

Type 2 Diabetes Patients' Need for Physical Activity Programming: A Qualitative Study at a Yogyakarta Hospital Clinic

Kebutuhan Penderita Diabetes Tipe 2 terhadap Program Aktivitas Fisik: Penelitian Kualitatif di Rumah Sakit di Yogyakarta

Novita Intan Arovah*, Bernadeta Wara Kushartanti*, Tracy L Washington**, Kristiann C Heesch***

*Sport Science Faculty, Yogyakarta State University, Yogyakarta, Indonesia** School of Public Health and Social Work, Queensland University of Technology, Queensland, Australia ***Institute of Health & Biomedical Innovation, Queensland University of Technology, Queensland, Australia

Abstract

Physical activity programs offered in Indonesian hospitals are often inadequate to accommodate type 2 diabetes (T2D) patient's physical activity. This study aimed to identify the enablers and barriers to T2D patients' physical activity as well as their preferences and in experiences with physical activity program, with a view to developing future programs that are best suited to these patients' needs and preferences. Four focus group were conducted with 28 patients (50% female) of the T2D clinic at the Yogyakarta Public Hospital. Thematic analysis was carried out using NVivo 10. The most commonly reported types of physical activity were walking and participation in the hospital-based exercise program. Participants were motivated to be physically active for the health benefits and for social interaction. The main barriers to physical activity were a lack of enjoyment, the absence of knowledge about appropriate activities for T2D patients, and a shortage of time due to social and family obligations.

Keywords: Diabetes, exercise, health promotion, physical activity, qualitative

Abstrak

Program aktivitas fisik pada penderita diabetes tipe 2 (T2D) di rumah sakit di Indonesia sering kali belum dapat membantu pasien mencapai tingkat aktivitas fisik yang dianjurkan. Penelitian ini bertujuan untuk mempelajari penghambat dan pendukung perilaku aktivitas fisik pasien T2D, serta kebutuhan dan pengalaman mereka terhadap program aktivitas fisik, agar dapat mengembangkan program aktivitas fisik yang sesuai dengan kebutuhan mereka. Empat diskusi kelompok dilakukan dengan 28 pasien T2D di Rumah Sakit Umum Daerah Yogyakarta. Analisis tematik dilakukan dengan menggunakan NVivo 10. Jenis aktivitas fisik yang paling sering dilaporkan adalah jalan kaki serta mengikuti program olahraga di rumah sakit. Peserta melakukan aktivitas fisik supaya mendapat manfaat kesehatan dan untuk interaksi sosial. Hambatan utama yang dilaporkan adalah kurang menikmati aktivitas fisik khususnya olahraga, tidak memiliki pengetahuan yang cukup tentang aktivitas fisik yang sesuai untuk pasien T2D, serta keterbatasan waktu yang dikarenakan oleh kewajiban sosial dan keluarga.

Kata kunci: Diabetes, olahraga, promosi kesehatan, aktivitas fisik, kualitatif

How to Cite: Arovah NI, Kushartanti BW, Washington TL, Heesch KC. Physical activity programming for type 2 diabetes patients' need: a qualitative study at a Yogyakarta hospital clinic. *Kesmas: Public Health Journal*. 2019; 13 (4): 169-176. (DOI:10.21109/kesmas.v13i4.1942)

Correspondence: Novita Intan Arovah, Sports Science Faculty, Yogyakarta State University, Colombo Street No 1 Karang Malang Yogyakarta, 55281, E-mail: novita@uny.ac.id, Phone: +62274513092
Received : December 19th 2017
Revised : February 19th 2019
Accepted : March 13th 2019

Introduction

Indonesia has 10 million cases of type 2 diabetes (T2D), the seventh highest number in the world.¹ Currently, Indonesia is challenged by escalating numbers of healthy years lost from T2D and high health expenditures associated with managing T2D cases.^{2,3} According to the Indonesian Ministry of Health⁴ the highest prevalence of diagnosed T2D cases in Indonesia exists in Yogyakarta (2.6%). Therefore, preventing T2D complications among T2D patients should be a public health priority in Indonesia, especially in urban areas such as Yogyakarta City.

Physical activity is critical to preventing T2D complications: it improves glycemic control,^{5,6} body mass index,^{7,8} arterial stiffness,⁹ and systemic inflammation.⁹ Yet, physical activity programming is relatively underutilized in Indonesia, which may be due to a dearth of practical physical activity programs that have achieved sustained, long-term improvement in physical activity levels and a lack of knowledge about the most appropriate ways to promote physical activity to T2D patients.

Currently, physical activity programs for Indonesian T2D patients are generally offered on a weekly basis as one-hour group exercise sessions in hospitals. Although these programs provide the right type of health-enhancing physical activity, the frequency at which they are available is insufficient for meeting international physical activity recommendations.¹⁰ Efforts to increase the frequency are often stymied by limited resources. Therefore, there is a pressing need to develop less resource-intensive physical activity programs that will help T2D patients meet physical activity recommendations, allowing them to successfully manage the complications of T2D.

The development of effective hospital-based physical activity programs requires an understanding of T2D patients' preferences for physical activity programming and influences on their physical activity participation. Previous research suggests that the perceived barriers and benefits of physical activity included within various behavior change theories significantly influence physical activity participation.^{11,12} This study explored Indonesian T2D patients' perceived barriers to and benefits of physical activity participation as well as their preferences for and experience with current physical activity programming. The outcomes of this research can inform the development of hospital-based physical activity programming tailored to the needs of T2D patients going forward.

Method

Participants were purposively selected from a cohort of clinically diagnosed T2D patients attending the T2D clinic at a public hospital in Yogyakarta, Indonesia. The

inclusion criteria were having a confirmed T2D diagnosis in their medical record and no health condition preventing physical activity. Participants were recruited via fliers and brochures in the Indonesian language (Bahasa) that were placed in the hospital clinic waiting room. To recruit participants, the lead author established a temporary desk in the waiting room to answer questions about the study. Potential participants were initially screened in person, and patients' written consent was obtained before reviewing their medical records. Eligible participants were subsequently invited to participate in a focus group via a phone call from the lead author.

Focus groups were conducted at the public hospital. To maintain homogeneity within each group, each participant was assigned to a group based on their gender and physical activity level, resulting in the following four groups: one physically active women's group, one physically active men's group, one physically inactive women's group, and one physically inactive men's group. Physically active participants were defined as patients who attended the weekly, one-hour hospital-based T2D physical activity program or any other formal physical activity program lasting more than or equal 60 minutes per week. At this level, the programming is the typical amount of physical activity programming available for Indonesian T2D patients. Patients who performed less than this amount of physical activity were defined as physically inactive. This study recruited both physically active and inactive patients; although physically inactive T2D patients represent the main target population for future physical activity programming, physically active patients are still secondary targets, given that most are not meeting international physical activity recommendations for moderate-intensity physical activity (more than equal 150 minutes/week).¹³

The lead author moderated and audio-recorded the focus group sessions in the Indonesian language. She asked participants to describe their physical activity participation and then asked questions to address the study's objectives. The questions were as follows: (1) What are the benefits for you of doing physical activity?; (2) Are there any benefits of increasing your physical activity level for managing your T2D?; (3) What has motivated or would motivate you to be more physically active?; (4) What are factors/conditions which prevent you from being physically active?; (5) What do you think of the current physical activity promotion program in the hospital?; and (6) What else could the hospital provide to support you to increase your physical activity level? After participating in a focus group, each participant received an incentive of IDR 100.000 to cover their transport expenses.

Focus group recordings were transcribed verbatim.

The lead author conducted a thematic analysis using NVivo 10 qualitative software. The analyses were as follows: familiarization with the data, generating initial codes, identifying themes with codes, reviewing themes, finalizing the resultant themes, and synthesizing the themes. The final themes were confirmed in consultation with the co-authors. Based on the themes, the authors made final recommendations for developing future physical activity interventions in Indonesian hospital settings.

Ethical clearance for the study was obtained from the Human Research Ethics Committee of Queensland University of Technology (Approval Number: 140000886).

Results

Twenty-eight participants (50% female) attended four focus groups. Eight participants attended each physically active group, and six participants attended each physical-

ly inactive group. Participants were aged 62.8 ± 5.4 years. On average, men were older than women, with a mean age of 66.5 ± 4.6 vs. 61.6 ± 5.1 years for physically active men and women, respectively, and 62.8 ± 2.3 vs. 59.6 ± 6.8 for physically inactive men and women, respectively. The key themes that emerged are listed in Table 1.

When asked about their physical activity participation, participants tended to describe their exercise routines. Physically inactive participants reported that they exercised “never” or “rarely.” Physically active participants stated that they regularly exercised at least weekly: most attended the hospital’s once-weekly physical activity program and exercised (usually walked) on their own. Some physically active women joined community physical activity programs, but no physically active men joined such programs. A few physically active participants reported they sometimes did other activities, such as bicycling, stair climbing, and breathing exercises.

Physical activity benefits were coded into physiologi-

Table 1. Key Themes within Four Codes

Code	Theme	Specific within Theme
Physical activity patterns	Frequency	None Irregular once per week
	Type	Community T2D exercise program in hospital Other aerobic exercise programs Exercise on own Combination (physical activity program & on own)
Perceived physical activity enablers	Physical benefit	Feel alert and fit Health Plasma glucose control Prevent type 2 diabetes complications Increased longevity (anti-aging)
	Psychological enabler	Enjoy exercise Social support Encouragement by other type 2 diabetes patients Enjoy social interaction
Perceived physical activity barriers	Physical barrier	Pain related to comorbidities Physical impairment related to type 2 diabetes Physically unfit (persistent) Physically unfit (occasional)
	Psychological barrier	Lack of enjoyment from exercise Lack of motivation Lack of time Lack of knowledge Lack of skill to join exercise programs Lack of positive outcomes
	Social-related barrier	Social responsibilities
	Environmental barrier	Lack of encouragement to do physical activity Distance/transportation to physical activity program Weather
	Perceptions of physical activity programs	Hospital programming
	Perceived needs for physical activity programming	Incorporate educational opportunities Increase frequency of physical activity Add clinical evaluations Greater variety of physical activity programs Add consultations with health providers Do better marketing of physical activity programs

cal, psychological, and social benefits. Unsurprisingly, these benefits were reported by more physically active participants than by their physically inactive counterparts.

The physiological benefits reported include: (1) physical fitness improvements; (2) blood glucose control; (3) T2D complication management; and (4) prolonged longevity. Among these, physical fitness was the most often reported benefit, followed by blood glucose control. One physically active man reported that regular physical activity helped control his blood glucose level by decreasing his reliance on oral anti-diabetic drugs. He stated, "After doing the exercise, I do not take the drug... If I take the medicine after doing the exercise, [my blood glucose] will drop; therefore, I skip it." Avoiding T2D complications was clearly important as well. A physically active man commented, "My heart goes out to some of my T2D friends who once looked healthy, but now they cannot even walk on their own. I don't want to get the same ordeal: that's why I do the exercise."

Physically active women tended to report a sense of enjoyment from exercising, whereas physically inactive men perceived an obligation to exercise to manage their T2D. A sense of accomplishment was another psychological benefit, especially among regular walkers, who reported that they felt a sense of accomplishment when they reached their self-created walking target (e.g., walking steps, distance, or time). The target was measured using various methods, such as timing their walks and designating specific start-stop points. Some techniques were less conventional but still effective. For example, a physically active man reported, "In my neighborhood park, I often see people put things, such as stones or sticks, in the pot plants in the corner of the walking path; it turns out that they put in one per lap." Participants attending physical activity programs reported that a benefit of joining these programs was the structure they provided to their exercise routines.

Most physically active participants reported that they appreciated the opportunity the hospital physical activity program offered for socializing with other T2D patients. One female participant mentioned, "Meeting my friend in the exercise class always makes me happy and helps me forget about my problems at home." Likewise, those who exercised independently (e.g., walkers) enjoyed the opportunity to socialize with walking companions and with acquaintances they met during their walks. A male participant reported, "When for some reason I miss my walking routine, let's say for 1 or 2 days, many people will ask me: 'where have you been?', in a way that makes me happy because it means that many people care for me." Participants reported that this type of support, in addition to other physiological and psychological benefits, motivated them to continue to exercise.

Barriers that prevented participants from increasing their physical activity levels or joining physical activity programs were classified into physiological, psychological, social, and environmental barriers.

Perceived physiological barriers differed for physically active and physically inactive participants. Physically active participants reported that occasional feelings of being physically unfit temporarily reduced their participation in physical activity. In contrast, physically inactive participants reported more persistent feelings of being too physically unfit to engage in physical activity and that pain related to comorbidities and T2D-related impairment were significant barriers to participation in regular physical activity. One female participant complained, "I actually would like to do more exercise; however, sometimes it is often just too painful for me, as doctors told me that I have osteoarthritis and gout in my knees."

Each participant reported at least one of six psychological barriers. These were: (1) lack of enjoyment from doing physical activity; (2) lack of motivation; (3) lack of time; (4) lack of knowledge about appropriate physical activity for T2D patients; (5) lack of confidence in their ability to do the exercises in physical activity programs; and (6) lack of positive outcomes, particularly T2D clinical outcomes. These barriers were mainly reported by physically inactive participants. However, physically active participants also described a lack of knowledge about appropriate physical activity for T2D patients. One such participant reported, "Frankly, there is still very limited information about exercise and diabetes." For most participants, this lack of knowledge was the main barrier to their participation in physical activity.

Living in a relatively communal society, most physically active participants reported that their scheduled exercise sessions occasionally conflicted with social responsibilities, such as attending community gatherings. Some physically inactive participants said that family obligations and a lack of encouragement by family members to participate in physical activity were deterring them from being physically active. A physically inactive female participant said, "I often do not have enough time to do exercise; in fact, I even decided to retire from my work to care for my elderly mother who needs my support almost constantly."

Poor weather was identified as an occasional barrier to doing physical activity on their own in the outdoors and to participating in the hospital physical activity program because it was conducted outdoors. Long distances and poor transportation options for reaching the hospital physical activity program were also noted, particularly by physically inactive women. One physically inactive female participant mentioned, "I cannot drive and unfortunately my house is quite far away from this

hospital. Therefore, it deters me from participating in the hospital exercise program." Dissatisfaction with the hospital's physical activity facilities was mentioned by a few physically active and inactive participants as these participants perceived that the hospital parking lot, where the program was held, was inadequate.

A few physically inactive participants reported that they were unaware of the hospital's physical activity program because their doctors had not referred them to the program; more generally, there was little information available to patients about the program. A physically inactive woman stated, "I guess we need more publications about the hospital program so that more people will be aware of it." However, most participants were aware of the program and had positive perceptions of it. A physically active woman commented, "I think the program is really good. I am happy [with] the instructors [and] my friends [in the program]. So far so good!" Likewise, a physically inactive man stated, "I think that it is indeed a good program, but the factor is just me. I just don't have an urge to join it." Participants across groups suggested that future programming should include (1) more educational programming; (2) more frequent exercise sessions; (3) regular clinical evaluations; (4) more intensive contact time with physical activity promotion officers (face-to-face or using a medium like text messaging); and (5) better marketing (specifically of the hospital physical activity program).

Discussion

Numerous studies have examined the determinants of T2D patients' health behaviors and adherence to overall T2D management programs globally¹⁴ as well as to engagement in physical activity.^{15,16} However, the current study is among only a few studies in Indonesia to explore T2D patients' perceptions about current practices in T2D management.¹⁷ Furthermore, this is the first study in Indonesia that specifically explores physical activity behaviors and T2D patients' perceived needs for physical activity programming. A central feature of this study was a comparison of physical activity influencers across genders and physical activity levels. This comparison allowed us to understand how gender and physical activity levels influence T2D patients' attitudes toward physical activity and physical activity programming.

Consistent with prior global studies,^{11,12} as well as in the Indonesian context,¹⁷ the findings from this study showed that the physically active participants perceived more physical activity benefits and fewer physical activity barriers than did physically inactive participants. The main benefits expressed by participants were disease-related; in other words, physical activity was for managing blood glucose levels and preventing or managing

complications arising from T2D. In contrast, physically inactive participants did not consider physical activity important to T2D management. Few gender differences were identified in this regard. The most notable difference was that more physically inactive women reported engaging in multiple physical activity programs as compared with physically inactive men. However, physically inactive women also perceived barriers not mentioned by participants in other groups, such as the distance from home to a physical activity program and the lack of time available because of family care obligations. Understanding these patterns of physical activity barriers and benefits is important for improving physical activity programming targeted to specific groups of T2D patients (e.g., physically inactive women) and to all T2D patients in general. Based on the study's findings, the authors make the following recommendations for future physical activity programming for T2D patients receiving care from Indonesian hospitals.

The findings suggest that a lack of knowledge about appropriate physical activity for T2D patients contributes to these patients' lack of engagement in physical activity. Therefore, the first recommendation is to integrate the diabetes self-management education within the hospital care system and hospital-based physical activity programs. Doing so could increase T2D patients' problem-solving skills and improve their self-care behaviors, especially physical activity. This recommendation is supported by previous studies that showed that diabetes education materials improve clinical outcomes and quality of life in T2D patients.¹⁸ These studies conclude that the delivery of educational materials by booklet,¹⁸ audio-video materials, and websites improves outcomes. To increase physical activity behavior over the long-term, developing education materials that are guided by behavioral change theories can improve health outcomes.¹⁵ With limited resources available for Indonesian hospital physical activity programs, theory-based diabetes education materials delivered in booklet format may be most feasible solution.

Some participants were aware that the current weekly hospital physical activity program was not adequate for meeting physical activity recommendations; however, increasing the frequency of hospital-based physical activity classes in Indonesia is not likely to be feasible due to resource limitations. Therefore, the second recommendation is for hospital-based physical activity programs to promote lifestyle physical activity: patients would be encouraged to incorporate short bouts of moderate physical activity into their daily routines. This approach has been successful in increasing physical activity levels elsewhere. For example, one United States (US) study showed that a lifestyle physical activity pro-

gram could be as effective as individually supervised exercise for increasing physical activity levels while being more cost-effective. These findings indicate that a lifestyle physical activity program could be effective in improving physical activity levels in settings where resources for physical activity programming are limited, such as in Indonesian hospitals.

Walking could be the most appropriate physical activity to promote to T2D patients. Walking was popular among this study's participants, as it is elsewhere (e.g., Australia,¹⁹ the US,²⁰ and India.²¹); according to a systematic review of programs that promoted walking (19 randomized controlled trials (RCTs) and 29 non-RCTs), walking programs are effective in increasing walking times from 30 to 60 minutes per week.

Based on the findings of this study, some T2D patients who fail to see a connection between physical activity and improved clinical health indicators lack motivation for engaging in regular physical activity. Therefore, the third recommendation is to include regular clinical evaluations as part of physical activity programming to allow T2D patients to monitor their clinical status over time as their physical activity levels change. This recommendation is supported by previous research showing that monitoring provides a sense of purpose to an individual's participation in physical activity and physical activity programming.

In this study, participants complained about limited interactions with physicians and health educators at the hospital. However, increasing face-to-face contact would require additional personnel and time that is not feasible in most Indonesian hospital settings; therefore, the fourth recommendation is to provide less resource intense alternatives, such as text messages or websites. The use of text messaging in physical activity programming may be the most feasible within the Indonesian context, as a recent survey²² revealed that almost 90% of the Indonesian population owns a mobile phone that includes a text message service. Moreover, previous studies have suggested that mobile text messages can be an effective tool for delivering physical activity interventions by providing psychosocial support.²³ Yet, despite the potential successful application of such programs in studies elsewhere,^{24,25} this approach has not been initiated in Indonesia.

The hospital-based physical activity program that was available to participants in the current study was not integrated into the health care system; therefore, not all T2D patients were aware of the program. Thus, the fifth recommendation is to better promote hospital-based physical activity programs to T2D patients. For example, hospitals could implement referral systems whereby health care providers would refer T2D patients to the local physical activity program and more broadly disseminate

program information, such as through brochures placed in T2D patient clinics at the hospital.

The major strength of this study was the recruitment of T2D patients in Indonesia, an understudied population. Another strength was the use of homogeneous focus groups to ensure power equality within each focus group, a practice that is considered essential in qualitative research and particularly important in focus group research undertaken to understand physical activity behaviors. However, limitations of this study should also be noted. First, most physically active patients in this study regularly attended the hospital-based physical activity program. Their perspectives may not fully represent the views of physically active patients who did not participate in that program. Second, since the mean age of patients was over 60 years, the results may not be applicable for younger age groups. Nonetheless, since the age range of study participants represents the typical age range of T2D patients in Indonesia who access its health care system, the findings are relevant to the largest segment of the T2D population. Lastly, the findings and recommendations generated from this study are based on the analysis of data from one group of T2D patients in Indonesia; therefore, caution is warranted in transferring these recommendations to populations with different characteristics or from different settings.

Conclusion

The findings indicate that hospital-based programs that promote physical activity among T2D patients in Indonesia should include educational programming, regular clinical evaluations, consultations with health educators, and strategies to extend the reach of these programs to include more T2D patients. Most notably, walking should be promoted. These recommendations account for available resources and T2D patients' physical activity behavioral patterns, barriers, and benefits, in addition to their perceived needs for additional physical activity programming. These recommendations can inform the development of future physical activity programs that cater to the needs of both male and female T2D patients who receive care from the Indonesian health care system.

Acknowledgment

The study received funding from the Indonesian Research and Higher Education Ministry (University Unggulan Grant 25|UPT/UN34.21/2016). The lead author received a scholarship from the Australian Postgraduate Award.

References

1. International Diabetes Federation. IDF diabetes atlas seventh edition 2015.

2. Soewondo P, Ferrario A, Tahapary DL. Challenges in diabetes management in Indonesia: a literature review. *Globalization and Health*. 2013; 9(1): 63.
3. Soewondo P, Soegondo S, Suastika K, Pranoto A, Soeatmadji DW, Tjokroprawiro A. The DiabCare Asia 2008 study: outcomes on control and complications of type 2 diabetic patients in Indonesia. *Medical Journal of Indonesia*. 2010; 19(4): 235-44.
4. Indonesian Ministry of Health. Riset kesehatan dasar (RISKESDAS) 2013. In: Kesehatan BPP, editor. Jakarta: Kemenkes RI; 2013.
5. Kaizu S, Kishimoto H, Iwase M, Fujii H, Ohkuma T, Ide H, et al. Impact of leisure-time physical activity on glycemic control and cardiovascular risk factors in Japanese patients with type 2 diabetes mellitus: the Fukuoka Diabetes Registry. *PloS One*. 2014; 9(6): e98768.
6. Umpierre D, Ribeiro PA, Kramer CK, Leitão CB, Zucatti AT, Azevedo MJ, et al. Physical activity advice only or structured exercise training and association with HbA1c levels in type 2 diabetes: a systematic review and meta-analysis. *JAMA*. 2011; 305(17): 1790-9.
7. Fagour C, Gonzalez C, Pezzino S, Florenty S, Rosette-Narece M, Gin H, et al. Low physical activity in patients with type 2 diabetes: the role of obesity. *Diabetes and Metabolism*. 2013; 39(1): 85-7.
8. Fritz T, Caidahl K, Krook A, Lundström P, Mashili F, Osler M, et al. Effects of nordic walking on cardiovascular risk factors in overweight individuals with type 2 diabetes, impaired or normal glucose tolerance. *Diabetes Metabolism Research and Reviews*. 2013; 29(1): 25-32.
9. Jennersjö P, Ludvigsson J, Länne T, Nystrom F, Ernerudh J, Östgren CJ. Pedometer determined physical activity is linked to low systemic inflammation and low arterial stiffness in type 2 diabetes. *Diabetic Medicine*. 2012; 29(9): 1119-25.
10. Colberg SR, Sigal RJ, Fernhall B, Regensteiner JG, Blissmer BJ, Rubin RR, et al. Exercise and type 2 diabetes the American College of Sports Medicine and the American Diabetes Association: Joint position statement. *Diabetes Care*. 2010; 33(12): e147-e67.
11. Ahmad B, Ramadas A, Kia Fatt Q, Md Zain AZ. A pilot study: the development of a culturally tailored Malaysian Diabetes Education Module (MY-DEMO) based on the Health Belief Model. *BMC Endocrine Disorders*. 2014;14.
12. Hallgren EA, McElfish PA, Rubon-Chutaro J. Barriers and Opportunities: A Community-Based Participatory Research Study of Health Beliefs Related to Diabetes in a US Marshallese Community. *The Diabetes educator*. 2015; 41(1).
13. World Health Organization. Global recommendation on physical activity for health. Geneva Switzerland: WHO Press; 2010.
14. Ayele K, Tesfa B, Abebe L. Self care behavior among patients with diabetes in Harari, Eastern Ethiopia: The health belief model perspective. *PloS One*. 2012;7(4):e35515.
15. Avery L, Flynn D, van Wersch A, Sniehotta FF, Trenell MI. Changing physical activity behavior in type 2 diabetes: a systematic review and meta-analysis of behavioral interventions. *Diabetes Care*. 2012; 35(12): 2681-9.
16. Dutton GR, Tan F, Provost BC, Sorenson JL, Allen B, Smith D. Relationship between self-efficacy and physical activity among patients with type 2 diabetes. *Journal of Behavioral Medicine*. 2009; 32(3): 270-7.
17. Rochmawati DH, Hamid AYS, Helena N. Makna kehidupan klien dengan diabetes melitus kronis di kelurahan Bandarharjo Semarang: sebuah studi fenomologi. *Jurnal Keperawatan Jiwa*. 2013; 1(1).
18. Plotnikoff, Karunamuni N, Courneya K, Sigal R, Johnson J, Johnson S. The Alberta diabetes and physical activity trial (adapt): a randomized trial evaluating theory-based interventions to increase physical activity in adults with type 2 diabetes. *Annals of Behavioral Medicine*. 2012; 45(1): 45-56.
19. Australian Bureau of Statistics. Physical activity in Australia: a snapshot, 2004-05. Australian Bureau Statistics: ABS Canberra, Australia; 2011.
20. Berrigan D, Carroll DD, Fulton JE, Galuska DA, Brown DR, Dorn JM, et al. Vital signs: walking among adults-United States, 2005 and 2010. *Morbidity and Mortality Weekly Report*. 2012; 61(31): 595-601.
21. Mathews E, Lakshmi J, Ravindran TS, Pratt M, Thankappan K. Perceptions of barriers and facilitators in physical activity participation among women in Thiruvananthapuram City, India. *Global Health Promotion*. 2015; 23(4): 27-36.
22. Pew Research Centre. Emerging nations embrace internet, mobile technology: cell phones nearly ubiquitous in many countries. Washington DC: Pew Research Center; 2014. Available from: www.pewglobal.org/2014/02/13/emerging-nations-embrace-internet-mobile-technology/.
23. Fukuoka Y, Komatsu J, Suarez L, Vittinghoff E, Haskell W, Noorishad T, et al. The mPED randomized controlled clinical trial: applying mobile persuasive technologies to increase physical activity in sedentary women protocol. *BMC Public Health*. 2011;11(1):933.
24. Fjeldsoe BS, Miller YD, Marshall AL. MobileMums: a randomized controlled trial of an SMS-based physical activity intervention. *Annals of Behavioral Medicine*. 2010;39(2):101-11.
25. Thompson D, Cantu D, Bhatt R, Baranowski T, Rodgers W, Jago R, et al. Texting to increase physical activity among teenagers (TXT Me!): Rationale, design, and methods proposal. *JMIR Research Protocols*. 2014;3(1).