

Exploring User-Perceived Features for Personalized Physical Activity Promotion Function in A Healthcare Application: A Qualitative Study

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Abstract

Background: Healthcare applications are widely used to support weight loss and lifestyle modification. Many of these applications offer tailored feedback on dietary intake and nutritional behavior. However, most lack personalized features that promote physical activity (PA), which is important for weight management, metabolic health, and chronic disease prevention. To enhance the effectiveness of physical activity promotion function in healthcare applications, it is essential to understand which personalized features are useful for promoting PA.

Objective: This study aimed to explore the essential features perceived by users of personalized PA promotion in healthcare applications.

Methods: A qualitative study was conducted using focus group interviews (FGIs) with healthcare application users. Participants were recruited regardless of age, sex, or body mass index. A thematic analysis was conducted using a combination of inductive and deductive approaches. Question 1 (“How do you perceive the importance of physical activity?”) was analyzed inductively, while Questions 2 (“What are the motivating factors for engaging in physical activity?”) and 3 (“What are the barriers to engaging in physical activity?”) were analyzed deductively based on the Social Ecological Model.

Results: Eleven participants were interviewed and were unfamiliar with the term “physical activity” but recognized the importance of movement and reducing sedentary behavior. The identified motivators included improvements in mood, changes in physical appearance, and support from family. Application features, such as goal setting, feedback, reminders, and praise, were also cited as effective motivators. The reported barriers included time restrictions due to work, fatigue, weather, remote work, and social pressure in workplace settings. Many participants emphasized the need for personalized suggestions tailored to their physical conditions, daily schedules, and weather.

Conclusions: Participants expressed the need for application features that provide personalized context-aware support for physical activity. Features, such as timely feedback, adaptive goals, and motivational messages based on daily conditions, may enhance engagement and address common barriers. These insights can guide the development of healthcare applications with personalized PA support functions.

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Original Manuscript

Original Paper

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Abstract

Background: Healthcare applications are widely used to support weight loss and lifestyle modification. Many of these applications offer tailored feedback on dietary intake and nutritional behavior. However, most lack personalized features that promote physical activity (PA), which is important for weight management, metabolic health, and chronic disease prevention. To enhance the effectiveness of physical activity promotion function in healthcare applications, it is essential to understand which personalized features are useful for promoting PA.

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Results: Eleven participants were interviewed and were unfamiliar with the term “physical activity” but recognized the importance of movement and reducing sedentary behavior. The identified motivators included improvements in mood, changes in physical appearance, and support from family. Application features, such as goal setting, feedback, reminders, and praise, were also cited as effective motivators. The reported barriers included time restrictions due to work, fatigue, weather, remote work, and social pressure in workplace settings. Many participants emphasized the need for personalized suggestions tailored to their physical conditions, daily schedules, and weather.

Conclusions: Participants expressed the need for application features that provide personalized context-aware support for physical activity. Features, such as timely feedback, adaptive goals, and motivational messages based on daily conditions, may enhance engagement and address common barriers. These insights can guide the development of healthcare applications with personalized PA support functions.

Keywords: personalized physical activity promotion; healthcare application; user-perceived features; focus group interview; qualitative research; Social Ecological Model; behavioral motivators; physical activity barriers; digital health.

Introduction

Background

Physical inactivity is globally recognized as a critical public health issue that significantly contributes to the prevalence of obesity, cardiovascular diseases, type 2 diabetes, and other chronic conditions. The World Health Organization (WHO) emphasizes that physical activity (PA) is essential for preventing and managing chronic diseases and advocates accessible interventions to promote an active lifestyle among diverse populations [1]. To achieve these health benefits, WHO recommends that adults aged 18–64 years should engage in at least 150–300 min of moderate-intensity aerobic PA or 75–150 min of vigorous-intensity PA weekly [2]. Despite robust evidence supporting the benefits of PA, many individuals fail to achieve recommended levels due to perceived barriers such as lack of time, fatigue, and environmental constraints (such as limited space and pollution) [3].

The recent proliferation of mobile health (mHealth) applications has provided promising tools for

behavioral modification, offering personalized, convenient, and cost-effective interventions [4]. Advances in smartphone technology and wearable devices have enabled the integration of numerous basic personalized features such as goal setting, activity reminders, self-monitoring dashboards, and adaptive feedback functions [5,6]. Recently, sensor-based tracking and artificial intelligence (AI)-driven algorithms have been developed to deliver contextually tailored content that considers user real-time behavior, environmental conditions, and individual preferences [7].

Despite the progressive development of personalized features in mHealth technologies, significant gaps remain in effectively addressing the nuanced needs and preferences of users. Many applications rely on generalized, developer-driven assumptions rather than actively incorporating direct user input regarding what constitutes meaningful personalization [8-10]. Consequently, features often fail to accommodate daily fluctuations in the physical conditions, emotional states, social contexts, or environmental constraints of users, limiting both effectiveness and sustained user engagement [11].

Furthermore, empirical research on user-centric personalization remains limited. Current literature primarily examines app effectiveness through quantitative methodologies, emphasizing metrics such as application usage frequency and adherence rates. Qualitative research deeply exploring the subjective experiences, preferences, and perceptions of users regarding personalized app features is notably limited. Capturing such insights is essential for developing digital interventions that closely align with user expectations and daily life realities, thus enhancing user engagement, adherence, and sustainability of PA behaviors [12,13].

Objectives

This qualitative study aimed to address this gap by systematically investigating the essential user-perceived features that support personalized PA promotion in healthcare applications. The findings of this study will contribute valuable knowledge for the development of more engaging, personalized, and context-sensitive digital health interventions.

Methods

Study Design

This study employed a qualitative research design utilizing focus group interviews (FGIs) and was reported in line with the COREQ (Consolidated Criteria for Reporting Qualitative Research) checklist (Multimedia Appendix 1) [14]. FGIs, which leverage group dynamics to collect in-depth information, are widely used for various research purposes [15].

Participants and Recruitment

Participants were broadly recruited through a healthcare application, CALOmama PLUS (Wellmira Inc., Tokyo, Japan) with no restrictions on sex, age, or body mass index (BMI). CALOmama PLUS is a healthcare application which users can register their daily information (diet, exercise etc.) and AI instantly provides advice based on the registered information [16]. Interviews were conducted either face-to-face or online. In both settings, participants received a detailed explanation of the study via email in advance and were asked to provide preliminary consent to indicate their availability. The purpose and content of the study were explained again before the interview.

Data Collection and Survey

FGIs were conducted face-to-face and online using Google Meet (Google LLC, Mountain View, CA, USA). According to the participants' schedule, three 1-h interviews were conducted. Interviews were recorded using digital voice recorders (ICD-TX650; Sony, Tokyo, Japan) and transcribed. All FGIs were facilitated by Y.N., a professor with extensive experience in conducting interviews. In addition, four researchers (Y.S., R.M., S.M., and T.Y.) also participated in the interviews. The semi-structured focus group guide was created by Y.S. and reviewed by all authors to reduce assumptions and potential bias of the first author. The semi-structured focus group interview guide is available in Multimedia Appendix 2. The questionnaire, sent in advance by email, collected information on three domains: baseline characteristics, healthcare application usage, and PA levels. Baseline characteristics included sex, age, height, weight, smoking status, exercise habits, walking habits, employment status, educational background, household income, cohabitation status, and marital status. For healthcare application usage, participants were asked about the duration of usage, reasons for use, and perceived physical changes after use. PA was assessed using the Global Physical Activity Questionnaire (GPAQ) [17]. The interview questions were: 1. How do you perceive the importance of PA? 2. What are the motivating factors for engaging in PA? 3. What are the barriers to engaging in PA?

Data Analysis

All FGI sessions were audio-recorded and transcribed. The transcripts were analyzed using NVivo software (MacOS Release 14.23.4; Lumivero, Denver, CO, USA) following a thematic analysis approach. Thematic analysis is a qualitative method for identifying, analyzing, and reporting themes within data relevant to research questions [18]. Themes may be derived inductively from the data or deductively based on existing theories or frameworks [19]. Researchers are encouraged to use either or both approaches depending on the research purpose [20].

In this study, an inductive approach was applied to analyze responses to Question 1, whereas a deductive approach based on the socioecological model was used for questions 2 and 3 [21]. This model considers not only individual factors, but also interpersonal, organizational, and community-level environmental factors. Two researchers (Y.S. and J.K.) independently reviewed the transcripts, categorizing content into "factors," "categories," and "codes." Discrepancies were discussed and resolved in consultation with a third researcher (Y.N.) until consensus was achieved.

Ethical Considerations

The study protocol was reviewed and approved by the Institute of Health and Sports Sciences at the University of Tsukuba (approval number: Tai 023-140). Before the FGI, the researcher (Y.N.) introduced all the research staff and the purpose of this research. Written and verbal consents were obtained from face-to-face and online participants, respectively.

Results

Participant Characteristics

Eleven application users (three men and eight women) participated in the FGI; their characteristics are listed in Table 1. Participant ages ranged from 31 to 76 years. Of the participants, two lived alone, whereas eight were married. Over half (six participants) had been using the app for <1 year. The reasons for use included dietary (five participants), weight (four participants), and general health (two participants) management. The range of values for BMI, occupational moderate to vigorous PA

(MVPA), transport-related MVPA, leisure-time MVPA, and sitting time were 17.9–28.6 kg/m², 0–180 min/week, 0–840 min/week, 0–560 min/week, and 180–840 min/day, respectively.

Question 1 Analysis

The responses to Question 1 were analyzed using an inductive approach, and the FGI content was broadly categorized into “Awareness” and “Consciousness.” To understand the current perceptions of PA, awareness was subcategorized into “Status.” Furthermore, subcategories were defined as “Exercise” and “Daily activities” under “Consciousness.” All participants were aware of the negative effects of prolonged sedentary behavior, whereas the term “physical activity” was not widely recognized. Some noted spending long periods sitting both at home and at work, and observed a reduction in step counts due to working at home (Table 2).

Table 1. Demographic characteristics of the participants (N=11)

Variables	Participants										
	A	B	C	D	E	F	G	H	I	J	K
Sex	Male	Female	Male	Female	Female	Female	Female	Female	Female	Male	Female
Age (years)	76	37	70	53	49	31	55	44	55	65	33
BMI ^a (kg/m ²)	19.79	24.03	17.93	19.81	24.52	19.47	21.36	23.63	28.57	24.39	22.03
Exercise habits	Yes	No	Yes	No	No	Yes	Yes	No	Yes	Yes	No
Walking habits	Yes	No	Yes	No	No	Yes	Yes	No	Yes	Yes	No
Educational level	UG ^b	UG	UG	UG	JC ^c / TCG ^d	UG	JC/TCG	UG	UG	UG	JC/TCG
Duration of app use (years)	3-5	<1	≥5	1-3	<1	1-3	<1	<1	<1	3-5	<1
Reason for starting app use	Weight management	Diet management	Diet management	Health management	Diet management	Diet management	Weight management	Health management	Diet management	Weight management	Weight management
Occupational MVPA ^e (min/week)	0	0	0	0	0	0	0	0	180	0	0
Transport-related MVPA (min/week)	0	150	0	360	0	80	840	60	120	150	450
Leisure-time MVPA (min/week)	180	240	560	360	120	240	0	30	0	180	150
Sitting time (min/day)	720	600	720	330	360	480	840	480	240	180	720

^aBMI: Body mass index.
^bUG: Undergraduate degree.
^cJC: Junior college degree.
^dTCG: Technical college degree.
^eMVPA: Moderate to vigorous physical activity.

Table 2. Summary of awareness of the importance of physical activity (Question 1)

Categories	Subcategories	Codes
Awareness	Status	Lack of awareness
	Exercise	Importance
		Household activities
Consciousness	Daily activities	Commuting activities
		Work activities

Awareness

Recognition of the importance of PA was classified under the subcategory “Status” and coded as “Lack of awareness.”

“This is the first time I’ve heard the term “physical activity”, and I was not clear on the difference from exercise.” (Lack of awareness)

“Aside from intentional exercise, I don’t really engage in the kind of physical activity defined today. I do some gardening, but I don’t think it counts for much.” (Lack of awareness)

“I just learned about physical activity today, so I haven’t really paid attention to my daily movements. But now I realize that even small efforts can be effective.” (Lack of Awareness)

Consciousness

Within “Consciousness,” two subcategories were identified: “Exercise” and “Daily activities.” Many participants expressed an awareness of the importance of exercise; therefore, the subcategory “Exercise” was coded as “Importance.” For “Daily activities,” based on the GPAQ domains and participant statements, codes were created for “Household activities,” “Commuting activities,” and “Work activities.”

“I think exercise is important and try to do it as much as possible. I’ve been swimming since I was a child and still swim during my free time on weekends.” (Importance)

“I want to move as much as possible because it helps with weight management and posture and reduces stress.” (Importance)

“I make a conscious effort to walk around the house and go shopping to avoid being sedentary.” (Household activities)

“Even if I’m doing housework, I notice a big difference in calories burned and steps taken between days spent entirely at home and days when I go out, so I try to go out at

least once a day.” (Commuting activities)

“During commutes, I try not to sit on the train and use the stairs instead of escalators.” (Commuting activities)

“Remote work has reduced both my physical activity and exercise, making me realize I need to move more.” (Work activities)

“I try to stand up and move my legs even when working at my desk.” (Work activities)

Question 2 Analysis

A deductive approach was used for the second FGI question, which explored factors promoting PA. The content was classified using the social ecological model [17] into “Individual factors,” “Sociocultural environmental factors,” “Physical environmental factors,” and “Organizational factors.” In summary, individual factors such as health checkup results and mood were frequently cited as triggers for increasing PA. Family and friends were considered important for promoting PA, and support from healthcare providers was considered essential. Other factors included the work environment and mandatory workplace instructions (Table 3).

Table 3. Summary of motivating factors for promoting physical activity (Question 2)

Factors	Categories	Codes
Individual	Demographic	Appearance
	Biological	Biological health
	Psychological	Mood
		Experience
Sociocultural environmental	Social networks	Family
		Peers
		Social media
	Smartphone application	Goals and planning
		Feedback and monitoring
Physical environmental	Built environment	Reward
Organizational	Policy	Office ergonomics
		Directives

Individual Factors

Individual factors were classified as demographic, biological, and psychological. Demographic and biological categories were subdivided into codes, such as appearance and biological health, respectively. Psychological factors were subdivided into codes, including mood and experience.

“Seeing physical changes, such as a slimmer body line or fitting into previously tight clothes, motivates me to keep going.” (Appearance)

“Health checkup results are a major trigger for me to start exercising.” (Biological)

health)

“Enjoyable and fun exercise sessions, especially with others, make it easier to continue.” (Mood)

“Exercising helps clear my mind and improves my mood, which motivates me to continue.” (Mood)

“Past experiences of successfully losing weight through exercise and diet encourage me to try again.” (Experience)

Sociocultural Environmental Factors

We classified sociocultural environmental factors into social networks and smartphone applications. In addition, the social network category was subdivided into codes, including family, peers, and social media. The smartphone application was subdivided into codes, such as goals and planning, feedback and monitoring, and reward.

“Having family or friends to exercise with makes it easier to stay motivated.” (Family)

“Swimming classes with friends motivate me to continue exercising regularly.” (Peers)

“I often walk or attend gym sessions with friends nearby, which helps sustain physical activity.” (Peers)

“Watching YouTube videos or seeing others’ experiences on social media inspires me to be more active.” (Social media)

“If an app clearly shows how to achieve weight loss through recommended routines, I would be motivated.” (Goals and planning)

“Setting clear goals and plans in the app, receiving feedback and monitoring, and getting encouragement or rewards are all motivating.” (Feedback and monitoring)

“Immediate positive reinforcement from the app for even small activities would be encouraging.” (Reward)

“Receiving compliments from characters on the application motivates me.” (Reward)

Physical Environmental Factors

We classified physical environmental factors into built environments and subdivided the categories into code office ergonomics.

“I wish my company had a treadmill desk so I could work while walking.” (Office ergonomics)

Organizational Factors

We classified organizational factors into policies and subdivided them into code directives.

"Mandatory standing breaks before meetings would be very beneficial." (Directives)

"Forced participation, like mandatory office attendance or children's school events, increases my physical activity more than voluntary measures." (Directives)

"Notifications on computers for breaks would be helpful." (Directives)

Question 3 Analysis

A deductive approach was also used for the third FGI question, which explored barriers to PA, and the content was classified using the social ecological model into "Individual factors," "Sociocultural environmental factors," and "Physical environmental factors." In summary, the most frequently cited barriers were time constraints due to work-life balance and weather conditions. Many participants noted that remote work increased their sedentary time and made it more difficult for them to be physically active. Other barriers included a lack of knowledge about the benefits of PA and concerns about being watched by others at work (Table 4).

Table 4. Summary of barriers to promoting physical activity (Question 3)

Factors	Categories	Codes
Individual	Demographic	Age
		Socioeconomic status
	Biological	Biological health
		Fatigue
		Habit
	Psychological	Attitude
		Knowledge
	Work-life balance	Restriction
Sociocultural environmental	Social networks	Colleagues
	Natural environment	Weather
Physical environmental	Work environment	Work from home
		Facility

Individual Factors

We classified individual factors into demographic, biological, and psychological factors, as well as work-life balance. Demographic and biological categories were subdivided into codes, such as age, socioeconomic status, biological health, and fatigue. Psychological factors were subdivided into codes, including habits, attitudes, and knowledge. Work-life balance was subdivided into code restrictions.

“Due to my age, I rarely go out except when necessary, and even then, I usually drive rather than walk.” (Age)

“Financial constraints make it difficult to continue going to a sports club.” (Socioeconomic status)

“Injuries or health issues make it hard to be active.” (Biological health)

“Fatigue after work is a major barrier.” (Fatigue)

“Convenient services like home delivery reduce the need for movement.” (Habit)

“I tend to relax on the sofa and use my smartphone during free time.” (Habit)

“I’m not sure if small activities outside of intentional exercise are really beneficial.” (Knowledge)

“Time constraints due to work and household responsibilities make it difficult to be active.” (Restriction)

Sociocultural Environmental Factors

Socio-cultural environmental factors were classified as social networks. In addition, the social network category was subdivided into code colleagues.

“It’s hard to move when others are around at work.” (Colleagues)

Physical Environmental Factors

We classified physical environmental factors into natural and work environments. The natural environment category was subdivided into code-weather categories. Work environment was subdivided into codes, including work from home and facilities.

“Hot or rainy weather makes it difficult to exercise outdoors.” (Weather)

“Menstrual periods and rainy days reduce my desire to go out. Low atmospheric pressure causing headaches is also a barrier.” (Weather)

“Working from home leads to long sedentary periods and reduced physical activity.” (Work from home)

“During telework, sitting all day at home, I often realize I’ve only taken about 400 steps, which is unhealthy.” (Work from home)

“On weekdays, commuting was my primary physical activity. With partial teleworking recently, physical activity drastically decreased.” (Work from home)

"My previous job involved sitting at a desk reading and writing, with little physical activity. Even commuting was by car." (Facility)

Discussion

Principal Findings

In this study, FGIs were conducted to identify essential features for promoting PA. Question 1 assessed participants' perceptions of the importance of PA, while Questions 2 and 3 examined motivating factors and barriers.

Regarding Question 1, although participants had limited awareness of the term "physical activity," they demonstrated an understanding of exercise and the need to move their bodies. Similarly, a previous study [22] reported low awareness of Japan's physical activity guidelines among 7,000 adults aged 20–69 years registered with an online survey company, with 1.7% and 5.3–13.4% demonstrating spontaneous and assisted recalls, respectively. These findings indicate that public awareness and knowledge of PA guidelines remain limited, underscoring the need for increasing public awareness and understanding of PA guidelines.

Conversely, as indicated by participant demographic characteristics, over half (6 of 11 participants) reported regular exercise habits. According to the 2023 National Health and Nutrition Survey [23], 36.2% of men and 28.6% of women have regular exercise habits, showing no significant changes over the past decade. However, compared with 2019 (men: 33.4%, women: 25.1%), a slight increase was observed. Even among participants without regular exercise habits, comments indicated conscious efforts to reduce sitting time and engage in incidental PA. Given participants' desire for reminder functions in applications, implementing education and promotion strategies using healthcare applications could be beneficial.

In Question 2, motivating factors for promoting PA were analyzed using the social ecological model. At the individual level, improvements in appearance, medical examination results, and enhanced mood were identified as motivators. These findings align with previous research; for instance, a previous study [24] reported health concerns, appearance satisfaction, and emotional encouragement as motivators for individuals with obesity attempting weight loss. Moreover, positive mood after exercise has been reported as a key motivator for PA promotion, significantly correlating with achieving recommended levels of leisure-time walking [25].

At the socio-cultural level, social networks and smartphone applications were identified as important factors. Participants highlighted family and peer support as crucial motivators. Similarly, a previous research [26] has emphasized that spousal support significantly influences exercise adherence in couples with diabetes. Another study [27] further demonstrated that changes in PA were positively correlated between spouses, indicating the importance of targeting couples in interventions. Participants also

emphasized the motivational role of social media, consistent with prior studies showing increased exercise intention following exposure to fitness-related content [28].

The key motivating functions of smartphone applications included goal setting, feedback and monitoring, and rewards. A previous study [29] has similarly emphasized the importance of goal-setting compliance during the initial weeks of weight-loss interventions. Behavioral planning using smartphone applications has shown moderately positive associations with increased PA in individuals with cardiovascular diseases [30]. Furthermore, personalized feedback tailored to user preferences significantly enhanced PA and weight loss outcomes [31]. Digital self-monitoring techniques have also demonstrated significant effects on weight loss and moderate PA promotion in overweight adults [32]. Moreover, rewards and behavioral planning are effective strategies for promoting long-term PA [33]. Incorporating these behavioral change techniques into healthcare applications is expected to enhance the future promotion of PA.

Physical, environmental, and organizational factors primarily focus on workplace issues. Participants highlighted the need for improved workplace environments and policies, particularly considering modern sedentary work practices. This finding aligns with that of prior studies suggesting that workplace interventions effectively reduce sitting time and promote PA [34]. Therefore, developing feasible intervention programs using healthcare applications that address these factors is essential.

In Question 3, barriers to PA were analyzed using the social ecological model. Individual factors prominently emerged, with biological health issues, such as pain and injuries, identified as significant barriers, consistent with previous findings [35-38]. Fatigue and socioeconomic factors were also mentioned, aligning with existing research. Interviews with African American women identified economic constraints, physical strain, and sedentary jobs as key barriers [35]. Lack of knowledge regarding the benefits of PA was another barrier identified, consistent with previous studies reporting insufficient recognition of the benefits of leisure-time activity [36]. Time constraints due to work-life balance were the most frequently cited, in line with numerous previous studies [37,38]. In addition, convenient lifestyles that reduce opportunities for outdoor activities were reported as barriers, suggesting that future healthcare applications should propose outdoor activities to address this issue.

Within sociocultural environmental factors, social networks emerged as a barrier, with concerns about colleagues' perceptions making interruptions in sedentary behavior challenging. Participants requested discrete activity suggestions suitable for workplace environments via healthcare applications. Physical and environmental factors included natural and work environments. Further, weather conditions significantly influenced PA participation, with participants requesting activity suggestions suitable for indoor conditions during poor weather. Future healthcare applications should incorporate weather considerations into recommendations. Work environments, particularly teleworking facilities, were also significant barriers. The COVID-19 pandemic has altered the lifestyle and increased inactivity concerns. The 2023 National

Health and Nutrition Survey [23] indicated that the average step counts have significantly decreased over the past decade, with teleworking likely contributing to reduced commuting-related activities. However, teleworking offers relative autonomy and fewer concerns regarding the perceptions of colleagues, potentially making interventions through healthcare applications more effective.

Limitations

This study had some limitations. First, recruiting participants under the description "interviews regarding personalized exercise recommendation functions on healthcare applications" might have attracted participants already highly interested in exercise. Although six participants initially reported regular exercise habits, the interviews revealed that nearly all the participants were physically active, which may have biased the findings. Second, the sample (three men and eight women) likely skewed the results toward the perspectives of women. Considering the potential sex differences, future studies should ensure balanced sex representation. Third, the study was limited to users of a single healthcare application, which raises questions about its generalizability to other applications.

Conclusions

This study aimed to identify the essential features of healthcare applications that promote PA among application users through focus group interviews. These findings highlight population-level dissemination of the PA concept, the motivational role of application-based feedback, and the necessity for tailored exercise recommendations aligned with daily physical conditions. These insights will guide future enhancements of personalized PA promotion functions in healthcare applications.

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Conflicts of Interest

Shinichiro Mizuno and Tomoko Yanagisawa are employees of the healthcare application company (Wellmira Inc.).

Data Availability

The data presented in this study are available on request from the corresponding author.

The data are not publicly available due to protecting privacy.

Authors' Contributions

Conceptualization, all authors; investigation, Y. S., R. M., S. M., T. Y., and Y. N.; resources, S. M. and T. Y.; data curation, Y. S., R. M., and Y. N.; formal analysis, Y. S., J. K., and Y. N.; writing—original draft, Y. S. and Y. N.; writing—review and editing, Y. N.; supervision, T. Y. and Y. N.; project administration, T. Y. and Y. N. All authors have read and agreed to the published version of the manuscript.

Abbreviations

WHO: World Health Organization

PA: Physical activity

mHealth: mobile health

FGI: focus group interview

MVPA: moderate to vigorous physical activity

Multimedia Appendix 1

COREQ (Consolidated Criteria for Reporting Qualitative Research) checklist.

Multimedia Appendix 2

Focus group interview guide.

References

1. World Health Organization. Physical activity. 2024. <https://www.who.int/news-room/fact-sheets/detail/physical-activity>
2. WHO guidelines on physical activity and sedentary behaviour. Geneva: World Health Organization; 2020.
3. Koh YS, Asharani PV, Devi F, Roystonn K, Wang P, Vaingankar JA, Abdin E, Sum CF, Lee ES, Müller-Riemenschneider F, Chong SA, Subramaniam M. A cross-sectional study on the perceived barriers to physical activity and their associations with domain-specific physical activity and sedentary behaviour. *BMC Public Health*. 2022;22(1):1051. doi: 10.1186/s12889-022-13431-2
4. Domin A, Spruijt-Metz D, Theisen D, Ouzzahra Y, Vögele C. Smartphone-based interventions for physical activity promotion: scoping review of the evidence over the last 10 years. *JMIR Mhealth Uhealth* 2021;9(7):e24308. doi: 10.2196/24308
5. Conroy DE, Yang CH, Maher JP. Behavior change techniques in top-ranked mobile apps for physical activity. *Am J Prev Med*. 2014;46(6):649-652. doi: 10.1016/j.amepre.2014.01.010
6. Lewis BA, Napolitano MA, Buman MP, Williams DM, Nigg CR. Future directions in physical activity intervention research: expanding our focus to sedentary behaviors, technology, and dissemination. *J Behav Med*. 2017;40(1):112-126. doi: 10.1007/s10865-016-9797-8
7. Oba T, Takano K, Katahira K, Kimura K. Use patterns of smartphone apps and wearable devices supporting physical activity and exercise: large-scale cross-sectional survey. *JMIR Mhealth Uhealth*. 2023;11:e49148. doi: 10.2196/49148
8. Yardley L, Morrison L, Bradbury K, Muller I. The person-based approach to intervention development: application to digital health-related behavior change interventions. *J Med Internet Res*. 2015;17(1):e30. doi: 10.2196/jmir.4055.
9. Hardeman W, Houghton J, Lane K, Jones A, Naughton F. A systematic review of just-in-time adaptive interventions (JITAIs) to promote physical activity. *Int J Behav Nutr Phys Act*. 2019;16(1):31. doi: 10.1186/s12966-019-0792-7.
10. Wei Y, Zheng P, Deng H, Wang X, Li X, Fu H. Design Features for Improving Mobile Health Intervention User Engagement: Systematic Review and Thematic Analysis. *J Med Internet Res*. 2020 Dec 9;22(12):e21687. doi: 10.2196/21687.
11. Waki K, Enomoto S, Yamauchi T, Nangaku M, Ohe K. Personalized mHealth intervention (StepAdd) for increasing physical activity in Japanese patients with type 2 diabetes: secondary analysis of social cognitive theory measurements of a single-arm pilot study. *JMIR Form Res*. 2025;9:e60221. doi: 10.2196/60221
12. Dennison L, Morrison L, Conway G, Yardley L. Opportunities and challenges for smartphone applications in supporting health behavior change: qualitative study. *J Med Internet Res*. 2013;15(4):e86. doi: 10.2196/jmir.2583
13. O'Brien N, Heaven B, Teal G, Evans EH, Cleland C, Moffatt S, Sniehotta FF, White M, Mathers JC, Moynihan P. Integrating evidence from systematic reviews, qualitative research, and expert knowledge using co-design techniques to develop a web-based intervention for people in the retirement transition. *J Med*

- Internet Res. 2016;18(8):e210. doi: 10.2196/jmir.5790.
14. Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. *Int J Qual Health Care*. 2007; 19(6):349-357. doi: 10.1093/intqhc/mzm042
 15. Krueger R, Casey M. *Focus groups: A practical guide for applied research*. 3rd edition. Thousand Oaks, CA: Sage; 2014. ISBN: 0761920714, 9780761920717.
 16. Nakata Y, Sasai H, Goshō M, Kobayashi H, Shi Y, Ohigashi T, Mizuno S, Murayama C, Kobayashi S, Sasaki Y. A Smartphone Healthcare Application, CALO mama Plus, to Promote Weight Loss: A Randomized Controlled Trial. *Nutrients*. 2022 Nov 2;14(21):4608. doi: 10.3390/nu14214608
 17. Bull FC, Maslin TS, Armstrong T. Global physical activity questionnaire (GPAQ): nine country reliability and validity study. *J Phys Act Health*. 2009;6(6):790-804. doi: 10.1123/jpah.6.6.790.
 18. Braun V, Clarke V. Using thematic analysis in psychology. *Qual. Res. Psychol*. 2006;3(2):77-101. doi: 10.1191/1478088706qp063oa
 19. Braun V, Clarke V. Thematic analysis. In H. Cooper, P. M. Camic, D. L. Long, A. T. Panter, D. Rindskopf, & K. J. Sher (Eds.), *APA handbook of research methods in psychology, Vol. 2. Research designs: Quantitative, qualitative, neuropsychological, and biological*. 2012;57-71
 20. Saunders CH, Sierpe A, von Plessen C, Kennedy AM, Leviton LC, Bernstein SL, Goldwag J, King JR, Marx CM, Pogue JA, Saunders RK, Van Citters A, Yen RW, Elwyn G, Leyenaar JK; Coproduction Laboratory. Practical thematic analysis: a guide for multidisciplinary health services research teams engaging in qualitative analysis. *BMJ*. 2023;381:e074256. doi: 10.1136/bmj-2022-074256
 21. Sallis JF, Cervero RB, Ascher W, Henderson KA, Kraft MK, Kerr J. An ecological approach to creating active living communities. *Annu Rev Public Health*. 2006;27:297-322. doi: 10.1146/annurev.publhealth
 22. Tajima T, Harada K, Oguma Y, Sawada S. Current status of awareness, knowledge, beliefs, and behavioral intentions regarding the Japanese physical activity guidelines and their relationship with physical activity and sedentary behavior. *Jpn J Public Health* 2022;69(10):790-804. doi: 10.11236/jph.21-150
 23. 2023 National Health and Nutrition Survey in Japan. Ministry of Health, Labour and Welfare. 2024. (in Japanese) <https://www.mhlw.go.jp/content/10900000/001338334.pdf>
 24. Binsaeed B, Aljohani FG, Alsobaii FF, Alraddadi M, Alrehaili AA, Alnahdi BS, Almotairi FS, Jumah MA, Alrehaili AT. Barriers and motivators to weight loss in people with obesity. *Cureus*. 2023;15(11):e49040. doi: 10.7759/cureus.49040
 25. Verity J, Cleland, Kylie Ball, Jo Salmon, Anna F Timperio, David A Crawford. Personal, social and environmental correlates of resilience to physical inactivity among women from socio-economically disadvantaged backgrounds. *Health Educ Res*. 2010;25(2): 268-281. doi: 10.1093/her/cyn054
 26. Beverly EA, Wray LA, The role of collective efficacy in exercise adherence: a qualitative study of spousal support and Type 2 diabetes management. *Health Educ Res*. 2010;25(2):211-223. doi: 10.1093/her/cyn032
 27. Cobb LK, Godino JG, Selvin E, Kucharska-Newton A, Coresh J, Koton S. Spousal influence on physical activity in middle-aged and older adults: The

- ARIC Study. *Am J Epidemiol*. 2016;183(5):444-451. doi: 10.1093/aje/kwv104
28. Durau J, Diehl S, Terlutter R. Motivate me to exercise with you: The effects of social media fitness influencers on users' intentions to engage in physical activity and the role of user gender. *Digit Health*. 2022;8:20552076221102769. doi: 10.1177/20552076221102769
29. Bizhanova Z, Sereika SM, Brooks MM, Rockette-Wagner B, Kariuki JK, Burke LE. Identifying predictors of adherence to the physical activity goal: a secondary analysis of the SMARTER weight loss trial. *Med Sci Sports Exerc*. 2023;55(5):856-864. doi: 10.1249/MSS.0000000000003114
30. Patterson K, Davey R, Keegan R, Kunstler B, Woodward A, Freene N. Behaviour change techniques in cardiovascular disease smartphone apps to improve physical activity and sedentary behaviour: Systematic review and meta-regression. *Int J Behav Nutr Phys Act*. 2022;19(1):81. doi: 10.1186/s12966-022-01319-8
31. Kariuki Jacob Kigo, Burke Lora E, Zickmund Susan, Beatrice Britney Kimball Elisabeth R, Galyean Patrick, Cheng Jessica, Sereika Susan M, Bizhanova Zhadyra, Cedillo Maribel, Wells Jessica, Conroy Molly B. The utility and limitations of remotely delivered feedback messages regarding physical Activity in a 12-month weight loss intervention: insights from the SMARTER trial focus groups. *J Cardiovasc Nurs*. 2024. doi: 10.1097/JCN.0000000000001134
32. Berry R, Kassavou A, Sutton S. Does self-monitoring diet and physical activity behaviors using digital technology support adults with obesity or overweight to lose weight? A systematic literature review with meta-analysis. *Obes Rev*. 2021;22(10):e13306. doi: 10.1111/obr.13306
33. Howlett N, Trivedi D, Troop NA, Chater AM. Are physical activity interventions for healthy inactive adults effective in promoting behavior change and maintenance, and which behavior change techniques are effective? A systematic review and meta-analysis. *Transl Behav Med*. 2019;9(1):147-157. doi: 10.1093/tbm/iby010
34. Schaller A, Stassen G, Baulig L, Lange M. Physical activity interventions in workplace health promotion: objectives, related outcomes, and consideration of the setting—a scoping review of reviews. *Front Public Health*. 2024;12:1353119. doi: 10.3389/fpubh.2024.1353119
35. Harley AE, Rice J, Walker R, Strath SJ, Quintiliani LM, Bennett GG. Physically active, low-income African American women: an exploration of activity maintenance in the context of sociodemographic factors associated with inactivity. *Women Health*. 2014;54(4):354-372. doi: 10.1080/03630242.2014.896440
36. Das BM, Sartore-Baldwin M, Mahar MT. The invisible employee: university housekeeping employees' perceptions of physical activity. *J Phys Act Health*. 2016 Sep;13(9):952-956. doi: 10.1123/jpah.2015-0509
37. Congello NC, Koniak-Griffin D. Review: partner Support and physical activity among Mexican American women. *Ethn Dis*. 2018;28(4):555-560. doi: 10.18865/ed.28.4.555
38. Jaarsma EA, Dijkstra PU, Geertzen JH, Dekker R. Barriers to and facilitators of sports participation for people with physical disabilities: a systematic review.

Scand J Med Sci Sports. 2014;24(6):871-881. doi: 10.1111/sms.12218

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Supplementary Files

Multimedia Appendixes

Focus group interview guide.

URL: <http://asset.jmir.pub/assets/7cf39a82edf924f9eec6bb548537e023.pdf>

CONSORT (or other) checklists

COREQ (Consolidated Criteria for Reporting Qualitative Research) checklist.

URL: <http://asset.jmir.pub/assets/5dbfbf0e604e25a9d40a82e71e63de0f.pdf>