The relationship between sufficient leisure time physical activity and happiness: An age stratification perspective

Po-Fu Lee1,2 · Frank Jing-Horng Lu3 · Diane L. Gill4 · Yi-Hsiang Chiu5 · Yu-Hsuan Kuo5 · Chien-Chang Ho6,7,8

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Abstract
Leisure time physical activity (LTPA) has been frequently reported as a method of improving happiness. However, the effects of LTPA sufficiency and age differences in adults have been less discussed in the literature. The aim of this study was to examine the relationship between LTPA sufficiency and happiness based on an age stratification perspective. A total of 16,412 data observations from the Taiwanese Physical Activity Annual Survey (PAAS) were used for this study. Multivariate logistic regression analyses were applied to examine the odds ratio of the LTPA-sufficient population on happiness. The odds of happiness were 2.5–3 times higher among LTPA-sufficient young adults (25–29 years old) than among the insufficient group. However, unexpectedly, a negative association was observed between sufficient LTPA and happiness in 35- to 39-year-old men. Intrapersonal differences (e.g., achievement goals and motivational level) and the environment (social context) might play a fundamental role in the LPTA-happiness relationship. Sufficient LTPA was associated with increased happiness among Taiwanese adults. However, the relationships between sufficient LTPA and happiness were not consistent when stratified by age. Further research on the relevant mechanism underlying this phenomenon is warranted. Trial registration: This study was approved by the Institutional Review Board of Chung Shan Medical University Hospital (CRREC-104-015), registered on 18 October 2016.

Keywords Happiness · Leisure time physical activity · Quality of life · Adults · Taiwan

Background
Pursuing happiness is an essential goal of life. Happiness is a state of mind characterized by joy and contentment, and it reflects an individual’s life satisfaction and subjective well-being (Lathia et al., 2017). Studies have indicated that happier people are more likely to be productive and creative at work, are more prosocial and healthier, live longer and have better relationships (Jalali & Heidari, 2016; Myers & Diener, 2018; Oswald et al., 2015). Although the concept and
determinants of happiness are diverse, it is generally accepted that happiness comprises positive mental and affect states (Aszatolas et al., 2012; Huppert, 2009; World Health Organization, 2011). It is also defined as experiencing positive affect, experiencing less negative affect, and being influenced by one’s overall evaluation in life (Deaton, 2012; Kahneman et al., 1999; Myers & Diener, 1995; Waterman, 1993).

Currently, unfavorable mental conditions not only damage an individual’s health and social function but also gradually impair socioeconomic development and create public problems (Harvey et al., 2017; Knudsen et al., 2010). Fortunately, these problems are usually treatable and preventable (Mykletun & Harvey, 2012). Desirable and rewardable activities, particularly the voluntary and intrinsic nature of leisure pursuits, have been reported to benefit increased levels of happiness (Gallagher et al., 2012; Iwasaki et al., 2013; Stubbe et al., 2007; Wang et al., 2012). In addition, the long-term effects of LTPA on increased levels of happiness have been observed in a previous cohort study (Wang et al., 2012). Furthermore, a recent systematic review of 23 studies in LTPA and happiness (Zhang et al., 2018) concluded that as little as 10 min or 1 instance of LTPA per week can result in an increased level of happiness.

Due to a positive connection with an individual’s health status and quality of life, happiness has been extensively researched. However, happiness may be influenced by the fulfillment of personal goals and the ability of self-regulation across the lifespan (Hoppman & Gerstorf, 2016). For example, the descent of desires for infeasible aspirations in middle age, as well as the individual adaptation to personal strengths and weaknesses, commonly affect one’s perceived happiness level (Blanchflower & Oswald, 2016). Personal goals may act as goalposts for one’s overall evaluation in life, guiding people to recognize facts (such as limited resources and energy) and governing goal pursuit and adjustment. Although Hyde and colleagues (Hyde et al., 2013) described the characteristics of LTPA and happiness across the lifespan, they did not address the association between LTPA and happiness. In addition, the broad range of adulthood in their review (25–64 years old) may not be able to clearly distinguish the LTPA-happiness relationship across different periods of adulthood.

Numerous studies have indicated the association between LTPA and happiness. To our knowledge, no study has yet reported the relationship between LTPA and happiness when considering age, obesity status, self-reported health status, occupation, and education. Therefore, the purpose of the present study was to examine the relationship between LTPA engagement and happiness based on an age stratification perspective among Taiwanese adults.

**Material and Methods**

**Data source**

The present study reviewed a secondary database from Taiwan’s Physical Activity Annual Survey (PAAS) in 2018. This nationwide survey includes physical activity behaviors, self-reported health status, personal characteristics, and self-evaluations (including happiness) of citizens. The data collection for the PAAS 2018 was conducted by the Institute for Public Opinion, Shih-Hsin University. A computer-assisted telephone interview (CATI) was conducted from August to October 2018. A group of trained and experienced interviewers was employed in the CATI to ensure the quality of data collection.

All data collections were followed by stratified proportional sampling. The sampling population came from citizens aged over 13 years and stratified by 22 cities/counties across the country. The sample size of each city/county was determined by its proportion to the country population. The total sample size was 25,654, with sampling errors of 3% and confidence intervals (CI) of 95%, which allowed for achieving a sufficient sample size and statistical power. The participants were fully informed about the objective, procedure, and content of the telephone survey. This study was conducted in accordance with the Declaration of Helsinki, and all procedures were approved by the Institutional Review Board of the Chung Shan Medical University Hospital (CRREC-104-015). Oral consent was given before the interview. All relevant information is contained in the deidentified secondary dataset and has been released for public research purposes.

**Data clearance**

To ensure that the data were correctly applied, the ages were first filtered through the dataset to select the adults aged between 25 and 64 years for further analyses (Hyde et al., 2013). Then, the outliers and missing values of each variable were excluded. The boxplot method was applied for outlier exclusion (Schwertman et al., 2004) to identify the cutoffs for each variable. Finally, 16,412 data points were included in the present study.

**Measurements**

**Demographic variables**

Variables such as gender, age, education, occupation, self-reported health status, height, weight, body mass index...
(BMI), and obesity status of participants were employed for the demographic assessment. Participants were grouped into 8 classes according to their age. Education was categorized into 3 levels: elementary school or lower, junior or senior high school, and college or higher. Occupations included white collar, government employee, blue collar, owner/manager, specialist, freelancer, other, and unemployed. The self-reported health status included excellent or good, fair, and very bad or poor. The cutoffs for BMI were suggested by the Health Promotion Administration, Ministry of Health, and Welfare of Taiwan: underweight (BMI < 18.5 kg/m²), normal weight (18.5 ≤ BMI < 24 kg/m²), overweight (24 ≤ BMI < 27 kg/m²) and obese (BMI ≥ 27 kg/m²).

Sufficient LTPA

In this study, sufficient LTPA was assessed by a series of questions during the CATI. First, the participants were asked to describe their current LTPA participation. The question was as follows: “Have you taken part in any LTPA in the past month?” Respondents with a positive response were then asked to note their LTPA participation frequency and duration, such as “How many times do you participate in LTPA per week?”; “How many minutes do you usually spend at one time?” Furthermore, LTPA intensity was assessed by participants’ breathing and sweating status. The question was, “When you are doing LTPA, you usually feel….” Then, participants chose their response from structural answers such as “no changes in my breath and sweating,” “I breathe faster but do not sweat,” “I breathe normally but sweat,” “I breathe quickly and sweat.” Participants who reported that they usually breathed quickly and sweated were thus considered to engage in moderate-intensity LTPA. Thus, participants were dichotomized into groups. First, participants who reported participating in LTPA more than 3 days per week, at least 30 min per time, breathing quickly and sweating were classified into the sufficient LTPA group. The rest of the participants were considered the insufficient LTPA group.

Happiness

As mentioned previously, the concept and determinants of happiness are diverse (Diener, 2000; Jalali & Heidari, 2016; Myers & Diener, 2018; Veenhoven, 2010). There are several approaches to measuring happiness, such as the Oxford Happiness Inventory (OHI) (Argyle et al., 1995) and the Satisfaction with Life Scale (Diener et al., 1985). Nevertheless, these approaches commonly use one single item question (Taking all things together (in general), how happy would you say you are?) to measure happiness in the LTPA domain (Barreto, 2014; Baruth et al., 2011; Lera-López et al., 2016; Maher et al., 2016; Min et al., 2017; Richards et al., 2015). This item has been validated previously (Goldberg et al., 1997; Kye & Park, 2014) and has been tested for its temporal stability (test-retest reliability; r = 0.86) (Abdel-Khalek, 2006). In the PAAS 2018, happiness was measured by the abovementioned single question on a five-point scale that ranged from 1 (very unhappy) to 5 (very happy). Furthermore, to provide binary data, all respondents were dichotomized into two groups as happy (i.e., very happy, happy, and fair) and unhappy (i.e., unhappy and very unhappy), according to Wang’s approach (Wang, 2015).

Statistical analysis

Data analyses were performed using IBM SPSS software 25, USA. Student’s t-test and chi-square test were used to analyze the differences in participants’ demographic characteristics. In addition, two waves of multivariate logistic regression analyses were conducted for the general survey population and for groups stratified by age to determine the odds ratios (ORs) of sufficient LTPA for happiness. All regression models in our analysis were followed by confounding factor adjustment to avoid possible influences. The present study calculated the ORs with 95% confidence intervals (CIs) for happiness. Statistical significance was assessed at the levels of P < 0.05.

Results

The demographic characteristics of the research population are shown in Table 1. A total of 16,412 data points were employed and dichotomized into groups regarding their happiness status. More than 87% of participants were classed into the happy group; this group had a higher proportion of females (53.51%), a lower rate of obesity (15.47%), a higher level of education (44.33% in college), and a lower jobless rate (4.02%) than the unhappy group. Approximately 80% of individuals in the happy group self-reported that they were in excellent or good health. Except for the pooled age, significant differences were found in all of the demographic data between the two groups.

Table 2 presents the cross-analysis between sufficient LTPA and happiness status. In total, 27.7% of the happy group and 18.6% of the unhappy group achieved sufficient LTPA. Men had a higher sufficient LTPA participation rate than females in both the happy and unhappy groups. Significant differences were found (p < 0.001) in all comparisons. Table 3 reveals the preliminary results of multivariate logistic regression without age stratification. The results indicated that the sufficient LTPA groups had approximately 1.5 to 2 times the odds of happiness than the insufficient LTPA groups.

Table 4 presents a series of multivariate logistic regressions to perform the age stratification. The results indicated...
that LTPA-sufficient male respondents were more likely to be happy than the LTPA-insufficient male group at ages 25–29 (OR, 2.90; 95% CI, 1.50–5.62), 45–49 (OR, 1.80; 95% CI, 1.06–3.04), and 50–54 (OR, 2.66; 95% CI, 1.52–4.67). Moreover, women in the LTPA-sufficient group aged 25–29 (OR, 2.66; 95% CI, 1.52–4.67), 35–39 (OR, 4.03; 95% CI, 1.92–8.45), 40–44 (OR, 2.45; 95% CI, 1.46–4.12), 45–49 (OR, 3.43; 95% CI, 1.69–6.94), and 60–64 (OR, 2.01; 95% CI, 1.24–3.24) were two times more likely to be happy than women in the LTPA-insufficient group. Surprisingly, men aged 35 to 39 had an OR below 1 (OR, 0.54; 0.37–0.79). The results indicated that compared to those in the LTPA-insufficient group, the individuals who engaged in sufficient LTPA in this particular age group were only half as likely to be happy.

**Discussion**

The present study aimed to analyze the associations between sufficient LTPA and happiness among Taiwanese adults in terms of age differences. A representative database was used for the multivariate logistic regression analysis from an age stratification perspective. The main findings of this study are

| Variables                     | Perceived Happiness Status | P-value |
|-------------------------------|----------------------------|---------|
|                              | Happy (n = 14,346)         | Unhappy (n = 2066) |
| Age a (y)                    | 44.45 (11.29)              | 44.56 (10.47) | 0.684 |
| 25–29 years old              | 11.89%                     | 7.60%     | < 0.001** |
| 30–34 years old              | 11.54%                     | 13.46%    |         |
| 35–39 years old              | 14.20%                     | 15.39%    |         |
| 40–44 years old              | 13.30%                     | 14.91%    |         |
| 45–49 years old              | 12.58%                     | 12.88%    |         |
| 50–54 years old              | 12.56%                     | 14.42%    |         |
| 55–59 years old              | 12.53%                     | 12.49%    |         |
| 60–64 years old              | 11.39%                     | 8.86%     |         |
| Gender (% men)               | 46.49%                     | 55.57%    | < 0.001** |
| BMI (kg/m²)                  | 23.57 (3.73)               | 23.91 (3.77) | < 0.001** |
| Obese Status (%)             |                            |          |
| Underweight                  | 4.90%                      | 4.08%     |         |
| Normal weight                | 53.97%                     | 51.34%    |         |
| Overweight                   | 25.65%                     | 26.22%    |         |
| Obese                        | 15.47%                     | 18.36%    |         |
| Education (%)                |                            |          |
| Elementary school or lower   | 4.28%                      | 3.66%     | < 0.001** |
| Junior or senior school      | 51.39%                     | 57.49%    |         |
| College or higher            | 44.33%                     | 38.85%    |         |
| Occupation (%)               |                            |          |
| White collar                 | 18.76%                     | 18.04%    | < 0.001** |
| Government servant           | 7.51%                      | 3.70%     |         |
| Blue collar                  | 20.65%                     | 28.16%    |         |
| Owner/manager                | 6.75%                      | 5.16%     |         |
| Specialists                  | 9.11%                      | 7.00%     |         |
| Free lancey                  | 5.07%                      | 6.81%     |         |
| Other                        | 28.13%                     | 23.49%    |         |
| Jobless                      | 4.02%                      | 7.64%     |         |
| Self-reported health status (%)|                        |          |
| Excellent or good            | 79.63%                     | 57.40%    | < 0.001** |
| Fair                         | 5.68%                      | 6.64%     |         |
| Very bad or poor             | 14.69%                     | 35.96%    |         |

Abbreviations: BMI, body mass index; LTPA, leisure time physical activity

*P < 0.05; **P < 0.001

aValues expressed as means (standard deviation) for continuous variables
as follows: (1) a higher proportion of adults who reported being happy had sufficient LTPA; (2) sufficient LTPA was associated with happiness in both men and women; and (3) the relationships between sufficient LTPA and happiness were not consistent across different ages. Differences in gender, life conditions and socioeconomic status may be the reason for these disparity results. Our findings provide new information and insights to depict the form of the LTPA-happiness relationship through adulthood in Taiwan.

A previous study suggested that not only exercise but also PA (e.g., daily standing and walking) is related to happiness (Lathia et al., 2017). In this study, pooled LTPA-sufficient populations presented 1.5 to 2 times the odds of happiness as the insufficient group, particularly among women. In addition, from the age perspective, influential ORs were found in both genders aged 25 to 29 (OR = 2.90 for men, 2.66 for women). This indicated that approximately 2.5 to 3 times the odds of happiness could be found through sufficient LTPA participation at such ages. A similar study indicated that young adults can typically increase their life satisfaction and happiness by engaging in regular exercise (Grant et al., 2009).

Notably, a study reported a U-shaped relationship between age and happiness and a reverse U-shaped pattern between age and stress around the world (Graham & Ruiz Pozuelo, 2017; Kim et al., 2021). In other words, happiness may decline from younger age to middle-aged adults and return up as age increases. In addition, their results indicated that the higher the ranking of happiness is, the lower the turning point of the stress curve (Graham & Ruiz Pozuelo, 2017). In our study, we found that men had the highest OR (2.90) in the 25–29 age group, followed by a descending trend until the 35–39 age group (OR = 0.54), and then ascended to the next peak in the 50–54 age group (OR = 2.66). However, the ORs after 54 years of age became slack, and no significance was found. It has been reported that one’s happiness could be impacted by social factors and life conditions, such as loss of family support or life interest, physical illness and functional disability (Christensen et al., 1999; Fässberg et al., 2016; Kim et al., 2021). In this study, Taiwanese men commonly played an essential role in family economics. Men 30 to 40 years old often face problems such as declining job prospects (Danziger & Ratner, 2010), the rise of precarious work (Kalleberg, 2009), and work-family conflict (Lambert et al., 2017). Their burdens and desires for infeasible aspirations sometimes contribute to frustration (Blanchflower & Oswald, 2016). Therefore, we suggest that socioeconomic status and family factors may limit leisure activities and impact happiness levels.

Moreover, men’s odds ratio in the 35–39 age group (0.54) indicated that LTPA-sufficient individuals have only half the odds for happiness when compared with LTPA-insufficient individuals. Recently, the 3×2 achievement

### Table 2 The comparison between LTPA sufficiency and happiness status in Taiwan

| Variables | Perceived Happiness Status | P-value |
|-----------|---------------------------|---------|
|           | Happy (n = 14,346) | Unhappy (n = 2066) |
| Total (N = 16,412) | | |
| Sufficient LTPA | 27.7% | 18.6% | < 0.001** |
| Insufficient LTPA | 72.3% | 81.4% | |
| Men (n = 7818) | | |
| Sufficient LTPA | 29.3% | 21.5% | < 0.001** |
| Insufficient LTPA | 70.7% | 78.5% | |
| Women (n = 8594) | | |
| Sufficient LTPA | 26.3% | 15.1% | < 0.001** |
| Insufficient LTPA | 73.7% | 84.9% | |

Abbreviations: LTPA, leisure time physical activity
**P < 0.001

### Table 3 Multivariate logistic regression for sufficient LTPAs to happiness

| Variables | Model 1 (unadjusted) |  | Model 2 (adjusteda) |  |
|-----------|---------------------|------|---------------------|------|
|           | OR 95% CI           | P-value | OR 95% CI           | P-value |
| Men       |                     |       |                     |       |
| Sufficient LTPA | 1.51 | 1.30–1.76 | < 0.001** | 1.54 | 1.32–1.80 | < 0.001** |
| Insufficient LTPA | 1.00 | –       | –                   | 1.00 | –       | – |
| Women     |                     |       |                     |       |
| Sufficient LTPA | 2.01 | 1.67–2.43 | < 0.001** | 2.04 | 1.69–2.47 | < 0.001** |
| Insufficient LTPA | 1.00 | –       | –                   | 1.00 | –       | – |
| Total     |                     |       |                     |       |
| Sufficient LTPA | 1.67 | 1.49–1.88 | < 0.001** | 1.69 | 1.51–1.91 | < 0.001** |
| Insufficient LTPA | 1.00 | –       | –                   | 1.00 | –       | – |

Abbreviations: CI, confidence interval; LTPA, leisure time physical activity; OR, odds ratio
*P < 0.05; **P < 0.001

a Adjusted for obese status, self-reported health status, occupation, and education
goal model (Elliot et al., 2011) has been applied to the LTPA setting (Briki, 2019). The results suggest that the self-avoidance goal negatively predicted happiness and was mediated by dispositional self-control. Pre-middle aged men could be facing the same issue. For example, the situation of a man who regularly participates in LTPA to avoid fitness decline or to avoid loss of body shape might fit this scenario. Barriers such as prolonged working hours, care for children, and preoccupation with business pressure could impact dispositional self-control and cause a lower level of happiness (Wai et al., 2008).

On the other hand, women exhibited a wave trend with 5 significant odds across adulthood. Compared with the LTPA-insufficient group, the LTPA-sufficient group in all of these waves presented more than 2 times the odds of happiness. Two declines were observed between ages 30–34 and 50–59, although they did not reach significance. The happiness of middle-aged women is related to their health status, financial distress, social support, and psychological factors (e.g., self-esteem, positive thinking, or self-fulfillment) (Kim & Hur, 2019). The variety of these individualized factors can be great. Adverse effects, such as health status and quality of life, might mitigate the benefit of LTPA (Wu & Tsay, 2017). Additionally, on average, Taiwanese women face menopausal symptoms after 50 years of age (Li et al., 2018). Physical changes and improper coping strategies significantly decrease quality of life and reduce general life satisfaction (Ngai, 2019).

Although previous studies have indicated the benefit of LTPA for happiness, the present study provides different arguments. Indeed, the LTPA-happiness relationship seems clear from a general perspective. Meaningful benefits have also been found in our results, particularly for women. However, the relationship at some ages remains unclear. Intrapersonal differences and social contexts may influence the happiness benefits of LTPA. Additionally, psychological status, such as achievement goals, motivational level, and dispositional self-control, should be further investigated.

The strength of the present study was using representative data for analysis. However, there are still some limitations that should be addressed. First, we used a single-item question to evaluate participants’ general perception of happiness. Although this method has been supported by many kinds of research, it should be considered that happiness may comprise different aspects of life, such as psychological, social, physical, and spiritual happiness. Furthermore, although we controlled for confounding variables during our analyses, we suggest that future studies include a multidimensional measurement of happiness. Moreover, because the present study adopted a cross-sectional study design, a cause-and-effect relationship cannot be guaranteed. Future studies may adopt a longitudinal

| Ages       | Model 1 (unadjusted) | Model 2 (adjusted)* |
|------------|----------------------|---------------------|
|            | OR 95% CI            | P-value             | OR 95% CI            | P-value             |
| Men        |                      |                     |                     |
| 25–29      | 3.07 1.60–5.91       | 0.001*              | 2.90 1.50–5.62       | 0.002*              |
| 30–34      | 1.36 0.92–1.99       | 0.120               | 1.23 0.79–1.92       | 0.357               |
| 35–39      | 0.63 0.44–0.89       | 0.009*              | 0.54 0.37–0.79       | 0.001*              |
| 40–44      | 1.26 0.80–1.98       | 0.322               | 1.37 0.86–2.18       | 0.181               |
| 45–49      | 2.01 1.21–3.33       | 0.007*              | 1.80 1.06–3.04       | 0.030*              |
| 50–54      | 3.20 1.88–5.45       | < 0.001**           | 2.66 1.52–4.67       | 0.001*              |
| 55–59      | 1.30 0.84–2.01       | 0.234               | 1.16 0.74–1.82       | 0.512               |
| 60–64      | 1.62 1.07–2.47       | 0.023*              | 1.29 0.82–2.03       | 0.279               |
| Women      |                      |                     |                     |
| 25–29      | 2.84 1.28–6.30       | 0.010*              | 2.66 1.19–5.92       | 0.017*              |
| 30–34      | 1.27 0.69–2.36       | 0.441               | 1.13 0.59–2.16       | 0.714               |
| 35–39      | 4.26 2.05–8.89       | < 0.001**           | 4.03 1.92–8.45       | < 0.001**           |
| 40–44      | 2.61 1.58–4.34       | < 0.001**           | 2.45 1.46–4.12       | 0.001*              |
| 45–49      | 3.13 1.61–6.07       | 0.001*              | 3.43 1.69–6.94       | 0.001*              |
| 50–54      | 1.30 0.81–2.09       | 0.285               | 1.18 0.70–1.98       | 0.533               |
| 55–59      | 1.03 0.65–1.66       | 0.889               | 0.94 0.58–1.54       | 0.810               |
| 60–64      | 2.11 1.34–3.34       | 0.001*              | 2.01 1.24–3.24       | 0.004*              |

Abbreviations: CI, confidence interval; LTPA, leisure time physical activity; OR, odds ratio

*P < 0.05; **P < 0.001

*Adjusted for obese status, self-reported health status, occupation, and education
design to understand the cause and effect relationship between LTPA and happiness. Alternatively, a qualitative design could be used to understand the relationship between sufficient LTPA and happiness.

Conclusion

This study demonstrates that sufficient LTPA was associated with increased happiness in both genders. However, the relationships between sufficient LTPA and happiness were not consistent when stratified by age in Taiwanese adults. In addition, aging, social factors, health and psychological status may play a pivotal role in the LTPA-happiness relationship.

Abbreviations

ACSM: American Colleges of Sport Medicine; BMI: Body mass index; CATI: Computer-assisted telephone interview; CI: Confidence interval; LTPA: Leisure time physical activity; OHI: Oxford Happiness Inventory; OR: Odds ratio; PAAS: Taiwan’s Physical Activity Annual Survey

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Authors’ Contributions

LPF participated in the design, conducted the statistical analyses, interpreted the data, and drafted the manuscript. HCC supervised the study, assisted in data interpretation, and critically reviewed the manuscript. LFJH and GDL helped in conducting the study and revising the manuscript. CYH and KYH helped to manage and analyze the data. All authors read and approved the final manuscript.

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Data Availability

All relevant material is presented in the present manuscript.

Declarations

Ethics Approval and Consent to Participate

The study was conducted in accordance with the Declaration of Helsinki, and all procedures were approved by the Institutional Review Board of the Chung Shan Medical University Hospital (CRREC-104-015). Oral informed consent was obtained from each subject after a full explanation of the study.

Consent for Publication

Not applicable.

Competing Interests

The authors declare that they have no competing interests.

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