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Introduction to nutrition informatics in Australia

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Abstract

Aim The aim of this study was to provide an introduction to nutrition informatics, including a brief history and a rationale of its importance for Australian dietetics. **Methods** The study method used was a narrative review informed by a literature review and expert consultation with the Academy of Nutrition and Dietetics. **Results** Nutrition informatics has demonstrated potential to improve efficiencies, reduce costs, support research and ultimately enhance patient care. Governments and organisations have identified this as an emerging priority area. The Dietitians Association of Australia has launched initiatives to advocate and provide strategic advice on dietetic involvement in biomedical informatics and specifically nutrition informatics. **Conclusions** If nutrition standards and processes are not integrated into information systems, dietitians may inherit technologies that do not support dietetic work practices, and opportunities to enhance nutrition services may be missed. It is recommended that dietitians be aware of the opportunities and potential benefits of nutrition informatics, become familiar and involved in technology initiatives, and take the lead in guiding the development and implementation of technologies that may impact patient nutritional care.

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Introduction to nutrition informatics in Australia

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ABSTRACT

Aim: The aim of this study was to provide an introduction to nutrition informatics, including a brief history and a rationale of its importance for Australian dietetics.

Methods: The study method used was a narrative review informed by a literature review and expert consultation with the Academy of Nutrition and Dietetics.

Results: Nutrition informatics has demonstrated potential to improve efficiencies, reduce costs, support research and ultimately enhance patient care. Governments and organisations have identified this as an emerging priority area. The Dietitians Association of Australia has launched initiatives to advocate and provide strategic advice on dietetic involvement in biomedical informatics and specifically nutrition informatics.

Conclusions: If nutrition standards and processes are not integrated into information systems, dietitians may inherit technologies that do not support dietetic work practices, and opportunities to enhance nutrition services may be missed. It is recommended that dietitians be aware of the opportunities and potential benefits of nutrition informatics, become familiar and involved in technology initiatives, and take the lead in guiding the development and implementation of technologies that may impact patient nutritional care.

Key words: electronic health record, informatics, information technology, nutrition care, nutrition informatics.

INTRODUCTION

Today we live in a digital world, where every sixty seconds, 168 million emails sent, 695,000 Facebook status updates, 98,000 tweets, and 13,000 iPhone applications

downloaded.[1] As our technological prowess grows we are presented with considerable challenges and opportunities within our organisations and a rise in consumer expectations. Within healthcare, in parallel to the rise in technology, a paradigm shift from a paternalistic medical model to a personalised patient-centred approach,[2, 3] and the emergence of the e-patient is gaining momentum. The e-patient is using technology to search the Internet for a diagnosis, find a provider, seek dietary advice, join social media for community discussions and support, and manage scheduling of medical care.[4, 5]

For centuries clinicians have documented their findings and treatments on paper records and despite the rapid advent of technology in healthcare, including dietetics, there is still significant use of paper records and manual filing systems in varied practice areas.[6] Use of Health Information Technology (HIT) is rapidly increasing, and is now accepted as integral in improving healthcare delivery, patient safety, efficiency, clinical decision-making and curtailing increasing healthcare costs.[4, 7, 8] It is becoming increasingly difficult for healthcare professionals to practice without the use of information systems (IS).

'Biomedical informatics is the interdisciplinary field that studies and pursues the effective uses of biomedical data, information and knowledge for scientific inquiry, problem solving and decision making, driven by efforts to improve human health.'[9] Nutrition informatics, a subset of biomedical informatics, 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'.[10] Despite only being officially defined in 2008,[11] nutrition informatics has been practised to varying degrees and consistency across dietetics for decades, including nutrient databases to examine dietary intake, computerised menu ordering systems and more broadly as a source of dissemination of nutrition information for individuals and professionals.

Sub-optimal nutrition is associated with many chronic diseases which contribute to greater than one-third of premature and preventable deaths in Australia[12] and costs in excess of eight billion dollars per year.[13] With the adoption of HIT to redesign the future of healthcare, the cost of sub-optimal nutrition dramatically rising[13] and the emergence of the e-patient, dietitian participation in HIT and associated systems is imperative to optimise nutrition care and support research.[14, 15] It is also critical that dietitians engaged in technology development and use, are able to demonstrate the benefits to the broader profession.

The launch of the electronic health record (EHR) in Australia by the National E-Health Transition Authority (NEHTA) is a prime example of the healthcare transition from paper systems. NEHTA was established by the Australian government for the co-ordination and delivery of e-health in Australia.[16] Transitioning to EHR is a priority of many international governments as part of a vision for improving the future of healthcare services and promoting a more integrated approach.[17, 18] Minimal literature exists on nutrition informatics in Australia, and with the rapidly emerging requirement to incorporate dietary standards and processes such as the International Dietetics and Nutrition Terminology (IDNT) and Nutrition Care Process (NCP) into EHR, a review article seems timely.

The aim of this review is to provide an introduction to nutrition informatics, including a brief history and rationale of its importance for Australian dietetics. The field of nutrition informatics is extensive, crossing all areas of dietetic practice, and consequently this article identifies literature relevant to the Australian dietetics context broadly.

METHODS

Searches of Scopus, CINAHL and Medline databases were conducted and peer-reviewed English language publications studied to identify key articles on the history of nutrition informatics, potential benefits, challenges and recommendations. The searches were from the earliest date within each database until August 2013, using the key words *nutrition* or *dietitian/dietician* in combination with *informatics*, *technology*, *computer*,

electronic and *software*. Additional papers were identified through reference harvesting of relevant papers, and a key author search.

Expert consultations were made with the Academy of Nutrition and Dietetics' (Academy) (formerly the American Dietetic Association) Nutrition Informatics committee representatives (Chair and Chair, Nutrition Informatics Interoperability & Standards Sub-committee) and staff (Director, Nutrition Informatics) to learn from their experience. The consultations included meetings and email communications throughout 2012 and 2013. Information from the literature and the Academy consultation were combined thematically to detail the history of nutrition informatics and provide a rationale for embracing technology. In addition, some potential challenges and recommendations for Australian dietitians were identified. The results were outlined as a narrative review.

RESULTS

A list of key terms and definitions that are commonly used in nutrition informatics is outlined in Table 1.

Table 1: Terms and definitions

Term	Definition
Electronic Health Record (EHR)	A longitudinal electronic record of patient health information generated by one or more encounters in any care delivery setting. Included in this information are patient demographics, progress notes, problems, medications, vital signs, past medical history, immunisations, laboratory data and radiology reports.[19]
Health Information Technology (HIT)	A wide range of products and services—including software, hardware and infrastructure—designed to collect, store and exchange patient data throughout the clinical practice of medicine.[20]
Information Systems (IS)	The software and hardware systems that support data-intensive applications.[21]
Information	The technology to treat information. The acquisition, processing,

Technology (IT)	storage and dissemination of vocal, pictorial, textual and numerical information by a microelectronics-based combination of computing and telecommunications are its main fields.[22]
Interoperability	The ability of health information systems to work together within and across organisational boundaries in order to advance the effective delivery of healthcare for individuals and communities.[23]
Standard	A document established by consensus and approved by a recognised body that provides for common and repeated use, rules, guidelines or characteristics for activities or their results, aimed at the achievement of the optimum degree of order in a given context.[24]

The history and benefits of nutrition informatics were identified through a literature review. The review identified the first article on the use of computers in dietetics in 1962.[25] Further articles on computer use in dietetics followed, and it appears the first book on the topic 'Computers in Nutrition' was published in 1979.[26] During this era, the term computer referred to a large motherboard which required a significant amount of space, was expensive and not widely utilised within dietetics.

Papers published from 1960 to the 1989 focused on the benefits of hospital and foodservice systems (including improved menu planning[27, 28], elimination of data entry redundancy[29, 30] and decreased food costs[30, 31]), as well as improved accuracy in the calculation of nutrient analysis data.[32, 33] Remarkably for the time, these articles predicted that computers would be critical tools for dietetic practice. By 1990, computer software for nutrition tasks was available in many areas of professional practice.[34]

In 1996 the term 'Nutrition informatics' was first used by Hsu-Hage and Wang who highlighted the benefits of the Internet as a means of accessing and communicating nutrition-related information.[35] Utilising the Internet for nutrition assessment tools, nutrition education and telemedicine to improve nutrition care efficiencies,[36, 37] reduce costs[38] and reach clients in rural and remote areas[38] continues to be documented in the literature.

From 1996 to 2008, articles on innovative hospital patient meal ordering processes identified opportunities to enhance patient care. Bedside menu ordering demonstrated increased tray accuracy,[39] efficiency and effectiveness,[40] labour savings,[41, 42] patient satisfaction,[39-42] nutritional intake[42] and weight gain.[43] Room Service (a model of bedside ordering initiated by the patient, with on-demand meal ordering and delivery) demonstrated increased patient satisfaction[44-46] and nutritional intake.[44, 45] These operational innovations were made possible by technological advances allowing the use of smaller wireless mobile devices.

Today the topic of EHR dominates publications in the area of nutrition informatics. Articles outline tremendous potential for dietetics, such as data integration, incorporation of standards, improved monitoring, tracking and reporting, and support of research, all of which contribute to improved efficiencies, clinical decision-making, cost savings and ultimately patient nutrition care.[6, 47-52] In 2014, Rossi et al demonstrated that an electronic system for capturing IDNT and NCP resulted in significant improvements in nutrition care efficiency and effectiveness for haemodialysis patient outcomes compared with a paper-based system.[53]

Across the decades of nutrition informatics literature the shortcomings of paper records are also consistently reported. These include that they can only be viewed by one person at a time, are difficult to store and retrieve, not always legible and compatible with data standards, and finding data/information is often difficult. Paper records were reported to impede efforts to monitor, communicate and improve healthcare and were linked with increased medical errors.[4, 6, 54]

In order to progress from manual systems to IS, it is important to understand the requirement of a consistent and structured framework to assist in the delivery of patient care. Incorporating standardised dietetic processes and terminologies into IS can ensure accurate and consistent data entry, deliver data storage and retrieval in one location, provide standard recording and reporting processes, allow the transfer of data from one care setting to another, and enable data analysis to demonstrate patient nutrition care

outcomes.[55] In turn, this data can be utilised for continuous quality improvement, which is more difficult with a manual system. Dietitians have developed standardised processes and terminology[56] and, although they are only in the early phases of adoption, these will ensure dietitians are well-positioned to transition to IS.

The technology transformation from large expensive hardware in the 1960s, to affordable, intuitive handheld devices available today has enabled rapid progress within dietetics. IS continue to be flagged in the literature as creating efficiencies in healthcare, with benefits to dietitians and patients, however there is minimal published data on best practices for nutrition systems,[14] and no clear indication of the prevalence of nutrition-related IS.

Computer technologies now form a part of everyday work, supporting dietitians in all areas of practice. Examples include:

- *Clinical dietetics*: Documentation of patient care via EHR; integration of the IDNT and NCP into IS; nutrition screening; ordering of nutritional supplements; and remote care/telemedicine.
- *Foodservice dietetics:* Recipes, menus and nutritional analyses of dietary intakes; menu planning; event management; menu forecasting; inventory management; food recall management; and staffing and workload statistics.
- *Community and public health nutrition:* Population food intake analyses; digital population studies; and communication with clients and providers via EHRs.
- *Private practice and business:* Consultation and business practice survey development and management (customer satisfaction, business opportunities); financial management; nutrition (e.g. intake analysis) apps; and cost-benefit analysis.
- *Research:* Web-based search tools; nutritional analysis programs; statistical analysis software; reference management software; and leveraging digital data for outcomes evaluation. Informatics research includes the evaluation and use of standards, and methods of data aggregation and analysis.
- *Education:* Course development; distance education management; blended learning opportunities; educational resources; scheduling and tracking student progress and simulated experience.[57]

Expert consultations revealed HIT opportunities have been embraced by our international colleagues and provided information on their achievements in nutrition informatics. In 2006, nutrition informatics was discussed in the Journal of the American Dietetic Association. A review outlined the history and current use of computers in dietetics, detailed the application to professional practice, and identified future work for the development of nutrition informatics.[14] The Academy (as it is now known) established a Nutrition Informatics Work Group in 2007, which defined the practice of nutrition informatics.[11]

In 2010, the Academy's Nutrition Informatics Work Group became the Nutrition Informatics Committee that developed numerous strategies, became involved in HIT standards committees (e.g. Health Level Seven International (HL7), Systematised Nomenclature of Medicine-Clinical Terms (SNOMED-CT)), and represented dietitians internationally. Some of their key achievements include publications on nutrition informatics, a nutrition informatics web page[58] and blog,[59] and a nutrition informatics community for member discussions.

The Academy designed and conducted nutrition informatics member surveys in 2008 and 2011, commencing a longitudinal analysis of trends in the use of IT by dietitians. The survey will be repeated again in 2014, to assess changes in the adoption and use of technology; gauge differences in how members are accessing and using data and information; and determine the roles dietitians play in relation to IS.[60] The survey results identified an increase in adoption of, and comfort with technology, as well as an improved understanding that IT can assist with nutrition decision-making and problem solving.[11, 60]

Anecdotally Australian dietitians are less familiar than their American colleagues with HIT and nutrition informatics terminology. However, interest and enthusiasm is rapidly developing and there has been regular publication of Australian studies on nutrition informatics at conferences.[61-66] In 2012, the Dietitians Association of Australia (DAA) launched two informatics initiatives: a Health Informatics Advisory Committee (HIAC)

and member-initiated Nutrition Informatics Interest Group. The HIAC role is to advocate for and provide strategic advice to the DAA Board on dietetic involvement in nutrition informatics and the implementation of IDNT in Australia. The interest group role is to support members with resource development, continuing professional development and advocacy related to nutrition informatics.[67]

A modified version of the Academy nutrition informatics survey was conducted with Australian dietitians in 2012 which aimed to measure the extent of IT utilisation by dietitians; workplace roles dietitians play in relation to IS; and perceived barriers and benefits to use.[68] The results will provide baseline data on the current status of nutrition informatics in Australia, an opportunity to monitor change with a longitudinal study, and guide strategies to enhance awareness, reduce barriers and address the challenges to embracing technology.

DISCUSSION

Driven by technological advances, government policy and consumer demands, HIT is already integral in Australian healthcare. Valuable opportunities to enhance nutrition services and achieve the benefits that HIT has to offer may be missed if dietitians are not among key stakeholders in IS development. [17, 18] Consequently, for dietitians it is not so much a question of should we be involved, but how can we be involved to benefit our profession and our clients?

As with other innovation and workplace changes, challenges are apparent. Initially, they will be raising awareness of nutrition informatics; setting up processes to ensure the selection of appropriate technologies and IS; demonstrating the potential benefits of IS; and providing education within the dietetic profession. Ensuring accurate and accessible communication and support at a national level for the selection of credible systems and the uniform use of systems will also play a vital role in data interoperability and the future of dietetics IS advancement at a local, national and international level.

Whilst HIAC will develop strategic advice on the advancement of nutrition informatics and determine the potential responsibilities, no single organisation, practice area or

dietitian could be responsible for executing all of the recommendations. With few (if any) Australian dietitians working solely in informatics, dietitians across all areas of practice have the opportunity to contribute to this field. Information Technology can be daunting to those who have had little experience working with computers, however, only the basic concepts are required to work effectively within practice area IS. The following recommendations may be considered by individuals for their own professional development within their practice area, as well as the national advancement of nutrition informatics:

- Increase awareness of nutrition informatics across the dietetics profession and the broader health community.
- Increase familiarity with HIT terminology and IS.
- Become involved in nutrition-related IS initiatives.
- Evaluate and publish on the use and effectiveness of nutrition informatics initiatives.
- Advocate for the recognition of a nutrition informatics practice area.
- Gain membership of committees and standards organisations, such as HL7, SNOMED-CT and NEHTA.
- Advocate for incorporating nutrition care (e.g. IDNT and NCP) into EHR.

Numerous resources are available to assist in enhancing nutrition informatics knowledge, including:

- Academy Nutrition Informatics blog (www.eatright.org/media/blog.aspx?blogid=6442451184)
- Academy Resources for Health Professionals – Nutrition Informatics (www.eatright.org/HealthProfessionals/content.aspx?id=6442471521)
- Health Informatics Society of Australia (www.hisa.org.au)
- National E-Health Transition Authority (www.nehta.gov.au)
- Standards Australia – e-health (www.e-health.standards.org.au)

As the infrastructure of HIT is developed in Australia, nutrition care standards and processes should be integrated with IS to support the provision of optimal nutrition care. It is essential that dietitians are aware of the eminence and imminence of nutrition

informatics and take the lead in guiding the development and implementation of technologies that may impact on patient nutritional care in all environments.

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Conflict of interest

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Authorship

KM determined the key concepts for the paper, conducted the literature review, communicated with the Academy and developed a draft document. PW, KW, MF and EB assisted in development of the paper. YP reviewed and provided comments on the paper. All authors approved of the final version of the paper.

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