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Transition to adulthood

Duan, Yanping; Brehm, Walter; Wagner, Petra; Chung, Pak-Kwong; Graf, Sebastian; Zhang, Ru; Si, Gangyan

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Authors
Yanping Duan, Walter Brehm, Petra Wagner, Pak Kwong Chung, Sebastian Graf, Ru Zhang, and Gangyan Si

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Transition to Adulthood: Relationships among Psychosocial Correlates, Stages of Change for Physical Activity and Health Outcomes in a Cross-Cultural Sample

Abstract

Background: A successful transition from late adolescence to adulthood is essential. Physical activity (PA) can support this process and lead to positive health outcomes. The change in PA from inactive to active stages is influenced by psychosocial correlates, and as such, this study tested the relationships among psychosocial correlates, stages of change for PA and health outcomes in university students from Hong Kong (n=404) and Germany (n=366)**. Method:** The questionnaire contained (1) PA and stages of change; (2) ten psychosocial correlates including outcome expectations, affective attitude, barriers, self-efficacy, body-concept, plans, intrinsic motivation, activity emotions, assessment of activity situation, and social support; (3) five health outcomes including fitness, subjective well-being, health satisfaction, physical complaints, and BMI. **Results:** Barriers and intrinsic motivation were the critical psychosocial variables related to stages of change. Specific planning was more important for Hong Kong students' stage progression within inactive stages. Competitive or enjoyable PA programs were more effective for male students moving from inactive to active stages. The link between stages of change for PA and health outcomes (i.e., fitness, health satisfaction) was well established. **Conclusion:** Public health researchers should conduct effective psychosocial interventions that motivate young adults to engage in PA for positive health outcomes.

Transition to Adulthood: Relationships among Psychosocial Correlates, Stages of Change for Physical Activity and Health Outcomes in a Cross-Cultural Sample

Introduction

Transition from adolescence to adulthood

In previous decades the transition from late adolescence to adulthood has been extended due to prolonged education, entering full-time employment later and a delaying the start of a family[1]. This transition period is also a time of intense social transition which is associated with a number of significant life events (e.g. leaving home, becoming more independent from parents and being more responsible for oneself). Engaging in physical activity (PA) can assist in this important phase not only by promoting physical development, and improving fitness and health, but also by developing valuable psychosocial resources, such as confidence, self-regulation and perseverance[2,3]. In industrialized societies, developing a healthy lifestyle which includes PA, is considered essential for young people during the transition to adulthood[2]. However, it is during adolescence and young adulthood where the greatest drop in PA is found[4].

Health enhancing physical activity: Recommendations

There is an agreement that recommendations for Health enhancing physical activity (HEPA) should depend on population age[5]. Most of the recommendations combine children and adolescents aged 5–17 years [6] while only few differentiate between children aged 5-11 years and adolescents aged 12 – 17 years[7]. Accumulating at least 420 minutes per week or one hour each day of moderate PA is recommended for both groups[6,7]. For adults aged 18– 64 years, the recommendations are reduced considerably to at least an accumulated

150 minutes of moderate PA per week[8,9]. However, no special recommendations are made regarding the transition phase from adolescence to adulthood. As such, it could be argued that the HEPA recommendation, for this phase, should fall somewhere in between the recommendations for adolescents and adults. Considering the recommended 420 minutes for children and 150 minutes for adults, 240 minutes of moderate intensity PA per week may be an adequate transitory recommendation. The energy consumption required for HEPA of at least moderate intensity for 240 minutes is 1560 kcal (240minutes*6.5 MET)[10,11]

University Students as a special group in the transition phase

University students are undoubtedly in the transition stage from late adolescence to adulthood. Considerable evidence has revealed a significant decline in PA behavior participation among university students worldwide. Approximately half of the youth population do not engage in the recommended 240 minutes per week[12]. Such a pattern of inactivity, which is reinforced during university, has a significant effect on behavior and health in later adulthood[13,14]. Therefore, it is critical for university students to be motivated to adopt and maintain HEPA during this transition period.

Health-enhancing physical activity integrated into a behavior stage model

By addressing the psychosocial antecedents and health outcomes that are associated with HEPA behavior, researchers may be better able to understand the process of PA behavior change. One particular stage model, the Four Steps from Inactivity to Activity Model (FIT) [15], can be used to facilitate the understanding of the required steps to HEPA. Adapted from previous stage models (Transtheoretical Model, TTM; Health Action Process Approach, HAPA) [16,17], the FIT model investigates and describes (1) self-reported PA behavior

47 including frequency, intensity and type; (2) a stage algorithm to assign individuals into six
48 stages of PA change from lower to higher levels including not-considering, considering,
49 preparing, fluctuating, exploring, and maintaining. Among these six stages, the former
50 three are regarded as inactive stages while the latter three active stages; (3) ten
51 psychosocial correlates, which are essential for the transition between stages, including
52 barriers, self-efficacy, outcome expectations, body concept, plans, affective attitudes,
53 intrinsic motivation, assessment of activity situation, activity emotions and social support;
54 (4) five health outcomes associated with the stages of change including fitness, subjective
55 well-being, health satisfaction, physical complaints and risk factors (BMI)[15].
56 The FIT model posits that there are sequential and logical relationships among the
57 psychosocial correlates, stages of change for PA and health outcomes. By improving
58 critical psychosocial correlates through intervention, there is potential to enhance
59 individual's stages of change for PA. Subsequently, staying in the maintenance stage can
60 lead to positive health consequences (outcomes). This assertion has recently been
61 supported in a cross-sectional study in German and Chinese adult samples (27-55 years)[14].
62 However, this study stated that a stage algorithm based on recommendations for HEPA
63 must vary for different populations including young adults[15]. Therefore, there is a definite
64 need for the cross-cultural application of the FIT model among young adults.
65 *Research questions*
66 The overall research question is concerned with the relationships among psychosocial
67 correlates, PA behavior change and health outcomes in two university student samples
68 from Hong Kong and Germany. More specifically:

(a) Are the self-reported stages of change effective in discriminating PA level in young adults? *(a1)* Do the inactive stages achieve < 1560 Kcal in energy consumption, and do the active stages achieve ≥ 1560 Kcal? *(a2)* On the basis of previous research[15,18], is there a systematic relationship between participants' self-reported PA level and their self-selected stage of change (i.e., not-considering, considering, preparing < fluctuating < exploring < maintaining)?

(b) Are there associations between the psychosocial correlates and the stages of change? *(b1)* Do psychosocial correlates improve over the stages? Do the effects of demographic variables (nationality and gender) vary at certain stages of change? *(b2)* How well do energy consumption, demographics and psychosocial correlates explain the stages of change?

(c) Are there associations between the stages of change and health outcomes? *(c1)* Are the stages of change significantly correlated with health outcomes? *(c2)* How well do demographics and stages of change explain health outcomes?

Methods

Participants

Participants were university students from Hong Kong Baptist University, Hong Kong, China and the University of Bayreuth, Germany. In the Hong Kong sample, 792 students were recruited from Physical Education classes with the assistance of PE lecturers; 510 of whom submitted completed questionnaires during a PE course one-week later. Questionnaires containing missing data (over 50%) and obvious wrong answers were deleted. After this was done, 404 valid questionnaires remained. The mean age of

participants was 19.12 years (SD=1.24) ranging from 17-24 years with 209 females (51.7%). In the German sample, questionnaires were delivered via an on-line survey. University students were informed about this study through a website link during their academic lectures; 429 questionnaires were collected online. Using the same data exclusion methods as in the Hong Kong sample, 366 valid questionnaires were collected. The mean age was 22.51 years (SD=1.59) ranging from 17-24 years with 200 females (54.6%). In general, the entire valid sample of this study was 770 university students with a mean age of 20.73 years (SD=2.21).

Measures

With the use of a cross-sectional study design, participants were asked to complete self-report questionnaires in their native languages. All questionnaires have been well established and validated in previous studies among adult populations in China and Germany[15,19,20]. Prior to the main survey, both samples of young adults were asked about their understanding of the questionnaire to ensure the content validity of the questionnaire. Table 1 provides a brief introduction and Cronbach's α of questionnaires in Hong Kong and German samples. In addition to answering the questionnaires listed in Table 1, participants were also required to report their nationalities, age and gender.

Table 1

Data Analysis

Data were analyzed with SPSS 22.0. The distribution of the stages of change on nationality and gender were examined with X^2 tests. T-tests were used to examine the differences between energy consumption at each stage and the HEPA criterion (1560 kcal). Univariate

F tests with multiple contrasts (Bonferroni) were computed to test the relationships between energy consumption, stages of change and demographic variables.

To test the relationships between the psychosocial correlates and the stages of change, univariate *F* tests with multiple contrasts (Bonferroni), and a multivariate ordinal logistic regression analysis were performed. To test the relationship between the stages of change and health outcomes, means and standard deviations were computed for health outcomes across stages of change. Additionally, spearman correlations and multiple regression analyses were computed.

Results

Participant Characteristics

On average, the Hong Kong students were younger than the German students (M age = 19.12 years, SD=1.24, versus M age = 22.51, SD=1.59; t [768] =33.19, P<.001). No significant gender difference was observed between the two samples (X^2[1, N = 770] = 0.65, P = 0.42). Most participants, in the mixed sample, were women (N=409, 53.1%).

Stages of Change for PA

The stage of change distribution for the entire sample was: not-considering (n = 46, 6.0%), considering (n = 176, 22.9%), preparing (n = 94, 12.2%), fluctuating (n = 148, 19.2%), exploring (n =84, 10.9%) and maintaining (n = 222, 28.8%). There was a relationship between nationality and stage of change (X^2 [5, N = 770] = 198.01; *p* <.001). More Hong Kong students were at the stages of not-considering, considering, preparing and exploring (7.9%, 33.9%, 14.9%, 14.1%, respectively) compared to German students (3.8%, 10.7%, 9.3%, 7.4% respectively); while more German students were at the maintaining stage

(52.2%) compared to Hong Kong students (7.7%). Besides this, the nominal contingency coefficient (0.452) showed a significant correlation between nationality and stage of change (P<.001). The relationship between gender and stage of change was statistically significant, X^2 [5, N = 770] = 12.12, *p <.05*, although the magnitude of gender by stage of change distribution was small (contingency coefficient = 0.124, lower than the criterion value of .30) [30].

Regarding the achievement of the HEPA criterion (1560 Kcal), except for the fluctuating stage (t [147] = 0.85, P>.05), the average energy consumption per week was significantly less than 1560kcal for the inactive stages (not-considering: t [45] = -18.69, p<.001; considering: t [175] = -33.68, p<.001; preparing: t [93] = -12.37, p<.001) and significantly more for the active stages (exploring: t [83] = 4.05, p<.001; maintaining: t [221] = 18.82,p<.001). Regarding energy consumption across stages, as summarized in Table 2, significant differences were observed across the stages of change for energy consumption ($F_{5,764}$=111.4, P=.000, η²=.43). Participants in the inactive stages reported lower energy consumption compared to those in the active stages, with students at the maintaining stage reporting the highest energy consumption. Moreover, the main effect of nationality on energy consumption was also significant ($F_{1, 768}$ = 46.94, P=.000, η² =.059). German students (M = 2181.14 kcal, SD =1150.36) consumed more energy than Hong Kong students (M = 874.54 kcal, SD =1097.17). There were no significant interaction effects among nationality, gender and stage of change on energy consumption (P>.05).

Table 2

Psychosocial Correlates and Stages of Change

Univariate analysis revealed that ten psychosocial correlates significantly differed across the stages of change (See Table 2). A gradient pattern of improvement was found for each psychosocial correlate across the stages of change (i.e., “not-considering” was low through to “maintaining” which was high; the exception was barriers to PA which was, as expected, in the opposite direction). The effect sizes were strong for the association between each stage of change and barriers (η^2=0.27) as well as intrinsic motivation (η^2 = 0.25); medium for the association between each stage of change and activity emotions (η^2 = 0.17), affective attitude (η^2 = 0.16), plans (η^2 = 0.11), and self-efficacy (η^2 = 0.10). The associations between the stages of change and other psychosocial correlates were small (η^2 < 0.10).

Regarding the interaction effects between the stages of change and the demographic variables on the ten psychosocial correlates, only three were significant: nationality by stages of change on plans ($F_{5, 764}$ = 3.31, P<.01), gender by stages of change on intrinsic motivation ($F_{5, 764}$= 3.25, P<.01), and assessment of activity situation ($F_{5, 764}$= 2.78, P<.05). Nationality by gender by stages of change was not significant (P>.05). The descriptive values show that students from both countries made more plans as the stage increased, but plan gain was higher for Hong Kong students progressing from “considering” to “preparing”. Males and females both had higher intrinsic motivation from the “considering” to “maintaining” stages, but males gain more motivation when progressing from “preparing” to “fluctuating”. Both males and females placed more importance on the activity situation from the “preparing” to the “maintaining” stage, but the increase in importance was higher for males from “fluctuating” to “exploring”.

When energy consumption, demographics, and psychosocial correlates of stages of change were entered into a multivariate ordinal logistic regression model, statistically significant results were revealed: likelihood ratio $X^2(15, N = 770) = 734.86$; $p < 0.001$; Cox and Snell Pseudo-R Square=0.615. As shown in Table 3, four out of 15 correlates were significant (P<.05; PA, barriers, plans and intrinsic motivation), after the other correlates were held constant.

Table 3

Stages of Change and Health Outcomes

The mean values and standard deviations of each health outcome are presented in Table 4. Students in the maintaining stage demonstrate better fitness, higher positive well-being, lower negative well-being, more health satisfaction, fewer physical complaints and higher BMI than students at the lower stages. Correlation test results demonstrated that stages of change for PA was linearly correlated with all health outcomes (P<.005) (See Table 4). In particular, stages of change for young adults had the highest association with fitness, followed by health satisfaction, positive well-being, physical complaints, BMI and negative well-being.

Table 4

Table 5 shows the multiple regression analysis for predicting health outcomes. Nationality, gender, and stages of change were all significant predictors of fitness and health satisfaction. For positive well-being, nationality and stage of change were significant. Regarding negative well-being, only stages of change was significant. For physical complaints, gender and stages of change were significant. Lastly, for BMI, nationality and gender were significant whereas stage of change was not.

Table 5

Discussion

This study examined the relationship among psychosocial correlates, stage of change for PA and health outcomes among Hong Kong and German university students. To summarize, in response to research question (a), it can be stated that the self-report stage assessment is effective in discriminating PA behavior change. For research question (*a1*), the appropriateness of stage classification from inactive to active was supported when compared with the HEPA criterion (1560 kcal). This finding is in line with previous work examining stage classification [15, 31]. Regarding research question (*a2*), mean energy consumption scores at each stage demonstrated a gradient pattern of improvement as the stage increased, which is also verified by other studies[15, 32]. Furthermore, energy consumption per week did not discriminate three former inactive stages, although energy consumption did discriminate between "preparing" and "fluctuating", as well as the three latter active stages. This finding is consistent with one study examining a mixed sample of German and Chinese adults[15].

With respect to research question (b), a close association between young adults' psychosocial correlates and the stages of change for physical activity was found. Considering research question *(*b1*)*, a pattern of increasing mean scores for each psychosocial correlate across the stages of change was confirmed. In addition, some psychosocial correlates found to discriminate between adjacent stages in this study provide empirical support for conducting stage-specific interventions, such evidence can be found in other studies[15,33]. For example, regarding the progression of students from the

227 “considering” to the “preparing” stage, interventions should include strategies aimed at (1)
228 enhancing confidence to initiate PA; (2) fostering the development of a positive attitude
229 towards PA; (3) enhancing intrinsic motivation, and (4) making detailed plans for PA. In
230 particular, for Hong Kong students, interventions should clearly address creating specific
231 and effective plans in order to progress from "considering" to "preparing". The difference in
232 planning between university students in Hong Kong and Germany might be due to age
233 differences, as the Hong Kong students (M = 19 years) were younger than the German
234 students (M = 23 years). As a result the Hong Kong students’ motivation to formulate plans
235 may be less stable, which could be strengthened through training in effective planning. In
236 addition, to encourage progression from “exploring” to “maintaining”, intervention strategies
237 may need to focus on enhancing intrinsic motivation, emotional experience, and building
238 confidence to continue engaging in PA, and also consider how to reduce perceived barriers
239 to PA. Furthermore, the intervention should address the development of PA programs that
240 are related to intrinsic motivation (competition, fun, and enjoyment) for male students as
241 they progress from the inactive stage (i.e., preparing) to the active stage (i.e., fluctuating).
242 In response to research question *(*b2*)*, energy consumption, demographics and
243 psychosocial correlates explained 61.5% of the variance of the stages of change for PA in
244 young adults. Barriers and intrinsic motivation emerged as highly significant psychosocial
245 variables related to the stages of change (P<.001). This finding is consistent with previous
246 PA studies with young adults[34,35]. Barriers such as, lacking time, low motivation and low
247 body confidence continually prevent university students from participating in PA. Moreover,
248 experiencing fun and joy from doing exercise is more likely to keep students engaged in
249 and persist in PA[34,36]. In addition, through the use of this holistic model, this study has

250 revealed no cultural discrepancies in explaining PA change among Hong Kong and
251 German students.
252 With respect to research question (c), the associations between the young adults' stages of
253 change and health outcomes have been empirically confirmed. The present findings for
254 research question (*c1*) are in line with another report that found associations between PA
255 and positive health outcomes (e.g., fitness, health satisfaction, and positive well-being)
256 were stronger than associations between PA and negative health outcome (e.g., physical
257 complaints, BMI and negative well-being) [3]. These results strengthen the assumption that
258 associations between PA and health outcomes may have a hierarchical structure, although
259 this assumption requires further detailed analyses.
260 In response to research question (c2), within the demographics and stages of change
261 model, all the stages of change for PA were significant for each health outcome, with the
262 exception of BMI. A possible reason might be that the present sample consisted of normal
263 weight university students whose BMIs across the stages fell within the normal range,
264 which is not a risk factor. In addition, with respect to the explained variances of health
265 outcomes, it should be noted that the explained power of demographics and stage of
266 change was relatively low (<50%). One possible explanation might be the relatively low
267 prevalence of health impairments within this young adult sample.
268 A number of limitations should be considered when interpreting the results of this study.
269 Firstly, the questionnaire delivery differed in Hong Kong compared to Germany. The
270 difference between completing hard copy questionnaires and online questionnaires may
271 have led to a discrepancy among item interpretation and response effects. Secondly,
272 reliance on the self-reporting of PA is another limitation. Although, the validation of the PA

behavior measures employed in this study have been well established [10,11] and used in other studies [3,15,37]. However, objectively measured PA would be able to improve the validation of stage assessment. Thirdly, self-reported fitness may cause data bias due to its subjective quality and the potential for social desirability. Finally, the cross-sectional design cannot provide strong evidence for determining causal relationships. Thus, prospective and experimental designs are encouraged for further research in this area.

Conclusion

The current study has provided empirical evidence of the links between psychosocial correlates and stages of change for PA, as well as between the stages of change for PA and health outcomes, among young Hong Kong and German adults. Barriers and intrinsic motivation were the most critical psychosocial variables related to the stages of change. Interventions targeting the development of planning strategies to enable Hong Kong students to progress from the “considering” to the “preparing” stage may require more detail compared to similar interventions for German students. In addition, PA programs which aim to increase intrinsic motivation (i.e. competition, enjoyment) may be more effective for male students who are progressing from inactive (“preparing”) to active (“fluctuating”) stages. Furthermore, the stage of change for PA was closely related to fitness and health satisfaction among young adults. In conclusion, public health researchers should aim to conduct effective psychosocial interventions that motivate young adults to engage in PA for positive health outcomes.

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Tables

Table 1: Measurement tool of "Physical Activity Behaviour Survey for University Students"

		Cronbach's α	
Physical Activity Behaviour			
Stage Algorithm[19,20]	"Physically active" refers to doing PA for at least accumulated 240 minutes per week. Participants were asked to select one out of six statements that best describes their level of PA behaviour. (1)Not-considering: "Within the last year I was not, and I am not thinking about to start in the future"; (2) Considering: "Within the last year I was not, but I am thinking about to start soon"; (3) Preparing: "Within the last year I was not, but I am just making decisions and building up plans to start"; (4) Fluctuating: "Yes, but not regularly in every week"; (5) Exploring: "Yes, I have been for less than 12 months"; (6) Maintaining: "Yes, I have been for 12 months or more".		
Physical Activity Behaviour [10,11]			
Type of Activity	5 categories for sport and exercise activities (e.g. fitness training), 3 categories for everyday life activities (e.g. climbing stairs, walking to the bus station et al).		
Quantity of Activity	6 options including (1) Once or occasionally per month; (2) Twice to three per month; (3) Less than 1 hour per week; (4) 1-2 hours per week; (5) 2-4 hours per week; (6) More than 4 hours per week.		
Intensity of Activity	3 options including (1) Mild; (2) Moderate; (3) Vigorous.		
Calculation of energy consumption	Quantity (time per week) * Intensity (4 kcal/min for mild intensity; 6.5 kcal/min for moderate intensity; and 9 kcal/min for vigorous intensity)		
Psychosocial Correlates		HK	Germany
Barriers[19,20]	15 items, e.g. "I don't have time to engage in PA."	0.91	0.89
Self-Efficacy[17, 20]	7 items, e.g. "I am confident that I can participate in planned PA even if I am tired."	0.72	0.79
Outcome Expectations[20, 21]	18 items. e.g. "By engaging in regular PA, I would expect to improve my fitness."	0.93	0.86
Body Concept[11,20]	6 items. e.g. "I am attractive."	0.90	0.88
Affective Attitudes[20,22]	4 items. e.g. "When I think of participating in PA, I feel satisfied."	0.96	0.90
Plans[20,23]	5 items, e.g. "I plan in detail what kind of PA I will conduct."	0.89	0.84
Intrinsic Motivation[20,24]	4 items. e.g. "I intend to be physically active regularly within the next weeks and months because PA participation can make me happy."	0.87	0.86
Assessment of Activity Situation[19,20]	3 items. e.g. "conducting PA under professional guidance is important when I engage in PA."	0.58	0.76
Activity Emotions[19,20]	2 items. e.g. "I have a lot of fun when I am physically active."	0.72	0.70
Social Support[20,25]	3 items. e.g. "Family members and/or friends engage in PA with me."	0.80	0.86
Health Outcomes		Cronbach's α HK	Germany
Fitness [20,26]	4 sub-factors including strength, coordination, endurance and flexibility with five items each. e.g., "I am able to carry heavy boxed up several floors."	0.88	0.79
Subjective Well-being[20,27]	21 items. 12 positive items: e.g. "I have felt energetic in the last week;" and 9 negative items: e.g. "I have felt nervous in the last week."	0.77	0.41
Health Satisfaction[20,28]	7 items. e.g. "I am satisfied with my general health status."	0.87	0.81
Physical Complaints[20,29]	15 items. e.g. "I have headaches almost every day."	0.83	0.82
Body Mass Index	Kg/m^2, self-reported weight and height		

Table 2 Descriptive Statistics and Univariate Summaries for Energy Consumption and Psychosocial Correlations across the Stages of Change (N=770)

Variables	NC(n=46)	CO(n=176)	PR(n=94)	FL(n=148)	EX(n=84)	MA(n=222)	Multiple Comparison(p<.05) $F_{5,764}$	η^2	p
Energy Consumption (kcal)							111.44	0.43	<0.001
Adjust Mean	341.62	464.94	659.49	1690.72	2140.54	2565.75	NC,CO,PR<FL<EX<MA		
SD	139.47	74.32	100.02	67.50	94.16	81.03			
Barriers (1 low, 7 high)							55.63	0.27	<0.001
Mean	3.82	3.56	3.24	2.57	2.44	1.77	MA<EX,FL,PR,CO,NC;		
SD	0.81	0.80	0.92	0.93	0.94	0.68	EX,FL<PR,CO,NC; PR<NC		
Self-efficacy (1 low, 5 high)							16.29	0.10	<0.001
Mean	2.58	2.82	3.21	3.33	3.21	4.02	NC,CO<PR,FL,EX<MA;		
SD	0.83	0.72	0.69	0.87	0.90	0.67			
Outcome expectations (1 low, 7 high)							12.89	0.08	<0.001
Mean	4.17	4.56	4.88	5.09	5.02	5.24	NC,CO<FL,EX,MA		
SD	1.03	0.96	0.94	0.87	0.92	0.82	NC<PR; PR<MA		
Body concept (1 low, 6 high)							15.37	0.09	<0.001
Mean	3.50	3.46	3.69	3.98	4.16	4.61	NC,CO,PR<EX,MA;		
SD	0.87	0.86	0.92	0.86	0.84	0.81	FL,EX<MA		
Plans (1 low, 5 high)							18.15	0.11	<0.001
Mean	2.56	2.89	3.37	3.42	3.50	3.71	NC,CO<PR,FL,EX,MA;		
SD	0.95	0.69	0.77	0.72	0.73	0.72	PR,FL<MA		
Affective attitude (1 low, 7 high)							27.55	0.16	<0.001
Mean	4.33	4.56	5.39	5.66	5.63	6.09	NC,CO<PR,FL,EX,MA;		
SD	1.24	1.17	0.96	0.89	0.95	0.83	PR,FL,EX<MA		
Intrinsic motivation (1 low, 6 high)							48.87	0.25	<0.001
Mean	3.33	3.60	4.24	4.63	4.70	5.38	NC,CO<PR<FL,EX<MA;		
SD	1.17	0.97	0.87	0.81	0.78	0.73			
Assessment of activity situation (1 low, 6 high)							5.49	0.04	<0.001
Mean	3.44	3.60	3.71	3.80	3.88	4.01	NC,CO<MA;		
SD	1.02	0.95	0.99	0.99	0.76	1.17			
Activity emotions (1 low, 6 high)							30.03	0.17	<0.001
Mean	3.98	4.01	4.48	4.66	4.77	5.25	NC,CO<PR,FL,EX<MA		
SD	1.01	0.81	0.72	0.76	0.75	0.68			
Social support (1 low, 5 high)							7.95	0.05	<0.001
Mean	2.62	2.70	3.06	3.21	3.36	3.49	NC,CO<FL,EX,MA;		
SD	0.91	0.83	0.92	0.88	0.92	1.06	CO<PR<MA		

Note: NC indicates non-considering stage; CO, considering stage ; PR, preparing stage; EX, exploring stage; FL, fluctuating stage; MA, maintaining stage; SD, standard deviation.

Table 3 Multivariate Ordinal Regression for Predicting Stages of Change for Physical Activity[#] (N=770)

Name of Variable	OR	95% CI	OR for SD Change	Wald Test
Nationality (HK=0, German=1)	1.38	0.74-2.59		1.03
Gender (female=0, male=1)	1.18	0.76-1.83		0.55
Nationality × gender	1.06	0.60-1.88		0.04
Age(y)	1.04	0.93-1.15	1.08	0.44
Energy Consumption (kcal)	1.00	1.00-1.00	4.14	146.04***
Barriers	0.59	0.48-0.71	0.56	28.54***
Self-efficacy	1.19	0.95-1.50	1.17	2.28
Outcome expectations	1.06	0.88-1.29	1.06	0.41
Body concept	1.11	0.92-1.33	1.10	1.15
Affective attitude	1.00	0.83-1.21	1.00	0.00
Plans	1.25	1.02-1.52	1.20	4.66*
Intrinsic motivation	1.56	1.25-1.95	1.64	15.16***
Assessment of activity situation	1.04	0.90-1.22	1.04	0.30
Activity emotions	1.06	0.84-1.33	1.05	0.22
Social support	1.00	0.85-1.18	1.00	0.00

PA indicates physical activity; OR, odds ratio; SD, standard deviations; BMI, body mass index; and kcal, kilo-Calorie.

Stages of change were coded as 0 (non-considering) to 5（maintaining）for this analysis. For the Wald test, the full model with 15 correlates, and the degree of each comparison was 1. Model fit: likelihood ratioχ^2（15）=734.86; p<0.001; Cox and Snell Pseudo-R Square=0.615; Nagelkerke Pseudo-Square=0.637; McFadden Pseudo-Square=0.284.

* p<0.05

** p<0.01

*** p<0.001

Table 4 Descriptive Statistics and Correlation Summaries between Health Outcomes and Stages of Change (N=770)

Variables	NC(n=46)	CO(n=176)	PR(n=94)	FL(n=148)	EX(n=84)	MA(n=222)	r	p
Fitness (1 low, 5 high)							.564***	.000
Mean	3.51	3.63	3.97	4.17	4.09	4.51		
SD	0.67	0.64	0.51	0.50	0.49	0.34		
Positive well-being (1 low, 5 high)							.379***	.000
Mean	3.05	2.86	3.13	3.22	3.31	3.65		
SD	0.73	0.69	0.70	0.72	0.64	0.68		
Negative well-being (1 low, 5 high)							-.151***	.000
Mean	2.34	2.36	2.45	2.32	2.14	2.12		
SD	0.72	0.67	0.71	0.74	0.65	0.60		
Health satisfaction (1 low, 7 high)							.487***	.000
Mean	4.12	3.88	4.31	4.69	4.78	5.49		
SD	1.24	1.13	1.12	1.06	1.14	0.98		
Physical complaints (1 low, 5 high)							-.261***	.000
Mean	2.40	2.29	2.27	2.07	2.12	1.89		
SD	0.60	0.65	0.64	0.61	0.61	0.55		
BMI (kg/m^2)							.169***	.000
Mean	20.3	21.11	21.61	21.28	21.48	21.96		
SD	3.01	3.26	3.50	2.57	3.26	2.15		

Note: NC indicates non-considering stage; CO, considering stage; PR, preparing stage; EX, exploring stage; FL, fluctuating stage; MA, maintaining stage; SD, standard deviation; BMI, body mass index. *** p<.001.

Table 5 Multiple Regression Analysis for Predicting Health Outcomes (N=770)

	Health Outcomes					
	Fitness β	Positive Well-being β	Negative Well-being β	Health Satisfaction β	Physical Complaints β	BMI β
Nationality	.409***	.291***	.117	.441***	-.102	.311***
Gender	.169***	.035	-.001	.090**	-.222***	.262***
Age	-.021	-.022	-.003	.000	.090	.021
Stages of change	.358***	.246***	-.207***	.272***	-.221***	-.038
	adj. R^2 = .440	adj. R^2 = .193	adj. R^2 = .030	adj. R^2 = .381	adj. R^2 = .115	adj. R^2 = .155

Note: ** p<.01, *** p<.001.