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Structured Volunteering Promotes Psychological Adaptation: Evidence from RI-CLPM and Latent Profile Analysis in Hong Kong Older Adults

Kit Man
nicholas.mankit@gmail.com

South China Normal University

So, Sophia Lau
South China Normal University

Sun-wah Chan
South China Normal University

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Abstract

This four-wave longitudinal study examined whether structured volunteering initiated in later life enhances psychological well-being among Hong Kong older adults through the Social Cognitive Theory serial mediation pathway: prosocial behaviour → resilience → self-efficacy → psychological well-being. A pooled analysis (N = 1,232) compared a large non-volunteering control group (n = 1,173) with 59 newly joined volunteers in a community programme. Using RI-CLPM, serial mediation, Latent Profile Analysis, and mixed ANOVAs, results showed significant Group × Time interactions, with the volunteering group exhibiting greater improvements in prosocial behaviour, resilience, self-efficacy, meaning in life, and well-being. Volunteering nearly doubled the proportion of older adults in the high-adaptation profile by T4. Structured volunteering offers a low-cost, culturally congruent intervention for successful ageing.

Introduction

Hong Kong is experiencing one of the most rapid population ageing processes in the world. According to the Census and Statistics Department (2023), the number of residents aged 65 and over is projected to increase from 1.5 million (approximately 20% of the total population) in 2021 to 2.52 million (31% of the total population) by 2039. This demographic shift places unprecedented pressure on healthcare systems, social services, and community resources, while highlighting the urgent need to promote successful ageing.

Psychological well-being (PWB) has emerged as a critical determinant of healthy ageing. It encompasses eudaimonic dimensions such as personal growth, purpose in life, and the capacity to function positively amid challenges (Ryff, 1989, 1995). The Hong Kong Health Bureau's Primary Healthcare Blueprint emphasizes mental and psychological health as integral to holistic well-being for older adults (Health Bureau, 2023). Empirical evidence shows that higher PWB confers substantial protective effects, including lower all-cause mortality risk (Steptoe et al., 2015; Zhu et al., 2023), modification of socioeconomic-mortality associations (Boylan et al., 2022), and reduced incidence of chronic diseases (Boehm & Kubzansky, 2012; Pressman et al., 2019; Steptoe, 2019).

As a modifiable protective resource, enhancing PWB through volunteering remains underexplored in Hong Kong's Chinese cultural context. Guided by Social Cognitive Theory (Bandura, 1986), the present four-wave longitudinal study integrates variable-centered and person-centered approaches. RI-CLPM examined within-person relationships in the non-volunteering control group (n = 1,173). Serial and moderated serial mediation analyses were conducted in the volunteering group (n = 59). Latent Profile Analysis (LPA) was performed on the pooled sample at T4 (n = 1,232) to identify distinct psychological adaptation profiles, with volunteering versus control examined as a covariate. This multi-method design offers comprehensive insights into volunteering in a collectivistic Asian context.

Volunteering in the Hong Kong Cultural Context

Volunteering has become a significant social phenomenon in Hong Kong. According to the latest survey by the Agency for Volunteer Service (2024), the total monetary value of voluntary services in 2024 reached HK$10.9 billion, with nearly 35% of the adult population actively participating. Notably, older adults aged 65 and above demonstrate substantially higher engagement, contributing an average of 22.59 hours compared to 7.52 hours among adults aged 30 or below (Agency for Volunteer Service, 2024).

This pattern indicates that volunteering is disproportionately driven by older adults in Hong Kong's rapidly ageing society, where the proportion aged 65 and over is projected to rise to 31% by 2039. Older adults' active participation represents a valuable community resource and a promising avenue for promoting successful ageing.

Hong Kong represents a distinctive sociocultural context for studying volunteering among older adults. As a former British colony and Special Administrative Region of China, it blends Eastern and Western influences yet remains fundamentally collectivistic, prioritizing cooperation, interpersonal harmony, and group relationships over individual interests (Allik & Realo, 2004; Hui & Yee, 1994; Kemmelmeier et al., 2006). In this context, the family is the basic unit of survival, and social engagement constitutes a major form of prosocial behavior (Pang-White, 2009; Chong et al., 2013).

Such characteristics imply that volunteering aligns with traditional Chinese values of reciprocity and collective contribution, potentially enhancing positive ageing outcomes (Chong et al., 2006; Leung et al., 2005), despite generally lower volunteering rates in collectivistic contexts (Aydinli-Karakulak et al., 2016; Kemmelmeier et al., 2006). Nevertheless, longitudinal research examining these processes in Hong Kong's unique cultural milieu remains scarce.

Literature Review

Volunteering and Psychological Well-Being in Older Adulthood

Volunteering has emerged as a promising, low-cost intervention for enhancing psychological well-being among older adults. Cross-sectional evidence consistently shows that engagement in volunteering is positively associated with higher levels of psychological well-being in later life (Jiang et al., 2021; Ho, 2017; Warner et al., 2024). More recent studies have further demonstrated that volunteering contributes to improvements across multiple dimensions of well-being, including subjective, psychological, and social well-being, while increasing gratitude and reducing loneliness (Shdaifat et al., 2025).

Rigorous experimental research supports these benefits. A randomized controlled trial found that volunteering produces meaningful gains in psychological well-being among older adults (Jiang et al., 2021). However, short-term programs may not yield immediate improvements, suggesting that sustained engagement is necessary. Large-scale trials such as the HEAL-HOA dual randomized controlled trial are currently examining the longer-term impact of volunteering on loneliness, social connectedness, and mental health outcomes in older populations (Warner et al., 2024; Yeung et al., 2025).

Taken together, these findings indicate that volunteering functions as a meaningful activity that promotes psychological well-being and buffers against social isolation in ageing populations. Nevertheless, longitudinal research that tracks changes over time and elucidates underlying mechanisms within the sociocultural context of Hong Kong remains limited.

Volunteering, Resilience, and Self-Efficacy as Mechanisms of Psychological Well-Being

Volunteering serves as a powerful behavioral pathway for enhancing self-efficacy among older adults. Participation provides mastery experiences, social modelling, and positive reinforcement—core sources of self-efficacy within Social Cognitive Theory (Bandura, 1986). Older adults who volunteer report significant gains in self-efficacy (Müller et al., 2014; Wootton, 2017). Self-efficacy mediates the relationship between volunteering intention and actual behavior even in non-Western contexts (Wang et al., 2011), with recent evidence showing direct benefits on happiness and social connectedness (Alganami & El Keshky, 2025). In the Hong Kong Chinese context, volunteering also reduces loneliness through enhanced self-efficacy (Lee, 2022).

Volunteering further fosters psychological resilience. Longitudinal and cross-sectional studies show that regular engagement builds adaptive capacities and buffers age-related stressors (Llenares et al., 2020; Lee et al., 2022; Gong et al., 2026).

Under the SCT framework, resilience and self-efficacy are mutually reinforcing mechanisms (Hampton et al., 2025; Develos-Sacdalan & Bozkus, 2018; Şahinler et al., 2025; Gaboardi et al., 2024). Collectively, they contribute to higher psychological well-being, with higher levels of both constructs positively correlated with life satisfaction (Sharma, 2013; Remm et al., 2023) and serving as key mediators or moderators of well-being outcomes (Hong et al., 2022; Yang, 2026). These findings support a serial mediation pathway in which volunteering enhances resilience, which in turn strengthens self-efficacy, ultimately leading to improved psychological well-being.

Volunteering, Loneliness, Meaning in Life, and Psychological Well-Being

Volunteering also plays a critical role in alleviating loneliness among older adults. Randomised controlled trials have demonstrated that structured volunteering interventions can significantly reduce loneliness in lonely older adults, with sustained effects observed over six months on both social and mental health outcomes (Yeung et al., 2025; Warner et al., 2024). These benefits are particularly evident in the HEAL-HOA dual randomized controlled trial, which specifically targets loneliness, social connectedness, and mental health in older populations (Warner et al., 2024). Parallel mediation analyses further indicate that volunteering reduces loneliness through enhanced social integration and self-efficacy (Lee, 2022).

Loneliness, in turn, exerts a strong negative influence on psychological well-being. It is associated with heightened death anxiety, poorer life satisfaction, and increased risks to both physical and mental health in later life (Shankar, 2023; Güler & Yıldırım, 2025; Pinson, 2010; Wu & Zhang, 2011; Lim & Kua, 2011). By mitigating loneliness, volunteering therefore serves as a protective mechanism that safeguards overall well-being.

Moreover, volunteering enhances a sense of meaning in life, which further contributes to psychological well-being. Engaging in prosocial activities strengthens role-identity salience, purpose, and perceptions of meaning, leading to higher levels of well-being among older adults (Thoits, 2012; Klein, 2017; Sherman et al., 2011). In the Hong Kong context, volunteering for elderly mental health programmes has been shown to produce dual impacts on meaning in life (Leung et al., 2019), while longitudinal case studies confirm that volunteering promotes resilience and a greater sense of purpose with ageing (Lee et al., 2022).

Taken together, these findings illustrate that volunteering operates through multiple interconnected pathways—reducing loneliness, building resilience and self-efficacy, and fostering meaning in life—to promote sustained psychological well-being.

Social Cognitive Theory (SCT) as the Overarching Theoretical Framework

Social Cognitive Theory (Bandura, 1986) serves as the primary theoretical lens for the present study. At its core, SCT posits that human functioning results from the dynamic interplay of personal, behavioral, and environmental factors through triadic reciprocal determinism. Personal factors include cognitive and affective variables such as self-efficacy; behavioral factors encompass chosen actions; and environmental factors refer to social norms and interpersonal influences. These three domains continuously interact, creating a reciprocal cycle (Bandura, 1986; Wang et al., 2011).

In the context of ageing and volunteering, SCT offers a powerful explanatory framework. Prosocial behavior—operationalized as volunteering—represents the key behavioral component. Repeated engagement generates mastery experiences, vicarious learning, verbal persuasion, and positive emotional states, which directly strengthen self-efficacy, the central personal cognitive mechanism in SCT (Bandura, 1986; Müller et al., 2014; Wang et al., 2011; Alganami & El Keshky, 2025). Higher self-efficacy, in turn, promotes persistence and adaptive coping that foster psychological resilience (Hampton et al., 2025; Develos-Sacdalan & Bozkus, 2018).

The four-wave longitudinal design is particularly well-suited to SCT because reciprocal determinism unfolds across time. The hypothesized serial mediation pathway is: Prosocial Behavior → Resilience → Self-Efficacy → Psychological Well-Being. Loneliness functions as a critical environmental and personal risk factor that can moderate the entire mediation chain (Lee, 2022; Yeung et al., 2025).

To capture both average mechanisms and individual heterogeneity, the study integrates variable-centered (RI-CLPM) and person-centered (LPA) approaches within the SCT framework (Hamaker et al., 2015). SCT is especially relevant to Hong Kong older adults because it accounts for both individual agency and sociocultural embeddedness in a collectivistic, Confucian-influenced context, where volunteering offers a culturally acceptable prosocial outlet (Chong et al., 2013; Aydinli-Karakulak et al., 2016).

The current study extends SCT in three ways: (1) testing a fully longitudinal serial mediation model using RI-CLPM, (2) examining context-dependent moderation by meaning in life and loneliness, and (3) applying the theory to Hong Kong Chinese older adults through both variable- and person-centered analyses, thereby enriching its cross-cultural applicability (Chong et al., 2013; Aydinli-Karakulak et al., 2016; Lee et al., 2022; Gaboardi et al., 2024).

The Present Study

Guided by this framework, the present four-wave longitudinal study examines the effects of volunteering on psychological well-being among community-dwelling older adults in Hong Kong. Specifically, RI-CLPM was employed to examine within-person longitudinal relationships in the large non-volunteering control group (n = 1,173). Serial and moderated serial mediation analyses were conducted in the volunteering group (n = 59), consisting of newly joined older adults who began volunteering from zero in a structured community programme. These analyses tested the hypothesized pathway as well as the moderating roles of meaning in life and loneliness. Additionally, LPA was performed on the pooled sample (n = 1,232) at T4 to identify distinct psychological adaptation profiles, with group membership (volunteering versus non-volunteering control) examined as a covariate.

By comparing the natural trajectory of non-volunteering older adults with the changes observed in newly joined volunteers, this design allows for a clearer evaluation of the added value of structured volunteering intervention. The study thus contributes to the literature by testing SCT mechanisms using advanced longitudinal modelling in a collectivistic Asian ageing context.

Significance of the Study

This study holds substantial theoretical, methodological, and practical significance for research on volunteering, psychological well-being, and healthy ageing in rapidly ageing societies.

Theoretically, it advances Social Cognitive Theory (Bandura, 1986) by testing triadic reciprocal determinism in a fully longitudinal, multi-wave design. RI-CLPM provides rigorous within-person evidence of the dynamic interplay between prosocial behaviour, resilience, self-efficacy, and psychological well-being in natural settings. The integration of LPA addresses the limitations of variable-centered approaches that assume homogeneity, while examining context-dependent moderation by meaning in life and loneliness clarifies boundary conditions of SCT mechanisms. The comparison between natural trajectories and structured intervention further extends the theory's applicability to collectivistic Asian contexts.

Methodologically, the multi-method design responds to calls for more sophisticated longitudinal modelling. The volunteering group (n = 59) in a structured community programme strengthens causal inference, complemented by the large non-volunteering control group (n = 1,173). Combining RI-CLPM, serial mediation, and LPA offers complementary variable- and person-centered insights beyond traditional cross-sectional or PROCESS-based analyses.

Practically, the findings inform healthy ageing policies in Hong Kong and similar Asian societies. Structured volunteering emerges as a low-cost, culturally congruent intervention that disrupts natural inhibitory patterns and promotes sustained improvements in psychological well-being, aligning with Confucian values of harmony and contribution.

Overall, this study bridges theory and practice by offering empirically grounded, culturally sensitive evidence that structured volunteering can meaningfully enhance psychological well-being in later life.

Methods

Study Design and Data Sources

The current study presents a multi-cohort pooled comparative analysis of four-wave longitudinal data drawn from two independent prospective cohort studies of community-dwelling older adults in Hong Kong. Both cohorts were originally designed as three-wave studies and extended with a fourth wave of follow-up.

Cohort 1 (previously published) recruited 1,302 community-dwelling older adults (aged 55+) from eight district council members' offices. Data were collected at T1 (September 2024), T2 (January 2025), T3 (May 2025), and T4 (September 2025), with 1,173 participants retained (retention rate ≈ 96%).

Cohort 2 (volunteering group) comprised 59 newly joined volunteers who enrolled in the government-launched Community Care Team (CCT) program and began volunteering from zero. This group was compared with 108 non-volunteering controls from the same sub-district. Assessments occurred at T1 (November 2024), T2 (February 2025), T3 (July 2025), and T4 (December 2025), with 59 participants retained.

For the present investigation, the four-wave datasets from both cohorts were harmonized and pooled to enable direct cross-cohort comparisons of volunteering/prosocial behavior, psychological well-being, and the moderating and mediating roles of resilience and self-efficacy. All measures were assessed with identical or highly comparable instruments across cohorts and waves. This secondary pooled analysis specifically examines whether volunteering/prosocial engagement enhances psychological well-being through resilience and self-efficacy, and whether these mechanisms differ between the two cohorts (general community sample vs. structured volunteering group). Ethical approval for the fourth-wave data collection and secondary analyses was obtained from the university's committee. Detailed descriptions of the original study protocols are available in the previously published reports (full citations will be restored upon acceptance).

Procedure and Materials

The pooled analytic sample consisted of 1,173 non-volunteering participants across four waves and 59 volunteering participants across three waves. Inclusion criteria for both cohorts were identical: community-dwelling older adults aged 55 years or above, with the ability to read simple Chinese and provision of informed consent. Individuals with severe cognitive impairment or conditions that prevented survey completion were excluded. Attrition analyses at T4 revealed no significant differences in baseline demographics or key study variables, indicating minimal selection bias.

Data were collected via self-administered Cantonese questionnaires by trained research assistants at district council offices or participants' homes, with phone reminders to minimize attrition. Waves were spaced at approximately four- to five-month intervals. All constructs were assessed using validated scales administered consistently across waves.

Primary analyses used RI-CLPM on the non-volunteering control group (n = 1,173). Serial and moderated serial mediation were tested using Hayes' (2022) PROCESS macro (Version 5.0). Latent Profile Analysis (LPA) was conducted on the pooled T4 sample (N = 1,232), with volunteering group membership examined as a covariate. All analyses were performed using IBM SPSS Statistics version 27.

Prosocial behavior was measured with the 12-item Prosocialness Scale for Adults (PSA; Caprara et al., 2005; Zhan et al., 2023). Items are rated on a 5-point Likert scale (1 = never to 5 = always). In Cohort 2, this scale specifically captured engagement in structured volunteering activities. Cronbach's α at T4 was .956 (non-volunteering group) and .856 (volunteering group).

Psychological well-being was assessed using the 5-item WHO-5 Well-Being Index (WHO-5; Topp et al., 2015; Kong et al., 2016). Respondents rate how they have felt over the past two weeks on a 6-point scale (0 = at no time to 5 = all of the time). Cronbach's α at T4 was .945 (non-volunteering group) and .631 (volunteering group).

Resilience was measured with the 10-item Connor-Davidson Resilience Scale (CD-RISC-10; Campbell-Sills & Stein, 2007). Items are rated on a 5-point scale (0 = not true at all to 4 = true nearly all the time). Although resilience was included in the original study protocol for both cohorts, it was not the primary focus of the previously published three-wave reports. Cronbach's α at T4 was .925 (non-volunteering group) and .841 (volunteering group).

Self-efficacy was assessed with the 10-item General Self-Efficacy Scale (GSE; Schwarzer & Jerusalem, 1995; Zhang & Schwarzer, 1995). Items are rated on a 4-point scale (1 = not at all true to 4 = exactly true). Cronbach's α at T4 was .908 (non-volunteering group) and .822 (volunteering group).

Meaning in life was evaluated using the 10-item Meaning in Life Questionnaire (MLQ; Steger et al., 2006; Liu & Gan, 2010) was used. Items are rated on a 7-point scale (1 = absolutely untrue to 7 = absolutely true). Cronbach's α at T4 was .918 (non-volunteering group) and .850 (volunteering group).

Loneliness was measured with the 6-item UCLA Loneliness Scale (ULS6; Wongpakaran et al., 2020; Neto, 2014), scored on a reversed 4-point Likert scale (1 = often, 4 = never), with higher scores indicating lower loneliness. Cronbach's α at T4 was .903 (non-volunteering group) and .728 (volunteering group).

Covariates: Demographic information (age, gender, marital status, education level, monthly income, living arrangements, housing type) and self-rated health (single item: 1 = poor to 5 = excellent) were collected at baseline and retained as covariates.

Results

Descriptive Statistics

Table 1 presents the means and standard deviations of the key study variables across the four waves for both the non-volunteering control group (n = 1,173) and the volunteering group (n = 59). At baseline (T1), the volunteering group reported slightly lower levels of prosocial behavior, psychological well-being, self-efficacy, meaning in life, and resilience compared to the non-volunteering group, while also showing comparable or slightly lower loneliness. Over the four waves, the volunteering group exhibited consistent and substantial increases across most positive outcomes (prosocial behavior, psychological well-being, self-efficacy, meaning in life, and resilience), whereas the non-volunteering group showed relatively stable or modest fluctuations. Loneliness scores in both groups demonstrated some variability but remained generally higher in the non-volunteering group by T4.

Psychological Outcomes: Longitudinal Group Differences

A series of 2 (Group: volunteering vs. non-volunteering) × 4 (Time: T1–T4) mixed-design repeated measures ANOVAs were conducted. Mauchly's test of sphericity was performed for all variables, and Greenhouse-Geisser corrections were applied when the assumption was violated. Results are presented in Table 2.

Significant main effects of Time emerged for all variables ($p < .001$). Critically, significant Group × Time interactions were found across all outcomes, indicating that the volunteering group exhibited substantially greater positive longitudinal changes than the non-volunteering control group.

For prosocial behaviour, after Greenhouse-Geisser correction, significant effects were observed for Time ($F(2.78, 3419.5) = 1507.573$, $p < .001$), Group ($F(1, 1230) = 3.750$, $p < .001$), and the Group × Time interaction ($F(2.78, 3419.5) = 930.008$, $p < .001$). Post-hoc analyses confirmed volunteering participation improvements across all time points ($p < .001$).

Similar significant Group × Time interactions were observed for psychological well-being ($F(2.62, 3228.3) = 1474.183$, $p < .001$), self-efficacy ($F(2.79, 3430.4) = 787.124$, $p < .001$), meaning in life ($F(2.00, 2465.3) = 172.238$, $p < .001$), loneliness ($F(1.59, 1957.3) = 221.464$, $p < .001$), and resilience ($F(2.50, 3080.4) = 602.417$, $p < .001$).

Overall, these robust interactions highlight the psychological benefits of structured volunteering and provide strong empirical support for the study hypotheses.

Within-Person Longitudinal Relationships: RI-CLPM

To examine the dynamic within-person relationships between prosocial behaviour and psychological well-being in a natural (non-intervention) context, a RI-CLPM was conducted on the non-volunteering control group (n = 1,173) across four waves. The model adequately fit the data and separated stable between-person differences from within-person change over time.

As the path diagram of the RI-CLPM shown in Figure 1, at the between-person level, the random intercepts of prosocial behaviour and psychological well-being were strongly and positively correlated (r = .704, p < .001), indicating that individuals with a higher trait-like tendency to engage in prosocial behaviour also tended to report higher overall psychological well-being.

At the within-person level, consistent positive cross-lagged effects were observed from prosocial behaviour to subsequent psychological well-being. Specifically, when an individual's prosocial behaviour was higher than their own personal average at one time point, their psychological well-being was also higher than their personal average at the next wave: T1 PSA → T2 WHO (γ = 0.049, p = .045), T2 PSA → T3 WHO (γ = 0.050, p = .048), and T3 PSA → T4 WHO (γ = 0.050, p = .048).

Conversely, a significant negative reverse effect emerged from psychological well-being to subsequent prosocial behaviour. When psychological well-being exceeded an individual's personal average at one wave, prosocial behaviour was lower than their personal average at the next wave: T1 WHO → T2 PSA (β = -0.047, p = .019), T2 WHO → T3 PSA (β = -0.065, p = .018), and T3 WHO → T4 PSA (β = -0.065, p = .018).

These asymmetric reciprocal relationships support the hypothesized SCT mechanisms in natural settings, with prosocial behaviour prospectively enhancing well-being, while higher-than-usual well-being temporarily suppressed subsequent prosocial engagement (consistent with motivational saturation and resource conservation processes).

Serial Mediation Pathway from Prosocial Behavior to Psychological Well-Being

The hypothesized serial mediation pathway (T1 prosocial behaviour → T2 resilience → T3 self-efficacy → T4 psychological well-being) was first examined as a supplementary analysis using Hayes' (2022) PROCESS macro (Model 6) with 10,000 bootstrap resamples. In the volunteering group (n = 59), as Figure 2 shown, T1 prosocial behaviour significantly predicted T2 resilience (β = 0.691, SE = 0.101, p < .001), which in turn predicted T3 self-efficacy (β = 0.578, SE = 0.155, p = .001), and T3 self-efficacy significantly predicted T4 psychological well-being (B = 0.523, SE = 0.123, p < .001). The full serial indirect effect was statistically significant (Effect = 0.209, 95% bootstrap CI [0.070, 0.395]).

Table 3 also shown the same serial mediation pathway was also significant in the large non-volunteering control group (n = 1,173): T1 prosocial behaviour strongly predicted T2 resilience (β = 0.654, p < .001), which predicted T3 self-efficacy (β = 0.579, p < .001), and T3 self-efficacy predicted T4 psychological well-being (β = 0.360, p < .001). The serial indirect effect was 0.136 (95% bootstrap CI [0.109, 0.165]).

These supplementary PROCESS results were consistent with the primary RI-CLPM findings, confirming the robustness of the SCT serial mediation mechanism across both intervention and natural contexts.

Moderating Effect of Baseline Meaning in Life on the Serial Mediation Pathway

Moderated serial mediation analyses (PROCESS Model 92 and Model 91) were conducted as supplementary analyses to examine boundary conditions of the serial pathway. In the volunteering group, baseline meaning in life significantly moderated the path from T1 prosocial behaviour to T2 resilience (interaction β = 0.2004, p = .0295), such that the serial indirect effect was stronger at higher levels of T1 meaning in life. In contrast, T2 loneliness did not significantly moderate the overall pathway (Model 91).

Supplementary analyses in the non-volunteering control group (n = 1,173) revealed markedly different moderating patterns. T1 meaning in life negatively moderated the T1 prosocial behaviour → T2 resilience path (interaction β = -0.0669, p = .0001), such that the serial indirect effect was stronger among individuals with lower baseline meaning in life (See Figure 3). Similarly, T2 loneliness positively moderated the T2 resilience → T3 self-efficacy path (interaction β = 0.0443, p = .0095), indicating that lower loneliness (higher ULS-6 scores) facilitated the translation of resilience into self-efficacy.

Together, these findings demonstrate the robustness of the SCT serial mediation mechanism while highlighting important context-dependent moderation effects: meaning in life and loneliness operate in a facilitative manner under structured volunteering intervention, but in a compensatory manner in natural (non-intervention) settings.

Latent Profile Analysis: Psychological Adaptation Profiles at T1 and T4

Latent Profile Analysis was conducted on the pooled sample (n = 1,232) at both T1 and T4 to identify distinct psychological adaptation profiles. Three profiles emerged at both time points: a low-adaptation profile (Class 1), a moderate-adaptation profile (Class 2), and a high-adaptation profile (Class 3). As shown in Figure , the proportion of participants in the low-adaptation profile increased substantially from T1 (21.0%) to T4 (47.7%), reflecting a general decline in psychological adaptation over time in the overall sample.

Group membership (volunteering versus non-volunteering control) was examined as a covariate. At T1, volunteers were already more likely to belong to the high-adaptation profile (OR = 5.30). By T4, this association became markedly stronger (OR = 12.72). Correspondingly, the percentage of volunteers in the

high-adaptation profile (Class 3) nearly doubled from 10.94% at T1 to 19.80% at T4. Profile means further revealed that the high-adaptation class at T4 exhibited higher levels of prosocialness, resilience, self-efficacy, meaning in life, and psychological well-being, along with lower loneliness compared to T1 (see Figure 4).

These person-centered findings complement the variable-centered RI-CLPM results by demonstrating that structured volunteering not only elevates average levels of well-being but also helps a significantly greater proportion of older adults maintain or transition into a high psychological adaptation profile over four waves.

Discussion

Longitudinal Effects of Volunteering on Psychological Well-Being

The present four-wave longitudinal study provides compelling evidence that structured volunteering confers significant and sustained psychological benefits among Hong Kong older adults. Compared with the large non-volunteering control group (n = 1,173), the volunteering group (n = 59), who were newly joined volunteers participating from zero in a structured community programme, demonstrated markedly greater positive changes across all key outcomes. Repeated measures ANOVA revealed significant Group × Time interactions for prosocial behaviour, psychological well-being, self-efficacy, meaning in life, resilience, and reductions in loneliness, with the volunteering group showing steeper improvement trajectories from T1 to T4. These robust longitudinal gains extend prior cross-sectional and short-term randomized trials (Ho, 2017; Jiang et al., 2021; Warner et al., 2024; Shdaifat et al., 2025) by demonstrating that volunteering effects are not transient but accumulate over time, particularly when older adults begin volunteering as novices. The unique "from zero" design minimizes self-selection bias and strengthens causal inference, indicating that volunteering itself—rather than pre-existing traits—drives the observed improvements in psychological functioning.

Within-Person Longitudinal Mechanisms: Evidence from RI-CLPM

The primary analysis using RI-CLPM on the non-volunteering control group (n = 1,173) provided rigorous within-person evidence of the dynamic reciprocal processes proposed by Social Cognitive Theory in natural settings. At the between-person level, the random intercepts of prosocial behaviour and psychological well-being were strongly correlated ($r = .704$, $p < .001$). At the within-person level, consistent positive cross-lagged effects were observed from prosocial behaviour to subsequent psychological well-being across all waves ($\gamma \approx 0.049–0.050$, $p < .05$). Conversely, a significant negative reverse effect emerged from psychological well-being to subsequent prosocial behaviour ($\beta = -0.047$ to -0.065, $p < .05$). These asymmetric reciprocal relationships illustrate SCT's triadic reciprocal determinism: prosocial behaviour prospectively enhances well-being through mastery experiences, while higher-than-usual well-being temporarily suppresses further prosocial engagement, consistent with motivational saturation and resource conservation processes in natural, non-intervention contexts.

Supplementary Serial Mediation and Moderating Effects

Serial mediation analyses using PROCESS Model 6 confirmed the hypothesized pathway (T1 prosocial behaviour → T2 resilience → T3 self-efficacy → T4 psychological well-being) in both groups. In the volunteering group, the full serial indirect effect was significant (Effect = 0.209, 95% CI [0.070, 0.395]). The same pathway was also significant in the non-volunteering control group (Effect = 0.136, 95% CI [0.109, 0.165]). Moderated serial mediation analyses (Models 92 and 91) further revealed important context-dependent boundary conditions. In the volunteering group, baseline meaning in life positively moderated the serial pathway, whereas in the non-volunteering group the moderating patterns were reversed (compensatory effects for those with lower baseline meaning in life and lower loneliness). These findings highlight that the roles of meaning in life and loneliness are not universal but depend on whether older adults are in structured intervention or natural settings.

Person-Centered Insights: Latent Profile Analysis

Latent Profile Analysis conducted on the pooled sample (n = 1,232) at T1 and T4 identified three distinct psychological adaptation profiles. From T1 to T4, the proportion of participants in the low-adaptation profile increased substantially, reflecting a general decline in psychological resources over time in the overall sample. Critically, group membership (volunteering versus control) was a significant covariate. At T1, volunteers were already more likely to belong to the high-adaptation profile (OR = 5.30). By T4, this association became markedly stronger (OR = 12.72). Correspondingly, the percentage of volunteers in the high-adaptation profile nearly doubled from 10.94% at T1 to 19.80% at T4. These person-centered results complement the variable-centered RI-CLPM findings by demonstrating that structured volunteering not only elevates average levels of well-being but also helps a significantly greater proportion of older adults maintain or transition into a high psychological adaptation profile over time.

Theoretical and Practical Implications

Theoretically, this study advances Social Cognitive Theory by demonstrating fully RI-CLPM, a robust serial mediation mechanism, context-dependent moderation, and individual heterogeneity in adaptation profiles. The contrasting patterns between intervention and natural contexts highlight the dynamic interplay between personal resources and environmental factors in SCT. Culturally, the findings are particularly relevant for Hong Kong, where volunteering aligns with collectivistic values of reciprocity and community contribution while satisfying individual needs for competence and dignity (Chong et al., 2013; Aydinli-Karakulak et al., 2016; Pang-White, 2009).

Practically, the results support expanding structured community-based volunteering programmes, especially for newly joined older adults, as a scalable, low-cost intervention to promote healthy ageing and aging in place. Given that older adults in Hong Kong already contribute high volunteer hours (Agency for Volunteer Service, 2024), such programmes could meaningfully reduce loneliness and enhance well-being across diverse socioeconomic groups.

Limitations

Several limitations should be acknowledged. First, the volunteering group's small sample size (T1 n = 85 to T4 n = 59) relative to the large control group (n = 1,173) may have limited statistical power for some moderation analyses. Second, although PROCESS macro (Model 6) was used for initial serial mediation testing, it is generally considered ill-suited for multi-wave longitudinal data because it does not adequately account for within-person dependencies and temporal structures (Hamaker et al., 2015); thus, RI-CLPM served as the primary method. Third, the socioeconomically homogeneous sample (mainly grassroots older adults in public housing) limits generalizability. Fourth, self-selection into the CCT programme and reliance on self-report measures may introduce bias and common method variance.

Future research should employ larger, diverse samples and randomized designs. Cross-cultural studies and investigations into culturally salient constructs such as dignity and filial piety would also enrich the literature.

Conclusion

In conclusion, this four-wave longitudinal study demonstrates that structured community-based volunteering programme, like CCT, can meaningfully enhance psychological well-being among Hong Kong older adults. Guided by Social Cognitive Theory, RI-CLPM analyses in the large non-volunteering control group (n = 1,173) together with serial and moderated serial mediation in the newly joined volunteering group (n = 59) confirm the hypothesized sequential pathway: prosocial behaviour → resilience → self-efficacy → psychological well-being. Meaning in life facilitated, while loneliness conditionally moderated, these mechanisms.

Significant Group × Time interactions across all outcomes, combined with LPA on the pooled sample (n = 1,232) at T4, further revealed that volunteers were disproportionately represented in the moderate-to-high adaptation profile, showing markedly greater positive longitudinal changes than non-volunteers.

These findings highlight structured volunteering as a potent, modifiable, low-cost, and culturally congruent intervention that promotes successful ageing and Aging in Place in Hong Kong's rapidly ageing, collectivistic context. Investing in community-based volunteering programmes not only supports older adults' psychological well-being but also strengthens intergenerational solidarity and community resilience.

Declarations

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Declaration of Interest Statement

The authors have no relevant financial or non-financial interests to disclose.

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Data Availability Statement

The data supporting the findings of this study are available within the article and its supplementary material. Raw data that support the findings of this study are available from the corresponding author, upon reasonable request.

Ethics Statement

All subjects gave their informed consent for inclusion before they participated in the study. The study was conducted in accordance with the Declaration of Helsinki, and the protocol was approved by the Ethics Committee of the university (Approvals Number: SCNU-PSY-2024-449 and SCNU-SS-2025-017). Clinical trial number: not applicable.

Author Contributions

Dr. MAN Kit (first author) leads conceptualization, data curation, formal analysis, investigation, methodology, project administration, resources, software, validation, visualization, and manuscript writing.

Dr. LAU So (second author) supports conceptualization, data curation, formal analysis, methodology, project administration, and manuscript writing.

Dr. CHAN Sun-wah (third author) supports data curation, formal analysis, project administration, and manuscript writing.

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Tables

Table 1 Descriptive statistics of key variables.

Variables	Mean (S.D.)							
	Non-volunteering group (n=1,173)				Volunteering group (n=59)			
	T1	T2	T3	T4	T1	T2	T3	T4
Prosocial Behavior	39.409 (9.579)	39.749 (10.334)	40.989 (9.423)	41.085 (90451)	34.051 (6.396)	42.661 (6.116)	45.542 (5.361)	48.780 (5.449)
Psychological Well-Being	15.609 (4.878)	17.591 (5.960)	11.703 (5.057)	16.292 (5.561)	14.271 (4.571)	17.881 (3.265)	19.797 (2.524)	21.695 (2.070)
Self-Efficacy	27.724 (5.518)	28.468 (6.903)	27.611 (5.603)	23.239 (5.896)	26.271 (4.752)	29.441 (4.099)	31.712 (4.009)	33.169 (4.136)
Meaning in Life	47.607 (11.230)	50.021 (12.436)	50.714 (10.402)	54.501 (9.593)	43.949 (10.763)	52.746 (7.906)	56.068 (5.798)	58.237 (5.637)
Loneliness	20.650 (2.993)	18.625 (4.787)	17.548 (3.472)	21.731 (3.094)	16.814 (3.679)	18.525 (2.849)	19.085 (2.373)	21.186 (2.193)
Resilience	22.355 (7.062)	24.301 (7.667)	23.930 (7.102)	22.319 (7.066)	22.661 (7.160)	27.627 (5.632)	31.017 (3.989)	32.017 (4.626)

Table 2 Repeated measures ANOVA tables for the effects of time and group on prosocialness, psychological well-being, self-efficacy, meaning in life, loneliness and resilience.

Repeated Measures ANOVA

Effect	Sum of Squares	*df*	Mean Square	*F*	*p* Value	η^2
Prosocialness						
Group	1349.070	1	1349.070	3.750	0.009	0.003
Time	8478.839	3	2826.280	1507.573	0.000	0.551
Group x Time	5230.519	3	1743.506	930.008	0.000	0.431
Psychological well-being						
Group	2176.691	1	2176.691	19.764	0.000	0.016
Time	2300.211	3	766.737	1043.964	0.000	0.459
Group x Time	3248.131	3	1082.710	1474.183	0.000	0.545
Self-efficacy						
Group	2578.996	1	2578.996	19.007	0.000	0.015
Time	874.623	3	291.541	168.850	0.000	0.121
Group x Time	4077.214	3	1359.071	787.124	0.000	0.390
Meaning in life						
Group	934.385	1	934.385	2.056	0.152	0.002
Time	13442.849	3	4480.950	880.820	0.000	0.417
Group x Time	2628.657	3	876.219	172.238	0.000	0.123
Loneliness						
Group	121.645	1	121.645	2.501	0.114	0.002
Time	1454.149	3	484.716	376.743	0.000	0.022
Group x Time	854.804	3	284.935	221.464	0.000	0.013
Resilience						
Group	5854.437	1	5854.437	29.263	0.000	0.023
Time	3490.731	3	1163.577	730.926	0.000	0.373
Group x Time	2877.002	3	959.001	602.417	0.000	0.329

Table 3 The serial mediation effect of resilience and self-efficacy between prosocial behavior and psychological well-being of the non-volunteering group.

Mediation Analysis

	T2 Resilience	T3 Self-efficacy	T4 Psychological Well-being	T4 Psychological Well-being
Constant	0.720** (3.249)	0.376* (2.008)	-0.281 (-1.327)	-0.751** (-4.312)
Gender	-0.100* (-2.428)	-0.020 (-0.584)	-0.064 (-1.628)	-0.010 (-0.324)
Age	-0.008** (-3.394)	-0.006** (-2.823)	0.001 (0.493)	0.007** (3.691)
Marriage	-0.075** (-3.815)	-0.032 (-1.900)	-0.015 (-0.776)	0.032* (2.042)
Education	-0.042* (-2.327)	0.034* (2.233)	-0.038* (-2.152)	-0.030* (-2.112)
Income	0.099** (4.380)	-0.033 (-1.702)	0.009 (0.416)	-0.025 (-1.416)
Self-rated Health	0.122** (3.962)	0.086** (3.324)	0.177** (6.022)	0.089** (3.686)
T1 Prosocial Behavior	0.654** (27.994)	0.244** (9.606)	0.703** (31.446)	0.311** (12.704)
T2 Resilience		0.579** (23.478)		0.256** (9.204)
T3 Self-efficacy				0.360** (13.213)
n	1173	1173	1173	1173
R-squared	0.562	0.690	0.601	0.735
Adjust R-squared	0.558	0.688	0.598	0.732
F Test	*F* (9,1163)=165.659,*p*=0.000	*F* (10,1162)=259.058,*p*=0.000	*F* (9,1163)=194.603,*p*=0.000	*F* (11,1161)=292.388,*p*=0.000

* $p < 0.05$ ** $p < 0.01$, *t* value in parentheses

Total Indirect Effect

Item	Total Indirect Effect	Boot SE	*z*	*p* Value	BootLL	BootUL
T1 Prosocial Behavior=> T4 Psychological Well-being	0.391	0.021	18.236	0.000	0.350	0.434
Sum of Indirect Effects	0.391	0.021	18.236	0.000	0.350	0.434

Note: BootLLCI and BootULCI are the lower and upper limits of 95% CI from Bootstrap resampling, bootstrap type = Percentile Bootstrap

Figures

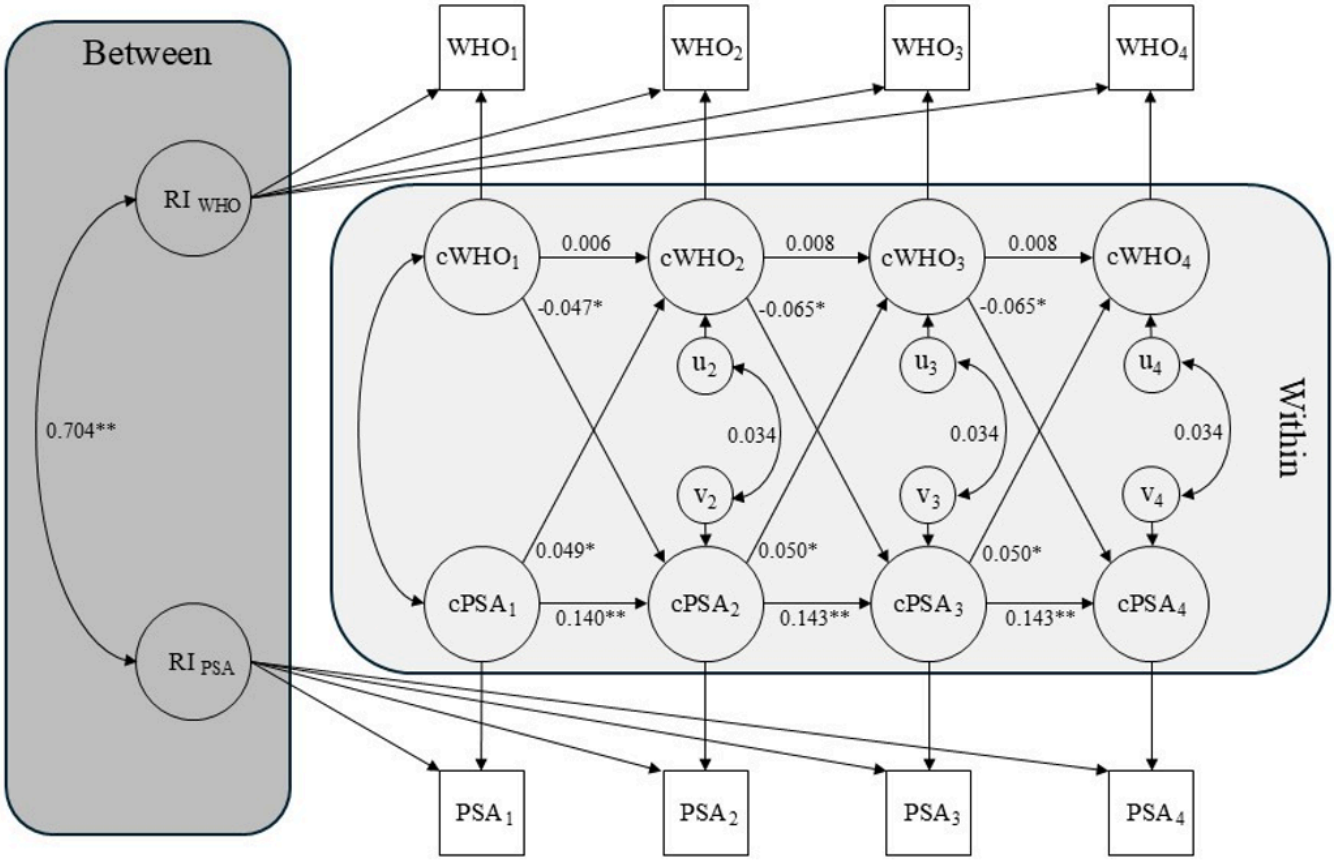


Figure 1

Path diagram of the random intercept cross-lagged panel model with standardized effects (Hamaker et al., 2015).

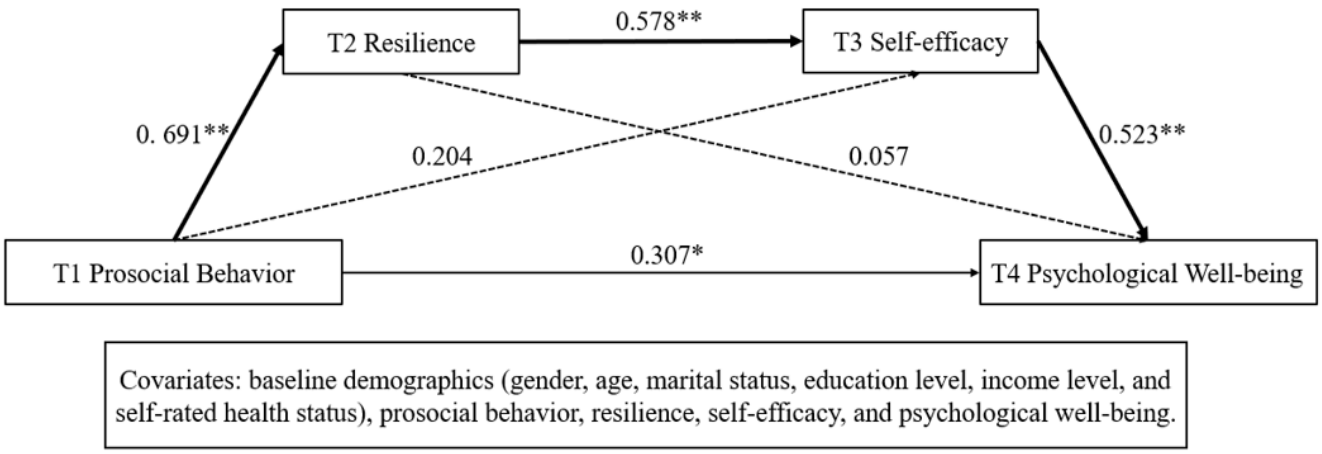


Figure 2

Serial mediation model to explain the associations between T1 prosocial behavior and T4 psychological well-being in the volunteering group, with T2 resilience and T3 self-efficacy as the mediator. (*Note: *p<0.05 ** p < 0.01*)

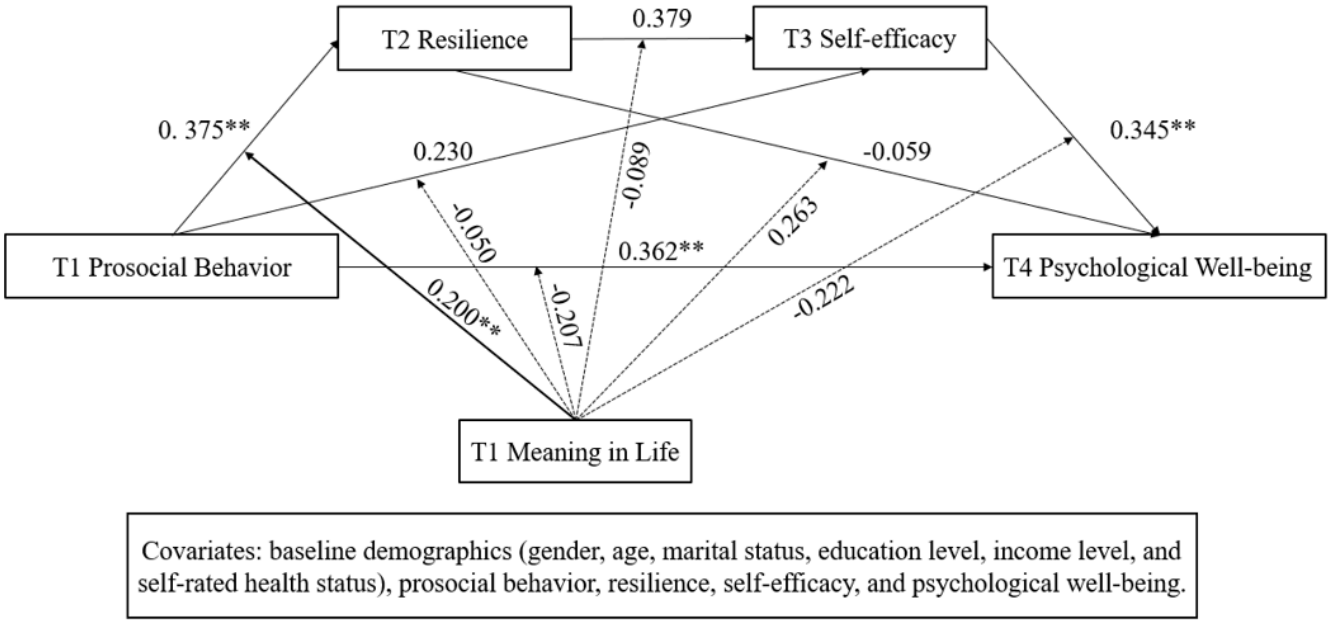


Figure 3

Moderated mediation model (PROCESS Model 92) to explain the associations between T1 prosocial behavior and T4 psychological well-being in the volunteering group, with T2 resilience and T3 self-efficacy as the mediator and mediate by T1 meaning in life. (*Note: *p<0.05 ** p < 0.01*)

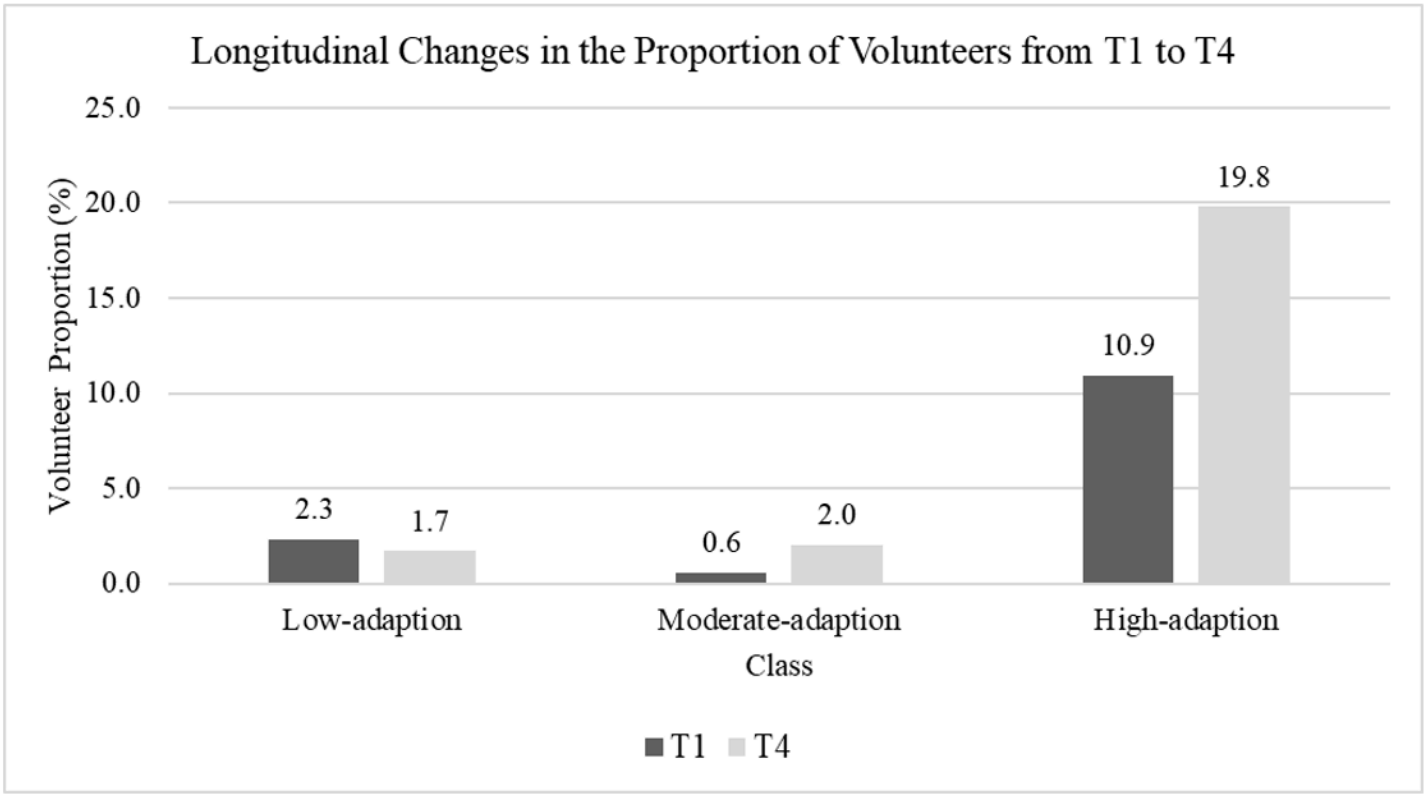


Figure 4

Proportion of volunteers in each latent psychological adaptation profile at T1 and T4 (n = 1,232).