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Preplanned Studies

Towards Sustainable Development Goals: Study on the Consequences of Food Insecurity Among Global Population — Worldwide, 2022

Ping He[1,&]; Wanwei Dai[2,&]; Yanan Luo[3]; Ruoxi Ding[1]; Xiaoying Zheng[4,#]

Summary

What is already known about this topic?

The global population is predicted to reach 8 billion by the end of 2022, which can delay the progress and exacerbate the challenges of achieving the Sustainable Development Goals (SDGs), especially the goal of "Zero Hunger."

What is added by this report?

During the next 15 years, it is predicted that the world's population will increase from 8 billion to 9 billion people. Although food insecurity is anticipated to decrease over the next three decades for most of the world, food insecurity is anticipated to increase in Africa. Accelerating population growth is projected to lead to larger percentages of infants with low birth weight and of children under 5 years old with stunted growth.

What are the implications for public health practice?

Rapid population growth will make it more difficult to achieve the SDGs for ending hunger and ensuring good health and well-being. It is important to develop foresight and adopt proactive planning that is guided by careful demographic analysis.

The Sustainable Development Goals (SDGs) were adopted in 2015 as a universal call to action to eradicate poverty, protect the planet, and ensure the well-being, peace, and prosperity of all people by 2030. However, progress toward achieving the SDGs has halted and efforts to meet the SDGs are facing unprecedented challenges (*1*). Of the 17 SDGs, only two — eliminating preventable deaths under five years old and universal primary and secondary education — were close to being achieved, and the goals to eliminate hunger, poverty, and inequality are the farthest off track (*2*). As the coronavirus disease 2019 (COVID-19) pandemic is in its third year, the world keeps witnessing devastating reversals of the previously steady progress in poverty reduction over the past 25 years (*3*). The war between Russia and Ukraine, the two largest global producers and exporters of certain food items, is further challenging the SDG achievement.

The world is about to enter a new demographic era, with the global population anticipated to exceed 8 billion people by the end of 2022 (*4*). Rapid population growth will inevitably exacerbate the challenges to achieving the SDGs, especially for the goal of ending hunger and ensuring sufficient access to safe and nutritious food (*5*). Difficulties are compounded in the poorest countries, most of which are the main contributors to current and projected future population growth. The total population of low-income regions is projected to double in size between 2020 and 2050; sub-Saharan Africa will account for most of the global increase expected by the end of this century. The exacerbation of food insecurity and malnutrition among millions of people in such a once-in-a-century global depression will not only elevate all-cause mortality by impairing disease management and increasing disease severity, but will also be damaging to newborns and children, severely affecting human capital development and leading to an intergenerational cycle of malnutrition (*6*).

On the arrival of the 33rd World Population Day, we aimed to investigate the consequences of food insecurity in the new demographic era. Specifically, our study examined 1) changing patterns and trends of global population growth; 2) the association between changing demographics and food insecurity; and 3) how the changing demographic patterns and their relation to food insecurity affect achievement of health-related SDGs.

Data on population trends were obtained from the United Nations Population Division, which provided detailed data on population size, mortality rates, and fertility rate by global region. Population size was based on three scenarios with low, medium, and high fertility assumptions (https://population.un.org/wpp/Download/Standard/Population/). Population food

insecurity data from 2010–2030 were obtained from the report of the State of Food Security and Nutrition in the World, 2021, which provided food insecurity data under assumptions of with, and without, the COVID-19 pandemic (*7*). Malnutrition-related data, including the percent of low birth weight newborns from 2010–2015, stunted children under 5 years from 2010–2020, and overweight children under 5 years from 2010–2020, were obtained from the United Nations Children's Fund (https:// data.unicef.org/ resources). We assumed that the rate of change in the percent of the population experiencing food insecurity would remain unchanged after 2030. Using this assumption, we estimated the scale of population food insecurity from 2031–2050 as the product of the population size and the percent of the population with food insecurity.

The United Nations Population Division predicts that 2022 is the last year the world will have fewer than 8 billion people. It took only 12 years to increase from 7 billion to 8 billion, but the growth rate was projected to decrease after 2022. According to predictions based on the three fertility rate assumptions, the world population will increase from 8 billion to 9 billion in 15 years (Figure 1). Due to aging, the mortality rate is increasing rapidly in the most of the world, while in Africa, mortality is rapidly decreasing, and this will cause the largest proportion of global population increase to be in Africa (Supplementary Figure S1, available in http://weekly.chinacdc.cn).

Figure 2 shows predictions of food insecurity by region, from 2010 to 2050. Trends of populations with food insecurity are similar to trends in the proportion of populations with food insecurity. The general tendency is that the number of people living in food insecurity decreases for the most of the world during 2010–2050, while in Africa, it increases during the same period. The COVID-19 pandemic led to a surge in food insecurity, from 650.3 per million in 2019 to 768.0 per million in 2020 worldwide. In Asia, the COVID-19 pandemic caused a 15.69% increase, and in Africa, it caused a 19.6% increase. Due to the small number of people living in food insecurity in North America and Oceania, our study did not make predications for these areas.

The relationship between child development, population growth rate, and food insecurity is shown in Figure 3. Accelerating population growth was related to a higher percentage of low birth weight newborns and stunted children under 5 years old. Asia, with the biggest regional population worldwide, was anticipated to have similar trend to the global one. However, in Africa and Latin America and the Caribbean, the relationship between population growth and percent low birth weight was not evident. Similar results were found in the associations between the percents with food insecurity and with malnutrition, in which a larger percent of a population in food insecurity was associated with a higher percent of low birth weight and stunted children under 5 years. However, a relationship of overweight, population growth rate, and food insecurity was not seen.

DISCUSSION

Our study provided the most recent projections of world population growth and the number of people living in food insecurity through 2050 and potential consequences for health-related SDGs. Our analyses suggest ed that the world population will be almost 8 billion in 2022, increasing to 9 billion shortly after 2035, and over 10 billion by 2050. Africa will be the

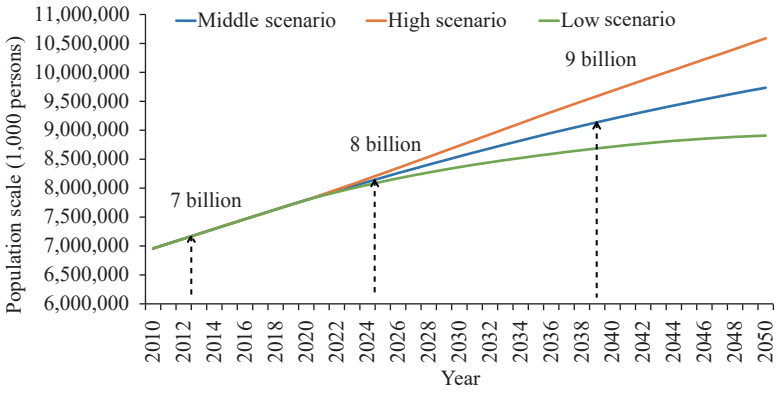

FIGURE 1. Predictions of world population scale, 2010–2050.
Note: Data source: United Nations Population Division (https://population.un.org/wpp/Download/Standard/Population/).

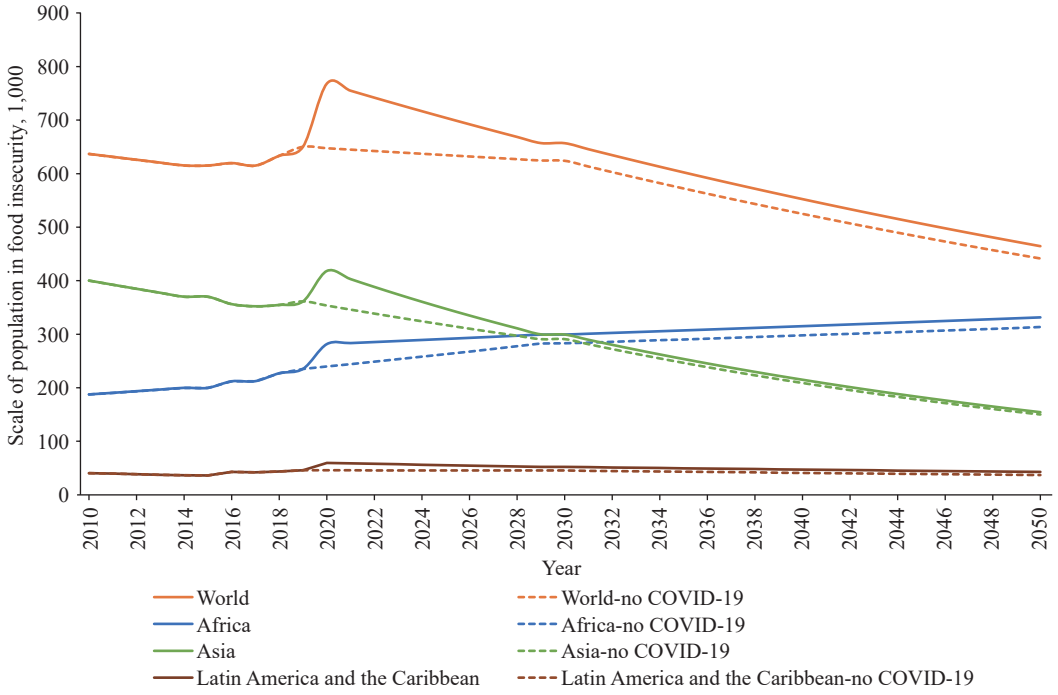

FIGURE 2. Prediction of the number of people living in food insecurity, 2010–2050.
Note: Data obtained from United Nations Children's Fund (UNICEF), The State of Food Security and Nutrition in the World 2021, 2021. No COVID-19 represents the trend of prediction of the number of people living in food insecurity under the assumption that COVID-19 has not occurred.

main contributor to population growth for the next 30 years. The number of people suffering from hunger in Africa was projected to increase to a staggering scale — a projected increase that has been significantly worsened by the COVID-19 pandemic. With these increases in population and food insecurity, the proportions of newborns with low birth weight and children under 5 with stunted growth were also projected to rise.

Our study showed that population growth was a consequence of two trends: persistently high fertility rates and substantial decreases of mortality in most African countries that are not yet aging populations (*5*). Increasing numbers of people increase demand for food. The Food and Agriculture Organization projects that by 2050, population and economic growth will lead to a doubling of global demand for food. Population growth may also affect food supply and access, since population growth in many regions is associated with land fragmentation and resettlement into fragile environments that directly reduce food production. Food insecurity has also been exacerbated by the COVID-19 crisis by affecting food costs and infrastructure. It is estimated that COVID-19 increased the number of people suffering from hunger by almost 320 million in one year (*8*).

Despite a variety of public programs, vulnerable populations such as women and children are always disproportionately affected by food insecurity (*9*). As a result, subsequent increases in low birth weight and stunting of children boost mortality across a broad spectrum of communicable and non-communicable diseases (*10*), further stalling progress of SDG 3: good health and wellbeing.

Certain limitations should be noted for proper interpretation of our results. First, data from Europe, North America, and Oceania were not included in the food insecurity and malnutrition analyses due to a very small number of people living with food insecurity in these areas compared to other regions. Second, projections of the population in food insecurity were based only on the global population; future analyses that employ more predictors are warranted. Finally, analyses on the relationship between child development, population growth rate, and food insecurity were based on data from 2010 to 2015, which may lead to potential bias in estimations.

In conclusion, rapid population growth makes it more difficult for our world to achieve the SDGs of zero hunger and good health and well-being-challenges that are more daunting in low-income countries. On the arrival of a world with 8 billion people, it is

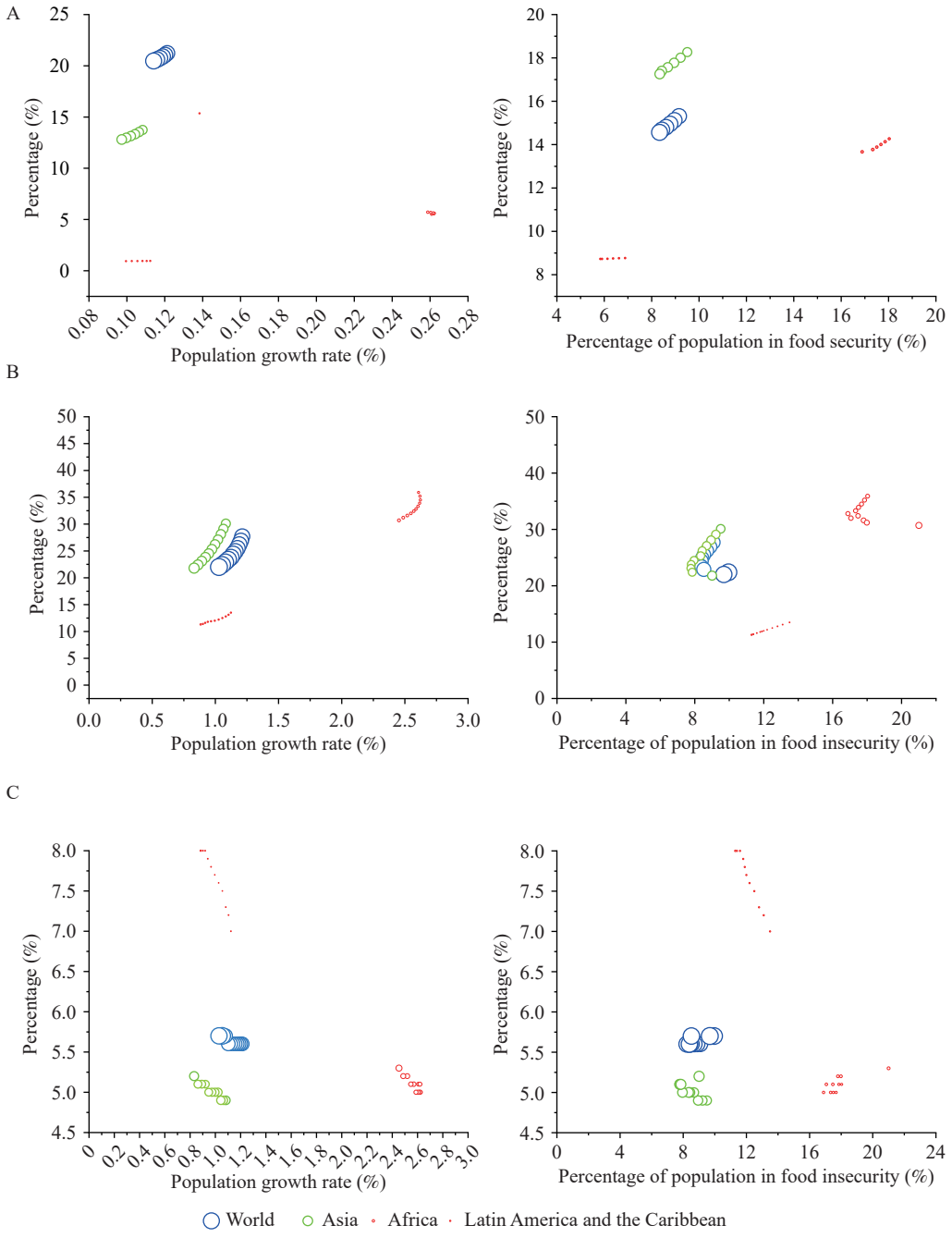

FIGURE 3. Malnutrition, population growth rate, and percent of populaiton in food insecurity. (A) Percent low birth weight (%), 2010–2015; (B) Percent stunded children under 5 years (%), 2010–2020; (C) Percent overweight children under 5 years (%), 2010–2020.
Note: Data obtained from United Nations Population Division (https://population.un.org/wpp/Download/Standard/Population/) and the United Nations Children's Fund (https://data.unicef.org/resources/resource-type/datasets/). Bubble size represents the population scale, with larger bubbles representing larger populations.

important to develop foresight and proactive planning that is guided by demographic analyses to not only ensure healthy lives and promote well-being, but also to build a more sustainable, resilient, and equitable future for all.

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[#] Corresponding author: Xiaoying Zheng, xzheng@pku.edu.cn.

[1] China Center for Health Development Studies, Peking University,

Beijing, China; [2] Department of Scientific Research Administration, Peking University The Third Hospital, Beijing, China; [3] Department of Global Health, School of Public Health, Peking University, Beijing, China; [4] School of Population Medicine and Public Health, Chinese Academy of Medical Sciences/Peking Union Medical College, Beijing, China.
[&] Joint first authors.

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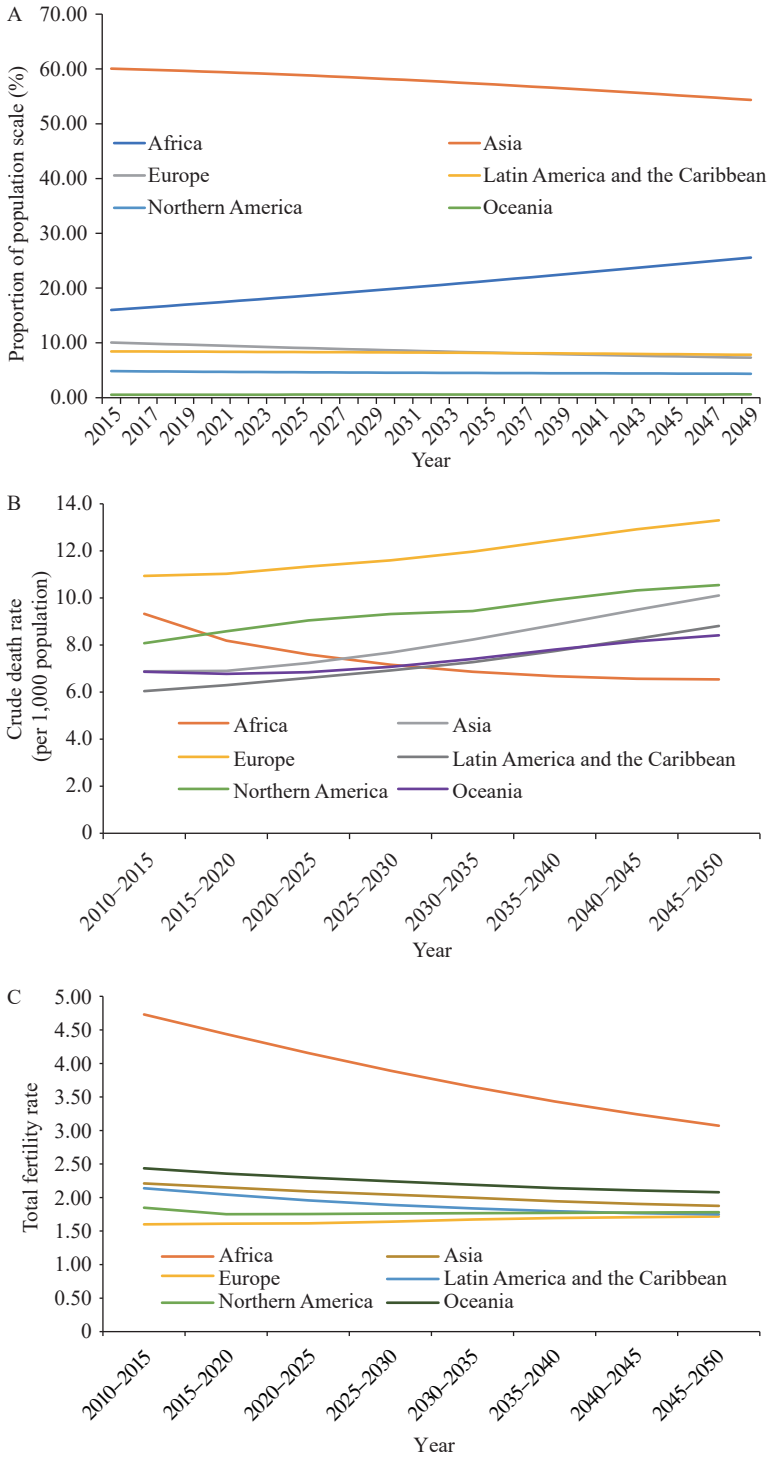
REFERENCES

1. General Assembly of the United Nations. Resolution adopted by the general assembly on 6 July 2017, A/RES/71/313. Work of the statistical commission pertaining to the 2030 agenda for sustainable development. New York: General Assembly of the United Nations; 2017. https://www.un.org/en/development/desa/population/migration/generalassembly/docs/globalcompact/A_RES_71_313.pdf.
2. Time to revise the sustainable development goals. Nature 2020;583(7816):331 – 2. http://dx.doi.org/10.1038/d41586-020-02002-3.
3. Heggen K, Sandset TJ, Engebretsen E. COVID-19 and sustainable development goals. Bull World Health Organ 2020;98(10):646. http://dx.doi.org/10.2471/BLT.20.263533.
4. Our World in Data. Population boom: charting how we got to nearly 8 billion people. 2021. https://www.visualcapitalist.com/cp/population-boom-charting-nearly-8-billion-people/. [2022-6-10].
5. Wilmoth J, Menozzi C, Bassarsky L. Why population growth matters for sustainable development. New York: United Nations Department of Economic and Social Affairs; 2022 Feb. Report No.: Policy Brief No.130. https://www.un.org/development/desa/dpad/wp-content/uploads/sites/45/publication/PB-130-FINAL.pdf.
6. Wells JC, Sawaya AL, Wibaek R, Mwangome M, Poullas MS, Yajnik CS, et al. The double burden of malnutrition: aetiological pathways and consequences for health. Lancet 2020;395(10217):75 – 88. http://dx.doi.org/10.1016/S0140-6736(19)32472-9.
7. UNICEF. The state of food security and nutrition in the world 2021. San Jose: UNICEF, 2021. https://data.unicef.org/resources/sofi-2021/.
8. United Nations Department of Economic and Social Affairs. Global population growth and sustainable development. New York: United Nations Department of Economic and Social Affairs; 2022. https://www.un.org/development/desa/pd/content/global-population-growth-and-sustainable-development.
9. Flores HL, Amiri A. CE: addressing food insecurity in vulnerable populations. Am J Nurs 2019;119(1):38 – 45. http://dx.doi.org/10.1097/01.NAJ.0000552585.15471.a7.
10. Sun YB, Liu BY, Rong S, Du Y, Xu GF, Snetselaar LG, et al. Food insecurity is associated with cardiovascular and all-cause mortality among adults in the United States. J Am Heart Assoc 2020;9(19):e014629. http://dx.doi.org/10.1161/JAHA.119.014629.



SUPPLEMENTARY FIGURE S1. Prediction of (A) population proportions, (B) crude death rates, and (C) total fertility rates by region, 2010–2050.
Note: Data source: United Nations Population Division (https://population.un.org/wpp/Download/Standard/Population/).

Preplanned Studies

Adverse Childhood Experiences and Depressive Symptoms Trajectories Among Middle-Aged and Elderly — China, 2011–2018

Jiajia Li[1]; Shiqi Lin[1]; Lijun Pei[1,#]

Summary

What is already known about this topic?

Previous studies in western populations have found consistent relationships between adverse childhood experiences and the development of mood and anxiety disorders, especially depressive symptoms in adolescence and adulthood.

What is added by this report?

This study used a longitudinal design and analytic method to model depressive symptom trajectories from 2011 to 2018 among the middle-aged and elderly in China. This study also investigated the association between adverse childhood experiences and adulthood depressive symptoms in the Chinese population.

What are the implications for public health practice?

Future public policy could consider early prevention and intervention on adverse childhood experiences to prevent adult depressive symptoms. Besides, it is essential to create safe, stable, and nurturing environments for children's development.

Adverse childhood experiences (ACEs) refer to stressful or traumatic events that children may suffer before age 18 and are highly prevalent worldwide. Studies on ACEs indicate that stressful childhood experiences (e.g., child maltreatment, household challenges, peer victimization, and community challenges) are linked to poor health outcomes and health behaviors in adulthood (*1*). Mental health outcomes, particularly depression, may occur more often in the population with ACEs. Importantly, ACEs have repeatedly been found to increase the risk of mental health problems following development (*2*). In China, the prevalence of depression has aggressively increased to 20% among the elderly population (*3*). However, few studies have investigated the association between ACEs and depression in adulthood in China. Therefore, this study aimed to examine the association between ACEs and depressive symptoms and the development trajectories among the middle-aged and elderly in China. We used data from the Chinese Health and Retirement Longitudinal Study (CHARLS). Overall, individuals' trajectories of depressive symptoms showed an increasing trend. ACEs and their specific domains were associated with each individual's depressive symptoms. This study emphasizes the long-term relationship between ACEs and depressive symptoms among middle-aged and elderly and encourages policies to promote better early ACEs prevention and intervention.

The CHARLS was conducted by the National School of Development at Peking University, a nationally representative, multi-disciplinary, and public dataset focused on Chinese families and individuals aged 45 and above. The CHARLS utilized a multi-stage stratified probability-proportional-to-size sampling (PPS) technique to select participants. The detailed design of the CHARLS has been reported previously (*4*). The institutional review board of Peking University has approved the CHARLS study, and all participants of CHARLS have signed consent forms before the face-to-face interview. The four waves of CHARLS in 2011 (Baseline), 2013, 2015, and 2018, along with 2014 life-history data, were used in this study. Finally, 9,069 individuals who had completed all the five surveys (reported no losses to follow-up and missing values) were included in this study.

Depressive symptoms were measured using the Center for Epidemiological Studies Depression Scale-10 (CESD-10) in the CHARLS questionnaire. The CESD score (range 0–30) is a summation of responses to 10 statements, for which participants rate their feelings and behaviors one week before the interview date. Higher CESD scores indicate greater depressive symptoms.

ACEs exposures were retrospectively collected by the 2014 life-history questionnaire. This study defined

ACEs according to the original ACE questionnaire and additional recommended items from other studies (5). A total of 18 ACEs items on 4 specific domains were collected, including child maltreatment (emotional neglect, physical abuse, domestic violence, and domestic verbal violence), household challenges (household substance abuse, household mental illness, parental separation or divorce, parental incarceration, household financial adversity, household food deprivation, family member physical health problems, parental death, sibling death), peer victimization (physical bullying and peer rejection), community challenges (community safety, and community hygiene). All the items were dichotomized and summed, thus creating an ACEs score ranging from 0 to 18 (higher scores indicating greater adversity level) and four specific ACEs domains scores.

The individual's trajectory in adulthood depressive symptoms was investigated by fitting a growth curve model with two levels. Furthermore, this study examined the association between ACEs and depression symptoms. Finally, adjusted coefficients and trajectories were estimated after adjusting for the potential confounding variables, including age, sex, marital status, region, education level, smoke, drink alcohol, social participation, and self-report of health.

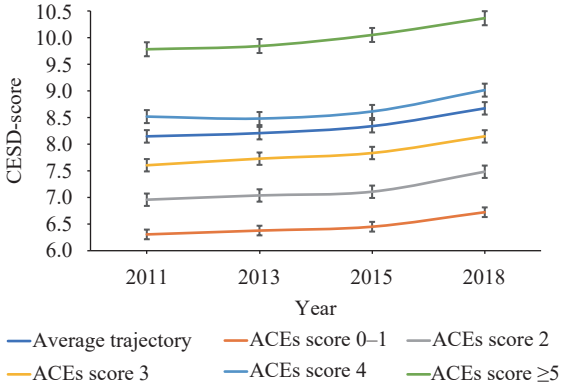


FIGURE 1. Predicted trajectories of depressive symptoms by ACEs score, China, 2011–2018.
Note: Results are based on model 1 in Table 1. ACEs score 0–1, ACEs score 2, ACEs score 3, ACEs score 4, and ACEs score ≥5 stand for different ACEs levels (higher scores indicating greater adversity level). ACEs score 4 and ACEs score 5 and above displayed higher depressive symptoms trajectories than average trajectory.
Abbreviations: ACEs=adverse childhood experiences; CESD=Center for Epidemiological Studies Depression.

All the statistical analysis was carried out by R (version 4.1.0, R Development Core Team, Vienna, Austria).

Supplementary Table S1 (available in https://weekly.chinacdc.cn/) shows baseline characteristics of

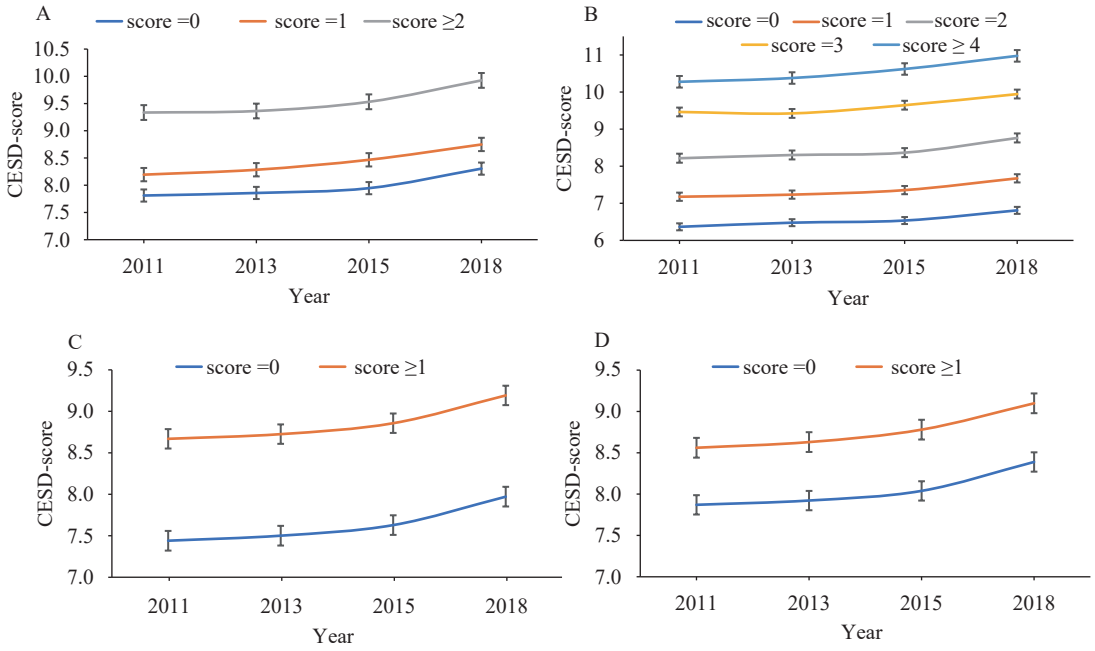


FIGURE 2. Predicted trajectories of depressive symptoms by different ACEs domains, China, 2011–2018. (A) Child maltreatment; (B) Household challenges; (C) Peer victimization; (D) Community challenges.
Note: Results are based on model 2 to 5 in Table 1, respectively. Four specific ACEs domains scores were collected based on a total of 18 ACEs items on 4 specific domains. All the items were dichotomized and summed, thus creating a score (higher scores indicating greater adversity level).
Abbreviations: ACEs=adverse childhood experiences; CESD=Center for Epidemiological Studies Depression.

TABLE 1. Association between ACEs and depressive symptoms among middle-aged and elderly, China, 2011–2018.

Variables	Beta	95% CI	*P*-value
Model 1 ACEs score			
0–1	Ref.		
2	0.27	(−0.02 to 0.57)	0.072
3	0.85	(0.56 to 1.10)	<0.001
4	1.50	(1.20 to 1.80)	<0.001
≥5	2.50	(2.20 to 2.80)	<0.001
Model 2 Child maltreatment score			
0	Ref.		
1	0.35	(0.17 to 0.54)	<0.001
≥2	1.30	(1.10 to 1.60)	<0.001
Model 3 Household challenges score			
0	Ref.		
1	0.56	(0.29 to 0.84)	<0.001
2	1.29	(1.00 to 1.60)	<0.001
3	2.22	(1.90 to 2.50)	<0.001
≥4	2.79	(2.40 to 3.10)	<0.001
Model 4 Peer victimization score			
0	Ref.		
≥1	0.74	(0.56 to 0.91)	<0.001
Model 5 Community challenges score			
0	Ref.		
≥1	0.60	(0.43 to 0.77)	<0.001

Note: Separate models were estimated for the ACEs and its four specific domains. All the models were adjusted for age, sex, marital status, region, education level, smoke, drink alcohol, social participant, and selfs-report of health. ACEs and four specific ACEs domains scores were collected based on a total of 18 ACEs items on 4 specific domains. All the items were dichotomized and summed, thus creating a score (higher scores indicating greater adversity level).
Abbreviations: ACEs=adverse childhood experiences; CI=confidence interval.

participants. Figure 1 presents the trajectories of depressive symptoms from 2011 to 2018, and Figure 2 presents the trajectories of depressive symptoms by different ACEs domains. Supplementary Table S2 (available in https://weekly.chinacdc.cn/) further demonstrate depressive Symptom Scores of the participants by different ACEs domains. Overall, the depressive symptoms were increasing from 2011 to 2018 and the changing patterns over time were similar at different ACEs score levels. The patterns of CESD-s score variation at the different levels indicated that higher ACEs exposure groups displayed higher depressive symptoms than lower ACEs exposure groups. Besides, exposure to higher specific ACEs domains, namely, child maltreatment, household challenges, peer victimization, and community challenges, was associated with a more significant gradient in depressive symptoms trajectories. Supplementary Table S3 (available in https://weekly.chinacdc.cn/) further demonstrate the interaction between ACEs and survey year on depressive symptoms

Table 1 presents the results of the association between ACEs and adulthood depressive symptoms. The results showed a significant and consistent increase in depression symptoms scores with cumulative ACEs exposure. Individuals with ACEs scores 2, 3, 4, and ≥5 had 0.27, 0.85, 1.50, and 2.50 point higher depressive symptoms scores than those with 0–1 ACEs scores, respectively. Regarding specific ACEs domains, exposure to higher child maltreatment, household challenges, peer victimization, and community challenges were associated with higher depressive symptoms scores.

DISCUSSION

This study used a longitudinal design and estimated

the trajectories of depressive symptoms at the population level from 2011 to 2018 among the middle-aged and elderly in China. The results showed an increasing trend of depressive symptoms trajectory, and ACEs exposures were associated with the risk of depressive symptoms in the middle-aged and elderly. This study contributes to the present knowledge about the temporal trajectories of depressive symptoms and how these associations varied between ACEs and their specific domains.

A prior study found enduring effects of ACEs on mental health in adulthood (*6*). People who were verbally abused in childhood have a 1.6 times higher risk of depressive symptoms (*7*); those with a family history of mental illness had the highest risk of depression (*8*). These findings on specific domains of ACEs (i.e., child maltreatment and household challenges) were consistent with our study. There are several possible underlying mechanisms behind our findings. Firstly, psychologically, exposure to ACEs could increase negative self-cognition, the likelihood of a behavioral response that exacerbates a threat in the environment, and negative beliefs about self-worth, affecting coping strategies for stressful life events. Secondly, biologically, exposure to ACEs (and even prenatal stress exposure) may permanently alter biological systems, including brain functioning, endocrine, and immune systems, and these changes can exert long-term effects on later mental health. Finally, behaviorally, ACEs could increase the risk of developing unhealthy behaviors, including drug and alcohol use, negative eating patterns, and avoidance of stressful experiences, people, and situations. Also, ACEs are associated with decreased adaptive coping skills (i.e., active coping, emotional support, planning, and reframing). These psychosocial, behavioral, and biological factors then work independently and interactively to increase the risk of depressive symptoms (*9*).

This study had several strengths. First, this study utilized large national representative datasets from 2011 to 2018, providing a valid and reliable result. Second, a growth curve model was used to estimate the trajectories of depressive symptoms from 2011 to 2018, which could help us understand the trend of depression in the Chinese population. Third, the association between ACEs and depressive symptoms in adulthood was investigated, providing more evidence on this research area and future public health policymaking.

Limitations also need to be acknowledged. First, ACEs were assessed retrospectively, in which potential recall bias existed. However, unlike some subjective measurements, ACEs are less likely to be forgotten. Besides, research has reviewed the evidence of the validity of retrospective reports of ACEs and concluded that such bias is not sufficient to invalidate retrospective data (*10*). Second, due to the nature of the observational study, we cannot ascertain the causal relationship between ACEs and depressive symptoms.

Therefore, future public health efforts to promote mental health might include reducing the prevalence of ACEs in the population and supporting those who have experienced adverse sequelae as a function of ACEs. Moreover, building a surveillance system on ACEs in China is essential to collect, analyze ACEs data, and support the implementation of ACEs primary prevention strategies.

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Conflicts of interest: No conflicts of interest.

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[#] Corresponding author: Lijun Pei, peilj@pku.edu.cn.

[1] Institute of Population Research/China Center on Population Health and Development, Peking University, Beijing, China.

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REFERENCES

1. Petruccelli K, Davis J, Berman T. Adverse childhood experiences and associated health outcomes: a systematic review and meta-analysis. Child Abuse Negl 2019;97:104127. http://dx.doi.org/10.1016/j.chiabu.2019.104127.
2. Bevilacqua L, Kelly Y, Heilmann A, Priest N, Lacey RE. Adverse childhood experiences and trajectories of internalizing, externalizing, and prosocial behaviors from childhood to adolescence. Child Abuse Negl 2021;112:104890. http://dx.doi.org/10.1016/j.chiabu.2020.104890.
3. Tang T, Jiang JL, Tang XF. Prevalence of depressive symptoms among older adults in mainland China: a systematic review and meta-analysis. J Affect Disord 2021;293:379 – 90. http://dx.doi.org/10.1016/j.jad.2021.06.050.
4. Zhao YH, Hu YS, Smith JP, Strauss J, Yang GH. Cohort profile: the China health and retirement longitudinal study (CHARLS). Int J Epidemiol 2014;43(1):61 – 8. http://dx.doi.org/10.1093/ije/dys203.
5. Afifi TO. Chapter 3 - Considerations for expanding the definition of ACEs. In: Asmundson GJG, Afifi TO, editors. Adverse childhood experiences: using evidence to advance research, practice, policy, and prevention. Amsterdam: Academic Press. 202035 – 44. http://dx.doi.org/10.1016/B978-0-12-816065-7.00003-3.
6. Kalmakis KA, Chandler GE. Health consequences of adverse childhood experiences: a systematic review. J Am Assoc Nurse Pract

2015;27(8):457 – 65. http://dx.doi.org/10.1002/2327-6924.12215.
7. Sachs-Ericsson N, Verona E, Joiner T, Preacher KJ. Parental verbal abuse and the mediating role of self-criticism in adult internalizing disorders. J Affect Disord 2006;93(1 – 3):71 – 8. http://dx.doi.org/10.1016/j.jad.2006.02.014.
8. Li M, D'Arcy C, Meng X. Maltreatment in childhood substantially increases the risk of adult depression and anxiety in prospective cohort studies: systematic review, meta-analysis, and proportional attributable fractions. Psychol Med 2016;46(4):717 – 30. http://dx.doi.org/10.1017/S0033291715002743.
9. Sheffler JL, Stanley I, Sachs-Ericsson N. Chapter 4 - ACEs and mental health outcomes. In: Asmundson GJG, Afifi TO, editors. Adverse childhood experiences: using evidence to advance research, practice, policy, and prevention. Amsterdam: Academic Press. 202047 – 69. http://dx.doi.org/10.1016/B978-0-12-816065-7.00004-5.
10. Hardt J, Rutter M. Validity of adult retrospective reports of adverse childhood experiences: review of the evidence. J Child Psychol Psychiatry 2004;45(2):260 – 73. http://dx.doi.org/10.1111/j.1469-7610.2004.00218.x.

SUPPLEMENTARY TABLE S1. Characteristics of participants, China, 2011–2018. (N=9,069)

Variables	No. of participants	Percentage (%)
ACEs score		
0–1	1,264	13.94
2	1,561	17.21
3	1,820	20.07
4	1,635	18.03
≥5	2,789	30.75
Child maltreatment score		
0	4,836	53.32
1	2,979	32.85
≥2	1,254	13.83
Household challenges score		
0	1,168	12.88
1	2,718	29.97
2	2,431	26.81
3	1,614	17.80
≥4	1,138	12.55
Peer victimization score		
0	3,844	42.39
≥1	5,225	57.61
Community challenges score		
0	5,423	59.80
≥1	3,646	40.20
Age (years)		
>45	1,893	20.87
>50	1,516	16.72
>55	2,103	23.19
>60	1,688	18.61
>65	1,016	11.20
>70	562	6.20
>75	291	3.21
Sex		
Male	4,872	53.72
Female	4,197	46.28
Marital status		
Current married	3,102	34.20
Others	5,967	65.80
Region		
Rural	7,782	85.81
Urban	1,287	14.19

TABLE S1. (Continued)

Variables	No. of participants	Percentage (%)
Education level		
Illiterate	2,379	26.23
Can read	1,721	18.98
Elementary school	2,043	22.53
Middle school	1,929	21.27
High school and above	997	10.99
Smoke		
Ever	3,476	38.33
No	5,593	61.67
Drink		
Ever	3,517	38.78
No	5,552	61.22
Social participant		
Yes	4,229	46.63
No	4,840	53.37
Self-report of health		
Excellent	550	6.06
Very good	1,546	17.05
Good	4,572	50.41
Fair	2,058	22.69
Poor	343	3.78

Notes: Number of participants and percentage for categorical variables. ACEs variables came from the 2014 survey, other covariates variables came from the 2011 baseline survey.
Abbreviations: ACEs=adverse childhood experiences; CESD=Center for Epidemiological Studies Depression.

SUPPLEMENTARY TABLE S2. Depressive symptom scores by exposure variables, China, 2011–2018. (N=9,069)

Variables	CESD-score (Mean±SD)			
	2011	2013	2015	2018
Overall	8.37±6.28	7.95±5.80	8.18±6.45	8.86±6.58
ACEs score				
0–1	6.65±5.50	6.07±4.89	6.23±5.47	6.91±5.71
2	7.14±5.64	6.76±5.18	6.87±5.63	7.82±6.07
3	7.91±6.04	7.43±5.45	7.61±6.15	8.37±6.48
4	8.75±6.45	8.33±5.88	8.45±6.42	9.10±6.57
≥5	9.91±6.60	9.60±6.20	10.01±7.01	10.52±6.88
Child maltreatment score				
0	8.14±6.20	7.54±5.69	7.77±6.28	8.47±6.47
1	8.35±6.28	8.05±5.78	8.25±6.43	9.05±6.62
≥2	9.32±6.48	9.32±6.02	9.57±6.95	9.94±6.75
Household challenges score				
0	6.56±5.52	6.30±4.79	6.33±5.49	7.00±5.74
1	7.40±5.79	6.97±5.30	7.13±5.89	7.95±6.14
2	8.52±6.25	8.07±5.80	8.16±6.32	8.90±6.53
3	9.69±6.66	9.20±6.21	9.50±6.82	10.09±6.91
≥4	10.35±6.63	10.00±6.26	10.77±7.20	11.14±7.03

TABLE S2. (Continued)

Variables	CESD-score (Mean±SD)			
	2011	2013	2015	2018
Peer victimization score				
0	7.70±6.05	7.26±5.59	7.49±6.20	8.10±6.33
≥1	8.86±6.39	8.47±5.89	8.69±6.59	9.42±6.70
Community challenges score				
0	8.09±6.17	7.63±5.64	7.86±6.29	8.64±6.54
≥1	8.78±6.40	8.44±5.99	8.65±6.67	9.20±6.63
Age (years)				
>45	7.50±5.87	7.44±5.59	7.74±6.20	8.75±6.38
>50	8.00±6.15	7.86±5.80	7.81±6.41	8.51±6.37
>55	8.45±6.36	8.10±5.83	8.25±6.42	8.98±6.70
>60	9.00±6.43	8.26±6.03	8.65±6.52	9.16±6.73
>65	8.99±6.51	8.29±5.79	8.61±6.79	8.98±6.78
>70	8.82±6.35	7.99±5.71	8.36±6.67	9.01±6.62
>75	8.62±6.31	7.74±5.44	7.94±6.33	8.17±6.18
Sex				
Male	7.21±5.69	6.90±5.19	6.88±5.87	7.58±5.97
Female	9.36±6.58	8.86±6.12	9.30±6.72	9.97±6.87
Marital status				
Current married	8.06±6.15	7.76±5.70	7.98±6.34	8.68±6.50
Others	10.24±6.69	9.10±6.23	9.42±6.96	9.97±6.93
Region				
Rural	8.95±6.44	8.36±5.89	8.77±6.58	9.45±6.65
Urban	7.24±5.79	7.17±5.53	7.04±6.04	7.74±6.28
Education level				
Illiterate	10.08±6.84	9.29±6.35	9.82±6.93	10.33±7.01
Can read	9.21±6.44	8.67±5.91	9.05±6.52	9.84±6.84
Elementary school	8.06±5.90	7.63±5.48	7.95±6.12	8.61±6.39
Middle school	7.13±5.63	6.96±5.20	6.84±5.99	7.63±5.91
High school and above	5.85±4.98	6.11±4.96	5.83±5.30	6.58±5.43
Smoke				
Ever	7.73±5.96	7.29±5.38	7.38±6.16	8.06±6.19
No	8.77±6.43	8.37±6.00	8.68±6.58	9.36±6.76
Drink				
Ever	7.86±6.02	7.32±5.48	7.46±6.15	8.14±6.27
No	8.69±6.41	8.69±6.42	8.69±6.43	8.69±6.44
Social participant				
Yes	7.75±5.98	7.45±5.58	7.68±6.27	8.39±6.41
No	8.91±6.47	8.39±5.95	8.62±6.58	9.27±6.70
Self-report of health				
Excellent	4.46±4.33	4.89±4.50	5.34±5.33	6.03±5.63
Very good	5.48±4.85	5.90±4.75	6.06±5.36	6.77±5.81
Good	7.73±5.57	7.59±5.33	7.67±5.95	8.49±6.15
Fair	11.78±6.50	10.37±6.26	10.83±7.04	11.31±7.02
Poor	15.63±6.94	12.48±6.98	13.12±7.35	13.10±7.28

Notes: Mean and SD for continuous variables, number of participants and percentage for categorical variables. ACEs variables came from the 2014 survey, other covariates variables came from the 2011 baseline survey.
Abbreviations: ACEs=adverse childhood experiences; CESD=Center for Epidemiological Studies Depression; SD=standard deviation.

SUPPLEMENTARY TABLE S3. Interaction between ACEs and survey year on depressive symptoms among middle-aged and elderly, China, 2011–2018.

Model number	Variables	Beta	95% CI	*P*-value
	ACEs score			
	0–1	Ref.		
	2	0.01	(−0.47 to 0.49)	0.960
	3	0.79	(0.33 to 1.30)	<0.001
	4	1.50	(1.01 to 2.00)	<0.001
	≥5	2.30	(1.90 to 2.70)	<0.001
Model 1	Year	0.08	(−0.04 to 0.20)	0.178
	Year×ACEs score			
	Year×(0–1)	Ref.		
	Year×2	0.11	(−0.05 to 0.27)	0.168
	Year×3	0.02	(−0.13 to 0.18)	0.756
	Year×4	−0.01	(−0.16 to 0.15)	0.934
	Year×(≥5)	0.08	(−0.06 to 0.23)	0.254
	Child maltreatment score			
	0	Ref.		
	1	0.12	(−0.18 to 0.41)	0.443
	≥2	1.20	(0.75 to 1.60)	<0.001
Model 2	Year	0.09	(0.03 to 0.15)	0.005
	Year×Child maltreatment score			
	Year×0	Ref.		
	Year×1	0.10	(0.01 to 0.20)	0.042
	Year×(≥2)	0.07	(−0.07 to 0.20)	0.327
	Household challenges score			
	0	Ref.		
	1	0.49	(0.29 to 0.94)	0.030
	2	1.40	(1.00 to1.90)	<0.001
	3	2.30	(1.80 to 2.70)	<0.001
	≥4	2.50	(2.00 to 3.10)	<0.001
Model 3	Year	0.13	(0.01 to 0.25)	0.043
	Year×Household challenges score			
	Year×0	Ref.		
	Year×1	0.03	(−0.12 to 0.18)	0.682
	Year×2	−0.06	(−0.21 to 0.09)	0.439
	Year×3	−0.02	(−0.18 to 0.14)	0.837
	Year×(≥4)	0.10	(−0.07 to 0.28)	0.254
	Peer victimization score			
	0	Ref.		
	≥1	0.60	(0.33 to 0.87)	<0.001
Model 4	Year	0.10	(0.03 to 0.16)	0.006
	Year×Peer victimization score			
	Year×0	Ref.		
	Year×(≥1)	0.06	(−0.03 to 0.15)	0.205

TABLE S3. (Continued)

Model number	Variables	Beta	95% CI	*P*-value
	Community challenges score			
	0	Ref.		
	≥1	0.75	(0.47 to 1.00)	<0.001
Model 5	Year	0.15	(0.10 to 0.21)	<0.001
	Year×Community challenges score			
	Year×0	Ref.		
	Year×(≥1)	−0.06	(−0.15 to 0.03)	0.171

Note: Separate models were estimated for the ACEs and its four specific domains. All the models were adjusted for age, sex, marital status, region, education level, smoke, drink, social participant, and self-report of health.
ACEs and 4 specific ACEs domains scores were collected based on a total of 18 ACEs items on 4 specific domains. All the items were dichotomized and summed, thus creating a score (higher scores indicating greater adversity level).
Abbreviations: ACEs=adverse childhood experiences; CI=confidence interval.

Preplanned Studies

The Distribution and Potential Exposure Factors of Physical Activity Level Among Middle-Aged and Elderly Population — Six Communities, Beijing, China, October 2020 to January 2021

Heming Pei[1]; Ning Kang[1]; Fan Yang[1]; Xinming Song[1]; Gong Chen[1,#]; Dongmin Wang[2,#]

Summary

What is already known about this topic?

Available evidence suggested that 31% of the world's population do not meet the minimum recommendations for physical activity.

What is added by this report?

The latest findings showed that physical activity level (PAL), metabolic equivalents (MET) in min/week with <4,500 (low), 4,500–6,000 (moderate) and ≥6,000 (high) accounted for 45.72%, 25.62%, and 28.66% of middle-aged and elderly population in Changchunyuan Community, Weixiuyuan Community, Zhongguanyuan Community, Yanbeiyuan Community, Kangzeyuan Community, and Xima Community, respectively. The moderate and high PAL was associated with a decreased risk of hypertension, cardiovascular disease, dyslipidemia, and poor sleep.

What are the implications for public health practice?

More attention should be given to the middle-aged population who may be at high risk of insufficient physical activity in urban environments as it is of public health significance for improving the community population health.

Over the past few decades, transitions in population structure and the growing urbanization process have led to a sharp increase in the number of middle-aged and elderly persons dwelling in urban community in Beijing (*1*). In recent years, levels of physical activity have declined worldwide, including in China, mainly because of rapid urbanization, reduced physical activity in the workplace, changes in modes of transportation, and other lifestyle aspects (*2*). Physical inactivity was responsible for an overall global economic burden that costs healthcare systems $53.8 billion worldwide in 2013, taking both direct costs (healthcare expenditure) and indirect costs (productivity losses) into account (*3*). Considering its prevalence, global reach, and health impact, physical inactivity should be viewed as a pandemic, with far-reaching health, economic, environmental, and social consequences (*4*). The pandemic of physical inactivity is associated with a range of chronic diseases and early deaths in middle-aged and older adults. The economic burden of physical inactivity remains unquantified at the global level (*3*). To minimize such burdens brought by physical inactivity, interventions should target middle-aged and older adults to maintain their activities of daily living (ADL) (*5*). This study aimed to describe the physical activity level (PAL) and its associated factors among the middle-aged and elderly populations in Beijing. The findings of multivariable logistic regression indicated that a certain of physical activity (PA) intensity [≥4,500 metabolic equivalents (MET)-min/week] was associated with varying age, education, registered residence, living arrangement, chronic diseases, and poor sleep. These might become components of a comprehensive intervention measurement for preventing physical inactivity among middle-aged and older adults. A community-based study was conducted between October 2020 and January 2021 among middle-aged and elderly populations in Beijing, China. A stratified random sampling method was used to obtain a representative sample of the community population between 40 and 79 years of age. The sampling of study areas was stratified by the type of sociodemographic features in the community, while considering the accessibility of eligible participants and feasibility of laptop-based questionnaire collection within the areas. Six communities including Changchunyuan Community, Weixiuyuan Community, Zhongguanyuan Community, Yanbeiyuan Community, Kangzeyuan

Community, and Xima Community were selected as the study areas where participants were randomly selected proportionally to the total samples. The inclusion criteria were age between 40 and 79 years and functional independence in activities of ADL. Taking note of minimum representative numbers, approximately 4% of the target population was randomly selected as the sample group. Trained interviewers conducted the face-to-face computer-assisted personal interview (CAPI) with a total of 1,319 participants. After data cleaning, 1,284 data points were included in the analysis. The study protocol was approved by the Ethics Committee at School of Psychological and Cognitive Sciences, Peking University (protocol number #2019-08-04).

The structured questionnaire included sociodemographic questions (age, gender, education level, marital status, living arrangement, income, and household registration), behavioral questions (alcohol consumption and smoking), individual health status and medical history (hypertension, dyslipidemia, cardiovascular disease, diabetes, chronic lung diseases, digestive disease, arthritis, or rheumatism), all of which were self-reported by the participants, and were based on clinical diagnoses in secondary or higher hospitals.

PA was measured using the International Physical Activity Questionnaires-Long Form (IPAQ-L) by metabolic equivalents (METs). As one MET is defined as the oxygen consumption while sitting at rest [3.5 mL O^2 /(kg·min)], IPAQ-L calculated metabolic equivalent minutes per week by assigning standardized MET values of 3.3, 4, 6, and 8 for walking, moderate-intensity activities, cycling, and vigorous-intensity activities. Furthermore, for the outliers, each time variable exceeding 180 minutes was truncated in accordance with IPAQ scoring protocol to minimize the possible measurement error and prevent misclassification. PAL was categorized into three levels according to MET-min/week, with <4,500 MET-min/week (low PAL), 4,500–6,000 MET-min/week (moderate PAL), and ≥6,000 MET-min/week (high PAL). Sleep quality was evaluated by using the Pittsburgh Sleep Quality Index (PSQI), where a self-rated PSQI score demonstrated superior sensitivity and specificity in distinguishing good and poor sleepers at a cut-off of 5 (*6*).

Univariate logistic regressions were performed to assess differences between three physical activity levels in terms of individual exposures (sociodemographic characteristics, lifestyle behaviors, individual health status, and medical history). Multivariable logistic regression was used to evaluate the association between exposure factors and different physical activity levels after adjusting for potential confounding factors, and adjusted odds ratios (aOR) with corresponding 95% confidence intervals (CIs) were calculated. All statistical analyses were performed using R software (version 3.4.4; R Foundation for Statistical Computing, Vienna, Austria).

Among 1,284 participants included in the analysis. Table 1 presents sociodemographic characteristics, behavioral factors, and chronic disease distribution at different physical activity levels. Low, moderate, and high PAL accounted for 45.72%, 25.62%, and 28.66% among 1,284 middle-aged and elderly people, respectively. There were significant differences between moderate PAL group and low PAL group in terms of age, gender, education, registered residence, living arrangement, hypertension, cardiovascular disease, and smoke. There were differences between high PAL group and low PAL group in terms of age, education, living arrangement, dyslipidemia, cardiovascular disease, and sleep quality (Table 1).

TABLE 1. The distribution of sociodemographic characteristics, behavioral factors, and chronic diseases affecting physical activity level among middle-aged and elderly population in Beijing, China, October 2020 to January 2021.

Exposure factors	Physical activity level*				
	<4,500 MET-min/week (n=587)	4,500–6,000 MET-min/week (n=329)		≥6,000 MET-min/week (n=368)	
	n (%)	n (%)	cOR (95% CI)	n (%)	cOR (95% CI)
Age (years)					
<60	264 (44.97)	119 (36.17)	1.00	141 (38.32)	1.00
≥60	323 (55.03)	210 (63.83)	1.44 (1.09–1.91)†	227 (61.68)	1.32 (1.01–1.72)†
Gender					
Male	171 (29.13)	64 (19.45)	1.00	100 (27.17)	1.00
Female	416 (70.87)	265 (80.55)	1.70 (1.23–2.37)§	268 (72.83)	1.10 (0.82–1.48)

TABLE 1. (Continued)

Exposure factors	Physical activity level*				
	<4,500 MET-min/week (n=587)	4,500–6,000 MET-min/week (n=329)		≥6,000 MET-min/week (n=368)	
	n (%)	n (%)	cOR (95% CI)	n (%)	cOR (95% CI)
Education level					
Junior high school or below	192 (32.71)	94 (28.57)	1.00	96 (26.09)	1.00
High school	151 (25.72)	110 (33.43)	1.49 (1.05–2.11)†	145 (39.40)	1.92 (1.37–2.69)§
College or above	244 (41.57)	125 (37.99)	1.05 (0.75–1.45)	127 (34.51)	1.04 (0.75–1.44)
Marital status					
Married	471 (80.24)	278 (84.50)	1.00	297 (80.71)	1.00
Other	116 (19.76)	51 (15.50)	0.75 (0.52–1.07)	71 (19.29)	0.97 (0.70–1.35)
Registered residence					
Agricultural	84 (14.31)	29 (8.81)	1.00	37 (10.05)	1.00
Non-agricultural	503 (85.69)	300 (91.19)	1.72 (1.11–2.73)†	331 (89.95)	1.49 (0.99–2.27)
Living arrangement					
Not with child	390 (66.44)	194 (58.97)	1.00	219 (59.51)	1.00
With child	197 (33.56)	135 (41.03)	1.38 (1.04–1.82)†	149 (40.49)	1.35 (1.03–1.76)†
Income (per month)					
<3,000 CNY	135 (23.00)	75 (22.80)	1.00	89 (24.18)	1.00
3,000–6,000 CNY	276 (47.02)	157 (47.72)	1.02 (0.73–1.45)	187 (50.82)	1.03 (0.74–1.43)
>6,000 CNY	176 (29.98)	97 (29.48)	0.99 (0.68–1.45)	92 (25.00)	0.79 (0.55–1.15)
Hypertension					
No	383 (65.25)	251 (76.29)	1.00	249 (67.66)	1.00
Yes	204 (34.75)	78 (23.71)	0.58 (0.43–0.79)§	119 (32.34)	0.90 (0.68–1.18)
Dyslipidemia					
No	450 (76.66)	263 (79.94)	1.00	309 (83.97)	1.00
Yes	137 (23.34)	66 (20.06)	0.83 (0.59–1.15)	59 (16.03)	0.63 (0.45–0.88)§
Diabetes					
No	494 (84.16)	281 (85.41)	1.00	326 (88.59)	1.00
Yes	93 (15.84)	48 (14.59)	0.91 (0.62–1.32)	42 (11.41)	0.69 (0.46–1.01)
Chronic lung diseases					
No	570 (97.10)	318 (96.66)	1.00	360 (97.83)	1.00
Yes	17 (2.90)	11 (3.34)	1.17 (0.52–2.51)	8 (2.17)	0.75 (0.30–1.72)
Cardiovascular disease					
No	516 (87.90)	310 (94.22)	1.00	348 (94.57)	1.00
Yes	71 (12.10)	19 (5.78)	0.45 (0.26–0.74)§	20 (5.43)	0.42 (0.24–0.69)§
Digestive disease					
No	542 (92.33)	302 (91.79)	1.00	339 (92.12)	1.00
Yes	45 (7.67)	27 (8.21)	1.08 (0.65–1.77)	29 (7.88)	1.03 (0.63–1.67)
Arthritis or rheumatism					
No	496 (84.50)	289 (87.84)	1.00	318 (86.41)	1.00
Yes	91 (15.50)	40 (12.16)	0.76 (0.50–1.12)	50 (13.59)	0.86 (0.59–1.24)
Smoke					
No	501 (85.35)	298 (90.58)	1.00	319 (86.68)	1.00
Yes	86 (14.65)	31 (9.42)	0.61 (0.39–0.93)†	49 (13.32)	0.90 (0.61–1.30)

TABLE 1. (Continued)

Exposure factors	Physical activity level*				
	<4,500 MET-min/week (n=587)	4,500–6,000 MET-min/week (n=329)		≥6,000 MET-min/week (n=368)	
	n (%)	n (%)	cOR (95% CI)	n (%)	cOR (95% CI)
Alcohol consumption					
No	183 (31.18)	85 (25.84)	1.00	126 (34.24)	1.00
Yes	404 (68.82)	244 (74.16)	1.30 (0.96–1.76)	242 (65.76)	0.87 (0.66–1.15)
Sleep quality					
Good sleep	306 (52.13)	179 (54.41)	1.00	225 (61.14)	1.00
Poor sleep	281 (47.87)	150 (45.59)	0.91 (0.70–1.20)	143 (38.86)	0.69 (0.53–0.90)§

Note: cOR, Risk of exposure factor was estimated by computing the crude odds ratio, and the precision of the odds ratio was assessed by its 95% CI.
Abbreviations: MET=metabolic equivalent; CI=confidence interval; PAL=physical activity level.
* PAL of 4,500–6,000 MET group and PAL of ≥6,000 MET group compared with physical activity level of <4,500 MET group (as control group), respectively.
† $P<0.05$.
§ $P<0.01$.

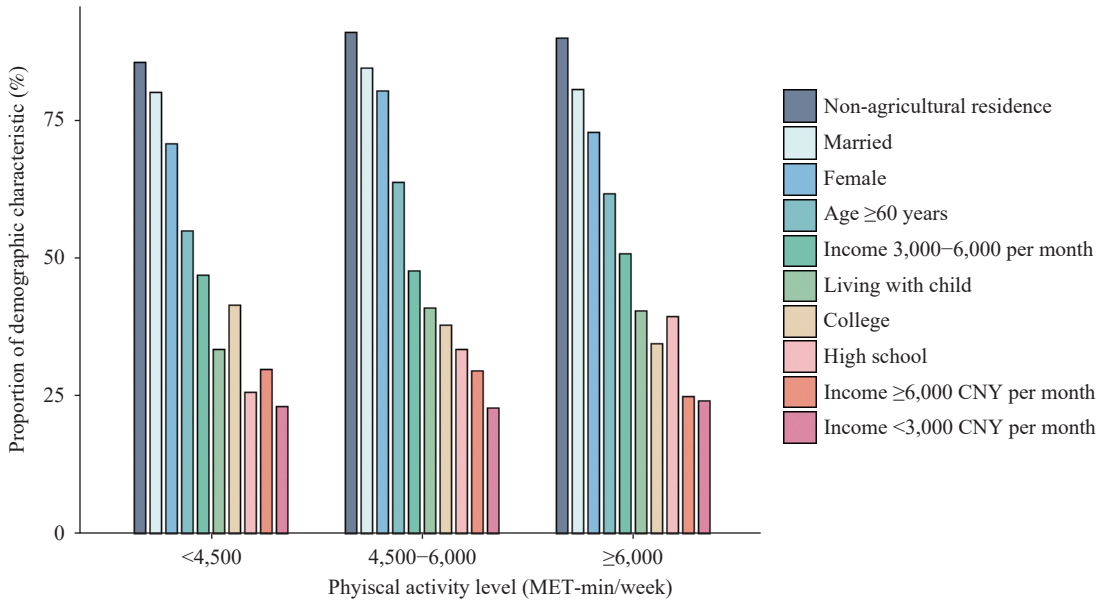


FIGURE 1. Proportion of sociodemographic characteristics at different physical activity level among middle-aged and elderly population in Beijing, China, October 2020 to January 2021.

Figure 1 shows the distribution of sociodemographic characteristics at various PALs. The sociodemographic characteristics comprising the highest proportions for the 3 PALs were similar, and the top 5 were non-agriculture, married, female, aged ≥60, and having an income of 3,000–6,000 CNY per month; the lowest one was income <3,000 CNY per month.

Figure 2 shows the proportion of selected chronic diseases and behavioral factors at PAL. The proportion order for the three PALs was basically consistent, and the top three were poor sleep quality, hypertension, and dyslipidemia; the lowest one was chronic lung diseases (Figure 2).

Table 2 shows the association of physical activity level and exposure factors by multivariate logistic regression analysis. The likelihood of moderate PAL was higher among participants aged ≥60 years (aOR: 1.65, 95% CI: 1.21–2.26), having a non-agriculture residence (aOR: 1.66, 95% CI: 1.03–2.73), and living with at least one child (aOR: 1.35, 95% CI: 1.00–1.80) in the multivariate logistic regression analysis. Moderate PAL was also associated with a reduced risk of hypertension (aOR: 0.58, 95% CI: 0.42–0.80) and cardiovascular disease (aOR: 0.43,

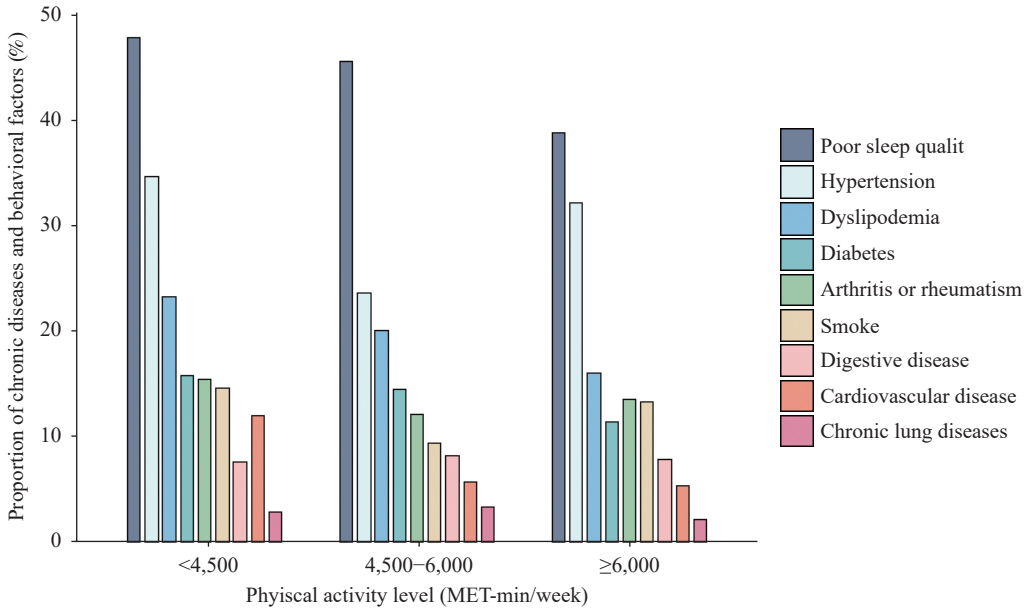


FIGURE 2. Proportion of chronic diseases and behavioral factors at different physical activity levels among middle-aged and elderly population in Beijing, China, October 2020 to January 2021.

TABLE 2. Association between physical activity levels and exposure factors by multivariate logistic regression analysis among middle-aged and elderly population in Beijing, China, October 2020 to January 2021.

Exposure factors	aOR (95% CI)	Forest plots
Model 1 PAL 4,500–6,000 MET-min/week		
Age (years)		
<60	1.00	
≥60	1.65 (1.21–2.26)	
Gender		
Male	1.00	
Female	1.40 (0.96–2.07)	
Education level		
Junior high school or below	1.00	
Senior high school	1.33 (0.92–1.93)	
College	0.98 (0.67–1.42)	
Registered residence		
Agricultural	1.00	
Non-agricultural	1.66 (1.03–2.73)	
Living arrangement		
Not with child	1.00	
With child	1.35 (1.00–1.80)	
Hypertension		
No	1.00	
Yes	0.58 (0.42–0.80)	
Cardiovascular disease		
No	1.00	
Yes	0.43 (0.24–0.73)	
Smoke		
No	1.00	
Yes	0.84 (0.49–1.40)	

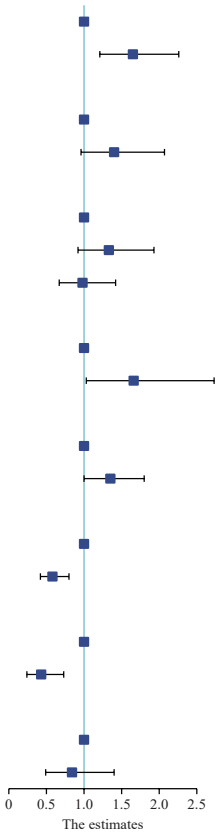
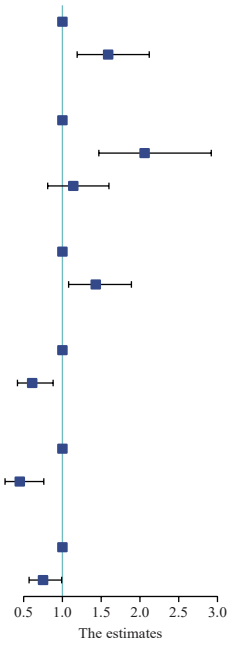


TABLE 2. (Continued)

Exposure factors	aOR (95% CI)	Forest plots
Model 2: ≥6,000 MET-min/week		
Age (years)		
<60	1.00	
≥60	1.59 (1.19–2.12)	
Education level		
Junior high school or below	1.00	
High school	2.06 (1.47–2.92)	
College	1.14 (0.81–1.60)	
Living arrangement		
Not with child	1.00	
With child	1.43 (1.08–1.89)	
Dyslipidemia		
No	1.00	
Yes	0.61 (0.42–0.88)	
Cardiovascular disease		
No	1.00	
Yes	0.45 (0.26–0.76)	
Sleep quality		
Good sleep	1.00	
Poor sleep	0.75 (0.57–0.99)	



Notes: aOR means Odd Ratio after adjusting for confounding factors.
Model 1: After adjusting for age, gender, education, registered residence, living arrangement, hypertension, cardiovascular disease, and smoking at PAL 4,500-6,000 MET-min/week.
Model 2: After adjusting for age, education, living arrangement, dyslipidemia, cardiovascular disease, and sleep quality.
Abbreviations: CI=confidence interval; PAL=physical activity level; MET=metabolic equivalents.

95% CI: 0.24–0.73), respectively.

Among those with a high PAL, the likelihood of the PAL was higher among participants aged ≥60 (aOR: 1.59, 95% CI: 1.19–2.12), education level of at least high school (aOR: 2.06, 95% CI: 1.47–2.92), and living with at least one child (aOR: 1.43, 95% CI: 1.08–1.89). This PAL was associated with a decreased risk of dyslipidemia, cardiovascular disease, and poor sleep, aOR (95% CI) was 0.61 (95% CI: 0.42–0.88), 0.45 (95% CI: 0.26–0.76), and 0.75 (95% CI: 0.57–0.99), respectively, indicating that low PAL may be relative to the increased risks of cardiovascular disease, hypertension, dyslipidemia, and poor sleep quality (Table 2).

DISCUSSION

The latest findings showed that participants with a low PAL accounted for 45.72%, those with moderate and above PA accounted for 54.28% among middle-aged and elderly population. The findings of multivariable logistic regression showed that the likelihood of moderate and high PAL was mainly among elderly population, indicating that the middle-aged population who may be at higher risk of low PAL in urban areas can also be a target population for chronic disease intervention. Moreover, the moderate PAL was associated with a decreased risk of hypertension and cardiovascular disease (CVD), the high PAL was related to a reduced risk of dyslipidemia, CVD, and poor sleep quality. On the contrary, above diseases and poor sleep quality may be an influencing factor for a low PAL. Our findings indicated that a certain of PA intensity (≥4,500 MET-min/week) was associated with varying sociodemographic characteristics (age, education, and registered residence), living arrangements, and chronic diseases. Identifying the exposure factors serving as barriers or motivators in middle-aged and older adults' physical activity could contribute toward the development of intensity-specific health promotion interventions. These might become components of a comprehensive intervention measurement for preventing physical inactivity among community-dwelling middle-aged and elderly population in urban areas.

This finding of distribution characteristics was

consistent with that in Shenzhen, indicating that the prevalence of physical inactivity in urban Chinese residents was high, especially in middle-aged adults where the prevalence was 45.79% (*7*). Those findings using a multivariable logistic regression were consistent with a large prospective study in China, in which higher occupational or nonoccupational physical activity was associated with significantly lower risks of major CVD among Chinese adults (*8*). Even for an elder age, maintaining a high PA level or increasing PA from low to high levels resulted in lower mortality risks (*9*). Leisure-time physical activity (LTPA) was decreased for those aged over 65 years or those with a history of cardiovascular disease. In addition, high-intensity LTPA had more obvious cardiovascular benefits than those of moderate-intensity leisure-time physical activity (*10*–*11*).

Previous studies have proposed various mechanisms to explain the health benefits of LTPA. In general, the protective effects of PA on the risks of CVD include adjustments to blood pressure, lipid levels, glucose tolerance, or body mass index (*12*–*13*).

This study was subject to limitations. First, the current study was cross-sectional, and the chronological sequence between exposure factors and physical activity was unclear; therefore, a causal relationship could not be established between the two. Further evidence is warranted using a prospective cohort or randomized controlled trial design to confirm the direction of the association. Second, self-reported chronic diseases may be subject to potential recall bias, especially for the elderly population.

However, this study had several strengths. It was a community-based study with a relatively representative sample, and multiple communities were selected as the study areas to provide diversity in sociodemographic features and physical activity level patterns to avoid selection bias. The trained investigators conducted the face-to-face CAPI which was performed to reduce the potential information bias in the survey. PA was measured using the IPAQ-L by metabolic equivalents to minimize the possible measurement error and misclassification bias. Sleep quality was evaluated by using the PSQI, with a superior sensitivity and specificity in distinguishing good and poor sleepers to reduce the potential measurement bias.

In conclusion, this study represents the most up-to-date data with a relatively large sample size and standardized method to explore the association between physical activity level and various sociodemographic factors and chronic diseases among middle-aged and elderly population in Beijing. The results suggested that more attention should be given to the middle-aged population who may be at high risk of physical inactivity in urban areas.

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[#] Corresponding authors: Gong Chen, chengong@pku.edu.cn; Dongmin Wang, dongmin_wang@pku.edu.cn.

[1] Institute of Population Research/Institute on Aging, Peking University, Beijing, China; [2] Department of Physical Education, Peking University, Beijing, China.

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REFERENCES

1. Beijing Municipal Bureau of Statistics, Beijing Survey Team of National Bureau of Statistics. Beijing statistical yearbook. Beijing: China Statistics Press. 2020. http://nj.tjj.beijing.gov.cn/nj/main/2020-tjnj/zk/indexch.htm. (In Chinese).
2. Dumith SC, Hallal PC, Reis RS, Kohl III HW. Worldwide prevalence of physical inactivity and its association with human development index in 76 countries. Prev Med 2011;53(1 – 2):24 – 8. http://dx.doi.org/10.1016/j.ypmed.2011.02.017.
3. Ding D, Lawson KD, Kolbe-Alexander TL, Finkelstein EA, Katzmarzyk PT, van Mechelen W, et al. The economic burden of physical inactivity: a global analysis of major non-communicable diseases. Lancet 2016;388(10051):1311 – 24. http://dx.doi.org/10.1016/S0140-6736(16)30383-X.
4. Kohl III HW, Craig CL, Lambert EV, Inoue S, Alkandari JR, Leetongin G, et al. The pandemic of physical inactivity: global action for public health. Lancet 2012;380(9838):294 – 305. http://dx.doi.org/10.1016/S0140-6736(12)60898-8.
5. Cunningham C, O'Sullivan R, Caserotti P, Tully MA. Consequences of physical inactivity in older adults: a systematic review of reviews and meta-analyses. Scand J Med Sci Sports 2020;30(5):816 – 27. http://dx.doi.org/10.1111/sms.13616.
6. Buysse DJ, Reynolds III CF, Monk TH, Berman SR, Kupfer DJ. The pittsburgh sleep quality index: a new instrument for psychiatric practice and research. Psychiatry Res 1989;28(2):193 – 213. http://dx.doi.org/10.1016/0165-1781(89)90047-4.
7. Zhou YF, Wu J, Zhang SC, Yan SJ, He LP, Mkandawire N, et al. Prevalence and risk factors of physical inactivity among middle-aged and older Chinese in Shenzhen: a cross-sectional study. BMJ Open 2018;8(10):e019775. http://dx.doi.org/10.1136/bmjopen-2017-019775.
8. Bennett DA, Du HD, Clarke R, Guo Y, Yang L, Bian Z, et al. Association of physical activity with risk of major cardiovascular diseases in Chinese men and women. JAMA Cardiol 2017;2(12):1349 – 58. http://dx.doi.org/10.1001/jamacardio.2017.4069.
9. Huang YY, Jiang CQ, Xu L, Zhang WS, Zhu F, Jin YL, et al. Mortality in relation to changes in physical activity in middle-aged to older Chinese: an 8-year follow-up of the Guangzhou Biobank Cohort Study. J Sport Health Sci 2021;10(4):430 – 8. http://dx.doi.org/10.1016/j.jshs.2020.08.007.

10. Cheng WK, Zhang Z, Cheng WS, Yang C, Diao LL, Liu WJ. Associations of leisure-time physical activity with cardiovascular mortality: a systematic review and meta-analysis of 44 prospective cohort studies. Eur J Prev Cardiol 2018;25(17):1864 – 72. http://dx.doi.org/10.1177/2047487318795194.
11. Li JQ, Zhang ZT, Si SC, Xue FZ. Leisure-time physical activity and cardiovascular disease risk among hypertensive patients: a longitudinal cohort study. Front Cardiovasc Med 2021;8:644573. http://dx.doi.org/10.3389/fcvm.2021.644573.
12. Rossi A, Dikareva A, Bacon SL, Daskalopoulou SS. The impact of physical activity on mortality in patients with high blood pressure: a systematic review. J Hypertens 2012;30(7):1277 – 88. http://dx.doi.org/10.1097/HJH.0b013e3283544669.
13. Joseph G, Marott JL, Torp-Pedersen C, Biering-Sørensen T, Nielsen G, Christensen AE, et al. Dose-response association between level of physical activity and mortality in normal, elevated, and high blood pressure. Hypertension 2019;74(6):1307 – 15. http://dx.doi.org/10.1161/HYPERTENSIONAHA.119.13786.

Commentary

Aging in China: Challenges and Opportunities

Hongman Wang[1,#]; Hong Chen[2]

According to China's seventh national census (*1*) of 2020, the number of people 60 years and above was 264.02 million (18.70% of the total population), and the number of people 65 years and above was 190.64 million (13.50%). The proportion of elderly people in the seventh census is greater than that in the sixth national census. China will therefore face substantial pressure for balanced population development in the long term. In 2016, *The Lancet* published an editorial — Ageing in China: A ticking bomb (*2*). As the country with the largest number of elderly people in the world, how can China meet the challenges brought by a rapidly aging population? Will China's demographic "ticking bomb" explode?

With the first 100-year goal of the nation achieved in 2021, China has become a moderately prosperous society, with abject poverty eradicated and a life expectancy that has increased from 70.1 years in 1996 to 77.3 years in 2019. More people living longer requires planning for health and social systems that support people to be happy and healthy as they grow old — especially when population aging coincides with an increasing burden of noncommunicable diseases (NCDs). As China is rapidly moving toward an aging society with a large population, we must act today to address the challenges of tomorrow. To meet such challenges, the "Active National Initiative for Population Aging: Theory and Practice at Present and in Future" was launched in China. The following efforts have been made to address the challenges from theoretical and practice perspectives.

DEFINITION OF SENIOR CITIZEN

A "senior" in China is recommended to be defined as an individual 65 years or older. Although the *Law of the People's Republic of China on the Protection of the Rights and Interests of the Elderly,* promulgated in 1996, defines a senior as 60 years and above, the *Principles and Recommendations for a Vital Statistics System,* issued by the United Nations in 2015, defines a senior as 65 years or above. An adjustment from 60 years to 65 years would reduce the number of elderly people by nearly 73.38 million in China.

HEALTHY AGING AND HEALTHY LONGEVITY

Happy, healthy, and successful aging is more than merely the absence (or management) of NCDs. Rather, healthy aging is making the most of the opportunities from population aging — for example, promoting older people's social participation and contributions to the community — and requires health and social support systems that are designed for people as they age, including effective management of NCDs along the continuum of care and throughout the life course. Measurement of healthy aging is discussed as well. Experts on aging suggest that healthy aging should not only be measured by the absence of disease, but also with the consideration of activities of daily living (ADL) or instrumental activities of daily living (IADL).

For technical guidance and review, the *Criteria and Methods for Accreditation of Blue Zones* (*3*) (in Chinese, English, and Russian) has been published by an aging research team in Peking University led by Dr. Hongman Wang for "Theoretical and Empirical Research on Healthy China." This document emphasizes that we should pay attention to healthy longevity, rather than longevity by itself.

However, to realize healthy aging, it is necessary to put the strategy of "healthy aging" in the entire human life cycle as a priority strategy for China and actively respond to the challenges of an aging population. "Active aging and healthy aging" is a trend of the times and ranks highly among community aims of health for all.

This year, the theme of the symposium Health Care & Social Care of the Elderly in China is "Active National Initiative for Population Aging: Theory and Practice at Present and in the Future." Population aging brings not only challenges, but also opportunities.

A lesson learned from countries that have already experienced their demographic transition is to plan ahead — the earlier, the better. Collective efforts are needed, including community engagement, civil society involvement, and primary health care platform

development — along with political commitment and academic and industrial community collaborations — to transform societies successfully and meet healthy aging targets.

Proactive policies have been taken and implemented at central and local government levels (*4*). China advocates that "Every person should take care of their own health" in its Healthy China 2030 Action Plan. We see older adults and their families striving for the good health of the elderly and enterprises that have been playing active roles in healthy aging (*5*). Some nursing homes are employing the younger elderly to care for the older elderly. China's response and actions on population aging are positive. We believe that by adhering to the concept of healthy aging and summing up the experience in a timely manner, China will be able to turn challenges into opportunities with a virtuous circle of population development. China is taking action for healthy aging, and its population aging will be healthier and more productive, providing reference for development of a "positive outlook on aging and healthy aging" policy around the world. This is Chinese wisdom and a program that China contributes for a shared future of health for all, healthy aging of mankind, and a healthy China and a healthy world.

A report of the "Theoretical and Empirical Research on Healthy China" research group shows that after China's entry as an aging population, the Party and the government have attached great importance and actively responded to the research by systematically issuing relevant policies and regulations on aging. The elderly have become a valuable wealth, and the industry for the elderly has become a sunrise industry. Aging not only has no negative impact, rather, it reflects positive energy. It is a fact that the Chinese elderly are becoming healthier and better educated year by year, especially those born in the 1950s and 1960s. They love their country, family, work, and study. The elderly in the new era are not the elderly who "lie flat" and don't care. They are the elders who keep pace with the times, glow with youth, love to work, and contribute to society and family. The elderly are creating value in special ways. In cities, people in their 80s or 90s, if healthy enough, still send and pick up their grandchildren from school and contribute to the housework. In rural areas, the elderly not only manage their families, but also take good care of their grandchildren's life and study and work in the farmland; they enjoy these activities and refuse to be regarded as old. Many older people with cultural, artistic, or traditional skills have become masters, set up cooperatives, or engage in handicraft making. Their products go to the market and even abroad, bringing considerable income. As a Chinese saying goes, having an elder person at home is better than having a treasure at home. The elderly have become the backbone of the family. With China's good aging policies and comprehensive poverty alleviation measures, the elderly have become an indispensable force for China's economic and social development. Most older people in the new era are educated and possesses certain skills. They refuse to accept aging, are willing to contribute to society, are living full lives, and are making great contributions to China's socialist construction.

At the advent of the Chinese top policy-making bodies' release of China's national efforts to respond actively to population aging, we feel it is appropriate to share the Chinese political commitment and active effort by leadership and academia with the world. We hope this short communication can contribute to a better world for the elderly and for people of all ages to live in a world with universal health for all.

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[#] Corresponding author: Hongman Wang, pkuwhm2006@163.com.

[1] Health Science Center, Peking University, Beijing, China; [2] Chinese Center of Disease Control and Prevention, Beijing, China.

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REFERENCES

1. National Bureau of Statistics of the People's Republic of China. The seventh national census bulletin (No. 5). 2021.http://www.stats.gov.cn/tjsj/tjgb/rkpcgb/qgrkpcgb/202106/t20210628_1818824.html. [2022-4-18]. (In Chinese).
2. The Lancet. Ageing in China: a ticking bomb. Lancet 2016;388 (10056):2058. http://dx.doi.org/10.1016/S0140-6736(16)32058-X.
3. Wang HM. Blue book of elderly health: research and policy implementation of healthy aging in China. Beijing: Chinese Financial & Economic Publishing House. 2020. (In Chinese).
4. The State Council. The state council on the issuance of the "14th Five-Year Plan" national aging career notice of the development and elderly service system planning.2022. http://www.gov.cn/zhengce/content/2022-02/21/content_5674844.htm. [2022-2-24]. (In Chinese).
5. The Communist Party of China Central Committee and the State Council. "Healthy China 2030" Blueprint.2016. http://www.gov.cn/zhengce/2016-10/25/content_5124174.htm. [2022-2-24]. (In Chinese).

Notifiable Infectious Diseases Reports

Reported Cases and Deaths of National Notifiable Infectious Diseases — China, April 2022

Diseases	Cases	Deaths
Plague	0	0
Cholera	0	0
SARS-CoV	0	0
Acquired immune deficiency syndrome*	3,837	1,387
Hepatitis	117,617	39
Hepatitis A	896	0
Hepatitis B	95,933	28
Hepatitis C	17,712	10
Hepatitis D	22	0
Hepatitis E	2,525	1
Other hepatitis	529	0
Poliomyelitis	0	0
Human infection with H5N1 virus	0	0
Measles	52	0
Epidemic hemorrhagic fever	333	2
Rabies	9	5
Japanese encephalitis	0	0
Dengue	0	0
Anthrax	22	0
Dysentery	2,587	0
Tuberculosis	61,185	341
Typhoid fever and paratyphoid fever	421	0
Meningococcal meningitis	7	0
Pertussis	3,415	0
Diphtheria	0	0
Neonatal tetanus	2	0
Scarlet fever	1,639	0
Brucellosis	7,124	0
Gonorrhea	7,821	1
Syphilis	39,513	3
Leptospirosis	3	0
Schistosomiasis	1	0
Malaria	34	0
Human infection with H7N9 virus	0	0
COVID-19[†]	65,484	422
Influenza	37,567	0
Mumps	9,968	0

Continued

Diseases	Cases	Deaths
Rubella	97	0
Acute hemorrhagic conjunctivitis	2,455	0
Leprosy	34	0
Typhus	89	0
Kala azar	24	0
Echinococcosis	283	0
Filariasis	0	0
Infectious diarrhea[§]	74,986	0
Hand, foot and mouth disease	44,794	0
Total	481,403	2,200

* The number of deaths of acquired immune deficiency syndrome (AIDS) is the number of all-cause deaths reported in the month by cumulative reported AIDS patients.
† The data were from the website of the National Health Commission of the People's Republic of China.
§ Infectious diarrhea excludes cholera, dysentery, typhoid fever and paratyphoid fever.
The number of cases and cause-specific deaths refer to data recorded in National Notifiable Disease Reporting System in China, which includes both clinically-diagnosed cases and laboratory-confirmed cases. Only reported cases of the 31 provincial-level administrative divisions in the mainland of China are included in the table, whereas data of Hong Kong Special Administrative Region, Macau Special Administrative Region, and Taiwan are not included. Monthly statistics are calculated without annual verification, which were usually conducted in February of the next year for de-duplication and verification of reported cases in annual statistics. Therefore, 12-month cases could not be added together directly to calculate the cumulative cases because the individual information might be verified via National Notifiable Disease Reporting System according to information verification or field investigations by local CDCs.

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