location in the cluster demonstrating more influence. The high betweenness centrality for this user also demonstrates a stronger 'bridging' role by comparison with user A in the US data.

Discussion

The results of this study demonstrate that approximately one third of respondents used social media in a professional capacity. Although it is expected that social media has become more widespread and will continue to increase over time, as in other disciplines,^{20,21} it should be noted that this study did not aim to sample from a representative group and results should be interpreted with caution. While early studies have suggested a decline in dietetic

services,⁵ current dietetic social media use appears to be targeted toward communication of information and professional development with the lowest ranked benefit being the delivery of health care.

A study of surgeons' professional use of social media also found a preference toward use for professional development and networking and an age associated positive attitude.²⁰ The analyses in the present study did not support the theory that older age groups are associated with late adoption and the reason for slowed adoption social media in some professions.²² It can be postulated from this study that the user need i.e. the work setting, had greater influence on the professional use of social media among dietitians than the age of the respondents. While early adopter members are more likely to utilise social media as a form of communication a similar pattern has also been seen as other technologies were introduced.²³

Given the widespread introduction of social media platforms other than Twitter a clear separation of professional from personal use may not be possible. The medical profession has acknowledged a need to separate professional from personal social media by defining e-professionalism to avoid violation of professional boundaries by a patient potentially seeing personal social media content.^{24,25} The results of this study revealed that the majority of respondents were aware of e-professionalism, yet some indicated that they were never concerned with its problems. Blurred boundaries between personal and professional use of social media may cause loss of trust from patients/clients or even legal action in health care system.²⁴ For this reason, where possible it is recommended that dietitians separate their use by holding separate accounts or applying filtering settings within the social media platforms.

The DAA and the Academy of Nutrition and Dietetics have developed guidance for the maintenance of a professional presence on social media,^{26,27} addressing potential risks of privacy violation, antitrust, defamation, content context and copyright issues.^{10,28} These endeavours from professional organisations can contribute to awareness of e-professionalism. It is also worth noting that the measurement of e-professionalism is subjective in the present study. Little has been reported on the prevalence or on cases of 'unprofessionalism' among dietitians though it appears to be a concern spanning across many health professions.²⁹ Further, the members sampled were largely current users of social media while those with barriers to use, including e-professionalism, are less likely to have responded to the survey and may warrant a future study as well as continuing awareness-raising.

The popularity of using social media echoes the findings of an early survey of the DAA,³⁰ in which 77.7% respondents reported using social networking sites in a personal capacity. The use of social networking sites for professional purposes was found by the DAA to be much lower. For dietitians who are existing personal social media users and interested in exploring the professional use of social media, a first step could be the management of clear communication messages. This can maintain a dietitian's professional image and also have an impact within the profession via network connections.⁴

The professional use of Twitter as part of a dietitian's work appears to be growing in popularity³⁰ and not limited to particular fields of practice. This may indicate that Twitter has made an impact on the field of dietetics though a recent review highlighted that dietitians do not understand the use of social media in dietetic practice.²¹ This study found that Twitter was used *regularly* among the dietitians who already use it, which suggests the potential of using this platform in a variety of settings. Twitter can be used to gather professional development information about a certain events/conference or health topics³¹ and continued networking with fellow event attendees.

When the results of this study were compared to a survey conducted with British dietitians a decade ago,¹³ the finding that social media platforms are important tools used to receive information continued to be the dominant form of use. While a review found social media use in dietetic practice was largely limited to delivery of content primarily for weight management,²¹ very few studies are focussed on use by the dietitians themselves. While Twitter has been proven to be effective in encouraging lifestyle changes,³² the purpose of using social media in dietetics appears to be more closely related to dissemination of research findings for professional development. Conversely, the success of social media in research settings may not always translate to dietetic practice in other settings where resources are limited and dissemination protocols are less clear potentially creating barriers to continued use.

The investigation of perceived barriers were similar to a survey of other health professionals in Australia³³ finding limited knowledge of the practical application of social media as the main reason for resistance to adopt social media. It is, therefore, recommended that dietitians be upskilled in the application of social media, particularly in relation to time management and technical issues. Such strategies have been implemented in Australia via workshops at DAA national conferences though no formal impact evaluations have been reported. To address the perceived barrier of social media being redundant, resources incorporating a needs assessment tool should be developed in collaboration with influential dietitians who adopt social media.

Identification of influential social media users' needs to be measured objectively as these users should be targeted for professional development of those with barriers to use of social media. A review of published healthcare studies found only one of 52 included studies whereby a social network analysis was performed. All other studies provided purely descriptive measures.³⁴ The one study social network study targeted physicians and was published in 1990, before social media was available. No other studies were identified for health professional network analyses that were not targeting patients.

Professional networks today can be more readily measured. In this study, the NodeXL social media metric tool was found to be successful in demonstrating impact within two dietetic social media networks. Influential users were identified though both were seen as holding a bridging role between sourcing and disseminating new information,

likely via re-tweeting of posts. Although rate limited to 1000 users per hour when user information is extracted from Twitter, NodeXL may have a role in the successful dissemination of health information by identifying those individual of significance in social media platforms. Taking the public list 'Dietitians' as an example, if the purpose was to broadcast a message, user A has the ability to spread information in short time; while user B is able to reach large audience of users who are otherwise unlinked, as well as influential individuals. Metrics visualised on graphs enable the presentation of the overall network and individual characteristics at the same time. Such tools may help dietitians effectively spread quality information online via targeted Twitter users. This is increasingly important approach considering the role of the Internet as a main source of health information for the public³⁵ and the large volume of misinformation that is available.³⁶

Overall, NodeXL was used to demonstrate not only how information spreads through the network at the macro level, but also how a user's position in a social network may affect access to resources at the micro level.¹⁸ However, it is an analytical tool originally designed for marketing purposes and therefore, it is suggested that dietitians and other health professionals work with the metrics that suit their needs.

The low response rate of the survey (7% based on the number of DAA members at the time of data collection) is a potential limitation of the study despite the gender balance being similar between the survey (3%) and membership overall. Further, a unified definition and examples of social media at the start of the survey could have increased responses and supported participants to complete the survey. Finally, it was assumed in the interpretation of the metric analysis that those users who had joined the public networks were using Twitter for professional purposes.

To the authors' knowledge, this is the first study investigating the use of social media among Australian dietitians in a professional capacity via both a subjective survey and objective metric analysis. The responses to the survey showed a low level of engagement in the professional use of social media among Australian dietitians though should be considered within the scope of the research. The results demonstrate opportunities for dietitians as well as need for future research in evaluating e-professionalism and social media use in practice. The use of NodeXL identified significant individuals in a network of Twitter social media users. Regular monitoring of dietitians social media use is required over time as new platforms become available, likely to impact on the network clusters found in this study. Engagement of influential users to upskill new users is a potential strategy for encouraging increased use.

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Conflict of interest

The authors have no conflicts of interest to declare.

Authorship

YP designed the study developed the survey, interpreted the data and revised the manuscript, QP developed and implemented the survey, analysed the data and drafted the manuscript.

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ORIGINAL RESEARCH**Clients expect nutrition care to be provided by personal trainers in Australia**Katelyn BARNES , Bettina BEACH, Lauren BALL and Ben DESBROW*Nutrition & Dietetics Department, School of Allied Health Sciences, Griffith University, Brisbane, Queensland, Australia***Abstract****Aim:** To describe client expectations and the experience of nutrition care provided by personal trainers and explore factors that influence expectations of nutrition care.**Methods:** A cross-sectional survey identified expectations of nutrition care provided by personal trainers. Likert scales explored expected nutrition care, nutrition knowledge of personal trainers and experiences of those who had received nutrition care from a personal trainer. Expectations were evaluated using descriptive statistics. Associations between expectations and participant characteristics were explored with Pearson chi-squared tests.**Results:** Six hundred twenty-seven Australian residents participated (77% female; 16–74 years of age). Participants frequently expected personal trainers to be knowledgeable about and discuss general healthy eating, muscle gain and weight loss. Half of the participants expected personal trainers to discuss and be knowledgeable about nutrition for chronic disease. Of the 334 participants who had engaged a personal trainer, 98% received nutrition care. Half of these participants ($n = 167$) were satisfied with the nutrition care they received, and 40% reported positive dietary changes because of their personal trainers' nutrition care. Tertiary education and perceived healthfulness of diet lowered expectations of nutrition care from personal trainers ($P < 0.001$). Engagement of a personal trainer did not influence expectations of nutrition discussions ($P > 0.01$) but increased expectations of personal trainer nutrition knowledge ($P < 0.01$).**Conclusions:** Clients expect personal trainers to provide nutrition care. Client expectations may compel personal trainers to provide nutrition care beyond the recommended scope of practice. Strategies to manage client expectations, including awareness of the personal trainer scope of practice, are needed to ensure safe and effective nutrition care from personal trainers.**Key words:** fitness professional, nutrition knowledge, nutrition skills, patient care.**Introduction**

Diet and physical activity are pervasive modifiable risk factors for chronic disease.¹ The majority of adults in the USA, UK and Australia do not meet the recommended intake of fruits and vegetables, and less than half achieve recommended levels of physical activity.^{2–8} To help prevent and manage chronic disease, World Health Organization recommends upskilling of health professionals and coordination between industries to facilitate improvements in dietary behaviours and physical activity of individuals and communities.^{9,10}

Fitness professionals, such as personal trainers, are a large workforce engaged in the promotion of physical activity and health.^{11,12} Personal trainers are ideally placed to act as advocates for healthy eating because individuals who use a personal trainer are likely to seek advice concerning other health behaviours such as diet.^{13–15} International standards encourage personal trainers to provide nutrition care in line with national dietary guidelines.¹⁶ Similarly, in Australia, the regulatory body for fitness professionals, Fitness Australia, has developed a scope of practice that endorses personal trainers to provide nutrition care in line with national dietary guidelines.¹⁷ Such nutrition care may play an important role in the prevention of chronic diseases.

A major risk for the fitness industry is the provision of nutrition care beyond the scope of practice because of the potential for unsuitable advice, which may lead to poor health outcomes for clients.¹⁸ Personal trainers have been reported to provide nutrition care to clients beyond their scope of practice, including nutrition advice for managing chronic conditions (e.g. cardiovascular disease and/or diabetes), nutritional deficiencies, food intolerances and

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allergies.¹⁹ Personal trainers are often advertised as being able to provide nutrition care beyond their scope of practice.²⁰ Moreover, personal trainers have reported feeling confident and prepared to provide such specialised nutrition care to their clients despite having limited education in nutrition and similar nutrition knowledge to the general Australian population.^{21,22} However, it remains unclear if the provision of nutrition care beyond the scope of practice is initiated by the personal trainer or if it arises as a consequence of client expectations for specific dietary advice. The expectations on personal trainers from the perspective of clients, and potential clients, regarding nutrition have not been investigated.

Exploring expectations regarding nutrition care provided by personal trainers is important to help clarify the level of nutrition care that clients would like. This information can inform personal trainer education and occupational standards and may help to direct public health messages about seeking nutrition information. Therefore, the present study aims to describe the expectations of nutrition care provided by personal trainers in Australia and experiences of receiving nutrition care from personal trainers among individuals with an interest in fitness. A secondary aim included exploring factors that may influence expectations, such as previous engagement of a personal trainer, previous experiences with a personal trainer, level of education, perceived healthfulness and gender.

Methods

A cross-sectional online survey was conducted to explore the expectations of Australian residents with an interest in health and fitness regarding personal trainers providing nutrition care. The study was approved by the Griffith University Human Research Ethics Committee (Ref: 2016/045). STROBE reporting guidelines for cross-sectional studies were followed where appropriate.

Participants: Potential participants included Australian residents ≥ 16 years of age, with an interest in fitness, regardless of previous engagement of a personal trainer. Participants were recruited through purposive and snowball sampling from March to April 2016. Purposive sampling involved emailing study details to personal trainers within the professional networks of the research team and requesting that they share it with their clients, as well as surveying members of two large local gyms. Snowball sampling involved advertising the survey via the research teams personal and professional Facebook and Twitter accounts and inviting individuals who were interested in fitness and/or regularly engaged in exercise. The survey details were sent via mass email to all students and staff of a large University in March 2016, inviting individuals who were interested in fitness or regularly engaged in exercise.

Instrument: The survey was developed and administered using LimeSurvey version 1.9x (LimeSurvey GmbH, Hamburg, Germany), formulated after a review of literature on nutrition care, nutrition services and nutrition skills provided by personal trainers. All participants were asked questions on self-reported health and use of personal training,

expectations of nutrition care and demographics. Only participants who had previously engaged a personal trainer were asked about their experience in receiving nutrition care from a personal trainer. Table 1 outlines the survey tool, including survey sections, area of enquiry and response format.

The survey was piloted with seven individuals from a local fitness facility (four had engaged a personal trainer) for face and content validity, using a 'think-out-loud' approach to confirm interpretation of questions and to ensure appropriate survey logic (i.e. participants who had never engaged a personal trainer were not asked if their personal trainer had provided nutrition advice). Prior to data collection, minor wording changes were made in accordance with feedback to enhance clarity. The finalised online survey contained 35 items, required approximately 10 minutes to complete and was available in English.

Data analysis: Likert scales regarding topics that personal trainers should discuss were collapsed to agree, uncertain and disagree. Likert scales for knowledge of nutrition topics were collapsed to little or no knowledge, unsure and knowledgeable. Frequency distributions for all collapsed Likert scales were calculated. Mean and standard deviation were calculated for continuous numerical items (age, body mass index (BMI, calculated from height and weight)). Demographic characteristics of survey participants were compared with census data²² using chi-squared goodness of fit analysis. Pearson chi-squared tests were conducted to detect differences in responses based on gender (male or female), age (<30 or >30 years), education level (current or previous attendance at university vs no attendance at university), self-reported healthfulness of diet (unhealthy and neither healthy nor unhealthy diet vs healthy diet) and previous engagement of a personal trainer (currently or previously engaged a personal trainer (client) vs never engaged a personal trainer (non-client)). Pearson chi-squared tests were also used to explore the relationship between participants' expectations for nutrition care and reported experience of receiving nutrition care from a personal trainer (for clients only). Statistical significance was set at $P < 0.01$ to reduce the likelihood of false positive errors. Bonferroni corrections were applied to all significant Pearson chi-square results to pinpoint significant variations between participant groups. Data analysis was conducted using SPSS statistics version 22 (IBM Corp. Armonk, USA).²⁴

Results

Seven hundred fifty-six individuals opened the online survey. There were 129 (17%) incomplete responses, resulting in 627 usable responses. Table 2 outlines the demographic characteristics of participants, self-reported health and previous use of personal training services. The mean age (\pm SD) of participants was 29.8 ± 11.2 years (range: 16–74 years), with $n = 483$ (77%) being female. Participants were categorised into clients ($n = 334$, 53%) and non-clients ($n = 293$, 47%). The majority of participants ($n = 365$, 58%) reported to have a healthy weight (BMI: 18.5 – 24.9 kg/m²), and most ($n = 386$, 62%) perceived their diet as 'healthy'.

Table 1 Summary of survey tool including survey section, area of enquiry and response format

Section	Area of enquiry	Response format
Self-reported health and use of personal training services	Height and weight	Open number fields
	Perceived healthfulness of diet	<i>Likert scale</i> : Not at all healthy; not healthy; neither healthy nor unhealthy; healthy; very healthy
Previous interactions with personal trainers and nutrition care (completed only by 'clients')	Previous interactions with a personal trainer	<i>Choice</i> : Never engaged a personal trainer (non-client); currently or previously engaged a personal trainer (client)
	Receipt of nutrition care [list of nutrition topics] ^(a)	<i>Choice</i> : Yes, no, unsure
	Influence on dietary behaviours and attitude towards food	<i>Likert scale</i> : Negative impact; neutral impact; positive impact; I have not received advice on this topic
Participant expectations of personal trainers with regards to nutrition care (completed by all participants)	Satisfaction and usefulness of nutrition care	<i>Likert scale</i> : Unsatisfied; neutral; satisfied
	Agreement that personal trainers are able to provide advice on and should discuss [list of nutrition topics] ^(a)	<i>Likert scale</i> : Strongly disagree, disagree, neutral agree, strongly agree
	Rating of knowledge that personal trainers have on [list of nutrition topics] ^(a)	<i>Likert scale</i> : No knowledge, little knowledge, adequate knowledge, a lot of knowledge
Demographics	Location (State)	Dropdown menu
	Age	Open number field
	Gender	<i>Choice</i> : Male, female, rather not say
	Level of education	<i>Choice</i> : Some high school, high school certificate, Certificate level (I, II, III, IV or V), Diploma, Bachelor Degree, Postgraduate Degree

^(a) Full list of nutrition topics is presented in Table 3.

Relative to national demographic data (Australian Bureau of Statistics, 2016), there was an overrepresentation of females ($\chi^2 = 183.287$; $P < 0.001$), university educated individuals ($\chi^2 = 550.79$; $P < 0.001$) and those within the healthy weight range ($\chi^2 = 187.21$; $P < 0.001$) in the survey sample.

Table 3 shows the total number of participants who expected personal trainers to discuss and to be knowledgeable about specific nutrition topics. The majority of participants ($n = 497$, 79%) indicated that personal trainers should discuss nutrition. However, participants reported variable views regarding which nutrition topics personal trainers should discuss. Most agreed that personal trainers should discuss, and be knowledgeable about, general healthy eating ($n = 554$, 88%; $n = 577$, 92%, respectively), nutrition for muscle building ($n = 507$, 80.9%; $n = 577$, 92%, respectively) and nutrition for weight loss ($n = 479$, 76%; $n = 559$, 89%, respectively). Fewer participants reported that personal trainers should discuss nutrition in relation to the management of chronic conditions ($n = 292$, 47%), deficiencies/disordered eating ($n = 228$, 36%) and food intolerances and allergies ($n = 215$, 34%). However, many participants expected personal trainers to be knowledgeable about nutrition for the management of chronic conditions ($n = 344$, 55%), deficiencies/disordered eating ($n = 302$; 48%) and food intolerances and allergies ($n = 273$, 44%).

No differences were found between participants who had, or had not, engaged a personal trainer with regard to expectations of nutrition topics to be discussed ($P > 0.01$). However, compared with those who had not previously engaged a personal trainer, those who had engaged a personal trainer more frequently reported that personal trainers should be knowledgeable on the management of chronic conditions (including cholesterol, diabetes and hypertension) (48% vs 60%; $\chi^2 = 9.12$, $P = 0.001$) and of food intolerances and allergies (36% vs 50%; $\chi^2 = 13.305$, $P < 0.0001$).

Significant associations were found between some demographic variables and participants' expectations. Compared with participants who had not attended university, those who had attended university less frequently agreed that personal trainers should provide: nutrition management for chronic disease (42% vs 64%; $\chi^2 = 15.32$, $P < 0.001$), advice for food intolerances or allergies (30% vs 53%; $\chi^2 = 18.92$, $P < 0.001$) and nutrition advice for sports performance (32% vs 53%; $\chi^2 = 17.64$, $P < 0.001$). Compared with participants who had not attended university, those who had attended university less frequently agreed that personal trainers should be knowledgeable on: nutritional management of chronic diseases (50% vs 73%; $\chi^2 = 20.52$, $P < 0.001$), food intolerances or allergies (38% vs 62%; $\chi^2 = 22.75$, $P < 0.001$) and deficiencies/disordered eating (43% vs 67%; $\chi^2 = 21.06$, $P < 0.001$).

Table 2 Summary table of demographic characteristics of participants, self-reported body mass index (BMI), healthfulness of diet and use of personal training services (n = 627)

Demographic characteristics	n (%)
Geographical location	
Queensland	565 (90.1)
Other states and territories	62 (9.9)
Age (years)	
<30	385 (61.4)
>30	242 (38.6)
Gender	
Male	144 (23.0)
Female	483 (77.0)
Ethnicity	
Australian	431 (68.7)
Other	196 (31.3)
Level of education currently completing or previously completed	
Not university level (High school certificate; Certificate I, II, III, or IV; or Diploma)	133 (21.1)
University level (Bachelor or Postgraduate degree)	494 (78.9)
<hr/>	
Self-reported health and personal training characteristics	n (%)
BMI (kg/m ²)	
<18.5	33 (5.3)
18.5–24.9	365 (58.2)
25–29.9	145 (23.1)
30+	84 (13.4)
Perceived healthfulness of diet	
Healthy	386 (61.6)
Neither healthy or unhealthy	111 (17.7)
Not healthy	130 (20.7)
Personal training services	
Previously engaged a personal trainer (client)	334 (53.3)
Never engaged a personal trainer (non-client)	293 (46.7)

Participants who reported that their diet was 'healthy' less frequently reported that they expected nutrition care from personal trainers compared with participants who reported their diet to be neutral or unhealthy, specifically with regard to: management of chronic disease (52% vs 70%; $\chi^2 = 11.18$, $P = 0.001$) and deficiencies/disordered eating (44% vs 59%; $\chi^2 = 10.46$, $P = 0.001$). The associations between demographic factors and expectations were most often significant, where >20% of participants reported that they were uncertain if personal trainers should discuss the nutrition topic. Nutrition topics participants were uncertain a personal trainer should provide advice on included: deficiencies/disordered eating (n = 169, 27% uncertain), food intolerances or allergies (n = 169, 27% uncertain) and management of chronic disease (n = 140, 22% uncertain).

Most participants expected personal trainers to be skilled or experts in collecting nutrition information (n = 480, 76%), creating personalised meal plans (n = 426, 68%) and providing nutrition counselling (n = 445, 71%). Half of participants reported that nutrition care should only be provided when the client requests it (n = 350, 56%). The majority of participants expected a personal trainer to spend up to 15 minutes discussing nutrition when providing nutrition care (n = 483, 77%).

Of the 334 participants who had previously engaged a personal trainer, almost all reported receiving nutrition care (n = 328, 98%). The most common nutrition topics discussed with a personal trainer were: general healthy eating (n = 253, 76%), weight loss (n = 222, 69%) and muscle building (n = 212, 64%). Among those who engaged a personal trainer, a lower proportion of participants reported receiving nutrition care than those who expected nutrition care for most topics. There was a significant difference between expectations and receipt of nutrition care for: general healthy eating (94% vs 76%; $\chi^2 = 7.171$, $P = 0.007$), weight loss (72% vs 67%; $\chi^2 = 7.593$, $P = 0.006$), performance supplements (77% vs 54%; $\chi^2 = 7.051$, $P \leq 0.001$), management of chronic disease (56% vs 13%; $\chi^2 = 27.051$, $P \leq 0.001$) and deficiencies/disordered eating (70% vs 13%; $\chi^2 = 27.051$, $P \leq 0.001$).

When nutrition care was provided, half of the participants indicated that they were satisfied with the service that was delivered (n = 167, 50%) and reported the nutrition care to be useful (n = 190, 57%). However, fewer indicated that the nutrition care had improved their dietary behaviours (n = 132, 40%). Of the 120 participants who had engaged a personal trainer and rated their diet as unhealthy or neutral, one third indicated that their dietary behaviours improved based on the nutrition care received from their personal trainer (n = 40, 33%).

Discussion

The present study described expectations of nutrition care from personal trainers in Australia and explored factors that influence nutrition expectations. The results suggest that, generally, personal trainers are expected to provide nutrition care and to be knowledgeable on a range of nutrition topics. Furthermore, participants expected personal trainers to provide nutrition care, some of which extends beyond the scope of practice and formal education of fitness professionals. Strategies to manage expectations of nutrition care from personal trainers may be required to assist personal trainers to provide safe and effective nutrition care.

Participants expected personal trainers to provide nutrition care on many topics, some of which extended beyond the scope of practice for personal trainers. Most concerning was that half the participants expected personal trainers to provide nutrition care for complex topics such as the treatment and management of chronic diseases and deficiencies or disordered eating. Idealistic expectations may be because of unfamiliarity with the complexity of chronic disease management, coupled with the perception that personal

Table 3 Number of clients who expected personal trainers to be knowledgeable and discuss nutrition and number of clients who reported receiving nutrition care from personal trainers

Nutrition topics	Number of participants who agreed...		
	Personal trainers are knowledgeable on... (n = 627 (%))	Personal trainers should discuss... (n = 627 (%))	My personal trainer has provided advice on... (n = 334 (%))
Any nutrition care	N/A	497 (79.2)	328 (98.2)
General healthy eating	577 (92.0)	554 (88.4)	253 (75.7)
Muscle building	577 (92.0)	507 (80.9)	212 (63.5)
Weight loss	559 (89.2)	479 (76.4)	222 (66.7)
Sport-specific nutrition	534 (85.2)	464 (74.0)	235 (66.5)
Performance supplements (e.g. protein powders)	488 (77.8)	386 (61.6)	182 (54.4)
Vitamin and mineral requirements	439 (70.0)	392 (62.5)	131 (39.2)
Management of chronic diseases	344 (54.9)	292 (46.6)	44 (13.2)
Deficiencies/disordered eating	302 (48.2)	228 (36.4)	42 (12.5)
Food intolerances or allergies	273 (43.5)	215 (34.2)	50 (14.9)

trainers provide a template to achieve health through physical activity and diet.^{25,26} Previous researchers have suggested that personal trainers are perceived as the 'gatekeepers' to health and fitness, with their position (and possibly physique) providing a sense of authority because they have successfully controlled modifiable factors associated with health (exercise and diet).²⁶ Given the amount of time personal trainers and clients spend together to achieve health-related goals, the nutrition care that is provided may be opportunistic.^{14,15,27}

Engaging a personal trainer did not influence expectations of nutrition care in the present study. Personal trainers report that they are often asked about nutrition and feel confident in responding to clients.¹⁸ Such interactions may reinforce client expectations that personal trainers are able to provide nutrition care for any topic. While it is promising to note that few clients reported receiving nutrition care which is considered beyond the scope of practice (e.g. nutrition for chronic disease management), many still expected a personal trainer to discuss such nutrition care. This may indicate that personal trainers are aware of their boundaries and avoid providing nutrition care beyond translation of national guidelines. Alternatively, personal trainers may have a limited opportunity to provide nutrition care for topics such as chronic disease or food allergies because of lack of session time or lack of clients with chronic conditions. The majority of participants in the present study were healthy young adults, and the opportunity for personal trainers to provide such nutrition care may be limited in this sample. Still, clients expected a personal trainer to provide nutrition care that they did not receive. As such, it appears the general perception that personal trainers are panaceas of health information influences expectations greater than previous experience.

Expectations to provide nutrition care beyond translating the national dietary guidelines compromise a personal trainer's ability to work within the industry-defined scope of practice. The education personal trainers currently receive is too short to adequately support the knowledge

and clinical reasoning required to provide nutrition care for complex health issues or for individual dietary manipulation.^{20,22,28,29} Indeed, several case reports highlight negative client health outcomes that can result from personal trainers providing nutrition care beyond the scope of practice.^{30,31} As such, changing clients' expectations of nutrition care from personal trainers may help to reduce one component of this risk. Participants who did not expect personal trainers to provide nutrition care on topics that extended beyond the fitness professional scope of practice reported higher levels of education or self-perceived healthfulness, which may indicate higher nutrition and health literacy.³² As such, public health messages that aim to improve nutrition and health literacy of the general public, with a focus on information sourcing, may help manage expectations of personal trainers and direct individuals to more appropriate sources of information for their specific nutrition concerns.

Given the prevalence of poor dietary behaviours in Australia and internationally, opportunities to promote healthy dietary behaviours should be explored. Nutrition care provided by primary health clinicians, such as general practitioners and allied health workers, is often well received and trusted.³³ However, health professionals often report barriers to providing nutrition care such as a perceived lack of patient readiness.^{34,35} In contrast, the present study suggests that individuals expect to receive nutrition care from personal trainers, and 40% of participants reported positive dietary changes as a result of nutrition care from their personal trainer. While the nature, extent and impact of these changes are unclear; expectations of nutrition care in the personal training context indicate that individuals are likely to be accepting of nutrition care from a personal trainer, and therefore, personal training is an important context in which nutrition care should be provided. It is important that personal trainers clearly communicate the boundaries of nutrition care they are able provide and enable their clients to access further nutrition care through appropriate referrals to health professionals. Historically, referrals between personal trainers and health

professionals, such as dietitians, have been low.³⁶ Increased collaboration between fitness and health professionals is needed to deliver safe and effective nutrition care when individuals are most willing to receive it.

This is the first study that has quantitatively explored expectations of clients and potential clients with regard to nutrition care provided by personal trainers. The data was not representative of the general Australian population, with overrepresentation of females, educated individuals and those within a healthy weight range.²³ However, fitness industry data show that the majority of personal trainer clients are female (~70%),³⁷ and use of fitness services by those above the healthy weight range is limited.^{38,39} As such, while not representative of the general population, current participants appear to be aligned with a typical client base for personal trainers in Australia.¹² An unavoidable response bias may be present in the data, where participants were more interested in nutrition and/or fitness and therefore reported greater expectations of personal trainers. The final limitation of this paper is that it did not consider awareness of the nutrition components of the fitness professional scope of practice. Further research into awareness and acceptability of the current Fitness Australia scope of practice for registered fitness professionals is needed. This should be conducted among both the personal trainer client base and personal trainers.

Overall, these findings indicate that client expectations of personal trainers to provide nutrition care may contribute to the industry-identified risk of personal trainers providing nutrition care beyond their scope of practice, which may result in poor health outcomes for clients. Still, personal training is clearly an important context in which healthy dietary behaviours should be promoted.

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Conflict of interest

The authors have no conflict of interests to declare.

Authorship

All authors contributed to study conception and design. BB collected data. KB analysed the results and drafted the manuscript. All authors were involved in the interpretation of the data and approved the final manuscript.

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Australian team sports athletes prefer dietitians, the internet and nutritionists for sports nutrition information

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Abstract

Aim: To evaluate the information sources that are used and preferred by Australian athletes and to assess if preferences influence nutrition knowledge (NK).

Methods: Elite and non-elite Australian team sport athletes, playing Australian football (AF), cricket, lawn bowls, soccer or hockey, were recruited via the sporting organisations' qualified sports dietitians or club presidents. Athletes completed one of two online, validated sports NK questionnaires. Frequency analysis on previous sources of advice, preferred sources of information and preferred type of support were assessed. Differences in NK scores (%) based on previous sources of dietary advice and preferences for obtaining information were assessed using *t* test or Mann-Whitney *U* test.

Results: Demographic and information source questions were completed by 410 athletes; 331 also completed NK questions. Athletes were mostly non-elite (76%) and AF players (79%). Forty-four per cent of athletes reported having previously received advice from a dietitian. Twenty per cent, 19% and 16% of athletes chose “dietitian,” “internet” and “nutritionist” as their preferred source of nutrition information, respectively. Athletes preferred information on sports nutrition (35%), individual consultations (33%), and information on general healthy eating (33%), over cooking classes (4%) and group presentations (3%). There were no significant associations between preferred and previous information sources and NK scores.

Conclusions: Australian athletes prefer dietitians, the internet and nutritionists for sports nutrition information. There is an interest in and need for access to a qualified sports dietitian and reputable internet-based nutrition information. Education programs and advice given to athletes need to be evaluated.

KEYWORDS

athlete, counselling, dietitian, education, information source, sports nutrition

1 | INTRODUCTION

Dietary intake has a significant effect on athletic performance¹ and is influenced by several factors, one of which is nutrition knowledge (NK).^{2,3} Therefore, it is not surprising

that the assessment and evaluation of athletes' NK is a popular topic. Since 2015 at least 20 papers on the NK of athletes have been published. Literature reviews published in 2011⁴ and 2016⁵ concluded that there were significant gaps in athletes' NK. It has been postulated that the low NK scores

could be explained by the use of questionnaires that have not undergone adequate validation.⁵ However, results from the newly developed and extensively validated Nutrition for Sport Knowledge Questionnaire (NSKQ)⁶ and Abridged Nutrition for Sport Knowledge Questionnaire (A-NSKQ)⁷ found that mean NK scores of elite and non-elite athletes were just 46% to 51%.^{7,8} Thus, it is unlikely that low NK scores are explained by the use of NK questionnaires that are not validated.

There has been minimal research undertaken to explain why athletes have poor NK. It is plausible that athletes do not have access to reputable nutrition information. Studies that have evaluated American collegiate athletes' preferred nutrition information sources have reported mixed findings; including that athletes are most likely to seek information from a strength and conditioning coach,⁹ a physician,¹⁰ the media and the internet,¹⁰ their parents and family,¹¹ an athletic trainer,¹² and their coach.¹³ Indian college athletes preferred obtaining nutrition information from their parents,¹⁴ while Iranian¹⁴ and Nigerian¹⁵ athletes were most likely to obtain nutrition information from their coaches. To our knowledge, only three studies in Australian athletes have assessed preferred sources of information.¹⁶⁻¹⁸ Devlin and Belski¹⁶ found that 97.8% of elite Australian football (AF) players chose "club dietitian" as their primary source of information, but the questionnaire was completed under dietitian supervision, which may have biased results. Andrews and Itsiopoulos¹⁷ also reported that elite and sub-elite Australian soccer players chose their club dietitian as their primary source of information most often, but this was selected by only 32% of respondents. Australian triathletes most commonly relied on "their own previous knowledge," followed by sports dietitians for post-exercise nutrition information.¹⁸ The reasons why certain sources of information are preferred do not appear to have been explored.

In addition to the limited information on Australian athletes' preferred sources of information, there is a dearth of knowledge about whether athletes' preferred source of information influences NK scores. The aims of this paper were to: (a) evaluate the sources of information that have previously been used and are preferred by Australian athletes and (b) assess whether athlete's nutrition information sources influences their NK.

2 | METHODS

Study reporting complies with Strengthening the Reporting of Observational Studies in Epidemiology guidelines. This cross-sectional study reports on ancillary data from two cross-sectional studies that evaluated the NK of Australian athletes. For study 1, Australian athletes competing in metropolitan and state leagues, and playing for national sporting teams

were invited to participate via direct recruitment from their clubs qualified sports dietitian (AF, soccer) or via email from their club president (AF, cricket, lawn bowls and hockey). Recruitment took place between February and May 2017. For study 2, members of one metropolitan AF and netball league in Melbourne, Australia, were invited to participate via email (from the league president); recruitment took place from April to May 2017. To be eligible, participants needed to be residing in Australia, aged 17 years and older, and play competitive sport (at any level). Athletes playing in metropolitan and state leagues are referred to as non-elite and athletes playing in national leagues are referred to as elite.

For study 1, a power analysis for an independent sample *t* test was conducted in G-POWER to determine a sufficient sample size using an alpha of 0.05, a power of 0.80, a large effect size ($d = 0.8$) and two tails. Based on these assumptions, the desired sample size for each group (elite vs non-elite athletes) was 51. A power calculation was not undertaken for study 2.

For study 1, data were collected using the NSKQ.⁶ A sub-set of the NK data from study 1 is reported elsewhere.⁸ For study 2, data were collected using the A-NSKQ; all the NK data from study 2 are reported elsewhere.⁷ The questionnaires were self-administered online, making supervision impossible. However, participants were instructed to answer questions honestly and not to look up answers to questions.

The NSKQ comprises 89 NK items and the A-NSKQ comprises 37 NK items. Both questionnaires asked the same demographic questions, including items on previous sources of advice and preferred sources of nutrition information. The only difference was that for one item on preferred means of nutrition education, the NSKQ provided closed-ended responses and the A-NSKQ allowed open-ended responses to capture unexpected replies. Copies of the questionnaires are available from the corresponding author.

The research was approved (S16/267) by the La Trobe University's SHE College Human Ethics Sub-Committee (SHE CHESC). All participants were provided with the participant information statement and consent form (online) and "agreed" to participate (electronically).

Data analyses were conducted in IBM SPSS version 23 software (IBM Corp., Armonk, New York). In previous studies reporting on NK, responses with more than 10% missing data were excluded. In the present study, all responses of individuals who completed the demographic and information sources questionnaires were included. There were no missing data for demographic variables. Assessment of the association between NK and information sources was only conducted on the sub-set of participants who had completed at least 90% of the NK questions. As per previous studies, under the assumption that non-response to NK

questions was most likely due to not knowing the correct option, missing data for NK questions were coded as incorrect.

Frequency analyses of participant characteristics (age, gender, level of education, sport played and sporting level) were conducted. Frequency analyses were also conducted for athletes' previous sources of advice on diet preferred (most preferred, top 3 choices) sources of nutrition, support received at sporting organisations, attitudes towards receiving support at sporting organisations and preferred types of support.

Data for previous sources of advice, preferred sources of nutrition information and preferred types of nutrition-education support were assessed for the whole cohort and stratified based on age (17-25, 26-35, ≥ 36 years), gender (male, female), level of education (high school, diploma and university), and level of sport played (elite, non-elite). Differences in these responses based on participant characteristics were assessed using χ^2 analysis. For age and level of education, where differences in groups were statistically significant, adjusted residuals were evaluated to assess which groups differed from one another. Values between -2 and 2 indicate no significant deviations from expected values.

Differences in NK scores (%) based on previous sources of advice on diet (yes/no for each option) and differences in NK scores (%) based on preferred sources of information (yes/no for ranked as "number 1" source of information) were assessed using *t* test or Mann-Whitney *U* tests, for normal and skewed data, respectively.

3 | RESULTS

In total, there were 410 complete responses to the demographic and information sources questions. Response rates could not be calculated because the questionnaires were, in part, distributed via club managers and total exposure was not known. Participants were predominately aged 17-25 (61%), male (60%), university educated (54%), involved in AF (79%) and playing their chosen sport at the non-elite level (76%) (Table 1). Two-hundred-and-six of the responses were from the NSKQ; NK score (%) was available for 154 respondents (completion rate: 54%). Two-hundred-and-four of the responses were from the A-NSKQ; NK score (%) was available for 177 participants (completion rate: 85%) (Table 1).

Forty-four per cent of all athletes reported having previously been given advice on their diet from a dietitian. The question did not specify whether the dietitian was a generalist or sports dietitian. A higher proportion of participants reported that they had been given diet advice from their family (58%), friends (51%), coach or trainer (48%) and teammates (47%). Males were significantly more likely to have

TABLE 1 Combined participant characteristics (n = 410) and total nutrition knowledge score of individuals who completed the demographic questions in study 1 and study 2

Characteristics	N (%) or mean \pm SD
Age (years)	
17-25	250 (61%)
26-35	126 (31%)
≥ 36	34 (8%)
Gender	
Male	247 (60%)
Female	163 (40%)
Highest level of education	
Primary school/High school	125 (30%)
Diploma	64 (16%)
University	221 (54%)
Sport played	
Australian football	323 (79%)
Other	87 (21%)
Highest level of sport played	
Non-elite	311 (76%)
Elite	99 (24%)
Completed the questionnaire	
Yes	331 (72%)
No	79 (18%)
Mean NK score (%)	
NSKQ (n = 154)	48.2 \pm 12.1
A-NSKQ (n = 177)	47.0 \pm 13.2

Abbreviations: A-NSKQ, Abridged Nutrition for Sport Knowledge Questionnaire; NK, nutrition knowledge; NSKQ, Nutrition for Sport Knowledge Questionnaire.

received advice from a dietitian (males: 50%, females: 35%, $P = .002$). Likewise, elite athletes were more likely to have received advice from a dietitian (elite: 83%; non-elite: 32%, $P < .001$) (Table 2). More males were classified as elite athletes.

Dietitian was selected as the most preferred ("number 1") source of nutrition information by 20% of participants; however, a similar proportion of respondents chose the internet (19%) and nutritionist (16%) as their "number 1" source of information. Males chose "dietitian" as their most preferred source of information more frequently than females (males: 26%, females: 10%, $P = .003$) (Table 3). In contrast, males chose nutritionist less frequently than females (13% vs 22%, $P = .022$). Non-elite athletes demonstrated a greater preference for the internet than elite athletes (22% vs 10%, $P = .011$). For the cohort as a whole, athletic trainer (14%) was also a popular choice for preferred source of nutrition

TABLE 2 Per cent participants who reported that they had previously been given advice by various professionals; stratified for gender, age, education and sporting level

Professional	Total cohort	Gender	Age	Level of education	Highest playing level
Doctor	23	M: 21	17-25: 23	HS: 26	Elite: 26*
		F: 27	26-35: 21	Dip: 14	Non-elite: 15
			36+: 28	Uni: 25	
Dietitian/nutritionist	44	M: 50*	17-25: 46	HS: 57* [†]	Elite: 32*
		F: 35	26-35: 44	Dip: 42	Non-elite: 83
			36+: 31	Uni: 37 [†]	
Team-mates	47	M: 52*	17-25: 45	HS: 52	Elite: 43*
		F: 40	26-35: 52	Dip: 44	Non-elite: 62
			36+: 50	Uni: 46	
Family	58	M: 58	17-25: 62	HS: 50	Elite: 66*
		F: 58	26-35: 50	Dip: 56	Non-elite: 35
			36+: 68	Uni: 63	
Friends	51	M: 50	17-25: 46* [†]	HS: 42* [†]	Elite: 54
		F: 54	26-35: 62 [†]	Dip: 58 [†]	Non-elite: 42
			36+: 50	Uni: 47	
Coach/trainer	48	M: 53	17-25: 53* [†]	HS: 50	Elite: 50
		F: 42	26-35: 43	Dip: 50	Non-elite: 45
			36+: 33	Uni: 48	

*Statistically significantly different: $P < .05$; [†]Statistically significantly different from expected value based on adjusted residual value.

Abbreviations: Dip, diploma; HS, high school; Uni, university.

information. A smaller proportion of participants chose family or friend (10%), academic journal (6%), doctor (6%), mass media (3%), coach (2%) and social media (2%) as their most preferred source of nutrition information (Figure 1).

Fifty-nine per cent of participants (72% non-elite, 18% elite) reported receiving neither nutrition information nor access to a dietitian at their sporting organisation. However, 87% (68% both, 19% nutrition information only) believed that these services should be available.

There were no significant differences in NK score (%) based on choosing a dietitian (yes: 45%, no: 45%, $P = .983$), the internet (yes: 47%, no: 44%, $P = .106$), or a nutritionist (yes: 44%, no: 45%, $P = .476$) as the most preferred source of information.

There were no significant differences in NK based on previously received advice from a dietitian (yes: 45%, no: 44%, $P = .164$). There were no significant differences in NK between individuals whose club provided “no nutrition support” (44%), “nutrition information only” (46%), or “access to a dietitian and nutrition advice” (45%) ($P = .723$).

There were no significant differences between elite and non-elite athletes' NK (elite: 46%; non-elite: 44%, $P = .215$; see Supplementary file 1 for additional comparisons).

There were 206 ranked responses for preferred means of education. The preferred means of education for the

whole cohort were “Access to nutrition information relevant to sport” (35%) and “Individual consultations” (33%), followed by “Access to nutrition information relevant to healthy eating” (25%). Only 3% and 4% chose “Access to group presentations” and “Cooking classes,” respectively (Figure 2).

There were significant differences in preference for individual consultations based on age ($P = .009$), with a trend towards younger participants preferring individual consultations; however, post-hoc analyses (based on adjusted residuals) indicated no differences from expected values when individual groups were compared. Likewise, there were significant preferences for cooking classes based on level of education ($P = .003$), with a trend towards individuals with a diploma preferring this option, but no significant differences in individual groups were evident. (Table 4).

The A-NSKQ open-ended responses indicated that athletes would find the following useful: provision of general information; provision of information on foods to consume before, during and after competition/training; meal plans; access to a nutritionist or dietitian; recipe ideas, food provision and support with practical aspects of choosing foods; and general support. Novel and unexpected responses included “I think it's the individual's responsibility,” “How

TABLE 3 Participants top sources of information; stratified for gender, age, education and sporting level

	Total cohort		Gender age		Level of education sporting level	
	First choice (%)	In top 3 (%)	First choice (%)	First choice (%)	First choice (%)	First choice (%)
Academic journal	6	15	M: 5	17-25: 7	PS/HS: 1* ^a	Non-elite: 7
			F: 8	26-35: 6	Dip: 3	Elite: 3
				36+: 3	Uni: 10 ^a	
Athletic trainer	14	42	M: 13	17-25: 14	PS/HS: 13	Non-elite: 16*
			F: 14	26-35: 15	Dip: 14	Elite: 7
				36+: 9	Uni: 14	
Coach	2	14	M: 4	17-25: 2	PS/HS: 3	Non-elite: 3
			F: 1	26-35: 2	Dip: 3	Elite: 0
				36+: 3	Uni: 2	
Dietitian	20	41	M: 26*	17-25: 24* ^a	PS/HS: 30* ^a	Non-elite: 12*
			F: 10	26-35: 14	Dip: 11	Elite: 46
				36+: 6 ^a	Uni: 16	
Doctor	6	19	M: 5	17-25: 5	PS/HS: 6	Non-elite: 8*
			F: 9	26-35: 8	Dip: 3	Elite: 0
				36+: 9	Uni: 7	
Family/friend	10	37	M: 8	17-25: 10	PS/HS: 8	Non-elite: 12*
			F: 13	26-35: 10	Dip: 14	Elite: 3
				36+: 12	Uni: 10	
Internet search	19	47	M: 20	17-25: 17	PS/HS: 15	Non-elite: 22*
			F: 17	26-35: 20	Dip: 17	Elite: 10
				36+: 30	Uni: 21	
Mass media	3	13	M: 2	17-25: 1*	PS/HS: 1	Non-elite: 3
			F: 3	26-35: 3	Dip: 5	Elite: 1
				36+: 12	Uni: 3	
Team-mates	2	21	M: 2	17-25: 2	PS/HS: 2	Non-elite: 2
			F: 3	26-35: 3	Dip: 2	Elite: 4
				36+: 3	Uni: 2	
Nutritionist	16	37	M: 13*	17-25: 16	PS/HS: 22*	Non-elite: 14*
			F: 22	26-35: 18	Dip: 23	Elite: 24
				36+: 15	Uni: 12 ^a	
Social media	2	13	M: 2	17-25: 2	PS/HS: 1	Non-elite: 2
			F: 2	26-35: 2	Dip: 3	Elite: 2
				36+: 0	Uni: 2	

^aPost-hoc analyses shows difference from expected values; *Statistically significant: $P < .05$.
Abbreviations: Dip, diploma PS/HS, primary school/high school; Uni, university.

nutrition affects the workings of the gut” and “How/why fat is stored.”

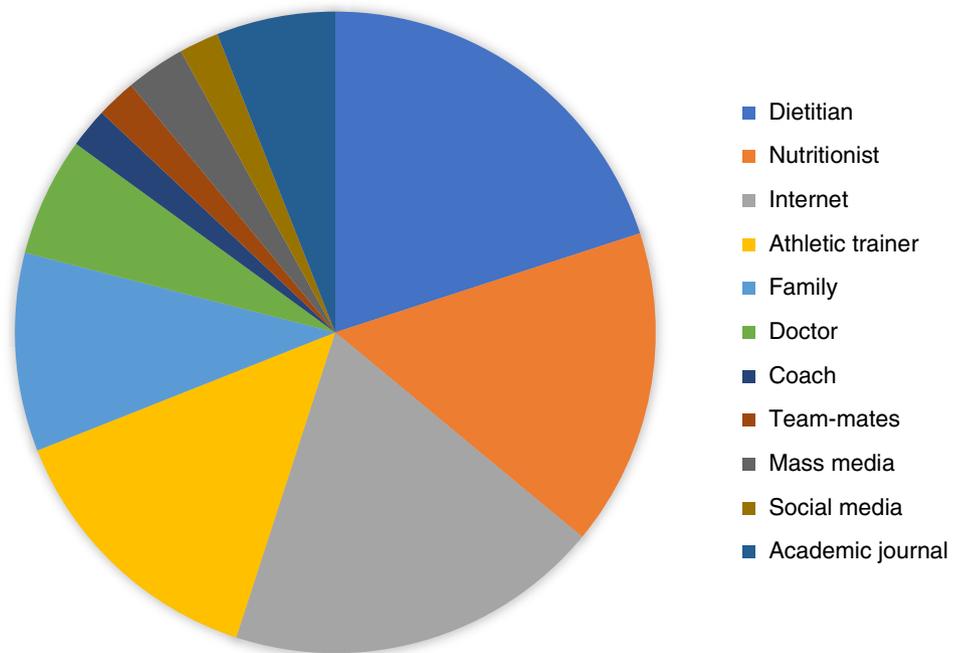
4 | DISCUSSION

Previous research has shown that Australian athletes have low NK scores^{8,16-18} and fail to comply with best-practice

sports nutrition guidelines.^{19,20} As NK is one factor that can influence nutrition behaviour,^{2,3} it is pertinent to explore the preferred information sources that athletes use, and how preferences influence NK. This is one of the first papers to investigate these topics in Australian team sports athletes.

Previous sources of advice: Over 50% of athletes reported to have been given advice from their family, friends, coach or team-mates. Family and friends are known to

FIGURE 1 Australian athletes' preferred ("number 1") nutrition information sources, depicting elite and non-elite Australian football, soccer, hockey, cricket, netball and lawn bowls players (n = 410) most preferred information sources. Athletes were asked to rank the top 3 sources of information (relied on) regarding nutrition. The proportion of participants that selected each option as "1" are presented



be key information sources for both athletes^{14,21,22} and non-athletes, especially among adolescents.²³ Over 80% of New Zealand rugby coaches²¹ and around 50% of UK sports coaches report that they provide their athletes with advice.²² Coach was also reported as a common nutrition information source by American,¹¹ Iranian²⁴ and Nigerian¹⁵ college athletes and New Zealand runners.²⁵ It is likely that athletes spend more time with their family, friends and coaches, who are not nutrition professionals, than with a dietitian. Studies have shown that there is room for improvement in coaches NK.⁵ Likewise, previous research has demonstrated that there are gaps in the Australian populations' understanding of detailed nutrition messages.²⁶ Therefore, advice (and

misinformation) from family, friends and coaches has the potential to have a great impact on athletes. Nutrition is a popular topic, so even when athletes are consulting with a dietitian it is possible that they are simultaneously discussing their diet with others. This is likely to lead to confusion and may help explain why athletes with access to a dietitian did not have better NK scores.

There were fewer elite than non-elite athletes surveyed in our studies (Table 1), which reflects the smaller proportion of athletes playing sports at highly competitive levels. About 72% of non-elite and 18% of elite athletes reported that their [current] sporting organisation provided "neither nutrition information nor access to a dietitian." Only one-third of non-

FIGURE 2 Australian athletes' preferred ("number 1") type of nutrition-education support, depicting elite and non-elite Australian football, soccer, hockey, cricket, netball and lawn bowls players (n = 206) most preferred type of nutrition education. Athletes were asked to "what type of support do/would you find useful, please rank from 1 (most useful) to 5 (least useful)?" The proportion of participants that selected each option as "1" are presented

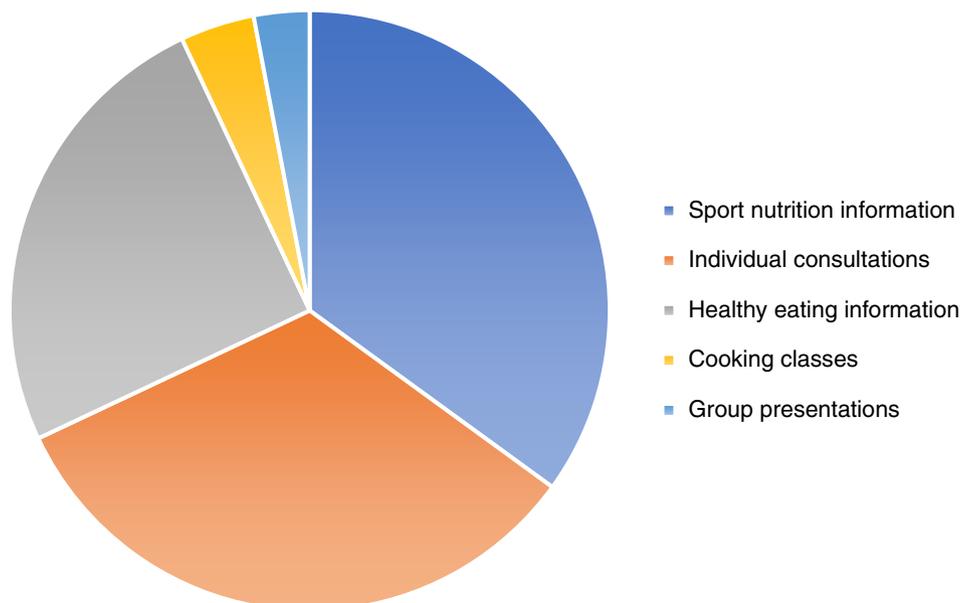


TABLE 4 Participants most preferred means of education for available responses (204/410); stratified for gender, age, education and sporting level

	Total cohort	Gender age		Level of education	Sporting level
Access to nutrition information relevant to healthy eating	25	M: 25	17-25: 20	PS/HS: 25	Non-elite: 26
		F: 26	26-35: 34	Dip: 30	Elite: 23
			36+: 31	Uni: 23	
Access to nutrition information relevant to sport	35	M: 34	17-25: 35	PS/HS: 38	Non-elite: 34
		F: 37	26-35: 29	Dip: 25	Elite: 35
			36+: 54	Uni: 36	
Access to group presentations	3	M: 3	17-25: 2	PS/HS: 21	Non-elite: 4
		F: 7	26-35: 5	Dip: 14	Elite: 2
			36+: 15	Uni: 15	
Individual consultations	33	M: 34	17-25: 38*	PS/HS: 34	Non-elite: 33
		F: 28	26-35: 29	Dip: 23	Elite: 33
			36+: 0	Uni: 37	
Cooking classes	4	M: 5	17-25: 5	PS/HS: 4*	Non-elite: 3
		F: 2	26-35: 3	Dip: 15	Elite: 7
			36+: 0	Uni: 0	

*Statistically significant: $P < .05$; for age and education; individual results are not statistically significant different from expected values.

elite athletes but over 80% of elite athletes had previously received advice from a dietitian. Although a large proportion of elite athletes had access to professional nutrition advice, it is unclear when the athletes last saw the dietitian or how often they received advice. This may, in part, explain the lack of difference between elite and non-elite athletes NK. Available literature indicates that the majority of athletes have not consulted a dietitian; for example, previous studies reported just 40% of Nigerian college athletes,¹⁵ 30% of National Collegiate Athletic Association athletes,²⁷ and 12.5% of elite Australian triathletes¹⁸ had accessed such services. While the recognition of the value of a sports dietitian has increased over time,^{27,28} even in the professional environment, dietetic services are usually only available on a part-time basis.^{16,28} Barriers to provision of dietetic services in both non-elite and elite environments are not known, but may include economic and time constraints.²⁹

Preferred source of information: Dietitians, the internet and nutritionists' were chosen as the preferred nutrition information sources. Australian athletes' preference for dietitians was akin to previous findings in other Australian studies.¹⁶⁻¹⁸ While many respondents (48%) reported that they had been previously given diet advice from their coach or trainer, only 2% of athletes actually selected "coach" their most preferred source of nutrition information. This is in contrast to existing international reports, which found that American college athletes were more likely to seek advice from a trainer or coach than a dietitian,¹² and felt more

comfortable discussing their nutritional needs with their trainer, coach,¹³ parent or friend¹¹ than with a dietitian. These differences may be reflective of varying roles of a sporting coach in an Australian and international context.

The popularity of the internet is in line with several other studies^{11,22,30} and mirrors findings from earlier research, which reported magazines to be a popular information source.³¹⁻³³ Given the strong preference for using the internet to obtain nutrition information and the lack of access to dietitians among some athletes, it seems prudent that dietitians (or club officials) provide advice on obtaining evidence-based information and education on assessing source credibility.

Factors that influence preference for information sources: Previous sources of advice and preferences for obtaining nutrition information were influenced by age, gender, level of education and sporting level. In the literature, there is limited information on factors that impact the use of and preference for certain advice sources. However, it is known that females, older, and more educated individuals tend to have higher general NK.³⁴ Many of the findings of the present study are axiomatic, for example, individuals with higher levels of education were more likely to use academic journals as their top source of information. Elite athletes were more likely to prefer dietitians, while non-elite athletes were more likely to prefer the internet, which may reflect the types of nutrition information which they have access to.

Lack of association between NK and access to dietitian: Our results indicated that there were no significant differences between NK scores (%) of participants who had previously received advice from a dietitian or selected nutritionist or dietitians as their preferred source of information. This is akin to previous findings in elite Australian athletes.¹⁷ A study in American collegiate athletes reported that individuals who indicated that a sports dietitian was their prime source of information had a better understanding of dietary periodisation.³⁵ However, the present study was assessing declarative knowledge (correct/incorrect answers to a factual statement) rather than procedural knowledge (reported behaviours). Additional published research on the association between information source and NK is lacking. However, several before-and-after studies evaluating education programs designed and run by dietitians have reported improvements in NK and eating behaviours.³⁵⁻³⁸ The NSKQ and A-NSKQ are designed to measure changes in NK, not nutrition behaviour.

In the present study, about 50 of the participants were recruited from elite teams known to have access to a qualified sports dietitian. However, these dietitians work on a part-time basis. Much of their role involves the provision of meals (and supplements), which reduces the need for specific education on guidelines that are intended to assist with planning an appropriate diet. They work towards counselling and motivating athletes to make food choices that will enhance performance and recovery. They provide practical tips and focus their education on simple concepts related to choosing appropriate food before, during and after training and competition. For instance, rather than explaining that athletes should aim to have 0.3 g protein/kg body weight after a resistance training session, they would provide a 100 kg athlete with examples of recovery meals or snacks that contain 30 g of protein. The lack of association between dietetic advice and NK in the present study may have occurred because the NSKQ and A-NSKQ test several specific sports nutrition guidelines, which are not necessarily the focus of dietetic interventions. It is also possible that some of the other athletes who answered “yes” to receiving advice from a dietitian saw a dietitian who was not qualified to work in sport, or was not current with evolving research. Sports nutrition is a specialised and rapidly evolving field. Obtaining qualifications as a sports dietitian involves postgraduate study. Achieving accredited sports dietitian status involves ongoing professional development to keep abreast of new literature. Ideally, all dietitians should work within their scope of practice and refer on to a more appropriate colleague if required.²⁸

Preferred type of nutrition support: Access to nutrition information relevant to sport was the most preferred type of nutrition support. This was followed closely by “individual consultations” and “access to general healthy eating

information.” The open-ended responses indicated a preference for provision of general advice and sports-specific advice (especially in relation to the pre-competition meal and recovery nutrition) and provision of meal plans. These findings, combined with athletes' poor awareness of (and failure to follow) specific sports nutrition guidelines, suggest that more focused education may be beneficial. Indeed, our results demonstrate that athletes have an interest in theoretical concepts, such as those covered in the NSKQ and A-NSKQ.

Limitations: A limitation of the present study is that the questionnaires were self-administered online and thus it is possible that athletes looked up the answers to questions; however, given the low scores and average times taken to complete the tools, the authors believe this is unlikely to have occurred. A further limitation was that the low completion rates meant that NK scores were not available for all respondents. In addition, while respondents were asked whether they had received advice from a dietitian, the researchers were not able to determine the extent of the advice, how recently the advice had been given. The specific qualifications and area of expertise of the dietitian was also not known. In relation, the soccer (n = 5) and elite AF players (n = 46) were recruited by their dietitian, which may have biased responses regarding preferred sources of information. The present study was undertaken in an Australian context and most athletes were young, university educated, and involved in AF—therefore, the results may not be applicable to all athletes.

Finally, this was a quantitative study and was unable to explore several relevant concepts in adequate depth. Athletes' reasons for choosing one nutrition source over another are unclear. The quality and method of delivery of nutrition interventions provided to athletes is not known. The internet was a preferred source of information, but we did not query the search terms and websites used by athletes. Moreover, we did not investigate athletes' barriers to obtaining adequate NK. These issues are well suited to qualitative research studies, such as focus groups.

In conclusion, Australian team sport athletes appear to prefer dietitians, the internet and nutritionists for sports nutrition information. These results support athletes' interest in and need for access to a qualified sports dietitian and reputable internet-based nutrition information. Future research could focus on evaluating novel education methods, including provision of information via online (website) modules or web-based mobile applications¹¹ designed by qualified dietitians. Future research could also assess whether athletes' preferences for educational support affects their improvement in NK after undertaking education programs. Additional studies exploring why athletes prefer information sources is required. Exploration of the reasons for athletes' poor NK also warrants further study.

CONFLICT OF INTEREST

The authors have no conflicts of interest to declare.

AUTHOR CONTRIBUTIONS

G.L.T. planned and undertook data analysis, wrote the manuscript, and oversaw manuscript preparation. A.F., R.H. and R.B. assisted with study designed and contributed to revising the paper for intellectual content. All authors read and approved the final manuscript. The content of the manuscript has not been published elsewhere.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of this article.

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ORIGINAL RESEARCH

An evaluation of empathic tendencies of dietitians working in Ankara

Ayşin YILDIZ, Aydan ERCAN and Selen MÜFTÜOĞLU *Department of Nutrition and Dietetics, Faculty of Health Sciences, Baskent University, Ankara, Turkey***Abstract****Aim:** This study was carried out to determine the level of empathic tendencies of dietitians working in Ankara, Turkey.**Methods:** The study was conducted between February and June 2016 on 175 dietitians aged between 20 and 60 who worked in Ankara, Turkey and volunteered to participate in the study. The Empathic Tendency Scale (ETS) and the Empathic Skill Scale (ESS) were used as data collection tools in the study.**Results:** The median of ETS scores of male dietitians was found to be lower than that of female dietitians ($P < 0.05$). The differences between the median values of ETS and ESS were determined to be statistically significant in terms of the age groups and the 20–24 age range was found to be the age group with the lowest ETS and ESS ($P < 0.05$). In this study, it was found that the ETS and ESS median scores of married dietitians were higher, those of the dietitians with no children were lower, and that the ETS median score of the dietitians who had higher level of education was higher ($P < 0.05$). A positive relationship was found between the working environment satisfaction of the dietitians and empathic behaviours variable ($r = 0.133$, $P = 0.008$).**Conclusions:** The empathic skill of the healthcare staff is an important part of the relationship that they establish with patients. When this is assessed from a nutritional point of view, dietitians need to be able to use communication skills effectively, especially empathy, in order to increase the effectiveness of nutrition education they provide.**Key words:** dietitian, empathic skill, empathic tendency, empathy, Turkey.**Introduction**

Empathy is one of the social skills necessary for being effective in our relationships with other individuals.¹ Developing a sense of empathy for another person is based on three basic factors: (i) entering the role of the person to be empathised with, viewing the world just as the person does, and experiencing the person's feelings; (ii) ability to achieve a non-verbal communication and read the underlying meanings; (iii) ability to establish a sincere communication without judging.^{2,3} Especially in the field of healthcare, empathy can be said to be one of the basic components of patient care. Understanding the needs, feelings, and current state of the patient makes up the basic tasks of the health professional, and empathy is the basis for this understanding.^{4,5}

Clinical empathy is defined as the communication skill that a person uses to help another person by leaving his/her

personal stance aside (perspectives, opinions, ideas, feelings, etc.).⁶ For this reason, developing empathy is based on the communication skills of a health professional.^{7,8} When the necessary empathic relationship is established, the patient is less likely to take a defensive attitude, and expresses his/her needs more easily, thereby increasing the speed and satisfaction of patient recovery by reducing the anxiety and adverse outcomes that can occur during treatment.^{9,10}

Healthcare educators identify empathy as a significant factor in patient care that must be developed during medical education and which can be assessed at admission to the course. Likewise, empathy is an important component of 'professionalism' that can be cultivated in healthcare practice.¹¹ For example, The Association of American Medical College's Medical School Objectives Project (MSOP) lists empathy among their educational objectives by emphasising that medical schools should strive to educate altruistic physicians who are 'compassionate and empathetic in caring for patients' and who can understand a patient's perspective by exercising empathy.¹² Similarly, studies conducted to determine the empathy levels of nurses show a significant improvement after a basic empathy educational programme.¹³

While there is a fairly large and growing literature studying the role of empathy in patient-healthcare staff

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relationships in the fields of medicine, nursing, and psychology, a limited number of studies exist on the importance and development of empathic communication in dietitians, even though empathy has an obvious role in effective dietary counselling. A study on this topic investigating dietitian activity and patient compliance has found that 'human-centred' approaches produce better outcomes than 'strategy-centred' approaches. In addition, a high level of interaction with patients has been observed to increase patient satisfaction and promote positive health behaviours.¹⁴

Clinical dietitians spend a considerable amount of time providing patient care and nutrition counselling. In order to be successful in this area, it is necessary to have a good understanding of human behaviour in addition to a satisfactory level of nutrition knowledge. Therefore, establishing a trust-based relationship between the dietitian and the patient promotes effective nutritional counselling and improves outcomes. Achieving satisfactory results depends on the dietitian's ability to listen to the patient with empathy, understanding the desires and aspirations of the person.¹²⁻¹⁴ Therefore, this study aimed to determine the empathy tendencies of dietitians and to collect data to support future work in the development of empathy skills.

Methods

This study was conducted using a cross-sectional study design and the sample was comprised of dietitians aged between 20 and 60 who worked in Ankara, Turkey and volunteered to participate in the study between February and June 2016. Dietitians working in hospitals or clinics in Ankara were identified and invited to participate.

In this study, a questionnaire consisting of three parts was used. The first part was a 'Personal Information Form' with items on the education level, professional background, current department, and occupational perceptions of the dietitians participating in the study. The second and the third parts consisted of the Empathic Tendency Scale and Empathic Skill Scale which were developed and validated by Dokmen in Turkey.¹⁵

The Empathic Tendency Scale is a Likert-type scale with 20 items, which is intended to measure individuals' potential for developing empathy in everyday life. Half of the items were designed to have a negative perspective to balance the tendency of individuals to say 'yes'. Each item is scored between 1 and 5 to indicate to what extent one agrees on the idea in the item. Each number that individuals mark makes up the score for that item and the items with a negative perspective are reversely scored. The total score obtained by evaluating responses to the positive and reverse items expresses the empathic tendency scores of the subjects. A high score indicates a high empathic tendency, whereas a low score denotes a low empathic tendency.^{16,17}

The Empathic Skill Scale consists of six different scenarios about daily life, which are presented in short paragraphs. Below each instance there are 12 responses. Individuals are provided with 72 empathic responses and

are asked to choose four of the 12 responses in each instance in descending order of importance. There is an irrelevant response in each instance. These six responses in total are intended to control the attention of the individuals.

The four responses that the individuals choose related to each instance are scored and thus a total score from 24 responses is obtained. High scores indicate a high empathic skill, while low scores mean a low empathic skill. If an individual chooses even one of the irrelevant responses, his/her form is excluded from the evaluation on the grounds that no adequate attention has been given to the questionnaire.^{16,17}

Descriptive statistics were given depending on the categorical or quantitative nature of the data collected in the study. Categorical variables were expressed as numbers (n), while quantitative variables were expressed as mean, standard deviation (SS), median, interquartile range values. The normality of the distribution of quantitative data was evaluated by the one sample Kolmogorov-Smirnov test. Comparison between two groups was performed by Mann-Whitney *U*-test for continuous data is not normally distributed and among more than two groups was performed by Kruskal-Wallis test. In addition, the correlation coefficient and statistical significance between two quantitative variables were calculated by using 'Pearson Correlation Analysis'. 'Point-Biserial Correlation Analysis' was used when one of the variables was categorical and the other quantitative. SPSS 21.0 statistical software package was used for the statistical evaluation of the data. The level of significance in all hypothesis tests was evaluated by taking $P \leq 0.05$.

Results

A total of 175 dietitians, 19 of whom were male, participated in the study. The median of the ETS scores of male dietitians was found to be lower than that of female dietitians ($P < 0.05$). The difference between ETS and ESS median values were found statistically significant in age groups and the 20-24 age range was determined to be the age group with the lowest ETS and ESS values ($P < 0.05$). It was also found in the study that married dietitians had higher ETS and ESS median scores, the dietitians with no children had lower ETS and ESS median scores, and that the dietitians with a higher education had higher ETS median scores ($P < 0.05$). Finally, the differences between the duration of dietitians' work experience and the ETS and ESS median values were examined and the ESS median values of dietitians with 11-20 years of work experience were found to be higher ($P < 0.05$) (Table 1).

Table 2 presents a comparison between ETS and ESS scores based on the demographic features, occupational perceptions and communication skills of dietitians. Accordingly, a statistically significant negative correlation was found between the marital status and the ETS score

Table 1 ETS and ESS mean scores by the demographic characteristics of the dietitians

Demographic characteristics	Scale scores								
	The empathic tendency scale				The empathic skill scale				
	n	Median (IQR)	\bar{X}	SD	n	Median (IQR)	\bar{X}	SD	
Gender	M	19	69 (9.0)	69.7	6.8	13	132 (16.0)	132.7	10.7
	F	156	73 (10.0)	74.1	7.1	120	133 (36.5)	135.4	27
		$P = 0.028$				$P > 0.05$			
Age (years)	20–24	18	67.5 (10.75)	68.7	7.8	14	123 (17.0)	124.6	25.5
	25–34	74	74 (10.25)	74.1	7.4	60	128 (28.75)	130.3	22.0
	35–44	34	77(7.75)	76.8	6.0	25	145 (46.0)	153.5	26.5
	45–60	47	72(8.0)	72.7	6.1	33	129 (31.5)	134.1	26.6
		$P = 0.006$				$P = 0.006$			
Marital status	Married	93	75 (8.0)	74.7	6.8	67	139 (34.25)	139.1	25.9
	Single	77	72 (10.5)	72.3	7.2	61	126 (25.5)	129.8	23.6
	Other	5	68 (0)	72.4	10.4	5	143 (0)	146.8	41.0
		$P = 0.021$				$P = 0.036$			
Number of children	No child	98	72.5(10.5)	72.4	7.1	78	125.5 (27.0)	129	22.4
	1 child	39	76 (8.0)	75.1	7.1	31	139 (37.0)	144.7	28.4
	2–3 children	33	75 (9.5)	76.3	6.5	20	144.5 (39.0)	147.6	26.6
		$P = 0.018$				$P = 0.001$			
Level of education	Graduate	111	73 (10.0)	72.9	7.5	82	130 (35.5)	133.5	26.2
	Master	44	75 (8.25)	74.2	6.6	33	134 (24.5)	133.2	20.9
	PhD	20	77 (10.25)	76.4	5.7	18	139 (50.25)	145.7	30.6
		$P = 0.028$				$P = 0.05$			
Work experience (years)	0–5	68	73 (11.0)	72.5	7.9	54	125 (29.25)	128.1	23.1
	6–10	25	73 (10.0)	74.2	6.5	20	130 (22.0)	132.2	23.0
	11–20	28	75.5 (7.75)	75.4	6.6	20	140 (32.5)	145.7	23.6
	20+	54	73 (9.25)	73.7	6.6	39	139 (42.0)	140.9	29.3
		$P = 0.031$				$P = 0.05$			

IQR, interquartile range.

($r = -0.171$, $P = 0.026$) and the ESS ($r = -0.186$, $P = 0.036$). In other words, the married individuals had higher empathy scale scores, while the single individuals had lower scores. As the number of children and the level of education increased, the scores obtained from the empathy scale increased as well (ETS: $r = 0.223$, $P = 0.003$; ESS: $r = 0.306$, $P = 0.000$; ETS: $r = 0.159$, $P = 0.036$, respectively). Additionally, the ESS score ($r = 0.241$, $p = 0.005$) was also found to increase as the duration of work experience increased.

A positive correlation was found between the work environment satisfaction of the dietitians and the variable for behaving empathically ($r = 0.133$, $P = 0.008$). In addition, there was a linear relationship between ETS scores and being empathic in the workplace ($r = 0.161$, $P = 0.033$), achieving communication with patients ($r = 0.213$, $P = 0.005$), understanding patients ($r = 0.178$, $P = 0.02$), attaching importance to the feelings and thoughts of patients ($r = 0.233$, $P = 0.002$), attaching importance to the feelings and thoughts of co-workers ($r = 0.214$, $P = 0.002$), and attaching importance to the feelings and thoughts of colleagues ($r = 0.231$, $P = 0.002$). Also, a positive relationship was observed between achieving communication with patients and empathic skill ($r = 0.201$, $P = 0.021$).

Discussion

An empathic approach is of great significance for recognising and understanding the patient. Healthcare staff should be able to look at the events with the eyes of patients and put themselves in the place of a patient. Ferri *et al.* point out that nurses can determine the needs of patients more accurately and achieve positive results when they approach them with an empathic attitude.¹⁸ Additionally, an individual who feels s/he is understood by the healthcare staff thinks that s/he is cared, trusted and valued. In this case, it becomes easier for the staff to reach the individual and as a result, the individual accepts the treatment to be applied. Therefore, a customised care and a favourable therapeutic environment are provided. The rate of healing increases after such a service and the negative consequences of treatment and care are reduced.^{19,20}

In studies conducted on this issue in various occupational groups in Turkey, it was found that there were differences between genders in terms of ETS scores. The results of the studies indicated that ETS scores of women were higher than those of men.^{18,21,22} This was thought to be associated with the fact that women are more emotional than men and that their empathic skills are higher.²³ It has

Table 2 Comparisons between ETS and ESS scores according to the demographic characteristics, occupational perceptions, and communications skills of the dietitians

		<i>The empathic tendency scale</i>			<i>The empathic skill scale</i>		
		<i>n</i>	<i>r</i>	<i>P</i>	<i>n</i>	<i>r</i>	<i>P</i>
Demographic characteristics	Age	173	0.087	0.255	132	0.164	0.060
	Marital status	170	-0.171	0.026*	128	-0.186	0.036*
	Number of children	170	0.223	0.003*	129	0.306	0.000*
	School graduated	174	0.077	0.313	132	-0.047	0.589
	Level of education	175	0.159	0.036*	133	0.129	0.139
	Work experience	175	0.087	0.250	133	0.241	0.005*
Occupational perception	Satisfaction with job selection	175	0.138	0.068	133	-0.001	0.987
	Satisfaction with the income	175	-0.039	0.611	133	-0.008	0.930
	Satisfaction with the work environment	175	0.133	0.008*	133	0.159	0.068
	Planning to change the job	175	-0.141	0.063	133	-0.113	0.197
Communication skills	Being empathic in the workplace	175	0.161	0.033*	133	-0.09	0.304
	Achieving communication with patients	174	0.213	0.005*	132	0.201	0.021*
	Understanding the thoughts of patients	172	0.178	0.020*	131	0.143	0.103
	Attaching importance to the feelings and thoughts of patients	173	0.233	0.002*	132	-0.012	0.896
	Attaching importance to the feelings and thoughts of patient relatives	172	0.132	0.085	131	0.038	0.665
	Attaching importance to the feelings and thoughts of co-workers	174	0.214	0.004*	133	0.005	0.952
	Attaching importance to the feelings and thoughts of colleagues	173	0.231	0.002*	133	0.071	0.418
	Behaving empathically towards colleagues	173	-0.004	0.963	132	0.089	0.308

* $P < 0.05$.

been observed in studies on the effect of gender on empathy that empathic thinking and skills are generally higher in women than they are in men.^{24,25} Similarly, the ETS scores of female dietitians were found to be higher than those of men in this study ($P < 0.05$).

Significant demographic characteristics, such as age and marital status, have been found to be associated with empathic thinking and skills. In this study, it was determined that age groups had an effect on empathic tendencies and skills and that the empathic tendency and skill scores of married dietitians were higher than those of single dietitians ($P < 0.05$). It was determined in one of the studies conducted on this topic that there was a significant difference between the empathic skill scores in terms of age groups and that this difference came from 36 to 45 year age group.²⁶ In another study, it was found that as the age increased in males, the empathic skills increased as well.²⁷ Sen *et al.*²⁸ found that the mean empathic skill score of married individuals (138.18 ± 20.54) was significantly higher than the mean score of single individuals (135.41 ± 21.06). In a study investigating the empathic tendencies of doctors, it was determined that the empathic tendencies of married physicians were higher than those of the singles, and that married doctors were more successful than singles, especially in providing health care and guiding patients.²⁹ On the other hand, in a study on nurses, no significant relationship was found between marital status and empathic thinking.²⁸

In another study investigating the empathic tendency level and the factors affecting this in intensive care nurses relating to a comparison between having children and empathy, it was determined that the empathic tendency score (70.25 ± 1.17) of those who had children was found to be higher than that of nurses with no children (62.47 ± 1.62) ($P < 0.05$).³⁰ Similarly, in the study of physicians' empathic tendencies, it was observed that the empathic tendencies of individuals with children were higher than those who did not have any children.²⁷ Likewise, in this study, the ETS scores of individuals who had children were higher than those who did not have any children ($P < 0.05$).

As with many issues, the level of education has an effect on empathic tendencies and skills. In general, studies show an increased empathic thinking and empathic skills as a result of higher levels of education and experience.³¹ For example, in a study conducted on nurses, empathic skills were determined to increase according to the education level of nurses.³² A study of nurses who provided child care services found a significant relationship between the level of education and empathy skills.³³ Also, a significant increase in the empathic tendency scores was observed with an increase in the level of education in a study conducted on teachers with graduate and master's degree.²³ In this study, it was found that the empathic tendency increased with increasing educational level ($P < 0.05$), but that the empathic skill did not change.

No significant relationship was found between the duration of work experience and empathic tendency and skills in teachers in the study of Saygılı, Akbulut, and Elikesik,²³ in family physicians in the study of Karaoğlu,³⁴ in health-care workers in the study of Sen *et al.*²⁸ and in nurses working in internal clinics in the study of Ergin.³³ In this study, it was determined that empathic skill scores increased as the years of work experience increased ($P < 0.05$). The study found that empathic tendency scores were related to being satisfied with the work environment rather than the duration of work experience ($P < 0.05$).

In a study on the relationship between communication skills and empathy, the ETS mean score of nurses who stated they usually/always achieved putting themselves in the place of patients was found to be 70.98 ± 8.1 , while the score of those who had difficulty doing this was 69.0 ± 10.4 .²⁸ In a study conducted by Arpacı and Özmen,³⁵ the mean ETS score of nurses (74.69 ± 7.91) who thought they were always able to understand patients was significantly higher than that of nurses (69.80 ± 9.95) who thought that they rarely managed to understand their patients. Similarly, in a study on determining the communication skills and empathy levels of students attending health sciences faculty, the empathic tendency score of the group who stated they had difficulties in patient relations was 67.2, while the empathic tendency score of the group that stated that they did not have difficulties in patient relations was 70.0. Although this relationship was concluded to be statistically insignificant, the empathic tendency scores of the group that stated they had no problems in patient relations were higher than those of who had difficulties.³⁶ Similarly, this study found that the empathic tendency scores of the dietitians who achieved being empathic, managed to establish communication with patients, understood and attached importance to the feelings and thoughts of patients were higher ($P < 0.05$).

This study has some limitations which are the small sample size, the long questionnaire and the lack of previous research studies on this topic. In the future, large-scale studies are needed on empathic skills or empathic tendency issues among health care professionals, especially dietitians.

In conclusion, the empathic skill of healthcare personnel is an important part of the relationship that they establish with patients. The patient satisfaction obtained as a result of this relationship enhances patient confidence and compliance to treatment. For this reason, the development of empathic skill levels of health workers is important in terms of both the patient and the health worker. When this case is assessed from a nutritional point of view, it is necessary for dietitians to be able to use communication skills effectively, especially empathy, in order to increase the effectiveness of nutrition education they provide. Although the empathic tendency is parallel to the personal characteristics of individuals, empathic skills can be improved through education. In order to improve empathic skills and raise awareness, psychodrama and empathic skills development programs, where role-taking and role modelling techniques are employed in both dietetic education and business life,

must be included in undergraduate education and/or in-service training programs.

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Conflict of interest

The authors have no conflict of interest to declare.

Authorship

AY, AE and SM were responsible for the conception of the study, data collection, statistical analysis and the designed of the manuscript. SM was responsible for the editing and approval of the manuscript.

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ORIGINAL RESEARCH**Prospects for early childhood feeding interventions:
An exploration of parent's concerns and acceptability
towards social media intervention opportunities**Nikki BOSWELL ¹, Rebecca BYRNE ² and Peter S.W. DAVIES¹¹University of Queensland, School of Medicine and ²Queensland University of Technology, Faculty of Health, Brisbane, Queensland, Australia**Abstract****Aim:** The present study aims to (i) consult with parents regarding child feeding concerns, as relevant to child feeding interventions, (ii) determine parents' willingness to participate in online and social media-based interventions and (iii) determine differences in intervention acceptability based on geographic diversity and demographic characteristics.**Methods:** Three hundred thirty Australian parents of children (2.0–5.0 years) with child feeding concerns participated in an online, cross-sectional survey. Kruskal–Wallis with Dunn's multiple-comparison test, using Bonferroni adjustment, was used to compare differences between variables and participants characteristics (region of residence, parent age, parent education and income).**Results:** About 53.9% of respondents were concerned about child fussy eating, with lack of time and child tantrums common barriers to addressing concerns. Respondents indicated that a combination of online platforms (websites, email, Facebook) was their preferred method of intervention participation, although, a combination of online and face-to-face methods also had modest preference, particularly among lower educated parents. Participants indicated that they would participate in an online intervention (participating once a week) for more than 12 weeks (42.7%), compared with only 4 weeks (participating once a week) for traditionally delivered interventions. About 32.4% of respondents said they would be concerned about their privacy in an online intervention.**Conclusions:** Fussy eating is likely to be an appealing focus for future child feeding interventions, with strategies to address common barriers an important curriculum area. Online interventions are likely to offer an acceptable and plausible alternative to traditional interventions that are able to reach geographically diverse populations, although face-to-face intervention components still hold appeal.**Key words:** children, education, e-health, social research, technology.**Introduction**

Establishing an appropriate feeding dynamic during early childhood is important in reducing child feeding and growth problems, including overweight and obesity which affects around 1 in 4 Australian children aged 4–5 years.^{1,2} For this reason, many early childhood feeding interventions aim to support parents establish responsive feeding practices.^{2–6} While these interventions have often shown success in achieving these objectives, evidence of parent's acceptability towards such interventions

is limited.^{7,8} Failure to consider parent's acceptability towards intervention design, key messages, and modes of delivery are likely to impede on the overall impact and effectiveness of an intervention and may contribute to participant disengagement and study dropout.⁹ Attrition rates in childhood obesity interventions, which range from 27% to 73%, provides some evidence in this regard, and suggest that further understanding of parent's acceptability towards intervention protocols are needed.¹⁰ Increasing researchers understanding of parent's acceptability towards child feeding interventions, in this regard, will allow more appropriate designs, that are likely to have higher rates of engagement, adherence, and consequently, outcome success.^{9,11,12} Furthermore, given the increasing attention towards Internet-based interventions as a potentially efficient means of delivering child feeding interventions, gauging parent's acceptability towards Internet-based interventions, as well as parent's concerns regarding such interventions, offers opportunity to better meet the needs

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of modern parents.^{9,11,12} Specifically, issues surrounding participants concerns for privacy and social desirability bias have been flagged as potential barriers in delivering Internet-based interventions.¹²

Despite these potential barriers, Internet-based technologies appear a plausible means to reach geographically diverse and otherwise vulnerable populations, who are often under-represented in early childhood feeding interventions.^{3–6} For instance, key early childhood feeding interventions in Australia (NOURISH, InFANT (Infant Feeding Activity and Nutrition Trial) and Healthy Beginnings Randomised Controlled Trial) have recruited samples exclusively from Brisbane, Adelaide, Melbourne and Sydney, which reduces the generalisability of the results as regional and remote areas were not represented.^{3–6} Since these interventions were planned in 2007–2008, however, ownership and use of Internet-enabled devices has expanded rapidly, with all but 1% of the Australian population having Internet-enabled devices and 65% of Internet users, using social media.^{13,14} This wide reach of internet-based devices offers new opportunity to reach a diversity of participants and a novel means to engage in intervention delivery. This opportunity was recognised in the InFANT Extend program, an extended version of the InFANT randomised controlled trial, which allowed participants to opt in to an online intervention component that supported engagement with face-to-face program delivery in Melbourne.¹⁵ The social media site Facebook was specifically used in the InFANT Extend program, as particularly appealing for use in research in Australia as the most popular social media platform, accumulating 95% of social media usage and a consistent distribution of users across metropolitan and regional areas (95% and 97%, respectively).^{14–16}

Given the importance of understanding parent's acceptability towards child feeding interventions and the opportunity for Internet-based intervention delivery, the present study aims to (i) consult with parents regarding child feeding concerns and behavioural motivations, (ii) determine parents' willingness to participate in social media and Internet-based interventions and (iii) determine differences in these areas of intervention acceptability based on geographic diversity and other demographic characteristics (income status, parent education and parent age). Consideration will specifically be given to opportunities and concerns regarding intervention via Facebook, because of its high popularity and significant research potential. The findings of the present study will be of benefit in planning future early child feeding interventions in Australia.

Methods

Between November 2017 and January 2018, Australian parents of children aged 2.0–5.0 years self-enrolled to complete an online, cross-sectional survey. The survey was directed towards parents with child feeding concerns through advertising on the social media website Facebook. The advertisement provided background information about the survey and a link to a website which contained a plain

language statement, participant consent form and access to the online survey, hosted by Checkbox. Children were excluded from the present study if parents reported they had a medical condition likely to affect their growth, development or metabolism. Parents with more than one child in the target age were advised to refer to the child whose birthday occurred next. Participants were not provided any incentives for completing the survey.

The health belief model¹⁷ and social cognitive theory¹⁸ were chosen as relevant theoretical frameworks to guide the development of survey items because constructs of the health belief model attempt to understand behavioural motivations (i.e. intentions to perform behaviours based on the perceived susceptibility, severity and benefits of a behavioural outcome),¹⁷ while the social cognitive theory supports understanding of, and consequently change in, health-related behaviours through cues to action.¹⁸ Furthermore, the health belief model and social cognitive theory are frameworks commonly used by researchers across the literature, thus the results of the present study will be readily adaptable to future interventions. A schematic model depicting behavioural motivations, behaviour change intentions and cues to action, as they align with the health belief model and social cognitive theory are shown in Figure 1.

Parents reported the child's gender and age to the nearest half year, parent's gender, highest level of education, marital status (single parent or otherwise), family income (categorical increments from less than \$40 000 to more than \$150 000), Australian state of residency, and type of residing region (based on Rural, Remote and Metropolitan Areas (RRMA) classification).¹⁹

To capture responding parents' behavioural motivations related to participating in a child feeding intervention, parents were asked to identify concerns from a pre-defined list including concerns relating to weight concerns (overweight and underweight), and eating behaviours (overeating, undereating, fussy eating, high intake of discretionary food), as well as perceived barriers in addressing these concerns. Similarly, parents were asked to identify strategies they would be interested in learning to address their concerns, and the delivery mode they would prefer for such a learning experience, from a pre-defined list.

Parents' cues to action were captured in categorical questions reflecting the frequency in which parent's access Facebook, participate in Facebook groups, and the type of content they share and engage with on Facebook. Parents were asked to indicate if they would join a Facebook group as an intervention platform, if they would be concerned about their privacy in this group, if they believed their honesty in this group would differ to an in-person intervention, the type of content they would access, how often they would expect new content posted, and how quickly they would expect administration of a Facebook intervention to respond to comments or questions. All survey items were devised for the present study based on expert knowledge of child feeding interventions and behaviour change theory. The survey was piloted in a convenience sample of three

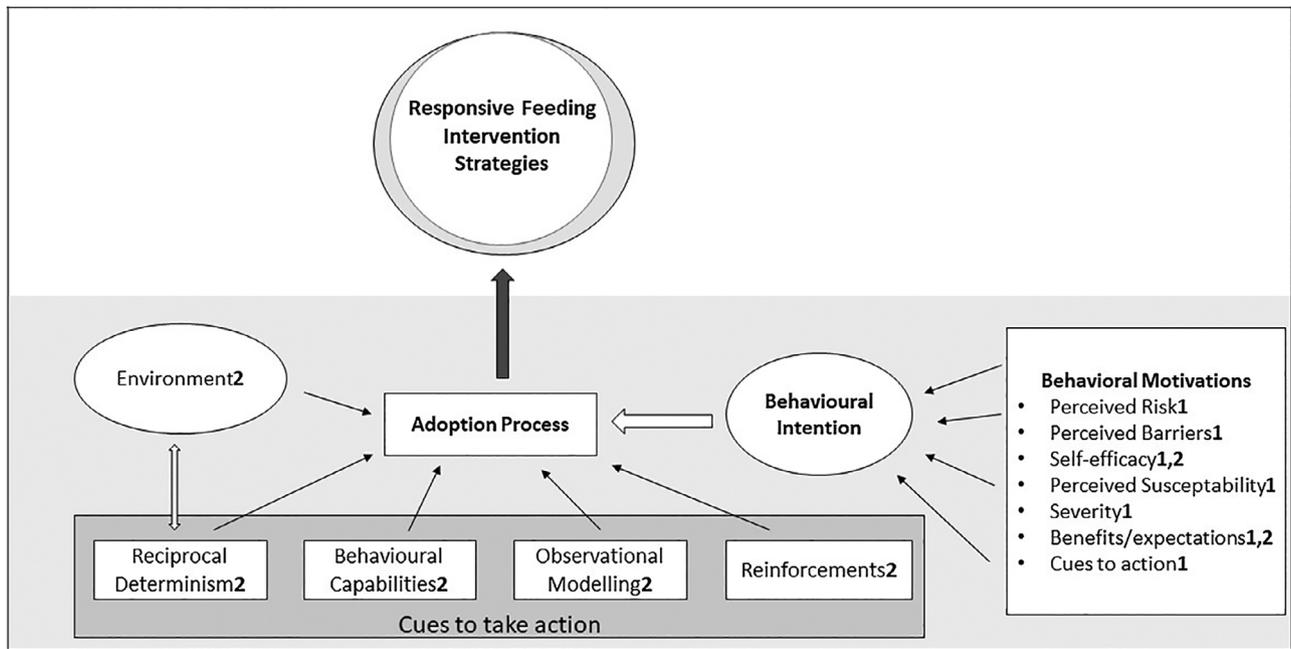


Figure 1 Schematic model of behavioural motivations and behaviour change intentions aligning with the constructs of the health belief model (1) and social cognitive theory (2). (Adapted from Uesugi *et al.*,¹¹ with permission)

parents with young children. See Table S1 (Supporting Information) for further details.

Participants were asked to report their receptiveness to participate as an intervention ‘champion’. The idea of a ‘champion’ draws from public health concepts and is a unique construct intended to enhance social media-based interventions by using select participants to support researchers by being highly engaged and facilitating participant engagement with the intervention.

Descriptive and frequency data were created using SPSS v25 (SPSS Inc., Chicago, IL, USA). Confidence intervals (CIs) were calculated to provide estimates of sample parameters using standard *t*-distribution formula based on sample means. All hypotheses assumed a 0.05 significance level and a two-sided alternative hypothesis. Select behavioural motivation variables (parents’ child feeding concerns, perceived barriers, intervention strategies of interest, preferred mode of intervention delivery) were analysed to determine differences between geographic region and demographic characteristics. Kruskal–Wallis test, with Dunn’s multiple-comparison test using Bonferroni adjustment, was used to determine differences in these behavioural motivation variables and ordinal geographic/demographic variables (region of residence, parent education and income). Linear regression was used to determine the relationship between parents age with behavioural motivations.

The present study has been prepared in accordance with STROBE guidelines (STrengthening the Reporting of OBservational studies in Epidemiology), however, a sample size calculation was not performed.²⁰ Ethical approval for this research project has been granted through The University of

Queensland (approval number 2017001504). In accordance with ethics approval, cases with missing data were excluded as they were considered to have withdrawn from the study.

Results

The present study recruited 330 Australian parents’ children of 2.0–5.0 years of age. Further descriptive data are reported in Table 1.

Parent reported behavioural motivations (concerns, barriers, intervention strategies and preferences) regarding child feeding, as presented in Table 2, indicate that parents greatest child feeding concern relates to their child being a ‘fussy’ eater (53.9%). Fewer parents were concerned about their child being overweight (9.4%), compared with underweight (15.2%). Parents reported *time* to be the biggest barrier (50.6%) to them addressing their child feeding concerns, followed by their child having *tantrums* (36.7%), and a lack of *money* (31.2%). Over 60% (61.2%) of parents indicated they would like strategies to support their child eat *the right type of food*, 56.4% to *reduce fussy eating*, 53.9% to *prepare quick meals*, 49.4% to support their child eat *the right amount of food*. Further details about desired intervention strategies and differences in behavioural motivations between demographic groups can be seen in Table 2.

The largest proportion of parents (32.7%) indicated that a combination of online platforms (e.g. website, email and/or Facebook group) was their preferred method of intervention participation, although a combination of online and face-to-face mediums was also preferred by 22.1% of respondents. Forty-three percent (42.7%) of participants

Table 1 Demographic data (n = 330)

Child gender (male)	51.8% (171)
Age (years)	
2	17.6% (58)
2.5	21.5% (71)
3	15.5% (51)
3.5	12.4% (41)
4	11.8% (39)
4.5	11.5% (38)
5	9.7% (32)
Mean (SD)	3.26 (0.97)
Parent gender (male)	3.3% (11)
Parent age (years), mean (SD)	34.1 (5.4)
Single parents	9.4% (31)
Income	
Less than \$40 000	11.0% (34)
\$40 000–\$69 999	16.1% (50)
\$70 000–\$99 999	24.2% (75)
\$100 000–129 999	19.0% (59)
\$130 000 or more	29.7% (92)
Australian State	
Victoria	19.7% (65)
New South Wales	23.9% (79)
Queensland	24.2% (80)
Australian Capital Territory	5.5% (18)
Western Australia	10.0% (33)
Tasmania	5.5% (18)
Northern Territory	0.9% (3)
South Australia	10.3% (34)
Region type	
Capital city	36.4% (120)
Metro (population: over 100 000)	29.1% (96)
Large rural (population: 25 000–99 999)	13.9% (46)
Small rural (population: 10 000–24 999)	11.2% (37)
Large remote (population: 5000–9999)	3.6% (12)
Small remote (population: less than 5000)	5.8% (19)
Parent education	
Did not complete high school	3.3% (11)
Completed year 12 or equivalent	10% (33)
Post-secondary qualifications	25.2% (83)
Bachelor's degree	35.5% (117)

% (n) reported for dichotomous variables.

indicated that they would participate in an online program (participating once per week), for more than 12 weeks. The preferred duration for a face-to-face only program (participating once per week) was 4 weeks (26.1%), although 30.9% said they would not participate face-to-face (see Table S2). Additional details reflecting differences in preferred methods of intervention delivery between demographic groups can be seen in Table 2. Parents perceived severity of their child feeding concern, importance in getting support, and motivation towards addressing these concerns can be seen in Table S2.

Parent reported Facebook use and acceptability towards social media-based child feeding interventions, are detailed in Table 3.

Discussion

The present study provides valuable information regarding parent's behavioural motivations, behaviour change intentions and cues to action related to participation in an early childhood feeding intervention, as aligning with the constructs of the health belief model and social cognitive theory. Briefly, the results of the present study indicated the main concern for respondents was their child as a fussy eater (53.9%), with lack of time and child tantrums common barriers to addressing these concerns. Respondents indicated that a combination of online platforms (websites, email and Facebook) was their preferred method of intervention participation, although, a combination of online and face-to-face methods also had modest preference, particularly among lower educated parents. Participants indicated that they would participate in an online intervention (participating once a week) for more than 12 weeks (42.7%), compared with only 4 weeks (participating once a week) for a traditionally delivered intervention.

More specifically, although the most prominent concern of parents regarding child feeding related to perceptions of their child being a 'fussy' eater, many parents were also concerned about their child eating too many discretionary foods, and not enough fruit and vegetables. While this appears consistent with the recruitment of parents who self-identify as having child feeding concerns, it also appears consistent with national data which shows that Australian children (2–18 years) derive around 30% of energy from discretionary food, 99% do not to meet recommended intake of vegetables, and 22% do not to meet recommended intake of fruit.¹ While there is no consensus on the definition of 'fussy' eating, which makes it difficult to ascertain prevalence, parents' perceptions of fussiness, as measured in the present study, are equally important.^{21,22} That is, perceptions of 'fussiness' are understood to result in alterations in parents-child feeding interactions, such that parents are more inclined to use non-responsive feeding practices which in turn have been seen to increase fussy behaviours.^{23,24} Given this, parents who simply perceive child feeding difficulties, are likely to benefit from child feeding interventions which focus on use of responsive feeding strategies.

Despite high concerns about childhood obesity within the public health sector, only 9.4% of parents in the present study indicated they were concerned about their child being overweight. Low level of parental concern towards child overweight appears consistent with findings across the literature which shows that parents are often unaware of child weight issues.^{25–28} This can specifically be seen in a study of Australian children aged 5–6 years, wherein 89% of parents of overweight children were unaware of their child's weight.²⁹ Given this low concern for child weight, but high concern for child fussiness, child feeding interventions may benefit from framing core messages around responsive feeding strategies that support parents to manage child fussiness rather than focus directly on child weight. Since responsive feeding practices have been seen to support both healthy

Table 2 Parent reported behavioural motivations (concerns, barriers, intervention strategies and preferences) regarding child feeding based on health belief model constructs

	% (n)	95% CI	Kruskal–Wallis H			Linear regression Parent age B (P-value)
			Region	Parent education	Income	
			H (P-value)	H (P-value)	H (P-value)	
Concerns						
Are you concerned about? (multiple respondent selections):						
Your child being overweight	9.4 (31)	6.25–12.54	3.25 (0.66)	4.25 (0.37)	4.89 (0.29)	0.95 (0.16)
Your child being underweight	15.2 (50)	11.32–19.07	4.33 (0.50)	3.93 (0.41)	4.38 (0.35)	-0.11 (0.06)
Your child being a ‘fussy’ eater, for example, eating a limited number of foods, refusing to participate in meals	53.9 (178)	48.52–59.27	9.91 (0.07)	2.35 (0.67)	2.88 (0.57)	0.02 (0.70)
Your child under eating, for example, not eating enough food	24.8 (82)	20.14–29.49	5.05 (0.41)	7.53 (0.11)	1.86 (0.76)	-0.03 (0.58)
Your child overeating, for example, eating too much food	16.4 (54)	12.04–20.39	5.50 (0.35)	4.20 (0.98)	3.86 (0.42)	-0.17 (0.01)
Your child not eating enough vegetables or fruit	48.2 (159)	42.8–53.59	1.24 (0.94)	5.18 (0.26)	1.64 (0.80)	-0.00 (0.95)
Your child eating too many discretionary foods	47 (155)	41.61–52.38	6.75 (0.24)	4.83 (0.30)	2.77 (0.59)	-0.06 (0.27)
Perceived barriers						
What barriers might prevent you from making changes to improve these concerns? (multiple respondent selections)						
Time	50.6 (167)	45.20–55.99	3.30 (0.65)	7.69 (0.10)	8.03 (0.09)	0.16 (0.01)
Money	31.2 (103)	26.20–36.19	25.84 (0.00)^a	14.63 (0.00)^d	59.75 (0.00)^f	-0.10 (0.09)
Family support	15.5 (51)	11.59–19.40	7.81 (0.16)	4.03 (0.40)	3.34 (0.50)	-0.02 (0.71)
Confidence	13.6 (45)	9.90–17.29	2.46 (0.78)	2.20 (0.69)	7.69 (0.10)	0.08 (0.18)
Cooking skills	10.3 (34)	7.02–13.57	5.11 (0.40)	7.69 (0.10)	5.16 (0.27)	0.04 (0.51)
Shopping skills	2.1 (7)	0.55–3.64	16.43 (0.00)^b	9.48 (0.05)^e	5.84 (0.21)	-0.05 (0.36)
Knowledge about food and nutrition	12.7 (42)	9.10–16.29	2.40 (0.84)	9.32 (0.06)	5.65 (0.22)	-0.00 (0.91)
Knowledge about child growth and development	12.1 (40)	8.58–15.61	11.02 (0.06)	2.81 (0.58)	4.95 (0.29)	-0.06 (0.28)
Just too hard (self-efficacy)	9.7 (32)	6.50–12.89	9.05 (0.10)	3.90 (0.41)	7.72 (0.10)	-0.03 (0.61)
Do not know what to do or where to get help	17 (56)	12.94–21.05	3.12 (0.68)	4.77 (0.31)	4.78 (0.31)	0.49 (0.40)
My child will have tantrums	36.7 (121)	31.49–41.90	6.72 (0.24)	4.42 (0.35)	4.01 (0.40)	-0.06 (0.30)
No barriers	18.5 (61)	14.31–22.68	14.55 (0.01)^c	4.38 (0.35)	10.05 (0.033)^g	0.12 (0.09)
Intervention strategies						
Would you be interested in learning strategies and skills to? (multiple respondent selections):						
Support your child eat the right amount of food	49.4 (163)	44.0–54.79	4.28 (0.50)	1.59 (0.80)	16.80 (0.00)^j	0.01 (0.85)
Support your child eat the right type of food	61.2 (202)	55.94–66.45	3.17 (0.59)	6.91 (0.14)	1.73 (0.78)	-0.00 (0.91)
Reduce your child’s fussy eating	56.4 (186)	51.04–61.75	6.81 (0.23)	2.16 (0.70)	3.79 (0.43)	0.08 (0.12)
Help you create tasty, healthy family meals	48.5 (160)	43.1–53.89	1.50 (0.91)	7.91 (0.09)	5.82 (0.21)	-0.00 (0.98)
Help you create affordable family meals	45.8 (151)	40.42–51.17	13.42 (0.02)^h	14.63 (0.00)ⁱ	15.35 (0.00)^k	-0.162 (0.02)
Help you prepare quick meals	53.9 (178)	48.52–59.27	2.30 (0.80)	3.67 (0.45)	3.01 (0.55)	0.05 (0.43)

Table 2 Continued

	% (n)	95% CI	Kruskal–Wallis H		Linear regression Parent age B (P-value)
			Region H (P-value)	Parent education H (P-value)	
Intervention delivery preference					
In thinking about the previous question: What would be the best way for you to develop the skills and strategies selected? (single respondent selection)					
Website information and materials	21.5 (71)	17.06–25.93	12.81 (0.02)^l	14.39 (0.00)^m	0.12 (0.04)
Email information and materials	8.2 (27)	5.23–11.16	5.74 (0.33)	3.01 (0.55)	0.14 (0.01)
A Facebook group setting	12.4 (41)	8.84–15.94	6.37 (0.27)	4.21 (0.37)	0.05 (0.38)
A combination of online platforms only (e.g. website, email and/or Facebook group)	32.7 (108)	27.63–37.76	7.10 (0.21)	2.37 (0.66)	–0.05 (0.30)
A face-to-face education group	3.0 (10)	1.15–4.84	6.57 (0.25)	1.63 (0.80)	0.03 (0.55)
A combination of a face-to-face group and online platforms (e.g. website, email and/or face-to-face group)	22.1 (73)	17.62–26.57	3.18 (0.67)	16.24 (0.00)ⁿ	–0.08 (0.16)

95% confidence interval (CI) of sample mean assumed a 0.05 significance level and a two-sided alternative hypothesis. B represents standardised regression coefficients.

Bold values indicate significant p-values.

Dunn–Bonferroni *post hoc*—significant differences between (frequency [means]):

^a Capital city (17.5% [0.18]) and Metropolitan (40.0% [0.40]; P = 0.00); Capital city (17.5% [0.18]) and Large rural (53.7% [0.54]; P = 0.00).

^b Capital city (4.4% [0.04]) and Metropolitan (18.9% [0.19]; P = 0.00).

^c Capital city (27.2% [0.27]) and Large rural (4.9% [0.05]; P = 0.02).

^d Did not complete high school (75% [0.75]) and bachelor's degree (23.6% [0.24]; P = 0.02); did not complete high school (75% [0.75]) and post-graduate qualification (25.6% [0.26]; P = 0.04).

^e No significant *post hoc*.

^f Less than \$40 000 (67.6% [0.68]); \$40 000–\$69 999 (42.0% [0.42]); \$70 000–\$99 999 (42.7% [0.43]); \$100 000–\$129 999 (27.1% [0.27]); \$130 000 or more (4.3% [0.04]); linear trend (P = 0.00).

^g \$40 000–\$69 999 (4% [0.04]) and \$130 000 or more (26.1% [0.26]; P = 0.01).

^h Capital city (32.5% [0.32]) and Metropolitan (53.3% [0.53]; P = 0.04).

ⁱ Bachelor's degree (36.4% [0.36]) and post-secondary qualification (63.3% [0.63]; P = 0.00); post-graduate qualifications (36.6% [0.37]) and post-secondary qualifications (63.3% [0.63]; P = 0.00).

^j Less than \$40 000 (29.4% [0.29]) and \$130 000 or more (60.9% [0.61]; P = 0.01).

^k \$70 000–\$99 999 (54.7% [0.55]) and \$130 000 or more (30.1% [0.30]; P = 0.02); less than \$40 000 (61.8% [0.62]) and \$130 000 or more (30.1% [0.30]; P = 0.02).

^l No *post hoc*.

^m Completed year 12 or equivalent (9.7% [0.09]) and post-graduate qualifications (8.5% [0.08]; P = 0.03).

ⁿ Did not complete high school (62.5% [0.62]) and post-graduate qualifications (14.6% [0.14]; P = 0.02); did not complete high school (62.5% [0.62]) and bachelor's degree (18.2% [0.18]; P = 0.04).

Table 3 Parent reported Facebook use and acceptability towards social media-based child feeding interventions

	% (n)	95% CI
How often do you login to Facebook?		
Multiple times a day	82.7 (273)	78.61–86.78
Once a day	13.9 (46)	10.16–17.63
3 or more times a week	1.8 (6)	0.36–3.23
1–2 times a week	0.9 (3)	–0.11–1.91
Less than weekly	0.3 (1)	–0.29–0.89
Never	0.3 (1)	–0.29–0.89
Would you join a Facebook group run by a child feeding specialist to get support feeding your child?		
Yes	86.4 (285)	82.7–90.09
Would you be concerned about your privacy if you joined a Facebook group to get support feeding your child ^a ?		
Yes	32.4 (107)	27.35–37.44
If you were to join a Facebook group to get support with child feeding ^a , would you access? (multiple respondent selections)		
Videos	62.1 (205)	56.86–67.33
Text posts	84.2 (278)	80.26–88.13
Live streaming	18.8 (62)	14.58–23.01
Q & A's with child feeding specialist	63.3 (209)	58.09–68.50
Links to website content and articles	84.2 (278)	80.26–88.13
None	2.1 (7)	0.55–3.64
If you were to join a Facebook group to get support with child feeding ^a what type of information would you share? (multiple respondent selections)		
Photos of you participating in healthy activities	14.2 (47)	10.43–17.96
Completed homework tasks	31.5 (104)	26.48–36.51
Question related to feeding strategies, child development, nutrition, health eating etc.	83 (274)	78.94–87.05
Personal experience	66.4 (219)	61.30–71.49
How often would you expect admin of a Facebook group providing support for child feeding to post new content? (text posts, photos, videos, discussion topics)		
2–3 times per day	9.4 (31)	6.25–12.54
1 time a day	39.1 (129)	33.83–44.36
4–5 times per week	39.1 (129)	33.83–44.36
2–3 times per week	2.4 (8)	0.74–4.05
1 time per week	8.5 (28)	5.49–11.50
Less than once per week	1.5 (5)	0.18–2.81
If you joined a Facebook group get support with child feeding, how often would you access this group?		
2–3 times per day	5.5 (18)	3.04–7.95
1 time a day	12.4 (41)	8.84–15.95
2–3 times per week	4.8 (16)	2.49–7.10
4–5 times per week	24.2 (80)	19.57–28.82
1 time per week	33.0 (109)	27.92–38.07
Less than once a week	20.0 (66)	15.68–24.31
How quickly would you expect admin of a Facebook group providing support for child feeding ^a to answer questions or respond to posts?		
An hour	3.9 (13)	1.81–5.98
A few hours	38.2 (126)	32.95–43.44
A day	48.2 (159)	42.80–53.59
A few days	8.8 (29)	5.74–11.85
A week	0.9 (3)	–0.11–1.91
If you were provided with appropriate guidance, would you consider being involved with a research project as a 'Champion'?		
Yes	23.8 (78)	19.20–28.39
No	39.3 (129)	34.03–44.56
Maybe	36.9 (121)	31.69–42.10
Social desirability bias		
Do you think you would be more or less honest/frank about your personal circumstance and experiences with child feeding in a Facebook group compared to a face-to-face in a group?		
More honest/frank in a Facebook group	26.4 (87)	21.64–31.15

Table 3 Continued

	% (n)	95% CI
Less honest/frank in a Facebook group	15.5 (51)	11.59–19.40
Unsure	17 (56)	12.94–21.05
About the same	41.2 (136)	35.88–46.51

95% confidence interval (CI) of sample mean assumed a 0.05 significance level and a two-sided alternative hypothesis.

^a The phrase 'support feeding your child' refers to skills, strategies and knowledge provided by a child feeding specialist (University qualified nutritionist/researcher) to support your child eat appropriate amounts and types of food, and the supporting skills, strategies and knowledge parents need to select and prepare healthful foods, create positive meal times and eating opportunities.

weight and increased intake of fruit and vegetables, framing interventions in this way is likely to both appeal to parents while supporting obesity focused outcomes.^{7,8,30,31}

The main barriers parents identified in addressing their child feeding concerns in the present study were *time*, followed by *child tantrums*. Importantly, these barriers did not differ based on demographic variable (although *lack of time* as a barrier increased slightly with parent age) which indicates the largely universal relevance of these factors to parents of young children. Lack of *money* was also a common barrier which expectedly increased for those of lower incomes and lower education, as well as those residing outside of capital cities. These barriers appear consistent with the strategies and skills parents reported they would be interested in developing. To date, current early child feeding interventions have included components such as positive parenting (encouragement of autonomy, warmth and self-efficacy—as the strongest predictor of health behaviours and an inhibitor of barriers¹⁷), as relevant to overcoming child tantrums, however, less attention appears to be given to supporting parents overcome food utilisation barriers such as time, money and grocery shopping skills.^{3,32} Future child feeding intervention are likely to benefit by framing curriculum to address these barriers, particularly in low socioeconomic and populations outside of capital cities.

Further to exploring parents' behavioural motivations and behaviour change intentions, the present study explored parent's cues to action within interventions delivered through Internet-based platforms, particularly the social media site Facebook. Specifically, 86.4% of parents indicated that they would participate in a Facebook group run by a child feeding specialist, with the largest proportion of participants indicating that a combination of Internet-based mediums (e.g. website, email and/or Facebook group) would be their preferred method of intervention delivery. This preference did not differ based on geographic regions which suggests online interventions are likely to be beneficial in reaching a diversity of participants that is often not possible with traditional interventions. On this note, however, interventions which offer Internet-based components (e.g. website and email) in combination with face-to-face elements, also holds much appeal, particularly among lower educated parents. This distinction in acceptability among lower educated parents is likely to be important in tailoring interventions that appropriately support *observational*

learning, as a key facet of the social cognitive theory that underpins cues to behavioural action.¹⁸

In this regard, the preference for Internet-based components in intervention delivery, exclusively or in combination with traditional delivery, has benefits for both researchers and participants by supporting opportunity for passive (one-way) intervention content (e.g. articles or videos via websites or emails) that can be accessed by participants when convenient, as well as the opportunity for active (two-way) intervention engagement through the additional use of social media platforms, such as Facebook, that allow interactions between participants and researchers across geographical boundaries.^{15,33} The desire for such interactive opportunities during an intervention were similarly indicated in a study into parents' acceptability of eHealth interventions (parent with children of 4–18 years; n = 75), which showed that two-thirds of respondents would prefer to interact with other program members and/or staff during an intervention, with social media as a key means to do so.³⁴ This appeal of Internet-based intervention elements, exclusively or in combination with traditional intervention components, is further supported by the findings of a recent systematic review, which suggested that Internet-based interventions have the potential for wide reaching public health impact,³⁵ while an additional review concluded that social media sites offer much promise in reaching target populations and allowing observational learning, without many of the burdens and limitations of traditional intervention, including reliance on geographically related samples.^{13,36}

On this note, the majority of participants in this survey indicated they would actively engage with a Facebook group intervention by asking questions, sharing personal experiences, and sharing completed homework tasks, as similarly reported in the previously mentioned InFANT extend study.¹⁵ Only 14% of participants in the present study, however, said they would share photos of themselves participating in intervention activities. The reluctance of participants in the present study to share photos of themselves may be related to concerns regarding privacy, as was a concern for 30% of participants in this survey and has been identified across the literature as a prime limitation of social media interventions.^{12,37} To somewhat overcome this limitation, the idea of an intervention 'champion' was proposed to participants, as a trained and supported participant, that takes the lead in intervention engagement and

participation to maximise the potential for *observational learning* and peer *reinforcement*. With almost a quarter of participants in this survey indicating that they were willing to participate as a 'champion' and a further 37% indicating they would consider it; this concept holds much promise for Facebook interventions. This finding is, however, substantially lower than rates reported in a pilot study of Australian parents (of children 6 months to over 2 years of age; $n = 34$) which showed that 65% of respondents were 'interested' or 'very interested' in becoming a peer nutrition educator, while 76% of respondents were very interested or interested in receiving child nutrition information from a trained peer educator.³⁸ Finally, over 40% of participants in this survey did not feel their honesty would differ between a face-to-face intervention or a Facebook-based intervention, while only 16% said they would be less honest. These findings are similar to a previous Facebook-based obesity prevention intervention that indicated mothers concerns regarding participation in an online group with people they had not met, varied.³⁹

The present study provides researchers and practitioners with insight into what makes Facebook an acceptable and feasible means of delivering early childhood feeding interventions as aligning with the behaviour change constructs of the social cognitive theory. Furthermore, the present study, provides specific details regarding the child feeding concerns of parents, barriers in addressing these concerns, desirable intervention strategies, and details about preferences for engagement with intervention protocols, as beneficial for future intervention planning. The use of theoretical models throughout the present study is the strength of this paper that supports the translation of the results into clinical practice. On this note, the results of the present study suggest that parents are adequately motivated to engage in behaviour change strategies initiated within an intervention protocol, in accordance with the constructs of the health belief model, however, care should be taken to support participants overcome barriers that may inhibit their participation. The results of the present study additionally suggest that Facebook interventions can adequately incorporate key elements aligned with the social cognitive theory to facilitate behaviour change, while traditional methods of intervention delivery, particularly in conjunction with online materials, may still hold appeal to some participants.

Despite these strengths, caution should be taken when interpreting these results as the survey developed for the present study may have limited validity because of insufficient piloting and lack of sample size calculation. Additionally, multiple comparisons were conducted in the present study which may increase the risk of error, although, Dunn's Bonferroni *post hoc* was used to mitigate this risk. Furthermore, the results of the present study should be interpreted with caution due to sample bias because participants were recruited through Facebook, thus indicating that they already prefer this social media platform. Despite this potential limitation, Facebook was selected as a method of recruiting participants because of the ability to

instantaneously reach a geographically diverse sample. The high popularity of Facebook within the target demographic, however, means the results are still likely to be relevant to a large portion of parents of children during early childhood.¹⁴ Additionally, this sample should not be interpreted as representative of the general population, as participants who had concerns with child feeding were specifically recruited. On this note, the present study demonstrates the feasibility of online interventions to reach a geographically diverse sample, with all Australian states and RRMA classifications represented. Participants within the present study were, however, skewed towards the higher income and higher educated groups.

Based on the present study, parents of young children appear to recognise the importance of addressing their child feeding concerns. This recognition is conducive with the behavioural motivations necessary for them to improve their child feeding practices. In consideration of parents' child feeding concerns and identified barriers, future intervention may benefit from framing intervention messages towards management of fussy eating rather than weight-based focuses. Further to this, online intervention components (e.g. website, email and/or Facebook) appear well accepted by parents of young children and may offer an effective and efficient means of supporting behaviour change across a diversity of geographic regions in accordance with the social cognitive theory. Face-to-face intervention components, however, still hold appeal particularly for lower educated parents.

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Conflict of interest

The authors declare that they have no competing interests.

Authorship

NB was the lead researcher for this project, supervised by PSWD and RB. NB wrote the first draft of the manuscript and conducted all data analyses. PSWD and RB provided guidance on statistical methodology, proof reading and editing.

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Supporting information

Additional Supporting Information may be found in the online version of this article at the publisher's web-site:

Table S1 Survey questions as they align with constructs of the HBM¹ and SCT².

Table S2 Parent reported severity, importance and motivation to address child feeding concerns.

ORIGINAL RESEARCH

Predictors of nutrition care process and terminology use, applicability and importance within Asia-Pacific dietitians

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Abstract

Aim: Many dietitians are yet to incorporate the Nutrition Care Process and Terminology (NCPT) into practice. The present study investigated factors predicting (i) NCPT use, (ii) perceived importance of NCPT implementation and (iii) perceived NCPT applicability to personal dietetic practice among dietitians in the Asia-Pacific region.

Methods: Dietetic association members from Australia, New Zealand and Singapore were invited to participate in an online survey assessing NCPT implementation, knowledge, and self-rated familiarity, attitudes, benefits, concerns, barriers, and enablers. Forward stepwise logistic regression used all factors to identify predictive dietetic characteristics for current NCPT use, importance or applicability to practice.

Results: A total of 377 dietitians (5%–55% of national dietetic memberships surveyed) completed at least one survey question. In logistic regression models, independent positive predictors of current NCPT users were knowledge ($P = 0.003$), confidence to implement ($P = 0.036$), confidence to write nutrition diagnoses ($P = 0.002$) and experiencing managerial support ($P = 0.004$). Not seeing a reason to change was a significant negative predictor of NCPT use ($P = 0.003$). An independent positive predictor of dietitians viewing NCPT implementation as important was feeling that it will improve patient care ($P < 0.001$), while negative predictors were seeing minimal benefit in changing ($P < 0.001$) and a preference to continue with current routine ($P = 0.015$). Independent positive predictors of dietitians viewing NCPT as applicable to their practice were NCPT knowledge ($P = 0.009$), seeing the value of NCPT ($P < 0.001$) and attendance at workshops or conferences ($P = 0.014$).

Conclusions: NCPT implementation may be enhanced through activities building confidence, gaining managerial corroboration and demonstration of NCPT benefits, including improved patient care.

Key words: attitudes, dietitian, implementation, knowledge, nutrition care process terminology, predictors.

Introduction

The early 2000s saw the development of the Nutrition Care Process (NCP) for dietitians. This standardised framework encompassed each of the four main nutrition care activities: (i) Assessment, (ii) Diagnosis, (iii) Intervention and (iv) Monitoring and Evaluation; operating within variable practice settings, economic environments, social systems and health-care systems.^{1–3} The Diagnosis step is a defining part of the NCP framework, referring to identification of a specific nutritional problem rather than a medical problem.

An accompanying standardised terminology was developed for use with the NCP, originally known as the International Dietetics and Nutrition Terminology (IDNT). The NCP and associated terminology is now referred to as NCPT. The NCPT has evolved to include over 1500 nutrition terminologies.⁴

A 2014 survey of Australian dietitians found that the most commonly reported anticipated benefits of using NCPT were having a common vocabulary to identify nutrition problems (75%), provision of a framework for dietetic care (71%), assisting with transfer of patient care (56%) and encouraging critical thinking (55%).⁵ NCPT use has been demonstrated to improve recognition from other health professionals, enhance communication within interdisciplinary teams and increase productivity.^{6,7} It has also been used to increase funding to dietetic departments because of improved identification of malnutrition diagnoses.⁷

Despite these advantages, worldwide implementation of NCPT among dietitians is yet to occur.⁸ The majority of

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publications reporting on NCPT implementation have been conducted in USA, although some implementation has also been reported in the Asia-Pacific region, including Australia,^{5,9} South Korea¹⁰ and Malaysia.¹¹ In Australia, the Dietitians Association of Australia has endorsed voluntary use of the NCPT since 2009, however, approximately 30% of dietitians report that they yet to incorporate any aspect of NCPT into their medical record documentation.⁵ In Asia, the Asian Federation of Dietetic Associations has not released a vision paper or statement regarding the NCPT implementation in Asian countries and the implementation rate is unknown, although qualitative research suggests it is low.¹² Knowledge of what factors are independent predictors of NCPT use and attitudes can assist in better targeting implementation programs, and potentially improve rates of NCPT use among dietitians outside USA. To date there have been no published studies which have investigated this concept.

The objective of the present study was to investigate predictors of NCPT use, along with attitudes towards the applicability and importance of NCPT implementation, via survey of dietitians working in the Asia-Pacific region.

Methods

Members of National dietetic associations from Australia, New Zealand and Singapore were invited to complete a survey online with the use of 'Survey Monkey' (www.surveymonkey.com, Palo Alto, CA). The only eligibility criterion was currently being a dietitian (as recognised by country of practice). The electronic survey link was disseminated by association newsletters twice, appearing 2 weeks apart. Survey completion was taken as consent. The survey questions were optional and all participants could leave the survey at any time. The online survey consisted of the previously validated attitudes, support and knowledge survey ('ASK NCP') developed by Porter *et al.*¹³ This survey was used to ascertain dietitian's views and experiences regarding NCPT implementation. Survey questions combined open-ended, dichotomous and closed-ended questions employing a 5-point Likert scale ('1 'strongly agree' to 5 'strongly disagree'). For the predictive model analysis, 'agree' and 'strongly agree' were grouped as were 'disagree' and 'strongly disagree'.

Ethics approval was granted by the Metro-South Health Service District Human Research Ethics Committee. Free text answers to questions around barriers and enablers were incorporated into categories and grouped where appropriate. Three outcome variables were chosen *a priori*, based on perceived relevance for future NCPT implementation planning: (i) current NCPT use (answers grouped as yes vs no); (ii) whether implementing the NCPT within the dietitian's practice is important to them (not important or not sure vs important) and (iii) whether the dietitian considers NCPT to be applicable to their practice (not applicable or not sure vs applicable). Data analysis was completed using SPSS Statistics for Windows (Release 24.0, 2016; IBM Corp, Armonk, NY).

Factors included in the analysis as potential covariates included respondent characteristics, assessed knowledge of NCPT, values around NCPT, confidence around using NCPT, attitudes towards NCPT, educational enablers and barriers. These are detailed in Table 1. Type of work, defined as majority clinical (hospital based or private practice) or non-clinical, along with years as a dietitian, were also considered as potential confounding factors. A forward stepwise logistic regression was performed using all factors, with gender and country of practice retained in the models as a forced block because of anticipated cultural differences. Missing data were ignored for this analysis. This type of analysis was chosen as it is a simple data-driven approach for obtaining a parsimonious model, which is ideal from a practical standpoint. In this approach, variables are added to the model one at a time. For all outcomes and factors, negative responses (no, not important, not applicable, not confident, disagree, etc.) were selected as the reference level in the logistic regression model. A *P*-value of <0.05 was considered significant. The STROBE guidelines for reporting observational studies in epidemiology were followed when reporting this research (<https://www.strobe-statement.org/>).

Results

A total of 377 dietitians completed at least one aspect of the survey. Respondents indicated that they currently resided in Australia (*n* = 209), Singapore (*n* = 51), New Zealand (*n* = 41) or other countries (*n* = 4). According to National Dietetic Association figures from the International Confederation of Dietetic Associations, this represented between 5% and 55% of targeted dietetic memberships (Australia: 209/4476, 5%; New Zealand: 41/578, 7%; Singapore: 51/92, 55%),¹⁴ for a total response rate of 6% to the question on country of residence. Respondent characteristics are shown in Table 1. Sixty-five percent of dietitians who answered the question on NCPT use reported using at least one part of the NCPT in their current practice. Most dietitians agreed that the NCP was applicable to their own practice (82%), and that implementing it in their practice was important (67%).

Independent positive predictors of being a current NCPT user were NCPT knowledge score (*P* = 0.003), confidence to implement (*P* = 0.04), confidence to write nutrition diagnoses (*P* = 0.002), and having management support (*P* = 0.004). Conversely, not seeing a reason to change was a negative predictor of NCPT use (*P* = 0.003) (Table 2). The model containing these factors had a correct classification percentage of 86.7%, and a Naglekerke *R*² value of 0.56.

An independent positive predictor of dietitians viewing NCPT implementation as important was feeling that it will improve patient care (*P* < 0.001), while negative predictors were seeing minimal benefit in changing (*P* < 0.001) and a preference to continue with current routine (*P* = 0.015) (Table 2). The model containing these factors had a correct

Table 1 Characteristics of the dietitians participating in the study (n = 377), along with factors included in final predictive model analyses

Characteristic/response	n (valid %)
Gender (female)	284 (94.7)
Country of residence	
Australia	209 (69.4)
Singapore	51 (16.9)
New Zealand	41 (13.6)
Other—Philippines, India, USA	4 (0.8)
Years since qualified as a dietitian	median 8.00 (SEM: 0.56)
Main area of work is in clinical setting ^a	231 (85.6)
Outcomes of interest	
NCP is applicable to my area of practice	282 (81.7)
Implementing the NCP within my own practice is important to me	213 (67.6)
I am a current user of NCP	222 (65.1)
Knowledge of NCPT (score 0–8)	median 6.0 (IQR: 5.0–7.0)
Values (agree) versus neutral or disagree	
Familiar with NCP and NCPT	307 (81.4)
I see the value of IDNT within my clinical practice	248 (72.1)
I feel isolated from knowledgeable colleagues with whom to discuss the NCP/IDNT	92 (26.9)
I see minimal benefit in changing my documentation to incorporate NCP	66 (19.2)
I see minimal benefit in incorporating IDNT in my clinical documentation	65 (18.9)
I do not feel the need to change my clinical practice	57 (16.8)
Confidence (very confident) versus somewhat or unsure/unconfident	
I feel incorporating the NCP/IDNT will improve patient care	188 (55.0)
How confident do you feel to implement the NCP into your own practice	85 (27.8)
How confident do you feel in identifying nutrition diagnoses	80 (26.2)
How confident do you feel in writing the PES statements	66 (21.6)
Attitudes (agree) versus neutral or disagree	
Incorporating NCP/IDNT into my current practice will be inconvenient	62 (19.6)
Generally I would prefer to continue my routine rather than change	50 (15.9)
NCP/IDNT interferes with my professional autonomy	44 (14.0)
Educational enablers experienced by dietitians	
Self-directed readings	158 (33.3)
Presentations	154 (32.4)
Webinars	136 (28.6)
Workshops	133 (28.0)
Readings sent out	81 (17.1)
Management support	76 (16.0)
Internet site of the 'Academy'	55 (11.6)
Internet site of the International Confederation of Dietetic Associations	32 (6.7)
Electronic health records	17 (3.6)
Current barriers experienced by dietitians	
Lack of training and support	121 (25.5)
Lack of time	120 (25.3)
Lack of knowledge	113 (23.8)
Electronic health records unavailable	56 (11.8)
Lack of resources	55 (11.6)
Organisational constraints	50 (10.5)
Lack of management support	44 (9.3)
Do not see a reason to change	43 (9.1)

^a Survey selections differed depending on country of work as countries tend to refer to clinical work in different terms, these have been grouped to produce a variable encompassing inpatient or outpatient hospital work, private practice, and individual counselling as clinical work.

classification percentage of 90.1%, and a Naglekerke R^2 value of 0.60.

Independent positive predictors of dietitians viewing NCPT as applicable to their practice were NCPT knowledge score

($P = 0.009$), seeing the value of NCPT ($P < 0.001$) and experiencing workshops or conferences ($P = 0.014$) (Table 2). The model containing these factors had a correct classification percentage of 87.1%, and a Naglekerke R^2 value of 0.35.

Table 2 Predictive model for NCPT use, importance and applicability, as determined by forward stepwise logistic regression using all factors, adjusted for gender and country of practice

	Odds ratio (95% CI)	P-value
Whether the dietitian is a current NCPT user		
Knowledge score	1.59 (1.18–2.14)	0.003
Confidence to implement NCP		0.036
Not confident, or unsure	Ref	
Somewhat confident	2.92 (1.15–7.41)	0.025
Very confident	5.42 (1.19–24.71)	0.029
Confidence to write PES statements		0.002
Not confident, or unsure	Ref	
Somewhat confident	4.84 (1.93–12.14)	0.001
Very confident	9.08 (1.65–50.04)	0.011
'Do not see a reason to change' was selected as a barrier to implementation	0.18 (0.05–0.56)	0.003
'Management support' was selected as having been experienced	6.79 (1.83–25.18)	0.004
Whether NCPT is perceived as important by the dietitian		
I see minimal benefit in changing my clinical documentation to incorporate NCPT		<0.001
Disagree	Ref	
Neutral	0.32 (0.13–0.77)	0.029
Agree	0.04 (0.01–0.13)	<0.001
I feel incorporating the NCPT will improve patient care		<0.001
Disagree	Ref	
Neutral	2.35 (0.82–6.71)	0.112
Agree	12.45 (3.90–39.41)	0.025
Generally, I would prefer to continue my routine rather than change		0.015
Disagree	Ref	
Neutral	0.28 (0.11–0.68)	0.005
Agree	0.35 (0.12–1.03)	0.057
Whether NCPT is perceived as applicable to the dietitian's practice		
Knowledge score	1.36 (1.08–1.72)	0.009
I see the value of IDNT within my clinical practice		<0.001
Disagree	Ref	
Neutral	3.79 (1.13–12.77)	0.029
Agree	25.72 (7.76–85.21)	<0.001
'Workshops and conferences' was selected as having been experienced	3.60 (1.29–9.99)	0.014
'Electronic health records' was selected as having been experienced	0.17 (0.03–1.08)	0.061

IDNT, International Dietetics and Nutrition Terminology; NCPT, nutrition care process (and terminology); PES, problem, etiology, signs and symptoms (this statement is used in nutrition diagnosis).

Discussion

Our survey of dietitians working in the Asia-Pacific region revealed interesting findings around factors predicting NCPT use, along with perceived applicability and importance. Significant predictors of NCPT use by dietitians were confidence, knowledge, seeing a reason to change and management support. As could be expected, a higher knowledge of NCPT was associated with higher use, independently of enablers or barriers experienced in gaining of this knowledge. A good understanding of NCPT is important to ensure the framework and terminologies are being used in an appropriate and effective way. For example, omission of certain details from the assessment section may flow on to a poor monitoring and evaluation section.

In addition to knowledge, confidence was also particularly important in predicting NCPT use. Dietitians who said

they were 'very confident' with writing Problem, (A) Etiology, Signs and Symptoms (PES) statements were over nine times more likely to use NCPT, and those 'very confident' with NCPT implementation were over five times more likely to use NCPT in their practice. Knowledge alone is not enough—dietitians who have a good knowledge of NCPT also need to be confident that they are applying the principles properly. This self-confidence in applying skills, also known as a sense of competence, is also recognised in the medical literature as being important when implementing new processes.¹⁵

Management support was also an important independent predictor of NCPT use, with dietitians who had experienced this support almost seven times as likely to use NCPT compared with dietitians who did not. Managers in large health-care organisations can help foster change by working to develop factors such as teamwork and tolerance for mistakes, which is thought to improve readiness for

change within a department.¹⁶ The support of senior leaders in an organisation, along with middle-level managers (who have the opportunity to enhance or sabotage efforts), can influence the speed and effectiveness of implementation of new processes.¹⁶

The only negative predictor of NCPT use identified in our study was dietitians reporting that they did not see a reason for change. Recommendations to use NCPT from dietetic associations alone may not result in desired changes in clinical practice. Motivation has been previously observed to be an important domain to explain behaviour change in health-care professionals, with incentives, intrinsic motivation and commitment noted.¹⁷ There are currently no monetary incentives for using NCPT, although some dietitians may consider that it provides incentives in other ways, such as saving time in the long term and improving record keeping and communication. Intrinsic motivation can be defined as performing an activity for inherent satisfaction rather than for an external consequence, and is promoted by factors such as enjoying a challenge, curiosity, and growing knowledge and skills.¹⁸ Commitment to a goal can help to keep momentum when motivation starts to slow, but may also be influenced by other work factors including job satisfaction and staff turn-over.¹⁹

Three factors significantly predicted whether or not dietitians would view NCPT implementation as important: feeling that the NCPT will improve patient care, seeing benefits and a willingness to change routine. The motivation of practitioners to provide good quality care for their patients has previously been identified as important for quality improvement initiatives in health care.²⁰ Similarly, trying to convince clinicians who believe they are *already* working at a high standard to then change is likely to be difficult, unless they can be shown that this change will really make a difference.²⁰

Investigation into predicting whether or not dietitians view NCPT as applicable to their practice did not provide as strong a model as the previous outcomes. This suggests that whether dietitians view NCPT as applicable to their practice is harder to predict and depends on a wider variety of factors. As with NCPT use, knowledge was again identified as important. Seeing the value of IDNT within practice was also a strong predictor of applicability, with dietitians agreeing with this statement 25 times more likely to see NCPT as applicable to them. Attendance at workshops and conferences was also an independent predictor of dietitians viewing NCPT as applicable for them. Workshops and conferences provide excellent opportunities for networking, being able to ask questions, discuss ideas and brainstorm solutions in real-time. Small group interactive education sessions that incorporate active participation such as case studies are more likely to be associated with change in professional health practice than passive, didactic education.²¹ The value of small group education for NCPT has been confirmed through evaluation of a statewide implementation.^{5,22} Experiencing case studies in these settings may also assist dietitians to picture how they could apply NCPT in

their own settings. Unexpectedly, experiencing electronic health records (eHRs) trended towards being negatively associated with NCPT applicability ($P = 0.06$). This may reflect that some eHR systems used by dietitians were not designed to optimise NCPT use. Examples may include a lack of (i) options to select NCPT diagnoses and thus minimise writing, (ii) means to identify problem resolution or (iii) reporting mechanisms including types of diagnoses or days until resolution. Increasing dietitian involvement in the early stages of eHR planning and integration may help to address these barriers.

Most of the respondents in our study were from Australia (69%). This may limit applicability of these findings to other countries, although our results suggest that country of work was not a significant predictor of NCPT use, importance or applicability. Being a study of NCPT practices, it is likely that a self-selection bias would have existed, whereby dietitians who are interested in NCPT were more likely to complete the survey. The overall response rate of 6% suggests that non-response bias may limit the generalisability of the results. Due to budget restraints, we were not able to use mail based surveys or incentives, factors that have been demonstrated to improve response rates when surveying health professionals.²³ A further limitation is that not all questions were answered by all participants. As we did not make all questions compulsory in order to reduce potential subject burden and frustration, it is possible that lack of data in some areas could skew the findings. Questions on age, state of practice (within the country) and position type (e.g. managerial vs clinician) were not included and these may have provided additional insight into NCPT use. The use of qualitative research methods may also provide a greater depth of understanding in this area.

Nevertheless, our study provides important direction for future projects focusing on NCPT implementation. Confidence and knowledge are key aspects in both NCPT use and for dietitians seeing NCPT as applicable to practice. Knowledge results in better understanding of the concepts behind how the assessment, diagnosis, intervention, and monitoring and evaluation parts of the framework link together. Dietitians are therefore better able to appreciate the NCP, see it as relevant and apply it to their own work. Access to educational opportunities, experienced colleagues, and resources including the Academy of Nutrition and Dietetics terminology reference sheets can help to improve knowledge of NCPT and should be prioritised in NCPT implementation. Our results highlighted the importance of confidence in addition to knowledge, and this can be achieved through active participation in hands-on exercises, writing PES statements and going through case studies. Larger workplaces such as hospitals need to consider a focus on managerial support, as implementation will take time and effort and is likely to be difficult for dietitians venturing to do it on their own.

Our findings suggest that implementation programs would benefit from clearly outlining the advantages to patient care, as well as benefits for the dietitians and

organisations from moving to NCPT, and providing motivation to change current practice. Use of Kotter's eight stages of change management, beginning with establishing a sense of urgency,²⁴ has been successfully used for NCPT implementation in the past.²⁵

A proactive stance on incorporating NCPT into eHR may help to change the perception of NCPT being less applicable if using this technology. If done effectively, incorporation of NCPT into eHR has the potential to improve confidence using NCPT, provide guidance through the framework, save time, and improve storage and accessibility of records.²⁶ The 2018 Framework for eHealth Readiness of Dietitians may be useful in guiding dietitians who are likely to move to eHR in the future.²⁷ This framework has similar dimensions to NCPT aspects identified in this project, such as aptitude ('confidence to implement NCP', 'confidence to write PES statement', 'knowledge'), advocacy ('management support'), access (access to information and resources to develop 'knowledge', NCPT inclusion in eHR systems) and attitude ('do not see a reason to change'). These can all help to guide the dietetics profession in its successful transition to eHealth. Incorporation of NCPT into an eHR can also provide opportunities to efficiently analyse data to report on caseloads, intervention effectiveness and identify areas to improve practice.

As recognised for many years, the ability to change and adapt to new challenges and opportunities is critical for ongoing success in health care.²⁸ Change interventions targeted at specific factors are likely to be more effective than interventions that are not.¹⁵ To our knowledge, this is the first study to identify specific factors that are independent predictors of NCPT use, importance and applicability in dietetics. Incorporation of our findings into future NCPT implementation projects will provide an evidence base to assist with achieving a successful and worthwhile change valued by dietitians.

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Conflict of interest

The authors confirm there are no conflicts of interest.

Authorship

AV and TOS were involved in the study design and drafted the manuscript, AV conducted the data collection, TOS and JL analysed the data, TOS and AV interpreted the findings. All authors critically reviewed the manuscript and approved the final version submitted for publication. The authors would like to thank the Dietitians Association of Australia, Dietitians NZ and Lyn Lloyd, Singapore Nutrition and Dietetics Association and Yen Peng Lim for their support and assistance with distributing the survey and for previous support of the NCPT. Thanks also goes to the many dietitians participating in this research.

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ORIGINAL RESEARCH

Empirically derived dietary patterns and serum inflammatory markers in Iranian female teachers: A cross-sectional study

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Abstract

Aim: To examine the relationship between dietary patterns and inflammatory markers including serum high sensitivity C-reactive protein (hs-CRP) and interleukin 17A (IL-17A) in females.

Methods: In the present cross-sectional study in female teachers living in Yazd, central Iran, data on anthropometric measurements and general information were gathered. A food frequency questionnaire was completed by participants and then, subjects were invited to give blood samples. Major dietary patterns were derived using principal component analysis and serum inflammatory markers were compared according to quintiles of dietary patterns scores.

Results: In total, 320 subjects aged 40.38 ± 8.08 years were included. Three dietary patterns were derived: (i) 'traditional' with a high intake of poultry, salt, eggs, other vegetables and red meat; (ii) 'vegetables and fruits' with a higher intake of tomatoes, yoghurt drinks, green leafy vegetables, dried fruits, fruits, other vegetables and organ meats and (iii) 'dairy and saturated fat' with a high loading of high-fat dairy products, butter, low-fat dairy, margarine, eggs, other vegetables and green leafy vegetables. Participants in the highest quintile of the 'vegetables and fruits' dietary pattern had significantly lower serum hs-CRP levels compared to those in the lowest quintile (3.6 ± 0.4 mg/L vs 2.6 ± 0.4 mg/L, respectively; $P < 0.05$). None of the dietary patterns were associated with circulating IL-17 levels.

Conclusions: Higher consumption of fruits and vegetables is inversely associated with serum hs-CRP but not IL-17 levels. Studies investigating the dietary patterns in association with IL-17 in other populations are recommended.

Key words: C-reactive protein, dietary food patterns, inflammation, interleukin-17.

Introduction

Inflammation plays an important role in the development of chronic diseases including obesity, atherosclerotic plaques, cardiovascular diseases (CVDs), insulin resistance and type II diabetes, autoimmune diseases and some cancers.^{1,2} High sensitivity C-reactive protein (hs-CRP) is a well-known acute

phase protein involved in inflammation.³ Hs-CRP is recommended as a predictive laboratory marker for CVD risk in patients with high susceptibility to CVDs or their recurrence.⁴ The circulating hs-CRP is synthesised and secreted predominantly by hepatocytes in response to pro-inflammatory cytokines such as tumour necrosis factor, interleukin 1 and interleukin 6 (IL-6).⁵ On the other hand, interleukin 17 is a novel class of pro-inflammatory cytokines, which are produced mainly by T-helper 17 (TH-17) cells and has six isoforms that have been named from A to F.⁶ Interleukin 17A (IL-17A) has been studied extensively in the past decade and has been suggested as an inducer of tissue inflammation.¹ This pro-inflammatory marker has been associated with the pathogenesis of several autoimmune diseases and human inflammatory conditions.¹ The current evidence suggests that IL-17A is involved in psoriasis,⁷ rheumatoid arthritis,⁸ multiple sclerosis,⁹ inflammatory bowel diseases¹⁰ and asthma.¹¹

Several studies have demonstrated the association between dietary factors and inflammatory markers.^{12,13} For

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instance, diets high in fruits and vegetables, Mediterranean diet and the Dietary Approaches to Stop Hypertension are inversely associated with serum hs-CRP levels.¹³

Empirically derived dietary patterns have recently emerged in nutritional epidemiology to examine diet–disease associations.¹⁴ In this approach, statistical methods are used to combine multiple foods or nutrients to derive a single exposure variable namely dietary pattern.¹⁵ It has been assumed that dietary patterns provide a better and more general insight into diet–disease relations¹⁴ and may be more predictive of chronic disease risk than individual nutrients or foods.¹⁵ A number of publications have considered the association between empirically derived dietary patterns and inflammatory markers while they predominantly focused on serum CRP levels as a general marker of systemic inflammation.¹⁶ Studies using empirical methods to derive dietary patterns revealed that red meat-based or so-called ‘Western’ dietary patterns are positively associated with biomarkers of inflammation, mainly hs-CRP; while vegetable- and fruit-based or ‘healthy’ dietary patterns were negatively associated. However, the results were inconsistent when studies considered dietary patterns in association with inflammatory markers other than hs-CRP.¹⁶ Moreover, we are not aware of any study investigating the association between dietary patterns and serum IL-17A as an inflammatory marker for autoimmune diseases.

In the present study we tried to examine the association between dietary patterns derived using a posteriori method (principal component analysis) and hs-CRP as a general inflammatory marker and IL-17A as a newly emerged marker of inflammation, autoimmune diseases and host defence in a cross-sectional study conducted among female teachers living in Yazd, Iran.

Methods

The present study is reported based on Strengthening the Reporting of Observational Studies in Epidemiology guidelines.¹⁷ The study was conducted in the context of a cross-sectional study on 20–60-year-old female teachers working in Yazd schools. The study protocol is fully described elsewhere.¹⁸ The objective of the original study was to assess the prevalence of metabolic syndrome (MetS) and its determinants and the recruitment began from November 2014 and ended in September 2015. In brief, using randomised cluster sampling method, 450 teachers who were not following a specific diet were included in the original study. Height, weight, waist circumference and blood pressure were measured. General information including marital status, medical history, as well as dietary food and supplement intake, socioeconomic status and physical activity were gathered using self-administered questionnaires. Study subjects were then invited to a laboratory to give 5 mL blood samples. Fasting blood sugar and lipid profile were assessed immediately after blood sampling. A number of participants had additional serum samples which were kept at -80°C for further analyses. We included participants with additional serum samples and those who had data about dietary

intake and reported reasonable amounts of daily energy intake (1500–4500 kcal/day) in the present study.^{19,20}

The study protocol was approved by the research council of the Nutrition and Food Security Research Centre of Shahid Sadoughi University of Medical Sciences. Written informed consent was obtained from each participant eligible to enter the study.

Dietary intakes over the past year were evaluated by the use of a semi-quantitative food frequency questionnaire (FFQ). The questionnaire was a modified version of a 168-item questionnaire of Tehran Lipid and Glucose Study.²¹ There were also 10 Yazd native food items that were frequently consumed in the region; therefore, in the questionnaire we had 178 food items. The 168-item FFQ used in Tehran Lipid and Glucose Study was designed to be open ended in its original form; therefore, it was modified to a multiple-choice questionnaire for this study. Participants answered two questions about each food item: (i) the frequency of food consumption (number of times per month, week or day the food was eaten) in the last year and (ii) the amount of food that was usually eaten in each time. To increase precision and accuracy of the estimates, we provided the portion size of foods as a unit. Participants were asked to report their frequency of food intake based on 10 multiple choice frequency response categories varying from ‘never or less than once a month’ to ‘10 or more times per day’. The amount of food eaten each time was asked using questions with five predefined choices. The choices were different according to each food item. Participants were also interviewed to answer a separate multiple-choice questionnaire about their supplement use. Finally, we computed daily intake of all food items which was converted to grams per day using household measures.²² Daily nutrient intake for each participant was calculated using the Nutritionist IV software (San Bruno, California, United States of America) designed for Iranian foods. To identify dietary patterns, the 178 food items in the questionnaire were divided into 41 food groups based on the similarity of their nutrients (Table S1, Supporting Information).

Participants were referred to a corresponding laboratory for collection of a blood sample up to 7 days after their FFQ. Five millilitre of venous blood sample was taken after 10–12 hours fasting. Serum samples were separated and kept at -80°C for further analyses. For the present study 350 serum samples were available; which were used to assess serum hs-CRP and IL-17A levels. The circulating hs-CRP and IL-17A levels were measured using ELISA kits (ELISA kit, Zellbio, Ulm, Germany for hs-CRP (ZB-1805-H9648) and human IL-17A ELISA development kit (HRP), MABTEC, Sweden (3520-1H-6)).

In all cases, anthropometric parameters (height, weight, waist circumference and hip circumference), were measured by a nutritionist. Weight was measured using a digital scale (SECA, model 813) with an accuracy of 100 g while the participants had minimal clothes on. Height was measured using a tape measure attached to the wall with an accuracy of 0.5 cm while the participants were in the standing position. The body mass index (BMI) was calculated by dividing

weight (in kg) by height (in m) squared. Waist circumference was also assessed using a tape measure with an accuracy of 0.5 cm at the narrowest area.²³

Economic status was assessed using a 9-item self-administered questionnaire. In the questionnaire we asked the number of family members, husband's occupation, the head of household (husband/herself/other family members), house ownership (owner/tenant), house type (apartment/house), number of bedrooms in the house, car ownership (yes/no), number of cars owned by the family, and family income per month. We assigned a score to each item and participants were categorised into low, middle and high economic status based on tertiles of the overall summed score.

Data on physical activity were obtained by using International Physical Activity Questionnaire. The information gathered in this questionnaire was converted to metabolic equivalent hours per week²⁴ and participants were placed into two categories (sedentary and active).

Some other variables were also collected by administration of a self-administered questionnaire. The questionnaire asked about the following factors: participants' age (20–50 years/over 50 years), marital status (single/married), education (college/Bachelor's degree/Master's degree or higher), menstruation status (yes/no), oral contraceptive use (yes/no), history of CVDs, type 2 diabetes or MetS (yes/no), family history of diabetes (yes/no), lifestyle change in recent year (yes/no), and vitamin D or multivitamin–mineral supplement use (yes/no).

Principal component analysis with orthogonal transformation was used to assess major dietary patterns. (This analysis was conducted on participants with complete and reasonable dietary data ($n = 430$)). Factors retained for further analyses were based on their natural interpretation, Eigenvalues (>1) and Scree test.²⁵ The derived factors were labelled on the basis of our interpretation of the data. We computed the factor score for each pattern by summing intakes of 41 food groups weighted by their factor loadings.²⁵ Each participant received a factor score for each identified pattern. Subjects were categorised based on quintiles of the dietary nutrient pattern scores.

The normality of continuous variables was checked using the Kolmogorov–Smirnov test. Comparison of continuous and categorical variables across quintiles of dietary patterns intake scores was done by the use of analysis of variance (ANOVA) and chi-square test, respectively. The age and energy adjusted intake of food groups and nutrients according to quintiles of dietary patterns were done using the analysis of covariance (ANCOVA) with Bonferroni correction. This analysis was also applied in different models to compare the concentration of serum hs-CRP and IL-17A levels across quintiles of dietary patterns scores. In the first model we controlled the age and energy intake (kcal/day). In the second model we further adjusted marriage status (married/single), physical activity (sedentary/high), education level (college/Bachelor's degree/Master's degree or higher), lifestyle change in recent year (yes/no), current oral contraceptive use (yes/no), menstruation status (yes/no), economic

status (low/middle/high) and any history of chronic diseases (yes/no). In the third model we adjusted omega-3 (yes/no), calcium (yes/no), vitamin D (yes/no) and multivitamin–mineral (yes/no) supplement use plus variables included in the second model. In the fourth model we adjusted all variables included in previous models plus BMI (kg/m^2) and waist circumference (cm). The assumptions for ANCOVA (normality of residuals and homogeneity of variances and others) were assured before reporting the results. All statistical analyses were done using the Statistical Package for Social Sciences (SPSS, version 15.0 for Windows, 2006, SPSS, Inc., Chicago, IL). P -value <0.05 was considered as statistically significant.

Results

From 350 participants whose blood samples were available for the analysis, 30 subjects reported their energy intake outside the acceptable range of 1500–4500 kcal/day. Therefore, 320 female teachers aged 40.4 ± 8.1 years were included in the current analysis.

Three major dietary patterns explaining 16.34% of total variation were derived using principal component analysis: (i) 'traditional' with a high intake of poultry, salt, eggs, other vegetables and red meats; (ii) 'vegetables and fruits' with a higher intake of tomatoes, yoghurt drinks, green leafy vegetables, dried fruits, fruits, other vegetables and organ meats and (iii) 'dairy and saturated fat' with a high loading of high-fat dairy products, butter, low-fat dairy, margarine, eggs and green leafy vegetables in this pattern. Loading factor for foods and food groups are described in Table S2.

Participants in the highest quintile of the 'dairy and saturated fat' pattern were significantly younger than those with lowest adherence with this dietary pattern ($P < 0.01$). Difference in weight, waist and hip circumference, physical activity, level of education, economic status, lifestyle changes, marital status, menopausal status, intake of omega-3, calcium, multivitamins, vitamin D, contraceptive, chronic diseases and MetS history were not significant across the quintiles of the dietary patterns score (Table 1).

Table 2 describes the age and energy adjusted intake of food groups and nutrients according to quintiles of dietary patterns. Participants in higher quintiles of the 'traditional' dietary pattern consumed more red meat, poultry, eggs, refined grains, soft drinks, energy, protein, fat, saturated and unsaturated fat, cholesterol, sodium, thiamine and niacin ($P < 0.05$). Moreover, subjects in the highest quintiles consumed less amounts of processed meats, whole grains, nuts, fruits and carbohydrates ($P < 0.05$). Female teachers in the highest quintile of the 'vegetables and fruits' dietary pattern had higher intakes of refined grains, vegetables, dietary fibre, energy, and carbohydrates and lower intakes of red meat, eggs, fat, saturated fat and unsaturated fat, and cholesterol ($P < 0.05$). The third dietary pattern was positively associated with low- and high-fat dairy products, eggs, refined grains, energy, protein, total fat, saturated fat, cholesterol, calcium, thiamine, riboflavin, and vitamin D

Table 1 General characteristics of study participants according to quintiles of major dietary patterns' score^a

	Traditional					Vegetables and fruits					Dairy and saturated fats				
	Q1	Q3	Q5	P-value		Q1	Q3	Q5	P-value		Q1	Q3	Q5	P-value	
Age (year)	40.6 ± 1.1	40.1 ± 0.9	40.1 ± 1.0	0.81		39.7 ± 1.0	41.1 ± 1.0	40.4 ± 1.0	0.87		42.4 ± 0.9	40.9 ± 0.9	37.2 ± 1.0	0.001	
Weight (kg)	70.9 ± 1.6	67.7 ± 1.2	69.5 ± 1.6	0.34		69.6 ± 1.6	70.5 ± 1.6	67.6 ± 1.3	0.16		70.4 ± 1.6	68.3 ± 1.3	67.4 ± 1.5	0.51	
Body mass index (kg/m ²)	28.2 ± 0.6	27.1 ± 0.5	27.8 ± 0.6	0.43		27.6 ± 0.6	28.4 ± 0.6	27.0 ± 0.5	0.21		28.2 ± 0.6	27.5 ± 0.5	26.7 ± 0.5	0.25	
Waist circumference (cm)	95.3 ± 1.4	92.7 ± 1.0	94.2 ± 1.4	0.30		93.9 ± 1.4	94.6 ± 1.3	91.4 ± 1.2	0.38		95.0 ± 1.4	93.9 ± 1.6	92.0 ± 1.3	0.36	
Hip circumference (cm)	108.7 ± 2.0	107.2 ± 1.0	108.0 ± 1.2	0.73		108.2 ± 1.3	109.3 ± 1.2	105.8 ± 1.0	0.19		108.7 ± 1.1	107.4 ± 1.1	106.4 ± 1.1	0.64	
Physical activity															
Sedentary	74%	68.3%	77.4%	0.63		78.1%	79.4%	65.6%	0.37		76.2%	78.1%	67.2%	0.55	
Active	25.4%	31.7%	22.6%			21.9%	20.6%	34.4%			23.8%	21.9%	32.8%		
Education															
College	25%	25%	15.6%	0.77		17.5%	18.8%	20.3%	0.41		23.8%	18.8%	15.6%	0.58	
Bachelor's degree	62.5%	65.6%	70%			73%	71.9%	68.8%			71.4%	70.3%	71.9%		
Masters degree/higher	12.5%	9.4%	9.4%			9.5%	9.4%	10.9%			4.8%	10.9%	12.5%		
Lifestyle change															
No	85.9%	76.2%	81%	0.68		82.8%	84.1%	95.5%	0.12		79%	85.7%	81.2%	0.91	
Yes	14.1%	23.8%	19%			17.2%	15.9%	9.5%			21%	14.3%	18.8%		
Marital status															
Married	93.8%	95.2%	90.5%	0.38		95.3%	96.8%	95.3%	0.05		87.5%	93.7%	95.3%	0.39	
Single	6.2%	4.8%	9.5%			4.7%	3.2%	4.7%			12.5%	6.3%	4.7%		
Economic status															
Low	25%	32.8%	39.1%	0.13		37.5%	28.1%	31.2%	0.63		39.1%	20.3%	32.8%	0.53	
Middle	28%	40.6%	26.6%			26.6%	26.6%	26.6%			29.7%	37.5%	29.7%		
High	46%	26.6%	34.4%			35.5%	45.3%	42.2%			31.2%	42.2%	37.5%		
Oral contraceptive use															
No	93.8%	95.3%	93.8%	0.92		98.4%	92.2%	93.8%	0.58		92.2%	93.8%	93.8%	0.30	
Yes	6.2%	4.7%	6.2%			1.6%	7.8%	6.2%			7.8%	6.2%	6.2%		
Chronic disease history															
No	59.4%	54.7%	57.8%	0.98		57.8%	57.8%	67.2%	0.28		50%	53.1%	60.9%	0.58	
Yes	40.6%	45.3%	42.2%			42.2%	42.2%	32.8%			50%	46.9%	39.1%		
Metabolic syndrome															
No	53.1%	75%	68.8%	0.63		64.1%	59.4%	70.3%	0.37		54.7%	65.6%	64.1%	0.55	
Yes	46.9%	25%	31.1%			35.9%	40.6%	29.7%			45.3%	34.4%	35.9%		

Table 1 Continued

	Traditional				Vegetables and fruits				Dairy and saturated fats			
	Q1	Q3	Q5	P-value	Q1	Q3	Q5	P-value	Q1	Q3	Q5	P-value
Menstruation												
No	17.2%	12.5%	10.9%	0.70	14.1%	12.5%	15.6%	0.98	17.2%	6.2%	9.4%	0.08
Yes	82.8%	87.5%	89.1%		85.5%	87.5%	84.4%		82.8%	93.8%	90.6%	
Omega-3 supplement use												
No	90.6%	87.5%	92.2%	0.79	84.4%	93.8%	95.3%	0.22	87.5%	92.2%	90.3%	0.77
Yes	9.4%	12.5%	8.7%		15.6%	6.2%	4.7%		12.5%	7.8%	9.7%	
Calcium supplement use												
No	82.8%	78.1%	85.9%	0.54	79.7%	79.7%	79.7%	0.81	67.2%	82.8%	84.4%	0.06
Yes	17.7%	21.1%	14.1%		20.3%	20.3%	20.3%		32.8%	17.2%	15.6%	
Vitamin D supplement use												
No	77.8%	74.6%	87.3%	0.47	80.6%	76.6%	82.5%	0.94	74.6%	77.8%	76.2%	0.10
Yes	22.2%	25.4%	12.7%		19.6%	23.4%	17.5%		25.4%	22.2%	23.8%	
Multivitamin–mineral supplement use												
No	88.5%	93.8%	92.2%	0.88	96.8%	90.5%	93.8%	0.14	87.3%	89.1%	92.2%	0.41
Yes	11.5%	6.2%	7.8%		3.2%	9.5%	6.2%		12.7%	10.9%	7.8%	

^aData are reported as mean ± SD, otherwise explained.

intake and inversely associated with nuts, fruits, soft drinks, carbohydrates, dietary fibre, sodium and pyridoxine intake ($P < 0.05$).

The comparison of the mean inflammatory markers according to the quintiles of dietary patterns is presented in Table 3. Individuals who highly adhered to the ‘vegetables and fruits’ dietary pattern had lower but non-significant circulating hs-CRP levels compared to women who had lower scores regarding this dietary pattern ($P = 0.19$). After adjustment for age and energy intake, those in highest quintile of ‘vegetables and fruits’ dietary pattern had significantly lower hs-CRP levels ($P = 0.03$). The association remained significant even after further adjustments for all potential confounders including marital status, physical activity, education level, lifestyle change in recent year, current oral contraceptive use, menstruation status, economic status, disease history, omega-3, calcium, vitamin D and multivitamin–mineral supplementation, BMI and waist circumference in the third and fourth models ($P < 0.05$). There was no association between other dietary patterns and serum circulating hs-CRP concentrations either in crude or multi-variable adjusted models ($P > 0.05$). We also could not find any association between dietary patterns and serum IL-17A levels in female adults ($P > 0.05$).

Discussion

The present study revealed that higher score of a dietary pattern high in tomatoes, yoghurt drinks, dried fruits, green leafy vegetables, fruits, other vegetables and organ meats is associated with lower circulating hs-CRP levels, however, none of the dietary patterns were associated with IL-17A.

There are limited data regarding the association between inflammatory markers and the patterns of dietary intake in people living in Middle-Eastern countries with their unique dietary characteristics and the inflammatory markers. Furthermore, limited data are available about the association between diet and serum IL-17A levels and in the present study we examined the dietary patterns derived by principal component analysis in relation with this inflammatory marker for the first time.

A few number of studies evaluated the association between empirically derived dietary patterns and levels of inflammatory markers and our results are in line with the results of previous investigations. Esmailzadeh *et al.*²¹ in a cross-sectional study on adult females also reported that healthy dietary pattern high in fruits and vegetables is inversely associated with the circulatory concentrations of soluble vascular cell adhesion molecule-1 (sVCAM-1), hs-CRP, IL-6 and E-selectin and a Western dietary pattern high in red and processed meats showed a positive relationship with the concentration of sVCAM-1, IL-6 and hs-CRP. A recent review study by Griep *et al.*²⁶ summarised eight observational studies regarding the association between dietary patterns and inflammatory markers and showed that a healthy diet characterised by high intakes of fruits and vegetables is related to low levels of CRP and the Western dietary pattern with high levels of meat and processed food

Table 2 Age and energy adjusted food groups and nutrients intake of participants based on quintile of major dietary patterns' score^a

	Traditional					Vegetables and fruits					Dairy and saturated fats				
	Q1	Q3	Q5	P-value		Q1	Q3	Q5	P-value		Q1	Q3	Q5	P-value	
Food groups															
Red meat (g/day)	28.1 ± 3.6	37.4 ± 3.6	54.1 ± 3.2	<0.001	45.8 ± 3.6	37.2 ± 3.7	29.9 ± 3.8	0.05	35.6 ± 3.7	39.1 ± 3.7	38.0 ± 3.9	0.96			
Refined grains (g/day)	190.0 ± 15.5	240.9 ± 15.5	249.2 ± 15.8	<0.001	207.5 ± 15.8	273.2 ± 16.0	227.0 ± 16.6	0.03	199.8 ± 15.8	262.1 ± 15.7	291.2 ± 16.3	0.002			
Processed meat (g/day)	1.8 ± 0.9	2.5 ± 0.9	6.7 ± 0.9	0.002	3.9 ± 1.1	4.4 ± 1.1	8.5 ± 1.1	0.002	7.5 ± 1.1	7.3 ± 1.1	4.1 ± 1.1	0.09			
Fish (g/day)	5.5 ± 1.0	7.0 ± 1.0	7.0 ± 1.0	0.74	6.5 ± 1.0	5.9 ± 1.0	7.1 ± 1.1	0.90	5.8 ± 1.0	6.3 ± 1.0	5.2 ± 0.1	0.22			
Poultry (g/day)	9.9 ± 3.0	18.5 ± 3.0	43.8 ± 3.0	<0.001	25.6 ± 3.3	18.5 ± 3.3	15.9 ± 3.5	0.33	24.2 ± 3.3	21.5 ± 3.3	17.6 ± 3.4	0.33			
Eggs(g/day)	10.6 ± 1.9	17.4 ± 1.9	33.1 ± 1.9	<0.001	27.4 ± 2.0	20.3 ± 2.0	14.5 ± 2.1	0.001	12.9 ± 2.0	18.7 ± 2.0	29.0 ± 2.0	<0.001			
Whole grains (g/day)	16.3 ± 5.8	32.5 ± 5.8	9.6 ± 5.9	0.040	14.0 ± 5.8	13.1 ± 5.9	21.3 ± 6.1	0.47	25.6 ± 5.9	19.1 ± 5.8	8.7 ± 6.1	0.321			
Nuts(g/day)	17.5 ± 2.7	22.3 ± 2.7	13.5 ± 2.7	<0.001	21.4 ± 2.7	13.6 ± 2.8	18.4 ± 2.9	0.33	17.7 ± 2.7	16.7 ± 2.7	9.9 ± 2.8	0.024			
Low-fat dairy products (g/day)	85.3 ± 13.4	92.1 ± 13.5	107.2 ± 13.6	0.64	113.6 ± 13.4	90.9 ± 13.5	83.2 ± 14.0	0.34	44.5 ± 12.2	72.7 ± 12.1	180.1 ± 12.6	<0.001			
High-fat dairy products (g/day)	91.6 ± 11.1	81.9 ± 11.1	114.5 ± 11.3	0.25	101.5 ± 11.2	91.3 ± 11.3	83.2 ± 11.7	0.69	57.6 ± 10.2	75.7 ± 10.2	169.6 ± 10.6	<0.001			
Fruits															
Fruits (g/day)	773.3 ± 51.3	623.1 ± 51.4	483.8 ± 52.1	0.001	640.9 ± 52.1	586.4 ± 52.7	750.3 ± 54.5	0.06	672.6 ± 51.9	683.7 ± 51.6	439.6 ± 53.8	0.005			
Vegetables (g/day)	247.9 ± 30.6	238.5 ± 30.7	257.4 ± 31.1	0.45	160.1 ± 28.7	218.7 ± 29.0	428.9 ± 30.0	<0.001	296.4 ± 30.8	229.1 ± 30.6	219.0 ± 31.9	0.44			
Soft drinks (g/day)	21.32 ± 5.58	20.0 ± 5.6	32.9 ± 5.7	0.04	43.8 ± 5.5	18.9 ± 5.6	21.7 ± 5.8	0.11	41.8 ± 5.6	26.5 ± 5.6	15.5 ± 5.8	0.02			
Nutrients															
Energy intake ^b	2058.7 ± 101.4	1980.5 ± 101.5	2387.6 ± 101.5	0.002	2115.9 ± 96.2	1821.7 ± 96.2	2604.9 ± 96.1	<0.001	2019.6 ± 100.3	2044.2 ± 99.6	2479.1 ± 101.3	<0.001			
Protein total (g/day)	57.3 ± 1.7	65.4 ± 1.7	73.7 ± 1.8	<0.001	67.7 ± 1.8	62.9 ± 1.9	62.3 ± 1.9	0.23	61.4 ± 1.8	64.7 ± 1.8	68.9 ± 1.9	0.02			
Carbohydrate (g/day)	318.3 ± 5.7	307.4 ± 5.74	278.9 ± 5.8	<0.001	285.6 ± 5.8	310.3 ± 5.8	323.4 ± 6.0	<0.001	312.2 ± 5.9	310.8 ± 5.9	288.6 ± 6.1	0.02			
Fat (g/day)	57.1 ± 1.9	56.6 ± 1.9	68.0 ± 2.0	<0.001	65.0 ± 2.0	59.1 ± 2.0	54.3 ± 2.1	0.01	58.6 ± 2.0	58.2 ± 2.0	66.1 ± 2.1	0.016			
Saturated fat (g/day)	19.6 ± 0.8	19.5 ± 0.8	23.7 ± 0.8	0.003	21.4 ± 0.83	20.9 ± 0.8	17.8 ± 0.87	0.004	17.6 ± 0.8	19.6 ± 0.8	26.5 ± 0.8	<0.001			
Mono-unsaturated fat (g/day)	21.4 ± 1.02	20.4 ± 1.0	25.6 ± 1.0	0.005	26.3 ± 1.0	21.2 ± 1.0	19.6 ± 1.0	<0.001	23.3 ± 1.0	21.5 ± 1.0	22.1 ± 1.1	0.76			
Poly-unsaturated fat (g/day)	16.0 ± 0.9	17.0 ± 0.9	16.0 ± 0.9	0.51	17.2 ± 0.9	14.4 ± 0.9	16.5 ± 0.9	0.21	16.5 ± 0.9	15.7 ± 0.9	14.6 ± 0.9	0.39			
Cholesterol															
Cholesterol (mg/day)	167.9 ± 10.7	200.9 ± 10.7	305.7 ± 10.98	<0.001	260.2 ± 11.8	219.9 ± 11.9	180.7 ± 12.3	<0.001	171.18 ± 11.16	211.1 ± 11.1	288.6 ± 11.5	<0.001			
Dietary Fibre (g/day)	32.5 ± 2.1	27.6 ± 2.1	25.4 ± 2.2	0.14	28.6 ± 2.1	25.7 ± 2.1	33.5 ± 2.2	0.039	31.96 ± 2.11	29.0 ± 2.1	20.3 ± 2.2	0.003			
Magnesium (g/day)	273.8 ± 8.6	270.5 ± 8.6	262.9 ± 8.7	0.72	268.0 ± 8.6	261.6 ± 8.7	277.9 ± 9.0	0.58	263.42 ± 8.64	263.6 ± 8.6	256.6 ± 8.9	0.31			
Sodium (mg/day)	2408.2 ± 201.3	2770.2 ± 201.6	4434.5 ± 204.4	<0.001	2981.7 ± 223.0	3125.7 ± 225.3	3276.1 ± 233.4	0.86	3554.1 ± 221.5	2662.7 ± 220.0	2919.7 ± 229.2	0.05			
Calcium (mg/day)	807.2 ± 31.1	785.1 ± 31.2	810.0 ± 31.6	0.93	790.63 ± 31.06	780.1 ± 31.4	802.7 ± 32.5	0.60	672.8 ± 28.4	766.5 ± 28.1	986.8 ± 29.3	<0.001			
Thiamine (mg/day)	1.7 ± 0.04	1.9 ± 0.04	1.9 ± 0.04	<0.001	1.77 ± 0.041	1.9 ± 0.04	1.9 ± 0.04	0.14	1.8 ± 0.04	1.9 ± 0.04	1.9 ± 0.04	0.04			
Riboflavin(mg/day)	1.7 ± 0.05	1.6 ± 0.05	1.7 ± 0.05	0.44	1.7 ± 0.05	1.6 ± 0.05	1.6 ± 0.05	0.37	1.5 ± 0.04	1.6 ± 0.04	1.9 ± 0.04	<0.001			
Niacin (mg/day)	16.4 ± 0.43	19.2 ± 0.43	19.6 ± 0.4	<0.001	17.8 ± 0.5	18.5 ± 0.5	18.6 ± 0.5	0.52	18.8 ± 0.46	18.8 ± 0.5	17.7 ± 0.48	0.47			
Pyridoxine (mg/day)	2.1 ± 0.1	1.9 ± 0.8	1.8 ± 0.1	0.12	1.9 ± 0.1	1.8 ± 0.1	2.0 ± 0.1	0.32	2.0 ± 0.1	1.9 ± 0.1	1.7 ± 0.1	0.02			
Cobalamin (mg/day)	396.4 ± 19.7	380.0 ± 19.8	362.6 ± 20.0	0.62	371.4 ± 19.6	349.6 ± 18.8	418.0 ± 20.5	0.14	364.8 ± 19.7	371.7 ± 19.6	356.0 ± 20.4	0.11			
Vitamin D (µm/day)	0.8 ± 0.1	0.9 ± 0.1	1.1 ± 0.1	0.69	1.1 ± 0.1	0.96 ± 0.1	0.9 ± 0.2	0.90	0.4 ± 0.1	0.69 ± 0.1	2.05 ± 0.1	<0.0001			

^aValues are reported as mean ± SE.

^bValues are just adjusted for age.

Table 3 Multivariate adjusted geometric means of inflammatory markers based on quintile of dietary patterns score^a

Inflammatory markers	Traditional					Vegetables and fruits					Dairy and saturated fats				
	Q1	Q3	Q5	P-value		Q1	Q3	Q5	P-value		Q1	Q3	Q5	P-value	
hs-CRP (mg/L)															
Crude	3.9 ± 0.5	3.6 ± 0.4	3.1 ± 0.5	0.79		3.8 ± 0.4	4.1 ± 0.4	2.9 ± 0.4	0.19		2.9 ± 0.5	4.0 ± 0.4	3.5 ± 0.4	0.55	
Model 1 ^b	3.9 ± 0.4	3.6 ± 0.4	3.2 ± 0.5	0.80		3.9 ± 0.5	4.4 ± 0.5	2.6 ± 0.5	0.03		2.7 ± 0.5	3.9 ± 0.4	3.7 ± 0.5	0.36	
Model 2 ^c	3.9 ± 0.5	3.6 ± 0.5	3.3 ± 0.5	0.89		3.8 ± 0.4	4.4 ± 0.5	2.5 ± 0.5	0.02		2.7 ± 0.5	4.1 ± 0.5	3.7 ± 0.5	0.39	
Model 3 ^d	4.0 ± 0.5	3.6 ± 0.5	3.3 ± 0.5	0.85		3.7 ± 0.4	4.3 ± 0.4	2.5 ± 0.5	0.04		2.7 ± 0.5	4.1 ± 0.5	3.5 ± 0.5	0.41	
Model 4 ^e	3.8 ± 0.5	3.7 ± 0.5	3.2 ± 0.5	0.90		3.6 ± 0.4	4.3 ± 0.4	2.6 ± 0.4	0.04		2.6 ± 0.5	4.1 ± 0.4	3.8 ± 0.5	0.16	
IL-17A (pg/mL)															
Crude	13.9 ± 4.1	13.1 ± 4.4	16.5 ± 4.1	0.75		14.9 ± 3.8	15.6 ± 3.8	11.2 ± 3.8	0.93		13.3 ± 3.8	10.1 ± 4.0	17.3 ± 4.1	0.58	
Model 1 ^b	13.4 ± 4.1	13.5 ± 4.0	15.9 ± 4.1	0.69		14.5 ± 3.8	16.5 ± 3.8	9.7 ± 4.0	0.81		12.4 ± 4.2	10.3 ± 4.0	17.9 ± 4.1	0.51	
Model 2 ^c	13.7 ± 3.8	13.3 ± 3.9	15.7 ± 4.0	0.72		14.7 ± 3.8	16.6 ± 3.9	9.6 ± 4.0	0.80		12.3 ± 4.0	10.4 ± 3.9	18.0 ± 3.9	0.52	
Model 3 ^d	13.3 ± 3.8	12.0 ± 3.1	16.1 ± 3.9	0.70		14.9 ± 4.1	16.8 ± 4.1	10.5 ± 4.2	0.87		11.5 ± 3.8	11.3 ± 3.8	17.4 ± 3.9	0.43	
Model 4 ^e	13.2 ± 3.8	11.9 ± 3.8	16.9 ± 3.8	0.74		15.1 ± 4.1	17.6 ± 4.05	9.5 ± 4.2	0.72		11.0 ± 3.8	11.1 ± 3.8	18.6 ± 3.8	0.21	

^a Values are reported as mean ± SE.
^b Adjusted for age and energy intake (kcal/day).
^c Adjusted for marriage status (married/single), physical activity (sedentary/high), education level (college/Bachelor's degree/Master's degree or higher), lifestyle change in recent year (yes/no), current oral contraceptive use (yes/no), menstruation status (yes/no), economic status (low/middle/high), disease history (yes/no) plus variables in model 1.
^d Adjusted for variables in model 2 and omega-3 (yes/no), calcium (yes/no), vitamin D (yes/no) and multivitamin-mineral (yes/no) supplementation.
^e Additionally adjusted for BMI (kg/m²) and waist circumference (cm).

intake adversely affects inflammatory markers. A study in 2008 by Nanri *et al.*⁵ in Japan also revealed that a healthy diet characterised by high intake of vegetables, fruit, yoghurt and soy products and fish was inversely associated with serum CRP levels.⁵

A number of studies have also investigated the association between a priori dietary patterns and circulatory CRP concentrations. For instance, Lavoie *et al.* showed an inverse association between a Canadian healthy eating index characterised by higher intake of grain products, vegetables and fruits, milk products, meat and its alternatives; and low intake of total fat, saturated fat, cholesterol, and dietary sodium was inversely associated with CRP levels.²⁷ Furthermore, the Dietary Inflammatory Index which was developed to assess the inflammatory potential of the diet has been shown to be significantly associated with several inflammatory markers including CRP.^{28,29} Observational studies have also suggested that serum CRP might be inversely related to higher scores of the Mediterranean- and Palaeolithic-like diets.^{30,31}

In the current study a pattern high in tomatoes, yoghurt drinks, dried fruits, green leafy vegetables, fruits, other vegetables and organ meats was related to lower hs-CRP levels. Previous studies have shown that fruits, tomatoes and other vegetables might affect inflammatory markers through their phytochemicals, vitamin C, vitamin E and folic acid.^{32–34} It is also revealed that particularly dark green leafy vegetables because of their high content of antioxidants like vitamin C and folate reduce the oxidative stress and inflammation.^{35,36} Yoghurt drinks were also highly loaded in this dietary pattern. Although the results of clinical trials regarding the effect of dairy products on serum inflammatory markers were inconsistent,³⁷ it is proposed that dairy consumption is associated with reduced serum CRP levels in human adults.³⁸

The other dietary patterns were not associated with serum hs-CRP levels. The 'traditional' dietary pattern, characterised by poultry, salt, eggs, other vegetables and red meat, was comprised of both healthy and unhealthy foods. This finding might be comparable with the results of the study reported by Anderson *et al.*³⁹ which found no association between a pattern high in fruits, vegetables, low-fat dairy, whole grains, poultry, and fish and serum CRP levels. In addition, Julia *et al.* in a cross-sectional study could not find any association between this inflammatory marker and a diet rich in fatty fish, eggs, and poultry.⁴⁰ We also did not find the association between a dietary pattern high in high-fat dairy products, butter, low-fat dairy, margarine, eggs and green leafy vegetables and serum hs-CRP levels. Two cross-sectional studies tried to examine the association between dietary patterns characterised with high fat dairy intake and serum CRP concentrations^{39,41} and did not reveal any significant association.

The present investigation did not find a significant association between the major dietary patterns found in the present study and IL-17A. Although a number of studies have examined the effect of dietary supplements like arginine,⁴² omega-3 fatty acids⁴³ and high-fat diet⁴⁴ in animal models, we are not aware of any study trying to examine the

association between a posteriori dietary patterns and IL-17A. Orchard *et al.* in a recently published investigation examined the association between healthy eating index and IL-17 in 40 participants survived from cancer and showed an association between this dietary pattern and IL-6 and tumour necrosis factor- α receptor 2 (TNFR-2) concentrations but not circulatory IL-17 levels.⁴⁵ Furthermore, we found a study on the association between food groups' intake and a dietary score and IL-17F among children.⁴⁶ This study revealed that vegetables or grains are associated with lower levels of IL-17F, while consumption of dairy or sweets was associated with higher IL-17F and also an unhealthy diet was shown to be associated with higher levels of this inflammatory marker. IL-17 has been linked to several autoimmune diseases including multiple sclerosis, rheumatoid arthritis and asthma.⁴⁷ IL-17A is produced by TH-17 cells and several studies have linked diets high in fat and cholesterol, protein, sugar and salt, as well as processed and fast foods known as Western diet to autoimmune diseases through the role of T cells including TH-17.⁴⁸ An explanation for not finding an association between dietary patterns and serum IL-17 levels might be the loading of diverse food groups in the dietary patterns derived in our population. For instance, organ meats which are high in saturated fats were also loaded in the 'vegetables and fruits' dietary pattern and also green leafy vegetables were loaded in the 'dairy and saturated fat' pattern and foods might interact in affecting the inflammatory markers.

Our study has some limitations that should be considered. We examined the association between dietary patterns and inflammatory markers in female teachers; this should be considered while generalising our results to the population. We selected teachers because they are highly educated and their health status is of great importance because of their roles in educating the children. Furthermore, they would provide more precise reports for the present study. The current study was cross-sectional in design; therefore, causal association cannot be inferred from its results and further prospective studies are highly recommended to confirm the current findings. Although we used a validated FFQ for dietary assessment, measurement error and misclassification of participants based on their dietary intakes should be considered. In addition, we tried to control for several confounding variables in our analyses, however, residual confounding from unknown or unmeasured factors such as periodontal diseases, sleep disorders and stress (physical or emotional) is inevitable. Furthermore, social desirability and social approval might have led to biased reporting of the dietary intakes; however, this point might not affect the associations found in the present study if we hypothesise that the reporting bias is the same among the study participants. It should be noted that although hs-CRP is regarded as a reliable and stable marker,⁴⁹ recent investigations have proposed that this inflammatory marker has a large intra-individual variation and it cannot be relied for risk prediction in individuals.⁵⁰ In fact, the within person variation might lead to attenuated risk estimates if hs-CRP is measured once in the epidemiologic studies like the

present study and the difference might be even larger if several samples were assessed for each participant.⁵¹

In conclusion, the present study provides an evidence for association between a dietary pattern high in tomatoes, yoghurt drink, dried fruits, green leafy vegetables, fruits, other vegetables, and organ meats and serum hs-CRP levels but dietary patterns were not significantly associated with serum IL-17A levels. Prospective cohort studies particularly those targeting IL-17 concentrations are recommended to confirm our results.

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Conflict of interest

The authors declare that there is no conflict of interest.

Authorship

ASA and NK conceived the study. ASA, SS and AN carried out the recruitment of participants. MS and AZ conducted the laboratory analyses. ASA and NK conducted the statistical analyses. NK wrote the first draft of the manuscript. All authors contributed to the conception, design and drafting of the manuscript. The authors would also like to thank all teachers involved in the study, without their collaboration the authors could not accomplish the present study.

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Supporting information

Additional Supporting Information may be found in the online version of this article at the publisher's web-site:

Table S1 Food groups and their corresponding food items used in principal component analysis to derive dietary patterns.

Table S2 Loading factor for foods and foods groups based on major dietary patterns derived from principle component analysis.

ORIGINAL RESEARCH

Evaluation of the impact of a post-hospital discharge Transitional Aged Care Service on frailty, malnutrition and functional ability

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Abstract

Aim: To investigate the relationship between nutritional status, functional ability and frailty in older adults participating in a 12-week Transitional Aged Care Service program.

Methods: A retrospective analysis of a clinical cohort of older adults aged 65+ years after hospital discharge. At entry into the program and at completion, nutritional status was measured using the Mini Nutritional Assessment (MNA), frailty status was measured using the Groningen Frailty Indicator and functional ability was measured using the Modified Barthel Index (MBI). Demographic data were obtained from electronic medical records.

Results: Baseline data were available for 115 participants (mean age = 81.7 (SD =7.9) years; 20.9% classified as malnourished and 89.6% as frail). A positive association was found between nutritional status and frailty ($r = 0.298$; $P = 0.001$), and frailty and functional ability ($r = 0.204$; $P = 0.029$). Multiple regression analysis, accounting for the cofounders of baseline MNA, MBI, age, gender, length of hospital stay and living situation, found that nutritional status and functional ability were able to indicate the presence of frailty on admission to the program ($P = 0.002$, $P = 0.007$, respectively). In those program completers ($n = 79$), significant improvements were found in nutritional status, frailty and functional ability ($P < 0.0005$).

Conclusions: Nutrition status, frailty and functional ability are closely and positively related, and should therefore be considered simultaneously in rehabilitation for older adults. A post-hospital transitional program with a multidisciplinary approach significantly improved all three outcomes, suggesting its value in enabling frail older people to remain independent for as long as possible.

Key words: frailty, functional ability, mini nutritional assessment, older adults, post-hospital discharge, transitional program.

Introduction

Globally, populations are ageing resulting in increased prevalence of malnutrition, frailty and functional impairment.¹

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These conditions typically coexist, and impact significantly on related morbidity and independence in older adults, placing an unprecedented burden on health-care systems. It is estimated that health-care expenditure is four times higher in adults aged 65+ years compared to their younger counterparts.² Thus, there is growing interest in how to treat and prevent manifestation of these three conditions.

Causes of malnutrition are multifaceted and may result from inadequate dietary intake, inability to meet energy requirements or underlying illness.³ Rates of malnutrition in community-dwelling older adults typically range between 24% and 56%.^{1,4,5} Malnutrition in older adults is related to a myriad of adverse health outcomes including reduced quality of life, longer and recurrent hospital admissions, diminished cognitive function, depressive symptomatology and mortality.^{6,7}

In the case of frailty, two main theoretical constructs have emerged. Fried *et al.* developed a phenotypic model

that included five possible components (weight loss, exhaustion, weakness, slowness and reduced physical activity),^{8,9} Rockwood and Mitnitski, on the other hand, described frailty using an accumulation of deficits model, which counted the number of impairments and conditions in an individual patient to create a Frailty Index.¹⁰ Because of inconsistencies in the definition of frailty, its estimated prevalence varies between studies, and is reported to range from 4% to 59% in older adults.^{11–13} A recent consensus document, including both Fried and Rockwood as co-authors, has resulted in an internationally recognised definition of frailty as a ‘medical syndrome with multiple causes and contributors that is characterised by diminished strength, endurance, and reduced physiologic function that increases an individual’s vulnerability for developing increased dependency and/or death’.¹⁴ Furthermore, frailty is recognised as being potentially reversible.

Functional ability is the actual or potential capacity of an individual to perform the activities and tasks that can be normally expected. In the case of older adults, functional ability is often measured by ability to perform activities of daily living (bowel and bladder control, grooming, toilet use, feeding, transfers, walking, climbing stairs, dressing and bathing).¹⁵

The extent to which the conditions malnutrition, frailty and functional impairment overlap has not been extensively researched. Although the conditions are distinctive, they present with similar observable characteristics including weight loss, loss of muscle mass, exhaustion, weakness and slowness, regardless of their aetiology.¹¹ These conditions not only have the potential to exacerbate each other, but also to contribute to other adverse health outcomes. Because of these associations and an overlap in manifestation, it has been suggested that these conditions should be considered together and could be treated collectively.¹¹

Malnutrition, frailty and functional impairment adversely impact on both individuals and associated health-care costs.¹¹ Nutritional interventions tailored to meet individual’s needs in community-dwelling older adults were found to decrease demand for health services.^{1,16,17}

Following discharge from a hospital admission, many older patients require ongoing care, before becoming independent in their own home.¹⁸ Studies have found most patients remain in the same nutritional state they were at the time of hospital admission or decline further while in hospital, with a similar pattern observed 30 days post-discharge.¹⁹ The Illawarra Transitional Aged Care Service is a 12-week multidisciplinary transitional program for clients over the age of 65 years who have recently been discharged from the hospital. The program offers therapeutic and care services, including a dietitian, to work with clients to improve their independence and confidence after hospital. Transitional care services aim to assist community-dwelling older adults to return to optimal independence, thereby preventing readmission to hospital or placement into residential aged care facilities.^{4,16}

The program offers services provided by nurses, social work, physiotherapists, occupational therapists, dietitians,

speech pathologists and a psychologist. The patient needs to have rehabilitation goals in order to qualify for entry to the program. Intervention across the program is multidisciplinary, with each discipline setting their own goals for the client. Overall client goals are determined with patient case managers at the start of the program and are reviewed throughout. Additionally, home care services can be provided through an external agency, if needed, for assistance with domestic chores, shopping, meal preparation, transport and personal care. The dietitian performs an initial home visit, a review as required, and a final home visit. Dietetic intervention is individualised, and can range from nutrition support, food fortification, assistance with compiling grocery lists, teaching how to prepare meals, provision of meal plans, advice on supplements if required, assistance accessing meal service providers, and liaison with family members.

The present study aimed to explore the relationship between nutritional status, frailty and functional ability in community-dwelling older adults discharged from hospital, and to evaluate the effect of a 12-week transitional program on these three conditions.

Methods

An analysis of a clinical cohort was undertaken, allowing for observation of a group of individuals at two time points, receiving similar care. The relationship between frailty, malnutrition and functional ability of participants at baseline and after completion of 12 weeks on the program was investigated.

The sample population included in the present study were all consenting clients entering the Illawarra Transitional Aged Care Program between October 2016 and August 2017, immediately following hospital discharge. To be eligible, the participant needed to be willing to work towards rehabilitation goals with assistance from a multidisciplinary team.

Data on nutritional status, frailty and functional ability were collected at two time points, at initial assessment (baseline) and at discharge from the program. Nutritional status was assessed by dietitians using the Mini Nutritional Assessment (MNA)⁶ which includes 18 items according to four domains (anthropometric measurements, global assessment, diet information and subjective assessment). A maximum score is 30.0, with less than 17.0 points regarded as malnourished, 17.0–23.5 points as ‘at risk of malnutrition’ and 24.0+ points as ‘well-nourished’. The MNA is validated with high demonstrated specificity and reliability.²⁰ At baseline, all participants were weighed using the same scales (Seca 803 flat scale) and heights were either reported by the participants or estimated using ulna length.²¹

Frailty was measured using the validated Groeningen Frailty Index (GFI)²² that considers physical, cognitive, social and psychological factors with a score ≥ 4 indicating the presence of frailty. Frailty was measured by the case manager or the dietitian during the initial home visit.

Functional independence was measured by an occupational therapist during the initial home visit using a Modified Barthel Index (MBI).^{23,24} The MBI is a highly valid and reliable tool, that is used to assess functional ability, through measurement of activities of daily living (bowel and bladder control, grooming, toilet use, feeding, transfers, walking, climbing stairs, dressing and bathing).²⁴ Scores range from 0 to 100, with 100 indicating total independence, while 0 indicates total dependency.⁸

In addition, age, gender and length of hospital stay were collected from electronic medical records, while information on living arrangements was obtained from the participant and coded as a dichotomous variable (1 for living alone and 2 for living with others).

Data were collected and collated by health district clinicians and a de-identified data set made available on the Illawarra Shoalhaven Local Health District nutrition server for further analysis (Figure 1). Participants on the transitional program received support from a multidisciplinary team, of dietitians, physiotherapists, occupational therapists, social workers, speech pathologists, nurses and psychologists. Participants received individualised dietetic support depending on their needs and requirements. If a client met their goal earlier than 12 weeks the final assessment was brought forward and completed for an early discharge, as is recommended by the NSW Transitional Aged Care Program Guidelines.

Data analysis was performed using SPSS, version 23.0 (IBM Corp., Armonk, NY, USA).²⁵ A significance level of $P < 0.05$ was used. Categorical variables were presented as frequencies and percentages, while continuous variables were shown as means and SD or medians and 25th and 75th interquartile ranges (IQRs). Sample size was calculated based on a mean predicted difference from baseline in frailty score of 1 (SD of change of 2.5). Assumptions included probability for rejecting the null hypothesis of 0.050 and probability of failing to reject the null hypothesis under the alternate hypothesis of $\beta = 0.200$ (80% power). Estimated sample size was $n = 49$, which was increased to 59 in order to account for a potential drop out of 20%. The overall relationship between nutritional status, functional ability and frailty at baseline of the program was determined using Spearman's rank-order correlations. To analyse whether nutritional status and/or functional ability predicted the coexistence of frailty at initial assessment at baseline, multiple regression analyses were performed, adjusting for baseline MNA, baseline MBI, age, gender, length of hospital stay, and whether the participant lived alone or with others.

To assess change in indicators after completion of the program, pre-post comparison was conducted using Wilcoxon signed rank tests for non-parametric continuous variables. In a subsample of those that completed the program and had both discharge MNA and GFI scores ($n = 79$), an

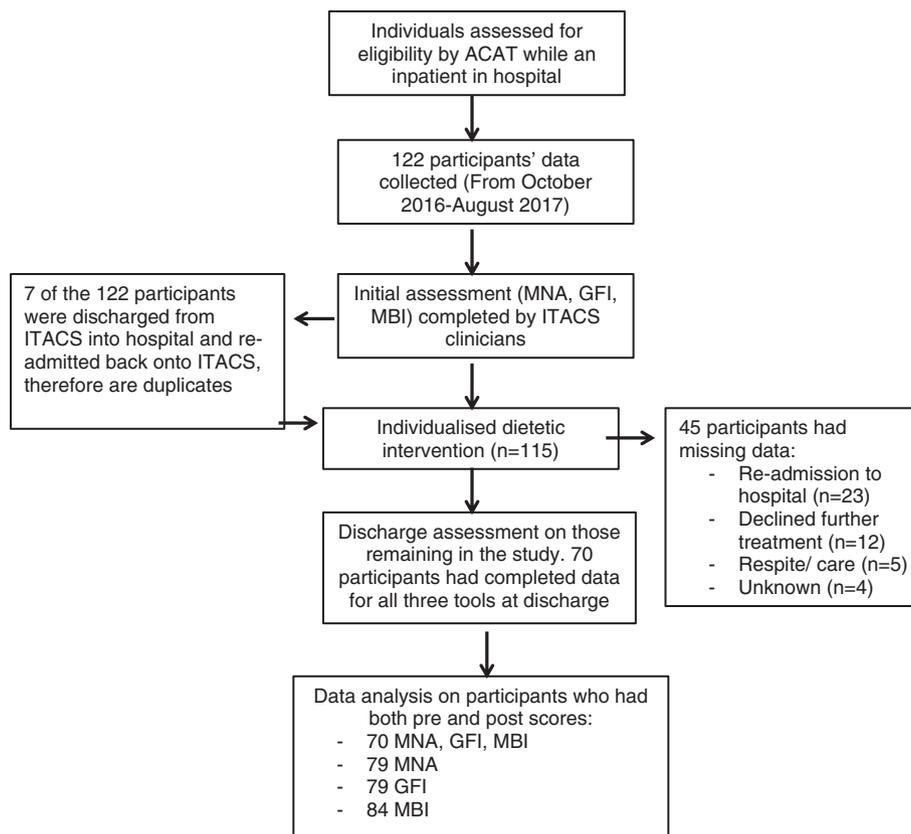


Figure 1 Flow-chart of participants throughout the study. ACAT, Aged Care Assessment Team; MNA, Mini Nutritional Assessment; GFI, Groningen Frailty Indicator; MBI, Modified Barthel Index.

exact McNemar's test was run to determine a change in nutritional status classification, expressed as a proportion, while a McNemar's test with continuity correction assessed change in proportion of those considered frail at baseline. Improvements in functional ability were assessed using a paired *t* test in those who had discharge MBI scores (*n* = 84).

The University of Wollongong Human Research Ethics Committee (Approval number 2017/102) granted ethical approval for the present study and site-specific approval was provided by the Illawarra Shoalhaven Local Health District. As part of standard protocol for the transitional program, all participants signed a client agreement, which includes written consent for information to be used for research purposes.

Results

One hundred and twenty two participants were recruited to the study. Of these 122 participants, 7 were duplicate clients that had been readmitted to the program twice during the study period, thus their second admission on the program was not included in the analysis, leaving a total of 115 participants, all of which had an initial assessment at baseline for the MNA, GFI and MBI. Some participants were discharged early from the program, therefore, not all nutritional, frailty, and functional ability assessments were able to be completed, resulting in missing data for 45 of the participants (39%). The reasons for early discharge were readmission to hospital, participants' declining further treatment, entering respite or care, or data missing for unknown reasons. Mean scores for GFI and MBI at baseline were similar for those who completed the transitional program and those who did not (7.03 (2.20) vs 7.62 (2.57); *P* = 0.192; and 83.0 (10.3) vs 80.1 (15.5); *P* = 0.280, respectively). MNA scores were slightly higher in the completers compared to non-completers (18.0 (3.2) vs 16.3 (3.8); *P* = 0.012). Seventy participants had complete data for MNA, GFI and MBI, while *n* = 79 had both an initial and discharge MNA and GFI score, and *n* = 84 had complete MBI assessments, as shown in Figure 1.

Demographic characteristics of the study are shown in Table 1. Mean age of the participants was 81.7 years (SD = 7.9), ranging from 53 to 96 years. Over two thirds (64.3%) were female, over half (52.2%) lived alone and 47.8% co-resided with others including their spouse, family or friends. The average length of hospital stay was 43.2 days (SD = 31.3), while 24 (21.0%) participants did not complete the study because of being readmitted back to hospital.

At baseline, 24 participants were malnourished (20.9%), 70 were at risk of malnutrition (60.9%) and 21 were well-nourished (18.3%). Mean MNA score was 20.2 out of a possible 30.0 (SD = 3.7). The number of participants who were malnourished following the completion of the transitional program decreased to six participants (7.6%), with reductions also seen in the percentage at risk of malnutrition (*n* = 29; 36.7%), accompanied by an increase in the

Table 1 Baseline characteristics of participants on Illawarra Transitional Aged Care Service program (*n* = 84)

Variable	Result
Age (years), mean ± SD	81.7 ± 7.9
Male, <i>n</i> (%)	41 (35.7%)
Female, <i>n</i> (%)	74 (64.3%)
Malnourished, ^(a) <i>n</i> (%)	24 (20.9%)
At risk of malnutrition, ^(a) <i>n</i> (%)	70 (60.9%)
Well-nourished, ^(a) <i>n</i> (%)	21 (18.3%)
Frail, ^(b) <i>n</i> (%)	103 (89.6%)
Robust, ^(b) <i>n</i> (%)	12 (10.4%)
Cognitively impaired, ^(c) <i>n</i> (%)	20 (17%)
Normal cognition, ^(c) <i>n</i> (%)	33 (29%)
Cognition unknown, <i>n</i> (%)	62 (54%)
Lives alone	60 (52.2%)
Lives with others	55 (47.8%)
Length of hospital stay, mean ± SD	43.16 ± 31.3

^(a) Mini Nutritional Assessment: malnourished <17/30; at risk of malnutrition = 17–23.5/30; well-nourished = 23.5–30/30.

^(b) Groningen Frailty Indicator: robust <4/15, frail >4/15.

^(c) As assessed by the mini-mental state examination or the Rowland Universal Dementia Assessment Scale or the Montreal Cognitive Assessment.

well-nourished category to 44 participants (55.7%; χ^2 test = 22.4; *P* < 0.001) as shown in Figure 2. The mean MNA score favourably increased by a mean of 3 points to 23.0 (SD = 3.9).

Most of the participants were characterised as being frail on admission (*n* = 103; 89.6%). Mean GFI score at baseline was 6.6 (SD = 2.4) with a range from 1.0 to 12.0 out of a possible score of 15.0; this mean score decreased (mean = 4.8; SD = 2.6) following the intervention, with a subsequent decrease in frailty prevalence to 64.6% (*n* = 51; *P* < 0.001) as shown in Figure 2.

Mean MBI score increased from 81.7 (SD = 12.5), with a range from 38 to 99 (score closer to 100.0 indicates a more favourable independent state) to 90.1 (SD = 10.8) at follow up, which represented a significant increase of 7.3 points (95% CI, 5.9–8.7; *P* < 0.01). Three outliers (i.e. outside of 1.5 × IQR from 25th and 75th percentile values) were detected, but were not considered extreme (i.e. more than 2 × IQR from 25th and 75th percentiles) and were kept in the analysis.

Using the non-parametric Spearman's rank-order test,²⁶ a weak inverse association was demonstrated between baseline MNA and GFI scores (*r* = 0.298; *P* = 0.001). Similarly, a weak inverse association between MBI and GFI scores was found at baseline (*r* = 0.204; *P* = 0.029). No association between baseline MNA and functional ability (MBI) was found (*r* = −0.069; *P* = 0.465).

Of the 79 participants with an MNA pre- and post-intervention, 64 experienced a positive increase in mean MNA score whereas nine participants experienced a decline in nutritional status and six participants remained in the same nutritional state. There was a statistically significant median increase in MNA score (2.0 points) from pre- (21.0; IQR:

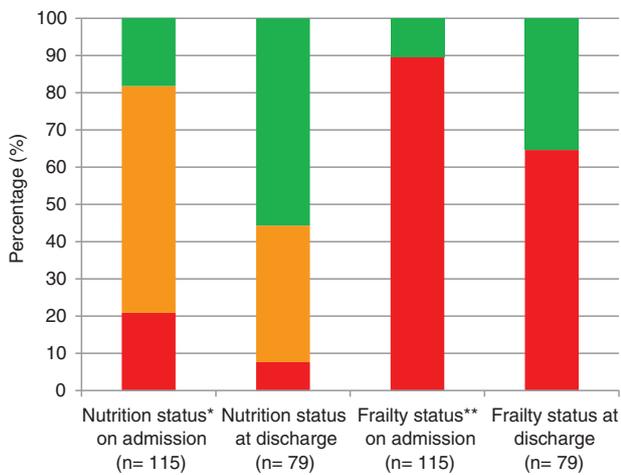


Figure 2 Change in proportion of Mini Nutrition Assessment categories and Groningen Frailty Indicator categories following a nutrition intervention. *Nutrition status measured by the Mini Nutritional Assessment, **Frailty measured by the Groningen Frailty Indicator. (■) Robust; (■) frail; (■) well-nourished; (■) at risk of malnutrition; (■) malnourished.

18.0, 23.0) compared to post-intervention (24.0; IQR: 21.0, 25.5) (Wilcoxon signed rank test, $z = 6.278$, $P < 0.005$).

Of the 79 participants who completed both pre- and post-intervention GFI assessments, 63 had improved their frailty status after the ITACS intervention, shown by a favourable decrease in mean GFI score. Eight participants experienced an increase in GFI score at the end of the intervention, presenting with a worsened frailty status compared to the beginning of the intervention, while eight remained frail throughout. Median change in GFI score was significant at 2.0 points (pre-intervention = 7.0 points; IQR: 5.0, 8.0) compared to post-intervention (4.0 points; IQR: 3.0, 7.0); Wilcoxon signed rank test ($z = -5.737$; $P < 0.005$).

Of the 84 participants with both initial and discharge MBI score, 72 had increased their functional independence, with their MBI scores being closer to 100. The functional ability of seven participants decreased throughout the study, while five participants did not experience

improvement in functional ability after the intervention. Median increase in MBI score (6.0 points) was significant ($z = 7.373$, $P < 0.0005$.) from pre- (86.0; IQR: 76.0, 89.0) to post-intervention (92.0; IQR: 87.0, 98.0).

A multiple regression model was performed to indicate the coexistence of frailty using variables of initial assessment at baseline of MNA, MBI, gender, age, length of hospital stay and social situation. All assumptions were met. The multiple regression model was statistically significant ($F(6,108) = 3.508$; $P = 0.003$; adj. $R^2 = 0.117$), but baseline MNA and MBI were the only variables that statistically significantly contributed to the indication ($P = 0.002$ and $P = 0.007$, respectively). Regression coefficients and standard errors can be found in Table 2.

Discussion

The present study showed that frailty status was associated with both nutritional status and functional ability in community-dwelling older adults who have been discharged from hospital. Participation in a 12-week multidisciplinary transitional program resulted in improvements in indicators of nutritional status, frailty and functional ability.

Transitional care programs result in multiple benefits including lowering the rate of hospital readmission and improvements in patient satisfaction.²⁷ Although the current study found beneficial improvements in all three outcomes indicators investigated, the lack of a control group limits interpretation of the role of the specific dietetic component of the transitional program.

As malnutrition may be considered a subset of those who are nutritionally at risk, these two groups may be considered together.²⁰ A prevalence of 81.8% of malnutrition identified in the current sample of community-dwelling transitional program participants is much higher than the range of 24–56% that has been reported in the literature.^{5,6} Similarly, 90% of participants entering the current transitional program were classified as being frail, a figure much higher than the reported range of 17–59% found in other similar populations.¹³ The advanced age of study participants (81.7 years) may explain reasons for widespread malnutrition and frailty,^{28–30} along with the vulnerability of those who live alone.^{1,31} Lastly, as a result of immediate

Table 2 Summary of multiple regression analysis to assess the association between frailty using the Groningen Frailty Indicator score and malnutrition at baseline

Variable	Unstandardised B	SE _B	Standardised B	Significance
Intercept	14.435	3.305		0.001*
Baseline MNA	-0.186	0.057	-0.293	0.002*
Baseline MBI	-0.052	0.019	-0.276	0.007*
LOS	0.001	0.007	0.015	0.869
Social situation ^(a)	0.080	0.466	0.017	0.865
Age	0.003	0.027	0.011	0.903
Gender	-0.145	0.441	-0.030	0.743

^(a) Social situation refers to living alone (coded as 1) or with others (coded as 2).

B, unstandardised regression coefficient; B, standardised coefficient; LOS, length of stay; SE_B, standard error of the coefficient.

* $P < 0.05$.

discharge from hospital, it is unknown whether participants' nutritional status had worsened during their admission, or related to the cause of underlying illness.³² It has been reported that most older inpatients remain in the same nutritional state after discharge as when they were an inpatient.^{4,19}

The favourable decrease in frailty status as nutritional status improved on the program is extensively supported by the literature.^{11,12,28,32} For example, Abellan and Vellas, concluded that older adults who are at risk of malnutrition, or malnourished, should also be considered to be frail.³² Boulos *et al.* found that as frailty level increased, so did the proportion of individuals suffering from poor nutritional status.¹² Other studies have suggested that if an individual is malnourished or at risk of malnutrition, they have a 90.0% chance of being pre-frail or frail, however, on the other hand only 50% of those who are frail tend to be at risk of malnutrition.²⁸

Studies have found that a shortened version of the MNA (MNA-SF) predicted both malnutrition and frailty,³³ while others report a significant association between domains included in the MNA and frailty.^{8,28} The association between malnutrition and frailty is becoming increasingly recognised⁸ and although these conditions differ in their aetiology, there is overlap in concepts and measures.⁸ Baseline functional ability was also an indicator of frailty in this high-risk group. Frailty can be described as a deterioration in activities of independence,³⁴ therefore it is unsurprising that our findings indicated individuals classified as functionally impaired using the MBI scale were also at increased risk of frailty. The association between functional ability and frailty is well explored, in particular, regarding the phenotype of frailty.⁸ The definition of frailty includes decreased physical functioning, while other components such as decreased strength and energy, can lead to reduced functional ability.^{8,35} Studies by Bollwein *et al.* and Montero-Odasso *et al.*, have found that pre-frail and frail participants have increased dependency, while low mobility has found to be a risk factor for frailty.^{28,36}

The clinical significance of the magnitude in change in frailty score observed in the current study warrants consideration in terms of potential impacts on functioning and independence in this high-risk population. Mean scores on the GFI were reduced by around two score points, but this translated into a quarter of the frail participants at baseline no longer being considered as frail (i.e. score of four or greater) following completion of the program. A number of well-validated models of frailty exist, including the GFI,¹⁴ that have been shown to predict increased vulnerability to adverse health outcomes and mortality.³⁷⁻⁴¹ The reversal of frailty through dietary and exercise interventions is well recognised,¹⁴ as has been demonstrated in the current study.

Likewise, a dramatic reduction in the proportion of participants classified as being malnourished from 21% to 8% over just 12 weeks is impressive. Our research has demonstrated that classification as being malnourished or at risk of malnutrition on admission to a hospital visit results in a

higher risk of adverse clinical outcomes, including increased length of stay, discharge to a higher level of residential care, and death in both acute and rehabilitation older patients over a 12- and 18-month period, respectively.^{42,43}

Our findings, together with others, suggest that the MNA and MBI be used as screening tools to identify those at risk of frailty, and in older adults discharged from hospital, to identify earlier and initiate treatment accordingly.

Other transitional programs that include dietitians, not only reduced length of hospital stay and increased individual's confidence after hospital, but also resulted in improvements in nutritional status, frailty and functional ability in participants.^{27,33,44,45} In the current study, a large number of participants remained frail after the intervention. This may be because of the intervention not being designed specifically to address the frailty syndrome, the advanced age of the participants and/or their recent hospital admissions. This suggests that individualised dietetic support may need to be combined with other interventions, such as resistance exercise training (RET), to successfully address frailty and malnutrition simultaneously.⁴⁶

A limitation of the study is the high loss to follow up in 39% of the recruited sample. This is a particularly difficult group to recruit to studies;⁴⁷ many patients were readmitted to hospital or referred to residential aged care facilities before the end of the program, or alternatively were discharged from the program early because of improvements. Because of the pragmatic nature of the study, which evaluated the effectiveness of a transitional program in older adults who completed the program, per protocol analysis was preferred over intention-to-treat analysis. Completers and non-completers did not differ at baseline in terms of frailty status or functional ability, however, potential bias cannot be ruled out because of differences in nutritional status at the baseline.

The present study confirms an intricate relationship between nutritional status, frailty and functional impairment, and thus nutrition interventions need to consider all three conditions when treating older adults on transitional programs. Further studies are needed to ascertain the most effective components of such programs, for maximum benefit to the target group and to assess generalisability of the findings in other patient groups.

In conclusion, the present study demonstrated that participation in a multidisciplinary transitional care program following hospital discharge in frail older adults resulted in improvements in nutritional status, accompanied by improvements in functional ability and a decreased frailty state.

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Conflict of interest

No authors have any conflicts of interest to declare.

Authorship

SC, CZ and KC designed the study; SC and CZ collected the data; RV cleaned the data and conducted statistical analyses and was responsible for the first draft of the manuscript; SB, AF, CG, JP and NE assisted in overseeing the study processes and management of staff involved in the data collection. All authors contributed to editing the manuscript. Victoria Amer and Alexandra Harman, clinical dietitians at Illawarra Shoalhaven Local Health District contributed to data collection.

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ORIGINAL RESEARCH

Dietetics in the digital age: The impact of an electronic medical record on a tertiary hospital dietetic department

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The use of health information technology within the hospital system is changing the way health professionals across the globe provide health care by increasing access to services, improving patient safety, increasing efficiency and reducing costs.^{1–3} Specifically, the introduction of electronic medical records (EMRs) has paved the way for this revolution to occur. However, a significant proportion of the current literature relating to EMRs has been conducted in physician and nursing populations.^{3–5} Evidence relating to the impact of electronic records on nutrition professionals

practice and clinical workflow is still very limited, despite the profession acknowledging the value of digital approaches to support practice over a decade ago.^{1,6–8}

Evidence suggests the introduction of EMRs has reduced medication errors, adverse drug events, length of stay, laboratory testing, radiological testing and medication administration times.^{2,3} The quality of care and the ability to monitor patients' vital signs have reportedly improved due to the introduction of these systems.^{2,3} Other stated improvements include decreases in documentation time for nursing staff.⁹ Existing literature suggests that there may be differences in the way health professionals are affected by EMRs depending on their role in the system with some studies having also reported possible negative consequences of EMR introduction. An example is an increased burden on physicians due to increased documentation time.⁹

The potential advantages for nutrition professionals using EMRs have been outlined extensively in the qualitative literature (invited reviews, invited commentary, etc.) although limited quantitative evidence exists relating specifically to

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the nutrition and dietetics profession.^{1,10–21} The implications discussed in this dietetic literature include data integration, tracking and reporting, cost savings, improved clinical decision-making and improved patient care.^{11–13,16} Improved documentation and ordering of clinical nutrition interventions resulting in reduced risk of drug nutrient interactions, transcription errors, incompatibilities in parenteral nutrition formulas and provision of clinical decision support as well as the ability to transfer nutrition-related documentation across institutions have also been described in surveys of clinicians.^{7,10}

A small number of studies have quantitatively assessed the impact of EMRs on dietitians. An electronic record implementation reduced the time spent undertaking nutrition assessments by 13 minutes (57 minutes/pt with electronic record vs 70 minutes/pt with paper records).²² This reduction translated to an estimated cost saving of US \$6500–10 000 annually in this particular outpatient setting (using hourly rate of US\$25/hour).²² Other workload efficiencies have also been shown, including reduced time to complete nutrition calculations,²³ increased services by nutrition support staff²⁴ and an increase in the number of resolved nutrition diagnosis.²² This research is often limited in scope and often focuses on systems used within an individual ward or systems only used by dietitians, rather than a hospital-wide EMR implementation.^{22,24}

The aims of this study were to understand the impact of an EMR on individual dietitians; examine the effect of an EMR on the data routinely used in nutrition assessments and investigate the changes to clinical practice and dietetic service provision.

Methods

This retrospective study was conducted at a 900-bed tertiary teaching hospital located in Brisbane, Australia. Four separate datasets were collected for analysis to provide an overall picture of the changes that have occurred since EMR implementation.

A retrospective analysis of departmental chart audit data, collected pre- and post-EMR implementation, was undertaken. This audit was completed at a dietetic departmental level, encompassing both inpatient and outpatient services. Data were collected for three consecutive days, 2 weeks prior and 12 months' post-implementation. The audit items included patient safety considerations (difficulty and timeliness of chart access, reason for delay in chart access, legibility of documentation, clarity of referrals), identification of patient alerts (allergies, malnutrition, pressure injury, interpreter, vision or hearing impairments) and the ability and time required to locate documented weights and weight history. This was a department level quality audit tool and as such validity and reliability were not assessed.

A retrospective analysis of the Pressure Injury Prevalence Audit was undertaken. This audit is completed quarterly with the results reported to the hospitals' Nutrition Care Committee. The main aim of the audit is to determine the prevalence of hospital acquired pressure injuries; however,

nutrition-related data are also collected. The analysis compared the result of this audit pre-EMR and then 12 months' post-EMR implementation, to assess any significant changes with implementation of an electronic record. The specific items included in this analysis are weight and height documentation on admission and malnutrition screening on admission.

A quantitative analysis of the nutrition diagnosis data that are entered into the EMR by clinical dietitians for each patient occasion of service was assessed. Reports were generated within the EMR and exported into an Excel (Microsoft, Redmond, WA) spreadsheet. All diagnoses recorded within the EMR during the first week of each quarter since implementation were analysed. The key metrics analysed in the present study were the proportion of patients seen by a dietitian who have a nutrition diagnoses entered within the EMR, percentage of diagnoses resolved and time taken for these diagnoses to be resolved.

Information on dietitian service provision was collected from the Health Round Table Reports.²⁵ This was used to analyse the service provision of the dietetics department pre- and post-EMR implementation. Three years' worth of data were analysed, pre-EMR (2013–2014), transition year (2015–2016) and post-EMR (2016–2017). Service provision within these data is reported as admissions requiring nutrition events. Data do not specifically report individual events, therefore do not report on all occasions of service for the dietetic department as admissions may require more than one dietetic consultation. Outpatient data are also not captured within the Health Round Table Report.

Summary statistics were expressed with descriptive representations such as counts and percentages. Data were presented over time where applicable to demonstrate changes between the pre- and post-EMR implementation measures. Statistical analysis was carried out using SPSS (IBM SPSS Statistics for Windows Version 25; IBM Corp., Armonk, NY) for the audit data and a chi-square test was used to determine statistical significance. The present study was approved by the Metro South Hospital and Human Research Ethics Committee (HREC/17/QPAH/546).

Results

The dietetic chart audit was completed pre- and post-EMR implementation by 29 and 21 dietitians, respectively. There were large improvements in medical record accessibility, referral clarity, weights being located in records, awareness of alerts and legibility of documentation, time to access medical records and time to locate weight documentation (Table 1).

Pre-EMR 75.7% (n = 137/181) of clinicians were able to access patient medical records compared with 100% (n = 119/119) post-EMR ($P < 0.001$). Access to charts within 1 minute improved from 68.5% (n = 106/183) to 99.2% (n = 119/120) post-EMR (Table 1, $P < 0.001$). Medical record legibility improved from 53.8% (n = 74/141) reporting very good pre-EMR to 99.2% (n = 117/118) post-EMR ($P < 0.001$). Clinician lack of awareness of medical

Table 1 Dietitian chart audit pre- and post-EMR (electronic medical record)

	Response	Pre-EMR (total n = 183)		Post-EMR (total n = 129)		Statistical significance P-value
		n	n (%)	n	n (%)	
Accessibility of chart	Yes	181	136 (76.4)	119	119 (100)	<0.001
	No		36 (20.2)		0	
	Partial		6 (3.4)		0	
Time until access (minutes)	<1	161	106 (65.8)	120	119 (99.2)	<0.001
	1–5		35 (21.7)		1 (0.8)	
	>5		20 (12.4)		0	
Referral clarity	Purpose	183	61 (33.3)	129	97 (75.2)	<0.001
Referral clarity	Referrer	183	55 (30.1)	129	58 (45.0)	<0.001
Referral clarity	Pertinent history	183	42 (23.0)	129	64 (49.6)	<0.001
Time looking for weight (minutes)	<1	114	97 (85.1)	117	112 (95.7)	<0.01
	1–5		11 (9.6)		5 (4.3)	
	>5		6 (5.3)		0	
Weight found	Yes	106	88 (83.0)	108	100 (92.6)	<0.01
	No		13 (12.3)		2 (1.9)	
	Partially		5 (4.7)		6 (5.6)	
Other relevant data	Yes	119	114 (95.8)	125	125 (100)	<0.05
	No		5 (4.2)		0	
	Partially		0		0	
Consult alerts	Unaware	103	85 (82.5)	110	38 (34.5)	<0.001
	Aware prior		13 (12.6)		72 (65.5)	
	Aware during or after consult		5 (4.9)		0	
Legibility	Very good	141	74 (52.5)	118	117 (99.2)	<0.001
	Good		38 (27.0)		1 (0.8)	
	Neutral		8 (5.7)		0	
	Poor		14 (9.9)		0	
	Very poor		7 (5.0)		0	

alerts (e.g. food allergies, need for interpreter) dropped from 82.5% (n = 85/103) pre-EMR to 34.5% (n = 38/110) post-EMR ($P < 0.001$).

Nutrition diagnosis data were unable to be tracked pre-EMR. Post-EMR, the total number of nutrition diagnoses increased from 155 to 227 post-EMR implementation between February 2016 and August 2017. The percentage of resolved diagnoses was also reported. Initially, in the first quarter of implementation 20.0% (n = 31) of diagnoses were resolved. There was a trend for increasing resolutions of nutritional diagnoses over the 18 months' post-EMR implementation with resolution rates peaking at 41.2% (n = 80) in May 2017 before a slight reduction to 34% (n = 77) in August 2017. The mean number of days taken to resolve nutrition diagnoses reduced from 51.5 days (n = 17) in February 2016 and reached its lowest in November 2016 with 26.2 days (n = 71). In the final quarters of February, May and August in 2017, the mean number of days to resolution stabilised at 32.1 days (n = 50), 34.0 days (n = 73) and 31.0 days (n = 64), respectively.

Results from the quarterly Pressure Injury Prevalence Audit report demonstrated improvements in data collected during admission used in dietetic practice. The mean percentage of heights and weights collected during eight audits (n = 3834 patients) pre-EMR was $79.3 \pm 3.8\%$ and rose to

$86.0 \pm 2.6\%$ during five audits (n = 2958 patients) post-EMR implementation. A similar trend was also seen for the number of malnutrition screening tools (MSTs) completed on admission. The mean pre-EMR screening was $57.5 \pm 6.4\%$ (n = 8 audits) and increased to $74.0 \pm 8.1\%$ (n = 5 audits) post-EMR. The percentage of patients who were identified as at-risk of malnutrition (MST ≥ 2) increased from 25.3% pre-EMR to 29.1% post-EMR implementation (Figure 1).

There were 4075 people admitted who received a nutrition intervention pre-EMR (2014–2015), 5687 during the transition year (2015–2016) and 7035 post-EMR implementation (2016–2017), a 72.6% increase. The mean time for each nutrition event reduced 22.0% from 118 minutes pre-EMR to 106 minutes during the transition year and to 92 minutes post-EMR.

Discussion

There has been limited quantitative research conducted to understand the effect of EMRs on dietetic practice and workflow. Although work overseas exists²⁴ this is the first study to assess changes within a tertiary hospital in Australia following hospital-wide implementation of an EMR. Previous work in Australia and internationally has

Percentage of Patients at risk of Malnutrition

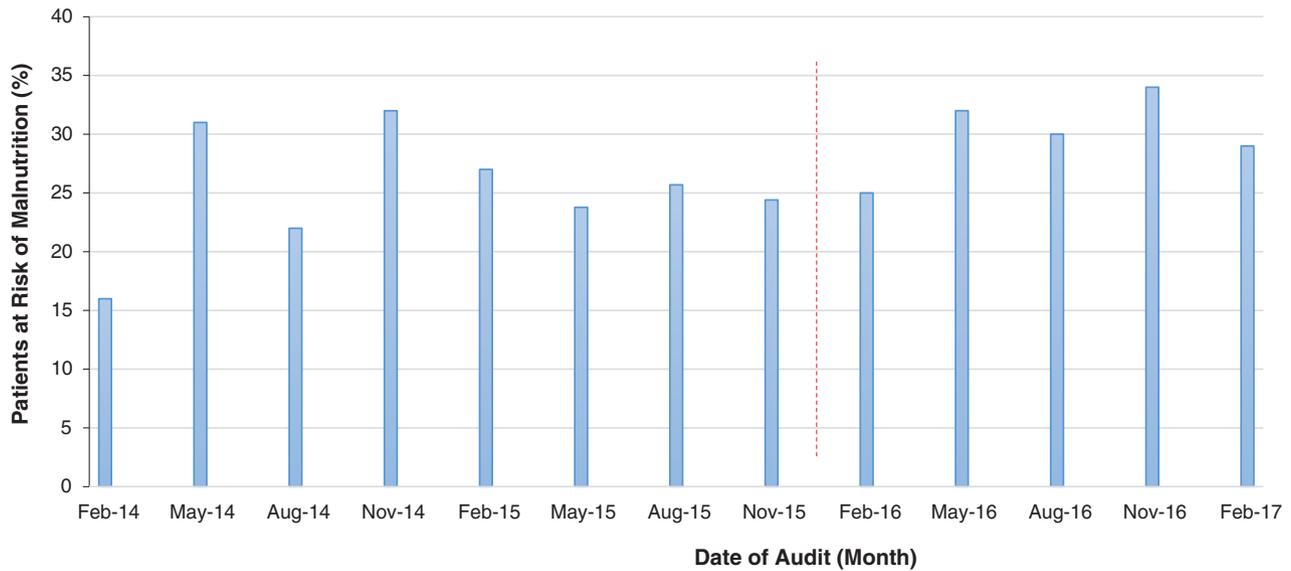


Figure 1 Percentage of patients at-risk of malnutrition (■; MST ≥ 2) pre- and post-EMR (---, electronic medical record introduced).

investigated the effect of specifically digitising nutrition records alone, both across a hospital²⁴ and on specific wards.²² The study results show there are many areas where electronic records have positively influenced day to day practice including an increased ability to find weights, access charts, notification of alerts, improved height/weight recordings on admission and improved MST screening on admission. Results from the current study are consistent with previous literature finding nutrition-specific electronic record implementation increased recording of height and weight during admission from 30% at baseline to 90% within 3 years at a 650-bed hospital.²⁴

The time to access charts and find recorded weights were reduced with the introduction of an EMR. These results are consistent with literature that has shown operational efficiency with EMR implementation across professions.^{3,23,26} Research assessing the time taken to complete clinical nutrition documentation showed a reduction of 13 minutes per consultation²² and a reduction in time taken to perform nutrition calculations from 9.7 to 3.2 minutes post-EMR implementation.²³ Physical therapists have also reported reductions in documentation time by as much as 30%.^{27,28} For nursing staff, documentation time reduced with EMR implementation by as much as 24.5% depending on the computer set up (i.e. bed side access or central station desk-top).⁹ This is consistent with the results from the present study as the dietetic chart audit indicated a minimum of 9 hours of dietetic time could be saved weekly from being able to access patients' medical records immediately. This has enabled the use of previously non-productive staff time to enhance patient care through other means.

A key finding from the current study is the large increase in the number of nutrition events year on year

since the implementation of an EMR. Between the financial years of 2014–2015 and 2016–2017 there was a 72.6% increase in the number of admissions receiving a nutrition intervention. This was despite little change to the mean number of nutrition events reported per admission and no increases to the number of clinical staff. This increase is only for inpatient admissions and may be an underestimation of the total increased demand as outpatient appointments have not been assessed in the present study. Similar increases have been published with one international hospital reporting referrals handled by the nutrition support team and clinical dietitians increased 54.11% from 7374 in the year 2000 to 11 369 in 2003.²⁴ The authors speculate the ability to handle such large increases in service provision is likely the result of a combination of factors; however, improved efficiency from the introduction of an EMR, including specific design features, is likely a major influence.

With the introduction of a specifically designed EMR, nutrition diagnosis data are now more accessible and can be incorporated into routine departmental audits. The percentage of nutrition diagnoses that were resolved during admission increased from 20% in February 2016 to 34% in August 2017. The literature regarding nutrition diagnosis resolution in hospital settings is mixed. Literature has shown both improved resolutions rates in a haemodialysis cohort²² and no difference when implemented in a tertiary teaching hospital.²⁹ The present results are consistent with an increase in resolution rates. It is speculated these results are likely due to the improvement in the delivery of nutrition care and the ability of an EMR to track patients, which facilitates proactive care and increased accuracy of triaging clinician time, as other authors have suggested.²²

The results of the nutrition diagnosis audit are difficult to interpret as the number of diagnoses actually captured within the EMR was variable. The trend was for an increased number of diagnoses recorded within the EMR since the implementation. Authors speculate this is a result of clinicians becoming more familiar with the EMR system and the change champions within the department encouraging staff to enter the diagnosis into the section required to generate reports. The system requires nutrition diagnoses and progress to resolution to be entered in a separate section to the remaining of the dietetic documentation within the EMR. This impacted upon nutrition diagnoses recorded within the EMR. Improvement in nutrition diagnoses documentation and resolution is anticipated if integrated as data fields within the clinical notes written by dietitians in the EMR. As others have suggested, increased use of the EMR and subsequent increase in diagnosis data will improve the ability to undertake future outcome-based research.³⁰

A strength of the present study is the completion of this research in the real-world setting. The data collected are routinely collected in clinical practice and allows for analysis of trends pre- and post-EMR implementation. The complex work environment of a large tertiary hospital also provides strength to this study. To the authors' knowledge there has been no literature published previously which has looked at the effect of a hospital-wide EMR implementation on a dietetics department in Australia or internationally. Data such as the Health Round Table data are standardised across health services and collected on a national and international scales.

There are several limitations that need to be considered. This was not a randomised controlled trial and the retrospective nature of the present study did not allow for the assessment of causality. However, the intention of the study was to retrospectively analyse changes post-EMR implementation. Future studies planning to assess changes post-EMR implementation could be more rigorously designed to allow maximum data collection and compliance from clinicians. This would enable the researchers more control over the prospective data collection, such as the dietetic chart audit used in the present study. Other limitations include the different study population for the dietetic chart audit. Staff movement in a tertiary hospital dietetic department is frequent and it is likely not all those who completed the survey pre-EMR implementation would have completed it post-EMR, with others not having completed the pre-survey and only completing it post-EMR. There were also some incomplete data collected from the surveys as some clinicians did not answer every question. This is likely to have resulted in an underestimation of the impact of the EMR, and as such the results presented may be conservative.

The findings from his study complement recently published work in the nutrition informatics space which established the Framework for eHealth Readiness of Dietitians.³¹ This conceptual model includes dimensions such as aptitude, advocacy, access, standards and attitude which help to guide the profession in its successful transition to

eHealth³¹ and has been developed to provide dietitians with a framework to assess and drive strategies to prepare the profession for the digitisation of the health-care system.³¹ There are a number of insights provided within this paper including improved patient safety, improved accessibility saving clinician time and the ability to impact on the nutrition care of more individuals. This understanding could be used to influence professional attitudes, standards and advocacy and guide development of a targeted strategy to better prepare dietitians for an EMR implementation at other hospitals.

The future of dietetics within this digital space appears bright. The authors anticipate the use of specifically designed EMRs will allow dietitians the ability to run reports in real time and integrate this information into nutrition dashboards. This ability to track information contained within the EMR will also allow clinicians to assess if changes in clinical practice have impacted outcomes in a more systematic manner than is currently available. These changes will continue to improve patient care and the quality of service that is provided to patients. Future research investigating dietetics and EMR's should focus on the patient outcomes and how these systems can be optimised to continue to improve clinical efficiency in dietetic practice.

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Conflict of interest

The authors report no conflict of interests.

Authorship

JM and AV conceived and planned the study with assistance from SE. JM and AV compiled the results and AV carried out statistical analysis. JM, AV and SE contributed to the interpretation of the results. JM took the lead in writing the manuscript. All authors provided critical feedback and helped to shape the research, analysis and manuscript.

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ORIGINAL RESEARCH

A dietetic clinical educator enhances the experience and assessment of clinical placement

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Dietitians are a crucial part of the health workforce and more dietitians will be required to meet the complex and increasing health needs of the population.^{1,2} Work-based placements are integral to health profession training and develop student competence through experiential learning and exposure to practice.³ In Australia, dietetic students undertake a minimum of 100 placement days in various workplaces including the clinical setting.^{2,4} Demand for clinical placements is rising due to an increase in students enrolling in accredited training courses. Further, the contraction of health service funding and casualization of the workforce have limited placement availability.³ Student

placements are perceived by practitioners to place additional stress and burden on work sites.^{3,5,6} Internationally, concern exists that increasing student numbers may compromise the quality of student learning experiences during placement and thus affect preparedness for practice.^{3,7}

Student learning is influenced by skills and attributes of supervising practitioners; student-practitioner relationship; student's ability to drive their own learning; and peer support.^{7–9} Leadership, management and partnerships provide support and guidance and are vital for positive placement learning environments in which students thrive.¹⁰ A positive learning environment has been shown to increase student satisfaction and success.⁹

Traditionally, practitioners have been responsible for observation and assessment of student performance.⁵ However, this model is challenged by inconsistent performance expectations between practitioners and difficulty interpreting competency standards,^{2,11} which can undermine assessment outcomes.¹²

A range of supervisory models have been proposed to address these challenges.^{3,7} One such framework is the Clinical Educator (CE) model.⁵ CEs are qualified practitioners that hold responsibility for the management and

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learning of students during clinical placement. CEs provide generalist teaching and pastoral care to students, and support practitioners in their role as preceptors. Preceptors are practitioners who provide direct teaching and education to students during placement and contribute to the evaluation of performance.^{3,13} CEs have been shown to increase workplace capacity in student supervision.⁵ However, broader impacts of the CE on placement experience for students and preceptors has not been explored. The aim of this study was to evaluate the impact of a CE model on the learning experience and environment for students, preceptors and managers in hospital-based dietetic placements.

Methods

Edith Cowan University (ECU) students complete a 20-week placement in the final 6 months of the 2 year course, of which 10-weeks occurs in a clinical hospital workplace. During clinical placement, students are supervised by preceptors and overseen by a University CE. ECU initiated the secondment of two dietetic CEs, each 0.3 full-time equivalent, who were substantive employees at two different metropolitan teaching hospitals. The CE positions were internally advertised and the CEs were appointed in a joint decision by the University and hospital. The appointed CEs demonstrated experience and skills in clinical dietetic practice, placement teaching and assessment, communication and problem solving. Each CE was based at their place of employment during the placement. They were responsible for coordinating and overseeing placements at their respective hospital and undertook weekly visits to students on placement at other hospital sites within an allocated region. Outside the placement period the CEs undertook university-based work such as classroom teaching and university student clinic supervision. For the purpose of this study 'onsite CE' refers to the CE being based at the hospital site as part of their usual employment; 'offsite CE' refers to the CE providing weekly visits to other hospital sites within an allocated region. In 2016, ECU introduced a programme of assessment for the 20-week placement.¹⁴ Programmatic assessment is the purposeful arrangement of multiple assessment moments to enable credible and defensible high-stake assessment decisions. Student performance is assessed at multiple times using fit for purpose instruments, undertaken by multiple skilled assessors and focuses on assessment that drives learning through quality feedback.¹² The CE model was implemented in 2016 to support the programme of assessment for clinical placements.

This study was positioned within a constructivist paradigm. A qualitative descriptive¹⁵ approach was used to discover and understand the experience of students, preceptors and the hospital dietetic managers who were involved with the ECU CE model. The research group had firsthand experience with both the CE model and the programme of assessment.¹⁵ Two researchers (KW and BC) were the CEs under investigation. A third researcher (JJ) developed and implemented the CE model and sought to understand the experience of stakeholders. The fourth

researcher (GQ) was not involved in the establishment or implementation of the CE model but had an intricate understanding of the programme of assessment, as did JJ. Purposive sampling was used to obtain meaningful information¹⁶ from individuals who had experienced the CE model.¹⁵ Multiple perspectives with diversity in work settings, demographics and experience was sought. The study received ethical approval from Edith Cowan University ethics committee (HREC #16537) and occurred between January and June 2017.

Researchers sent an email inviting all students (n = 11), preceptors (n = 45) and managers (n = 3) involved in the 2017 clinical placements to participate in a focus group. Students, preceptors and management participated in separate focus groups to ensure participants felt comfortable discussing their experience. Demographic and occupational characteristics of focus group participants were collected using a paper-based survey and presented as either mean (range) or percentage. Participants indicated consent to participate by signing a written consent form. The student focus group was held at ECU on conclusion of the clinical placement, where participation could not influence students' placement experience. Student participation had no influence on their assessment or course outcomes. Preceptor and management focus groups were held at a convenient time at their workplace, within 1 month of students completing the 2017 placement. Semi-structured focus groups with open questions and prompts were used to understand participant experience and capture the multiple meanings and interpretations. Questions were derived from the research aim, drew on the experience of the researchers and explored knowledge gaps identified in the literature.¹⁵ The questions were reviewed by researchers experienced in qualitative research. As one hospital had a single manager the session was conducted as an interview using the same semi-structured focus group questions.

Two researchers (JJ and GQ), experienced in focus group methodology, led all sessions. The experiential knowledge of these researchers enabled participants to discuss their experience without the need to clarify responses and allowed for depth in prompting questions. Each focus group was between 30 and 60 minutes. Focus groups were audio-recorded for accurate analysis and reporting and the researchers took notes. The recordings were transcribed verbatim with two researchers (KW and BC) checking accuracy. Focus group transcripts were thematically analysed by hand following the method described by Braun and Clarke.¹⁷ Participant interaction and level of agreement within each focus group and between focus groups was considered and documented during analysis and has been reported in the results.¹⁶ Two authors (KW and JJ) independently analysed each focus group whereby the transcripts were coded and grouped into categories that shared unifying features.¹⁶ The authors then met to discuss codes and categories, grouping data into themes that addressed the research question. Five themes were developed, and later collapsed into four themes. During analysis the researchers identified and discussed assumptions and beliefs

and the influence on the findings. As the researchers (KW and JJ) were insiders, a third researcher (GQ) independently reviewed the transcripts and developed themes for verification.¹⁶ Minor changes were made to the description of the themes. Data from the different participant groups were pooled to provide depth to the analysis. Illustrative quotes from all three participant groups have been reported.

Results

Participation rates, demographic and occupational characteristics for students, preceptors and managers are given in Table 1. Eight focus groups were held, with a total of 34 participants (Table 1). The mean age of participants was 30 years (22–49 years) for students, 34 years (25–53 years) for preceptors and 38 years (37–40 years) for managers.

The findings revealed that the CE (i) reduced the logistical burden of student placements and improved time efficiency; (ii) facilitated student assessment within a programme of assessment; (iii) was uniquely positioned to provide support and enhance student confidence; and (iv) had an enhanced capacity to manage underperforming and challenging students. At times a difference in opinion was expressed between preceptors with a CE based at their place of employment (onsite CEs) and those with a visiting CE (offsite CE) and this has been outlined in the results.

Theme 1: CE reduced the logistical burden of student placements and improved time efficiency: Prior to the CE appointment, hospital staff perceived a time and responsibility burden to coordinate student placements in addition to their existing large workloads. Following the commencement of an onsite CE position, preceptors and management reported improved placement organisation, with the CE taking on administrative responsibility. This reduced preceptor stress and fatigue, improved work flow, reduced burden on the site and allowed preceptors to commence a

Table 1 Focus group participation rates and participant demographics and occupational characteristics

Participant characteristics	Students	Preceptors	Management
Number of focus groups/ interview	1	Total Sites: 5 Offsite CE: 3 Onsite CE: 2	2
Total number of participants	10	21	3
Focus group/ interview participation rate (%)	91	47	100
Gender (%)			
Female	90	95	100
Male	10	5	0
Current workload (%)			
Full time	—	71	0
Part time	—	24	100
Casual	—	5	0

clinical teaching role earlier in the placement. This contrasted with persistent administrative burden for sites with offsite CEs.

'You like having students and you like being teachers but you don't want to feel a burden with all the extra organising. You do take a lot of time and then you are always having to catch up...' (Preceptor with offsite CE)

There was consensus amongst preceptors and management that placement sites are unique in relation to staff personalities, team dynamics, department and hospital systems and protocols. Onsite CEs had inherent understanding of these unique features, allowing them to administer logical placement flow and facilitate an effective learning environment which students found beneficial to their learning.

'...because we had [CE] who worked at the hospital...she did know those procedures and the processes and she was able to talk through those, and give you strategies if you needed them. Feedback which you could then apply straight away. So I think that was really helpful...' (Student)

Although preceptors with offsite CEs valued the support, the lack of inherent understanding of hospital systems limited capacity of the CE to undertake the full range of duties completed by onsite CEs such as orientation and timetabling.

Preceptors and managers agreed that the CE position improved communication between the university and placement sites. All groups perceived this communication to enable regular and timely support for student issues, which included modification of clinical tasks and implementation of learning strategies. This proactive administrative approach protected preceptors' teaching roles, minimising staff burden.

'I think you've got...identified gaps earlier on with this model. You can...act on it a lot earlier and...take a lot of stress off the last couple of...weeks' (Preceptor)

Onsite CEs were able to provide flexible support and reduced isolation, especially for part-time preceptors.

'They've got that person [the CE] to immediately communicate and deal with that issue, as opposed to try and resolve more themselves and probably not feeling as isolated...as a preceptor, because you have got that onsite support.' (Manager)

This contrasted with preceptors that had offsite CEs who reported less communication opportunities than those with onsite CEs. This was a particular concern for senior dietitians holding more site responsibility and part-time staff. They wanted clear and timely university support for challenging students and assessment paperwork.

Preceptors and management perceived the clinical placement to be unique, requiring CE support to develop diverse skills such as client-centeredness, communication, organisational and clinical specific skills, in concurrent timing. They

recognised that the changing, complex learning environment required fast conversion of theoretical knowledge to practical skills. They observed that expectations can constantly increase over the placement, intensifying students' stress. They viewed the clinical placement as a high stake environment from a clinical competence, patient risk and qualification perspective.

Theme 2: The CE facilitated student assessment within a programme of assessment: The CE role facilitated delineation of roles within the programme of assessment. Preceptors and management viewed the CE as holding administrative and assessment responsibilities, and preceptors having a teaching and mentoring focus.

'...having [CE] take on that focusing role...it changes the relationship. I think you don't have to be the one that's passing or failing them. You can just be that teacher and it's just much more relevant...' (Preceptor)

Clear preceptor-student role delineation, where the preceptor was not the sole assessor, resulted in students who readily sought feedback and asked more questions of preceptors and CEs. For preceptors with onsite CEs, more teaching time allowed them to provide frequent feedback. This encouraged deeper student self-reflection, driving student learning and confidence within a student-led approach.

'...she [the student] was really eager to ask me questions and even if they seemed silly in her head...I feel that it positively impacted on her performance because she was asking these questions and she obviously gained better knowledge and was able to implement that with the patient.' (Preceptor)

A difference of opinion between preceptors emerged regarding the terms CE and preceptor, which reflected individual site interpretations. Some preceptors viewed themselves as the 'educators', with the CE being responsible for overseeing the placement coordination and ensuring university requirements were met rather than educating.

The CE had an awareness of the student's clinical placement journey and development which encouraged assessment continuity. This familiarity with competency development assisted them to act as an advisor to both the student and the preceptor. All stakeholders described the CE as an informed mediator who collated student and site perspectives, shared opinions, moderated expectations, and bench-marked student competence against standards. Preceptors and management valued the CE's clinical experience and their understanding of site, industry and university requirements.

Preceptors reported that sharing student performance opinions with the CE reduced the burden of interpreting student performance and competence, and recognised that a larger opinion base allowed for consensus and minimised bias.

'If you have a student you are particularly worried about... whether it's a pass or fail for example, there's not that burden on you making the call...there's someone else sharing the opinion with you. So that does take a lot of pressure off...' (Preceptor)

CEs helped moderate and validate preceptors' and students' performance expectations and overcome inconsistent or high standards by observing students, providing insight into performance progression and comparing to competency standards.

'...we can have high standards as well, where...it's not achievable for students...' (Preceptor)

Preceptors explained that for CEs to effectively assess and moderate student performance they needed to spend adequate time observing the student to prevent inaccurate interpretations.

Theme 3: The CE was uniquely positioned to provide support and enhance student confidence: Students and preceptors with onsite CEs highlighted the CEs' unique knowledge of student and preceptor idiosyncrasies due to university-based teaching prior to placement and existing workplace relationships. Respectively, there was consensus that this knowledge could be used to enable an ideal student-preceptor pairing, which could facilitate skill development and improve students' self-confidence.

'...[CE] knows the other Dietitians. So she knows how they operate and she knows what their expectations are and how you can work to those expectations...' (Student)

Students articulated that the CE frequently provided constructive feedback, verbalising a considered opinion, which reduced anxiety. They actively sought CE feedback, which provided consistent support in a constantly changing environment, reassurance of progression, and enhanced student self-confidence.

Preceptors valued insight into a student's previous performance to prompt early student support. Students were divided on the benefits of the CE providing knowledge of prior performance to preceptors. Some indicated that it may impinge a student-led approach and taint future preceptor perceptions, others believed it enabled additional and tailored learning opportunities and consistency in teaching.

Student and preceptors described key attributes of the CE which enabled them to provide effective pastoral care, including: encouraging, supportive, helpful, reassuring, trustworthy, approachable and insightful. Selecting a CE with these attributes was important to management and students in order to develop a sound student-CE relationship. Students recalled an evolving need for support from initial technical support to later emotional support, requiring the CE to use these skills. Some students reported that the student-CE relationship developed throughout the placement, as the CE had a deeper insight into the student's

personal and professional circumstances than the preceptors and was actively aware of the high stress environment.

'...[The CE] would always come and talk to me... that was...nice to be able to vent to someone about how it was all going...about my life in general... I won't feel under pressure with her [the CE].' (Student)

Students with an offsite CE reported less opportunities to develop such a mentoring relationship and instead developed a closer relationship with their preceptors with whom they spent more time.

All groups recognised that the CE had a continual, personalised relationship with the student. Preceptors perceived this to assist students in managing stress. Preceptors reported concerns that students may not disclose anxieties to them, so valued a strong student-CE relationship. Preceptors observed reduced student stress when the CE was present. Students reported that talking through issues with the CE was helpful and supportive. They reported being relaxed with the CE, mutually celebrating progress and achievements.

[In relation to talking about student stress] *'They can talk with [the CE] a little more about that and they can just get...the clinical stuff from me...often they don't want to bring that up with their clinical supervisor [preceptor] 'cause they don't want it to impact on how they are assessed but there's an avenue for them to bring it up...'* (Preceptor)

Most preceptors reported that the CE provided generalist teaching, ensured adequate learning opportunities and had a dedicated role for pastoral support. Preceptors viewed themselves as having a technical teaching role. Some preceptors reported feeling comfortable providing pastoral support and others not.

Students preferred open, transparent communication about their progress. Apparent hidden conversations without student engagement compromised the student-CE relationship, increasing feelings of vulnerability.

'They [the CE and preceptor] went off and spoke for a while...it's...a weird thing... 'cause you know you are being spoken about and you're not allowed to listen. So I think either being able to hear it -'cause why not? - or do it without us knowing.' (Student)

Theme 4: The CE had an enhanced capacity to manage underperforming and challenging students: Preceptors described that the CE was particularly valuable in managing students who required additional support. They explained that CEs understood the limitations in student's clinical ability and possessed site specific knowledge which could assist the development of practical learning strategies. University-based teaching and assessment prior to the placement provided CEs with insight into student performance and enabled early identification of challenges during placement. Preceptors with onsite CEs reported that where student-preceptor pairs disagreed about student performance, the CE mediated challenging conversations, clarified

university expectations and complimented preceptor observations.

'I guess because they have their foot in the university camp as well, they obviously know what the expectations are from your side [the University], so it helps to bring those two together.' (Preceptor)

Preceptors appreciated the CE's clinical and communication skills to deliver preceptor interpretations of performance to the student in a non-judgemental manner, so as not to disrupt or compromise the teaching relationship.

Preceptors with onsite CEs appreciated the CE's ability to proactively adjust student rotations early, based on preceptor and student feedback. This was particularly useful when the pre-planned placement timetable may not have provided the opportunities to develop student deficits.

Preceptors reflected that prior to having a CE in place to liaise with the university there was a delay in intervention and at times this led to larger issues, increasing preceptor and student stress. In contrast, CEs facilitated timely, direct and open feedback to the university, which enabled pertinent issues to be addressed before they escalated. All stakeholders valued the CE role and wanted it to continue. Management, preceptors and students with onsite CEs articulated that it enhanced their level of support and improved overall student learning.

Discussion

This study evaluated the impact of a dietetic CE model on the experience of students, preceptors and management. The CE reduced the burden of clinical placements and alleviated issues by facilitating effective and timely communication between stakeholders. This contributed to meaningful relationships which supported provision of constructive feedback, developed consensus for assessment decisions and assisted management of underperforming students.

The increased stress and burden of student placements has been recognised^{3,5,6} and was highlighted by preceptors and managers in this study. Administrative duties conducted by onsite CEs improved placement organisation and efficiency, and reduced logistical burden of placements. These findings develop those by Ferguson *et al.*,⁵ who reported that implementation of a CE resulted in no additional burden to staff during placements. However, preceptors with an offsite CE did not report a reduction in administrative burden, likely as offsite CEs were unable to provide full assistance with placement planning due to unfamiliarity with hospital and departmental structure.

Communication between university, students and preceptors is important for creating an optimal learning environment and ensuring preceptors feel supported.¹¹ It was observed that the CE facilitated improved communication between the university and placement site, which enabled timely resolution of issues and reduced burden. Similar to findings by Ferguson *et al.*,⁵ the implementation of a CE supported a positive culture towards placements.

A student-led assessment approach and positioning of the supervising practitioner as a teacher rather than judge is known to support effective assessment.^{12,18,19} The CE role facilitated a student-led approach through role delineation with preceptors no longer acting as sole assessors, thus removing any conflict of interest.¹² This resulted in improved student-preceptor rapport and a change towards a stronger teaching and mentoring relationship. This allowed for more teaching and frequent feedback, which drives student learning.¹⁹

Standardised assessment within the workplace setting is unattainable and challenged by assessor unconscious bias when making performance observations. As such, subjectivity must be embraced as an integral part of a programme of assessment.^{2,12,18} This requires assessors proficient in using assessment instruments, and experienced and supported in making judgments on student performance.^{2,12,18} The CE's knowledge and experience of placement assessment enabled them to act as expert advisors. Further, the CE had awareness of the students' overall progress, which facilitated assessment continuity. Preceptors reported that the CE reduced the burden of interpreting student performance and competence through sharing of opinions. Similar to other studies,^{5,20} preceptors recognised that this collective approach minimised bias and facilitated consensus regarding a student's performance. The CEs helped to moderate preceptor and student expectations of performance, which can differ between assessors.^{6,11} Overall the CE assisted in reducing the subjectivity of judgement within the programme of assessment consistent with what programmatic assessment espouses.^{2,12,20}

Meaningful feedback and reflective practice are key drivers of student learning.^{18,21} CEs provided timely, relevant, constructive and frequent feedback to students which reduced anxiety, encouraged self-learning, enabled deeper self-reflection, and built self-confidence. The literature describes educator attributes that have a positive impact on student learning experience, including: practice knowledge; interpersonal skills; adaptability; open-mindedness; being non-judgemental; honesty and empathy; positive role modelling; approachability; professionalism; and respect for students.^{8,9,21} This study described similar CE attributes valued by stakeholders that facilitated positive relationships between stakeholders. For sites with onsite CEs, the CE's pre-existing relationship with students and preceptors enabled an ideal student-preceptor pairing, thus allowing for a tailored placement experience and enhancing student confidence. This approach may not always be feasible due to assumptions made by the CE regarding both parties and their interactions. Students with an offsite CE reported less opportunity to develop a mentoring relationship, which may have reduced the ability to provide support and enhance confidence.

Managing underperforming students is challenging and preceptors report feeling ill-equipped.^{6,11,22,23} Further, there is limited evidence regarding how to effectively manage underperforming students.^{22,23} Preceptor discomfort may relate to feeling inadequately prepared; lack of

knowledge and skills regarding practice and competency standards; personal attitudes and beliefs; competing responsibilities; and environmental factors such as time constraints.^{22,23} Potential strategies to manage performance include emphasising student responsibility for learning through reflective practice and learning contracts; support for preceptors in providing feedback; monitoring competency development and practice exposure; and ensuring students have clear expectations.^{22,23} The present study found improved communication between the CE and preceptors resulted in early action to address issues with student performance. The ability of the CE to modify clinical exposure, provide tailored learning opportunities, schedule additional meetings and utilise assessment tools to provide timely, relevant and constructive feedback was shown to assist in managing underperforming students.

Transferability of findings in this study to other settings may be limited by the small sample size, the purposive sampling and the focus on one university course. The level of preceptor experience was not considered in the present study and may have influenced their interpretations.¹¹ In this study, two of the researchers were the CEs under evaluation who held a deep understanding of the topic and were positioned as insiders. While this status can be beneficial, it may also lead to bias with unconscious projection of perceptions and assumptions onto the data.²⁴ All researchers adopted a critical reflexive approach to facilitate recognition of potential biases during study design, data collection and analysis, and reporting. Focus groups were conducted by non-CE researchers to avoid participants feeling compromised in discussion and the unconscious influence of the insider position. Data analysis was undertaken independently by two researchers, one of which was not a CE, and was then reviewed by a third non-CE researcher.

This research has identified that a CE model increased student confidence, enhanced preceptors' capacity to manage underperforming students, facilitated assessment, and reduced burden for preceptors and management. The results highlight the importance of the people involved in placement and their unique positioning to facilitate a positive student learning environment and high quality assessment.

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Conflict of interest

There are no conflicts of interest to declare.

Authorship

KW and BC conceived the study with assistance from JJ and GJ. JJ and GJ conducted all focus groups. KW transcribed the focus groups with support from a research assistance. KW and JJ conducted a thematic analysis of the data which was reviewed by GJ. BC and KW drafted the

manuscript and all authors provided significant critical input into the manuscript. The content has not been published elsewhere. The authors would like to acknowledge Anna Addison who assisted with focus group transcription and Philippa Lyons-Wall for early input into the study design.

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Art and science of designing patient education material for the 21st century

To the Editor:

I would like to share my experiences developing printed education materials with readers for this themed issue. Printed education materials (PEMs) are frequently used by dietitians to support education and counselling.¹ Yet, evidence from a Cochrane review suggests that PEMs produce at best only modest improvements in health-related behaviours.² This may in part be because very few health professionals have undertaken training about how to design effective materials.³ Technology and health care are also changing rapidly, and dietitians must adapt and change their practice accordingly.⁴⁻⁶ The 21st century dietitian will experience an increased focus on providing patient-/client-centred care, and will interact with individuals of all ages who are internet and tech savvy.⁷ Given the rise of chronic disease and multimorbidity,⁸ many PEMs will quickly be bypassed if they do not meet the needs of the patient or client.^{9,10} I propose three evidence-based steps for designing PEMs for dietetic practice in the 21st century and describe the lessons learned from my own practice.

Step 1: Design PEMs to accommodate low health literacy.¹¹ This is called the “universal precautions approach” and refers to the use of short sentences (less than 25 words); active voice; paragraphs broken into sections (preferably with subheadings); and restricting information to three key points.¹¹ Avoid using stigmatising terms such as “diabetic” and instead use the term “people/or person with diabetes.”¹²⁻¹⁴ Pictorial resources and images can transcend literacy and numeracy barriers.¹⁵ However, ensure images of people reflect the target audience and the physical abilities of those targeted.^{16,17} PEMs that combine text with related illustrations increase recollection and comprehension.¹⁸ Ensuring the material has ample amounts of white space and an obvious path for the eye to follow assists with comprehension.¹⁸ When writing PEMs, it is important that only essential information is included and in a logical order.¹⁹ Ensure the three key messages are chunked together or signposted for the reader.²⁰⁻²²

Evaluate the readability of the written material. The target level of readability is Grade 6 or below (corresponding to reading skills of a typical 11-12-year-old).²³ Suggestions for improving readability include writing in plain English,¹⁹

reducing or eliminating jargon, and ensuring all acronyms are defined.

Evaluate the understandability and actionability of the PEM. Understandability refers to whether the PEM is written in a manner that can be understood by patients from diverse backgrounds and with varying levels of health literacy.²⁴ Actionability refers to health information that is written in a manner that enables health consumers to easily identify what they need to do, based on the information presented.²⁴ An user-friendly tool is available for use by dietitians to evaluate these important concepts. The Patient Education Material Assessment Tool²⁴ provides users with a score out of 100 for both written and audio-visual PEMs. A score of >70 or 70% indicates an acceptable level of understandability or actionability.

Step 2: Ensure that your resources are culturally sensitive. Translation is not enough: instead resources must be adapted to each group in a culturally sensitive manner.²⁵ Take the time to find out the most common languages in your hospital or health district. Also, consider the emerging languages and cultures in your region as new resources may need to be developed, even if they are only used sporadically at first. Although it is difficult for dietitians to be an expert in each cuisine, translated PEMs that are attentive to cuisine and include foods common in each culture are known to enhance adherence.²⁶

Step 3: Gain feedback on the resources from your consumers.^{23,27} This is a valuable but often overlooked step. Ensure you ask consumers the question “What is the information that stands out the most for you?” You may be surprised to find that the most important dietetic message may not be clear for the target audience. Also ask consumers if other non-traditional formats for PEMs are desired. Perhaps, apps, games, videos, infographics, animations, or podcasts are preferred. In addition to your contact details (and email), include a link to appropriate evidence-based material online for consumers to seek further information. This can prevent consumers becoming confused with online material.¹⁰

Work on developing PEMs in our own health district includes:

TABLE 1 Evaluation of selected printed education materials in our dietetics department

PEM	Readability level	Actionability level (%)	Understandability level (%)
Low residue	Grade 9	57	47
Diverticular	Grade 11	40	25
Food fortification	Grade 12	40	22
HPHE surgical	Grade 13	20	33

Abbreviations: HPHE, high protein high energy; PEM, printed education material.

- Mandatory evaluation of all PEMs for consumers using the free online readability calculator (such as <http://www.readabilityformulas.com/free-readability-formula-tests.php>; www.readabilityformulas.com/free-readability-formula-tests.php; <http://www.hemingwayapp.com/>).²⁸ Readability levels of some frequently used PEMs in our dietetics department are shown in Table 1. Most of our resources had readability levels exceeding Grade 6, which is consistent with previous research by Australian dietitians,²⁹ and attention to this step of the design process is required.
- Revision of wording on PEMs to increase understandability. Examples from our own resources that were identified included: “A low residue diet may be recommended for people who experience repeated episodes of bowel obstruction.” This could be rephrased to “This eating plan is often used after people have a blocked bowel (bowel obstruction).” Similarly, “If you are underweight, increasing both protein and total energy (kilojoule or calorie) intake may assist in gaining weight” could be reworded to: “Extra help is needed to help you regain weight after your surgery. Foods that are high in fat or protein are especially important for your recovery.”
- Revise wording to increase actionability. The selection of PEMs shown in Table 1 performed poorly for actionability. Major areas for improvement in our own PEMs include the need to include sentences that directly address the patient and to include an example of one action the user can take. For example, “You can reduce how much salt you eat by looking at the nutrition information panel on packaged foods. Try and choose foods with no more than 120 mg of sodium per 100 g.”
- Our health district requires us to obtain feedback from at least five consumers on all PEMs. Evidence suggests this number is usually adequate. However, PEMs such as food lists may require up to 20 different consumers to ensure a diversity of views.³⁰ Feedback on our low potassium diet sheet found that a combined diabetic and low potassium diet PEM was desired by patients to reduce confusion. This was subsequently developed.

The science and art of developing PEMs is evolving rapidly. I hope dietitians find the steps outlined to be valuable for their practice.

CONFLICT OF INTEREST

The author has no conflicts of interest to declare.

AUTHOR CONTRIBUTIONS

K.L. conceptualised the letter and was primary responsibility for writing the article.

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