The experience of participating in remotely delivered online exercise classes during the COVID-19 pandemic among community-dwelling older adults and its post-pandemic implications

Abstract

The COVID-19 pandemic has accelerated the use of videoconferencing-delivered online exercise (VOE) classes among community-dwelling older adults. This phenomenon is new, and no research has investigated older adults' relevant experiences and post-pandemic perspectives. This study situated in a naturalistic paradigm and adopted a descriptive qualitative methodology to understand the phenomenon. In-depth interviews were conducted with 23 older adults (aged 55-89 years) who have participated in VOE since the COVID-19 pandemic. Utilizing thematic analysis, eight key themes were identified. Older adults experienced convenience, exercise regularity, technological transformation and motivation when using this new form of exercise delivery. At the same time, they also experienced certain technological barriers and compromised quality of instructor supervision. Looking forward, older adults welcomed the increased opportunity for supervised exercise due to increased virtual capacity. They also envisaged that mobility restricted groups such as frail older adults and caregivers would benefit from this form of exercise delivery.

***Keywords*:** remotely-delivered exercise class; videoconferencing online exercise; senior; physical activity

BACKGROUND

Regular physical activity (PA) participation reduces physical frailty and has substantial positive impacts on older adults' daily wellbeing, aging process and quality of life (King & King, 2010; Whitehead & Blaxton, 2017). Recognizing the substantial health benefits of PA, several national and international organizations (e.g., the World Health Organization) have recommended that older adults attain a sufficient level of daily or weekly PA to achieve these health benefits (World Health Organization, 2020a). For instance, older adults should perform at least 150-300 minutes of moderate-intensity aerobic physical activity, muscle-strengthening activities involving all major muscle groups, and multicomponent PA that emphasizes functional balance and strength training throughout the week (World Health Organization, 2020b).

Although it is well recognized that PA participation among older adults is important, updated evidence has shown that PA levels among older adults have been affected by the COVID-19 pandemic. For instance, studies conducted in Amsterdam, Singapore and the United Kingdom found that 50%, 36.9% and 42.3% of the respondents, respectively, reported a decrease in overall PA when compared with their daily life before lockdown (Brown et al., 2021; Lee et al., 2022; Visser, Schaap, & Wijnhoven, 2020).

There has been a general decrease in the PA level since the onset of the COVID-19 pandemic, but some studies have revealed that a proportion of older adults instead changed their PA mode during this time. Research conducted in the United States showed that community-dwelling older adults reported an increased level of PA through an online medium (Greenwood-Hickman et al., 2021), and a study conducted in Australia showed that 17% of the participants used new technology for online exercise during the lockdown (Strutt

et al., 2022). Some older adults in Canada also reported attaining a sufficient amount of PA through an online medium (Petersen et al., 2021).

COVID-19 has accelerated participation in exercise through an online medium. Videoconferencing-delivered online exercise (VOE), also called "tele-exercise" (Mois et al., 2019) in the literature, refers to the delivery of PA intervention using tele-technologies or videoconferencing software such as Zoom, Skype, Facetime and Voov. In VOE, both the instructor and the participants can see, hear and interact via simultaneous two-way video and audio transmission in real time through the use of videoconferencing software and a smartphone, tablet or computer with a web camera.

There is very little information in the literature regarding how community-dwelling older adults perceive VOE and what their experiences are. Preliminary evidences showed VOE was positively received by older adults. For instance, a study which collected text responses to a survey showed that community-dwelling older adults found VOE "easy and convenient" in a multi-component health during COVID-19 (Sanchez-Villagomez et al., 2021). Also, a recent online exercise feasibility study reported high adherence (i.e., 90%) among community-dwelling older adults (Schwartz, Har-Nir, Wenhoda, & Halperin, 2021).

Context of Hong Kong Special Administrative Region (S.A.R.)

Unlike the international trend of dropping of PA levels among older adults during the COVID-19 pandemic, quantitative studies conducted in Hong Kong S.A.R. have shown that community-dwelling older adults' PA levels were only minimally affected by COVID-19 during the first (January to February 2020) and second waves (March 2020 to April 2020) of the pandemic and returned to normal in the third wave (July to September 2020) (Lee et al., 2021). Even the oldest population accumulated an average of 181.3 minutes of moderate-to-vigorous intensity PA per week during the COVID-19 pandemic (Kwan et al., in press). A

study by Lee and colleagues (2021) found that older adults in Hong Kong maintained their PA levels during the COVID-19 pandemic by changing their modes of exercise from running, swimming, and going to the gym to stretching and speed walking activities. Although the prevalence of community-dwelling older adults' participation in home-based VOE during the COVID-19 pandemic is not known, some community centers have converted their exercise classes to videoconferencing-delivered online modes since the onset of the pandemic.

The use of videoconferencing technology in delivering remote health management interventions has been gaining increasing attention in recent years, as it was found to be feasible and to improve accessibility for those who live in rural areas (Banbury et al., 2017). However, the wide application of videoconferencing for community-based PA classes targeting older adults has only emerged as a result of the social distancing measures enacted with the outbreak of COVID-19. It is worthwhile to conduct an in-depth qualitative investigation to learn more about this phenomenon before attempting any large-scale quantitative study. Additionally, understanding the experiences of older adults in Hong Kong S.A.R, an urban center, can provide important insight into other urban centers throughout the world. The aims of our study are first to describe older adults' experiences with VOE participation since the onset of the COVID-19 pandemic, and second, to explore community-dwelling older adults' post-pandemic perspectives on VOE.

METHODS

Study design

This study employs a descriptive qualitative design (Sandelowski, 2000) that seeks to discover and understand a phenomenon and the perspectives of the participants, rather than developing a theory or understanding the culture or lived experience of the people. This methodology was chosen because it allows the researcher to provide direct descriptions of

phenomena and is particularly relevant in health care services (Bradshaw, Atkinson, & Doody, 2017).

Data collection and sampling

Purposive sampling was adopted as a sampling strategy. Community-dwelling older adults with experience using videoconferencing technology to participate in remote online exercise classes during the COVID-19 pandemic were invited to participate in the study through four community centers for older adults in Hong Kong. The specific inclusion criteria were: 1) community-dwelling older adults aged 55 or older, and 2) those who have participated in VOE during the COVID-19 pandemic once a week for at least one month. Those who could not communicate in Cantonese were excluded from the study.

Sample size considerations

Sample size was determined by the principle of data saturation (Bradshaw et al., 2017; Walker, 2012), which is also called inductive thematic saturation and is reached when no more new themes can be gleaned from the data analysis (Saunders et al., 2018).

Recruitment and interviews of participants took place between September 2021 and January 2022 through four community centers for older adults in Hong Kong S.A.R that offered VOE to their members. These centers are located in four administrative districts: Sai Kung, Eastern, Sha Tin and Kwai Tsing. In terms of area-based socio-economic status with reference to median household income, Sai Kung district ranked third (~USD 4,528) among 18 administrative districts in Hong Kong, Eastern ranked fourth (~USD 4,105), Sha Tin ranked tenth (~USD 3,592) and Kwai Tsing ranked sixteenth (~USD 3,078) (Census and Statistics Department, 2020).

Ethical considerations

Before the commencement of the study, ethical approval was obtained from the Human Research Ethics Committee (HREC) of Hong Kong Metropolitan University (Reference number: HESF2021/11). Information sheets with details of the study and issues regarding voluntary participation, confidentiality and potential risks and benefits were provided and explained to the participants before the commencement of data collection, and written consent was obtained. Those who participated online accessed the information sheet and consent form through the online platform Qualtrics™ before the interview.

Semi-structured individual interviews

Participants could choose to conduct their individual interviews through videoconferencing or face-to-face in the community center, and after the interview, were asked to fill in a short background form regarding demographic characteristics, PA, and their use of videoconferencing technologies. The first author with five years of experience in performing qualitative research conducted all the interviews. An interview guide pilot tested among community-dwelling older adults who have experiences in VOE was used to guide the interviews. The guide consisted of five main topics: a warm-up question, participants' general self-description of the experience, their positive and negative experiences of using VOE, and their future intention of joining VOE classes. For the warm-up question, they were asked to describe what type of exercise classes they had been attending. Then they were asked to describe their experience generally, with a question such as "Can you tell me more about your experience of videoconferencing-delivered online exercise classes?" Next, they were asked to tell what they liked and disliked about VOE. Finally, they were asked whether they would still want to have VOE offered by their community center if the COVID-19 pandemic were over and social distancing measures were removed.

The background form was used to collect demographic and technological characteristics of the participants, providing an important external reference to validate the findings of the study. Details included the following:

Demographic characteristics

Age, gender, educational level, living conditions and perceived health status were collected. A 5-point Likert scale was used for health status, with 1 being poor and 5 being excellent.

Technological characteristics

The participants' technological abilities were interrogated using two questions: 1) "What technological device did you use for attending online exercise classes (smartphone, tablet, computer, tablet/computer connected to a TV screen)?" and 2) "Indicate your perceived ability in operating videoconferencing software on a 5-point Likert scale, with 1 being low and 5 being high."

Technological acceptance was measured using the Senior Technology Acceptance Model 14-item scale (STAM-14) (Chen & Lou, 2020). STAM-14 comprises 14 items, with each item rated on a 10-point scale from 1 being very unsatisfied to 10 being very satisfied. STAM-14 consists of four constructs: attitudinal beliefs, control beliefs, gerontechnological anxiety and health. The total scores ranged from 14 to 140, with a higher score indicating a higher level of acceptance towards technology by older adults. The scale was shown to have good internal consistency (Cronbach's $\alpha = 0.817\text{-}0.915$) and construct validity (AVE = 0.155-0.795).

The satisfaction level with participation in VOE classes was measured using one question: "Indicate your satisfaction level with remotely-delivered online exercise classes on a 5-point Likert scale, with 1 being low and 5 being high."

Data analysis

All of the interviews were audio-recorded and transcribed verbatim. Aligning with the methodological orientation of descriptive qualitative research, in which straight descriptions of the phenomena are desired, thematic analysis of the data was performed (Braun & Clarke, 2006). This method consists of six steps: 1) familiarizing oneself with the data; 2) generating initial codes; 3) searching for themes; 4) reviewing themes; 5) defining and naming themes; and 6) producing the report. It is often used to describe or summarize patterns of meaning in the data that are in line with the descriptive design.

Trustworthiness was considered in the study through ensuring the credibility, auditability, and transferability of the data (LoBiondo-Wood & Haber, 2010). Credibility was ensured via data triangulation; three authors (JLC, VWQ, RYC) with backgrounds in PA, gerontology and health sciences iteratively reviewed the illustrative examples and refined the themes in team meetings. There were regular consultations with co-authors in which interpretations of the data were cross-examined. The triangulation process kept the interpretations in check and facilitated the production of solid evidence. Discrepancies were infrequent but, when they occurred, were resolved through discussion and consensus. Auditability was ensured through keeping an audit trail with details of the data analysis process. Transferability was ensured through keeping adequate information (i.e., verbatim transcriptions, audio-recorded interview content) for evaluation of the analysis.

RESULTS

Participants' demographic and technological characteristics

Twenty-three community-dwelling older adults aged 55 to 89 (mean: 69.78 ± 8.52) years participated in the study. All of the participants were female. Their mean STAM-14 score was 99, indicating a moderate level of technological acceptance (Table 1).

----------Table 1----------

Themes

Figure 1 shows the eight key themes identified in the study; four emerged as positive experiences, two as negative experiences, and the remaining two themes were related to post-pandemic perspectives. Details of the key themes, sub-themes and selected quotations can be found in supplementary file 1.

----------Figure 1----------

Positive Experiences

Convenience

VOE participants experienced improved time control in their daily lives. Due to the elimination of travel time, they could better manage household chores and exercise routines. Some appreciated the elimination of travel fatigue due to the lack of exposure to weather conditions during travel to community centers. They also experienced freedom in the form of trips to the washroom at their convenience, the lack of mask-wearing and the ease of replenishing their drinks during class. The following is a sampling of direct quotes from study participants:

"…at home [I] can clean the floor and do household chores until the last minute, when I hear the voice of the coach and start exercising." (Participant: 019; age: 71; STAM-14:102; perceived videoconferencing ability: average)

"…if you go to the community center, you need time, you need to wait for transport and you're affected by the weather. We don't encounter this situation if we [Zoom] at home." (Participant: 006; age: 74; STAM-14:84; perceived videoconferencing ability: good)

"…wearing a mask is bothersome; the lack of need for a mask at home feels so comfortable." (Participant: 003; age: 61; STAM-14:98; perceived videoconferencing ability: average)

"…drinking water at breaks and going to the washroom is convenient. As we age, we need to use the bathroom frequently if we drink water, [and there is] comparatively more freedom." (Participant: 002; age: 61; STAM-14: 102; perceived videoconferencing ability: average)

Motivated homebased-exercise

Participants experienced extrinsic motivation to perform an adequate amount and intensity of exercise when they had real-time instruction and supervision from an instructor in VOE classes.

"Given my situation, I won't always go out and attend so many [classes]…I am very bad, I am very passive. But I like that there is someone teaching me. If I exercise by myself, I just do some simple exercises…now there is a set time and I exercise for an hour…" (Participant: 001 age: 69; STAM-14: 92; perceived videoconferencing ability: average)

"…Because I am a lazy person, I do not have the perseverance to perform exercise or perform an adequate amount of exercise. [At zoom] there is an instructor, it is like more people and there are sharings, and I feel happy. Apart from the instructor, there are other classmates, sometimes we talk about the difficulties we encountered. We heeheehaha [laugh and chat] when we perform the exercise, it feels like a face-to-face class."

(Participant: 004, age:60, STAM-14:110, Perceived videoconferencing ability: Average)

"I am a person who cannot initiate myself to exercise; this kind of regular [zoom class] that we can attend at home is very precious. I want to join it even after the pandemic."

(Participant: 006, age:74, STAM-14:84, Perceived videoconferencing ability: Good)

"For human beings, there is the quality of laziness. The instructor always encourages us not to be lazy. I tell them, no, I don't know why if there was a telephone rang, I would always want to pick up the phone and end up there was no time for exercise. If I perform exercise at the centre or at zoom, there is an instructor there, I feel embarrassed to leave them and do other matters while doing exercise."

(Participant: 008, age:79, STAM-14:86, Perceived videoconferencing ability: Above average)

Regularity

Since the onset of the COVID-19 pandemic, VOE classes have enhanced the regularity of participants' exercise. Before VOE was offered by community centers, in-person exercise

classes had limited space, and some participants were not accepted due to the lottery system. However, since the outbreak of COVID-19, VOE classes have allowed the participants to continuously participate at home while receiving real-time instruction and supervision. Guaranteed enrollment in VOE classes improved the regularity of participants' exercise habits. Some participants mentioned that VOE classes also increased their amount of exercise.

"…before we had Zoom, we went to the community center, but space in the room was limited, the quota was limited. With Zoom, we can have … twenty to thirty people, and we can take the class. (Participant: 002; age: 61; STAM-14: 102; perceived videoconferencing ability: Average)

"I occasionally take brisk walks…and having this Zoom online exercise class [on top of brisk walking] increases my total amount of physical activity." (Participant: 011; age: 65; STAM-14: 114; perceived videoconferencing ability: average)

Technological transformation

Participants with different levels of computer literacy experienced different levels of technological transformation and advancement due to their participation in VOE classes since the onset of the COVID-19 pandemic. They overcame certain technological barriers by learning how to operate a smartphone, advancing their hardware and improving their VOE experience with the assistance from family members and staff of the community center.

"I explored for quite a while…my desktop did not have a webcam, but the instructor in the online exercise class wanted to see participants. At that time, I hadn't bought a tablet, I thought adjusting the camera would be tiring…At last I bought a tablet. Now I can exercise in the living room, and I feel better. The instructor can see me. When I advanced further, I asked my family member to buy an HDMI cable and connect it to the TV screen…I feel that I am becoming more and more advanced because of this pandemic!" (Participant: 005; age: 55; STAM-14:93; perceived videoconferencing ability: above average)

"At the beginning, we didn't know how to use it. We didn't even know how to enter [the virtual classroom]. Interestingly, sometimes we would successfully get into the [virtual classroom] but we could not hear any sound. We had a visual image, but no sound. It was a

mess. But after some practice, we became adapted to it. Now it is okay." (Participant: 019; age: 71; STAM-14:102; perceived videoconferencing ability: average)

"I told my daughter-in-law that I have to attend zoom class organized by the community centre. I told her I did not know how to set up, so my daughter-in-law sent my granddaughter to come over to my place…my granddaughter taught me how to set up …it became easy, now the community centre sent us the link to zoom, we only have to click it. If we do not know how to use it, we can call the centre, and the staff in the community centre will teach us how to use it." (Participant: 008, age:79, STAM-14:86, Perceived videoconferencing ability: Above average)

Negative experiences

Compromised supervision quality

While participants expressed that the quality of instruction received from VOE was similar to that of in-person instruction, they experienced a compromised quality of supervision. They expressed that they experienced less feedback or less timely feedback from the instructor due to factors like the camera's inability to capture their body parts or the instructor's difficulty in managing so many online students.

"At the end of the day, [the supervision quality] is not as good. For example, [I] might not correctly execute some movements, but the instructor may not spot it in a timely manner." (Participant: 004; age: 60; STAM-14:110; perceived videoconferencing ability: average)

"The instructor may not be able to observe your whole body or everybody [in zoom]. If the class is organized in a face-to-face format, it is easier to correct incorrect movements... If the instructor observed a wrong movement, he would tell that classmate and demonstrate again. In zoom, this aspect was compromised. It is hard to correct the movement immediately." (Participant: 009, age:68, STAM-14:131, Perceived VC ability: Good)

Technical barriers

While participants experienced technological transformation and advancement, they also expressed certain technical barriers they faced during VOE classes, like unstable WiFi

networks, data issues, the camera's inability to capture physical movements and hardware and software operations.

"If you are not using a computer but a mobile phone, you are using a lot of mobile data. The class lasts for an hour, it is using a lot [of data]." (Participant 008; age: 79; STAM-14:86; perceived videoconferencing ability: above average)

"The image sometimes flashes. It is like interference…" (Participant 015; age: 68; STAM-14:118; perceived videoconferencing ability: above average)

"Previously, when I used the computer (to attend zoom online exercise class), the instructor actually could not observe whether my leg movements were correct because I could not adjust the camera angle. You have to see whether the camera can capture the whole body, so the adjustment part is difficult." (Participant 009; age: 68; STAM-14:131; perceived videoconferencing ability: good)

"The mobile [phone] is okay but the screen is small, our eyes are not good. I feel more comfortable using the computer. If there is no computer, I think the mobile is too small, the screen is small. We have presbyopia, bigger is better." (Participant 023; age: 70; STAM-14:96; perceived videoconferencing ability: average)

Post-pandemic perspective

Increase in exercise opportunity due to increased virtual capacity

Rather than perceiving VOE as a delivery method that arose only due to the COVID-19 pandemic and wishing to return to face-to-face mode as soon as it is over, participants perceived this new delivery method as a solution to the physical space limitations of community centers, enabling increased exercise enrollment capacity for members.

"…there are thousands of members [in our center], but we only have 20 places [in each class]. We break our heads for those places, but we still don't necessarily get them…For example, I plan to register for Monday, but I cannot always register as I wish. It would be good if, on top of those face-to-face places, we could have online places to watch…" (Participant 019; age: 71; STAM-14:102, perceived videoconferencing ability: average)

"[There are] so many people! You cannot always be successfully drawn (in the lots drawing system). If that's the case, we can participate zoom online exercise class. It is fine to participant in zoom, I [can] learn more. I hope zoom online exercise class can be retained after the pandemic"

(Participant: 017, age:70, STAM-14:95, Perceived videoconferencing ability: Average)

"The face-to-face class has limited capacity. There are many monks but too few congees. Sometimes I could not be successfully drawn in the draw lots system. Even I want to join classes; I cannot join. Zoom allows more participants. It can solve the problem of limited physical capacity."

(Participant: 006, age:74, STAM-14:84, Perceived videoconferencing ability: Good)

Mobility-restricted groups

Beyond being a potential solution to space limitations at in-person exercise classes in community centers, VOE was perceived as a good delivery method for mobility-restricted groups to which the community center's in-person exercise classes had paid less attention before the pandemic. Frail older adults with restricted mobility found that the elimination of traveling made attending exercise class easier. Some expressed that VOE is a caregiver-friendly delivery mode for those who cannot be away from their care recipients.

"I need a walking stick if I go out. If I can exercise at home, I don't need the stick. For me, it is less tiring, I feel at ease. I only have to turn on the computer at the right time." (Participant 007; age: 87; STAM-14: 98; perceived videoconferencing ability: above average)

"…caregivers cannot always go out as they have to take care of family members…[Zoom exercise classes] are good for them—they do not have to be away from the care recipient but can still attend classes." (Participant 003; age: 61; STAM-14:98; perceived videoconferencing ability: average)

DISCUSSION

This study described the experiences of community-dwelling older adults who participated in VOE classes during the COVID-19 pandemic, and their perspectives on the potential use of VOE after the pandemic. The findings of this study unveiled that VOE is not only a delivery

mode that is welcomed by older adults during the pandemic. Its unique characteristics helped older adults to overcome PA participation barriers that has long been identified in PA literature. Although there are aspects of limitations identified, those aspects could be addressed or overcame by community support and continuous technological advancement.

Encouraging positive VOE experiences

The theme of "convenience" that emerged in our study furthered the understanding of "convenience" reported by older adults participating in virtual health management classes in previous studies (Sanchez-Villagomez et al., 2021). VOE as a new method of exercise class delivery reduces key environmental barriers and improves key facilitators that have been identified in previous PA studies. For example, systematic reviews found that concerns over "transportation," "convenience of location" and "access to a washroom" have always impacted participation in structured PA among community-dwelling older adults (Moran et al., 2014). VOE allows older adults to participate in structured PA classes in their home environment, with access to their own washroom, and without the need to travel, eliminating all of the key environmental barriers that older adults identified in previous studies.

"Motivated home-based exercise" is an interesting theme that emerged in our study in contradiction to a different recent VOE quantitative study conducted among the adult population group in Germany (Füzéki, Schröder, Groneberg, & Banzer, 2021). While the study in Germany found that 70% of VOE participants strongly agreed or agreed they had a harder time motivating themselves in VOE classes than in-person ones, the qualitative findings from our study indicate that older adults were motivated by real-time instruction and supervision to perform an adequate amount and intensity of exercise during the COVID-19 pandemic. Without the VOE, they seldom had the initiative to start an exercise routine by themselves and even if they did, the exercise they did was of less intensity or inadequate

intensity. A recent review of PA interventions, including face-to-face, home-based and a combination of the two, revealed no evidence that a certain mode of delivery was superior to any others in achieving good outcomes among older adults (Zubala et al., 2017). It will be interesting to see whether additional future evidence about VOE, with its hybrid characteristics of face-to-face and home-based delivery, will reveal it to be a superior delivery mode of PA intervention for older adults.

The theme of "regularity" was in line with a previous virtual health management intervention study (Sanchez-Villagomez et al., 2021), but our study added another dimension by showing how VOE improved the chances of successful exercise class enrollment during the COVID-19 pandemic. Before the widespread use of virtual classes necessitated by the pandemic, enrollment was restricted by the physical space available in community centers. Several participants expressed their appreciation of the extra places for enrollment in VOE classes, allowing them to continue their structured PA participation. Some even mentioned that they had increased their PA level because of the increased opportunities for enrollment. This is especially important because COVID-19 PA studies illustrated that those who were able to stay active during the pandemic experienced anxiety relief, and PA played an important role for older adults who are in social isolation during the pandemic (Airola, Rasi, & Outila, 2020; da Cruz, D'Oliveira, Dominski, Diotaiuti, & Andrade, 2022).

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Negative aspects of VOE experience that could be addressed

Similar to previous research on VOE, "compromised supervision quality" was a key negative aspect of VOE participation in this study. A recent study conducted in Germany (Füzéki et al., 2021) also found that more than half of VOE participants reported missing the individual guidance of an exercise instructor. Similarly, older adults in our study were worried about

incorrect movements leading to injury. Our study identified two main dimensions related to the compromised quality of supervision. One is the inability of the camera to capture participants' body parts, thus affecting the instructor's ability to provide feedback. The second is the capacity of the instructor to manage a bigger class compared with the in-person context. A recent feasibility study on VOE among older adults in Israel (Schwartz et al., 2021) provided some useful strategies to improve supervision quality in VOE. The study's protocol required the instructor to give at least one piece of feedback to each participant at each session and involved mentioning their names. Using these strategies, the study achieved a median score of 7 out of 7 when participants were asked whether they had received enough attention in class.

With technological assistance from younger family members and community centers, the participants in our study experienced technological transformation; older adults overcame various technological barriers such as upgrading hardware and learning software operations to participate smoothly in class. This finding confirmed a previous quantitative study conducted in Hong Kong that showed that facilitating factors significantly predict actual technology usage (Chen & Chan, 2014). Yet, despite the transformation, some technological barriers persisted, such as software operation, network and data issues, most of which have been identified in previous studies (Airola, Rasi, & Outila, 2020; Goethals et al., 2020); still, unique barriers found in our study were the camera's inability to capture participants' bodily movements and the screen sizes of their smart devices. While the feasibility study by Schwartz and colleagues (2021) showed that a 15-minute introductory technology session with participants could reduce the technological barriers faced by older adult participants, the issues of camera capture and screen size identified in our study revealed an important area of focus for technological companies to consider for innovative development in the near future.

Post-pandemic perspective

Systematic review showed that in the context of chronic disease management, the use of videoconferencing in delivering group classes has gained acceptance (Banbury et al., 2017). However, in the context of community health management, there are differing perspectives on the acceptance of VOE among older adult groups. For instance, older adults in France seemed to be unreceptive to using online tools to keep up with PA during the COVID-19 pandemic (Goethals et al., 2020), while in Israel, 97% of participants in a feasibility study of VOE indicated that they would participate in a future VOE class. In our study, data collected among older adult members of community centers support the continued use of VOE after the pandemic. Participants see VOE as increasing their opportunities to participate regularly in supervised and structured PA. VOE potentially solves the physical space limitations of community centers in Hong Kong. Older adults in our study expressed that they were "grateful" and "thankful" for VOE as an additional mode of PA delivery. Participants in our study also considered VOE as having good potential to serve mobility-restricted groups such as frail older adults, for whom travelling back and forth to a community center is tiring, and caregivers who cannot easily leave their care recipients. This finding further confirms findings from an earlier study of Hong Kong older adults, which showed that members of this population who rated their own health as poor were more likely to use technology to compensate for age-related deficiencies (Chen & Chan, 2014). Other findings further confirm the potential for videoconferencing-delivered interventions to reach aging people who have difficulty accessing existing health management programs (Banbury et al., 2017) and those who live in rural areas (Airola et al., 2020).

Limitations

Several limitations should be acknowledged when interpreting the findings of this study. First, the fact of voluntary participation might have attracted older adults with more positive experiences to participate in our study and thus might have created bias. Moreover, all the

participants were female, older men might have different experiences and perspectives. Second, the participants were recruited through community centers, and their views and experiences might differ from those who participate in online exercise classes through a commercial organization. Third, although not purposely recruited, the participants had a moderate level of technological acceptance as reflected in the STAM-14 scores, so our findings may only be valid for community-dwelling older adults who have a similar technological acceptance level. Lastly, the participants in our study were already exercise class attendees, and their views might have differed from those community center members who were less motivated with regard to exercise participation.

Strengths

This is the first study that adopted an in-depth qualitative research methodology to elicit rich contextual data on VOE experiences and perspectives among community-dwelling older adults in naturalistic settings. Previous literature only collected information through written responses to questionnaires, limiting the perspectives gathered from those with a lower literacy level. Furthermore, our study successfully recruited older adults across a wide age spectrum (55 to 89), their experiences and perspectives were not biased towards a certain age cohort, the study maximized the difference and provide generality to the phenomenon under investigation.

Practical implications and recommendations for future research

Our study findings provide practical implications for community centers and community health professionals to improve the quality of VOE by enhancing the identified positive aspects and addressing the negative aspects of VOE. The findings could also suggest areas of improvement to technology professionals regarding humanistic applications of gerontechnological hardware and software. Our study also elicited important perspectives on

the potential post-pandemic role of VOE for target client groups in community centers. Regarding future research, the descriptive qualitative research design this study adopted only offered direct description of the experience, future research might be benefited from a phenomenological research design and the phenomenological investigation of the VOE experience among a more specific group like live-alone oldest old group, or mobility-restricted group will further our understanding on how VOE could play a role in the aged community services. Moreover, the current study did not capture instructors' perspectives on online exercise. Future studies may want to collect data on this. This information is as important as users' perspectives to give important implications to future community services for older adults, which increasingly rely on technology to provide higher quality services to community members.

Competing interests

The authors declare that they have no competing interests.

Authors' contributions

JLC conceptualized the study, collected, analyzed data and wrote the manuscript. VWQ and RYC helped with data analysis and manuscript review. All authors read and approved the final manuscript.

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Table

Table 1. Participants' demographic and technological characteristics

Figure legends

Figure 1. Key themes identified in the study