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## RESEARCH ARTICLE

# Health literacy, dementia knowledge and perceived utility of digital health modalities among future health professionals

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## Abstract

**Objectives:** Studies of dementia knowledge (including dementia risk reduction) in health-care trainees highlight varying levels of understanding across countries and disciplines. This draws attention to the need for a well-trained health workforce with the knowledge to champion and implement such strategies. This study (a) assessed dementia knowledge and health literacy among a sample of Australian health-care students, (b) identified modality preferences of digital health interventions addressing dementia prevention and (c) examined potential relationships among health literacy, dementia knowledge, dementia prevention knowledge and a student's preferences for different digital health modalities.

**Methods:** A cross-sectional survey assessed dementia knowledge and health literacy in 727 health students across 16 Australian universities representing both metropolitan and regional cohorts. The All Aspects of Health Literacy Scale and the Dementia Knowledge Assessment Scale were administered. Questions about the perceived effectiveness of strategies and preferred digital health modalities for dementia prevention/risk reduction were asked.

**Results:** The students had relatively high health literacy scores. However, dementia knowledge and evidence-based dementia prevention knowledge were average. Only 7% claimed knowledge of available dementia-related digital health interventions. Associations among health literacy, dementia knowledge and dementia prevention, with recommendations for different digital modalities, are presented.

**Conclusions:** Health-related degrees need to increase dementia knowledge, health literacy and knowledge of effective dementia-related digital health interventions. It is imperative to equip the future health workforce amid an ageing population with increased dementia rates and where evidence-based digital health interventions will increasingly be a source of support.

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**KEYWORDS**

dementia, health communication, health education, health literacy, health services, information literacy

## 1 | INTRODUCTION

Worldwide, an estimated 10 million people are newly diagnosed with dementia per year and this is projected to increase from 82 million in 2030 to 152 million in 2050.<sup>1</sup> Adding to this burden, the global ageing population will increase the need for health care provided by qualified professionals.<sup>1</sup> While dementia is not a normal part of ageing, it does mainly affect older people and is a universal health-care challenge in the 21st century, with an increasing emphasis placed on dementia prevention.

Studies of dementia knowledge in health-care trainees highlight variations in the level of understanding across countries and disciplines. Liddle et al<sup>3</sup> found that dementia knowledge was found to vary among students enrolled in different Australian health-related programs. Poor dementia knowledge was found in health-care undergraduates in Hong Kong<sup>4</sup> where, for example, very little was known about dementia treatment or the fact that dementia medication does not necessarily prevent further decline. In contrast, Scerri and Scerri<sup>5</sup> found that Maltese nursing students had adequate knowledge of dementia. The mixed outcomes from these studies highlight the need for further investigations into health-care students' knowledge of dementia. There is also evidence to suggest that current practicing health-care professionals also possess inconsistent levels of dementia knowledge, which is why addressing the deficit during their education is essential.<sup>6</sup>

Evidence-based knowledge suggests that prevention, early intervention and modification of risk factors for dementia have the potential to significantly reduce future dementia burden.<sup>2</sup> Dementia onset could be prevented or delayed by behavioural interventions such as aerobic exercise, social activities, reduced tobacco smoking, management of chronic disease (e.g. diabetes and hypertension), obesity, low mood and hearing loss. Nevertheless, knowledge of dementia prevention and modifiable risk factors is still emerging in the research literature and, according to Livingston et al,<sup>2</sup> should be an area of focus for research and health service

**Policy Impact**

This study builds knowledge regarding future health professionals' health literacy, dementia knowledge and preferences for digital interventions. It highlights the need to increase dementia prevention, care and intervention content in health-care curricula at a tertiary level. The study informs policy that supports strategies to guide curriculum reform in dementia responsiveness.

**Practice Impact**

This study highlighted gaps in future health professionals' knowledge. It shows cause for practicing clinicians to reflect upon, and potentially improve, their own dementia knowledge and awareness of effective digital health tools that can be offered to people with dementia and their carers.

integration. Implementation of evidence-based strategies to lower future rates of dementia is dependent upon knowledge and delivery of this information by health-care professionals.

Health literacy is a set of cognitive and social skills that enable a person to access, process and understand appropriate and effective health information and services.<sup>7</sup> Health literacy can reduce the burden for informal carers of people with dementia,<sup>8</sup> but little is known about the relationship between health literacy and dementia knowledge in health-care trainees and professionals. Furthermore, higher health literacy levels during undergraduate study are found to be correlated with a more competent health-care workforce.<sup>9</sup> It is suggested that health-care professionals who possess high levels of health literacy are able to effectively communicate with patients, improve their patients' health literacy and support them in making appropriate health-care decisions.<sup>10</sup> Coleman's<sup>11</sup> literature

review highlights the need for health professionals to be competent in health literacy and calls for increased training in health literacy principles for undergraduate health professionals. Coleman<sup>11</sup> asserts the importance of health literacy in ‘*every clinical encounter and every public health communication*’ [p.70]. Effective clinician–patient communication is emphasised as an important component of health literacy. Research showing the potential clinical impact of clinician communication<sup>10</sup> and health literacy is only starting to emerge and needs further attention.<sup>11</sup>

Examination of health literacy in undergraduate health students has shown considerable variation. Training in health literacy principles in curricula for health-care undergraduates is lacking, with varying levels of health literacy reported for students enrolled in health-related programs across the world.<sup>11</sup> For instance, a study of senior nursing students across eight state universities in Louisiana, USA, found that while senior nursing students enter the workforce with some health literacy knowledge and experience, gaps exist in their knowledge. The study underscores the need for further training to address these gaps so that nurses can graduate with knowledge of the importance of health literacy and skills to assess and enhance patient understanding.<sup>12</sup> Another study in China also revealed that the nursing students’ health literacy levels were insufficient.<sup>13</sup> Studies conducted in Denmark<sup>14</sup> found that the health literacy levels of students are largely dependent on other factors such as personal background, educational path, economic factors and health behaviours and risks.

Training in health literacy at an undergraduate level not only increases the health literacy of students but is also associated with positive educational outcomes,<sup>11</sup> which, in turn, potentially improve future clinical care outcomes.<sup>10</sup> Presently, health professionals are a key point of contact for the general population, contributing to health information for diseases like dementia and providing advice to patients on modifiable risk factors. As such, health and social professionals play an integral role in patient education on dementia and modifiable risk factors.

A key factor in an individual’s health literacy is the ability to find good health information.<sup>15</sup> This study seeks to understand the students’ preferences for digital modalities to receive health information. Finally, with the rapidly digitalised health environment and development of digital health interventions that focus on dementia prevention and risk reduction,<sup>16–18</sup> it is imperative that health professionals are open to using and recommending effective evidence-based digital health interventions that may reduce dementia risk and prevent dementia. Yet research indicates that it is health professionals, rather than consumers, who are resistant to using digital health.<sup>19</sup> While the final objective may be to promote acceptance of digital health interventions and educate health professionals

regarding their efficacy,<sup>20</sup> it is first important to explore perceptions of digital health utility and, specifically, which modalities may be seen as the most useful.

The aim of this study was to (a) assess knowledge of dementia (including risk factors and prevention strategies) and health literacy among a sample of Australian health-care students; (b) identify modality preferences of digital health interventions addressing dementia prevention, as a measure of the population’s likelihood to recommend digital interventions to future patients; and (c) explore potential relationships among health literacy, dementia knowledge, dementia prevention knowledge and a student’s preferences for different digital health modalities. It is expected that an understanding of health students’ dementia knowledge and health literacy will contribute to the emerging literature in this area and inform the development of relevant curricula.

## 2 | METHODS

### 2.1 | Design

A cross-sectional survey was used to assess knowledge of dementia and health literacy among a sample of Australian health students. Human research ethics approval was received from each of the administering universities (The University of Queensland (2018002649), Bond University (CJ00300), The University of Southern Queensland (H20REA081) and Southern Cross University (#ECN-19-169).

### 2.2 | Participants and recruitment

Students enrolled in ‘Australian university degrees that can lead to a health professional qualification’ were invited to participate in the survey. Following gate-keeper permission obtained from several key universities where the authors have affiliations, potential student participants were approached through official channels such as university and/or faculty emails and social media accounts, as well as subject course site announcements where the study was advertised. Snowballing and social media channels enabled wider distribution of the invitation and survey link to students at other Australian universities.

### 2.3 | Procedures

Students interested in participating were directed to an online survey via the uniform resource locator (URL) link or quick response (QR) code listed in the study advertisements. Using the secure Qualtrics online survey platform,

which also hosted detailed information about the study, participants were asked to complete the online survey that took approximately 20 minutes to complete. Submission of the anonymous online survey was deemed as consent.

To encourage participation, participants of the online survey were offered the chance to win one of two AUD\$50 gift cards at each university as a token of appreciation for their time. Entering the draw for these gift cards was optional. After accepting the invitation to take part in the draw, participants were taken to a separate form where they were asked to enter their email addresses. These identifying emails were kept separate from their survey response data. The principal investigator at each university randomly drew the winners of the gift cards from the list of email addresses.

## 2.4 | Outcome measures

Demographic information (e.g. age, gender and health-care program of study), participants' dementia knowledge and health literacy were assessed using the Dementia Knowledge Assessment Scale (DKAS)<sup>21</sup> and All Aspects of Health Literacy Scale (AAHLS)<sup>22</sup> respectively. The DKAS<sup>21,23</sup> is a 25-item survey developed and validated in Australia, to measure people's knowledge of dementia. It has had some validation internationally<sup>21,24</sup> and in a range of populations and studies.<sup>25</sup> The tool includes a series of 25 statements about dementia with four main constructs pertaining to dementia: causes and characteristics; communication and behaviour; care considerations as well as risk factors and health promotion.<sup>21,23</sup> Respondents must select from 'Probably True = 0'; 'Probably False = 1' and 'False = 2'. A higher DKAS total score (of 50) is indicative of higher dementia knowledge. Previous research shows the subscales have acceptable internal consistency ( $\alpha \geq 0.65$ ), the overall scale has good reliability ( $\alpha = 0.85$ ) and validity<sup>21,23</sup> and is one of the scales to assess people's knowledge regarding dementia prevention. The current research showed a Cronbach's alpha of 0.85 for the overall scale.

The AAHLS<sup>22</sup> is a 14-item validated questionnaire covering three subscales that measure functional, communicative and critical health literacy. The tool draws on foundational health literacy work by Nutbeam<sup>7</sup> to ensure a range of literacy skills are tested. Respondents are required to select from three options 'Rarely, Sometimes or Never' for 12 of the questions, with scores weighted from 1 to 3 points, depending on the positive or negative intent of the question.<sup>22,26</sup> As recommended by Chinn and McCarthy,<sup>22</sup> Items 1 and 2 were aggregated to form a new score indicating functional health literacy and ability to access support. Two items are 'Yes/No' answers with scores weighted at 1 or 3. *Higher total AAHLS scores (of 39 possible points)*

*indicate a higher level of health literacy.* The AAHLS instrument has been previously reported as having adequate reliability ( $\alpha = 0.74$ ),<sup>22</sup> similar to the current study ( $\alpha = 0.63$ ).

As research continues to evolve regarding dementia prevention and risk, there is no questionnaire to measure health professionals' perceptions of what may be effective in preventing and reducing the risk of dementia. In the absence of such a measure, the authors with expertise in dementia research developed a scale drawing upon current dementia literature. Perceived effectiveness of strategies for dementia prevention (i.e. dementia prevention strategies: DPS) was measured using items developed by the investigators with categorical responses of 'yes', 'maybe' and 'no'. The scoring for the DPS is attached in Appendix S1. Scoring was dependent on current research evidence. A score of 2 was given for a correct answer, 0 for an incorrect answer (i.e. no evidence to support the prevention/risk reduction strategy) and 1 for an answer where there is mixed research evidence. The DPS was found to have adequate internal reliability ( $\alpha = 0.62$ ).

Similarly, as this is a relatively unexplored area of research, no measure exists that assesses the perceived usefulness of different digital modalities for dementia prevention and risk reduction. As such, the authors who have expertise in digital health and dementia met to discuss the modalities that currently exist for dementia risk reduction and symptom management. After further review of the current grey-and-white literature on dementia digital health measures, the authors developed a scale examining the perceived usefulness of different digital health modalities for dementia prevention/risk reduction for oneself and one's client/patient. The measure contained items such as 'If a program was developed to help people to reduce their risk of getting dementia or delay the onset of dementia, which (if any) of the following modalities do you think would be useful for a client?' Participants were asked about the utility of seven modalities including text messages, mobile applications (apps), online programs, emails, messaging (e.g. Messenger™), social media or others, wherein participants could add free text comments. See Appendix S2 for this scale. The possible responses ('yes', 'maybe' and 'no') were analysed as a categorical variable. The online survey was first pilot tested with a convenience sample of four students known to the research team, to assess the time to complete the survey, interest and any difficult questions. Problematic questions were reworded for clarity.

## 2.5 | Statistical analysis

Participant characteristics were summarised by the mean and standard deviation (SD) of continuous variables and frequency (%) of categorical variables. To assess the

TABLE 1 Sample characteristics.

Characteristics	Overall ( <i>N</i> = 727) <i>N</i> (%)
Mean (SD) Age ( <i>n</i> = 688)	28.6 (12.7)
Sex ( <i>n</i> = 660)	
Female	259 (39)
Male	401 (61)
Do you speak English at home? ( <i>n</i> = 668)	
Sometimes or less	101 (15)
Most of the time or always	568 (85)
What is the highest level of education of your parents? ( <i>n</i> = 668)	
Primary school or less	21 (3)
High school (not completed)	81 (12)
High school (completed)	126 (19)
TAFE/trade	114 (17)
University	327 (49)
Discipline enrolled in	
Nursing	220 (30)
Psychology/Counselling	159 (22)
Medicine	76 (10)
Occupational therapy	46 (6)
Speech pathology	34 (5)
Human movement/Exercise physiology	26 (4)
Physiotherapy	23 (3)
Dentistry, Pharmacy, Complementary medicine and Paramedicine	42 (6)
Other	61 (8)
Did not answer	40 (6)
Total AAHLS score ( <i>n</i> = 609)	
Mean (SD)	30.9 (3.4)
Total DKAS score ( <i>n</i> = 606)	
Mean (SD)	27.4 (9.4)
Total DPS score ( <i>n</i> = 598)	
Mean (SD)	23.4 (3.7)

Abbreviations: AAHLS, All Aspects of Health Literacy Scale; DKAS, Dementia Knowledge Assessment Scale; DPS, dementia prevention strategies; SD, standard deviation.

relationship between AAHLS, DKAS and DPS scores and recommendation of digital interventions for clients, we conducted ordinal logistic regression models with robust standard errors to account for the clustered nature of the data. Models were adjusted for age and sex as potential confounding variables. Models were fitted on the data of participants with no missing information on the required variables. To avoid the multiple-comparison problem, estimates were corrected using the Bonferroni correction method. Analyses were performed using R version 4.0.2.

TABLE 2 Proportion of participants recommending different digital health modalities

Text messages ( <i>n</i> = 585)	(%)
No	100 (17)
Maybe	242 (41)
Yes	243 (41)
Mobile ( <i>n</i> = 584)	
No	39 (7)
Maybe	189 (32)
Yes	356 (61)
Online programs (e.g. websites) ( <i>n</i> = 583)	
No	38 (6)
Maybe	181 (31)
Yes	364 (62)
Emails ( <i>n</i> = 578)	
No	102 (18)
Maybe	246 (43)
Yes	230 (40)
Online messaging (e.g. Messenger) ( <i>n</i> = 579)	
No	114 (20)
Maybe	285 (49)
Yes	180 (31)
Social media (e.g. Facebook, WeChat and WhatsApp) ( <i>n</i> = 583)	
No	109 (19)
Maybe	242 (41)
Yes	232 (40)
Other <sup>a</sup> ( <i>n</i> = 554)	
No	181 (33)
Maybe	270 (49)
Yes	103 (19)

<sup>a</sup>Participants could choose 'Other' and provide a free text comment. The majority of comments participants made included: N/A or 'Unsure/Not Sure'. Other suggestions included YouTube Videos (*n* = 1); Consumer information (*n* = 1) and Group presentations (*n* = 1).

### 3 | RESULTS

Participants' demographic characteristics are presented in Table 1. A total of 727 health students participated in the survey from a total of 16 Australian universities. Of those who provided demographic information, the majority of participants were men (60%) and with an average age of 28.6 years (SD = 12.7). Approximately three-quarters of the participants spoke English at home and about half had at least one parent who has finished a university degree. Participants had relatively high literacy scores indicated by the mean AAHLS, DKAS and DPS scores being 30.9 (of a possible 39), 27.4 (of a possible 50) and 23.4 (of a possible 34) respectively. When questioned about which modality they thought they would recommend to clients if it could

TABLE 3 Association between digital health modalities and health literacy, dementia knowledge and dementia prevention.

Modality	Predictor	OR	Lower CI <sup>a</sup>	Higher CI <sup>a</sup>	p-value <sup>a</sup>
Text messages	Health literacy	0.97	0.93	1.01	.5
Text messages	Dementia knowledge	0.99	0.98	1.01	>.99
Text messages	Dementia prevention	1.01	0.97	1.06	>.99
Mobile apps	Health literacy	1.02	0.95	1.09	>.99
Mobile apps	Dementia knowledge	1.01	0.98	1.03	>.99
Mobile apps	Dementia prevention	1.06	1.01	1.12	.02 <sup>b</sup>
Online programs	Health literacy	1.04	0.95	1.14	>.99
Online programs	Dementia knowledge	1.01	1.00	1.03	.6
Online programs	Dementia prevention	1.07	1.04	1.10	<0.001 <sup>b</sup>
Emails	Health literacy	1.02	0.98	1.06	>.99
Emails	Dementia knowledge	0.99	0.98	1.01	>.99
Emails	Dementia prevention	1.03	0.99	1.08	.4
Messaging	Health literacy	0.96	0.92	1.01	.2
Messaging	Dementia knowledge	1.00	0.98	1.02	>.99
Messaging	Dementia prevention	1.04	0.98	1.10	>.99
Social Media	Health literacy	1.01	0.94	1.09	>.99
Social Media	Dementia knowledge	1.00	0.97	1.03	>.99
Social Media	Dementia prevention	1.03	0.97	1.09	>.99
Other	Health literacy	1.01	0.97	1.05	>.99
Other	Dementia knowledge	1.01	0.99	1.02	>.99
Other	Dementia prevention	1.03	0.95	1.13	>.99

<sup>a</sup>Confidence intervals and p-values were corrected for multiple comparisons using Bonferroni correction.

<sup>b</sup>Significant.

reduce the risk of getting dementia or delay its onset, more than 60% of participants believed that mobile apps and online programs would be useful. No significant results were found in the other modalities. Finally, participants were also asked if they knew of any digital health programs currently available to reduce dementia risk or delay dementia onset. Of the 727 participants, 538 (74%) did not know of any, 48 (7%) people knew of a program or app and 141 (19%) participants did not answer. The two main interventions that the 7% knew about were the Dementia Australia website and 'brain training' apps.

Table 2 shows the proportion of participants who would, who would not or who were uncertain about recommending dementia prevention interventions, as a function of their modality.

Table 3 shows the association among health literacy (AAHLS), dementia knowledge (DKAS) and dementia prevention (DPS) scores with recommendations of different digital modalities for clients to help reduce the risk of developing dementia or delay its onset. The association was statistically significant for the association between dementia prevention and mobile application recommendation (OR: 1.06 [CI: 1.01, 1.12],  $p = .02$ ), and online program recommendation (OR: 1.07 [CI: 1.04, 1.10],  $p = <.001$ ).

## 4 | DISCUSSION

Australia's future health workforce needs to be knowledgeable and competent in supporting the increasing number of people who will be living with dementia. This workforce needs to be able to draw upon evidence-based information to effectively support people to prevent dementia through a range of health behaviours. Digital health interventions can be an effective way to support people with dementia and their carers,<sup>26,29</sup> and increase support to people in risk reduction and dementia prevention activities. Research that focuses on the role of digital health in supporting people to reduce their risk of dementia is rapidly emerging.<sup>16,17</sup> As such, there is also a need for health professionals to be knowledgeable and capable of recommending digital health interventions where appropriate.<sup>27,28</sup>

Students from health-related programs who participated in the current study had relatively high levels of health literacy but an average knowledge of dementia. That is, students who completed the AAHLS ( $n = 609$ ) appeared to have moderately high health literacy scores, with a mean of 30.9 of a possible 39. The AAHL tool developers did not create a cut-off to indicate poor or high literacy

skills, but rather, indicated that higher scores demonstrated higher levels of health literacy.<sup>22</sup> Given that participants are enrolled in health disciplines, this outcome is not unexpected, but a positive indication of their capabilities and proactive approach to understanding health information and conditions. The mean DKAS<sup>22</sup> score was 27.4, indicating average dementia knowledge (of a possible total of 50). As dementia is growing in prevalence in the population, ensuring future health-care professionals have adequate knowledge of the disease, its progression and effects on the person with dementia, and their families, are of key importance. A recent study to identify core competencies for multidisciplinary health and aged care workers assumes that workers would be familiar with common conditions such as dementia.<sup>28</sup>

A growing reliance on digital health presents a future workforce need that demands a greater understanding of which digital technologies can be used to support a range of outcomes for dementia care. The current study found that there was a preference for mobile apps and online programs. It is possible that this result is, in part, due to young people's familiarity with this type of digital technology. Participants may have had more familiarity with mobile phone apps aimed at increasing cognitive health. There is a large expanding market for brain health apps,<sup>29</sup> with one estimate projecting a \$US6 billion spend in 2020 as the market for brain health apps has become 'mainstream'.<sup>30</sup> Indeed, the successful marketing and expansion of brain health apps have been the subject of controversy, with a written submission from 70 international scientists demanding a better evidence base before allowing marketing claims that expose so many digital consumers to these apps.<sup>31,32</sup> Consumers and health professionals seeking quality dementia content and caregiving advice face a complex, commercially driven marketplace with a lack of quality standards.<sup>33</sup> Multiple marketing strategies increase people's exposure to brain health apps more so than other apps and, at times, companies have been fined for misleading claims regarding the benefits of these apps.<sup>34</sup> Considering the successful marketing of such apps, in conjunction with only 7% of the participants being aware of dementia-related digital health interventions, it is noteworthy that they favoured apps and online programs. That is, when asked which modality they would find useful or would recommend to a client if it was designed to help people reduce their risk of getting dementia, more than 60% of participants believed that mobile apps and online programs would be useful. Yet, no significant results were found for the other modalities. Further research would be needed to ascertain the rationale behind these perspectives.

Finally, it is interesting to note that, while not significant, all three health literacy scores were positively associated with the recommendation of mobile and online

interventions. This study is the only known research examining the potential relationship between health literacy and a preference for digital interventions. One study touched on the importance of digital competency and providing digital health recommendations as it reviewed digital health competency frameworks.<sup>27</sup> Otherwise, more research is needed in this area.

#### 4.1 | Limitations

This area of research is still emerging, which limits comparison with existing research on this subject. For instance, it was difficult to discuss the potential association among health literacy, dementia knowledge and preference for digital health modalities when there is little or no existing research. The current study did not investigate why participants were more likely to recommend mobile phone or online interventions. Further research is needed to understand this relationship. There is a potential recruitment bias as students opted in to participate, which may have given rise to a cohort who were interested in health literacy, digital health and dementia. Finally, two of the four tools needed to be developed by the original investigator team. These measures are not validated but address an important gap in the research.

#### 5 | CONCLUSIONS

This current study shows that health students in health-related degrees have high health literacy, but average dementia knowledge and average dementia prevention knowledge. It has demonstrated that knowledge about dementia prevention is associated with a preference for providing patient support for dementia prevention via mobile apps or online programs. While the current study cannot provide an evidence-based rationale for this result, it is proposed that it may be due to familiarity with health-related apps, particularly well-marketed brain health apps, which are not necessarily evidence based. The lack of evidence-based knowledge behind which digital health interventions may be useful is further supported by having only 7% of participants having knowledge in this area. Overall, it is recommended that health-related degrees address dementia knowledge and increase awareness regarding effective dementia-related digital health interventions. It is imperative that future health professionals are aware of the substantial prevalence and impact of dementia in the community so that they can effectively care for their clients. Furthermore, their knowledge of the evidence base for digital interventions that will increasingly facilitate quality care is vital.



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## CONFLICTS OF INTEREST

No conflicts of interest declared.


## DATA AVAILABILITY STATEMENT

Data available on request due to privacy/ethical restrictions.

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## SUPPORTING INFORMATION

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

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