MOBILE PHONES FACILITATION OF HEALTH PROMOTION AND DISEASE PREVENTION INITIATIVES: HEALTH STUDENTS INITIAL PERSPECTIVES

Kwaku Anhwere Barfi Mr.
*University of Cape Coast, kwaku.barfi@ucc.edu.gh*

Christiana Nsiah-Asamoah Dr
*University of Cape Coast, Ghana, cbuxton@ucc.edu.gh*

Rosemary Twum Dr
*University of Cape Coast, rosemary.twum@ucc.edu.gh*

Daniel Kweku Ainooson – Noonoo Mr
*University of Cape Coast, daniel.ainooson-noonoo@ucc.edu.gh*

Follow this and additional works at: [https://digitalcommons.unl.edu/libphilprac](https://digitalcommons.unl.edu/libphilprac)

Part of the Environmental Public Health Commons, Health Information Technology Commons, Library and Information Science Commons, Medical Education Commons, Medical Humanities Commons, and the Public Health Education and Promotion Commons

Barfi, Kwaku Anhwere Mr.; Nsiah-Asamoah, Christiana Dr; Twum, Rosemary Dr; and Ainooson – Noonoo, Daniel Kweku Mr, "MOBILE PHONES FACILITATION OF HEALTH PROMOTION AND DISEASE PREVENTION INITIATIVES: HEALTH STUDENTS INITIAL PERSPECTIVES" (2021). *Library Philosophy and Practice (e-journal)*. 5039.
[https://digitalcommons.unl.edu/libphilprac/5039](https://digitalcommons.unl.edu/libphilprac/5039)
MOBILE PHONES FACILITATION OF HEALTH PROMOTION AND DISEASE PREVENTION INITIATIVES: HEALTH STUDENTS INITIAL PERSPECTIVES

Kwaku Anhwere Barfi,
University of Cape Coast, kwaku.barfi@ucc.edu.gh

Christiana Nsiah-Asamoah,
University of Cape Coast, cbuxton@ucc.edu.gh

Rosemary Twum, Daniel
University of Cape Coast, rosemary.twum@ucc.edu.gh

University of Cape Coast, Daniel Ainooson – Noonoo
daniel.ainooson-noonoo@ucc.edu.gh

Abstract

Students are regarded as frequent users of mobile phones which has proven to be a convenient and acceptable method to promote healthy lifestyle. Students usually engage in relatively high levels of risky behavior and make unhealthy lifestyle choices, a study that investigates how health students access health information is necessary. The study adopted a descriptive cross-sectional study which was undertaken among third-year nursing students from three nurses training institutions in Ghana. A total of 270 students participated in the study. Most of the respondents who were currently subscribers of the health messages reported that they usually received health information on reproductive health issues, nutrition, and practicing safe sex. Most of the health students revealed that they needed more information on safe sex, diet, managing weight, and stress management. The results also show that health students are likely to remember and share short messages with friends. The findings serve as an ‘eye-opener’ for
health educators and mobile service providers concerning factors that should be taken into consideration when framing health text messages that will attract health students.

**Keywords:** mobile phones; health promotions; short message service; health students

**Introduction**

The world has witnessed tremendous proliferation, and innovation of mobile devices (Apăvăloaie, 2014). Mobile phones are increasingly dominant in developing countries (Pew Research Center, 2019) and their ownership is therefore increasing rapidly. It has been revealed that most adults aged between 25 to 29 live-in households with mobile phones, but no traditional landlines (Boulos, Wheeler, Tavares & Jones, 2011). Health educators and healthcare providers are curious whether mobile phones can facilitate the implementation of health promotion and disease prevention initiatives, especially among students.

Indeed, it has been found that mobile phones offer unprecedented coverage to people who would otherwise not have access to health care information and promotions (Matheny, Thadaney, Ahmed & Whicher, 2019; Zhuang, Xiang, Han, Yang & Zhang, 2016). The continuous use of mobile phone has resulted in a growing interest in the use for promotion services. Interventions via a short message service (SMS) are beneficial for tool for students (Ybarra, Prescott & Holtrop, 2014).
The portability and ‘always-on’ features of the mobile phone, in addition to its ability to distribute information widely to its users (van Steen & Tanenbaum, 2016; Wilmer, Sherman & Chein, 2017) is unprecedented. Mobile phones have become a key communication medium in most developing countries (Lim, Lozano, Naghavi, Foreman, Shibuya, Aboyans & AlMazroa, 2012). Mobile phones have become one of the popular used devices, with 3.9 billion unique mobile subscribers and 7.8 billion connections in the world (GSMA, 2018).

Mobile phones have had a profound impact in all aspects of life, including education (Anderson & Rainie, 2018). Developments on use of mobile phones to deliver information have led to the wide promotion for its use, thereby becoming a powerful tool for health promotion (Gilliland, Gauderman, Urman, Avol, Berhane, McConnell & Rappaport, 2015). The use of SMS for information dissemination is one of the major approaches employed by telecommunication companies for health promotion and interventions (Arps, Friesen & Overall 2018). Mobile-phone SMS has been employed for the provision of preventive health services (Free, Phillips, Watson, Galli, Felix, Edwards & Haines, 2013). Therefore, mobile phone applications, such as SMS offer a convenient and cost-effective way to support health care education (Vodopivec-Jamsek, de Jongh, Gurol-Urganci, Atun & Car, 2012). Also, the ubiquitous nature of mobile phones, ease to use by students, makes mobile phones and SMS more relevant for educating students on healthy lifestyles (Dégliseet, Suggs & Odermatt, 2012).

Again, compared with email, SMS are more conversational in approach that can occur quicker, and therefore students may feel obliged to respond faster than if the information was communicated via mobile phones (Buhi, Trudnak, Martinasek, Oberne, Fuhrmann & McDermott, 2013, Mbuagbaw, Mursleen, Lytvyn, Smieja, Dolovich & Thabane, 2015). Students aged between 18 and 29 years are more likely to use SMS than older adults (Perrin, 2015).
Reports from the National Communications Authority (NCA) in Ghana indicates that the total number of mobile phone subscriptions stood at 41,193,072 in 2019 (NCA, 2019). In Ghana, both MTN and Vodafone are networking companies that provide SMS services that allow customers to received messages and read them. Among the category of messages disseminated by the service providers in Ghana are general health tips information sent to subscribers as a medium for health education and disease prevention using SMS. These networking companies provide m-health tips that are subscribed to for a fee and are accessed daily (De Tolly, Skinner, Nembaware & Benjamin, 2012).

Personal observations from the researchers revealed that health students in tertiary institutions in Ghana, usually engage themselves in relatively high levels of risky health behavior and unhealthy lifestyle choices are consistently using mobile phones even at lecture theatres, it seems reasonable that research that explores how students access health information is warranted. Moreover, to the best of the researchers’ knowledge, there is a paucity of studies examining the use of mobile phones to access health information, health topics, and topics that health students would find more useful. Thus, this study addresses the following issues.

1. To find out the reasons that influence health students to subscribe to and receive health information messages.

2. To identify the types of short message service health students usually receive information on.

3. To find out the type of short message service health students are likely to share with their peers.

4. To know the type of language health students prefer in the dissemination of health information.
Theoretical framework

The study is underpinned by the social learning theory. The social learning theory was formulated in 1977 by Albert Bandura (Brauer & Tittle, 2012). The implication of the theory is that, interaction among humans gives rise to the adoption of certain behavior. The consequence of such behavior dictates whether or not people will be much indulged in such behavior. If the reward is high, then the possibility of indulging in such behavior will also be high. On the other hand, if the reward is low, then people will ordinarily not indulge in such behavior.

The social learning theory has been widely used in various disciplines from health, to education. However, in the current paper, the theory is adopted due to how the theory places premium on interactions. The assumptions of the social learning theory lay down premise which enable learners to interact with others using technology (Järvelä & Järvenoja, 2011). With the adoption of technology, such interaction by learners is interfaced by technology. With the use of such technologies like SMS, students are able to have real-time interactions with friends and also among their peers to share ideas.

Methods
Research Design and Study Participants

This was a descriptive cross-sectional study. The study population was third-year nursing students in Ghana. Purposive sampling was used to select all the health students. Purposive sampling, according to Teddie and Tashaskkori (2003), involves selecting certain units or cases based on specific purposes rather than randomly. Teddie and Tashaskkori (2003) further argued that purposive sampling is used in inductive studies to gather detail and in-depth information or data with a small number of participants to represent the target population to yield detailed
information about the issue. The selected nursing institutions are Nursing and Midwifery Training College at Sekondi, Nursing and Midwifery Training College at Cape Coast, and Nursing and Midwifery Training College at Kete Krachi. The technique affords easy responses from the participants. The researchers chose this sampling method because the cases were available and easy to study to get the expected responses.

The study participant was made of 328 third-year nursing students. Out of the total students, 270 (82.3%) gave their consent to participate in the study. These health students were given a questionnaire to complete. The health students who agreed to participate in the study were given three days to complete and return the questionnaire.

**Research Instrument and Data Collection**

The researchers administered the questionnaire to the students who gave their consent to participate in the study. The questionnaire was pilot tested at Nursing and Midwifery Training College at Sunyani and a reliability coefficient value of 0.76 was obtained using Cronbach’s alpha coefficient of reliability. The first section of the questionnaire included questions to assess demographic data, subscription for SMS health tips, and the use of such messages. In the second section of the questionnaire, their views concerning their satisfaction with the messages received, the usefulness, and easiness in understanding the SMS and future use of such messages were obtained. Also, information was obtained about the type of health SMS that they usually receive and what they shared with their peers. The third section of the questionnaire sought to assess the opinions of students concerning health issues that they usually receive information on and health-related issues that they would wish to receive more information on through SMS.

**Data Analysis**
The data were analyzed using the Statistical Package for the Social Sciences (SPSS) software application (version 21.0). Descriptive statistics were presented in the form of frequencies and percentages presented in frequency distribution tables for background information on participants, and responses given to the questions.

Results

The study was conducted to assess the experiences of nursing students concerning subscribing to SMS health information from telecommunication and mobile service providers such as MTN and Vodafone companies in Ghana. The study sought to obtain the views of the different categories of nursing students in Ghana. At the time of collecting data, 30.7% were currently receiving health information SMS messages, whereas 25.6% had subscribed in the past but terminated their subscription later. Most of the subscribers (95.2%) indicated that they had subscribed to MTN for these health SMS messages whilst the remaining (4.8%) had subscribed to Vodafone. Most (57.8%) of the students indicated that they subscribed to the health messages because they wanted to improve their knowledge and be well informed about health issues. A higher proportion (96.4%) of the current subscribers reported that the SMS health tips had been beneficial to them. Concerning how they had benefited from the SMS health tips, about 51.2% stated that receiving this health information enabled them to live a healthy lifestyle. Also, 27.5% indicated that health messages enabled them to prevent common health problems.
Table 1: Information on Background and Subscription for SMS among Study Participants

| Abbreviated Question                                      | Frequency | Percent |
|-----------------------------------------------------------|-----------|---------|
| **Program of study**                                      |           |         |
| Midwifery                                                 | 132       | 48.9    |
| General nursing                                          | 138       | 51.1    |
| **Subscribed for health SMS tips on phone**               |           |         |
| Yes                                                       | 83        | 30.7    |
| Subscribed before but now unsubscribed                    | 69        | 25.6    |
| No                                                       | 118       | 43.7    |
| **Network subscribed to (n=83)**                          |           |         |
| MTN                                                      | 79        | 95.2    |
| Vodafone                                                 | 4         | 4.8     |
| **Reasons why subscribed for health messages/tips (n=83)**|           |         |
| Improve my knowledge and be well informed about health issues | 48        | 57.8    |
| Curious about health issues                              | 14        | 16.9    |
| With such messages, I can prevent some health conditions  | 11        | 13.3    |
| Critical about my health                                 | 10        | 12.0    |
| **Has the SMS health tips been beneficial to you (n=83)**  |           |         |
| Yes                                                      | 80        | 96.4    |
Table 1 Cont.

| Health issues respondents usually receive text messages on, (multiple responses allowed) (n=83) |   |
|---------------------------------------------------------------------------------------------|---|
| Eating well/healthy nutrition                                                               | 78| 94.0 |
| Reproductive and sexual health issues and practicing safe sex                                | 75| 90.4 |
| Exercising/fitness                                                                          | 66| 79.5 |
| Dental/oral health care                                                                      | 40| 48.2 |
| Substance and alcohol abuse prevention messages                                              | 34| 41.0 |
| Mental health messages                                                                       | 33| 39.8 |
| Prenatal care messages                                                                       | 30| 36.1 |
| Emergency first aid messages                                                                 | 29| 35.0 |
| Child health care for parents                                                                 | 28| 33.7 |
| Types of checkups and screening                                                              | 27| 32.5 |
| Stress management                                                                            | 24| 28.9 |

| Why have you not subscribed to any health SMS alerts, (multiple responses allowed) (n=187) |   |
|---------------------------------------------------------------------------------------------|---|
| It is expensive to subscribe to receive health text messages                                 | 125| 66.8 |
| Messages are often repeated                                                                  | 89 | 47.6 |
| I have subscribed before but unsubscribed                                                    | 69 | 36.9 |
More than 75% of the respondents who were currently subscribers of these health messages reported that they usually receive health information on reproductive/sexual health issues, eating well/good nutrition, and practicing safe sex and exercising/fitness. For students who had not subscribed for any health SMS alerts, they reported that it was expensive to subscribe for such messages (66.8%) and the messages were usually repeated (47.6%).

Responses to questions assessing the perceptions of students toward health SMS messages received were obtained from both previous and current subscribers, a total of 152, 56.3% of all the study participants. The responses assessed their level of satisfaction, the usefulness of the messages, ability to understand and use it easily, future use of such messages, and willingness to recommend to others to also subscribe are presented in Table 2. More than 80% of the 152 who had previously and currently subscribed for health SMS messages reported that the messages were useful, easy to understand, and apply. They also indicated that they would use this kind of text message system in the future and would encourage others to subscribe to SMS health. However, 32.2% indicated that they have not been satisfied with most of the health text messages received.

**Table 2. Perceptions of Students' toward Health text messages received (n=152)**

| Abbreviated Question | Frequency | Percent |
|----------------------|-----------|---------|
| Messages are not practical | 39 | 20.9 |
| Messages are difficult to understand | 36 | 19.3 |
| Messages are not appropriate considering my needs | 35 | 18.7 |
| Because I know all that there is to know, nothing is new | 31 | 16.6 |
| In my opinion, they are not useful | 19 | 10.2 |

Source: Field data, 2019.
Some suggestions were made by the study participants concerning measures that can be taken to improve SMS health tips tailored to meet the needs of the youth and young adults as depicted in Table 3. Most (74.1%) indicated that it will be appropriate to receive health SMS information in the local Ghanaian dialects, of which 57% stated that it will be helpful to those who cannot read English. The majority (63.3%) of the study participants reported that they will prefer a balanced use of both casual and non-casual languages in disseminating health information. More than 70% of the study participants indicated that they are more likely to easily remember and share with their friends SMS messages that are short, straight-forward, personally relevant, come in the form of pictorial presentation, include interactive features such as videos, reflects real-life stories and are aligned with upcoming events. For both previous and current subscribers, more than 60% reported that they usually received health SMS messages that were centered on general preventive health messages, nutrition, and healthy eating habits, and exercises/physical activity.
Table 3. Suggestions from Study Participants on measures that can be taken to improve SMS health tips tailored to meet their needs

| Suggestion                                                                 | Frequency | Percent |
|----------------------------------------------------------------------------|-----------|---------|
| Will it be appropriate to receive such health information in local Ghanaian dialects (n= 270) |           |         |
| Yes                                                                       | 200       | 74.1    |
| No                                                                        | 70        | 25.9    |
| If yes and appropriate, why? (n= 200)                                      |           |         |
| Will be helpful to those who cannot read English                           | 114       | 57.0    |
| Can help me educate people who cannot read and understand English          | 86        | 43.0    |
| What type of language do you prefer in disseminating health information by SMS (n= 270) |           |         |
| Only casual/informal                                                      | 43        | 16.0    |
| Only non-casual /formal                                                   | 40        | 14.8    |
| Balance use of both casual and non-casual                                 | 171       | 63.3    |
| No response                                                              | 16        | 5.9     |
| Type of messages that health students are likely to share with their peers and will easily remember, (multiple responses allowed) (n=270) |           |         |
| Text messages that are short, straight-forward and personally relevant    |           |         |
for young people | 217 | 80.4
---|---|---
Text messages that include/reflect real-life stories | 204 | 75.5
Text messages that come in the form of pictorial presentation such as cartoons | 199 | 73.3
Text messages that include interactive features such as videos | 196 | 72.6
Text messages that are aligned with upcoming events | 191 | 70.7
Text messages that are enthusiastic | 172 | 63.7
Text messages that rhyme | 51 | 18.9

Table 3 Cont.

| Which messages do you usually receive SMS on, (multiple responses allowed) (n = 152) |  
|---|---|
| General preventive health messages | 109 | 71.7 |
| Nutrition and healthy eating habits | 103 | 67.7 |
| Reproductive and sexual health issues | 92 | 60.5 |
| Exercises and physical activity | 79 | 52.0 |
| Infectious diseases | 70 | 46.1 |
| Mental health issues | 56 | 36.8 |
| Chronic diseases (e.g. diabetes, hypertension) | 54 | 35.5 |
| Health issues respondents need more information on, (multiple responses allowed) (n=270) |  
|---|---|
| Reproductive /sexual health issues and engaging in safe sex | 174 | 64.4 |
| Eating well/nutrition | 162 | 60.0 |
| Stress management | 158 | 58.5 |
| Managing weight | 150 | 55.6 |
| Exercising/fitness | 145 | 53.7 |
| Emergency first aid messages | 92 | 34.1 |
| Substance and alcohol abuse prevention messages | 83 | 30.7 |
| Dental/oral health care | 80 | 29.6 |
As shown in Table 3, more than 50% of the study participants indicated that they need more information on reproductive or sexual health issues and engaging in safe sex, eating well, exercising/fitness, managing weight, and stress management. Responses concerning suggestions that can be used to improve health messages that are sent to subscribers are summarized in Table 3. Fifty percent of the respondents included reducing subscription charges, educating the public on the relevance of these messages, the need for messages to be simple, practical, and straightforward, adding other forms of media like audio, video, and pictures to health SMS messages, including more dietary-related messages and include more reproductive and sexual health issues.

**Discussion**

The study sought to investigate how health students access health information via SMS. The study was also intended to gain information from the students regarding health topics that
they prefer to receive text messages on and suggestions on how healthy text messages should be framed and presented to students.

In this study, the two main reasons that emerged as reasons why nursing students subscribe to health SMS are to improve their knowledge, be well informed about health issues, and because they were curious about health issues. Findings from this study acknowledge that health information conveyed to the students using SMS is beneficial. In other related studies, the use of SMS to enhance patient care, patient education, and public health programs were highlighted (Abaza & Marschollek, 2017). It has been highlighted that SMS can be a potentially cost-effective and rapid way of conveying health-related messages to students (Free et al., 2016).

In similar studies, it was found that text messaging can deliver content that affects behavioral health changes among young people (Wei, Hollin & Kachnowski, 2011), and receiving health SMS is a means of improving their adherence to healthy lifestyle practices (Woolford, Clark, Strecher & Resnicow, 2010). Similarly, text messaging has been described as a tool for ensuring behavioral changes in disease prevention and management by users (Cole-Lewis & Kershaw, 2010).

According to the study participants who had subscribed for health text messages, indicated that most of the SMS messages that they received were focused on how to eat well/healthy nutrition, reproductive and sexual health issues, and practicing safe sex and exercising/fitness. The use of SMS to provide nutrition education to college students has been reported in similar studies (Brown, O’Connor & Savaiano, 2014). There is evidence indicating that SMS is an acceptable and effective way to increase nutrition knowledge, promote positive diet-related behavior, and could encourage healthier food choices among students (Brown, O’Connor & Savaiano, 2014). For example, in the study of Thakkar, Karthikeyan, Purohit,
Thakkar, Sharma, Verma and Singh (2016), the use of text messaging as an intervention to educate students on diet and coronary heart disease risk proved to have a positive impact on whole-grain consumption and high-density lipoprotein cholesterol. More than 90% of the study participants also indicated that a large proportion of SMS that they received were centered on reproductive and sexual health issues. This is important because some of the youth might be shy of asking adults about sexual matters because of the African culture, although they have special sexual and reproductive health needs and hence the use of SMS is an effective strategy to enable them to be well-informed (Willoughby & L’Engle, 2015). Most messages address issues on contraceptive methods, sexually transmitted infections, where to find reproductive health services, and issues on unsafe abortion.

Concerning health issues that nursing students would prefer to receive more information on, more than 50% of the students indicated areas on reproductive/sexual health issues, balanced diet or nutrition, stress management, managing weight, and exercising/body fitness in decreasing order of priority. These health issues are of much concern to adolescents, the youth, and health students. Stressing this assertion is the evidence provided in past reviews that have found that SMS-based health promotion approaches that are effective in encouraging a wide range of positive health behavior usually focused on sexual health, smoking cessation, weight-loss, nutrition, and mental health for young students (Hebden, Balestracci, McGeechan, Denney-Wilson, Harris & Allman-Farinelli, 2013). For example, the study of Cullen, Thompson, Boushey, Konzelmann and Chen (2013) which was conducted among adolescents aged between 13 and 17 years revealed that about 84% and 90% of the students assessed health information on how to be physically active and make healthy food selections respectively. Similarly, in a study aimed at investigating the feasibility of mobile phone text messaging to promote healthy
behavior among students, it was found out that most of the participants chose to create personal text messages that focused on tips on healthy eating, physical activity as well as reminders to drink water (Wei, Hollin, Kachnowski, 2011).

The health students also indicated that the type of SMS that they are likely to share with their peers and those that they will also easily remember to include text messages that are short, personally relevant for students, including real-life stories, aligned with upcoming events and come in the form of pictorial presentation such as videos, cartoons. These assertions of the respondents corroborate with those of similar reports made by people concerning the kind of SMS-health-based information that they are likely to remember and share with their peers (Arps, Friesen & Overall, 2018). For example, in a study that was undertaken among young adults to assess factors to consider in designing SMS content for delivery to adults, it was found out that most of the study participants preferred short, and actionable health messages (Gkatzidou, Hone, Sutcliffe, Gibbs, Sadiq, Szczepura & Estcourt, 2015).

Regarding, the type of language that nursing students prefer in the dissemination of health information by SMS, most of the respondents stated that they prefer the use of both casual and non-casual language which must be well-balanced. This is supported by Woolford, Clark, Strecher and Resnicow (2011) findings.

Concerning suggestions on improving health messages that are received which will also encourage students to subscribe, the topmost suggestions given were: subscription charges must be reduced and there should be public education on the relevance of these messages. The other two suggestions were the need to disseminate messages that are simple, practical, and straightforward and adding other forms of media like audio, video, and pictures.
Conclusions and recommendations

Mobile phones may be a useful facilitation for health promotion and disease prevention. Findings from this study offer insights into using mobile phones SMS for health information that will be of much interest to health students. Health students prefer health messages that center on reproductive and sexual health issues, eating well/balanced diet, exercising, bodyweight management, and stress management. Again, these health students prefer the use of casual and non-casual language in text messages.

The findings also show that health students prefer text messages that are short, personally relevant for students, including real-life stories, are aligned with upcoming events and come in the form of pictorial presentations such as videos. Getting explanation via mobile phones SMS can be an effective and appealing method of knowledge acquisition for health students. The findings serve as an ‘eye-opener’ and inform health educators, ICT experts, and mobile service providers concerning factors that should be taken into consideration when framing health text messages that will catch the attention of health students.

Limitations

Ghana has sixty-one nursing and midwifery training schools. However, the research reports the results of only three public institutions in Ghana. The other fifty-eight public and private Nursing and Midwifery were not included in the research work because the researchers were not able to seek permission of those institutions and the sampled techniques employed for the study. By this reason, it can be concluded that the results can be generalized to these selected three institutions.
The researchers did not receive any financial support from any funding agencies in the public, commercial, or not-for-profit sectors.

REFERENCES

Abaza, H., & Marschollek, M. (2017). mHealth application areas and technology combinations: a comparison of literature from high and low/middle-income countries. *Thieme Open Access*, 1, e105-e122. [https://doi.org/10.3414/ME17-05-0003](https://doi.org/10.3414/ME17-05-0003).

Abi-Jaoude, E., Naylor, K. T., & Pignatiello, A. (2020). Smartphones, social media use and youth mental health. *CMAJ*, 192(6), E136-E141. [https://doi.org/10.1503/cmaj.190434](https://doi.org/10.1503/cmaj.190434).

Ainsworth, J., Palmier-Claus, J. E., Machin, M., Barrowclough, C., Dunn, G., Rogers, A., & Hopkins, R. S. (2013). A comparison of two delivery modalities of a mobile phone-based assessment for serious mental illness: native smartphone application vs text-messaging only implementations. *Journal of Medical Internet Research*, 15(4), e60. [https://doi.org/10.2196/jmir.2328](https://doi.org/10.2196/jmir.2328).

Al-Nakeeb, Y., Lyons, M., Dodd, L. J., & Al-Nuaim, A. (2015). An investigation into the lifestyle, health habits and risk factors of young adults. *International Journal of Environmental Research and Public Health*, 12(4), 4380-4394. [https://doi.org/10.3390/ijerph120404380](https://doi.org/10.3390/ijerph120404380).

Anderson, J., & Rainie, L. (2018). The positives of digital life. *Pew Research Center*, 52-68.
Arps, E. R., Friesen, M. D., & Overall, N. C. (2018). Promoting youth mental health via text-messages: A New Zealand feasibility study. *Applied Psychology: Health and Well-Being*, 10(3), 457-480. [https://doi.org/10.1111/aphw.1214](https://doi.org/10.1111/aphw.1214).

Apăvăloaie, E. (2014). Emerging markets queries in finance and business: The impact of the Internet on the business environment. *Procedia Economics and Finance*, 951–958. [https://doi.org/10.1016/S2212-5671(14)00654-6](https://doi.org/10.1016/S2212-5671(14)00654-6).

Auerbach, D. I., Buerhaus, P. I., & Staiger, D. O. (2007). Better late than never: Workforce supply implications of later entry into nursing. *Health Affairs*, 26(1), 178-185. [https://doi.org/10.1377/hlthaff.26.1.178](https://doi.org/10.1377/hlthaff.26.1.178).

Boettiger, A. N., Bintu, B., Moffitt, J. R., Wang, S., Beliveau, B. J., Fudenberg, G., & Zhuang, X. (2016). Super-resolution imaging reveals distinct chromatin folding for different epigenetic states. *Nature*, 529(7586), 418-422. [https://doi.org/10.1038/nature16496](https://doi.org/10.1038/nature16496).

Brauer, J. R., & Tittle, C. R. (2012). Social learning theory and human reinforcement. *Sociological Spectrum*, 32(2), 157-177.

Brown, O. N., O’Connor, L. E., & Savaiano, D. (2014). Mobile MyPlate: a pilot study using text messaging to provide nutrition education and promote better dietary choices in college students. *Journal of American College Health*, 62(5), 320-327. [https://doi.org/10.1080/07448481.2014.899233](https://doi.org/10.1080/07448481.2014.899233).

Boulos, M. N. K., Wheeler, S., Tavares, C., & Jones, R. (2011). How smartphones are changing the face of mobile and participatory healthcare: an overview, with example from
Buhi, E. R., Trudnak, T. E., Martinasek, M. P., Oberne, A. B., Fuhrmann, H. J., & McDermott, R. J. (2013). Mobile phone-based behavioral interventions for health: A systematic review. *Health Education Journal, 72*(5), 564-583. https://doi.org/10.1177%2F0017896912452071.

Cole-Lewis, H., & Kershaw, T. (2010). Text messaging as a tool for behavior change in disease prevention and management. *Epidemiologic Reviews, 32*(1), 56-69. https://doi.org/10.1093/epirev/mxq004.

Cullen, K. W., Thompson, D., Boushey, C., Konzelmann, K., & Chen, T. A. (2013). Evaluation of a web-based program promoting healthy eating and physical activity for adolescents: teen choice: food and fitness. *Health Education Research, 28*(4), 704-714. https://doi.org/10.1093/her/cyt059.

Culpepper, M. (2020). Exploring the Relationships of Social Media Usage and Symptoms of Anxiety and Depression in Adolescents. *Digital Commons ACU, Electronic Theses and Dissertations*. Paper 224.

De Jongh, T., Gurol-Urganci, I., Vodopivec-Jamsek, V., Car, J., & Atun, R. (2012). Mobile phone messaging for facilitating self-management of long-term illnesses. *Cochrane Database of Systematic Reviews, 12*(12), CD007459. https://doi.org/10.1002/14651858.CD007459.pub2.


De Tolly, K., Skinner, D., Nembaware, V., & Benjamin, P. (2012). Investigation into the use of short message services to expand uptake of human immunodeficiency virus testing, and whether content and dosage have an impact. *Telemedicine and e-Health*, 18(1), 18-23. https://doi.org/10.1089/tmj.2011.0058.

Déglise, C., Suggs, L. S., & Odermatt, P. (2012). Short message service applications for disease prevention in developing countries. *Journal of Medical Internet Research*, 14(1), e3. https://doi.org/10.2196/jmir.1823.

Dowshen, N., Kuhns, L. M., Gray, C., Lee, S., & Garofalo, R. (2013). Feasibility of interactive text message response (ITR) as a novel, real-time measure of adherence to antiretroviral therapy for HIV+ youth. *AIDS and Behavior*, 17(6), 2237-2243. https://doi.org/10.1007/s10461-013-0464-6.

Free, C., Phillips, G., Watson, L., Galli, L., Felix, L., Edwards, P., & Haines, A. (2013). The effectiveness of mobile-health technologies to improve health care service delivery processes: A systematic review and meta-analysis. *PLoS Med*, 10(1), e1001363. https://doi.org/10.1371/journal.pmed.1001363.

Gall, M. D., Borg, R. G., & Gall, 1. P. (2006). *Educational research: An Introduction*, 6th ed. Longman Publishers, New York.

Gauderman, W. J., Urman, R., Avol, E., Berhane, K., McConnell, R., Rappaport, E., Chang, R., Lurmann, F., & Gilliland, F. (2015). Association of improved air quality with lung development in children. *New England Journal Medical*, 372, 905-913. https://doi.org/10.1056/NEJMoa1414123.
George, D. R., Rovniak, L. S., & Kraschnewski, J. L. (2013). Dangers and opportunities for social media in medicine. *Clinical obstetrics and gynecology*, 56(3), 453-462. https://doi.org/10.1097/GRF.0b013e318297dc38.

Gkatzidou, V., Hone, K., Sutcliffe, L., Gibbs, J., Sadiq, S. T., Szczepura, A., & Estcourt, C. (2015). User interface design for mobile-based sexual health interventions for young people: design recommendations from a qualitative study on an online Chlamydia clinical care pathway. *BMC Medical Informatics and Decision Making*, 15(1), 72. https://doi.org/10.1186/s12911-015-0197-8.

Guy, R., Hocking, J., Wand, H., Stott, S., Ali, H., & Kaldor, J. (2012). How effective are short message service reminders at increasing clinic attendance? A meta-analysis and systematic review. *Health Services Research*, 47(2), 614-632. https://doi.org/10.1111/j.1475-6773.2011.01342.x.

Hebden, L., Balestracci, K., McGeechan, K., Denney-Wilson, E., Harris, M., Bauman, A., & Allman-Farinelli, M. (2013). ‘TXT2BFiT’a mobile phone-based healthy lifestyle program for preventing unhealthy weight gain in young adults: Study protocol for a randomized controlled trial. *Trials*, 14(1), 75. https://doi.org/10.1186/1745-6215-14-75.

Hongu, N., Hingle, M. D., Merchant, N. C., Orr, B. J., Going, S. B., Mosqueda, M. I., & Thomson, C. A. (2011). Dietary assessment tools using mobile technology. *Topics in Clinical Nutrition*, 26(4), 300-311. https://doi.org/10.1097/TIN.0b013e3182379525.

Hussein, W. I., Hasan, K., & Jaradat, A. A. (2011). Effectiveness of mobile phone short message service on diabetes mellitus management; the SMS-DM study. *Diabetes Research and Clinical Practice*, 94(1), e24-e26. https://doi.org/10.1016/j.diabres.2011.07.025.
Järvelä, S., & Järvenoja, H. (2011). Socially constructed self-regulated learning and motivation regulation in collaborative learning groups. *Teachers College Record, 113*(2), 350–374.

Kerr, D. A., Harray, A. J., Pollard, C. M., Dhaliwal, S. S., Delp, E. J., Howat, P. A., Pickering, M. R., Ahmad, Z., Meng, X., Pratt, I. S., & Wright, J. L. (2016). The connecting health and technology study: a 6-month randomized controlled trial to improve nutrition behavior using a mobile food record and text messaging support in young adults. *International Journal of Behavioral Nutrition and Physical Activity, 13*(1), 52. https://doi.org/10.1186/s12966-016-0376-8.

Lam, C. (2013). The efficacy of text messaging to improve social connectedness and team attitude in student technical communication projects: An experimental study. *Journal of Business and Technical Communication, 27*(2), 180-208. https://doi.org/10.1177/1050651912468888.

Lozano, R., Naghavi, M., Foreman, K., Lim, S., Shibuya, K., Aboyans, V., & AlMazroa, M. A. et al. (2012). Global and regional mortality from 235 causes of death for 20 age groups in 1990 and 2010: A systematic analysis for the global burden of disease study. *The Lancet, 380*(9859), 2095-2128. https://doi.org/10.1016/S0140-6736(12)61728-0.

Matheny, M., Thadaney, I, Ahmed, M., & Whicher, D. (Eds.) (2019). *Artificial intelligence in health care: The hope, the hype, the promise, the peril.* NAM Special Publication. Washington, DC: National Academy of Medicine.

Mbuagbaw, L., Mursleen, S., Lytvyyn, L., Smieja, M., Dolovich, L., & Thabane, L. (2015). Mobile phone text messaging interventions for HIV and other chronic diseases: an
overview of systematic reviews and framework for evidence transfer. *BMC Health Services Research*, 15(1), 33. [https://doi.org/10.1186/s12913-014-0654-6](https://doi.org/10.1186/s12913-014-0654-6).

Mitchell, K. J., Bull, S., Kiwanuka, J., & Ybarra, M. L. (2011). Cell phone usage among adolescents in Uganda: acceptability for relaying health information. *Health Education Research*, 26(5), 770-781. [https://doi.org/10.1093/her/cyr022](https://doi.org/10.1093/her/cyr022).

Orr, J. A., & King, R. J. (2015). Mobile phone SMS messages can enhance healthy behavior: a meta-analysis of randomized controlled trials. *Health Psychology Review*, 9(4), 397-416. [https://doi.org/10.1080/17437199.2015.1022847](https://doi.org/10.1080/17437199.2015.1022847).

Owens, C., Farrand, P., Darvill, R., Emmens, T., Hewis, E., & Aitken, P. (2011). Involving service users in intervention design: a participatory approach to developing a text-messaging intervention to reduce repetition of self-harm. *Health Expectations*, 14(3), 285-295. [https://psycnet.apa.org/doi/10.1111/j.1369-7625.2010.00623.x](https://psycnet.apa.org/doi/10.1111/j.1369-7625.2010.00623.x).

Partridge, S. R. (2015). Effectiveness of a healthy lifestyle program with telephone support to prevent unhealthy weight gain in young adults: a randomized controlled trial. *JMIR mHealth and uHealth*, 3(2), e66. [https://doi.org/10.2196/mhealth.4530](https://doi.org/10.2196/mhealth.4530).

Patrick, K., Griswold, W. G., Raab, F., & Intille, S. S. (2008). Health and the mobile phone. *American Journal of Preventive Medicine*, 35(2), 177-181. [https://doi.org/10.1016/j.amepre.2008.05.001](https://doi.org/10.1016/j.amepre.2008.05.001).

Perrin, A. (2015). Social media usage. *Pew Research Center*, 52-68.
Proudfoot, J. (2013). The future is in our hands: the role of mobile phones in the prevention and management of mental disorders. *Australian & New Zealand Journal of Psychiatry*, 47(2), 111-113. [https://doi.org/10.1177/0004867412471441](https://doi.org/10.1177/0004867412471441).

Ramachandran, A., Snehalatha, C., Ram, J., Selvam, S., Simon, M., Nanditha, A., & Oliver, N. *et al.* (2013). Effectiveness of mobile phone messaging in the prevention of type 2 diabetes by lifestyle modification in men in India: a prospective, parallel group, randomized controlled trial. *The Lancet Diabetes & Endocrinology*, 1(3), 191-198. [https://doi.org/10.1016/S2213-8587(13)70067-6](https://doi.org/10.1016/S2213-8587(13)70067-6).

Silver, L., Smith, A., Johnson, C., Taylor, K., Jiang, J., Anderson, M., & Rainie, L. (2019). Mobile connectivity in emerging economies. *Pew Research Center*, 7.

Schleider, J. L., Mullarkey, M. C., & Chacko, A. (2020). Harnessing wise interventions to advance the potency and reach of youth mental health services. *Clinical Child and Family Psychology Review*, 23(1), 70-101. [https://psycnet.apa.org/doi/10.1007/s10567-019-00301-4](https://psycnet.apa.org/doi/10.1007/s10567-019-00301-4).

Schnall, R., Okoniewski, A., Tiase, V., Low, A., Rodriguez, M., & Kaplan, S. (2013). Using text messaging to assess adolescents’ health information needs: An ecological momentary assessment. *Journal of Medical Internet Research*, 15(3), 54. [https://doi.org/10.2196/jmir.2395](https://doi.org/10.2196/jmir.2395).

Tashakkori, A., & Teddlie, C. (2003b). The past and future of mixed methods research: From data triangulation to mixed model designs. In A. Tashakkori & C. Teddlie (Eds.), *Handbook of mixed methods in social & behavioral research* (pp. 671-702). Thousand Oaks, CA: Sage.
Thakkar, J., Karthikeyan, G., Purohit, G., Thakkar, S., Sharma, J., Verma, S., Parakh, N., Seth, S., Mishra, S., Yadav, R., & Singh, S. et al. (2016). Development of macaronic Hindi-English ‘Hinglish’ text message content for a coronary heart disease secondary prevention program. *Heart Asia*, 8(2), 32-38. [https://doi.org/10.1136/heartasia-2016-010789](https://doi.org/10.1136/heartasia-2016-010789).

Tolou-Shams, M., Yonek, J., Galbraith, K., & Bath, E. (2019). Text messaging to enhance behavioral health treatment engagement among justice-involved youth: qualitative and user testing study. *JMIR m-Health and u-Health*, 7(4), e10904. [https://doi.org/10.2196/10904](https://doi.org/10.2196/10904).

Van Steen, M., Tanenbaum, A. S. (2016). A brief introduction to distributed systems. *Computing*, 98, 967–1009. [https://doi.org/10.1007/s00607-016-0508-7](https://doi.org/10.1007/s00607-016-0508-7).

Vodopivec-Jamsek, V., de Jongh, T., Gurol-Urganci, I., Atun, R., & Car, J. (2012). Mobile phone messaging for preventive health care. *The Cochrane Database of Systematic Reviews*, 12:CD007457. [https://doi.org/10.1002/14651858.cd007457](https://doi.org/10.1002/14651858.cd007457).

Wei, J., Hollin, I., & Kachnowski, S. (2011). A review of the use of mobile phone text messaging in clinical and healthy behavior interventions. *Journal of Telemedicine and Telecare*, 17(1), 41-48. [https://doi.org/10.1258/jtt.2010.100322](https://doi.org/10.1258/jtt.2010.100322).

Wilmer, H. H., Sherman, L. E., & Chein, J. M. (2017). Smartphones and cognition: A review of research exploring the links between mobile technology habits and cognitive functioning. *Frontiers in Psychology*, 8, 605. [https://doi.org/10.3389/fps.2017.00605](https://doi.org/10.3389/fps.2017.00605).
Willoughby, J. F., & L’Engle, K. L. (2015). Influence of perceived interactivity of a sexual health text message service on young people’s attitudes, satisfaction and repeat use. *Health Education Research*, 30(6), 996-1003. [https://doi.org/10.1093/her/cyv056](https://doi.org/10.1093/her/cyv056).

Woolford, S. J., Clark, S. J., Strecher, V. J., & Resnicow, K. (2010). Tailored mobile phone text messages as an adjunct to obesity treatment for adolescents. *Journal of Telemedicine and Telecare*, 16(8), 458-461. [https://doi.org/10.1258/jtt.2010.100207](https://doi.org/10.1258/jtt.2010.100207).

Willoughby, J. F., & L’Engle, K. L. (2015). Influence of perceived interactivity of a sexual health text message service on young people’s attitudes, satisfaction and repeat use. *Health Education Research*, 30(6), 996-1003. [https://doi.org/10.1093/her/cyv056](https://doi.org/10.1093/her/cyv056).

Wyber, R., Khashram, M., Donnell, A., & Meyer-Rochow, G. Y. (2013). The greatest good: Use of text messages between doctors in a tertiary hospital. *Journal of Communication in Healthcare*, 6(1), 29-34. [https://doi.org/10.1177%2F0898010116685468](https://doi.org/10.1177%2F0898010116685468).

Ybarra, M. L., Prescott, T. L., & Holtrop, J. S. (2014). Steps in tailoring a text messaging-based smoking cessation program for young adults. *Journal of Health Community*, 19(12),1393-1407. [https://doi.org/10.1080/10810730.2014.901441](https://doi.org/10.1080/10810730.2014.901441).

Zhuang, R., Xiang, Y., Han, T., Yang, G-A., & Zhang, Y. (2016). Cell phone-based health education messaging improves health literacy. *Africa Health Science*,16(1), 311-318. [http://dx.doi.org/10.4314/ahs.v16i1.41](http://dx.doi.org/10.4314/ahs.v16i1.41).