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ORIGINAL RESEARCH

The Association Between Smartphone Use and Risk of Hypertension in Adults: A Cross-Sectional Analysis

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Background: The smartphone use profoundly affects human health. At present, the effect of smartphone use on the risk of hypertension in adults aged 50 years and older remains unknown. This study aimed to explore the association between smartphone use and hypertension in this population.

Methods: From 2018 to 2019, people aged 50 years and older were enrolled in the Fujian Provincial Eye Study (FJES), a population-based cross-sectional survey of the public's general and ocular health in Fujian Province, China. Information on smartphone use was obtained from the baseline survey, and blood pressure measurements were obtained via standardized on-site examination. Univariate and multivariable logistic regression analyses were performed on the study variables. $P<0.05$ were considered statistically significant.

Results: This study ultimately enrolled 8,211 eligible participants aged ≥50 years, and the mean age was 64.39±8.87 years. The risk of hypertension decreased significantly with increasing smartphone use time, although people who spent more time on smartphones had higher systolic blood pressure (SBP). There was no significant association between smartphone use time and diastolic blood pressure (DBP). Multivariate logistic regression analysis showed that smartphone use time, along with age, BMI, diabetes and education level, was an independent predictor of hypertension risk.

Conclusion: The duration of smartphone use demonstrated a significant inverse association with hypertension risk and was identified an independent predictor of hypertension risk in adults aged 50 years and older. Thus, smartphone use duration is a potentially useful indicator for assessing the risk of hypertension in this population.

Keywords: smartphone use, hypertension, China

Introduction

Hypertension, a chronic medical condition characterized by persistently elevated arterial blood pressure, represents one of the most prevalent global chronic diseases and a major public health challenge.[1] With the aggravation of aging, the number of people suffering from hypertension is increasing. According to the Annual Report on Cardiovascular Health and Diseases in China 2021,[2,3] the number of hypertension patients in China was more than 260 million. Hypertension may lead to many complications, such as myocardial infarction, stroke, and kidney damage, and can cause millions of deaths worldwide every year.[4] Hypertension imposes heavy economic and health burdens on society, so the hypertension prevention and treatment situation is very serious. Published studies have shown that TV watching, internet surfing and other lifestyle practices have an important impact on the risk of hypertension.[5–7] Such activities are also linked to cardiovascular risk, with meta-analyses confirming associations with overweight/obesity, type 2 diabetes, and

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hypertension. Exploring the possible factors affecting hypertension is of great significance for the monitoring, diagnosis, treatment and prevention of hypertension.

Since the beginning of this century, global smartphone user adoption has escalated annually. With this emergent trend, smartphones not only serve as communication tools but are also equipped with multiple functions, such as those related to entertainment, payment, learning, and information acquisition. Smartphones now constitute an indispensable component of contemporary human existence, fundamentally reshaping daily routines and social dynamics.[8,9] However, smartphones are a "double-edged sword". On the one hand, they bring convenience to our modern life; on the other hand, the impact of smartphone use on health is a matter of concern.[10,11]

At present, the aging population has become a public health topic of global concern. With technological and economic progress, increasing digital inclusion among older adults has accelerated smartphone adoption in this demographic. The impact of smartphone use on the health of this population has attracted the attention of researchers.[12] Hu et al's research showed that the time spent on smartphones was negatively related to vision quality in adults aged 50 years and older.[13] However, the relationship between the time spent on smartphone use and the risk of hypertension in this population remains unknown. Based on the above mentioned concerns, this study aims to explore the association between smartphone use time and hypertension in Chinese people aged over 50 years. Logistic regression analysis was used to explore whether smartphone use time was an independent predictor of hypertension risk in this population.

Methods

The Fujian Provincial Eye Study (FJES) was a population-based cross-sectional survey of the public's general and ocular health in Fujian Province, southeast China, approved by the Ethics Committee of the Xiamen Eye Center affiliated with Xiamen University (No. XMYKZXKY-2018-001) and was implemented by the Eye Institute and Affiliated Xiamen Eye Center of Xiamen University.[14] The study was conducted in accordance with the Helsinki Declaration (revised in 2013). From 2018 to 2019, people aged 50 years and older were selected as study subjects, and informed consent was obtained from all eligible subjects prior to enrollment. During the implementation phase of the project, all investigators received unified training, and examinations were carried out consistently. The main contents of the survey were as follows: general information (age, gender, race, etc.) and a questionnaire (general condition; eye condition, socioeconomic condition, smartphone use, etc).

We obtained information on smartphone use from the baseline survey with the question "Do you have a smartphone?". The answer to the survey questions was yes or no. For the question "How much time do you use your smartphone every day?", the multiple choice response options were as follows: less than half an hour, half an hour to one hour, 1–2 hours, 2–4 hours, 4–6 hours and more than 6 hours13. In this study, blood pressure was acquired through an on-site test using validated automated sphygmomanometers, and the average of three measurements was used. Hypertension was defined as systolic blood pressure (SBP)≥140 mmHg and/or diastolic blood pressure (DBP)≥90 mmHg and/or hypertension history.[15] The responses for the question about education level were divided into primary school and high school and above. Smoking status was classified as nonsmoker or smoker. The income level responses were stratified into low, medium, and high categories.

Statistical Analysis

Statistical analyses were performed using SPSS 21.0. Normally distributed continuous variables were expressed as the mean ± standard deviation, nonnormally distributed variables were expressed as the median (25th–75th), and continuous variables were analyzed by Student's t or nonparametric tests. Categorical variables were described as absolute values and percentages and were analyzed by the chi-square test. Univariate and multivariable logistic regression analyses were performed on the study variables to analyze independent predictors of hypertension risk. Results with $P<0.05$ were considered statistically significant.

Results

A total of 8211 subjects (response rate, 81.8%) aged 50 years and older were eventually included, and 3375 (41.1%) were male. The mean age was 64.39±8.87 years. Table 1 summarizes the general information of the survey in more detail,

Table 1 Baseline Characteristics of the Study Population

Characteristics	Total (n=8211)	Normaltensive (n=3707)	Hypertensive (n=4504)	*P*
Demographic				
Age(years)	64.39±8.87	61.94±8.32	66.40±8.79	<0.001
Gender				
Female, n (%)	4836(58.9%)	2259(46.7%)	2577(53.3%)	
Male, n (%)	3375(41.1%)	1448(42.9%)	1927(57.1%)	0.001
BMI (kg/m^2)	23.36±3.28	22.60±2.97	23.96±3.39	<0.001
SBP (mmHg)	136±21	120±12	148±19	<0.001
DBP (mmHg)	76±13	69±9	81±12	<0.001
Heart rate (bpm)	79.08±11.07	78.09±10.34	79.88±11.56	<0.001
Smoke, n (%)	1262(18.9%)	542(42.9%)	720(57.1%)	0.183
Alcohol drink, n (%)	1159(17.9%)	494(42.6%)	665(57.4%)	0.134
DM, n (%)	2405(29.3%)	923(38.4%)	1482(61.6%)	<0.001
Hyperlipidemia, n (%)	1214(60.5%)	402(33.1%)	812(66.9%)	<0.001
Education				
Primary school and below	2801(39.5%)	1077(38.5%)	1724(61.5%)	
High school and above	4290(60.5%)	2064(48.1%)	2226(51.9%)	<0.001
Income (YUAN, RMB)				
Low (<2000)	2417(48.8%)	1067(44.1%)	1350(55.9%)	
Middle (2000–5000)	1948(39.3%)	918(47.1%)	1030(52.9%)	
High (>5000)	592(11.9%)	294(49.7%)	298(50.3%)	<0.001
Phone use duration	6942			
None	2218 (32.0%)	790 (35.6%)	1428 (64.4%)	
<2 Hours	3706 (53.4%)	1771 (47.8%)	1935 (52.2%)	
≥2 Hours	1018 (14.6%)	543 (53.3%)	475 (46.7%)	<0.001

Abbreviations: BMI, Body Mass Index; SBP, systolic blood pressure; DBP, diastolic blood pressure; DM, Diabetes Mellitus.

including the total sample size, gender, age, body mass index (BMI), SBP, DBP, education and income. The mean SBP was 136±21 mmHg, and the mean DBP was 76±13 mmHg.

In this study, the study population was categorized into three groups based on the smartphone use time: a group with people who do not use smartphones (None-smartphones), a group with people who use mobile phones for less than 2 hours per day on average (<2 hours) and a group with people who use mobile phones for no less than 2 hours per day (≥2 hours). There were 2218 people in the nonsmartphone group, and the average age of the group was 68 ± 9 years old, with males accounting for 34.3%. In the <2 hour group, there were 3706 people, the average age was 63 ± 8 years old, and the proportion of males was 40.3%. The number of people in the ≥2 hour group was 1018, and the average age was 61 ± 8 years old, with 47.0% men. In addition, 1269 people failed to respond to our questions about mobile phone use. It

was found that the older people in the study population spent less time using smartphones, and there was a significantly negative relationship between age and smartphone use time. In addition, males had a longer smartphone use time (Figure 1).

Figure 2 shows the relationship between smartphone use time and blood pressure. This study revealed a significant reduction in hypertension risk with increased smartphone use time, although people who spent more time on smartphones had higher SBP. There was no significant association between smartphone use time and DBP. In addition, the rate of hypertension was negatively associated with the time spent on smartphone use (Figure 3).

Univariate logistic regression analysis showed that the risk of hypertension was negatively associated with mobile phone use time and education level and positively associated with age (OR 1.063, 95% CI 1.057–1.068), male sex (OR 0.857, 95% CI 0.785–0.937), BMI (OR 1.146, 95% CI 1.129–1.163), diabetes (OR 1.479, 95% CI 1.342–1.630) and hyperlipidemia (OR 1.808, 95% CI 1.590–2.056). People who spent more time on smartphones had a lower risk of hypertension (OR 0.484, 95% CI 0.416–0.563) (Figure 4).

Furthermore, multivariate logistic regression analysis showed that smartphone use time, along with age, BMI, diabetes and education level, was an independent predictor of hypertension risk (Table 2).

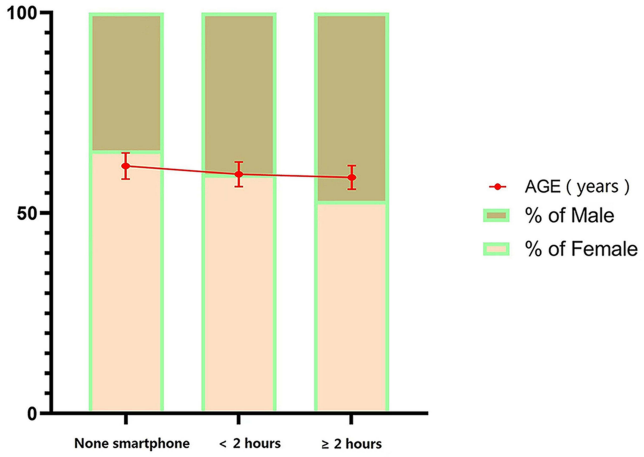

Figure 1 Age and gender distribution by smartphone use time.

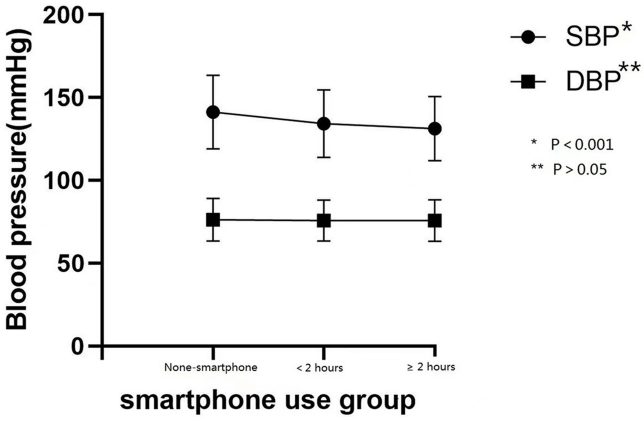

Figure 2 Blood pressure in population by smartphone use time.
Abbreviations: SBP, systolic blood pressure; DBP, diastolic blood pressure.

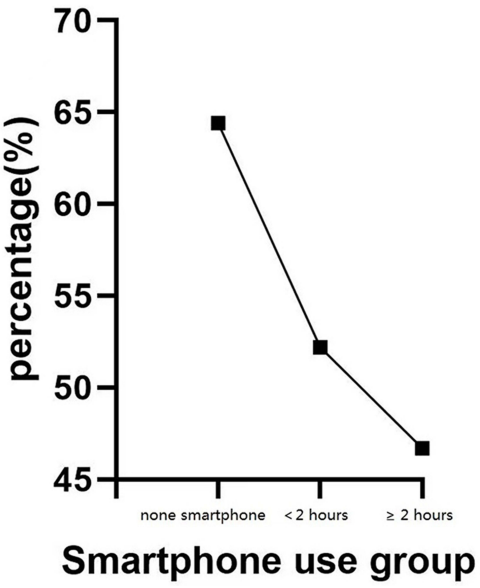

Figure 3 The rate of hypertension in population by smartphone use time.

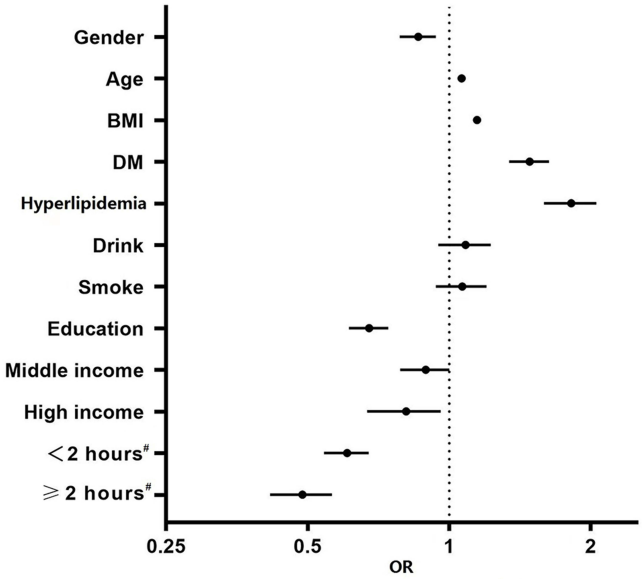

Figure 4 The risk of hypertension in population by univariate logistic regression analysis. #compared to the None-smartphones group.
Abbreviation: OR, Odds Ratio.

Discussion

To the best of our knowledge, this study initially established the association between the time spent on smartphones and the risk of hypertension in people aged 50 years and older. This study showed that older people spent less time on smartphones, and there was a significantly negative relationship between age and smartphone use time. Males had a longer duration of smartphone use. People who spent more time on smartphones had higher SBP. Furthermore, we found that the time spent on smartphones was negatively related to the risk of hypertension. After adjusting for age, BMI, economic level, hypertension, diabetes and other factors, multivariate logistic regression analysis showed that smartphone use time was an independent predictor of hypertension in adults aged 50 years and older. The longer the smartphone was used, the lower the risk of hypertension. These results suggest that daily smartphone use time may serve as a potential indicator for hypertension risk assessment in older adults.

Table 2 Multivariate Regression Logistic Regression Analysis

	MODEL1 OR (95% CI)	MODEL2 OR (95% CI)	MODEL3 OR (95% CI)
<2 hours[#]	0.801 (0.711–0.903)	0.840 (0.713–0.907)	0.851 (0.718–1.008)
≥2 hours[#]	0.707 (0.599–0.836)	0.683 (0.577–0.809)	0.748 (0.595–0.939)
Gender	0.923 (0.830–1.026)	0.941 (0.846–1.047)	0.951 (0.797–1.135)
Age	1.065 (1.058–1.072)	1.064 (1.057–1.071)	1.057 (1.048–1.066)
BMI	1.161 (1.142–1.180)	1.151 (1.132–1.171)	1.137 (1.111–1.162)
DM	–	1.422 (1.262–1.603)	1.589 (1.358–1.859)
Hyperlipidaemia	–	1.462 (1.264–1.692)	1.466 (1.224–1.756)
Drink	–	–	1.218 (1.013–1.465)
Smoke	–	–	0.989 (0.803–1.219)
Education	–	–	0.799 (0.674–0.947)
Middle income	–	–	0.945 (0.806–1.109)
High income	–	–	1.032 (0.812–1.312)

Notes: [#]Compared to the None-smartphones group. MODEL1: Gender+Age+BMI. MODEL2: Gender+Age+BMI+DM+Hyperlipidaemia. MODEL3: Gender+Age+BMI+DM+HG+Drink+Smoke +Education+Incom.
Abbreviations: BMI, Body Mass Index; DM, Diabetes Mellitus.

Our study showed that age, BMI, economic level, diabetes and hyperlipidemia were independent predictors of hypertension in the multivariate regression model. Higher age, higher BMI, and lower economic level were associated with a higher risk of hypertension. This was consistent with the findings of previous studies, further validating that lifestyle modifications - including smoking cessation, weight control, a low-fat diet and so on were important for the prevention and treatment of hypertension.[15–17] Additionally, it also verified the reliability of our research model.

To date, several studies have investigated the impact of smartphone use on blood pressure in adolescents.[18] A cross-sectional study conducted by Cassidy-Bushrow et al showed that prolonging the time spent on the internet using smartphones was related to an increase in blood pressure in 331 healthy adolescents.[19] Zou et al recruited more than 2600 healthy patients without a family history of hypertension.[20] They controlled for BMI, gender, sleep quality, and age. The study revealed that higher hypertension was related to smartphone addiction. Overall, in adolescents, time spent on smartphones was associated with increased blood pressure, which was mainly because the use of smartphones can lead to reduced physical activity, increased anxiety levels and forward head posture. Notably, the current evidence base lacks studies examining this association in adults over 30 years old. In contrast, the present study showed that the prolonged use of smartphones was associated with lower SBP and a reduced risk of hypertension among people aged 50 years and older. It was speculated that unlike adolescents, people aged 50 years and older who can use smartphones for a long time usually have better physical fitness, more physical strength, better eyesight and better cognitive ability. This was similar to the findings of a study conducted by Hu et al, which showed that a positive association between smartphone use tine and improved near visual acuity among individuals aged ≥50 years.[13] This study examined the relationship between near vision and smartphone use among ageing populations. The results indicated that individuals with better near vision tended to use smartphones for longer periods, whereas declining vision could limit engagement with digital devices. These findings suggest that visual function not only influences digital participation but may also indirectly affect social interaction and overall health in older adults.

Alongside the severe situation and heavy burden of hypertension prevention and control worldwide, smartphones have come to play key roles in communication, payment, shopping, entertainment and other aspects of daily life. Therefore, smartphones have almost become an essential tool in everyone's lives, which has established a good foundation for using smartphones as a tool in population health screening.[21] In the future, smartphone use time can be included in the set of hypertension risk assessment tools. Smartphone use time can be measured through multiple validated approaches, including questionnaires, smartphone app calculations and other methods, which are very simple,

economical and almost cost free. Therefore, smartphone use time, as an assessment tool for hypertension risk prediction, has potential advantages and deserves further attention and promotion.

We found in this study that the number of people who used smartphones for less than 2 hours accounted for a larger proportion of the study population. As mentioned above, smartphones have gradually become an indispensable tools in daily life. Even people with weak health conditions find it increasingly difficult to completely avoid using smartphones. For them, smartphones are used more to achieve the needs of life than for entertainment. Due to the current smartphone market, most smartphone products are mainly designed for young people. These smartphones often have complex functions and very high operational requirements, which presents adults with presbyopia with great difficulties in using smartphones. This is a social problem that deserves our attention, especially in the context of the gradual increase in global aging.[22] It is necessary to develop novel smartphones and strengthen smartphone use training for these individuals to facilitate their adaptation to the mobile internet era.[23] These complementary strategies address both technological accessibility and skill acquisition barriers.

Limitations

This study also has several limitations. First, the study was a cross-sectional study, which hindered the investigation of the causal association between smartphone use time and hypertension risk. It will be necessary to carry out randomized controlled trials or cohort studies to verify the temporal sequence of the observed association. Second, the collection of smartphone use time data was in the form of self-report questionnaires, which may introduce recall or reporting bias. Objective validation via usage tracking apps was not available. Third, we categorized smartphone use into three groups based on preliminary distribution and to ensure sufficient power in subgroup analyses. While more granular categorization could offer additional insights, the current grouping ensured balanced representation across the cohort. In addition, incomplete medication and medical history records precluded critical sensitivity analyses (eg, excluding baseline hypertension/medication users) and full adjustment for potential confounders, potentially affecting causal interpretation. Finally, other unmeasured factors may play a role in the relationship between smartphone use time and hypertension, so these factors should be taken into account in future research.

Conclusion

In conclusion, this study found that smartphone use time was an independent predictor of hypertension risk in adults aged 50 years and older. The smartphone use time was negatively correlated with the risk of hypertension. Smartphone use time was a potential tool to assess the risk of hypertension. The effect of smartphone use on physical and mental health in adults remains an urgent societal concern requiring further investigation.

Data Sharing Statement

Data and materials are available from the corresponding author upon reasonable request.

Ethics Approval and Informed Consent

This study was approved by the Ethics Committee of the Xiamen Eye Center affiliated with Xiamen University (No. XMYKZXKY-2018-001) and was implemented by the Eye Institute and Affiliated Xiamen Eye Center of Xiamen University. The study was conducted in accordance with the Helsinki Declaration (revised in 2013). Informed consent was obtained from all individual participants included in the study.

Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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Disclosure

All authors declare no competing interests in this work.

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