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A Cluster Randomized Controlled Trial of a Positive Physical Activity Intervention

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Objective: Due to global urbanization, technological advancements, and increasing convenience in daily activities, reduced energy expenditure in all aspects of life has become a major public health concern. A positive physical activity (PPA) intervention was developed to promote physical activity and fitness among Hong Kong families. PPA utilizes positive affective attitudes to circumvent barriers to health behavior change by helping families associate feelings of enjoyment with physical activity. Zero-Time Exercise (ZTEx) was introduced and promoted as a foot-in-the-door approach. ***Method:*** Using a community-based collaborative approach, the research team worked with social service organizations, a government department, and schools to implement a cluster randomized controlled crossover trial at a citywide scale. A total of 1,983 eligible participants from 1,467 families were recruited from all 18 districts in Hong Kong. Data were collected using structured questionnaires and physical fitness assessments at preintervention and 1-month and 3-month follow-up. ***Results:*** PPA was effective in increasing ZTEx and ZTEx with family members at 1-month and 3-month follow-up and in improving balance and endurance at 3-month follow-up. Semistructured focus groups provided further support for the intervention effectiveness and added in-depth insights into the participants' motivational, interpersonal, and affective experiences. ***Conclusion:*** The results not only shed light on the intervention's effectiveness for physical activity and fitness but also demonstrated that the community-based collaborative approach was successful in engaging relevant stakeholders in an active and fruitful partnership with effective capacity building for program development.

Keywords: randomized controlled trial, community-based intervention, positive psychology, physical activity, physical health

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Physical activity (PA) is defined as the use of skeletal muscles to produce any form of bodily movement for everyday functioning, such as activities pertaining to work, transportation, household chores, and recreation (World Health Organization [WHO], 2018a). Because PA has significant benefits for health and fitness, the WHO recommends that children and adults should engage in a

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minimum of 60 min and 150 min of moderate-intensity PA per week, respectively. However, due to global urbanization, technological advancements, and increasing convenience in daily activities, reduced energy expenditure in all aspects of life has become a major public health concern. Physical inactivity is a major cause of mortality and a primary risk factor for noncommunicable diseases. Approximately 23% of adults and 81% of adolescents surveyed did not meet the WHO recommendations worldwide, and the prevalence is even more severe in developed countries (WHO, 2018b). In Hong Kong, a staggering 71% of adults did not meet WHO recommendations on PA, 67% were physically inactive, 53% spent 6 hr or more on sedentary behavior per day, and 91% did not engage in any PA with family members (School of Public Health, 2013). This persistent and growing health-related problem calls for an urgent need to develop an intervention program that can effectively promote PA not only at the individual level but also at the family, community, and citywide levels. In light of these concerns, a set of community-based family "holistic health" intervention programs was developed, implemented, and evaluated in the Happy Family Kitchen Movement (HFKM) project to promote well-being and health in Hong Kong. By integrating positive psychology concepts with health-promotion activities (i.e., PA and healthy eating) in the programs, the results provided support for overall intervention effectiveness on well-being outcomes, including family harmony, subjective happiness, and mental quality of life (Ho, Mui, Wan, Yew, & Lam, 2020). To extend our previous work, the present article specifically reports findings on the physical health outcomes of the positive physical activity (PPA) intervention from the HFKM to examine its effectiveness for promoting PA and fitness among families.

Various models of health behavior change have been adopted in intervention programs that aim to increase PA. However, they have generally been criticized for inconsistent or lack of empirical support for theory assumptions (Marks, Murray, Evans, & Estacio, 2015). Although the intention to engage in health-promotion behaviors is presumed to be the primary mechanism of behavior change, it is often difficult to increase PA even when people have the intention to be active and healthy (Rhodes & Dickau, 2012). Meta-analyses of PA intervention studies revealed that the current theory-based programs were no more effective than non-theory-based programs (McEwan et al., 2019; Prestwich et al., 2014). Furthermore, most the existing interventions were focused at the individual level, disregarded the social context of PA, reported high dropout rates and low intervention compliance, tailored interventions to selective recipients (patients, unhealthy individuals), targeted multiple health-promotion behaviors (PA, healthy diet, and smoking cessation), and required intensive engagement (an average of 18 contact hours) from program facilitators and recipients (Albarracín, Wilson, Chan, Durantini, & Sanchez, 2018; Marks et al., 2015; Prestwich et al., 2014). These barriers or deficiencies reduce the feasibility, acceptability, and scalability of the interventions for real-world implementation in community settings. Community-based programs should be simple for implementation by community stakeholders, oriented to behaviors that can easily be adopted, cost-effective with brief intervention sessions, and flexible for adaptation in social and health services.

Positive psychology, the scientific investigation of positive subjective experiences, individual strengths and virtues, and positive institutions that contribute to optimal human functioning (Seligman, 2002), can be adopted for the understanding, examination, and promotion of PA and health. Increasing empirical evidence suggests that subjective well-being has a salutary impact on a wide range of health outcomes, such as longevity, general health, immune functioning, and cardiovascular health (Howell, Kern, & Lyubomirsky, 2007). Scholars speculate that participation in health-promotion behaviors may be the underlying mechanism linking positive psychological states to physical health (DuBois et al., 2012). In particular, individuals with greater optimism and who held positive attitudes about exercise were found to be more likely to participate in PA and adhere to a recommended exercise routine. The upward spiral theory of lifestyle change was recently proposed to explain the role of positive emotions in promoting health behavior change (Van Cappellen, Rice, Catalino, & Fredrickson, 2018). According to the theory, successful lifestyle change results from positive emotions experienced during a target health-promotion behavior, such as PA, which increasingly motivate the individual to engage in that activity as personal resources are broadened by the positive emotions. The motivation to engage in PA is a nonconscious, implicit process that helps to maintain the activity through a positive feedback loop. Because positive emotions also serve to build biological (e.g., cardiac vagal tone), cognitive (e.g., mindfulness), psychological (e.g., flourishing), and social resources (e.g., social integration), the positive feedback loop is further strengthened as these resources provide support for behavioral maintenance of PA (Fredrickson, 2013; Van Cappellen et al., 2018).

A series of community-based interventions based on a positive psychology framework and applied to family activities, such as cooking and dining together, has been conducted in Hong Kong to promote family communication and well-being (Ho et al., 2016a, 2016b). The results showed salutary intervention effects on family well-being. However, whether positive psychology concepts can be integrated with health-promotion behaviors to enhance physical health among families is largely unknown. The intervention described in the present article, namely, PPA, was developed with reference to positive psychology as a guiding framework and PA with family members as a platform. The intervention utilized positive affective attitudes to circumvent barriers to health behavior change by helping families associate feelings of enjoyment with PA. Through activating the incentive salience for PA, families would not only be motivated to change but also actually engage in it. With reference to previous positive psychology interventions conducted in Hong Kong (Ho et al., 2016a, 2016b) and taking compatibility with PA into consideration, the positive psychology themes of joy, gratitude, and savoring were adopted in PPA. The joy theme emphasized short-term pleasures and long-term gratifications from PA and PA with family members (Seligman, 2002). The gratitude theme involved the expression of thankfulness and appreciation to family members for doing and enjoying PA together (Peterson & Seligman, 2004). The savoring theme focused on enjoying and cherishing the present moment and the quality time spent doing PA with family members (Seligman, Rashid, & Parks, 2006). The intervention programs were brief and easy to implement so that people of all ages could engage in lifestyle change.

The target PA involved Zero-Time Exercise (ZTEx), which is simple; does not require extra time; and can be done while sitting, standing, and walking by moving and stretching different parts of

the body, such as the head, neck, shoulders, waist, back, and upper and lower limbs (Lam, Ho, Lau, Wan, & Chan, 2017; Lam et al., 2016). ZTEx adopts a foot-in-the-door approach by starting with a small amount of exercise during daily activities so as to match the busy working lives of Hong Kong people. ZTEx is adaptive to different contexts and situations and can be made into an enjoyable activity for family members of different generations to engage in together. Examples of ZTEx include stationary cycling while watching TV, stretching various parts of the body during a meeting, doing squats while waiting for the bus, and punching while walking.[1] The duration, flexibility, distance, and intensity of ZTEx can be increased with practice to maximize health benefits. Research has shown that even intermittent exercise can produce health benefits similar to those of continuous moderate-intensity exercise (Gillen et al., 2014). ZTEx is consistent with the PA guidelines for Americans, which emphasize that increases in bodily movement and reductions in sedentary behavior will benefit almost everyone, especially individuals who are the least physically active (Piercy et al., 2018). ZTEx enables busy city dwellers to practice PA in small steps in order to cultivate a healthier lifestyle and engage in more intensive physical exercise regimens. Pilot studies conducted on small samples showed that ZTEx training could increase PA, reduce sedentary behavior, and improve physical fitness (Lai et al., 2019; Yeung et al., 2018).

Using a mixed-methods approach, this study aimed to examine the secondary outcome measures of the HFKM by (a) testing the hypothesis that PPA is effective for promoting PA and fitness (i.e., ZTEx and ZTEx with family members and physical fitness assessments of balance and endurance) and (b) providing in-depth insights into the participants' motivational, interpersonal, and affective experiences during health behavior change. The use of both quantitative and qualitative methods provides the opportunity to examine whether the intervention is effective, as well as why it is effective, to shed light on the psychosocial processes involved (Marks et al., 2015). To the best of our knowledge, no similar studies have been conducted to implement and evaluate a community-based family intervention that integrates positive psychology with health-promotion behaviors to enhance PA and fitness.

Method

Participants

The HFKM (Ho et al., 2020) was a citywide project that involved participants from all 18 districts in Hong Kong. It was implemented from May 2015 to October 2016. To maximize the generalizability of the study results and increase public health impact, more inclusive eligibility criteria were adopted (Spoth, Kavanagh, & Dishion, 2002). The selection criteria of this study were as follows: (a) Cantonese speaking, (b) intact verbal and hearing abilities for interpersonal communication, (c) reading and writing abilities for questionnaire completion, (d) aged 12 or older for participation in the intervention evaluation, and (e) attend the program sessions with one or more family members. Participants were recruited from local social service organizations, the Social Welfare Department of the Hong Kong government, kindergartens, and primary schools. Meta-analyses of over 200 studies with more than 110,000 participants revealed small effect sizes in intervention studies that aim to facilitate health-promotion behaviors, including PA and healthy eating (Albarracín et al., 2018; Dusseldorp, van Genugten, van Buuren, Verheijden, & van Empelen, 2014; Michie, Abraham, Whittington, McAteer, & Gupta, 2009). Prior research on community-based family interventions with similar intensity, duration, and time points showed a maximum dropout rate of about 50% at follow-up (Ho et al., 2016a, 2016b). With reference to prior experience, a sample size of at least 1,920 was required for this cluster randomized controlled crossover trial (cRCT) to detect small effect sizes of .20 with a statistical power of .80, an α of .05, and an attrition rate of 50% while accounting for clustering effects (Campbell, Thomson, Ramsay, MacLennan, & Grimshaw, 2004). In total, 4,198 individuals were invited, and 1,983 eligible participants from 1,467 families participated in the study.

Participants were recruited from social service organizations, the government department, and schools through (a) promotional materials such as posters, banners, leaflets, and publications; (b) phone invitations; (c) face-to-face invitations; (d) promotion through websites and e-mails; (e) home visits; and (f) referrals from social service workers and teachers. Written consent was obtained prior to the study. For children enrolled in the study, written consent was obtained from the adult next of kin, caretakers, or guardians on their behalf. Participation was completely voluntary, and participants had the right to withdraw at any time without consequences. As an incentive for completing the questionnaires and physical fitness assessments, two HK$50 (about US$13) supermarket gift vouchers were given to each participating family at the end of the study. Ethics approval was granted by the Institutional Review Board of the University of Hong Kong/Hospital Authority Hong Kong West Cluster (UW 15–083) and registered under ClinicalTrials.gov (NCT02563613).

Procedure

Social service workers and teachers of the participating social service organizations and schools were trained in a 2.5-day workshop to design and implement the community programs. It was implemented from May 2015 to April 2016. The training workshop was delivered by clinical psychologists, registered social workers, a registered nurse, and academic researchers to comprehensively cover the contents of positive psychology, PA, program design, and program evaluation. Experiential learning was used to help trainees design and deliver family-friendly activities that integrate positive psychology themes with PA. Because all of the trainees were exposed to the contents of the intervention in order to deliver the different program sessions in a crossover trial, it was inevitable for them to be knowledgeable about the study design. They were provided with a practice manual in addition to supervision and consultation from the research team during the planning and implementation stages of the community programs so as to ensure their quality and consistency.

[1] Demonstration videos of ZTEx can be found at https://www.family.org.hk/en/health-communication/0-1-exercises/.

Practical information about ZTEx, with photos and text descriptions, as well as a fitness self-test for setting exercise goals and recording the results, can be found in the Zero-Time Exercise mobile app at https://www.family.org.hk/en/health-communication/zero-time-exercise-mobile-app/.

cRCT was used to randomly allocate 54 clusters of social service units and schools (from 28 nongovernmental organizations, 1 government department, and 7 schools) into three groups: positive physical activity (PPA), positive healthy diet (PHD), and control (C). The randomization procedure was conducted using computer-generated random numbers (allocation ratio of 1:1:1). An independent statistician who was not in contact with the social service units, schools, and participants performed the randomization and allocation. The participants were not informed about the other groups in the study. For the PPA group (Intervention Arm 1, consisting of 15 clusters, 528 participants), the participants received a core session of about 2 hr, followed by a booster session of about 1 hr 1 month later. For Group C (waitlist control arm, consisting of 20 clusters, 790 participants), the participants received a tea gathering session at the beginning and 1 month later. The core session in the PPA group consisted of group activities and homework assignments on positive psychology and PA; the booster session in the PPA group involved the consolidation of knowledge and skills obtained from the core session; and the tea gathering sessions included activities unrelated to the intervention, such as arts and crafts workshops (Ho et al., 2020). The PHD group (Intervention Arm 2, consisting of 19 clusters, 665 participants) is not described in detail here because it is outside the scope of the present article. A crossover design was adopted in which the participants received a core session from another intervention arm after the outcomes had been assessed at 3 months (i.e., the PPA group subsequently received the PHD core session, the PHD group subsequently received the PPA core session, and Group C subsequently received the PPA/PHD core session). This ensured that all of the participants had an opportunity to take part in the intervention programs because the study was conducted in the community.

To examine PA and fitness at the individual participant level, structured questionnaires and physical fitness assessments were administered at preintervention (baseline assessment, T_1), 1-month follow-up after the core session (before the booster session, T_3), and 3-month follow-up after the core session (T_4). These outcomes were not included immediately after the core session (T_2) because it was irrelevant to assess behavior change at this time. The time points were chosen based on prior experience with community-based family interventions that modified behaviors for promoting well-being and health within 3 months (Ho et al., 2017). This is the typical assessment duration for other similar interventions that promote health-related behavior change (Albarracín et al., 2018). Furthermore, 1-month and 3-month follow-ups aligned with the time frame of intervention implementation so that the effects of the core and booster sessions could be assessed. To minimize possible bias from the program facilitators and research team in handling the outcome assessments, the structured questionnaires were self-administered with standardized instructions, and the physical fitness assessments followed a standardized protocol with a prerecorded video to guide the procedure across all groups. As indicated by the Consolidated Standards of Reporting Trials (CONSORT) flow diagram in Figure 1 (Egger, Jüni, Bartlett, & the CONSORT Group, 2001), the retention rate for the PPA group was 87.3% at T_3 and 77.7% at T_4, whereas for Group C, it was 87.2% at T_3 and 75.4% at T_4.

Semistructured focus groups were conducted with the participants after the completion of the community programs and follow-up sessions. Purposive sampling was used to recruit those who attended both the core and booster sessions in PPA. Two trained interviewers conducted 11 focus groups for a total of 92 participants. Semistructured interview guidelines and prompts were developed according to a standardized focus-group protocol (Krueger & Casey, 2000) to provide in-depth insights into the participants' experiences, underlying motivations, and thoughts and feelings associated with behavior change, or lack of change, during and after participating in the intervention program. Flexibility was allowed during the group discussions to enable unanticipated themes to emerge. The focus groups were audio-recorded and lasted for approximately 60 min in a quiet venue. A separate written consent was obtained prior to the interview, and participation was completely voluntary. Another HK$50 supermarket gift voucher was given to each participant as an incentive.

Intervention Programs

After receiving the training workshop, social service workers and teachers designed and implemented the PPA programs by emphasizing on one of the three positive psychology themes of their choice (i.e., joy, gratitude, and savoring). The flexibility for interventionists to tailor their own programs enabled the unique needs of families from different clusters to be accommodated. The overall objective of the intervention was the same for all programs regardless of the choice of themes, which was to promote ZTEx and ZTEx with family members. In total, 58 intervention programs were implemented within the period from July 2015 to October 2016.

ZTEx and ZTEx with family members were promoted in the programs through positive psychology themes. Each theme consisted of three target behaviors for participants to engage in during group activities and homework assignments so that PA could be encouraged, reinforced, and sustained. The joy theme involved (a) sharing happy experiences in PA with family members, (b) discovering joy during PA, and (c) reminiscing about a PA experience that made one or one's family happy. The gratitude theme involved (a) appreciating the strengths of family members during PA and expressing one's gratitude for doing and enjoying PA together to family members through (b) words and (c) actions. The savoring theme involved (a) paying attention to the process of PA, (b) savoring the moment of PA, and (c) treasuring quality time during PA with family members (Ho et al., 2020). These behaviors were practiced during the intervention through hands-on experiential learning so that positive emotions were elicited and character strengths were utilized within a positive environment. Homework assignments were used to reinforce these behaviors on a routine basis.

Onsite observation was conducted at each of the core, booster, and tea gathering sessions to ensure the quality and consistency of the intervention programs. The degree of adherence in delivering the core messages of the intervention during the core (85.5%) and booster sessions (87.8%) was high. The degree of adherence to the fitness assessment protocol at T_1 (85%), T_3 (84.5%), and T_4 (85.1%) was also high. As rated on a scale of 1 to 5, the activities designed by the program facilitators for the core (mean [*M*] = 3.99, standard deviation [*SD*] = .74), booster (*M* = 4.09, *SD* = .62), and tea gathering sessions (*M* = 4.00, *SD* = .58) were of high quality. Furthermore, the intervention participants were actively

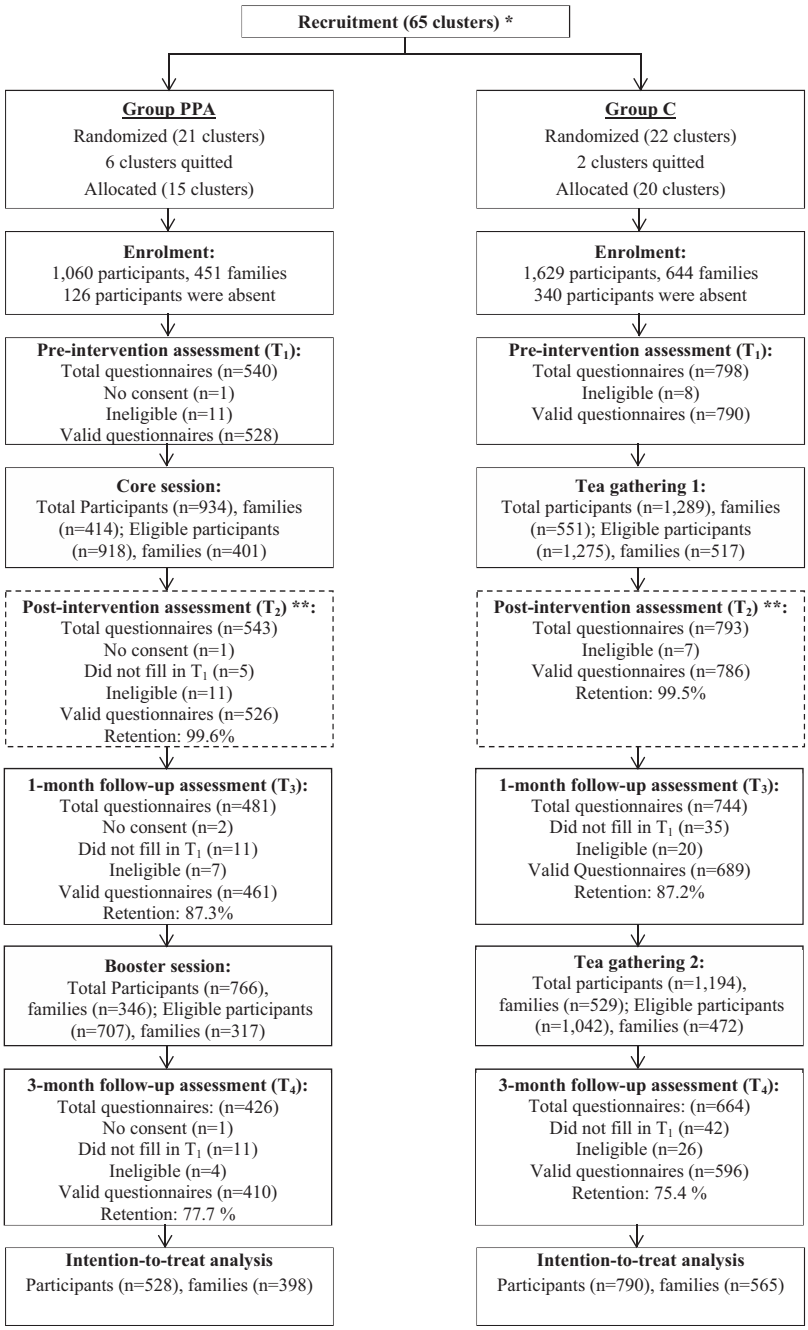

Figure 1. The Consolidated Standards of Reporting Trials (CONSORT) flow diagram of participants in Group PPA and Group C through each stage of the study (Ho et al., 2020). * 19 clusters (n = 665) were allocated to a positive healthy diet group (not reported in the article). ** ZTEx and physical fitness were not assessed immediately postintervention.

engaged in practicing the target behaviors during the core (M = 3.87, SD = .67) and booster sessions (M = 4.00, SD = .64).

Measures

ZTEx and ZTEx with family members. Participants self-reported the frequency of ZTEx and ZTEx with family members in the past 4 weeks on an 11-point scale, ranging from 0 (*never*) to 10 (*very frequently*). The operational definition of ZTEx was provided to the participants to improve the validity of the instrument (Iwai et al., 2001). This approach is commonly used to assess intervention-specific health behavior change (Hawkins et al., 2010; Park & Gaffey, 2007). Self-report single-item measures of PA have been evaluated for reliability and validity among adoles-

cents (Ng et al., 2019), older adults (Gill, Jones, Zou, & Speechley, 2012), and healthy adult populations (Silsbury, Goldsmith, & Rushton, 2015), which provided empirical evidence for good to excellent test–retest reliability; moderate to good convergent, concurrent, and discriminant validity against other self-report measures of PA and health; and moderate to good criterion validity against objective accelerometer data (Milton, Bull, & Bauman, 2011; Milton, Clemes, & Bull, 2013; Wanner et al., 2014).

Balance. Balance is a health indicator of physical fitness essential for preventing injuries and falls during daily activities and sports (Muehlbauer, Gollhofer, & Granacher, 2015). Participants were asked to perform the single-leg stance by standing on one leg of their choice, with the other leg raised such that the raised foot was close to the ankle of the standing leg but without touching it (Springer, Marin, Cyhan, Roberts, & Gill, 2007). During the assessment, participants' eyes remained open, looking forward, with the arms crossed over the chest. A stopwatch was used to measure the amount of time each participant was able to stand on one leg, with a maximum of 120 s. The time of assessment ended when the participants either uncrossed their arms, touched the standing leg or floor with the raised foot, or moved the standing foot to maintain balance or when the maximum time had been reached. The procedure was repeated twice, and each time was reported on a record sheet. To ensure adherence to the single-leg-stance protocol, a video prepared by the research team to demonstrate the procedure was shown on a large screen. Research assistants and volunteers provided assistance, monitored the procedure, and informed the participants that their assessment had ended when necessary.

Endurance. Muscular endurance is defined as the functional capacity of a muscle or group of muscles to perform repetitive motions over a period of time (Bemben, 1998). It is a health indicator for cardiovascular and respiratory fitness, mobility limitation, body composition, and mortality (Roshanravan et al., 2017; Vaara et al., 2014). Participants were asked to perform stationary cycling by sitting on a stable chair while leaning on its back, with the hands holding on to both sides, the hips flexed, the knees slightly bent, and the hamstrings off the chair (Lam et al., 2016, 2017). During the assessment, participants flexed the right hip with the right knee up and then returned to the original position with the right knee down and then successively flexed the left hip with the left knee up and then returned to the original position with the left knee down. This cycling movement was done at a pace of 1 cycle per second, with a maximum of 120 s. A stopwatch was used to measure the amount of time each participant was able to cycle, and the assessment ended when the participants either rested their legs on the chair with the hamstrings touching it, placed their feet on the floor, or stopped the cycling movement or when the maximum time had been reached. The procedure was repeated twice, and each time was reported on a record sheet. A video was used to demonstrate the procedure, and research assistants and volunteers provided assistance during the assessment.

Data Analysis

Quantitative data were analyzed using Statistical Package for the Social Sciences (SPSS) 25.0. Pearson's chi-square tests and multilevel linear mixed models were conducted to examine the comparability of demographic characteristics and baseline scores among the groups. Based on the principle of intention-to-treat analysis (Fisher et al., 1990), missing data were imputed using the expectation-maximization (EM) algorithm, which is an iterative procedure to identify maximum likelihood estimates (Schafer & Graham, 2002). Multilevel linear mixed models were conducted with the fixed effect of group allocation (i.e., PPA and C), and random effects of individuals (Level 1) nested within families (Level 2) nested within programs (Level 3). Self-reported PA and objective physical fitness assessed at T_3 and T_4 were included as outcome variables. Age, sex, education level, and baseline values at T_1 were included as control variables. Between-group differences in the outcome changes (i.e., PPA vs. C) and within-group changes across time points were examined (i.e., T_1 vs. T_3, T_1 vs. T_4). The intracluster correlation coefficient (ICC) was used to determine the relatedness of clustered data.

To ensure the reliability of the qualitative data, audio recordings were transcribed verbatim into Chinese. Thematic analysis was used to identify themes within the qualitative data (Braun & Clarke, 2006). Transcripts were read in detail, and broad themes were recorded. An in-depth analysis was then conducted using a process of constant comparisons to identify main themes and subthemes. To ensure objectivity during the analysis, a panel of researchers performed the coding analysis. Consensus was reached by reanalyzing the themes and checking the codes when necessary. The transcripts were reviewed to ensure that all meaningful interview data had been exhausted. Qualitative findings are reported in the online supplemental materials.

Results

Demographic Characteristics and Baseline Measures

The majority of the participants were aged 20 to 59 years, were female, and received secondary education (see Table 1). The PPA group had a higher proportion of males, $\chi^2(1) = 5.16$, $p = .02$, and lower education level than Group C, $\chi^2(4) = 15.68$, $p = .003$. No statistically significant differences were detected between the two groups on age. The PPA group scored lower on balance than Group C at baseline ($b = -5.21$, standard error [*SE*] = 2.17, $p = .02$). Baseline scores of ZTEx, ZTEx with family members, and endurance were not significantly different between the two groups.

Intervention Effectiveness

Table 2 shows that the PPA group's increase in ZTEx at T_3 and T_4 was significantly greater than that of Group C ($b = .55$, $SE = .14$, $p < .001$, $d = .29$ and $b = .61$, $SE = .13$, $p < .001$, $d = .35$, respectively; see Part A of Figure 2). Furthermore, the PPA group's increase in ZTEx with family members at T_3 and T_4 was significantly greater than that of Group C ($b = .85$, $SE = .15$, $p < .001$, $d = .42$ and $b = .55$, $SE = .14$, $p < .001$, $d = .29$, respectively; see Part B of Figure 2). For physical fitness assessments, the PPA group's improvement in balance at T_4 ($b = 4.46$, $SE = 1.56$, $p = .004$, $d = .18$; see Part A of Figure 3) and endurance at T_4 ($b = 3.49$, $SE = 1.65$, $p = .03$, $d = .14$; see Part B of Figure 3) was significantly greater than that of Group C. ICCs ranged from .11 to .35.

Table 1
Demographic Characteristics and Outcome Measures at Baseline

Variables	PPA (n = 528)	C (n = 790)	Group difference p value
Age (years)[a,b]			.14
12–19	33 (6.3)	37 (4.7)	
20–39	150 (28.4)	253 (32.0)	
40–59	249 (47.2)	396 (50.1)	
60 or older	96 (18.1)	104 (13.2)	
Sex[a,b]			.02*
Male	143 (27.1)	171 (21.6)	
Female	385 (72.9)	619 (78.4)	
Education level[a,b]			.003**
Primary or below	123 (23.3)	124 (15.7)	
Secondary	321 (60.8)	510 (64.6)	
Tertiary or above	84 (15.9)	156 (19.7)	
ZTEx[c,d,e] (1 item, 0–10)	4.91 (2.64)	4.96 (2.67)	.81
ZTEx with family[c,d,e] (1 item, 0–10)	3.49 (2.68)	3.46 (2.45)	.68
Balance[c,d,e] (0–120 s)	83.72 (39.21)	90.86 (40.57)	.02*
Endurance[c,d,e] (0–120 s)	69.16 (32.39)	68.74 (36.17)	.96

Note. PPA = positive physical activity group; C = control group; ZTEx = Zero-Time Exercise. Missing values were imputed using the expectation-maximization (EM) algorithm.
[a] n (%). [b] p values generated from Pearson's chi-square tests. [c] M (SD). [d] p values generated from multilevel linear mixed models. [e] The analysis controlled for age, sex, and education level.
* $p < .05$. ** $p < .01$.

Within-Group Changes

Table 2 shows that there were significant within-group increases from baseline in the PPA group on ZTEx at T_3 and T_4 ($p < .001$, $d = .34$ and $p < .001$, $d = .38$, respectively), ZTEx with family members at T_3 and T_4 ($p < .001$, $d = .47$ and $p < .001$, $d = .43$, respectively), balance at T_4 ($p = .02$, $d = .09$), and endurance at T_4 ($p < .001$, $d = .16$). For Group C, there were significant within-group increases from baseline on ZTEx with family members at T_3 and T_4 ($p = .01$, $d = .16$ and $p < .001$, $d = .22$, respectively) and significant within-group decreases from baseline on balance at T_3 and T_4 ($p = .02$, $d = .07$ and $p = .003$, $d = .09$, respectively).

Discussion

The results showed that PPA was effective in increasing ZTEx and ZTEx with family members at 1-month and 3-month follow-up, with a small effect size. Furthermore, PPA was effective in

Table 2
Effectiveness of PPA as Estimated by Multilevel Linear Mixed Modeling

	PPA	Control	Between-group change		ICC
Variables	M (SE)[a]	M (SE)[a]	b (SE)	Cohen's d[b]	rho/ρ
ZTEx					
T_1	4.91 (.12)	4.96 (.13)	—	—	—
T_3	5.73 (.09)***	5.18 (.11)	.55 (.14)***	.29	.17
T_4	5.76 (.09)***	5.16 (.10)	.61 (.13)***	.35	.23
ZTEx with family					
T_1	3.53 (.12)	3.46 (.13)	—	—	—
T_3	4.70 (.10)***	3.85 (.11)**	.85 (.15)***	.42	.31
T_4	4.55 (.09)***	4.00 (.11)***	.55 (.14)***	.29	.35
Balance					
T_1	85.71 (1.67)	90.92 (1.38)	—	—	—
T_3	87.38 (1.32)	86.62 (1.10)*	.76 (1.73)	.03	.23
T_4	90.11 (1.20)*	85.65 (.99)**	4.46 (1.56)**	.18	.11
Endurance					
T_1	68.90 (1.60)	69.00 (1.33)	—	—	—
T_3	70.10 (1.35)	69.36 (1.12)	.76 (1.75)	.03	.33
T_4	73.79 (1.26)***	70.30 (1.05)	3.49 (1.65)*	.14	.35

Note. PPA = positive physical activity; ICC = intracluster correlation coefficient; ZTEx = zero-time exercise. The analysis controlled for age, sex, and education level.
[a] Statistical significance indicates within-group change from T_1. [b] Cohen's d: small = .20; medium = .50; large = .80.
* $p < .05$. ** $p < .01$. *** $p < .001$.

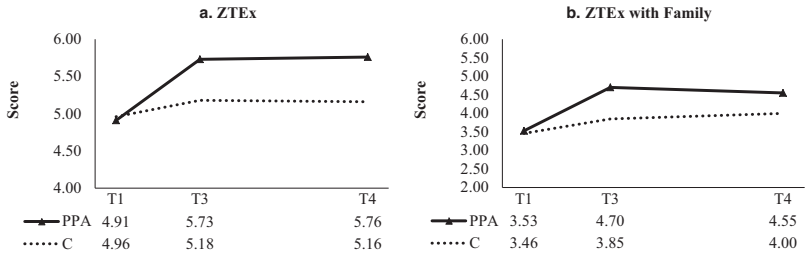

Figure 2. Effectiveness of PPA on ZTEx and ZTEx with family compared with the control group.

improving balance and endurance at 3-month follow-up, with a small effect size. Within-group improvements were also observed in PPA for ZTEx (T_3, T_4), ZTEx with family members (T_3, T_4), balance (T_4), and endurance (T_4). The control group showed within-group improvements in ZTEx with family members (T_3, T_4), decline in balance (T_3, T_4), and no changes in ZTEx and endurance. The qualitative results provided further support for the intervention effectiveness and added in-depth insight into the participants' motivational, interpersonal, and affective experiences associated with PA after participating in the program (see the online supplemental materials). The results are consistent with those found in the literature on health behavior change interventions, which typically produced small effect sizes of $d = .23$ (Albarracín et al., 2018), $d = .31$ (Michie et al., 2009), or $g = .31$ (Dusseldorp et al., 2014) for both self-reported and objective measures of health-related behaviors, including PA and healthy eating. However, prior studies used multiple sessions to deliver the intervention, which typically spanned over a period of 25 weeks (Michie et al., 2009) or lasted for approximately 18 hr on average (Albarracín et al., 2018). PPA is not only effective for promoting PA and fitness, but it is also cost-beneficial, requiring only two sessions, approximately 3 hr in total, making it a more feasible and acceptable option for implementation in community settings. The present study should be considered for its merits in (a) developing an innovative and practical health behavior change intervention, (b) implementing and evaluating the intervention in a territory-wide community context, (c) increasing the public health impact by targeting universal samples, (d) accounting for accessibility by training nonhealth professionals to become the source of delivery, and (e) extending the intended benefits beyond the study participants via close collaboration with the social service and education sectors.

The study findings provide support for the major proposition of the upward spiral theory of lifestyle change in which health-promotion behaviors are undertaken and maintained when positive emotions are experienced during these activities (Van Cappellen et al., 2018). Through the application of positive psychology themes, participants were able to associate feelings of enjoyment with ZTEx, which nurtured nonconscious motives for that health-promotion behavior and in turn led to successful lifestyle change. Physical fitness was ultimately improved. Nonconscious motives derived from the incentive salience of ZTEx were a central mechanism accounting for the maintenance of health-promotion behavior (Van Cappellen et al., 2018), as supported by sustained engagement in ZTEx and ZTEx with family members for up to 3 months. Whereas traditional forms of PA, such as going to the gym, jogging, hiking, and swimming, require extensive efforts to plan the behavior by evaluating the pros and cons, assessing the potential barriers, and setting specific goals (Ajzen, 1985), ZTEx utilizes the implicit motivational benefits of incentive salience because it can be done anytime and anywhere. The participants did not have to go through great lengths to plan ZTEx, as indicated by the qualitative interviews. As a foot-in-the-door approach, ZTEx aims at getting inactive individuals to comply to a large request for more regular and greater amounts of moderate to vigorous PA by having them agree to a modest request first for intermittent lower-intensity PA that is more readily integrated into daily life (Lai et al., 2019; Yeung et al., 2018). Because the positive affect experienced during ZTEx broadens and builds biological, cognitive, psychological, and social resources, which in turn serve to amplify the effects of positive emotion on health behavior change and maintenance (Fredrickson, 2013), individuals who engage in ZTEx would set a healthier lifestyle in motion with increasingly stronger motivation and more positive attitudes toward PA over time. Recent studies showed that induced feelings of joy can lead to increased activation and enhanced prioritization of PA goals, greater willingness to engage in various types of PA, and actual engagement in those activities (Cameron, Bertenshaw, & Sheeran,

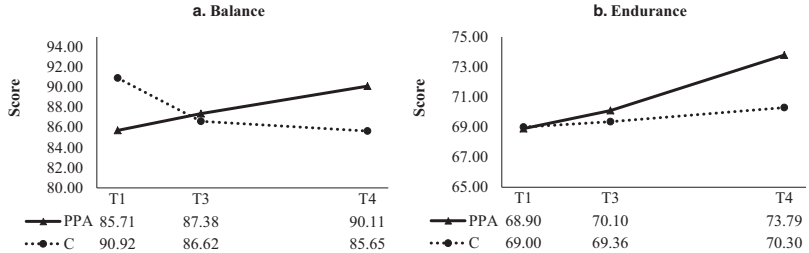

Figure 3. Effectiveness of PPA on balance and endurance compared with the control group.

2018). Further research is needed to examine whether PPA can promote engagement in more intensive forms of PA in the long run.

Although the study was conducted in Hong Kong, the findings should be generalizable to Western populations. The community-based intervention adopted a positive psychology framework that originated in the United States (Seligman & Csikszentmihalyi, 2000). Positive psychology interventions have been extensively examined in the West and have consistently shown beneficial effects on a wide range of outcomes for psychosocial well-being and mental health, including increased happiness, positive affect, mental quality of life, and resilience, as well as reduced pessimism, negative affect, and depressive symptoms (Bolier et al., 2013; Odou & Vella-Brodrick, 2013; Pietrowsky & Mikutta, 2012; Seligman, Steen, Park, & Peterson, 2005; Sin & Lyubomirsky, 2009). Therefore, individuals from Western countries (e.g., North America, Western Europe, and Australia) should be similarly susceptible to the intervention activities that emphasize positive affect, positive behavior, and positive cognition (i.e., joy, gratitude, and savoring) adopted in the present study. In addition, although the intervention program is family based, it is not only oriented for collectivistic cultures. Empirical evidence suggests that social support from family is an important determinant of PA across all age groups (Gill et al., 2018; Lindsay Smith, Banting, Eime, O'Sullivan, & van Uffelen, 2017; Wang, Pbert, & Lemon, 2014), especially if those family members can form a social norm for healthy lifestyles by also being physically active themselves (Scarapicchia, Sabiston, Pila, Arbour-Nicitopoulos, & Faulkner, 2017). Increased levels of moderate to vigorous PA from family support were consistently found across Western countries (Van Dyck et al., 2014). Therefore, family-based interventions have been recommended internationally for promoting PA among males and females, young and old. Nevertheless, for populations that prefer PA to be enacted in individual and/or nonfamilial group contexts, many positive psychology themes that have been proven to be effective in the literature (DuBois et al., 2012) can be adapted for integration with PA or specifically ZTEx. For example, the "best possible self" is an optimism exercise in which participants are asked to imagine their best possible physical health over the next several years and consider how to take steps toward a healthy lifestyle. Another example is "pleasurable and meaningful acts," which is a purpose-finding exercise in which participants are asked to complete the following three acts each day: (a) a pleasurable act done alone (e.g., working out at a fitness center), (b) a pleasurable act done with others (e.g., jogging with friends), and (c) a meaningful act (e.g., writing a physical activity diary). Future research can explore the various options in positive psychology for promoting PA among different populations and contexts.

The results of this study should be considered with the following limitations. First, as is the case with all intervention studies, the participants voluntarily chose to take part in the study, so self-selection bias is inevitable. The participants might be more aware of the psychological and physical needs of their family members and were more motivated to engage in health behavior change than those who did not participate. Second, it was impractical and unethical to decline social service users and students of the social service centers and schools from joining the community programs on the basis of the study inclusion criteria or consent to provide research data. Therefore, there were more people enrolled in the community programs than the actual number of eligible participants who took part in the study. Third, ZTEx was self-reported, so the results might be susceptible to response bias. However, it was not practicable to use pedometers, accelerometers, heart-rate monitors, or armbands in this study because they are too costly for a large-scale community-based program (Wanner et al., 2014). Furthermore, because ZTEx involves bodily movement during daily activities, motion monitor devices and sensors may not be able to distinguish the movements and workloads from other forms of PA (Silsbury et al., 2015). Nevertheless, positive results from the objective physical fitness assessments corroborated with self-reports on health behavior change. Fourth, performance on the fitness assessments of balance and endurance did not depend only on physical fitness but also the willpower to persist. This might explain the significant decline in balance for the control group because although the fitness assessments might have been novel and interesting to the participants at baseline, they likely lost interest by T_4 without proper education and promotion. Increasing participants' motivation to engage in health behavior change for improving physical health was an important mechanism of PPA. Fifth, because assessments were administered at 1-month and 3-month follow-up, the sustainability of the long-term intervention effects on PA and physical fitness is unknown. Nevertheless, this is one of the few community-based studies on health behavior change interventions that reported postintervention follow-up data (Dzewaltowski, Estabrooks, Klesges, Bull, & Glasgow, 2004). Furthermore, it was meant to be a foot-in-the-door approach to engage inactive city dwellers to start with a small amount of exercise so as to facilitate subsequent compliance with more intensive physical exercise regimens. Future research is encouraged to integrate PPA into the initial stage of programs for health behavior change intervention so that participants can practice ZTEx as a small step toward being physically active. Sixth, the results of this study showed small size effects because low-intensity, brief intervention sessions were provided to the general population. However, this approach is in line with the public health approach in which effective and cost-beneficial interventions that reach and benefit large numbers of the general public can be valuable (Spoth et al., 2002). The study contributes by expanding our knowledge of effective strategies for individual and family engagement, guiding utilization of empirically supported interventions in the community, and informing more ecologically sensitive intervention research. Finally, Bonferroni correction was not applied for testing multiple hypotheses in this study because (a) PPA was at the initial stage of development, in which it was more important to not miss a possible effect worthy of further study; (b) there would be an increased likelihood of Type II errors due to the reduced statistical power to detect an effect; and (c) a priori hypotheses were determined before any data were collected and analyzed, as specified in the clinical trials registration (Armstrong, 2014; Perneger, 1998). More conservative tests can be performed in future studies to confirm and replicate the study results with different populations.

The HFKM project was a large-scale, citywide cRCT to examine the effectiveness of a community-based family intervention in Hong Kong. It was conducted in close collaboration with numerous community partners from different organizations in the social service and education sectors. The results not only shed light on the intervention effectiveness on PA and fitness for the general population but also demonstrated that the community-based collaborative approach was successful in engaging relevant stakeholders in an active and fruitful partnership with effective capacity building for program development. The HFKM laid a good foundation and served as a practical example for nonhealth professionals from similar urban areas to design and deliver cost-effective PA intervention programs for physically inactive city dwellers.

References

Ajzen, I. (1985). From intentions to actions: A theory of planned behavior. In J. Kuhl & J. Beckmann (Eds.), *Action control: From Cognition to behavior* (pp. 11–39). Berlin, Germany: Springer. http://dx.doi.org/10.1007/978-3-642-69746-3_2

Albarracín, D., Wilson, K., Chan, M. S., Durantini, M., & Sanchez, F. (2018). Action and inaction in multi-behaviour recommendations: A meta-analysis of lifestyle interventions. *Health Psychology Review, 12,* 1–24. http://dx.doi.org/10.1080/17437199.2017.1369140

Armstrong, R. A. (2014). When to use the Bonferroni correction. *Ophthalmic & Physiological Optics, 34,* 502–508. http://dx.doi.org/10.1111/opo.12131

Bemben, M. G. (1998). Age-related alterations in muscular endurance. *Sports Medicine, 25,* 259–269. http://dx.doi.org/10.2165/00007256-199825040-00004

Bolier, L., Haverman, M., Westerhof, G. J., Riper, H., Smit, F., & Bohlmeijer, E. (2013). Positive psychology interventions: A meta-analysis of randomized controlled studies. *BMC Public Health, 13,* 119. http://dx.doi.org/10.1186/1471-2458-13-119

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology, 3,* 77–101. http://dx.doi.org/10.1191/1478088706qp063oa

Cameron, D. S., Bertenshaw, E. J., & Sheeran, P. (2018). Positive affect and physical activity: Testing effects on goal setting, activation, prioritisation, and attainment. *Psychology & Health, 33,* 258–274. http://dx.doi.org/10.1080/08870446.2017.1314477

Campbell, M. K., Thomson, S., Ramsay, C. R., MacLennan, G. S., & Grimshaw, J. M. (2004). Sample size calculator for cluster randomized trials. *Computers in Biology and Medicine, 34,* 113–125. http://dx.doi.org/10.1016/S0010-4825(03)00039-8

DuBois, C. M., Beach, S. R., Kashdan, T. B., Nyer, M. B., Park, E. R., Celano, C. M., & Huffman, J. C. (2012). Positive psychological attributes and cardiac outcomes: Associations, mechanisms, and interventions. *Psychosomatics: Journal of Consultation and Liaison Psychiatry, 53,* 303–318. http://dx.doi.org/10.1016/j.psym.2012.04.004

Dusseldorp, E., van Genugten, L., van Buuren, S., Verheijden, M. W., & van Empelen, P. (2014). Combinations of techniques that effectively change health behavior: Evidence from Meta-CART analysis. *Health Psychology, 33,* 1530–1540. http://dx.doi.org/10.1037/hea0000018

Dzewaltowski, D. A., Estabrooks, P. A., Klesges, L. M., Bull, S., & Glasgow, R. E. (2004). Behavior change intervention research in community settings: How generalizable are the results? *Health Promotion International, 19,* 235–245. http://dx.doi.org/10.1093/heapro/dah211

Egger, M., Jüni, P., Bartlett, C., & the CONSORT Group. (2001). Value of flow diagrams in reports of randomized controlled trials. *Journal of the American Medical Association, 285,* 1996–1999. http://dx.doi.org/10.1001/jama.285.15.1996

Fisher, L. D., Dixon, D. O., Herson, J., Frankowski, R. K., Hearron, M. S., & Peace, K. E. (1990). Intention to treat in clinical trials. In K. E. Peace (Ed.), *Statistical issues in drug research and development* (pp. 331–350). New York, NY: Marcel Dekker.

Fredrickson, B. L. (2013). Positive emotions broaden and build. In P. Devine & A. Plant (Eds.), *Advances in experimental social psychology* (Vol. 47, pp. 1–53). Cambridge, MA: Academic Press.

Gill, D. P., Jones, G. R., Zou, G., & Speechley, M. (2012). Using a single question to assess physical activity in older adults: A reliability and validity study. *BMC Medical Research Methodology, 12,* 20. http://dx.doi.org/10.1186/1471-2288-12-20

Gill, M., Chan-Golston, A. M., Rice, L. N., Roth, S. E., Crespi, C. M., Cole, B. L., . . . Prelip, M. L. (2018). Correlates of social support and its association with physical activity among young adolescents. *Health Education & Behavior, 45,* 207–216. http://dx.doi.org/10.1177/1090198117714826

Gillen, J. B., Percival, M. E., Skelly, L. E., Martin, B. J., Tan, R. B., Tarnopolsky, M. A., & Gibala, M. J. (2014). Three minutes of all-out intermittent exercise per week increases skeletal muscle oxidative capacity and improves cardiometabolic health. *PLoS ONE, 9,* e111489. http://dx.doi.org/10.1371/journal.pone.0111489

Hawkins, N. A., Smith, T., Zhao, L., Rodriguez, J., Berkowitz, Z., & Stein, K. D. J. J. C. S. (2010). Health-related behavior change after cancer: Results of the American Cancer Society's Studies of Cancer Survivors (SCS). *Journal of Cancer Survivorship, 4,* 20–32. http://dx.doi.org/10.1007/s11764-009-0104-3

Ho, H. C. Y., Mui, M., Wan, A., Ng, Y. L., Stewart, S. M., Yew, C., . . . Chan, S. S. (2016a). Happy Family Kitchen II: A cluster randomized controlled trial of a community-based family intervention for enhancing family communication and well-being in Hong Kong. *Frontiers in Psychology, 7,* 638. http://dx.doi.org/10.3389/fpsyg.2016.00638

Ho, H. C. Y., Mui, M., Wan, A., Ng, Y. L., Stewart, S. M., Yew, C., . . . Chan, S. S. C. (2016b). Happy Family Kitchen: A community-based research for enhancing family communication and well-being in Hong Kong. *Journal of Family Psychology, 30,* 752–762. http://dx.doi.org/10.1037/fam0000233

Ho, H. C. Y., Mui, M., Wan, A., Stewart, S. M., Yew, C., Lam, T. H., & Chan, S. S. (2017). Happy Family Kitchen: Behavioral outcomes of a brief community-based family intervention in Hong Kong. *Journal of Child and Family Studies, 26,* 2852–2864. http://dx.doi.org/10.1007/s10826-017-0788-3

Ho, H. C. Y., Mui, M., Wan, A., Yew, C., & Lam, T. H. (2020). Happy Family Kitchen movement: A cluster randomized controlled trial of a community-based family holistic health intervention in Hong Kong. *Journal of Happiness Studies: An Interdisciplinary Forum on Subjective Well-Being, 21,* 15–36. http://dx.doi.org/10.1007/s10902-018-00071-w

Howell, R. T., Kern, M. L., & Lyubomirsky, S. (2007). Health benefits: Meta-analytically determining the impact of well-being on objective health outcomes. *Health Psychology Review, 1,* 83–136. http://dx.doi.org/10.1080/17437190701492486

Iwai, N., Hisamichi, S., Hayakawa, N., Inaba, Y., Nagaoka, T., Sugimori, H., . . . Ohno, Y. (2001). Validity and reliability of single-item questions about physical activity. *Journal of Epidemiology, 11,* 211–218. http://dx.doi.org/10.2188/jea.11.211

Krueger, R. A., & Casey, M. A. (2000). *Focus groups: A practical guide for applied research* (3rd ed.). Thousand Oaks, CA: Sage.

Lai, A., Stewart, S., Wan, A., Thomas, C., Tse, J., Ho, D., . . . Lam, T. H. (2019). Development and feasibility of a brief Zero-Time Exercise intervention to reduce sedentary behaviour and enhance physical activity: A pilot trial. *Health & Social Care in the Community, 27,* e233–e245. http://dx.doi.org/10.1111/hsc.12728

Lam, T. H., Ho, H. C. Y., Lau, G., Wan, A., & Chan, N. (2017). *Promotion of Zero-Time Exercise (ZTEx) through anti-inertia reminders (AIR): New initiative from the Hong Kong Jockey Club FAMILY Project*. Paper presented at the Primary Care Research Symposium, Hong Kong.

Lam, T. H., Wan, A., Lai, A. Y., Ho, H. C. Y., Lau, G., & King, J. (2016). *Zero-Time Exercises for families: The Hong Kong Jockey Club FAMILY Project*. Paper presented at the 18th Beijing/Hong Kong Medical Exchange, Hong Kong.

Lindsay Smith, G., Banting, L., Eime, R., O'Sullivan, G., & van Uffelen, J. G. Z. (2017). The association between social support and physical activity in older adults: A systematic review. *The International Journal of Behavioral Nutrition and Physical Activity, 14,* 56. http://dx.doi.org/10.1186/s12966-017-0509-8

Marks, D. F., Murray, M., Evans, B., & Estacio, E. V. (2015). *Health psychology: Theory, research and practice* (4th ed.). London, England: Sage.

McEwan, D., Beauchamp, M. R., Kouvousis, C., Ray, C. M., Wyrough, A., & Rhodes, R. E. (2019). Examining the active ingredients of physical activity interventions underpinned by theory versus no stated theory: A meta-analysis. *Health Psychology Review, 13,* 1–17. http://dx.doi.org/10.1080/17437199.2018.1547120

Michie, S., Abraham, C., Whittington, C., McAteer, J., & Gupta, S. (2009). Effective techniques in healthy eating and physical activity interventions: A meta-regression. *Health Psychology, 28,* 690–701. http://dx.doi.org/10.1037/a0016136

Milton, K., Bull, F. C., & Bauman, A. (2011). Reliability and validity testing of a single-item physical activity measure. *British Journal of Sports Medicine, 45,* 203–208. http://dx.doi.org/10.1136/bjsm.2009.068395

Milton, K., Clemes, S., & Bull, F. (2013). Can a single question provide an accurate measure of physical activity? *British Journal of Sports Medicine, 47,* 44–48. http://dx.doi.org/10.1136/bjsports-2011-090899

Muehlbauer, T., Gollhofer, A., & Granacher, U. (2015). Associations between measures of balance and lower-extremity muscle strength/power in healthy individuals across the lifespan: A systematic review and meta-analysis. *Sports Medicine, 45,* 1671–1692. http://dx.doi.org/10.1007/s40279-015-0390-z

Ng, K., Hämylä, R., Tynjälä, J., Villberg, J., Tammelin, T., Kannas, L., & Kokko, S. (2019). Test-retest reliability of adolescents' self-reported physical activity item in two consecutive surveys. *Archives of Public Health, 77,* 9. http://dx.doi.org/10.1186/s13690-019-0335-3

Odou, N., & Vella-Brodrick, D. A. (2013). The efficacy of positive psychology interventions to increase well-being and the role of mental imagery ability. *Social Indicators Research, 110,* 111–129. http://dx.doi.org/10.1007/s11205-011-9919-1

Park, C. L., & Gaffey, A. E. (2007). Relationships between psychosocial factors and health behavior change in cancer survivors: An integrative review. *Annals of Behavioral Medicine, 34,* 115–134. http://dx.doi.org/10.1007/BF02872667

Perneger, T. V. (1998). What's wrong with Bonferroni adjustments. *British Medical Journal, 316,* 1236–1238. http://dx.doi.org/10.1136/bmj.316.7139.1236

Peterson, C., & Seligman, M. E. P. (2004). *Character strengths and virtues: A handbook and classification*. Washington, DC: American Psychological Association.

Piercy, K. L., Troiano, R. P., Ballard, R. M., Carlson, S. A., Fulton, J. E., Galuska, D. A., . . . Olson, R. D. (2018). The Physical Activity Guidelines for Americans. *Journal of the American Medical Association, 320,* 2020–2028. http://dx.doi.org/10.1001/jama.2018.14854

Pietrowsky, R., & Mikutta, J. (2012). Effects of positive psychology interventions in depressive patients—A randomized control study. *Psychology, 3,* 1067–1073. http://dx.doi.org/10.4236/psych.2012.312158

Prestwich, A., Sniehotta, F. F., Whittington, C., Dombrowski, S. U., Rogers, L., & Michie, S. (2014). Does theory influence the effectiveness of health behavior interventions? Meta-analysis. *Health Psychology, 33,* 465–474. http://dx.doi.org/10.1037/a0032853

Rhodes, R. E., & Dickau, L. (2012). Experimental evidence for the intention-behavior relationship in the physical activity domain: A meta-analysis. *Health Psychology, 31,* 724–727. http://dx.doi.org/10.1037/a0027290

Roshanravan, B., Patel, K. V., Fried, L. F., Robinson-Cohen, C., de Boer, I. H., Harris, T., . . . the Health ABC Study. (2017). Association of muscle endurance, fatigability, and strength with functional limitation and mortality in the Health Aging and Body Composition Study. *The Journals of Gerontology Series A, Biological Sciences and Medical Sciences, 72,* 284–291. http://dx.doi.org/10.1093/gerona/glw210

Scarapicchia, T. M. F., Sabiston, C. M., Pila, E., Arbour-Nicitopoulos, K. P., & Faulkner, G. (2017). A longitudinal investigation of a multidimensional model of social support and physical activity over the first year of university. *Psychology of Sport and Exercise, 31,* 11–20. http://dx.doi.org/10.1016/j.psychsport.2017.03.011

Schafer, J. L., & Graham, J. W. (2002). Missing data: Our view of the state of the art. *Psychological Methods, 7,* 147–177. http://dx.doi.org/10.1037/1082-989X.7.2.147

School of Public Health. (2013). *FAMILY project cohort study: Baseline findings*. Pok Fu Lam, Hong Kong: The University of Hong Kong.

Seligman, M. E. P. (2002). *Authentic happiness: Using the new positive psychology to realize your potential for lasting fulfillment*. New York, NY: Free Press.

Seligman, M. E. P., & Csikszentmihalyi, M. (2000). Positive psychology. An introduction. *American Psychologist, 55,* 5–14. http://dx.doi.org/10.1037/0003-066X.55.1.5

Seligman, M. E. P., Rashid, T., & Parks, A. C. (2006). Positive psychotherapy. *American Psychologist, 61,* 774–788. http://dx.doi.org/10.1037/0003-066X.61.8.774

Seligman, M. E. P., Steen, T. A., Park, N., & Peterson, C. (2005). Positive psychology progress: Empirical validation of interventions. *American Psychologist, 60,* 410–421. http://dx.doi.org/10.1037/0003-066X.60.5.410

Silsbury, Z., Goldsmith, R., & Rushton, A. (2015). Systematic review of the measurement properties of self-report physical activity questionnaires in healthy adult populations. *British Medical Journal Open, 5,* e008430. http://dx.doi.org/10.1136/bmjopen-2015-008430

Sin, N. L., & Lyubomirsky, S. (2009). Enhancing well-being and alleviating depressive symptoms with positive psychology interventions: A practice-friendly meta-analysis. *Journal of Clinical Psychology, 65,* 467–487. http://dx.doi.org/10.1002/jclp.20593

Spoth, R. L., Kavanagh, K. A., & Dishion, T. J. (2002). Family-centered preventive intervention science: Toward benefits to larger populations of children, youth, and families. *Prevention Science, 3,* 145–152. http://dx.doi.org/10.1023/A:1019924615322

Springer, B. A., Marin, R., Cyhan, T., Roberts, H., & Gill, N. W. (2007). Normative values for the unipedal stance test with eyes open and closed. *Journal of Geriatric Physical Therapy, 30,* 8–15. http://dx.doi.org/10.1519/00139143-200704000-00003

Vaara, J. P., Fogelholm, M., Vasankari, T., Santtila, M., Häkkinen, K., & Kyröläinen, H. (2014). Associations of maximal strength and muscular endurance with cardiovascular risk factors. *International Journal of Sports Medicine, 35,* 356–360.

Van Cappellen, P., Rice, E. L., Catalino, L. I., & Fredrickson, B. L. (2018). Positive affective processes underlie positive health behaviour change. *Psychology & Health, 33,* 77–97. http://dx.doi.org/10.1080/08870446.2017.1320798

Van Dyck, D., Cerin, E., Conway, T. L., De Bourdeaudhuij, I., Owen, N., Kerr, J., . . . Sallis, J. F. (2014). Interacting psychosocial and environmental correlates of leisure-time physical activity: A three-country

study. *Health Psychology, 33,* 699–709. http://dx.doi.org/10.1037/a0033516

Wang, M. L., Pbert, L., & Lemon, S. C. (2014). Influence of family, friend and coworker social support and social undermining on weight gain prevention among adults. *Obesity, 22,* 1973–1980. http://dx.doi.org/10.1002/oby.20814

Wanner, M., Probst-Hensch, N., Kriemler, S., Meier, F., Bauman, A., & Martin, B. W. (2014). What physical activity surveillance needs: Validity of a single-item questionnaire. *British Journal of Sports Medicine, 48,* 1570–1576. http://dx.doi.org/10.1136/bjsports-2012-092122

World Health Organization. (2018a). *Physical activity*. Retrieved from https://www.who.int/news-room/fact-sheets/detail/physical-activity

World Health Organization. (2018b). *Physical inactivity: A global public health problem*. Retrieved from https://www.who.int/ncds/prevention/physical-activity/inactivity-global-health-problem/en/

Yeung, W. F., Lai, A. Y., Ho, F. Y., Suen, L. K., Chung, K. F., Ho, J. Y., . . . Lam, T. H. (2018). Effects of Zero-Time Exercise on inactive adults with insomnia disorder: A pilot randomized controlled trial. *Sleep Medicine, 52,* 118–127. http://dx.doi.org/10.1016/j.sleep.2018.07.025

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