PROMOTION OF PHYSICAL ACTIVITY THROUGH HEALTH APPLICATIONS AMONG STUDENTS OF SELECTED UNIVERSITIES – A PRELIMINARY STUDY

Lynn Smith[A, C, D]

Department of Sport and Movement Studies in the Faculty of Health Sciences, University of Johannesburg, Johannesburg, South Africa
ORCID: 0000-0002-8562-5004 | e-mail: lynnvr@uj.ac.za

Cheryl-Ann Volkwyn[A, B, C, D]

Department of Sport and Movement Studies in the Faculty of Health Sciences, University of Johannesburg, Johannesburg, South Africa
ORCID: 0000-0002-3248-2871

[A] Study Design; [B] Data Collection; [C] Statistical Analysis; [D] Manuscript Preparation

Abstract Mobile health applications provide individuals with a mobile tool that can be tailored to meet various health needs and physical activity goals, which is particularly important during the COVID-19 pandemic and the associated social distancing protocols. The consequence that the pandemic has on the mental health of university students has prompted and increased the demand of physical activity interventions.

The aim of this study was to determine the self-perceived effects of mobile health applications on physical activity participation among university students. Participants included students registered in one of the faculties at a university in Johannesburg.

Data collection took place by means of an electronic questionnaire using Google Forms as a platform, completed by a sample of 192 students.

The findings in the study reflected that majority of university students use health applications to increase physical activity levels or to track current activity levels. Participants also indicated that specific health applications were used to set goals, monitor progress and receive feedback. Aerobic activities proved to be the more popular type of physical activity in comparison to anaerobic activity.

This study concluded that health applications can be used as a tool to facilitate and promote physical activity participation in the university student population.

Key words health applications, physical activity, activity promotion

Introduction

The recent outbreak of the Coronavirus (COVID-19) pandemic has reshaped the landscape of fitness and healthcare, with the resulting objective of limiting the spread of the virus (Guida, Carpentieri, 2021). In pursuit of this objective, healthcare delivery has evolved to digital technologies to ensure that fitness and treatment continue as proficiently as possible (Vaishya, Javaid, Khan, Haleem, 2020). In 2016, there were approximately 8,000 mobile health applications in the Google Play Application Store and more than 20,000 in the Apple Application Store

(Zapata, Fernandez-Aleman, Idri, Toval, 2015). By 2018, it was predicted that the number of smartphone and tablet owners would reach 3.4 billion, and more than 50% of users would have downloaded a health application, proving that smartphones have become an important part of people's daily lives, relying on them to assisting with various tasks through multiple innovative applications (Bhuyan et al., 2016). Lazar, Koehler, Tanenbaum and Nguyen (2015) have analysed numerous ways on how smart devices can be used in our daily routines. Given the fact that 23% of the adult population worldwide do not meet the minimum recommended guidelines for physical activity, they have looked extensively at health technologies such as physical activity trackers, wearable devices, sensors, shoe-worn pedometers, and global positioning systems, to name a few, in an attempt to increase physical activity, decrease the risk of hypokinetic diseases and improve mental health (Mollee, Middelweerd, Kurvers, Klein, 2017; Lazar et al., 2015). Of particular relevance, numerous studies have reported that health applications have contributed to an overall increase in physical activity and decrease in sedentary time amongst its users (Payne, Lister, West, Bernhardt, 2015). A study conducted among college students concluded that the use of technology had a significant impact on their physical activity behaviour (Bice, Ball, Hollman, Adkins, 2019). They determined that smartphone and application use supports individuals in becoming more mindful of their activity and self-aware of the time they spend being physically active (Bice et al., 2018). These applications suggest a range of exercise modes and include instructional videos, features for sharing with friends, and user statistics and norms (Coughlin et al., 2015). Other application features include the tracking of user activities and steps, providing motivational messages, demonstrating correct techniques when exercising, various settings to increase motivation and allowing self-monitoring (Litman et al., 2015). The instructional video features to source health information are especially popular amongst students who do not have prior medical knowledge, but those with prior medical knowledge use health applications more frequently to acquire information (Coughlin et al., 2015). Advances such as this in mobile technology may provide some solutions to global health issues caused by physical inactivity. Given this information, the purpose of this study was to determine the effect that health applications would have on physical activity participation among university students.

Methods

Ethical clearance was obtained from the institution's Research Ethics Committee (REC-01-146-2017). Institutional permission recruit students to participate in the research study was also obtained. Prior to participation, participants were informed of their rights and responsibilities, and the purpose of the research was elucidated. Informed consent to participate as well as to use the results obtained from this study for future research was acquired from participants.

Study design

This study was a descriptive, cross-sectional study with a quantitative approach. A self-administered, electronic questionnaire analysing the use and popularity of health applications, and the ways in which they can be utilised to promote physical activity was distributed to university students.

Study population and sampling strategy

The purposive sampling method was used to recruit participants. All students registered in one of the faculties at a university in the Johannesburg region were invited to participate on a voluntary basis. Upon meeting the

inclusion criteria, a total of 192 students formed the study sample. Participants were required to complete an electronic questionnaire on the Google Forms platform, which was made available by means of a hyperlink posted on the university's Learning Management System. The first page of the questionnaire highlighted the inclusion criteria and consisted of questions pertaining to participants' consent to partake in the study. If consent was not granted, or participants did not meet the inclusion criteria, they were redirected to the end of the questionnaire and were not given access to complete it.

Data Collection

Students registered in one of the faculties at a university in Johannesburg were asked to complete the questionnaire. The questionnaire chosen for this study was adapted from Litman et al. (2015) and Stoyanov, Hides, Kavanagh, Zelenko, Tjondronegoro and Mani (2015). It was loaded in electronic format on Google Forms and consisted of five sections, namely: demographics, mobile application usage, weight management, physical activity, and motivation. Physical activity was assessed in section 4, and in this section, participants were required to indicate whether they used health applications for physical activity, as well as the type of exercise activities offered by health applications and their perceived effectiveness. The questionnaire made use of closed-ended, Likert scale questions and some questions allowed for multiple response answers.

Data analysis

Quantitative data for 192 participants was collected during this study. Descriptive and inferential statistics were computed using the Statistical Package for the Social Sciences (SPSS) for Windows version 24.0 (Green, Salkind, 2016). Split file analysis was applied to compare variables and inferential statistics were used to generalize from the specific sample and population that was used (Holcomb, 2016).

Pilot Study

Prior to the primary study being conducted, a pilot study was done with the purpose of assessing the contextual validity of the adapted questionnaire, the difficulty of the items, ambiguity of questions and the content, understanding and time taken to complete the questionnaire. The pilot study was conducted among 40 participants who were registered students in one of the faculties at a Johannesburg university. All participants met the inclusion criteria and used health related applications on their smart devices. Subsequent to the pilot study, some questions were revised and reworded. The order of the Likert Scale in which answers were displayed was also adjusted to improve statistical analysis. For these reasons, the participants and results from the pilot study were not included in the primary study.

Results

This study explored the effect of mobile health applications on physical activity participation among students registered in one faculty at a Johannesburg university.

Study demographics

The sample size was 192 participants, and its characteristics are tabulated.

Table 1. Sample demographics

		Number (Percentage)
Gender	Male	58 (30.2)
	Female	134 (69.8)
Age	17–22	109 (56.8)
	23–29	53 (27.6)
	30 and older	30 (15.6)

Table 1 indicates that from the total study sample, 134 participants (69.8%) were females, and 58 participants (30.2%) were males. The participants' ages ranged between a minimum of 17 years and maximum age of 30 years. The mean ± SD was 22.7 ±3.7, which indicates that the sample was heterogeneous in terms of age.

Physical activity participation

Participants were asked to report on their self-reported physical activity levels while using a health application centred around physical activity participation. Table 2 highlights the data obtained around setting specific physical activity goals and the influence of goal setting on physical activity participation.

Table 2. Goal setting and physical activity participation while using the health application

		Frequency (Percentage)
Did you set a specific goal to increase physical activity while using the health app	yes	143 (74.5)
	no	49 (25.5)
How did your participation in physical activity change while using the health applications	participation decreased	1 (0.5)
	participation did not change	68 (35.4)
	participation increased	123 (64.1)

Table 2 shows that 143 participants (74.5%) set a specific goal to increase their physical activity levels while using a health application. There were 123 participants (64.1%) that indicated that their participation increased while using the health application, 68 participants (35.4%) reported no change, and one participant (0.5%) reported a decrease in physical activity.

Participants were required to select their main reason for using a physical activity health application. Figure 1 shows that 100 participants (52%) used health applications to track their current physical activity, 63 participants (33%) indicated the reason was to do more physical activity, 31 participants (16%) rely on health applications to facilitate their weight loss goal and 13 participants (6%) use it for work purposes.

Illustrated in Figure 2 are types of physical activity the participants focused on while using the health application. The greatest number of participants, 119 (62%) indicated that they used it for aerobic exercise, 93 participants (48%) for anaerobic exercise such as weigh training, 30 participants (15%) for yoga, 18 participants (9%) for Pilates, and 68 (35%) and 29 participants (15%) for road running and cycling, respectively. The remaining 20 participants (10%) stated that they used the application for other forms of activity which were not listed in the questionnaire.
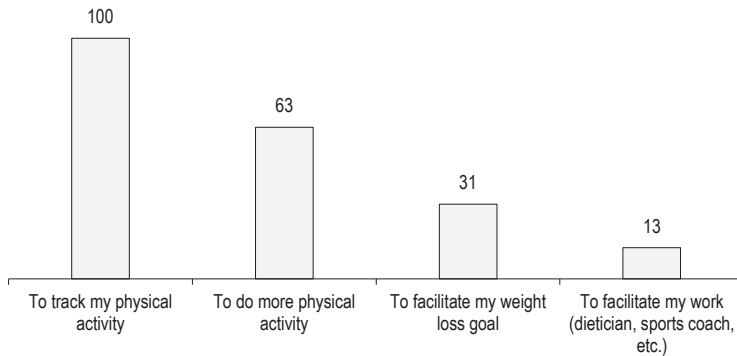
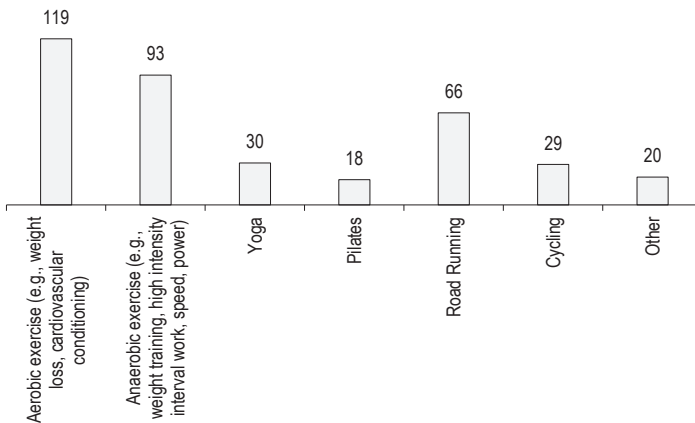**Figure 1.** Main reason for using physical activity health applications (n = 192)

Figure 2. Type of physical activity the user focused on (multiple response)

Discussion

The questionnaire utilized in this study analysed self-reported changes in physical activity in adjunct with the use of health applications. Students registered in a Faculty at a university on Johannesburg formed the study sample.

The novel COVID-19 pandemic has resulted in a decrease in physical activity of a global scale, due to the call to self-isolate (Hammami, Harrabi, Mohr, Krustrup, 2020). The American College of Sports Medicine has released a statement to make use of existing digital platforms to provide physical activity recommendations to individuals who wish to begin exercise programmes and for those who wish to maintain current fitness and strength (Denay et al., 2020). Most of the participants in the present study (74.5%) indicated that they set a specific physical activity

goal while using a health application. This finding is consistent with literature published by Bardus, van Beurden and Smith (2016), who stated that participants often use fitness technology for the purpose of goal setting, self-monitoring, and feedback. A little under a decade ago, approximately 40% of health applications included a goal setting function, such as a daily step count, which prompts users to set their daily step goal prior to using the application (Sullivan, Lachman, 2017). Research has shown that active monitoring together with feedback provided by the health application, can result in the translation of goal setting into an increase in physical activity (Sullivan, Lachman, 2017). This could justify why 64% of the participants in the present study indicated that health applications increased their physical activity levels. Similarly, a study assessing active monitoring on health applications showed that young to middle-aged men regularly made use of health applications and reported increases in physical activity (Saran, Pedrycz, Mucha, Mucha, 2018). In addition, an international study reported that the daily use of health applications on smartphones promoted physical activity in college students with health science-related majors (Penglee, Christiana, Battista, Rosenberg, 2019). Data analysed from January 2008 to January 2017 in a systematic review of 18 randomized controlled tests, concluded that exercise interventions comprising wearables and smartphone applications were effective in promoting physical activity in adults (Gal, May, van Overmeeren, Simons, Monninkhof, 2018). This finding is consistent with the data from the present study as 64.1% of the study population indicated that their physical activity increased while they were using a health-related application. Furthermore, the Eindhoven Running Survey done in 2014 indicated that 86% of the participants that completed the half marathon race reportedly used at least one or two monitoring smart devices over the preceding 12 months (Janssen, Scheerder, Thibaut, Brombacher, Vos, 2017). The results also showed that about 60% of the respondents used a smart sports watch and more than half of the respondents (53.3%) reported the use of applications (Janssen et al., 2017).

Most of participants in the present study cited tracking of physical activity as the mean reason for using health applications. A study conducted in the United States reported that wearable devices and health applications are used for sustained activity tracking in conditioned individuals, as well for initial use in those who are sedentary (Patel et al., 2017). A smaller proportion of the present study's sample (33%) indicated that they used health applications for the latter reason; the purpose of increasing their physical activity. This is consistent with longitudinal studies reporting that sedentary individuals were able to increase their daily steps by 2,500 with the use of step counters (Basset, Toth, LaMunion, Crouter, 2017). University students, particularly during the Covid-19 pandemic, are susceptible to sedentary behaviour, however, a pilot study demonstrated the effectiveness of using health applications to reduce sedentary time and increase the frequency of study breaks (Sui, Prapavessis, 2018).

The types of activities participants preferred to use health applications for varied from aerobic and anaerobic activities to yoga, Pilates, and road running (Schoeppe et al., 2016). In the present study, the three most common activities included aerobic training (62%), weight training (48%) and road running (35%). Similarly, research among children, adolescents and adults reported the aerobic exercises to be the most popular exercises with particular reference to walking, running, soccer and athletics (Hulteen et al., 2017). To corroborate the findings of the present study, previous research also conducted at a South African university revealed that students reported doing moderate- and vigorous intensity aerobic exercise on more days in comparison to strength training (Heeren et al., 2018).

Practical application

This research advocates for the online and remote delivery of health consultations, fitness assessments and exercise sessions. Individuals seeking comprehensive treatment for health conditions or unsupervised fitness routines tailored to their goals can access education-based interventions on mobile applications at a minimal cost. The findings of this study imply that mobile health applications are useful educational tools that can be used by patients and healthcare providers alike to monitor and promote health and wellness.

Conclusion

To conclude, most participants in this research study indicated that whether they were sedentary or physically active, the use of a health application increased their overall participation in physical activity. The promotion of physical activity was also prompted by setting goals related to activity, monitoring progress, and receiving feedback on the health applications, as well as the encouragement of performing activities that participants preferred and enjoyed.

Acknowledgements

References

Bardus, M., Van Beurden, S., Smith, J.C., Abraham, C. (2016). A review and content analysis of engagement, functionality, aesthetics, information quality, and change techniques in the most popular commercial apps for weight management. *International Journal of Behavioral Nutrition and Physical Activity*, *13* (1), 35. DOI: 10.1186/s12966-016-0359-9.

Bassett, D.R., Toth, L.P., Lamunion, S.R., Crouter, S.E. (2017). Step counting: a review of measurement considerations and health-related applications. *Sports Medicine*, *47* (7), 1303–1315. DOI: 10.1007/s40279-016-0663-1.

Bhuyan, S.S., Lu, N., Chandak, A., Kim, H., Wyant, D., Bhatt, J., Kedia, S., Chang, C.F. (2016). Use of mobile health applications for health-seeking behavior among US adults. *Journal of Medical Systems*, *40* (6), 153. DOI: 10.1007/s10916-016-0492-7.

Bice, M.R., Ball, J.W., Hollman, A., Adkins, M. (2019). Health technology use: Implications for physical activity behaviors among college students. *International Journal of Kinesiology in Higher Education*, *3* (1), 23–34. DOI: 10.1080/24711616.2018.1516524.

Coughlin, S.S., Whitehead, M., Sheats, J.Q., Mastromonico, J., Hardy, D. Smith, S.A. (2015). Smartphone applications for promoting healthy diet and nutrition: a literature review. *Jacobs Journal of Food and Nutrition*, *2* (3), 21.

Denay, K.L., Breslow, R.G., Turner, M.N., Nieman, D.C., Roberts, W.O., Best, T. M. (2020). ACSM call to action statement: COVID-19 considerations for sports and physical activity. *Current sports medicine reports*, *19* (8), 326–328. DOI: 10.1249/JSR.0000000000000739.

Gal, R., May, A.M., Van Overmeeren, E.J., Simons, M. Monninkhof, E.M. (2018). The effect of physical activity interventions comprising wearables and smartphone applications on physical activity: a systematic review and meta analysis. Sports Medicine Open, *4* (1), 42. DOI: 10.1186/s40798-018-0157-9.

Green, S., Salkind, N. (2016). *Using SPSS for Windows and Macintosh, books a la Carte*. Pearson.

Guida, C., Carpentieri, G. (2021). Quality of life in the urban environment and primary health services for the elderly during the COVID-19 pandemic: An application to the city of Milan (Italy). *Cities*, *110*, 103038. DOI: 10.1016/j.cities.2020.103038.

Hammami, A., Harrabi, B., Mohr, M., Krustrup, P. (2020). Physical activity and coronavirus disease 2019 (COVID-19): specific recommendations for home-based physical training. *Managing Sport and Leisure*, 1–6. DOI: 10.1080/23750472.2020.1757494.

Heeren, G.A., Jemmott III, J.B., Marange, C.S., Rumosa Gwaze, A., Batidzirai, J.M., Ngwane, Z., Mandeya, A., Tyler, J.C. (2018). Health-promotion intervention increases self-reported physical activity in sub-Saharan African University students: a randomized controlled pilot study. *Behavioral Medicine*, *44* (4), 297–305. DOI: 10.1080/08964289.2017.1350134.

Holcomb, Z. (2016). *Fundamentals of Descriptive Statistics*. Routledge.

Hulteen, R.M., Smith, J.J., Morgan, P.J., Barnett, L.M., Hallal, P.C., Colyvas, K., Lubans, D.R. (2017). Global participation in sport and leisure-time physical activities: A systematic review and meta-analysis. *Preventive medicine*, *95*, 14–25. DOI: 10.1016/j.ypmed.2016.11.027.

Janssen, M., Scheerder, J., Thibaut, E., Brombacher, A., Vos, S. (2017). Who uses running apps and sports watches? Determinants and consumer profiles of event runners' usage of running-related smartphone applications and sports watches. *PloS One*, *12* (7). DOI: 10.1371/journal.pone.0181167.

Lazar, A., Koehler, C., Tanenbaum, J. Nguyen, D.H. (2015). Why we use and abandon smart devices. *In Proceedings of the 2015 ACM International Joint Conference on Pervasive and Ubiquitous Computing*, 635–646. DOI: 10.1145/2750858.2804288.

Litman, L., Rosen, Z., Spierer, D., Weinberger-Litman, S., Goldschein, A. Robinson, J. (2015). Mobile exercise apps and increased leisure time exercise activity: a moderated mediation analysis of the role of self-efficacy and barriers. *Journal of medical Internet research*, *17* (8). DOI: 10.2196/jmir.4142.

Mollee, J., Middelweerd, A., Kurvers, R., Klein, M. (2017). What technological features are used in smartphone apps that promote physical activity? A review and content analysis. *Personal and Ubiquitous Computing*, *21* (4): 633–643. DOI: 10.1007/s00779-017-1023-3.

Patel, M.S., Foschini, L., Kurtzman, G.W., Zhu, J., Wang, W., Rareshide, C.A., Zbikowski, S.M. (2017). Using wearable devices and smartphones to track physical activity: initial activation, sustained use, and step counts across sociodemographic characteristics in a national sample. *Annals of internal medicine*, *167* (10), 755–757. DOI: 10.7326/M17-1495.

Payne, H., Lister, C., West, J., Bernhardt, J. (2015). Behavioral functionality of mobile apps in health interventions: a systematic review of the literature. *JMIR mHealth and uHealth*, *3* (1). DOI: 10.2196/mhealth.3335.

Penglee, N., Christiana, R.W., Battista, R.A., Rosenberg, E. (2019). Smartphone use and physical activity among college students in health science-related majors in the United States and Thailand. *International journal of environmental research and public health*, *16* (8), 1315. DOI: 10.3390/ijerph16081315.

Saran, T., Pedrycz, A., Mucha, D., Mucha, D. (2018). Follow-up monitoring of physical activity after rehabilitation by means of a mobile application: Effectiveness of measurements in different age groups. *Advances in Clinical and Experimental Medicine*, *27* (8), 1037–1044. DOI: 10.17219/acem/69131.

Schoeppe, S., Alley, S., Van Lippevelde, W., Bray, N.A., Williams, S.L., Duncan, M.J., Vandelanotte, C. (2016). Efficacy of interventions that use apps to improve diet, physical activity and sedentary behaviour: a systematic review. *The international journal of behavioral nutrition and physical activity*, *13* (1), 127. DOI: 10.1186/s12966-016-0454-y.

Stoyanov, S.R., Hides, L., Kavanagh, D.J., Zelenko, O., Tjondronegoro, D., Mani, M. (2015). Mobile app rating scale: a new tool for assessing the quality of health mobile apps. *JMIR mHealth and uHealth*, *3* (1). DOI: 10.2196/mhealth.3422.

Sui, W., Prapavessis, H. (2018). Standing Up for Student Health: An application of the health action process approach for reducing student sedentary behavior – randomised control pilot trial. *Applied Psychology: Health and Well-Being*, 10 (1), 87–107. DOI: 10.1111/aphw.12105.

Sullivan, A.N., Lachman, M.E. (2017). Behavior Change with Fitness Technology in Sedentary Adults: A Review of the Evidence for Increasing Physical Activity. *Frontiers in public health*, *4*, 289. DOI: 10.3389/fpubh.2016.00289.

Vaishya, R., Javaid, M., Khan, I.H., Haleem, A. (2020). Artificial Intelligence (AI) applications for COVID-19 pandemic. *Diabetes & Metabolic Syndrome: Clinical Research & Reviews*, *14* (4), 337–339. DOI: 10.1016/j.dsx.2020.04.012.

Zapata, B., Fernández-Alemán, J., Idri, A. Toval, A. (2015). Empirical studies on usability of mHealth apps: a systematic literature review. *Journal of Medical Systems*, *39* (2): 1. DOI:10.1007/s10916-014-0182-2.