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NATIONAL UNIVERSITY OF PHYSICAL EDUCATION AND
SPORTS FROM BUCHAREST
DOCTORAL SCHOOL**



**PHYSICAL ACTIVITY AWARENESS MODEL
IMPLEMENTATION WITHIN UNIVERSITIES FROM
QATAR**

**ABSTRACT
DOCTORAL THESIS**

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BUCHAREST – 2023

Background

Physical inactivity status worldwide

Scientific evidence shows that 31% of the world's population does not get enough physical activity and about 6-10% of major noncommunicable diseases worldwide are attributed to physical inactivity (cardiovascular disease, diabetes, high blood pressure, obesity, overweight, high blood cholesterol). The World Health Organization (WHO) states that in the Eastern Mediterranean Region (EMR), physical inactivity varies among the 22 countries between 14.1% (in Sudan) and 82.1% (in Saudi Arabia). In Qatar, the situation of adults aged 18-64 was reported in 2021 in the second edition of Qatar's National Physical Activity Guide, and the results are considered alarming: 41.4% of respondents were obese; 21.9% of respondents had high cholesterol levels; 16.7% of respondents had diabetes; 63.3% of the population between 18 and 64 years old do not participate in recreational physical activities; 86.2% of women aged 45-65 reported not participating in any form of vigorous physical activity.

Recent surveillance data show that 9.3% of people in Qatar die annually due to physical inactivity and 36.8% do not meet current global and national physical activity recommendations. Pratt et al. (2020) proposes that effective interventions shall be implemented to combat this situation. There is a need to improve and build capacity in the field to implement physical activity programs and an adequate allocation of resources for this area.

Barriers and solutions for physical activities in Qatar

The barriers that prevent adults from engaging in physical activity in Qatar are diverse. Extremely hot weather lasts for 6 months a year situation which limits the time spent outdoors hence most people are looking to spend their time in air-conditioned indoor spaces, consequently the use of public parks and outdoor recreation zones is very limited, too. Walseth et al. (2003) cites other condition that prevents adults from Qatar from engaging in physical activity, traditions, and culture. Although Islam encourages women to participate in sports, there are barriers to the use of the veil, gender segregation, and Muslim society's view of women and their sexuality.

The above-mentioned barriers for adults in Qatar to maintain an active lifestyle: high levels of obesity, lack of physical activity, the COVID-19 pandemic, tradition, and culture, are situations for which the state officials have created several documents, plans, and strategies to combat these conditions: Qatar National Vision 2030 (QNV 2030); Qatar National Health Strategy (QNHS 2018 - 2022); Qatar National Physical Activity Guidelines (QNPAG); Qatar National Sports Day (QNSD); Healthy 2022 World Cup: Creating a Legacy for Sport and Health; Step into Health (SIH).

Walking as a form of physical activity

Hanson et al (2015) consider in their scientific evidence in the field, that walking has ample benefits on human health. Walking regularly and for a long

time reduces systolic blood pressure and diastolic blood pressure, resting heart rate, body fat, body mass index, total cholesterol, depression, and increases VO₂max. Jackson et al (2008), Sisson et al (2008) and Allender et al (2006) talk about walking as a form of easy, accessible, and inexpensive physical activity, effective in involving adults in physical engagement, and they show that walking improves and maintains the general health of an individual.

Walking can be influenced by environmental factors, such as social considerations, related to the acceptability of walking among social groups, individual motivation to start walking regularly, and sustained commitment. Sisson et al (2008) established in the U.S. that community-based walking intervention programs help adults comply with national physical activity guidelines.

Plangger et al (2019) and Grajek et al (2021) talk about group walking as an approach to significantly increase the walking time while offering rewards that will meaningfully raise activity levels. [19, 20] Ogilvie et al (2007) and Richards et al (2016) reported that the use of pedometers, mobile step counting applications, and online messaging is a motivational strategy for adults to increase self-reported gait. Elizabeth et al (2019), Adrià et al (2016) demonstrate that the use of information and communication technologies (e.g., walking devices, mobile applications, and web-based interventions) are effective in changing behavior toward a healthier lifestyle. Factors such as managing time, motivation, and reminders are important in promoting this type of behavior for adults. Vetrovsky et al (2018) establishes that the use of e-mail communication during pedometer-based interventions is feasible and has the potential to enhance physical activity levels.

This PhD thesis presents a physical activity awareness model at Qatar community level over 13 chapters structured in 3 main parts and emphasizes that there is a need to improve physical activity awareness promotion in Qatar, combat the existence of physical activity barriers to improve the national recommendations and to align the organizational strategies in the field in order to provide a stronger impact on the physical activity benefits at the community level, thus to contribute to the national vision fulfillment.

Objectives

- Design a logic model to engage adults (18-64) from universities in learning the concept of physical activity for health as an approach to the community's wellbeing in Qatar (Part I).
- Study the impact of a walking program on Qatar community's physical activity levels and involvement while evaluating the effect of step measurement devices use, such as pedometers and mobile applications (Part II).

- Evaluates the effect of online messaging intervention to engage adults from Qatar community in physical activity implemented as walking intervention. The concept of online messaging intervention as motivation and awareness of physical activity in Qatar is explored. Study population is encouraged to achieve the goal of 10,000 steps/day using pedometers and mobile applications as step measuring instruments. (Part III)

Methods

Part I presents a theoretical study which emphasizes the importance of structured walking programs in Qatar and provides conceptual data for a logic walking program model addressed to adults from universities, using evaluation cycle components, step measurement theories, ways of engaging participants in the program and types of walking intervention designs. The measurable components of the logic model are: goal - a statement of the change that the program intends to make during the program journey; conditions - resources needed to implement the program; inputs - activities or actions needed to implement the program while making use of the resources; outputs - results of program activities expressed in terms of size and/or scope of services and products delivered or produced by the program; outcomes - results reflecting the changes that occur or the difference that is made for individuals, groups, families, organizations, systems or communities during or after the program.

Part II grants an evaluation of a real-world intervention. The main component of this study consists of an impact evaluation of changes in average daily step counts measured by pedometers and mobile phones applications. The intervention of this study was developed in two phases in 15 campuses from Qatar. Participants were recruited through the distribution of face-to-face, online and written promotional materials during a two-day visit from the SIH coordinating team to each site.

Part III employs a randomized pretest-posttest experimental study method with a follow-up period at 16 weeks after intervention completion. The eligible population has been randomly assigned to experimental group and control group and at 16 weeks after intervention, they were invited to complete online the International Physical Activity Questionnaire (IPAQ). The eligible population, participants in the Step into Health (SIH) program, are randomly assigned to one of two groups: Group 1 (experimental), which receives the intervention, and Group 2 (control) without intervention. The study population, pedometers and mobile applications users, were invited to participate in an 8 weeks physical activity intervention based on walking daily 10,000 steps and more. During this time, the experiment group received 16 messages through email and 16 phone SMS, twice a week, containing educational messages related to Qatar National Physical Activity Guidelines. (QNPAG, aspetar.com, 2021). After the intervention, the research population was not contacted for 16 weeks; afterwards,

the research team invited participants for a period of 4 weeks to complete the short form of IPAQ questionnaire. The 7 questions investigated the types of physical activities people do as part of their daily lives and the time spent as physically active in the last 7 days.

For Part I and Part II of the thesis the daily number of steps was measured using two types of equipment. One method is the Omron HJ-324U pedometer (Omron Healthcare Co., Ltd., Japan) [26]. This device has a USB connection that allows participants to upload recorded information; it is electronically supported by an online self-monitoring account and connected to the SIH web database. An efficient step recording was considered in this study during the recruitment process when the participants were advised to carry the pedometers at the hip level. The second method of measuring the steps is through the mobile application. It measures accumulated steps, monitors athletic performance, and compares it to the average healthy standard of 10,000 steps per day. The app offers several features designed to monitor fitness levels. In addition to counting steps and measuring distance, it also calculates calories and the amount of fat burned. The results obtained on the app are synchronized to the SIH program website, where overall performance and achievements can be monitored. To evaluate the physical activity interventions the number of daily steps is classified into the following categories: less than 5,000 steps per day - sedentary lifestyle index, 5,000-7,499 steps per day - low active, 7,500- 9,999 steps per day, active, more than 10,000 steps per day - active, more than 12,500 steps per day - very active. The average of steps uploads to the system is also calculated.

Target population

This research targets adults in the Qatar community registered SIH members which previously consented to their involvement in the program and participated on other occasions in SIH walking initiatives. The research population represents healthy adults in the Qatar community conforming with the inclusion criteria of 18 to 64 years old, women, and men, of different nationalities registered and active members of SIH program which consented their participation to the study and currently have pedometers or the steps measurement app on their mobile phones. Inclusion and exclusion criteria were applied.

The study population in Part II are members of the SIH in Campuses walking program which is part of the Step into Health program in Qatar. It encourages people to become more active and healthier through a walking intervention in 2 phases delivered as walking competition. This yielded in the first phase 288 participants. In the second phase of this impact evaluation, January - May 2019, the people in the above-mentioned target group continued to benefit from pedometers and walking applications received in the first phase and brought together 109 participants aged 18 – 64 which continued to self-report their walking achievements.

The sample population targeted in Part III of the thesis was randomly selected from all SIH Program registered members from the beginning of the program to the present. The cohort group underwent eligibility examination. Eligible subjects received the walking intervention and parallel educational messages through online messaging according to the type of randomized experimental research pretest-posttest with the control group (RCT). Once the intervention was completed, the number of daily steps performed by the subjects was analyzed. The sample size enclosed active members of different SIH community settings (SIH Qatar Community, SIH Campuses, SIH Workplaces) with a total of 299 participants (143 adults control group, 156 adults experiment group, 68 (22.7%) adults IPAQ participants).

Results

The theoretical study of part I study gives evidence of the importance and effectiveness of planned and structured walking interventions in Qatar. The use of the logic model brings measurable achievements, providing a systematic approach and identification of results in the short term as formative evaluation, in the medium term as process evaluation and in the long term as outcome evaluation. In a walking intervention, formative evaluation provides needs assessment results, process evaluation provides step-count results and motivational levels, and outcome evaluation highlights changes in lifestyle habits towards healthier choices. The logic model for walking interventions in Qatar universities, which was applied between December 2017 and December 2021 describes a program delivered as an intervention to increase the level of physical activity among the population by implementing and promoting safe, accessible and environmentally friendly walking as an enjoyable activity for all citizens. The model provides a map of activities to be implemented on campuses and targets adults aged 18-64, part of the university community in Qatar. The logic model components presented are the following: Program Goal, Aim, Inputs, Outputs, Outcomes (short and medium term), Impact (long term): Formative evaluation: existence of a high number of campuses to apply the program and existence of a health program to be implemented. Process evaluation: all parties involved should be willing to continue the program over time. This type of intervention can be complemented by an enhanced walking infrastructure. Walking is an ideal physical activity intervention to improve the health and awareness of the population. The logic model for engaging adults in physical activism for a healthy lifestyle proposes an educational approach as part of the walking program. Education is a system of circumstances and actions provided at the society level to shape personalities and behaviors.

The results of Part II present a quantitative overview of the data obtained by the 288 participants in the walking program throughout January - May 2018 (phase 1) and 109 participants January - May 2019 (phase 2), as well as an

analysis and interpretation of the data obtained by the 104 common participants in both phases. The age groups 35 – 54 comprised approximately 52% of the total study population (a total of 57 adults), thus, representing the adult population, staff and employees of university environment. Even though the campuses environment offers adequate recreational facilities and tools to all its members, the students showed less interest in engaging in this type of walking program. In terms of nationality, the non-Qatari expressed a higher interest in this type of walking program representing 81% (86 adults) out of total common population. The females preferred mobile application use (29 ladies) over the pedometers (24 ladies). Based on BMI self-reporting system, a bigger number of participants, both users of mobile applications (25 participants) and pedometers (23 participants) were registered in the overweight (25-30) category. During phase 1 of walking intervention the participants received reminders and technical support related to the mobile technology use and the $p = 0.000$ value shows a significant increase in steps uploads for pedometer users and mobile application users. The step uploads data showed an increase in daily recordings during the intervention phase 1 and since same participants were assessed into two different situations this increase can be directly attributed to the intervention materials, tools, and efforts. The walking competition intervention based on reminders, presentations about the mobile technology use and educational sessions related to benefits of walking for a healthier lifestyle was viewed as an effective way of engaging members in using mobile technology for active lifestyle. Both interventions took place during wintertime in Qatar where the weather allowed participants to walk more outside and around campuses. During summer time in Qatar, people are tending to perform less physical activity.

Part III of the thesis presents the results related to:

a. Prevalence of physical activity amongst study population:

The occurrences were assessed for both groups control and experiment, while considering the pre, during, and post-intervention timings as well as the 5 different steps' categories. Comparing the two groups (control and experiment), it is noticeable that, during the intervention stage of the research, the online messaging intervention had a positive impact on the adults of the experiment group with a low active lifestyle (5,000-7,499 steps per day) when they participated in a higher percentage in the walking program, although according to the national physical activity guidelines, their physical activity level is still low. The category of active adults of the experiment group (more than 10,000 steps per day) those who meet the national recommendations, had a decreasing prevalence before intervention - 21 adults (14.0%), during - 18 adults (13.4%), and after intervention - 14 adults (11.7%) (figure 2), in contrast to the active adults from the control group which had an increasing evolution from one period of research to another (pre-intervention - 16 adults (11.7%), along the way - 17 adults (13.7%), post-intervention - 19 adults (17.9%)) (figure 1). Hence, adults which have already understood the importance of regular physical activity and

are already active can motivate themselves to maintain their physical activity, already being part of their lifestyle.

b. Average steps per day amongst the study population

Regarding the results of the average daily steps, the control group had a lower average daily step in each research period (pre - 7644 ± 425 , during - 7866 ± 417 , post - 7639 ± 398), in comparison with the experimental group (pre - 8154 ± 403 , during - 8128 ± 395 , post - 7754 ± 377). Both groups fall into the category of 7,500-9,999 steps per day, somewhat active. The common denominator of the two groups is that in the post-intervention research period, both groups recorded the lowest average of steps per day (control - 7639 ± 398 and experiment - 7754 ± 377) (figure 3) which may be associated with the existence of wave 3 restrictions imposed by COVID-19 pandemic in Qatar. Statistically, the results are insignificant for both groups.

c. Average steps comparative analysis among pedometers and mobile applications users

Out of the total research population (299 adults), 180 used the mobile application, and 119 used pedometers throughout the research stages. Mobile app users of both groups (the control group and the experiment group), positioned themselves in the low physical activity category (5,000-7,499 steps per day) throughout the research period. The pedometers users of both groups (the control group and the experiment group), stood in the somewhat active physical activity category during the research period (7,500-9,999 steps per day). Compared to pedometers users (119 adults within somewhat active physical activity category of 7,500-9,999 steps per day), the mobile app users (180 adults within low physical activity category of 5,000-7,499 steps per day) are more numerous nevertheless, less active.

d. International Physical Activity Questionnaire (IPAQ) results

The IPAQ results related to the general characteristics of the study population such as group distribution, demographics and levels of physical activity deployed that from the total study population of 299 (100%) adults, 68 (22.7%) of them participated in completing the questionnaire, while 231 (77.3%) of them did not respond to the invitation. The results related to the study population's demographic characteristics presented the following findings: men (control group 31(83.7%) / experimental group 29 (93.5%)) participate in physical activities in greater numbers than women (control group 6 (16.2%) / experimental group 2 (6.4%)); adults aged 35-55 years (control group 24(64.8%)/experimental group 21(67.7%) and adults with BMI 26 – 30 kg/m² (control group 17 (45.9%)/experimental group experiment 14(45.1%) are more numerous in practicing physical activities. Participants of non-Qatari nationality (control group 31(83.7%)/experimental group 25(80.6%)) engage in physical activities in greater numbers (group of control 6(16.2%)/experimental group 6(19.3%) than those of Qatari nationality, and adults who are part of the Qatari workplace community (control group 24(64.8%)/experimental group 21(67.7%)

participate in greater number in physical activities to improve health. After 16 weeks from the intervention, the IPAQ Group (68 (100%)) adults recorded the highest participation in vigorous intensity physical activities (control group 22 (59.4%)/experimental group 15 (48.3%)) followed by moderate-intensity physical activities (control group 9 (24.3%)/experimental group 12 (38.7%)), and the fewest adults were identified in the low-intensity physical activity category (control group 6 (16.2%) /experiment group 4 (12.9%)). The results of steps per day of the adults who completed the IPAQ questionnaire (68 (22.7%)) oscillated during the walking program between the "somewhat physically active" category (7,500-9,999 steps/day) and the "physically active" category with 10,000+ steps/day, while the self-reported results in the questionnaire state that participants oscillated between the "vigorous" and "moderate" physical activity categories. The assessment of their own level of physical activity similar to the data reported by the step measuring devices demonstrates that the adults in the IPAQ group (68 (22.7%)) have a good awareness of their own physical activity. At the same time, the long-term participation, of the 68 (22.7 %) adults, (September 2021-July 2022) in physical activity both, during and after the walking program, indicates active behavior. Walking program combined with online messaging has the effect of engaging Qatar community in physical activity after 16 weeks since the program stopped on a percentage of 22.7% adults of the total study population while 77.3% of them stopped reporting their physical activity performance or using the step count devices.

Conclusions

A combination between the logic model, educational map, proper step-counting tools and appropriate intervention design according to the needs of the target audience is a successful journey to engage participants in a walking program. The authors of this paper recommend the implementation of planned intervention programs in Qatar with the purpose of impacting the community at national level through physical activity guidelines supporting the prevention of non-communicable diseases.

This study provided evidence that a mix of walking competitions, use of mobile technology to evaluate step counts, notifications systems and awareness presentations is an intervention that successfully engages adults from campuses in Qatar into healthy lifestyle. Based on these findings we would like to recommend a controlled design.

Qatar has many strategies and programs to promote physical activity among the population to increase awareness of regular physical activity and its benefits. Qatar's efforts in this direction are in line with global practices in the field.

The prevalence of physical activity findings amongst the study population supported hypothesis 1. SIH walking program engaged Qatar community adults (18-64 years) in regular walking as a form of physical activity. Participants stated

an interest in making use of the steps measuring devices to report steps achievements during the entire research period helping them to understand their physical activity level. The online messaging intervention has a positive effect on the adults with a sedentary lifestyle index helping them to reach the low active lifestyle category (5,000-7,499 steps per day), through increased health benefits awareness. A walking program in Qatar that deploys a combination of online messaging intervention, use of steps measuring devices (mobile applications and pedometers), and implemented during cool weather in desert climate, stimulates the population with a low physical activity level (5,000-7,499 steps per day) and provides sustenance to an active lifestyle enrichment.

The average steps per day amongst the study population reveals that the experiment group's participation in the walking program did not display statistically significant differences in regular engagement in physical activity compared to the control group hence hypothesis number 2 of this paper is not validated.

The restrictions of the COVID-19 pandemic hurt the physical activity levels of the research population hence hypothesis number 3 of this paper is not validated. During the end of intervention weeks and post-intervention research periods, both groups recorded the lowest average of steps per day (control - 7639 ± 398 and experiment - 7754 ± 377) (figure 3) when wave 3 restrictions of the COVID-19 pandemic were imposed. The restrictions execution on slowing the spread of COVID-19 virus in Qatar had priority amongst the study population since the online messaging intervention, statistically, did not increase physical activity levels.

The long-time participation of the 68 (22.7%) adults, (September 2021-July 2022) in physical activity both, during the walking program and after its completion, indicates an active, efficient and acquired behavior; the walking program combined with online messaging motivated a percentage of 22.7% of adults to continue an active lifestyle, at 16 weeks after the end of the intervention. Self-rated physical activity level similar to data reported by pedometers demonstrates that adults in the IPAQ sample (68 (22.7%)) have a good awareness of their own physical activity. The statistical findings demonstrate that walking in combination with online messaging programs implemented among adults in the Qatari community can increase awareness of the health benefits of physical activity by forming the basis of an active lifestyle. The Qatari community has a high preference for using mobile phone walking apps compared to pedometers, The present work highlights that the population that prefers this type of physical activity and seeks participation in organized walking programs are adults between the ages of 35-55. Significant research results demonstrate that the walking program with online messaging intervention improves physical activity in overweight adults (BMI 25.01 - 30.00 kg/m²). The research population representative of the Qatari university community met Qatari national physical activity recommendations and responded effectively to walking programs with

pedometers tending to remain in the active population category (10000+ steps/day). The current study reinforces previous scientific evidence that walking interventions in Qatar conducted during autumn/winter increase participants' step count when weather conditions favor outdoor activities.

Publications

- Salih Khidir D., Stănescu M., Sayegh S. *Logic model for walking interventions in Qatar*. Discobolul Volume 60, Supplementary Issue - 2021 Pages: 530-544, <https://doi.org/10.35189/dpeskj.2021.60.s1>
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- Salih Khidir D., Stănescu M., Abdulaziz F., Sayegh S., Bota A. *Effect of online messaging intervention to engage adults from the Qatar community in physical activity*. Pro Edu. International Journal of Educational Sciences No. 7, Year 4/2022. <https://peijes.com/> e- ISSN 2668-5825, p-ISSN 2668-5817. December 2022 <https://doi.org/10.26520/peijes.2022.7.4.5-18>

Keywords: physical activity, logic model, planning, walking intervention, online messaging, pedometer, IPAQ, mobile application, steps, awareness.