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ORIGINAL ARTICLE

Development and feasibility testing of a smartphone video-based exercise program for patients with knee osteoarthritis

Chidozie E. Mbada[1], Sonuga Oluwatobi[1], Henry Akintunji Awosika[1], Oluwadare Esan[2], Kayode Israel Oke[3], Moses Oluwatosin Makinde[1]*, Oyeleye Olufemi Oyewole[4], Adewale Isaiah Oyewole[1], Odole Adesola Christiana[5], Francis Fatoye[6]

[1]*Departments of Medical Rehabilitation, College of Health Sciences, Obafemi Awolowo University, Ile-lfe, Nigeria*
[2]*Departments of Orthopaedic and Traumatology, College of Health Sciences, Obafemi Awolowo University, Ile-lfe, Nigeria*
[3]*Department of Physiotherapy, School of Basic Medical Sciences, College of Medical Sciences, University of Benin, Benin, Nigeria*
[4]*Department of Physiotherapy, Olabisi Onabanjo University Teaching Hospital, Sagamu, Nigeria*
[5]*Department of Physiotherapy, University of Ibadan, badan, Nigeria*
[6]*Department of Health Professions, Manchester Metropolitan University, United Kingdom*

ABSTRACT

Background: Telerehabilitation has been recommended as a potential solution to bridge service delivery gap, especially in geographically remote areas with shortage of healthcare personnel and lack of access to physical therapy. This study was aimed to develop and test the feasibility of a smartphone video-based exercise program (VBEP) for patients with knee osteoarthritis (OA). **Methods:** This two-phase study involved the development and feasibility testing stages. A three-round modified Delphi approach was employed in the development phase involving a panel of four experts and a patient with knee OA. Based on consensus, five types of exercises comprising seated knee flexion and extension, quadriceps isometric setting, quadriceps strengthening exercise, hamstring clenches, and wall squats were developed into a video-program for knee OA. 15 consenting patients with knee OA participated in the feasibility testing of the program after 2 weeks of utilization. Feasibility of the VBEP was assessed using system usability scale and user experience questionnaire, respectively. The quadruple visual analog scale was used to assess the pain intensity. **Results:** The mean age and pain intensity of the participants were 67.3 ± 6.4 years and 61.1 ± 10.6, respectively. User perceived usability of the VBEP was 77.1 ± 13.1 (out of 100) with a high usability rating of 86.7%. Pragmatic quality score, hedonic quality rating, attractiveness, and perspicuity were 2.2 (out of 3.0), 1.6 (out of 3.0), 2.4 (out of 3.0), and 3.0 (out of 3.0), respectively. Efficiency, dependability, stimulation, and novelty scores were 2.3 (out of 3.0), 1.8 (out of 3.0), 2.3 (out of 3.0), and 1.0 (out of 3.0), respectively. **Conclusions:** The VBEP for knee OA has high usability and quality rating, as well as good user experience, and it may be a feasible alternative platform for rehabilitation of patients with knee OA.

Keywords: Exercise, Feasibility, Osteoarthritis, Telerehabilitation

***Address for correspondence:**
Dr. Moses Oluwatosin Makinde
Department of Medical Rehabilitation, College of Health Sciences, Obafemi Awolowo University, Ile-Ife, Nigeria.
E-mail: momak4success@gmail.com

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INTRODUCTION

Osteoarthritis (OA) is a degenerative joint disease characterized by articular cartilage destruction, synovial membrane inflammation, and subchondral bone remodeling.[1] OA is reported to be a leading cause of pain and disability in adults.[2] Among the different types, knee OA is the most prevalent affecting about 45% of all people in a lifetime.[3] With the rise in life expectancy and aging population, the prevalence of OA is projected to increase.[4]

Physical therapy is one of the conservative approaches to managing knee OA. Exercise programs among other different physical therapy approaches appear to be safe and effective, mainly reducing pain and improving function in knee OA patients.[5-7] Particularly, aerobic and strengthening exercise programs are reported to be effective.[8] However, there is lack of consensus on the best form of these exercise programs for maximum benefit among patients with knee OA.[5-11]

Conventionally, exercise therapy is recommended and directed by the physical therapist by way of in-person interactions. In-person healthcare delivery is prone to challenges of access to which can be as a result of costs[12] and geographical remoteness,[13] especially in rural areas.[14] Recently, in-person healthcare delivery is hamstrung by social distancing measures which are a fall out of the coronavirus disease 2019 (COVID-19) global pandemic.[15] Furthermore, the effectiveness of the traditional approach to implementing exercise programs is largely dependent on the skills and expertise of the therapists[16] and patients' adherence to intervention.[17] Thus, the need for innovative platforms that will help improve access and encourage standardized self-management for patients with knee OA.

Telerehabilitation has been recommended as potential solution to bridge service delivery gap, especially in geographically remote areas with shortage of healthcare personnel and the challenge of access to physical therapy.[18] Digital platforms such as mobile applications (apps), web apps, virtual reality games, and video programs have been recommended as effective to improving access to rehabilitation services.[19] Video-based programs seem much feasible for use in resource-limited settings, as dependence on internet supply will be limited, especially in countries such as Nigeria.[20]

Use of technology in healthcare is an ungoverned sector in Nigeria; however, in the wake of the COVID-19 pandemic, the country among a few other African nations is beginning to embrace telemedicine/telerehabilitation, mostly through private-owned initiatives.[21] As a result, there is an increased awareness of telerehabilitation, as well as a shift from skepticism to optimism on its adoption in Nigeria.[21] There is a need to employ digital platforms with proven acceptability and practicality. However, studies reporting effectiveness of video-based exercises to treat patients with OA are still few.[22] The objective of this study was to develop and test the feasibility of a smart-phone video-based exercise program (VBEP) for patients with knee OA.

METHODS

This two-phase study was aimed to develop and test the feasibility of VBEP for patients with knee OA. The development phase involved a three-round modified Delphi approach which was conducted among a panel of three physical therapists, an orthopedist, and a patient with knee OA. The care providers who participated in the Delphi were experts with at least 10 years of professional experience in the management of knee OA. Based on consensus, five types of exercises comprising knee flexion and extension in sitting, quadriceps isometric setting, quadriceps strengthening exercise, hamstring clenches, and wall squats were agreed on. Knee flexion and extension in sitting served as both warm-up and cool-down activities. Accordingly, the VBEP was developed following experts' opinions through iterative process used in video and software programs.

Modified Delphi technique

Before conducting a modified Delphi process using focus groups method, the researchers had developed a focus group discussion guide based on desk review on evidence-based exercises for management of knee OA, contents, and cultural sensitivity of available telerehabilitation products for knee OA. The modified Delphi technique conducted over a 2-week period, comprised three rounds of focus group discussions involving four experts (3 physical therapists, an orthopaedist) and a patient with knee OA. Each round of the Delphi lasted for an average of 1 h and 35 min. After the first round, itemization of the contents for the VBEP for knee OA was carried out. Revisions and scrutinization of items were done by the experts during the second round. Consensus on the contents of the VBEP was reached in the third round. Item content validity index (I-CVI) of the VBEP is presented in Table 1. The respondents rated the proposed items in terms of relevance using a 4-point Likert scale (1 = not relevant, 2 = relevant, needs major revision, 3 = moderately relevant, needs minor revision,

Table 1 Item content validity index of the video-based exercise programme.

	Knee flexion and extension in sitting (warm up and cool down activities)	Quadriceps isometric setting	Quadriceps strengthening exercise	Hamstring clenches	Wall squats
PT 1	4	4	4	4	4
PT 2	4	4	4	4	4
PT 3	4	4	4	4	4
Ortho	3	3	4	4	4
Patient	4	4	4	3	4
I-CVI	0.8	0.8	1.0	0.8	1.0

PT 1: 1st Physiotherapist, PT 2: 2nd Physiotherapist, PT 3: 3rd Physiotherapist, Ortho: Orthopaedist, Patient: Patient with knee OA, I-CVI: Item content validity index.

and 4 = very relevant, no modification). Items that were rated 4 were subject to I-CVI. An item's I-CVI is the number of reviewers giving a rating of either 3 or 4 for an item divided by the total number of reviewers.[23] The scores of 0.8, 0.8, 1.0, 0.8, and 1.0, respectively, were obtained for items 1, 2, 3, 4, and 5 of the VBEP.

Subsequently, scripting of the exercises to suit the intended population was done. Consenting human actors (one patient and two physical therapists) were taken through the script and rehearsed the protocol. Thereafter, the shooting of the video was carried out using a Canon 600d crop frame with a zoom lens 18–55 F3.5 and a 50 mm prime lens F1.8, a unidirectional condenser lapel microphone, a tripod stand, and a red head video light.

This following exercises were made into the VBEP:

1. Knee flexion and extension in sitting (used both as warm-up and cool-down activities): Participant sits in upright position on a firm chair, bends the affected knee as far back as possible, holds for 5–10 s, and subsequently fully straightens the affected knee as far forward as possible and holds for 5–10 s. This movement is repeated up to 10 times.
2. Quadriceps isometric setting: Participant sits in the upright position at the edge of a firm chair, straightens the affected knee as far as possible with toes pointing upward, presses the knee and heel firmly for 10 s, and relax. This movement is repeated up to 10 times.
3. Quadriceps strengthening exercise: Participant sits in the upright position on a firm chair, lifts up the affected knee as far as one can go, keeping the back straight for 5–10 s. The participant supports him/herself by placing both hands on either side of the seat. This movement is repeated up to 10 times.
4. Hamstring clenches: Participant sits in the upright position on a firm chair, slides the heel of the affected leg back until it touches the foot of the chair and keeps the foot flat on the floor. The participant's hip is at the same level or higher than both knees. Then, firmly pushes the heel back against the chair, holds for 10 s, and is repeated up to 10 times.
5. Wall squats: Participant leaned on the wall with feet one-foot apart and one-foot away from the wall. Participant's back firmly on the wall, slides down till on sitting position, hold for 10 s and slides back up with the back still firmly on the wall. This movement is repeated up to 10 times.

The quantitative component of the study was carried out in the second phase to assess the feasibility of the VBEP. The feasibility of the VBEP was tested in terms of engagement, satisfaction, level of motivation, and complexity of the program after a two-weeks utilization of the video application using the user experience questionnaire (UEQ) and system usability scale, (SUS) respectively.

The UEQ covers a broad impression of user experience. The subscales of the UEQ were perspicuity, efficiency, dependability, stimulation, novelty, and attractiveness. Attractiveness scale has 6 items (items 1, 12, 14, 16, 24, 25), perspicuity has 4 items (items 2, 4, 13, 21), stimulation has 4 items (items 5, 6, 7, 18), dependability has 4 items (items 8, 11, 17, 19), efficiency has 4 items (items 9, 20, 22, 23), and novelty has 4 items (items 3, 10, 15, 26). Furthermore, the scales of the UEQ can be grouped into pragmatic quality (perspicuity, efficiency, and dependability) and hedonic quality (stimulation and originality). Pragmatic quality describes task-related quality aspects while hedonic quality describes the nontask -related quality aspects.[24,25]

The SUS has ten statements on the perceived usability of the application. Respondents could indicate on a scale of 0–4 to what extent the presented statements were true for them. The sum of the respondents' answers was multiplied by 2.5 to obtain the final SUS score. The SUS score ranges from 0 to 100 (low and high usability, respectively).[26]

The quadruple visual analog scale (QVAS) was used to assess the pain intensity. This outcome measures pain intensity experienced by the participants at the time of assessment, typical or average pain, pain at its best, and pain at its worst, respectively. Total pain score is expressed over 100 (low intensity = <50; high intensity = >50).[27]

Ethical approval for this study was obtained from the Ethics and Research Committee of Obafemi Awolowo Teaching Hospitals' Complex (OAUTHC), Ile-Ife (ERC/2019/12/25). Administrative approval was obtained from the Head, Department of Medical Rehabilitation, OAUTHC, where this study was conducted. Each participant gave signed informed consent following full disclosure of the purpose of the study.

Quantitative phase

Fifteen participants were recruited into the quantitative phase of the study. They were patients with knee OA attending the physiotherapy unit of the Department of Medical Rehabilitation, OAUTHC, Ile-Ife, Nigeria. Eligibility was based on having knee OA of at least Grade 3 in the Kellgren–Lawrence scale; having the ability to respond to instructions and commands; and being without any obvious deformities affecting the trunk or upper and lower extremities. All participants had a mobile device with at least an Android OS of 4.1 or an Iphone interface, a suitable exercise space or corridor at home where the exercises can be conducted. Patients who had OA with morning stiffness of longer than 30 min, those that had knee OA associated with autoimmune diseases or any underlying systemic or visceral disease, as well as those with specific condition such as dementia, cognitive dysfunction, visual impairment, and previous history of epilepsy were excluded from the study.

Data analysis

The qualitative findings were thematically analyzed. Common themes were described based on frequencies. The qualitative data were analyzed using descriptive statistics of frequency, mean, and standard deviation. Analyses were carried out using SPSS 21.0 version software (SPSS Inc., Chicago, Illinois, USA).

RESULTS

Qualitative findings

Following completion of three modified Delphi rounds, the experts reached a consensus on each item, prioritizing exercises for management of knee OA. The first four evidence-based exercises were chosen in the focus group discussion to feature in the video.

The following evidence-based physical therapy exercises were made into a video. They include:

1. Active seated knee flexion and extension
2. Quadriceps isometric setting
3. Quadriceps strengthening exercise
4. Hamstring clenches
5. Wall squats.

Focus group outcomes

What do you think of the concept of a video-based exercise program?

After explaining the concept, all the focus group participants (100%) agreed that the concept was good and interesting, and they also indicated that they would be happy to have their patients use the VBEP when it is developed. The participants saw the use of this VBEP a step toward enhancing digital platforms in physiotherapy and pointed out that people prefer watching videos over reading a text.

How long can this video be?

The vast majority (3 out of 4) agreed that the video messages should be short and ranging between 5 and 10 min, that is, short, sharp and precise. All (100%) agreed that this should be designed to attract attention and engage people into the program and therefore should be short. How long videos can be also depends on how interested people would be in the management of knee OA.

Who should be in the video?

The participants were ambivalent about who should be in the video to present the scripted contents of the exercise program to the viewer. However, the main underlying idea supported by all the participants was that whoever presents its contents needs to be credible and convincing.

How professional should the video messages be?

Most participants (3 out of 4) agreed that the level of professionalism does not have to be of the highest achievable level; however, they also agreed that the video messages will need to look professional to be credible and engaging. It would be very important to work with a production team behind the camera (light, sound, etc.). The use of up-to-date production equipment was agreed by the participants.

Quantitative findings

The socio-demographic characteristics of the participants are presented in Table 2. The mean (±standard deviation [SD]) age of the participants was

67.3 ± 6.4 years. Participants were mostly females (60%) and traders (40%). The participants had unilateral pattern of OA affectation (80%) with a baseline total pain intensity score of 61.1 ± 10.6 on the QVAS [Table 3].

User perceived usability of the VBEP was 77.1 ± 13.1 (out of 100) based on the SUS. The frequency of acceptability on usability of the VBEP is presented in Table 4. The usability of the VBEP was high considering that it has high usability (86.7%).

Table 5 shows the frequency of users' experience of the VBEP based on the UEQ. Figure 1 shows a bar

Table 2 Sociodemographic characteristics of the participants. (*n* = 15)

Variable	Participants	Percentage
Sex		
Male	6	40.0
Female	9	60.0
Occupation		
Carpenter	1	6.7
Civil Servant	1	6.7
Retired Nurse	1	6.7
Retiree	6	40.0
Teacher	1	6.7
Trader	6	40.0
Ethnicity		
Igbo	3	20.0
Yoruba	12	80.0
Affectation		
Left	6	40.0
Right	6	40.0
Bilateral	3	20.0

Table 3 Pain characteristics of participants prior the use of the video-based exercise program. (*n*=15)

Pain characteristics	Minimum	Maximum	$\bar{X}$±SD
Current pain	2	7	4.7±1.2
Average pain	4	9	6.0±1.2
Best pain	1	5	3.2±1.0
Worst pain	5	9	7.7±1.0
Total QVAS	36.7	83.3	61.1±10.6

$\bar{X}$: Mean, SD: Standard deviation, QVAS: Quadruple visual analog scale.

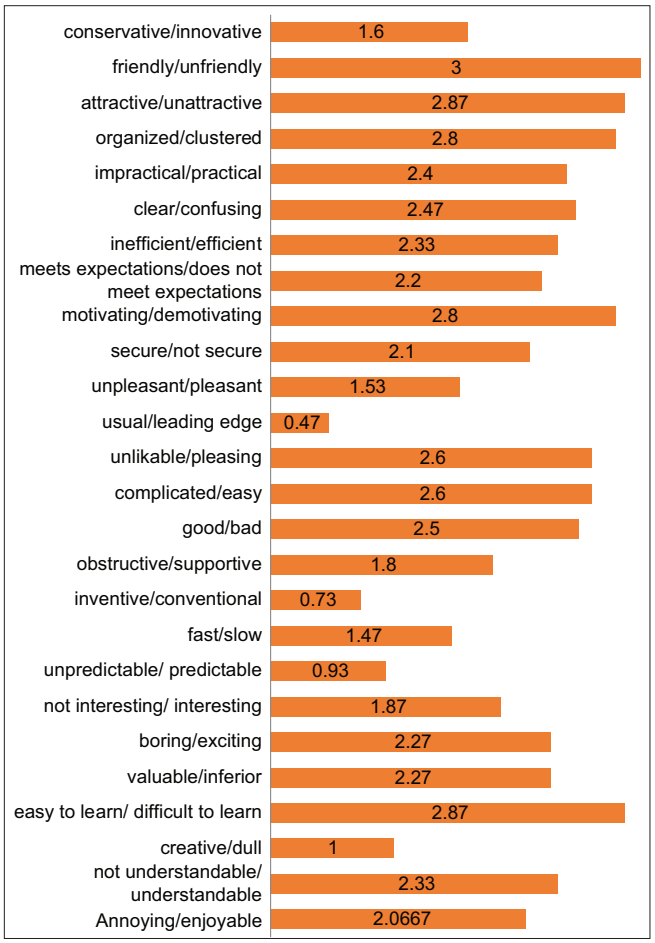

Figure 1 Bar chart showing responses on user experience of video-based exercise program in knee osteoarthritis based on user experience questionnaire scores.

Table 4 Responses on feasibility and acceptability of video-based exercise program in knee osteoarthritis based on system usability scale. (*n*=15)

Items	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	$\bar{X}$±SD
I think that I would like to use this OA self-treatment video frequently	0	0	0	6 (40.0)	9 (60.0)	0.4±0.5
I found this OA self-treatment video unnecessarily complex	4 (26.7)	7 (46.7)	2 (13.3)	2 (13.3)	0	1.1±1.0
I thought this OA self-treatment video was easy to use	3 (20.0)	7 (46.7)	3 (20.0)	2 (13.3)	0	2.7±1.0
I think that I would need assistance to be able to use this OA self-treatment video	3 (20.0)	6 (40.0)	5 (33.3)	1 (6.7)	0	1.3±1.0
I found the various functions in this OA self-treatment video were well integrated	0	0	0	6 (40.0)	9 (60.0)	0.6±0.5
I thought there was too much inconsistency in OA self-treatment video	3 (20.0)	9 (60.0)	3 (20.0)	0	0	1.0±0.7
I would imagine that most people would learn to use this OA self-treatment video very quickly	0	0	0	8 (53.3)	7 (46.7)	0.5±0.5
I found this OA self-treatment video very cumbersome/awkward to use	0	3 (20.0)	1 (6.7)	11 (73.3)	0	2.5±0.8
I felt very confident using this OA self-treatment video	0	0	5 (33.3)	8 (53.3)	2 (13.3)	1.2±0.7
I needed to learn a lot of things before I could get going with this OA self-treatment video	2 (13.3)	12 (80.0)	1 (6.7)	0	0	0.9±0.46

Maximum obtainable score 3. $\bar{X}$: Mean, SD: Standard deviation, OA: Osteoarthritis.

Table 5 Responses on user experience of video-based exercise program in knee osteoarthritis based on user experience questionnaire. (*n*=15)

Items	Minimum	Maximum	$\bar{X}$±SD
Annoying/enjoyable	0	3	2.1±0.8
Not understandable/ understandable	1	3	2.3±0.6
Creative/dull	0	3	1.0±1.0
Easy to learn/difficult to learn	2	3	2.8±0.4
Valuable/inferior	−2	3	2.3±1.4
Boring/exciting	1	3	2.3±0.6
Not interesting/interesting	−1	3	1.9±1.3
Unpredictable/predictable	−1	3	0.9±1.4
Fast/slow	0	3	1.5±1.0
Inventive/conventional	−3	3	0.7±2.1
Obstructive/supportive	−3	3	1.8±1.4
Good/bad	−2	3	2.5±1.5
Complicated/easy	2	3	2.6±0.5
Unlikable/pleasing	0	3	2.6±0.9
Usual/leading edge	−2	3	0.5±1.9
Unpleasant/pleasant	−2	3	1.5±1.6
Secure/not secure	−1	3	2.1±1.0
Motivating/demotivating	1	3	2.8±0.6
Meets expectations/does not meet expectations	−2	3	2.2±1.5
Inefficient/efficient	−2	3	2.3±1.4
Clear/confusing	−3	3	2.5±1.6
Impractical/practical	−2	3	2.4±1.3
Organized/cluttered	2	3	2.8±0.4
Attractive/unattractive	2	3	2.9±0.4
Friendly/unfriendly	3	3	3.0±0.0
Conservative/innovative	−2	3	1.6±1.6

Maximum obtainable score: 3. $\bar{X}$: Mean, SD: Standard deviation.

Table 6 Frequency and mean scores of subscales of the user experience questionnaire.

UEQ quality	Minimum	Maximum	$\bar{X}$±SD
Attractiveness	6	18	2.4±0.6
Perspicuity	5	12	3.0±0.4
Stimulation	1	12	2.3±0.8
Dependability	−4	12	1.8±1.0
Efficiency	0	12	2.3±0.8
Novelty	−3	11	1.0±0.9

Maximum obtainable score: 3.0. $\bar{X}$: Mean, SD: Standard deviation, UEQ: User Experience Questionnaire.

chart elaborating the details of the user experience of VBEP. Table 6 presents the mean scores of the VBEP subscales.

DISCUSSION

This study was aimed to develop a VBEP for patients with knee OA and to test its feasibility in terms of usability and user experience. Currently, a gamut of videos on health and wellness, as well as disease management, exists on YouTube, iTunes, and Google Play stores.[28] However, there is an apparent dearth of evidence on the validation of these applications/products on the claims of the developers, thus leaving a gap between technological innovations and health, hence this study. The patients who participated in this study were in the elderly category with a majority of them being females. It is reported that knee OA particularly affects 45% of people in their lifetime.[3] Approximately 10% and 18% of men and women, respectively, present with multifarious symptoms and radiological evidence in more than 50% of people over 65 years of age.[29] The patients in this study were mostly retirees and traders. In line with the findings of this study, Blagojevic *et al*.[30] implicated older age, female gender, and occupation as significant factors associated with the development of knee OA. However, it is adducible that the higher enrollment of Christians and people of Yoruba ethnic group in this study is expected, as it is representative of the demographic distribution of the study area. Furthermore, the patients who participated in this study had high level of pain based on the QVAS score. OA has been described as a leading cause of pain and disability among adults.[2]

This study commenced with the development of a VBEP following iterative process used in video and software programs. An initial desk-review of videos on exercises for knee OA was carried out. Available videos were critiqued, and the ones that met the inclusion criteria of relevance and feasibility as an intervention for patients with knee OA were selected. Consequently, the videos were analyzed for their exercise elements in terms of type and support in literature for effectiveness. Recommended evidence-based exercises were selected, and scripting of the video contents was done with the intent to extrapolate to the intended population. Thereafter, experts involving physiotherapists, an orthopedic physician, and a patient were consulted following a modified Delphi approach to pool opinions from the list gleaned from the videos reviewed as to what a cultural-sensitive and knee OA-specific video intervention would contain.

The Delphi technique secures a "group" consensus using a structured process in which many rounds of interviews are conducted via open-ended interview guide.[31] Choosing suitable experts for participation in the study is important for the Delphi technique to succeed. If the chosen experts adequately represent areas that are relevant to the study of interest, content validity may be ensured.[32] In this study, we invited experts from different fields with a variety of expertise, including an orthopedic physician and three

physiotherapists to participate in this Delphi round. In our opinion, the validity of the content was ensured. The Delphi technique has several advantages. One advantage is that each expert's opinion is considered equally.[31,33] Experts may compare their own opinions with those of others' and reassess topics to shape their values and opinions, which could be revised accordingly**.** The small sample of respondents in the modified Delphi constitutes a potential limitation. Although the size of Delphi subjects is variable and there is currently no consensus opinion, a sample size of 15–30 participants per group is recommended as a rule of thumb for homogeneous group of subjects, while 5–10 participants is recommended for heterogeneous group of subjects. The small sample size of participants in this study may affect the external validity of findings.

Most trials in the review involved muscle strengthening exercises or a combination of strength and aerobic exercise (e.g., walking) and have shown to some extent to relieve patients with knee OA of their symptoms.[34] In addition to the foregoing, previous studies have shown that improving muscle strength may reduce knee forces, reduce pain, and improve physical function.[7,27] Further, there is evidence that a consistent graded relationship exists between level of physical activity and better functional performance in adults with knee OA.[35] The video was broken down in three stages: warm up, main exercise, and cool down. It featured warm up of active seated knee flexion and extension, quadriceps isometric setting, quadriceps strengthening exercise, hamstring clenches, wall squats, and cool down of active seated knee flexion and extension.

The second objective of this study was to test the feasibility of the developed VBEP for knee OA. The participants for the feasibility testing in this study were relatively middle-aged with an average age of 67.3 ± 6.4 falling between 40 and 80 years within which knee OA is prevalent. Studies have shown that age significantly influences knee OA in individuals.[36] Further, from the gender distribution result of this study, more women (60%) than men (40%) were available to be recruited into this study. Accordingly, Blagojevic *et al.*[30] reported that knee OA is more prevalent among female individuals. A majority of the participants were traders and retirees, thus implying that the nature of one's occupation influences knee OA. Traders have been reported to have knee OA resulting from different physical activities indulged during work, example kneeling, squatting, lifting, and climbing can cause and/or aggravate knee OA.[37] On the other hand, retirees who have retired from active working in different occupations have in one way or the other being involved in strenuous physical activities, placing excessive stress on the knee can cause and/or aggravate knee OA.[38] The participants in this study utilized the VBEP for a 2-week period to elicit users' experience and usability. Common in feasibility studies between 7 and 14 days were required.[37]

The finding of this study showed a high usability rating for the VBEP with mean of 77.1 ± 13.1 out of 100. Based on previous research, a score of 68 (out of 100) is considered to be average with higher scores reflecting greater than average usability across comparable video applications. The usability of the VBEP was high considering that it has high usability of 86.7%. These findings also reflect the larger societal trends wherein consumer acceptance and demand for health and fitness app and videos to change behavior are growing.[39] Most studies on health apps for preventive purposes, as well as management of chronic illnesses, though built on different structural platforms and functions, reported high user acceptability.[40] Only few studies, however, reported average and low-to-moderate acceptability.[41] Based on the trend observed in the literature, the potential for technology-based health interventions to impact populations is possible like never before, with respect to increase in mobile phone ownership and the number of complexities of health apps.[42]

Findings from the UEQ show that the scores for all scales describing a pragmatic quality (efficiency, perspicuity, and dependability) aspect are good, that is, above 0.8. The scales describing hedonic quality (stimulation and originality), also, fun of use, show good evaluations as well. Therefore, it is implied that all features of the VBEP were rated well. The following categories, namely attractiveness, perspicuity, efficiency, dependability, and stimulation having mean scores of 2.4, 3.0, 2.3, 1.8, and 2.3, respectively, lies in the zone of positive evaluation score range from 0.8 to the maximum score of 3.0, which can be adduced that participants liked the design, easy to get familiar, good users' control with the interaction, and motivation in using the VBEP, respectively. The novelty category receives the score of 0.95, which lies in the zone of positive evaluation. It has a relatively lower value compared to other qualities of the VBEP meaning that its view relatively lacks creativity.

Dahl-Popolizio *et al.*[43] posited that new technologies offer a potential means of enhancing patient engagement in usual care or traditional therapy, as the use of computers

and gaming equipment in physiotherapy is progressively more relevant in the medical community. In addition, Mckay *et al.*[44] suggested that improved ways of assessing the quality and effectiveness of videos are required to use them for behavioral changes in health. However, more research is needed to be able to generate sufficient evidence on the efficacy of video-delivered exercises in knee OA.

Participants were satisfied with the mode of service delivery, would recommend it to others, and use it again in the future. The reduction in participant and caregiver burden was a common reason associated with satisfaction, as well as ease of use of VBEP.

CONCLUSION

The video-based program for knee OA has high usability and quality rating, as well as good user experience among patients with knee OA. It is therefore recommended that VBEP is a feasible alternative platform for rehabilitation of patients with knee OA.

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Conflicts of interest

There are no conflicts of interest.

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