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A Multi-Dimensional Approach to Measure the Use of Social Media Tools in Accessing Health Information: A Case Study of Griffith University Students, Queensland, Australia

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ABSTRACT
This research explores perceived user satisfaction and the impact of students using Mobile Wireless Communication Technology (MWCT) and Social Media tools (SM) for accessing health information. It was specifically concerned with whether there was a spatial pattern based on students' location or other social characteristics. An online survey was designed and utilised to collect quantitative, qualitative and spatial data. This study is unique, as it provides multi-dimensional empirical evidence (i.e., quantitative, qualitative, and spatial evidence) that underlies and complements each other. Our findings indicate that there is some evidence of a pattern of who to use these tools more extensively for accessing health information; for example, families with kids, people who live with partners etc. Proximity to campus was not found to be correlated, and no spatial structure was found in relation to the question: *Who used or did not use MWCT to access health information*. Therefore, this paper argues for the inclusion and expansion of health information utilising MWCT and SM tools amongst students, which, in turn, complements traditional methods to accessing health information. The study uses a multi-dimensional approach in obtaining empirical evidence. Utilising quantitative, qualitative, and spatial analysis, our analysis instruments are interweaved and complement each other. This also provides unique robustness to this study because of the variety of evidence provided. Potentially, the findings of this paper can be used by other organisations to promote the development of new approaches and the development of online tools to encourage the access of health information by students. This, in turn may play a positive role in their health status.

Categories and Subject Descriptors
Information systems, H.1.2 human factors

General Terms
Human Factors, Measurement

Keywords
Social media tools; spatial analysis; e-health; GeoHealth; accessing health information; qualitative analysis driven by spatial analysis.

1. INTRODUCTION
This research investigated the trends of accessing health information using Modern Mobile Communication Technology – MWCT (i.e., smart phone, tablets including iPads, netbooks and laptops) and Social Media tools – SM (i.e., Twitter, Facebook, MySpace, Reddit, LinkedIn, etc.) and provides new insights into the growing nexus between university students, health information and modern forms of communication technology.

Specifically, this study had 4 guiding aims:

1. Present a profile of a university student who uses MWCT and or SM to access health information.
2. Establish if the use of MWCT and / or SM in fact does cause a behavioral change - either positively or negatively 'how' this promotes positive behavioral changes in a users' health.
3. Explore for spatial patterns or spatial structure in the use of MWCT and /or SM tools to access health information.
4. Explore for patterns that are, or one would expect to be, out of the norm.

2. UNIVERSITY STUDENTS, TECHNOLOGY AND E-HEALTH
There is an emerging pattern of findings in both Australian and international studies that provide a strong justification for our research undertaking and focus. Literature suggests that the university environment is an ideal and cost-effective time period for developing healthy lifestyles [1] and as young adults are closely linked to MWCT and SM as a way of communication [2],

further research that explores the use of technology for improving e-health knowledge management would seem reasonable. What is more, there is a growing perception that healthy lifestyles depend on the early adoption of healthy living habits and readily accessible information [3] and that unhealthy lifestyles among youths are strongly linked to unhealthy habits in adulthood [1]. Further research identifies that the university years are often viewed as a key phase for personal growth and development. They also represent a period of increased risk for injury, morbidity, and mortality associated with multiple health behaviours [4].

Modern wireless communication technologies and SM are creating opportunities for promoting improved knowledge management amongst university students. There is increasing evidence in the literature about the growing use and importance of MWCT and SM among students, especially when connecting to health information [5], and that Australian universities need to undertake an innovative and proactive approach to the health and wellbeing of students [6]. Specifically, mental illness rates among Australian university students is five times higher than in the general population [3] and it is understood that depression is commonly linked with a range of other health risk behaviors that Australian university students engage in; such as tobacco use, illicit drug use, alcohol misuse and dependence, eating disorders and obesity [6]. As young adults are closely linked to MWCT and SM as a way of communication [2], and university students demonstrate higher mental health issues when compared to the general population [3], further research that explores the use of technology for improving e-health knowledge management would seem sensible. However, previous research has concentrated on Australian secondary schools for promoting better mental health, rather than the tertiary sector [7].

Therefore, this paper aims to provide information regarding the extent to which students at Griffith University, Queensland, Australia engage with MWCT and SM to access health information. On a secondary level, this paper provides evidence about the extent of use; spatial patterning and the quality of health information based on MWCT and SM utilisation and observed positive and negative impacts using this information.

3. KNOWLEDGE MANAGEMENT AND TECHNOLOGY

The phenomenon of modern communication technologies has been extensively researched throughout the world; especially in the United States and in European countries [8, 9]. With international literature recognising that 3 out of 4 Americans use MWCTs [10] and that 93% of SM users believe that organisations/companies/health institutions should have a SM presence [11], it is warranted that further studies should be undertaken to uncover user trends associated with MWCT and SM by Australian university students and their e-health trends. Interestingly, Australia leads in average time per person spent, (nearly 7 hours) on SM sites in December 2009, ahead of the United States and the United Kingdom [12]. Furthermore, current literature suggests that further studies into the area of human–computer interactions must investigate sustainable action plans and strategies that will create and encourage reform among academic institutions when it comes to adopting technology innovations [13, 14]. From a national (Australian) perspective, it has been forecasted that:

"Social media will affect how universities go about the business of education, from learning, teaching and assessment, through contact with school communities, addressing students' wellbeing, and widening participation, interfacing with industry, and maintaining contact with alumni" [15, p.54].

Mobile Wireless Communication Technology and SM are equipping university students with an improved ability to manage personal information, or more collectively termed 'Knowledge Management'. Knowledge management is defined as:

"A range of strategies and practices used in an organisation to identify, create, represent, distribute, and enable the adoption of information, insights and experiences. Such insights and experiences comprise knowledge, either embodied in individuals or embedded in organisations as processes or practices" [16, p.27].

Modern forms of communication technologies have become increasingly pivotal in the lives of university students and are fundamental in the processes associated with knowledge management into the 21st century, primarily being used by universities to deliver information to geographically diverse student cohorts [17]. Knowledge management practices that engage the individual in the co-construction of meaning, value, and knowledge should be central to the mission of developing future models in higher education [16, p.45]. Moreover, Usher [18] indentifies four important enabling qualities that SM technologies can potentially promote and improve throughout health education, these are: (1) Temporal Flexibility; (2) Networkability; (3) Multimodality; and (4) Message Tailoring Capabilities. The 'overlapping' of these enabling qualities, brings about a number of Health Outcome commonalities, these being: (1) the ability to communicate and control information either synchronously or asynchronously; (2) an increase in self-efficacy; (3) the ability to narrow /segment information for a particular audience, target group or individual; and (4) the ability to manipulate text. Similarly, a recent report by Ernest and Young [19] reported that 'enabling technologies' offer for the first time the potential to be connected into a health care ecosystem that can deliver actionable patient-centric information in a timely manner, overcoming the barriers of multiple data silos across many platforms.

4. METHODS

4.1 Objective

The objective of this research was to explore the perceived user satisfaction and impact of students using MWCT and SM for accessing health information, and whether there was a spatial pattern based on their location or other social characteristics. There is increasing evidence in the literature about the growing use of wireless communication technology and social media among students. However, there is a limited knowledge about the ways in which these technologies or applications are utilised by Australian University students to access health information. To address the primary aim of this study, an extensive literature review was completed. The review also encompassed the development of the evaluation framework based on Bandura's [20] Social cognitive theory of mass communication, Hawkins [21] Self Efficacy and Luszczynska et.al. [22] General self-efficacy scale), that underpins this study, as well as the procedures and instruments for collecting quantitative, qualitative, and spatial

data. As a result, an appropriate case study was identified and general study approach designed.

4.2 Survey Design

A 58 item survey was constructed (http://tinyurl.com/qa6olrm) based on several scales (i.e. Bandura's [20] Social cognitive theory of mass communication, Hawkins [21] Self Efficacy and Luszczynska et.al. [22] General self-efficacy scale). Responses were provided on a 7-point Likert scale, which ranged from a level of agreement 1 (not at all) to 7 (completely), with higher scores indicating higher agreement with the respective statement. Specifically, to address the study objective and aims, a case study research method was selected. Thus, to provide information regarding the extent to which students at Griffith University, Queensland, Australia engage with MWCT and SM tools to access health information, the online survey was designed and then circulated to collect both quantitative and qualitative empirical data. The Griffith University Survey Research Centre deployed the survey using the Qualtric on-line tool supported. It was hosted on the Griffith University website (Gold Coast campus, Australia). To attain a higher level of respondents, the survey was promoted internally via the Surveys Unit of the Office of Planning and Financial Services, Griffith University, using broadcast emails to students' email accounts that were attending Griffith University, Australia (Arts, Education & Law).

4.3 Participants

To address the aim of the research, all survey participants were full or part-time University students. Participants were required to record their general usage trends, associated with the use of MWCT and SM for accessing health information. Participants were required to give elaborations for specific quantitative responses, allowing for more descriptive data analysis. There were approximately 696 students enrolled at the time of survey activation, of which 508 participants provided any type of address and 416 of which were geocoded and located in south east Queensland.

4.4 Data Analysis

To measure the extent to which students used social media tools to access health information, a series of data analysis procedures were conducted. Also, to substantiate the survey findings and to obtain additional information and/or evidence, participants were given the opportunity to comment in their own words on the way that they were using MWCT and SW to access health information. Data analysis was undertaken using the Statistical Package for the Social Sciences (SPSS) (PASW18). Initial data preparation involved the development of one integrated SPSS file to incorporate all responses from the final survey. The quantitative analysis techniques employed in this study included descriptive statistics, t-test and Chi Squares. Additionally, analysis of variance (ANOVA) and post hoc tests were undertaken to obtain additional information on the findings. Descriptive statistics were used to summarise the responses and make an assessment of the participants overall perceivedness with using social media networking as a tool to access for health information. The frequencies analysis (descriptive statistics) used to provide a profile of respondents by demographic characteristics (e.g. gender, age, course major, geographic location etc.) with questions related to investigating participants' user trends, preferences and attitudes towards using MWCT and SM. ANOVA tests were then undertaken to assess measures that may differentiate female and male, social demographic measures, cultural groups etc. Statistically significant differences were reported to outline what measures have shown more pronounced differences.

To obtain an in-depth understanding of the perception of students who accessed health information using social media networking tools, content analysis (qualitative data analysis) was used for the analysis purpose. Thematic (i.e., content) analysis is defined by Gibson [23, p.1] as, *"An approach to dealing with data that involves the creation and application of 'codes' to data. The 'data' being analysed might take any number of forms – an interview transcript, field notes, policy documents, photographs, video footage"*. Thematic analysis demonstrated how evaluation of the raw data of the survey (text comments noted by survey participants) progressed and led to the identification of overarching themes [24]. To process the content analysis, the software tool Leximancer Crowd Tag was utilised. Content analysis was carried out on the data collected from particular questions in the survey. Themes and concepts that were identified as more pronounced were then formulated. In addition, important quotes were used to substantiate some of the findings presented (see Findings section). Qualitative data analysis procedures provided an important tool to understand hidden information, build a profile of a university student who uses or does not use MWCT and or SM to access health information, which type and how frequently. Likewise, it was also helpful in understanding patterns that 'one' would expect to be out of the norm. Therefore, the qualitative data analysis was generally used to obtain a greater level of information and evidence about our findings. This, in turn, underpinned some of the quantitative findings identified earlier in the survey.

The spatial analysis utilised the survey participants' residential street and suburb. Initially, participants' addresses were geocoded and converted to a GIS layer. We were able to geocode 99% of the addresses. Once addresses were geocoded, we used a join query to attach all the survey results to each respondent. Approximately 200 participants did not provide any detail about their address, and therefore were excluded from the spatial analysis procedures. This combined dataset created major opportunities for us to run spatial analysis, which helped to identify spatial trends across the different measures. This functionality provided unprecedented descriptive and predictive spatial analysis capabilities across several measures, enabling to attain better evidence of our survey results. To narrow down our spatial analysis efforts, we have incorporated two phases: (1) descriptive spatial analysis and (2) inferential spatial analysis (or predictive spatial analysis). Descriptive spatial analysis is usually associated with a basic examination that summarises existing spatial characteristics of particular measurements. These techniques usually address the question of "where" things happen.

Thus, in the first phase we presented the data spatially to identify patterns of selected key measures (e.g., access to health information using social networking media tools, behavioural change etc.), which also addressed our pre-identified study aim. As for the inferential spatial analysis, traditionally, it encompasses a variety of spatial statistical techniques that analyse current and historical measurements to make predictions about future trends. These techniques will usually address the question of "why" things happen in particular places or what factors can explain particular spatial phenomena. These techniques provided insight

about the spatial distribution of predictors; for example, whether factor A (e.g., student locations) is more pronounced in explaining the spatial variation in a given geographical area than factor B (e.g., access to health information using social media tools). Given that the distribution of participants' locations were not equal, we had to exclude some outliers to avoid spatial bias in our results and eventually included only geocoded participants who live in south east Queensland or north New South Wales with a commuting distance of 90 minutes. Specifically, in this paper we used the Bernoulli Model suggested and utilised previously by Witham and Oppenheimer [25] through the SatScan Tool. This enabled us to conduct a cluster analysis irrespective of the nature of the survey sample. Thus, the employed spatial analysis techniques provided important evidence to evaluate and understand the extent to which students used social media tools to access health information.

In summary, the methods used in this study to address the research questions and achieve the study aims were described. The overall research design, process and timeline were introduced, followed by an explanation and justifications to use these data collections and data analysis procedures. The section described the quantitative, qualitative, and spatial data collection and analysis methods in detail, with descriptions of these techniques highlighting the theoretical and methodological links. This makes the study unique, as it provides multi-dimensional empirical evidence (i.e., Quantitative, qualitative, and spatial evidence) and these underlie and complement each other.

5. FINDINGS

5.1 Quantitative Analysis Dimension

The primary focus of the survey was to identify the extent in which students use social media tools to access health information. After running descriptive statistics procedures, we focused on a few measures, which were found to be more pronounced. Table 1 identifies the number and percentage of students who use MWCT to access health information. Table 2 shows the characteristics of those students. Table 3 outlines whether the usage of MWCT tools have led to positive change and to what extent. In this table, over 44% of participants reported a positive change with another 25% indicating a mix of negative and positive changes. This has been investigated even further using qualitative analysis, which is presented, in the next section. In addition, based on our t-tests and ANOVA and ad hoc tests, we found that most of the participants which indicated that they used social media tools to access health information and reported about positive changes were born in Australia, and lived with other partners or kids. This was found to be statistically significant ($p<0.05$).

Table 1. The use of MWCT to access information about health

	Frequency	Percent
Yes	463	66.5%
No	231	33.2%

Table 2. Participant characteristics of those who use MWCT

	Use MWCT % (n)
Stage of Study	
Undergraduate	98.9 (562)
Postgraduate	98.4 (126)
Total n	696
Year of Study	
First semester	99.2 (254)
Second semester	100.0 (50)
1 – 2 years	98.7 (148)
2+ years	98.3 (235)
Total n	695
Enrolment Status	
Full-time	99.1 (570)
Part-time	97.5 (118)
Total n	696

Table 3. Has using MWCT lead to positive or negative changes in your health behaviours?

	Frequency	Percent
Yes – a positive change	268	44.2%
Yes – a mix of negative and positive changes	162	25.0%

5.2 Qualitative Analysis Dimension

Next, to attain a deeper understanding of the findings outlined above, content analysis was conducted for each measure using Leximancer software. We have decided to present a few examples, which were more pronounced. Then we tried to identify what the trends were as reported by participants. Through this analysis, key themes and concepts were identified. This type of analysis revealed the themes or concepts that were frequently mentioned by the survey participants. Participants' quotes have been used to substantiate and highlight major findings. As for the question: *"What is the main reason you use MWCT to access information about your health?"* Figure 1 (e.g., frequency of themes) presents the main themes and concepts identified by participants. The content analysis (via Leximancer) indicated that the content was frequently attributed to the words 'access to information',

‘remedies’, ‘healthy eating’, ‘nutrition’, ‘diet’ and ‘symptoms’. This could also be supported by one of the participants’ quotes:

“It is easy to find information about symptoms because I think I might have depression so I like to find people out there with similar problems and talk to them it takes me feel less alone though it doesn't change my feelings”.

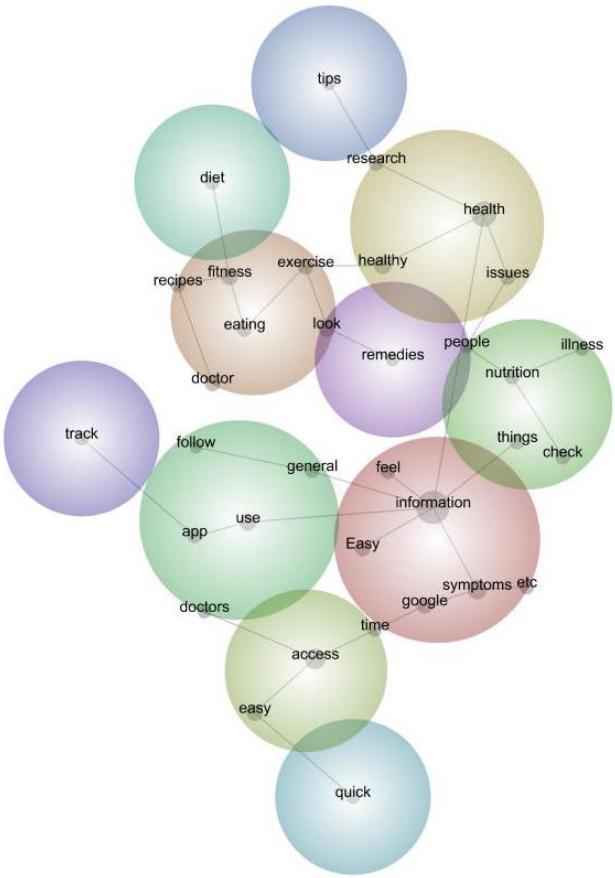

Figure 1. Thematic map of the question: “What is the main reason you use MWCT to access information about your health?”

As for the question: “List up to 3 positive changes in your health behaviours because of your use of MWCT”, Figure 2 illustrates some of the frequent themes re-occurred by survey participants. For instance, some major themes in the survey were: healthy eating, diet, better motivation, and more knowledge about health and physical exercise. This was also supported by one of the participants’ quotes:

“*Healthier food choices Better exercise techniques increased motivation to maintain healthy changes I have lost weight I am more confident with myself, my appearance is better”.*

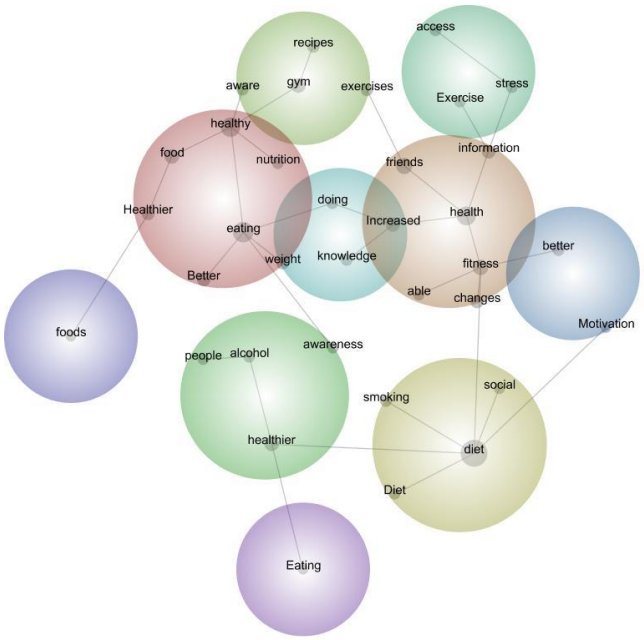

Figure 2. Thematic map of the question: “List up to 3 positive changes in your health behaviours because of your use of MWCT”.

5.3 Spatial Analysis Dimension

Of the 708 initial participants, only 508 individuals provided any type of information about their location (postcode, suburb, street address etc.). Therefore, only these 508 participants were included in the geocoding process, where 99% of the addresses were geocoded successfully. However, we excluded participants which we suspected had provided their home address rather than their current one (addresses in other states for example), and in the spatial analysis we included only participants that were located not more than 90 minutes driving time from any of the five main campuses of Griffith University (Figure 4). This reduced the number of final survey participants to 416. The primary reason for their exclusion was to avoid spatial bias of the analysis to the best of our ability and to include those participants who are located within a reasonable distance to any of the Griffith university campuses in southeast Queensland area. This also aligns with the study aim. The spatial distribution of the participants in the survey showed two main clusters where participants were living nearby: (1) Nathan campus and (2) Gold Coast campus. This was a concern or a limitation for this study as Moran’s I tests or Hotspots tests which showed spatially significance or pronounced “clustering” were essentially clustered due the nature of this survey and a result of the way it was advertised across these two major campuses. Thus, the hotspots which have been found spatially significant clustered (see Figure 3) were due to the spatial bias in the sample of this survey.

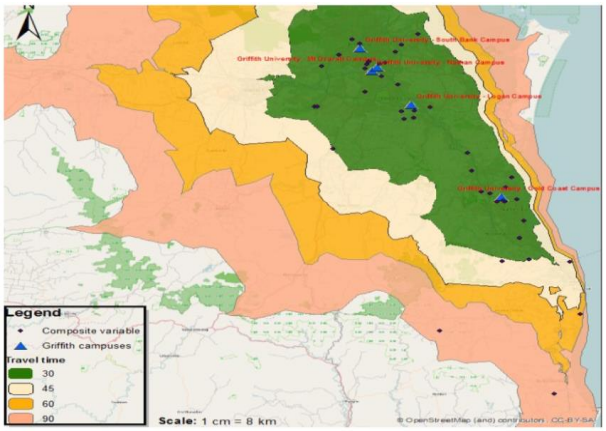

Figure 3. Communal and non-communal location of students based on vehicle travel time.

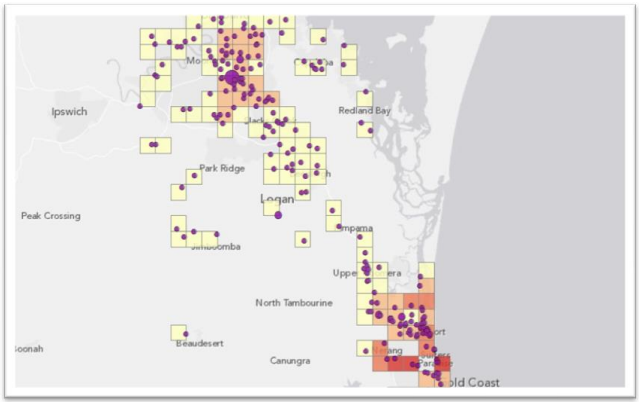

Figure 4. Spatial distribution of the survey participants due to the nature of the survey sample.

In an attempt to overcome this challenge (the nature of our survey sample), we have used the Bernoulli Model suggested and utilised previously by Witham and Oppenheimer [25]. The Bernoulli Model is mathematically a special case of the ordinal model, when there are only two categories. The Bernoulli model runs faster, making it the preferred model to use when there are only two categories. With the Bernoulli model there are cases and non-cases represented by a 0/1 variable. These variables may represent participants who were using social media tool to access health information and participants who did not. They may reflect cases and controls from a larger population, or they may together constitute the population as a whole [26]. Accordingly, these measures were counted as cases and controls in the analysis phase, and their total was denoted as the total population. To determine whether there was any significant geographical pattern in the distribution of those participants who used or did not use MWCT to access health information, we performed cluster analysis using the SaTScan statistics tool. Specifically, the scan statistics analysis uses a Monte Carlo procedure to pinpoint the location of, and test the significance of, spatial clusters [26]. The Bernoulli model of the program was used. However, the results indicated (p = 0.98) that there was no spatial structure in relation to the spatial distribution of people who were using or did not use MWCT to access health information. This has also been strengthened by analysing the results of these measures and then producing Kernel density surfaces (see Figure 5). Essentially, this map tells the same story: it could be observed that both measures of using MWCT are clustered in the same areas. This was to be expected (due to the nature of our sample); however it also supports the findings of the Bernoulli Model, which found no spatial structure irrespective of the survey sample nature. This is to say, that the Bernoulli Model and its algorithm [26] provided to us a reliable and validated statistical method to overcome the bias in our sample and to be certain in our findings. As noted earlier, no spatial structure has been found about who were using these tools for accessing health information.

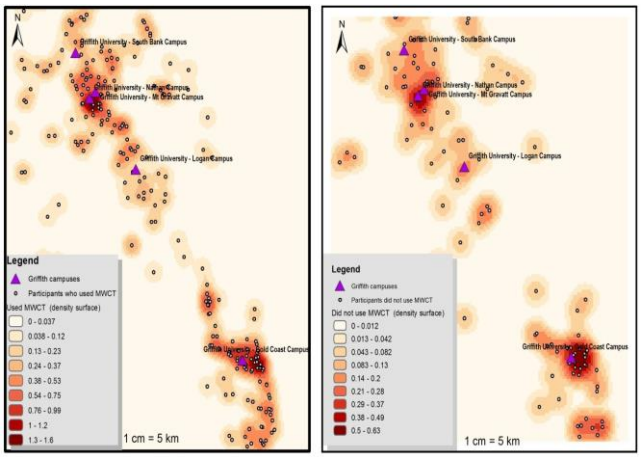

Figure 5. Comparison map shows the spatial distribution of those survey participants who used MWCT and did not, to access health information

5.4 Multi-dimensional approach for evidence

This study is unique mostly due to the fact that we effectively used different empirical methods to find evidence and/or create new knowledge. We did this by using the power of spatial analysis jointly with qualitative analysis to find interesting results. For instance, we created a composite variable using the join query tool in ArcGIS. From the 416 geocoded participants, 44 have addressed the following conditions and been identified by the GIS software: *'Born in Australia', 'Living with partners or kids', 'Answered yes to the question, do you use MWCT to access information about your health', 'Answered positive to the question, has using MWCT lead to positive or negative changes in your health behaviours'.* The map in Figure 3 shows how students were located in respect to the locations of the five different Griffith University campuses. The *"communal* distance" from the campuses (green zones) represents 15 minutes to 30 minutes (by using vehicle from the campuses) threshold, whereas, everything beyond (coloured by cream or orange) represents the 31 min, 45, 60 and 90 minutes respectively ("non communal distance" from the campuses). The map shows that more than 90% of the survey participants who were addressing these conditions are within the 30 minutes time travel threshold or the "communal distance". In terms of characteristics of this group, it was found that the average age of the participants was 31.5 years. This implies that this group may have kids or already live as a family seed. This assumption was also supported by the marital status measure which had a mean of 1.1 (Married/living with a partner etc.) and their fortnightly income had an average of $721.40 AUD. Next, qualitative analysis has been conducted on their complementary questions (e.g., 'What is the main reason you use MWCT to access information about your health' and 'Please list up to 3 positive changes in your health behaviours because of your use of

MWCT'). Figure 6 and Figure 7 show the frequency of words repeated in the thematic analysis. We also selected some quotes to exemplify the observed positive change topic:

*"Healthier cooking for family with wider ac*cess to receipts, *Healthy meal planning for the family, Emotional health connecting with friends and family"*.

As for the reason why students use MWCT to access information about their health, here are some of the observed quotes:

"*To get information I probably can't get at my local library; the variety of information available, It's easy to access, I am able to google any queries I may have and the information is there instantly, Instagram allows me to follow many different nutritionist, fitness professionals, sport professional etc to read and explore health and well-being information posted by them. I will sometimes google different health questions I have, I know this is slight".*

Figure 6. Frequency themes analysis of the question: List up to 3 POSITIVE changes in your health behaviours because of your use of MWCT.

Figure 7. Frequency themes analysis of the question: What is the main reason you use MWCT to access information about your health?

In summary, this section consisted of three methodological instruments: quantitative, qualitative, and spatial analysis. The findings of the survey indicated that there was a justification to use multi-dimensional approach in obtaining and producing evidence, as the limitations of the study due to its nature, were overcome by using these analysis instruments in an interweaved manner, where necessary.

6. DISCUSSION

This paper explored the perceived impact of students using social media tools for accessing health information. The overall findings suggested that the use of social media tools among university students increases their access to health information and to some extent the self-confidence of students about the use of this communication channel. Findings also indicated that most of students have reported positive impacts after using these tools, and that these students are likely to be born in Australia, with an average age of more than 30, living with partners or kids. Bandura [20], through his Social Learning Theory, identifies that having interaction with partners (or being an observer), who undertake certain behaviours, can increase the adoption of such behaviours – in this case the uptake and implementation of modern communication technologies (i.e. MWCT and SM). What is more, people who are also parents to children may use these tools to find more information about their day-to-day health issues, for example.

As for our clusters analysis of the survey, the findings suggested that there were significant clusters or spatial structure in terms of where people were using social media tools to access health information. However, this by itself is a scientific result. Some qualitative findings in the study suggested that people who were using social media tools were associated with topics such as prior health searching for health information before driving and some additional evidence about looking for information about physical activity and consumption of healthy food. This user trend is reflected in other studies, which identify that "about one-third of consumers are using the social space as a natural habitat for health discussions" [27, p.5].

There is growing evidence in the literature about social determinants, which prevent access to health infrastructure and information. This may be adding to what many health professionals term the 'digital divide', these being: (1) health literacy levels; (2) socioeconomic status' (3) ethnicity; (4) education levels; and (5) attitude [28]. However, in the scope of this study, we did not test the 'digital divide', and the evidence we found was mostly based on the qualitative items, which essentially asked participants, 'What was the main reason you do not use social media tools to access health information' (i.e., Question 2.19 in the online survey). These findings will be outlined in an extended journal paper of this study. Digital technologies are increasingly important as ways to gain access to most of the important social determinants of health including employment, housing, education and social networks [29]. However, little is known about the impact of the new communications technologies on opportunities for minimising the widening gaps between social determinants.

A primary reason why MWCT and SM are proving to be so successful (in creating and influencing behavioural changes) are their unique ability to accumulate messages across time, or more commonly referred to as the 'Cultivation Theory'. In other words, the more accurate and tailored media one is exposed to, the more likely one is to demonstrate a *cultivation* effect – as is the unique capabilities of modern communication technologies. Karabulut [30] further supports the match between technology and the Social Learning Theory by indicating that, *"The basic premise of learning is that it occurs in a social context, and people learn from each other by observing, modelling and reproducing"* (p.38). The Social Learning Theory proposes that behaviour can be learned through observation, but that exposure per se is not sufficient to produce a change in behaviour. Specifically, individuals must attend to, remember, and be motivated by messages (feedback) they receive from the media to engage in specific behaviours [20, 31]. In the context of MWCT and SM, behavioural theories can act as a research guide, but are never complete; they predict or explain some phenomena, but have limiting conditions, and will never be able to predict the whole [20]. In relation to this study, there is some evidence to some positive behavioural change which has been observed, and that will require further research over a longer time period. However, with the ubiquitous nature of MWCT, it has been shown to be powerful agents of behavioural change.

As this is just an initial study, which is planned to be extended in the near future, some limitations and recommendations for future research (but not limited) to the following:

- Extend this survey to the general public rather than just being accessible for students only;
- Obtain better location data from participants, for example, target survey sample in a non-spatial bias manner, perhaps aim for the general public this may provide better settings for more advanced spatial analysis;
- Expand the analysis to other measures which have not been covered in this paper but were included in the survey (e.g., self-efficacy);
- Include data with time stamp, to better understand the potential spatio temporal trends;
- Add other layers of interest for analysis purpose, for example the comparison of the remoteness index vs. the use of social media tools; and
- Explore impact on health outcomes.

Further, more research can undertaken that would specifically address how MWCT and SM could be used to interrupt the cycles that contribute to health inequities amongst university students.

7. CONCLUSION

The information and knowledge generated from this research has provided an "opening window" through which we can view and determine how Australian University students use MWCT and SM in an attempt to access and implement personal e-health information. Discussions and future research needs to be aimed at providing further understandings as to the implications of social / community exclusion from such identified technologies and the role social determinants, proximity to the campuses or remoteness have on accessing these tools. Evidence from this study could go towards guiding University Student Services and student wellness staff as to how to effectively implement e-health initiatives that could contribute to reducing health inequities amongst Australia's University students.

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