

BMJ Open Physical activities and influencing factors among public health nurses: a cross-sectional study

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To cite: Lin M-L, Huang J-J, Chuang H-Y, *et al.* Physical activities and influencing factors among public health nurses: a cross-sectional study. *BMJ Open* 2018;**8**:e019959. doi:10.1136/bmjopen-2017-019959

► Prepublication history for this paper is available online. To view these files, please visit the journal online (<http://dx.doi.org/10.1136/bmjopen-2017-019959>).

Received 7 October 2017
Revised 12 March 2018
Accepted 23 March 2018



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ABSTRACT

Objectives Public health nurses are responsible for promoting and managing the health of community members, and if they do not have enough physical activity or ignore their own health, not only will their own health decline but the quality of life of the public will also be affected. This study investigated the physical activity of public health nurses and analysed the effects of attitudes, subjective norms, perceived behavioural control and behavioural intention to engage in physical activity.

Methods This study adopted a cross-sectional research design, and convenience sampling was used to select the research subjects. 198 public health nurses were invited to participate, and 172 completed the questionnaire. Multiple linear regression was used to analyse the influencing factors of physical activity intention and physical activity.

Results Attitudes towards physical activity and perceived behavioural control of physical activity affected physical activity intention. When they had higher behavioural intention, their physical activity behaviour also improved. The physical activity intention significantly influenced the number of days that they had engaged in vigorous physical activity (95% CI 0.1786 to 0.3060, $p < 0.0001$), and significantly influenced the number of days that they walked daily for 10 min (95% CI 0.2158 to 0.4144, $p < 0.0001$), and also significantly influenced their daily sedentary time (95% CI -0.3020 to 0.0560, $p = 0.0046$).

Conclusions Encouraging public health nurses to heed their own health and motivating them to engage in physical activity warrants attention from policy-makers and government health agencies.

INTRODUCTION

In 2014, WHO named ‘insufficient physical activity’ as an issue warranting attention from international public health agencies. Over 14 million individuals die from chronic disease, and one of the primary reasons is physical inactivity.¹ Research has shown that physical inactivity is a worldwide concern in leading cause of morbidity, disability and premature mortality.² In the past 30 years in the USA, the proportion of individuals who are physically inactive has gradually declined in every state, but the prevailing rate of physical inactivity in many states remains high.³ In

Strengths and limitations of this study

- The health promotion behaviour of public health nurses has rarely been explored; in this study, the theory of planned behaviour was applied to explore the influencing factors of physical activity among public health nurses.
- In this study, the data were objectively collected with various physical activities and the relevant factors.
- This study was limited in terms of analysing some of the confounding factors that may affect physical activity, such as obesity and disability.
- The study adapted cross-sectional design, therefore, the result of the study could not be used as the inference of cause and effect.
- The inference of the results would be limited as the participants were limited to specific targets.

the past, the number of Taiwanese who did not engage in physical activity was 2.5 times that of Americans. In 2012, the Health Promotion Administration of Taiwan conducted a survey of physical activity among Taiwanese people and found that, among those aged 12–64 years, the average proportion of those who had done no physical activity in the last week was 29.4%. The proportion of women who had done no physical activity in the last week (30.7%) was higher than that of men (28.0%), especially among those aged 42–51 years. Therefore, the risk of insufficient physical activity for the health of Taiwanese people warrants attention.⁴

In Taiwan, public health centres are the basic agencies promoting public health work. As of the end of 2015, Taiwan has 370 public health centres, which provide community members with basic medical insurance and public health services, and health promotion is one of the essential public health services.⁵ Thus, promoting healthy living and physical activity is an essential activity of public health nurses at public health centres. Empirical evidence has confirmed that RNs’ personal health behaviours are related to

their professional health promotion practices.^{6–8} Previous studies have indicated nurses may translate their personal attitudes, beliefs and behaviours into their professional practices related to health promotion^{9–11}; therefore, it is important to explore the influencing factors of physical activity of public health nurses.

In 1985, Ajzen proposed the theory of planned behaviour (TPB), in which an individual decides whether to perform an act based on free will. Once people have more positive attitudes and subjective norms and better perceived behavioural control, they are more likely to change specific behavioural intentions into actual behaviours.¹² A US study based on TPB to examine the influencing factors of physical activity found that attitudes, subjective norms and perceived behavioural control explained 54.8% of total variance of intention, and intention explained 13.8% of total variance of physical activity.¹³ Another study examined the physical activity of middle-aged African-American women (n=137; mean age=49.2±7.8) and found that attitudes and perceived behavioural control explained 57.4% of total variance of physical activity.¹⁴ TPB has also been used to survey physical activity in Korean-Americans (n=198; mean age=26.0±9.16).

If people feel that physical activity is enjoyable and effective and that they can control their own physical activity, then there is more positive physical activity intention, so attitude and perceived behavioural control can serve as important predictors of physical activity intention ($R^2=0.31$). Meanwhile, physical activity intention and perceived behavioural control could significantly predict physical activity with the explained variance of 43%.¹⁵

A US study (from 1976 to 1998), for nurses aged 30–55 (n=71 570) found that more physical activities could reduce endometrial cancer risk, and make it less likely nurses would smoke, be less likely to have diabetes, higher alcohol and energy intakes but lower caffeine intake, and spend less time sitting.¹⁶ Health behaviour healthcare providers had a crucial effect on patients and the public; therefore, health behaviour of healthcare providers should be a concern.¹⁷ Healthcare providers are the gatekeepers of both patient and public health, so they need to pay attention to their own health. In addition, public health nurses are the first-line providers of healthcare to the public and must be even more self-aware of their health to serve as health promotion advocates and role models.

Public health nurses are important promoters of community health, but there have been few studies investigating the health behaviours of public health nurses. Public health nurses are in the front line to serve the public, and if they disregard or ignore their own health, their own health will decline and the quality of life of the public will be affected. To maintain public health, the health of nurses must receive appropriate attention. Thus, the purpose of this study is to investigate the physical activity of public health nurses and analyse the influence of attitudes, subjective norms, perceived behavioural

control and behavioural intention to engage in physical activity. The results of this study are expected to support increased physical activity among public health nurses and serve as an important reference for policy-making.

METHODS

Study design

This is a cross-sectional and correlational study with a questionnaire survey.

Participants

Participants' inclusion criteria of this study: (1) public health nurses serving at a Kaohsiung City public health centre and (2) willingness to participate in the study. Exclusion criteria: (1) currently pregnant and (2) have a health problem that makes physical activity unsuitable.

Recruitment

Participants were recruited from 38 district public health centres of Kaohsiung in Taiwan. Before the study, participants were informed about the purpose of the study and consent was obtained. The questionnaire was collected from January 2016 to February 2016. Altogether, 226 Kaohsiung public health nurses were invited to participate in the study through email. In total, 198 public health nurses were enrolled, and 172 completed the questionnaire, with a response rate of 86.9%.

Data collection tool

This study used TPB as a theory and referenced research tools used in previous studies of physical activity^{12 14 18} to develop questionnaires for public health nurses, including Demographic Inventory, Attitudes towards Physical Activity Scale (APAS), Subjective Norms of Physical Activity Scale (SNPAS), Perceived Behavioural Control of Physical Activity Scale (PBCPAS) and Physical Activity Intention Scale (PAIS). The content validity was evaluated by medical, sports, nursing and public health professionals, and obtained content validity index of 0.88. In a pilot study of public health nurses (n=30), Cronbach's alpha of the internal consistency as well as 1-week test-retest reliability of the questionnaire was examined. The Taiwan Version of International Physical Activity Questionnaire (TV-IPAQ), authorised for use by the Taiwan Ministry of Health, served as a tool for measuring physical activity.

Demographic inventory

The Demographic inventory includes age, educational level, marital status, work experience, public health work qualification, number of children and disease condition.

Attitudes towards Physical Activity Scale

The APAS includes nine items to measure subjective attitude towards physical activity, for example: 'for me, exercise is a healthy thing' and 'for me, sports are worth doing.' Each item comprises a Likert's scale ranging from 1 to 5. A total score for the Scale ranges from 9 to 45. The

higher score indicates higher level of attitude towards physical activity. The Cronbach's alpha and 1-week test-retest reliability coefficients are 0.81 and 0.91, respectively, in the pilot study. The Cronbach's alpha is 0.84 in the present study.

Subjective Norms of Physical Activity Scale

The SNPAS includes six items to measure friends, surrounding support systems and the effects of the environment on physical activity, such as 'my friends or family think I should exercise' and 'my environment makes it easy to go somewhere to exercise.' Each item comprises a Likert's scale ranging from 1 to 5. A total score ranges from 6 to 30. The higher score indicates higher level of positive subjective norms of physical activity. The Cronbach's alpha and 1 week test-retest reliability coefficients are 0.82 and 0.89, respectively, in the pilot study. The Cronbach's alpha is 0.80 in the present study.

Perceived Behavioural Control of Physical Activity Scale

The PBCPAS includes seven items to measure difficulty of engaging in physical activity, subjective control and other feelings, such as 'I have time for exercise' and 'I can decide on my own whether to exercise.' Each item comprises a Likert's scale ranging from 1 to 5. A total score ranges from 7 to 35. The higher score indicates higher level of perceived behavioural control. The Cronbach's alpha and 1-week test-retest reliability coefficients are 0.72 and 0.88, respectively, in the pilot study. The Cronbach's alpha is 0.75 in the present study.

Physical Activity Intention Scale

The PAIS includes four items to measure physical activity and the likelihood of and motivation physical activity in the coming week, such as 'I want to start (or continue) exercising next week' and 'I will try to exercise starting (or continuing) next week.' Each item comprises a Likert's scale ranging from 1 to 5. A total score ranges from 4 to 20. The higher score indicates higher level of behavioural intention. The Cronbach's alpha and 1-week test-retest reliability coefficients are 0.93 and 0.92, respectively, in the pilot study. The Cronbach's alpha is 0.95 in the present study.

TV-IPAQ (short version)

The TV-IPAQ (short version (SS)) was used to measure physical activity. The content validity was 0.994 and 0.992 for language equivalence and meaning similarity between the English and Taiwan versions of the IPAQ-SS, and consistency values for the English and Chinese versions in terms of intraclass correlation coefficients was 0.704.¹⁴ The TV-IPAQ (SS) primarily measures the physical activity of the participants in the past 7 days, including vigorous physical activity, moderately vigorous physical activity, daily walk time and daily sedentary time.

Ethical considerations

Data were collected from January 2016 to February 2016. The study was conducted by the principal investigator

contacting the in-charge nurse at each district's public health centre via phone or mail to invite public health nurses to participate in a questionnaire survey. Before data collection began, the study participants acknowledged the purpose and process of the study and the maintenance of their rights and signed a consent form. The study participants voluntarily completed the questionnaires and could consult with the researcher at any time if there were any questions during the process. After completing the questionnaire, the study participants returned the questionnaires to the in-charge nurse or sent them directly by mail to the principal investigator.

Sample size calculation

Sample size calculation was using G-power 3.1.9.2 software, a general medium effect size of 0.25 was predicted, α was set to 0.05, power was set to 0.80 and the required sample size was 128. Besides, extra 30% of the sample was required in case of missing answers, so at least 196 women were required in total.

Statistical analysis

Data analyses were performed by using SPSS V.20.0. Descriptive statistics were used to describe the demographic characteristics of the participants and the scales' scores. Pearson's correlation was used to examine the relationship among the variables. Multiple linear regression was used to analyse the influencing factors of physical activity intention and physical activity. In all tests of this study, p value < 0.05 was set to be statistically significant.

Patient and public involvement

Through literature review and clinical observation, we proposed the research questions, developed the research instruments and explored public health nurses' physical activity. During the study, the research team recruited public health nurses to participate in the study through the principles of disclosure and informed consent. None of the participants helped recruit and conduct the research. After the study, the research results will be shared with policy-makers to help promote the physical wellness of public health nurses. The findings will also be shared with the participants as a guide to improve their physical activity and health behaviour.

RESULTS

A total of 172 public health nurses met the inclusion criteria and completed the questionnaires. Nurses were recruited from 38 public health centres in Kaohsiung City. All participants were female, had no disability and their mean body mass index was 23.53 ± 4.27 . All of them had medical insurance. The mean age of the nurses was 42.98 ± 6.99 years. Among them, 167 (97.09%) had a college or above educational level; 125 (72.67%) were married. The mean year of work experience was 19.25 ± 7.00 years and the year of public health work qualifications was 9.80 ± 7.58 years. The mean score on APAS was

35.60 (± 4.64) with the actual score range being 20–45; the mean score on SNPAS was 22.55 (± 3.40) with the actual score range being 14–30; the mean score on PBCPAS was 26.22 (± 3.60) and the actual score range being 14–35; and the mean score on PAIS was 13.81 (± 3.30) with the actual score range being 4–20.

When comparing the physical activity in the past 7 days and the past 3 months, the majority ($n=103$, 60.47%) felt that they were similar. Sixty-eight respondents (39.54%) had engaged in vigorous physical activity in the past 7 days with an average of 0.97 days ($SD=1.60$) of vigorous physical activity per week; 85 respondents (49.42%) had engaged in moderately vigorous physical activity in the past 7 days, with an average of 1.43 days ($SD=2.06$) of moderately vigorous physical activity per week; 123 respondents (71.51%) took a daily walk for 10 min, with an average of 2.49 days ($SD=2.40$) per week. The average daily sedentary time of the respondents were 8.05 hours in the past 7 days ($SD=2.74$) (table 1).

The APAS and SNPAS were significantly correlated ($p=0.0014$). PBCPAS was also significantly correlated with APAS ($p<0.0001$) and SNPAS ($p<0.0001$). APAS, SNPAS and PBCPAS were all significantly correlated with PAIS ($p<0.0001$). Multiple regression analysis was used to explore factors predicting physical activity intention. The p value was set as the selection criterion in the selection strategy and key variables were chosen accordingly. After regression diagnosis, key variables influencing public health nurse's physical activity intention were selected from the analytical results, and are presented in table 2. The APAS and PAIS were significantly correlated (95% CI 0.0525 to 0.2499, $p=0.0029$). For every point increase in attitude towards physical activity, there was a 0.15-point increase in physical activity intention. The PBCPAS were also significantly correlated with PAIS (95% CI 0.2771 to 0.5318, $p<0.0001$). For every point increase in perceived behavioural control of physical activity, there was a 0.40-point increase in physical activity intention.

Multiple regression analysis was also used to explore factors predicting physical activity. The p value was set as the selection criterion in the selection strategy and key variables were chosen accordingly. After regression diagnosis, key variables influencing physical activity behaviour were selected from the analytical results, and are presented in tables 3–5. The physical activity intention significantly influenced the number of days in the past 7 days that they had engaged in vigorous physical activity (95% CI 0.1786 to 0.3060, $p<0.0001$). For every point increase in physical activity intention, there was a 0.24-day increase in the time of vigorous physical activity. The physical activity intention also significantly influenced the number of days in the past 7 days that they daily walked for 10 min (95% CI 0.2158 to 0.4144, $p<0.0001$). For every point increase in physical activity intention, there was a 0.32-day increase in the number of days that respondents took a daily walk for 10 min. The physical activity intention also significantly influenced their daily sedentary time (95% CI -0.3020 to 0.0560, $p=0.0046$). For every

Table 1 Public health nurse's physical activity ($n=172$)

| Item | n | % |
|--|-------------|-----------|
| Compare the amount of physical activity in the past 7 days and the past 3 months | | |
| Become more | 26 | 15.12 |
| Become less | 42 | 24.42 |
| About the same | 104 | 60.47 |
| Vigorous physical activity in the past 7 days | | |
| No | 104 | 60.47 |
| Yes | 68 | 39.54 |
| Daily vigorous physical activity time | | |
| None | 105 | 61.05 |
| Under 30 min | 21 | 12.21 |
| 30 min or more | 23 | 13.37 |
| Uncertain | 23 | 13.37 |
| Moderate vigorous physical activity in the past 7 days | | |
| No | 87 | 50.58 |
| Yes | 85 | 49.42 |
| Daily moderate vigorous physical activity time | | |
| None | 89 | 51.74 |
| Under 30 min | 26 | 15.12 |
| 30 min or more | 31 | 18.02 |
| Uncertain | 26 | 15.12 |
| Daily walk for 10 min in the past 7 days | | |
| No | 49 | 28.49 |
| Yes | 123 | 71.51 |
| | Mean | SD |
| The no of days spent on vigorous physical activity in the past 7 days | 0.97 | 1.60 |
| The no of days spent on moderate vigorous physical activity in the past 7 days | 1.43 | 2.06 |
| The past 7 days the no of days can be a daily walk for 10 min | 2.49 | 2.40 |
| The average daily sedentary time in the past 7 days | 8.05 | 2.74 |

point increase in physical activity intention, there was a 0.18-hour decrease in daily sedentary time.

DISCUSSION

In this study, the outcome data may have been clustered by Centre, so the intraclass correlation coefficient was calculated based on the research report of Killip *et al.*¹⁹ After calculation, the intraclass correlation coefficients varied between 0.18 and 0.24. These are significant and translate into a design effect between 1.64 and 1.85 which will mean that some of the more marginally significant findings may not be significant.

Table 2 Multiple regression analyses for predictive factors of physical activity intention (n=172)

| Variables | Coefficient | SE | t | P values | 95% CI |
|-----------|-------------|------|-------|----------|----------------|
| Intercept | 13.63 | 0.21 | 64.87 | <0.0001* | 13.21 to 14.04 |
| APAS | 0.15 | 0.05 | 3.03 | 0.0029* | 0.05 to 0.25 |
| PBCPAS | 0.40 | 0.06 | 6.27 | <0.0001* | 0.28 to 0.53 |

*Adjusted R²=0.322.

APAS, Attitudes towards Physical Activity Scale; PBCPAS, Perceived Behavioural Control of Physical Activity Scale.

According to a 2014 survey by the US Centers for Disease Control, adults without regular physical activity have a higher risk of early death and heart disease, stroke, type 2 diabetes, depression and cancer.¹ A previous study noted 48.6% of RNs reported they did not participate in any 30 min physical activity for most of the week, mainly due to lack of time and motivation, fatigue and cost.²⁰ A study focusing on nurses showed that 46.3% of nurses did not engage in regular physical activity, and lack of regular physical activity was a factor affecting sleep disorders.²¹ In addition, a significant factor correlated with nurse job strain is lack of physical activity.²² WHO (2010) recommends that adults over the age of 18 should undertake at least 150 min of moderate physical activity or 90 min of vigorous physical activity per week.⁵ The results of this study showed that most public health nurses undertake less than 30 min of vigorous or moderately vigorous physical activity per week. With reference to past research findings, the results of this study show that Taiwan's public health nurses are leaving themselves at health risk.

Most evidence indicates that professionals' physical activity habits are associated with higher physical activity promoting practices and their counselling practices.^{11 23-25} In addition, medical providers and community health workers who have not adopted healthy living or physical activity are less likely to encourage patients or community members to engage in healthy activities.¹⁰ Taiwan public health nurses are important personnel in advocating physical activity, but they do not practise such health behaviours themselves; therefore, helping public health nurses develop the ability to formulate their own physical activity plans benefits their health and allow them to have more positive attitudes for guiding patients and community members to attain healthy living.

The results of the present study showed that the physical activity intention of public health nurses was affected by attitudes towards physical activity and perceived behavioural control. In addition, physical activity intention also affected the time of vigorous physical activity per

day, the day of daily walking for 10 min per week and the amount of seated sedentary time per day. Previous studies found the fact that health workers have more physical activity and more positive attitudes about physical activity may make them promote more physical activity to patients.^{26,27} Leading public health nurses to pose positive attitudes towards physical activity is an important goal. Despite the fact that their job is to help people increase physical activity, they also need professionals' assistance in planning physical activity programmes. Previous study indicated that nurses take responsibility for the role of health promotion in the practice environment.²³ They may be able to make huge changes in the health of other people. Therefore, nurses, community health workers and other healthcare providers need to obtain even more health information for guidance in physical activity.²⁸ Thus, helping public health nurses develop positive attitudes towards physical activity and allowing them to formulate their own plans for physical activity increases their physical activity intention, thereby enhancing physical activity behaviour.

Walking is the most common form of physical activity among Taiwanese, and 42.6% of Taiwanese have walking habits.²⁹ In the present study, the proportion of public health nurses who engaged in daily walking for 10 min was also higher than the proportion engaging in vigorous or moderately vigorous physical activity, showing that walking is a common form of physical activity among public health nurses. In a study focusing on walking behaviours among university students, attitude, self-regulation and behavioural intention affected their walking behaviours.³⁰

In the present study, the physical activity intention of public health nurses also affected the number of days with daily walk for 10 min. Walking can alleviate lower back pain³¹ and can benefit public health nurses with high workload and work-related stress, helping them understand and appreciate the benefits of walking and stimulating their behavioural intention to take up walking. This

Table 3 Multiple regression analyses for predictive factors of vigorous physical activity (n=172)

| Variables | Coefficient | SE | t | P values | 95% CI |
|-----------|-------------|------|------|----------|--------------|
| Intercept | 0.77 | 0.11 | 7.04 | <0.0001* | 0.55 to 0.98 |
| PAIS | 0.24 | 0.03 | 7.51 | <0.0001* | 0.18 to 0.31 |

*Adjusted R²=0.245.

PAIS, Physical Activity Intention scale.

Table 4 Multiple regression analyses for predictive factors of a daily walk for 10 min (n=172)

| Variables | Coefficient | SE | t | P values | 95% CI |
|-----------|-------------|------|-------|----------|--------------|
| Intercept | 2.24 | 0.17 | 13.14 | <0.0001* | 1.90 to 2.58 |
| PAIS | 0.32 | 0.05 | 6.26 | <0.0001* | 0.22 to 0.41 |

*Adjusted R²=0.183.

PAIS, Physical Activity Intention Scale.

Table 5 Multiple regression analyses for predictive factors of the average daily sedentary time (n=172)

| Variables | Coefficient | SE | t | P values | 95% CI |
|-----------|-------------|------|-------|----------|----------------|
| Intercept | 8.20 | 0.21 | 38.83 | <0.0001* | 7.78 to 8.61 |
| PAIS | -0.18 | 0.06 | -2.87 | 0.0046* | -0.30 to -0.06 |

*Adjusted R²=0.046.

PAIS, Physical Activity Intention Scale.

allows them to elevate their walking behaviour to an even more beneficial healthy walking, which is a strategy worth consideration.

Long periods of sitting increase the risk of lower back pain,³² and extended periods of sitting and watching television is a lifestyle that increases the chance of colon cancer in women.³³ Studies have shown that reducing sedentary time by 30min per day and engaging in at least 10min of vigorous or moderately vigorous physical activity has significant benefits for body weight control and preventing metabolic syndrome.³⁴ The present study found that public health nurses remained seated without movement for over 8hours per day. Studies have shown that nurses have sedentary lifestyles, and, although they have relevant health knowledge, they often do not apply their health knowledge to themselves, causing themselves to become a high-risk group for cardiovascular disease.³⁵ Therefore, helping public health nurses achieve appropriate physical activity to decrease fatigue and stress and reducing their sedentary lifestyle benefits their health promotion.

According to this study, the physical activity of public health nurses in Taiwan was insufficient. Enhancing their positive attitudes towards physical activity and control of physical activity can both enhance their intention of physical activity, and thus increase the possibility of undertaking physical activity. Public health nurses help people understand the benefits of physical activity, but they also need more workplace resources to support their own physical activity. Therefore, to support public health nurses in their own physical activity by providing courses or programmes they would like or can easily adopt is suggested to the policy-makers in Taiwan government. The public health nurses in Kaohsiung City are the object of this study. Although it already covered more than 70% of them, the results of the study still have some limitations on the corollary of all public health nurses. Especially many of the confounding factors that affect physical activity do not appear in the study subjects. Therefore, there is a limitation in the research corollary.

CONCLUSIONS

Public health nurses are responsible for promoting and managing the health of community members, but it is easy for them to ignore their own health promotion. Their attitudes towards physical activity and perceived behavioural control affect their behavioural intention of physical activity. When they have higher behavioural

intention, their physical activity behaviour also improves. Therefore, encouraging public health nurses to face their own health situation, helping them develop plans for physical activity and encouraging them to develop motivations for physical activity are issues that should be faced by policy-makers and health agencies.

Acknowledgements The authors thank all participants for their participation and nurse managers of these public health centres for their administrative help.

Contributors M-LL and H-HW made primary contributions to the design, conduct, analysis and interpretation of the research. J-JH and H-YC contributed to the study design, data analysis plan and interpretation of the results. H-MT and H-HW contributed to the conduct of the research and interpretation of the results. All authors reviewed the manuscript and had full access to all data in the study and take responsibility for the integrity of the data.

Funding This study was funded by the Ministry of Science and Technology, Taiwan (MOST 104-2314-B-037 -045 -MY3).

Competing interests None declared.

Patient consent Obtained.

Ethics approval Kaohsiung Municipal Kai-Syuan Psychiatric Hospital Institutional Review Board (IRB No KSPH-2015-26).

Provenance and peer review Not commissioned; externally peer reviewed.

Data sharing statement No additional data are available.

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