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# Prevalence of physical inactivity in nine rural INDEPTH Health and Demographic Surveillance Systems in five Asian countries

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## Background:

Physical inactivity leads to higher morbidity and mortality from chronic non-communicable diseases (NCDs) such as stroke and heart disease. In high income countries, studies have measured the population level of physical activity, but comparable data are lacking from most low and middle-income countries.

Objective:

To assess the level of physical inactivity and its associated factors in selected rural sites in five Asian countries.

Methods:

Bangladesh, India, Indonesia, Thailand, and Vietnam. Using the methodology from the WHO STEPwise approach to Surveillance (STEPS), about 2,000 men and women aged 25–64 years were selected randomly from each HDSS sampling frame. Physical activity at work and during leisure time, and on travel to and from places, was measured using the Global Physical Activity Questionnaire version 2 (GPAQ2). The total activity was calculated as the sum of the time spent in each domain of activities in metabolic equivalent-minutes per week, and was used to determine the level of physical activity. Multivariable logistic regression was used to assess demographic factors associated with a low level of physical activity.

Results:

The prevalence of physical inactivity ranged from 13% in Chililab HDSS in Vietnam to 58% in Filabavi HDSS in Vietnam. The majority of men were physically active, except in the two sites in Vietnam. Most of the respondents walked or cycled for at least 10 minutes to get from place to place, with some exceptions in the HDSSs in Indonesia and Thailand. The majority of respondents, both men and women, were inactive during their leisure time. Women, older age, and high level of education were significantly associated with physical inactivity.

Conclusion:

This study showed that over 1/4 men and 1/3 women in Asian HDSSs within the INDEPTH Network are physically inactive. The wide fluctuations between the two HDSS in Vietnam offer an opportunity to explore further urbanisation and environmental impacts on physical activity. Considering the importance of physical activity in improving health and preventing chronic NCDs, efforts need to be made to promote physical activity particularly among women, older people, and high education groups in these settings.

chronic non-communicable diseases | risk factors surveillance | physical inactivity | low and middle-income countries | Asia

## Introduction

Physical inactivity leads to higher morbidity from cardiovascular disease, ischemic stroke, metabolic syndrome, cancer, non-insulin dependent diabetes mellitus, osteoporosis, and mental health 1 2 3 4 . Different studies have been conducted to measure prevalence of physical activity levels in different populations in many countries 5 6 7 8 9 10 . Such information is sparse from low and middle income countries 11. The World Health Survey results showed that 18% of the population in 51 countries were physically inactive. Of the 10 countries in the South East Asian and Western Pacific regions who participated in the World Health Survey, the highest prevalence of physical inactivity was observed in Malaysia (16.5%), Laos (10%), and India (9.4%) 9. Physical inactivity is more common among urban populations (18%, 14%, and 16% in Bangladesh, India, and Vietnam, respectively) compared with those in rural Asian countries (15%, 12%, and 6% in Bangladesh, India, and Vietnam, respectively) 12.

Few studies have used standardised protocols and instruments to measure physical activity patterns 9 10 13. Over the past two decades, efforts have been made to develop a simple, reliable, and comparable physical activity questionnaire to measure the population level of physical inactivity 13 14. The International Consensus Group for the Development of an International Physical Activity Questionnaire initiated the development of International Physical Activity Questionnaire (IPAQ) as a standardised questionnaire for physical activity measurement in 1998. The validity and reliability of IPAQ was tested in 12 countries in 2000 and the results showed that IPAQ has a high reliability and moderate criterion validity, and the study recommended the use of short form of IPAQ for population-based physical activity measurement 13. IPAQ has been used widely in different studies at national level 9 10 13. However, further study conducted in eight European countries noted a low test-retest reliability of the IPAQ 6, and it is possible to over-estimate the level of physical activity by using the IPAQ telephone survey 15.

The lack of use of standardised questionnaires makes both comparisons between studies and temporal trends difficult. This was recognised in the development of a core set of questions designed to measure physical activity levels in populations in low and middle-income countries 14. In 2001, the Global Physical Activity Questionnaire (GPAQ) was introduced as one module in the WHO STEPwise approach to surveillance (STEPS) for non-communicable disease (NCD) risk factors following validity studies in a number of sites which compared the two approaches, GPAQ and IPAQ 16. The instrument was and dimensions of physical activities which are culturally bound in different settings, while sufficiently equivalent to maintain comparability across settings. Knowledge on the level of physical activity for different domains such as work, transport, and leisure time activities is also important for developing appropriate health interventions. The GPAQ is therefore considered to be more appropriate for surveillance purposes 17 18. The GPAQ has been considered an intermediate format between long and short IPAQ 11.

Lack of epidemiological evidence on the burden of physical inactivity, particularly from low and middle-income countries, is a barrier in advocating the importance of developing public health interventions to improve physical activity in chronic disease prevention and control program. Obtaining valid population level of physical activity is very important in assessing the relative importance of physical inactivity to other chronic NCD risk factors, particularly obesity which will potentially become an epidemic threat in low and middle-income countries in near future.

### 1.1 Study objective

The aim of this study is to assess the level of physical activity and to identify demographic factors associated with physical inactivity in nine selected rural Health and Demographic Surveillance System (HDSS) sites in five Asian countries.

## 2 Methods

### 2.1 Study design

This study is a multi-centre cross-sectional study of chronic NCD risk factors 19 conducted in nine HDSS sites in two South Asian countries (Bangladesh and India), and three South East Asian countries (Vietnam, Indonesia, and Thailand). All these HDSSs are the members of the INDEPTH Network (www.indepth-network.org) in Asia and all INDEPTH Asian sites participated in this study.

### 2.2 Study subjects

The HDSS database provided the sampling frame for this study. Respondents aged 25–64 years old were selected randomly within each sex and 10-year age-group. The of 2,000 men and women being recruited in each site. The following assumptions were used for sample size calculation: level of confidence 95%, margin of error 6%, baseline level of risk factors 35%, expected response rate 95%. Details on study design and subject selection have been reported elsewhere 19.

## 2.3 Data collection

Data reported in this paper were collected as part of a larger chronic NCD risk factor surveillance activity within the HDSS. Details of the methodology and data collection processes have been covered elsewhere 19. The data collection were conducted during June and November 2005. Physical activity was measured using the GPAQ version 2/GPAQ2 14 17. The instrument gathers information on physical activity in three domains (activity at work, travel to and from places, and recreational activities), as well as time spent on sitting. The questionnaire also assesses vigorous and moderate activities performed at work and for recreational activities. Attempts were also made to make the term 'vigorous' and 'moderate' more objectively by relating the activity to increase in breathing and heart rate. Vigorous activities were defined as those which required hard physical effort and caused large increases in breathing or heart rate, and moderate activities were defined as those which required moderate physical effort and caused smaller increases in breathing or heart rate. Information on the number of days in a week spent on different activities and time spent in a typical day for each activity was also recorded.

The instruments were translated into local languages, and back-translated into English to ensure its validity. Show-cards with photos of different local physical activities used in this study provided respondents with a more objective standard in estimating the time they spent on different vigorous and moderate physical activities during their work and leisure time. Training for interviewers was conducted over three days which included reviewing and interpreting the instruments and the data collection methods followed by a day of field testing.

## 2.4 Data analysis

The data were entered using EPIDATA, and analysed using STATA Version 10. Data on physical activity were cleaned and analysed based on the data analysis protocol developed by the WHO 14. All physical activity domains were cleaned as a combined set of questions with each respondent having an overall clean response to all physical more than seven days of activity in a week, and those who reported minutes spent on activities following a zero-day of conducting activity. Activities reported undertaken less than 10 minutes were recorded as missing data. For GPAQ2, a maximum range of 16 hours per day was set. All durations were converted into minutes. In addition to the total minutes of activity, the activity volume was also computed by weighing each type of activity by its energy requirement in metabolic equivalents (METs). One MET was defined as the energy cost of sitting quietly, and was equivalent to a caloric consumption of 1 kcal/kg/hour. A MET-minute showed the total activity volume on weekly basis, and calculated by multiplying time spent on each activity during a week by the MET-values of each level of activity. MET-values for different level activities were established based on the Compendium of Physical Activities 20 and were set as 4 MET for moderate-intensity physical activity, 8 MET for vigorous physical activity, and 4 MET for transport-related walking or cycling. The total physical activity for GPAQ2 was calculated as the sum of total moderate, vigorous, and transport-related activities per week.

The number of days and total physical activity MET-minutes per week were used to classify respondents into three categories of low, moderate, and high level of physical activities (Table 1). Physical inactivity was defined as those who had low levels of physical activity; moderate and high levels of physical activity were collapsed in further analysis. Finally, we conducted multivariable logistic regression to identify demographic factors associated with physical inactivity for each HDSS and presented their associated ORs and 95% confidence interval (CI) 21. All analyses were weighted by the age and sex structure of HDSS population under surveillance in 2005.

Table 1. Criteria used for establishing levels of physical activity



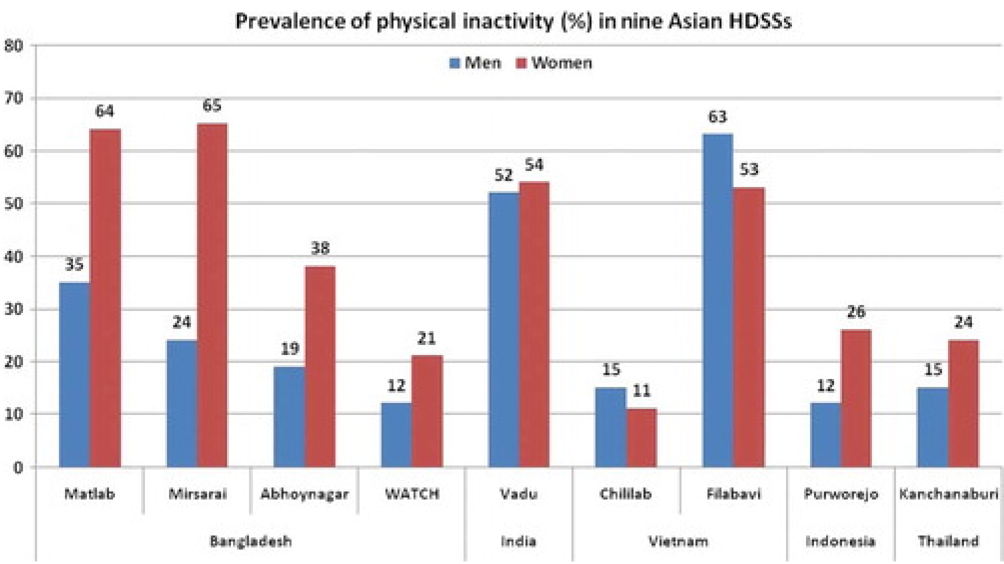
# 3 Results

A total of 18,932 individuals were randomly selected from the HDSS sampling frame. A total of 18,494 individuals were successfully interviewed giving a pooled response rate individuals (9,208 men and 9,221 women) from nine HDSS sites were analysed in this study. Most of the respondents had less than six years education (42%), and almost 45% were farmers or labours, which are common occupations in rural settings in Asian countries. Detailed characteristics of respondents are reported elsewhere 19.

## 3.1 Level of physical inactivity

Overall, the prevalence of physical inactivity ranged from 13% in Chililab HDSS in Vietnam to 58% in Filabavi HDSS in Vietnam. About 25% of men and 35% of women in the pooled sample reported low levels of physical activity. The age-adjusted prevalence of physical inactivity among men ranged from 12% in WATCH HDSS in Bangladesh and Purworejo HDSS in Indonesia to 63% in Filabavi HDSS in Vietnam. The prevalence ranged from 11% in Chililab HDSS in Vietnam to 65% in Mirsarai HDSS in Bangladesh for women. Overall, in all HDSSs, women had lower levels of physical activity compared with men, except in the two HDSSs in Vietnam (Fig. 1). Physical inactivity was more prevalent among men and women in the youngest (25–34 years) and the oldest age groups (55–64 years) (data not shown).

Figure 1. Prevalence of physical inactivity (95% CI) in nine HDSS sites by gender.

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There was a significant proportion (over 70%) of men and women in all these rural surveillance sites who did not engage in vigorous activity during their work or leisure time. More men and women in Purworejo HDSS (75 and 45%, respectively) engaged in

HDSSs (Table 2). Overall, just under a half (45%) of men and a quarter of women across these sites engaged in some vigorous activity in their work and leisure time. The average daily time spent on physical activity among men ranged from 244 minutes in Filabavi HDSS in Vietnam, to 603 minutes in Abhoynagar HDSS in Bangladesh. The corresponding figure among women ranged from 80 minutes in Matlab HDSS in Bangladesh to 498 minutes in Chililab HDSS in Vietnam. Fig. 2 displays the median time spent in daily physical activity in each HDSS. The overall median time spent on daily physical activity was 300 minutes in men and 150 minutes in women.

Figure 2. Average time spent in physical activity per day in minutes (median value with inter-quartile ranges) in nine HDSS sites.

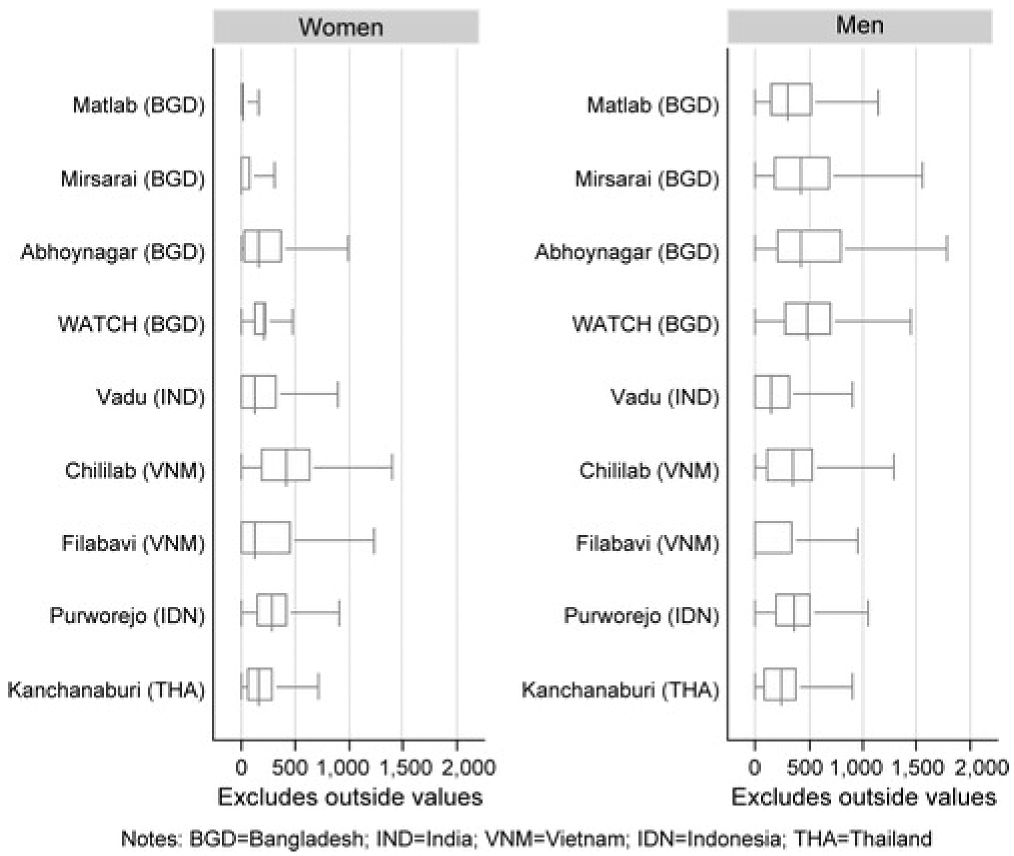


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Table 2. Percentage of population not engaging in vigorous activity (95% CI) in nine rural Asian HDSS sites by gender and age-groups

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In most HDSSs, more women reported that they had vigorous or moderate activities at work compared to men (Table 3). A more detailed analysis showed that more men reported vigorous activities at work, while more women reported moderate activities at work (data not shown). More men and women from HDSSs in South East Asia, except for Filabavi HDSS in Vietnam, reported vigorous or moderate activities at work compared to the respondents from HDSSs in South Asia (Table 3). In contrast with Purworejo HDSS in Indonesia, where almost all respondents reported vigorous or moderate activities at work, less than 20% of respondents in Vadu HDSS in India reported vigorous or moderate activities at work.

Table 3. Level of physical inactivity in different domains of activities in nine rural Asian HDSS sites by gender and age-groups



## 3.3 Transport-related physical activity

Over 75% men in the HDSSs in South Asia reported that they walked or cycled for at least 10 minutes to get from places to places. In Chililab HDSS, Purworejo HDSS, and Kanchanaburi HDSS, however, less than 60% respondents reported walking or cycling at least 10 minutes a day for transport. Women in the HDSSs in South Asian countries walked or cycled much less compared to men, or even when compared to women in the HDSSs in South East Asia (Table 3). Overall, respondents, who walked or cycled at least 10 minutes a day, spent on average one hour daily on walking or cycling for transport (data not shown).

## 3.4 Leisure time vigorous and moderate physical activity

Most respondents did not conduct vigorous or moderate activities during leisure, except in Chililab HDSS in Vietnam where about 38% of men and 23% of women reported vigorous activities during leisure (Table 3). Overall, fewer women reported spending time doing vigorous or moderate activities in their leisure time compared to men. Respondents also spent considerably less of their leisure time with vigorous activities (average from 43 minutes in Filabavi HDSS in Vietnam to 168 minutes in Vadu HDSS in India), and moderate activities (range from 35.3 minutes in Chililab HDSS in Vietnam to

## 3.5 Factors associated with a low level of physical activity

The multivariable logistic regression showed that in most HDSSs men had significantly higher odds of engaging in high level physical activity compared with women, except in the two HDSS in Vietnam. There were no significant differences in the odds of engaging in low level of activities across different age-groups in most HDSSs, except in two sites in Bangladesh (Matlab HDSS, WATCH HDSS) and Filabavi HDSS (Vietnam) where respondents 55–64 years old were significant more likely to report low levels of activity. Overall, respondents with less education has lower odds for low level of physical activity compared to those who have at least 12 years of education (the pooled odds ratio of low level of physical activity for those with less than six years of education was 0.68, 95% CI = 0.61–0.76). Similar significant results were also observed in Mirsarai HDSS, WATCH HDSS, Filabavi HDSS, Purworejo HDSS, and Kanchanaburi HDSS (Table 4).

Table 4. Strength of association between demographic variables and low levels of activity (odds ratio and its 95% CI) in nine rural Asian HDSSs

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## 4 Discussions

This paper reported the level of physical activity among selected rural populations in nine well-defined health and demographic surveillance sites in Asia using a standardised chronic NCDs risk factor surveillance tool. Overall, 25% of men and 35% of women in this study were physically inactive. Women, older age-groups, and people with higher level of education in most of the HDSSs are more likely to have low levels of physical activity. In general, results of this multi-site survey confirm that men were more active than women, except in Vietnam. These observations are in line with results observed in many low and middle-income countries which participated in the World Health Survey 9, as well as in the International Prevalence Study on Physical Activity 10. Men reported spending more time in doing vigorous and moderate activities compared to women. Consistently in all HDSSs, older people tend to have less vigorous and moderate activities in their daily activity.

In many low and middle-income countries, occupational and transport-related activities contribute more to overall physical activity compared to leisure time activities [17]. The majority of our study population worked in agricultural area, and the seasonal patterns of agricultural activities might possibly explain the variation of physical activity observed in this study [9]. The level of physical activity assessed in these surveys might be influenced by the timing of the survey. Compared to other HDSSs, less than 20% of respondents in Purworejo HDSS had low level of physical activity based on their self-reported physical activities at different domains. These results might reflect the more intensive harvest period in June to October which coincided with the data collection in Purworejo HDSSs. In most of the HDSSs, the study was conducted in the middle of the harvest season, except in Vadu HDSS, India, where the study period covered the period of the rainy season, monsoon, and early winter.

The study also showed that respondents in the HDSSs in India, Bangladesh, and Indonesia spent significantly less time doing vigorous or moderate activity during leisure time compared to respondents from other HDSSs. Sport in leisure time, a concept which might suit the Western population, is not an established concept in many rural Asian settings. Engaging in leisure time physical activity leads to better self-reported rate and is important to prevent obesity [22]. People spend a significant amount of time and energy in vigorous and moderate activities in their work, and therefore, it is a challenge to identify appropriate strategies to promote physical activity during leisure time for Asian rural population [1].

Patterns of transport-related activities are closely related to economic development. In South East Asian countries, where industrialisation and modernisation have taken place during the last few decades, fewer respondents reported walking or cycling to get from place to place. The socio-economic census conducted in Purworejo and Kanchanaburi HDSS in the same study period showed that about 27% of the households owned motorcycles and between half and three quarters owned bicycles (unpublished data). The economic liberalisation, Doi Moi, in Vietnam also brought significant progress for Vietnam's development. Urbanisation and uncontrolled growth of automobile ownership has resulted in Ho Chi Minh and Hanoi cities becoming polluted cities. Rural Vietnamese, however, mainly use bicycles as their main mode of transportation.

## 5 Limitations of the study

The variation on the levels of physical activity across different populations between HDSSs observed in this study, as well as in other studies 9 10, should be interpreted with caution; the variations could reflect true differences in physical activity levels in the populations, or measurement errors related to lack of equivalence in this cross-cultural research 23. The wide extremes between the two HDSS in Vietnam offer an opportunity to explore further urbanisation and environmental impacts on physical activity. Chililab HDSS is more urbanised than Filabavi, and the uptake in motorcycles is greater in Chililab, which might explain less people walk or cycle to get from places to places in Chililab.

The main difficulty in this study is in ascertaining the level of physical activities across different cultural settings. Subjective judgment of vigorous and moderate physical activity might differ across cultures. The variability observed across HDSSs might therefore reflect how people living at different geographical areas judge the level of their daily physical activity. Time-concept might differ from places to places, and in most rural settings, people do not get used to measuring the time they spend on certain activities in hours and minutes. People might under or over-report their physical activity. It is a challenge to use the instrument by taking into account local physical activities at each site while maintaining comparability across sites. Typical local physical activities at work and leisure time need to be incorporated as examples when the instrument was used in data collection. The use of 'at least 10 minutes of walking' concept in assessing physical activities at work may well underestimate the level of physical activity of certain occupations, for example, a rickshaw driver in Indonesia, Bangladesh, and India, who never walk 'at least 10 minutes during their work,' but instead perform vigorous activities in their daily work. However, the use of standardised interview protocols and locally tailored physical activity show-cards in all sites provided consistent guidance for field surveyors in conducting the interview. Achieving equivalence in this type of cross-cultural measurement is a research challenge 23.

## 4.2 Strengths of the study

The main strength of this study is its unique multi-HDSSs collaboration within the INDEPTH Network. Integrating this survey into the HDSS setting allows the researchers to assess the trend of physical activity within the surveillance system, and to use this physical activity 'baseline data' as potential predictors for future patterns of chronic NCDs and their other risk factors, such as hypertension and obesity 19 24. The

the HDSS database, allows more informative analysis of physical activity patterns across different socio-economic groups. This collaborative study is one of the fewer studies within the INDEPTH Network to obtain comparable 'network' data straight from the phase of research design to data analysis.

Availability of reliable sampling frame in the HDSS allows the researcher to select unbiased random sample of study subject with potentially high response rate, which might not be achievable in a stand-alone survey. This concern is of particular important in many low and lower-middle income countries, where availability of reliable population registration for sampling frame become major barriers to conduct and to obtain high quality surveys.

This study confirms the feasibility of conducting physical activity surveillance in low and middle-income settings. Integrating this surveillance into an ongoing health and demographic surveillance will enhance the usefulness of physical activity information 24. Results from this study will serve as a baseline data against which further intervention in improving physical activity in the population can be evaluated. The ability of GPAQ2 to provide information for three different domains of physical activity adds to the strength of this study in providing valuable information for intervention planning 22. Promoting physical activity during leisure time becomes essential with industrialisation and modernisation of transport facilities in many low and lower-middle income countries. These population-based data should be advocated and exposed to health policy makers in supporting evidence-based public health policy in order to promote physical activity in the population and to prevent the epidemic of chronic diseases 1.

## 6 Conclusions

This study showed over one in four men and one in three women in Asian HDSSs within the INDEPTH Network were physically inactive. Considering the importance of physical activity in improving health and preventing chronic NCDs, efforts need to be made to promote physical activity particularly among women in these settings. Promoting physical activity during recreational time, particularly for those without any vigorous or moderate work-related activities, should become one strategy to promote the population health and to prevent the emerging of chronic diseases.

Article contents Related research

## 7 Conflict of interest

The authors have declared no conflict of interest.

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