



# Association between mobile phone usage and hypertension among adults in an urban area of Puducherry: a case control study

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## Abstract

**Aim** To measure the association between mobile phone usage and hypertension among adults.

**Subject and methods** This community-based case control study was conducted in the urban field practice area of a medical college in Puducherry, India. Individuals with average BP  $\geq 140/90$  mmHg on three readings or hypertension diagnosed within the past year were defined as cases. Controls were individuals with average BP  $\leq 130/85$  mmHg on three readings. Fifty cases and 50 controls were matched for age and gender and interviewed using a structured questionnaire. Binary logistic regression was employed to calculate the adjusted odds ratios. Paired t test and chi-square tests were done to measure the *p* value.

**Results** Most of the study participants knew how to use the calling facility on their mobile phones, whereas only two-thirds of them were able to use the SMS facility. Only one-third owned a smartphone. The risk of hypertension was six times higher among those who had been using a mobile phone for more than 8 years [adjusted odds ratio 6.2 (1.6–23.8)] and four times higher among those who used the calling facility for more than 60 min per day [adjusted odds ratio 4.2 (1.1–16.7)].

**Conclusion** There was a significant positive association between hypertension and duration of mobile phone usage. However, further studies are required to confirm our findings.

**Keywords** Mobile phones · Hypertension · Association · Case control study

## Introduction

Over 900 million people use mobile phones in India, the country with the second highest number of mobile phone users globally (GOI 2012). In 2011 alone, 142 million mobile-cellular subscriptions were added in India. With numbers increasing, India is expected to become the country with the most mobile phone subscribers in the near future. Parallel to this dramatic increase in mobile phone usage over the last decade, public concern over the health effects of using this device has grown.

Since the invention of the mobile phone, there have been increasing misgivings regarding health problems associated with its use, which may include infertility and cancer due to exposure to radiation. The high frequency of mobile phone

use can also cause increased stress. In Sweden, researchers found high mobile phone use was associated with stress and sleep disturbances (Thomé et al. 2011), for example. According to the World Health Organization, electromagnetic hypersensitivity is characterized by symptoms such as redness, burning and tingling sensations, fatigue, nausea, palpitations and dizziness as well as an inability to concentrate (WHO 2005). A study conducted by International Agency for Research on Cancer classified mobile-phone-related radio-frequency radiation as a group 2B carcinogen based on an increased risk of glioma associated with mobile phone usage (IARC 2011).

Apart from these health problems, Crippa et al. of Guglielmo da Saliceto Hospital showed that talking on mobile phones also causes a significant acute rise in BP (Crippa et al. 2013). Hypertension is one of the most important risk factors for cardiovascular diseases. The overall rate of hypertension in India is 29.8%, with a prevalence of 27.6% in rural and 33.8% in urban areas (Anchala et al. 2014). In their study conducted in South India, Stalin et al. found that mobile phone usage had a negative association with hypertension (Stalin et al. 2016). However, another study showed that the use of mobile phones

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lowers stress because of the social contact and hence reduces BP (Suresh et al. 2011). These contrasting findings mean that the association between mobile phone usage and hypertension is not clear. Therefore, the main aim of this study was to measure the association between the usage of mobile phones and hypertension.

## Materials and methods

A community-based case control study was conducted among the adults residing in the urban field practice area of the Department of Community Medicine at Pondicherry Institute of Medical Sciences in 2015. The population of this area was 11,835 with the majority belonging to the middle socio-economic class. Individuals with average BP  $\geq 140/90$  mmHg on three readings (or) with hypertension diagnosed within the past year were defined as cases. Controls were individuals with average BP  $\leq 130/85$  mmHg on three readings. Cases and controls were matched for age (frequency matching) and gender. A total of 50 cases and 50 controls were included as study participants. Cases and controls were selected from the community through a door-to-door survey. Study participants were interviewed using a pretested structured questionnaire containing variables such as socio-demographic characteristics, type of mobile phone (ordinary/smartphone), duration and pattern of mobile phone usage, family history of hypertension, consumption of tobacco and alcohol, salt consumption, height, weight and BP. A sphygmomanometer and stethoscope were used for measuring BP, a bathroom weighing scale for measuring weight and a stadiometer for measuring the height of the individual. The data were entered in MS Excel, and analysis was done using SPSS version 17. Means, proportions and odds ratios were calculated. Paired *t* tests and chi-square tests were carried out to define the *p* value. A *p* value  $< 0.05$  was considered statistically significant. Confounding factors such as age, gender, education, socio-economic status, family history, tobacco use, alcohol use, salt consumption and body mass index were adjusted using binary logistic regression, and adjusted odds ratios were calculated. Institutional ethical committee clearance was granted. A participant information sheet written in the local language, namely Tamil, was provided to both cases and controls. Written informed consent was obtained from the study participants. Individuals diagnosed with health problems were counselled and referred to the nearby health centre for further management.

## Results

The comparison of socio-demographic and lifestyle risk factors between cases and controls is shown in Table 1. Due to

**Table 1** Socio-demography and lifestyle-related risk factors for high BP of study participants (*n* = 100)

Variables	Cases ( <i>n</i> = 50)	Controls ( <i>n</i> = 50)	P value
Age group (years)			
18–30	2 (4%)	2 (4%)	0.99
31–40	12 (24%)	12 (24%)	
41–50	13 (26%)	14 (28%)	
51–60	13 (26%)	13 (26%)	
61–70	10 (20%)	9 (18%)	
Gender			
Male	25 (50%)	25 (50%)	1.00
Female	25 (50%)	25 (50%)	
Education			
Higher secondary and above	9 (18%)	18 (36%)	0.29
High school	24 (48%)	18 (36%)	
Up to middle school	17 (34%)	14 (28%)	
Socio-economic status*			
Upper class ( $\geq 71$ \$)	12 (24%)	12 (24%)	0.16
Middle class (11–70.9\$)	37 (74%)	38 (76%)	
Lower class ( $< 11$ \$)	1 (2%)	0 (0%)	
Lifestyle risk factors			
Family history of hypertension	25 (50%)	16 (32%)	0.06
Current tobacco user	6 (12%)	5 (10%)	0.80
Current alcohol user	15 (30%)	7 (14%)	1.00
Predominately non-vegetarian diet	48 (96%)	47 (94%)	0.64
Salt consumption (g) [mean (SD)]	12.1 (4.4)	13.1 (5.0)	0.35
Body mass index (kg/m <sup>2</sup> ) [mean (SD)]	29.4 (6.1)	27.2 (3.9)	0.05
Total	50 (100%)	50 (100%)	

\*Based on modified BJ Prasad classification 2014

matching, age and gender were equally distributed among cases and controls. The proportion of participants with higher secondary education and above was greater among controls (36%) than cases (18%) but this was not statistically significant ( $p < 0.05$ ). A family history of hypertension was more prevalent among cases (50%) than controls (32%). The mean consumption of salt was slightly higher among the controls (5 g) than cases (4.4 g). However, neither of these differences was statistically significant.

Table 2 shows the pattern of mobile phone usage among the study participants. Almost all of them knew how to dial/attend calls. Fourth fifths of the cases knew how to send/read text messages compared with only 50% of the controls ( $p < 0.05$ ). Both cases (40%) and controls (33%) spoke frequently on mobile phones for job-related issues. Cases spoke for the longest time on their mobile phone for job-related issues (33%), whereas controls mostly spoke with their relatives. However, these differences were not statistically significant.

**Table 2** Pattern of mobile phone usage among study participants (*n* = 94)

Variables	Cases ( <i>n</i> = 48)	Controls ( <i>n</i> = 46)	<i>P</i> value
Knows how to dial/attend calls	48 (100%)	44 (96%)	0.24
Knows how to send/read SMS	38 (79%)	23 (50%)	0.00
Type of mobile phone			
Ordinary	31 (65%)	33 (72%)	0.73
Smartphone	17 (35%)	13 (28%)	
Call frequency			
First-degree relatives	13 (27%)	9 (20%)	0.52
Friends	5 (10%)	9 (20%)	
Other relatives	11 (23%)	13 (28%)	
Job related	19 (40%)	15 (33%)	
Speak for maximum duration			
Family members	11 (23%)	9 (20%)	0.35
Friends	9 (19%)	9 (20%)	
Relatives	12 (25%)	19 (41%)	
Job related	16 (33%)	9 (20%)	

Adjusted odds ratios calculated using binary logistic regression and the difference between the mobile phone patterns of cases and controls are shown in Table 3. The mean long-term usage among cases (7.9 years) was higher than among controls (6.2 years), which was statistically significant (*p* <

**Table 3** Association between mobile phone usage and hypertension (*n* = 100)

Variables	Cases ( <i>n</i> = 50)	Controls ( <i>n</i> = 50)	Odds ratio (95% CI)	Adjusted odds ratio* (95% CI)
Duration of usage (years)				
Mean (SD)	7.9 (4.6)	6.2 (3.3)		
> 8 [ <i>n</i> (%)]	21 (65.6)	11 (34.4)	2.6 (1.1–6.5)	6.2 (1.6–23.8)
≤ 8 [ <i>n</i> (%)]	29 (42.6)	39 (57.4)		
Total no. of calls per day				
Mean (SD)	19.3 (23.9)	11.8 (11.7)		
> 20 [ <i>n</i> (%)]	13 (56.5)	10 (43.5)	1.4 (0.6–3.6)	2.0 (0.4–9.2)
≤ 20 [ <i>n</i> (%)]	37 (48.1)	40 (51.9)		
Total call duration per day (min)				
Mean (SD)	114.1 (167.4)	50.8 (64.3)		
> 60 [ <i>n</i> (%)]	21 (67.7)	10 (32.3)	2.9 (1.2–7.1)	4.2 (1.1–16.7)
≤ 60 [ <i>n</i> (%)]	29 (42.0)	40 (58.0)		

\*The following confounding factors were adjusted using binary logistic regression: age, gender, education, socio-economic status, family history, tobacco use, alcohol use, salt consumption and body mass index

0.05). The total number of calls and their length per day were also significantly higher among cases than controls.

### Discussion

It was found that the total duration of mobile phone usage (years), total number of calls per day and total call length per day were significantly higher among cases (hypertensive individuals) than controls (non-hypertensive individuals). Confounding factors such as socio-demography and known risk factors for hypertension were equally distributed in both cases and controls.

In a study conducted by Crippa et al. at Guglielmo da Saliceto Hospital that investigated 94 middle-aged participants taking medication for mild to moderate hypertension, it was found that BP increased from 121/77 to 129/82 when they answered their calls (Crippa et al. 2013). We also found a positive association with hypertension. This could be due to stress/anxiety induced by high usage of mobile phones.

Sivaranjani Suresh et al. conducted a cross-sectional study of 21,135 participants, 13.8% of whom were predominantly mobile phone users. It was found that mobile phone use was inversely associated with hypertension, independent of age, gender, race/ethnicity, smoking, alcohol consumption, education, body mass index (BMI) and physical activity. This inverse association was stronger in women and individual aged < 60 years (Suresh et al. 2011). It is possible that the effects of mobile phone usage could reduce BP because of an increase in parasympathetic activity and reduction in sympathetic activity originating in the brainstem (Reid 1994). Another explanation is that mobile phones increase and sustain the social networks of the users, reducing stress and establishing greater connectedness with their communities (Suresh et al. 2011). Interestingly Braune et al. noted a significant increase in BP in a small group of ten healthy volunteers exposed to the electromagnetic field from a Global System for Satellite Communications (GSM) mobile phone compared with placebo exposure (Braune et al. 1998).

Our analysis was a case control study conducted among participants recruited from the local community. This is one of its strength compared with previous investigations. A potential limitation could be that the information about exposure (total calls and their duration) could have varied from time to time, which could have led to bias.

Our survey findings suggest that there is a positive association between the use of mobile phones and hypertension. However, more detailed studies should be done in future to confirm this relationship.

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## Compliance with ethical standards

**Conflict of interest** The authors declare that they have no conflict of interest.

**Ethical approval** All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

**Informed consent** Informed consent was obtained from all individual participants included in the study.

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