The Journal of Clinical Hypertension

WILEY

META-ANALYSIS OPEN ACCESS

The Impact of Socioeconomic Inequalities on the Risk of Hypertension in Bangladesh: A Systematic Review and Meta-Analysis

Kabir Hossain[1] | Tonmoy Alam Shuvo[1] | Asma-Ul Hosna[1] | Dipu Rani Dey[2]

[1]Department of Statistics, Noakhali Science and Technology University, Noakhali, Bangladesh | [2]Department of Pharmacy, Noakhali Science and Technology University, Noakhali, Bangladesh

Correspondence: Tonmoy Alam Shuvo (tonmoyalamshuvo@gmail.com)

Received: 21 October 2024 | **Revised:** 21 November 2024 | **Accepted:** 25 November 2024

Funding: The authors received no specific funding for this work.

Keywords: Bangladesh | hypertension | noncommunicable disease | social status | socioeconomic

ABSTRACT

Hypertension is a prevalent health issue in Bangladesh, impacting a significant portion of the population. This meta-analysis explored how social status inequalities impact hypertension risk in Bangladesh. We systematically searched various electronic databases and rigorously selected 12 studies for inclusion in the analyses. The I^2 statistic measured between study heterogeneity, and pooled effect estimates were obtained using the DerSimonian and Laird random effects model to address this variability. Publication bias was assessed through a funnel plot and Egger's test. Sensitivity analysis was conducted to evaluate the robustness of the findings. All analyses were performed using STATA 17. The analyses indicated that females had a significantly higher risk of developing hypertension compared to males, with a pooled odds ratio (OR) of 1.15 (95% confidence interval [CI]: 1.02–1.27). Urban residents showed a pooled OR of 1.11 (95% CI: 1.03–1.19) compared to rural residents. The pooled ORs for hypertension were 1.02 (95% CI: 0.89–1.14) for primary education, 1.07 (95% CI: 0.94–1.21) for secondary education, and 1.25 (95% CI: 1.03–1.47) for higher secondary education, suggesting an increasing risk with higher education levels. Wealth status showed a pooled OR of 1.08 (95% CI: 0.87–1.29) for the poorer class, 1.13 (95% CI: 1.04–1.22) for the middle class, 1.38 (95% CI: 0.68–2.07) for the richer class, and 1.49 (95% CI: 0.97–2.00) for the richest class, indicating a greater risk of hypertension among wealthier individuals. Working individuals had a 39% lower risk of hypertension (OR = 0.61, 95% CI: 0.43–0.80) compared to nonworking individuals.

1 | Introduction

Hypertension, often known as high blood pressure, is a major global public health problem because it has a strong correlation with cardiovascular conditions such as heart attacks and strokes [1]. Since hypertension seldom causes symptoms, it is commonly referred to as the "silent killer" [2] and affects over a billion people globally [3]. This condition is responsible for strains of blood vessels and organs, increasing the risk of heart failure, heart attacks, strokes, sudden death, kidney damage, and eyesight loss [4]. According to the World Health Organization (WHO), unusually high blood pressure, often caused by the thickening of artery walls, is responsible for 13% of global mortality each year [5, 6]. A complex interplay of various factors influences the development of hypertension. Age, heredity, and sex are nonmodifiable risk factors [7]. On the other hand, modifiable risk factors include physical inactivity, bad eating habits (especially a high salt intake), obesity, smoking, excessive alcohol use, and stress [8].

Studies conducted worldwide show that the prevalence of hypertension and the risk factors that are related to it vary by area.

For example, dietary habits and alcohol use are often associated with a greater incidence of hypertension in Eastern Europe [9]. In contrast, advances in hypertension treatment have been observed in Western Europe due to improved healthcare infrastructure and public health programs [10]. Hypertension affects about 50% of the US population [11]. The main causes of this trend include sedentary lifestyles, poor food choices, and obesity [12]. Sub-Saharan African studies indicate a high prevalence of ignored and untreated hypertension, mostly attributable to inadequate healthcare infrastructures [13]. Rapid urbanization, dietary changes, and rising levels of stress are the major causes of South Asia's prevalence of hypertension, particularly in countries like Pakistan and India [2]. The prevalence of hypertension in India is over 30%, with urban residents being the most affected [14]. Hypertension remains a rising health concern in Bangladesh [15]. According to the prevalence, one in five persons in Bangladesh who are 25 years of age or older suffer from hypertension [16].

Prehypertension affects around one-third of adults in rural Bangladesh, whereas hypertension affects about one-sixth of them [17]. About 20% of adults and 40%–65% of senior citizens in Bangladesh have high blood pressure [18]. Approximately four out of ten individuals with sedentary lifestyles had hypertension among the urban population in Bangladesh [19]. Higher prevalence rates of hypertension are often linked to lower levels of education [20]. People with lower earnings are more likely to suffer hypertension because they have less access to healthcare and better living circumstances [21]. The risk of having hypertension is additionally affected by one's working status. Stress levels are frequently raised by unemployment or irregular work, especially in urban areas, which increases the risk of hypertension [22].

This study investigated the relationship between social status and hypertension in Bangladesh. Specifically, it examined how socioeconomic indicators such as gender, wealth index, education level, working status, and residence were associated with the risk of developing hypertension. This study provided valuable insights into the social determinants of hypertension in Bangladesh, helping to identify high-risk groups based on socioeconomic status. It also contributed to understanding how social inequalities influence health outcomes, offering a foundation for more equitable healthcare strategies.

2 | Methods

2.1 | Variables

We selected factors such as wealth index (poorest (r), poorer, middle, richer, richest), education level (no education (r), primary, secondary, higher secondary), residence (rural (r), urban), currently doing any work (no (r), yes), and gender (male (r), female).

2.2 | Data Sources and Search Strategy

We extensively examined electronic databases such as MEDLINE/PubMed, Google Scholar, Bangladesh Journals Online, EMBASE, Web of Science, and reference lists of prior studies to locate papers that provided information on the social status-related variable linked to hypertension in Bangladesh. We only considered studies that were published in English. The following search phrases were used: "predictors," "factors," "determinants," "characteristics," "component," "sociodemographic," "hypertension," "occupation," "wealth status," "education," "residence," "socioeconomic," "occupation" etc. Boolean operators "AND" and "OR" were utilized to enhance the search process.

2.3 | Study Selection

We considered any study carried out in Bangladesh that revealed socioeconomic variables linked to hypertension. By taking into account a variety of inclusion criteria, we tried to present a comprehensive, systematic analysis of the problem. The research types (e.g., cross-sectional, cohort, or urban studies), age ranges, and geographic locations were all unrestricted.

2.4 | Data Extraction

All the selected studies were cross-sectional. The author and the year of publication, study year, age range, sample size, and odds ratio (OR) of the selected variables with a 95% confidence interval (CI) were taken from the included studies. The characteristics of the included studies are displayed in Table S1.

2.5 | Evaluation of Study Quality

The included studies' methodological quality was assessed using the Joanna-Briggs Institute's (JBI) critical assessment criteria for cross-sectional studies [23]. The included studies were evaluated and graded independently by two reviewers.

2.6 | Statistical Analysis

The I^2 statistics were used to quantify the between-study heterogeneity of the chosen studies [24]. The pooled effect estimates were calculated using the DerSimonian and Laird random effects model because of study heterogeneity [25]. A funnel plot and Egger's test were used to evaluate potential publication bias [26]. Sensitivity analysis was used to evaluate the findings' robustness. STATA version 17 was used for all analyses.

3 | Results

3.1 | Literature Search

Initially, 780 relevant papers were discovered. Four hundred articles remained after duplicates were eliminated. After examining the abstracts and titles, we eliminated 310 articles that were not relevant. After an extensive examination of all 90 articles to assess their qualifications, 78 were disqualified. We selected 12 articles that met the inclusion criteria for our analysis. The PRISMA statement-based flow diagram illustrates the article search and selection procedures (Figure 1).

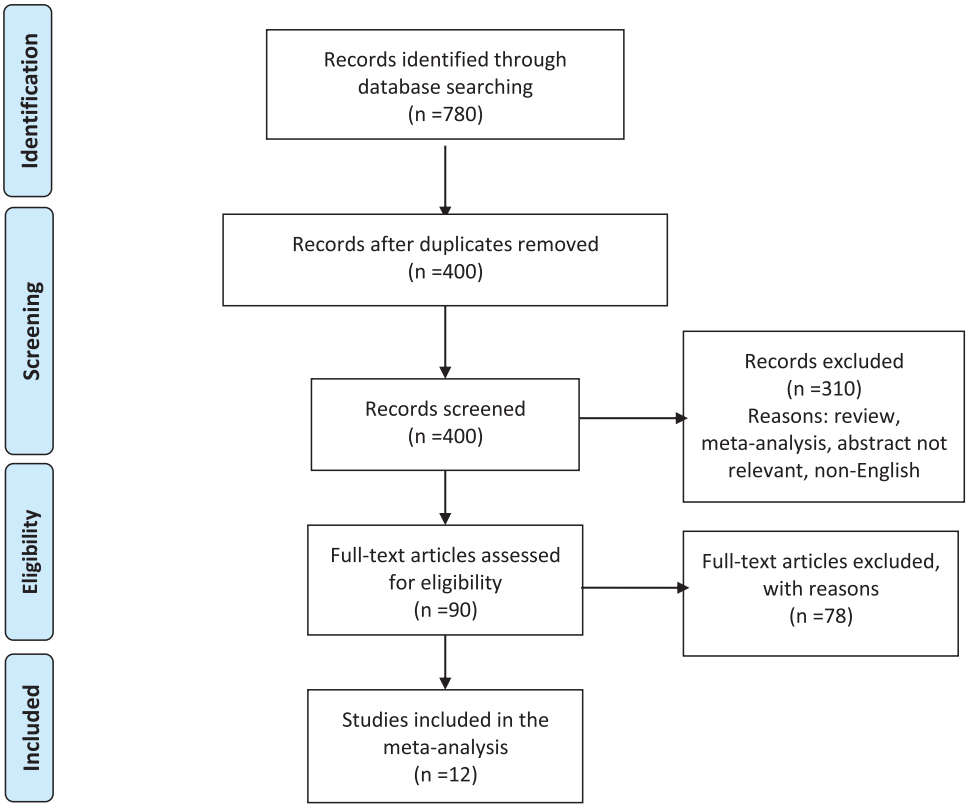

FIGURE 1 | PRISMA diagram.

3.2 | The Pooled Estimate

The analysis showed (Table 1) that females had a pooled OR of 1.15 (95% CI: 1.02–1.27) compared to males, who served as the reference group (OR = 1.00). This indicated that females had 15% higher odds of hypertension than males. The I^2 value of 63.44% suggested moderate heterogeneity among studies included in the analysis, indicating variability in effect sizes across studies. The forest plot of this analysis is presented in Figure S1.

Urban residents had a pooled OR of 1.11 (95% CI: 1.03–1.19), with rural residents as the reference group (OR = 1.00). The OR of 1.11 suggested that urban residents had 11% higher odds of hypertension compared to rural residents. The high I^2 value of 89.86% suggested substantial heterogeneity, meaning considerable variation in the study results. The corresponding forest plot for this analysis can be found in Figure S2.

The analysis examined the relationship between education level and hypertension, using individuals with no education as the reference (OR = 1.00). Those with primary education had a pooled OR of 1.02 (95% CI: 0.89–1.14), reflecting a 2% increase in hypertension odds. Individuals with secondary education had a pooled OR of 1.07 (95% CI: 0.94–1.21), showing a 7% increase in odds.

Those with higher secondary education had a pooled OR of 1.25 (95% CI: 1.03–1.47), indicating 25% higher odds of hypertension compared to those with no education. The heterogeneity was considerable for primary (I^2 = 96.20%) and secondary (I^2 = 93.67%) education, suggesting variability across studies. The moderate heterogeneity (I^2 = 63.74%) for higher secondary education still indicated some study-level differences but was comparatively lower. The forest plots for these analyses are presented in Figures S3–S5.

Individuals in the poorer group had 8% higher odds of hypertension compared to the poorest group, with a pooled OR of 1.08 (95% CI: 0.87–1.29). The middle wealth group showed 13% higher odds of hypertension (OR = 1.13, 95% CI: 1.04–1.22), while the richer group had 38% higher odds (OR = 1.38, 95% CI: 0.68–2.07). The richest group had the highest odds of hypertension, with a 49% increase in risk (OR = 1.49, 95% CI: 0.97–2.00). Figures S6–S9 show the forest plots of the ORs for all categories of wealth index. For the poorer category, moderate heterogeneity was observed (I^2 = 58.59%), indicating some variability among studies. The middle category exhibited relatively low heterogeneity (I^2 = 45.59%), suggesting more consistent findings across studies. In contrast, the richer (I^2 = 65.12%) and richest (I^2 = 63.95%) categories showed moderate heterogeneity, which highlighted variability in effect sizes among the included studies.

The analysis found that working individuals had 39% lower odds of hypertension (OR = 0.61, 95% CI: 0.43–0.80) compared to those who were not working. The high I^2 value of 87.78% indicated substantial heterogeneity among the studies, suggesting variability in the findings across different populations or study designs. The forest plot illustrating these findings can be found in Figure S10.

TABLE 1 | Pooled estimate of the effect size.

Factors		Pooled OR	95% CI	I^2 (%)
Gender	Male (r)	1.00	—	—
	Female	1.15	1.02–1.27	63.44
Residence	Rural (r)	1.00	—	—
	Urban	1.11	1.03–1.19	89.86
Education	No education (r)	1.00	—	—
	Primary	1.02	0.89–1.14	96.20
	Secondary	1.07	0.94–1.21	93.67
	Higher Secondary	1.25	1.03–1.47	63.74
Wealth Index	Poorest (r)	1.00	—	—
	Poorer	1.08	0.87–1.29	58.59
	Middle	1.13	1.04–1.22	45.59
	Richer	1.38	0.68–2.07	65.12
	Richest	1.49	0.97–2.00	63.95
Working Status	No (r)	1.00	—	—
	Yes	0.61	0.43–0.80	87.78

Note: OR = 1.00. r means reference category.
Abbreviations: CI, confidence interval; OR, odds ratio.

3.3 | Publication Bias

The funnel plots showed symmetry (Figures S11–S20), suggesting no visual evidence of publication bias across the meta-analyses. Egger's test results were insignificant ($p > 0.05$), indicating no small-study effects. Overall, there was no indication of publication bias.

3.4 | Sensitivity Analysis

We evaluated the robustness of our meta-analyses using the leave-one-out method. The forest plots of the sensitivity analyses are shown in Figures S21–S30. Consistent patterns across the sensitivity analyses affirmed the reliability and stability of the findings. These results underscored the validity and robustness of our conclusions.

3.5 | Quality of Evidence

The quality of the included studies and their bias risk were summarized in Table S2, assessed using the JBI tool. Most studies were found to have good quality. The table provided a detailed overview, highlighting the strengths and weaknesses of each study. This evaluation ensured transparency in the assessment process. Overall, it offered valuable insights into the reliability of the included studies.

4 | Discussion

This systematic review and meta-analysis investigated factors such as gender, residence, education, working status, and wealth index associated with hypertension in Bangladesh. Based on the result of our meta-analysis, the pooled odds of hypertension in women were 1.15 times higher than in men. Regarding place of residence, individuals living in urban areas were 1.11 times more likely to develop hypertension than individuals in rural areas. The pooled odds of having hypertension were 1.02, 1.07, and 1.25 times higher for those with primary, secondary, and higher secondary education than for those without any education. Additionally, individuals from poorer, middle, richer, and richest wealth index families had 1.08, 1.13, 1.38, and 1.49 times higher chances of developing hypertension than those from the poorest wealth index families. Working people were 39% less likely to develop hypertension than nonworking people (pooled OR 0.61, 95% CI: 0.43–0.80).

A cross-sectional study of individuals aged ≥ 25 in Dhaka, Bangladesh, found that female participants had a 1.21 times higher risk of hypertension than males [27]. A study in Bangladesh found that the prevalence of women with hypertension was 32.3% [28] and 22.1% [29] for married women. Likewise, with our findings, male participants had a significantly lower risk of hypertension than females, with a pooled OR of 0.97 [30]. Research conducted in Bangladesh found that the overall prevalence of hypertension was 26.4%, with a greater prevalence among women (32.4%) compared to males (20.3%) [31]. According to a community-based cross-sectional study done in the Central Indian district of Jabalpur, women were found to have significantly higher odds of hypertension than men, with an OR of 1.40 in urban areas and 1.20 in rural areas [32]. The equivalent results from an Iranian study conducted between 2004 and 2008 with 50,045 healthy participants from Golestan Province showed that female participants had 1.10 times higher odds of developing hypertension than male participants [33].

According to a Bangladeshi study, individuals with primary, secondary, and higher education had odds of 1.12, 1.21, and 1.23 times higher than those with illiteracy for having hypertension [27]. In the north and south of Dhaka, a cross-sectional study found that people with primary, secondary, and higher education had odds of 1.1, 1.5, and 2.1 times higher, respectively, of having hypertension than people with no education [34]. A South Indian study showed that for male participants, the odds of hypertension were 1.03 for those with 5 years of education, 1.01 for those with 8 years of education, and 1.03 for those with 12 years or more of education, in comparison to those who had not attended school [35]. Recent NHANES data showed that in the USA, individuals with higher education levels had 1.96–2.20 times higher odds of hypertension compared to those with less than a high school education [11].

A cross-sectional analysis of nationally representative data from two waves of the Bangladesh Demographic and Health Survey (BDHS) conducted in 2011 and 2017–2018 revealed that urban residents had 1.16 times higher odds of having hypertension than their rural counterparts [36]. According to a systematic review and meta-analysis conducted in Pakistan, participants

living in urban areas had 1.87 times higher pooled odds of having hypertension than participants living in rural areas, which is consistent with our pooled estimate [30]. A study conducted in Northwest China on adults over the age of 18 revealed that the odds of hypertension were 0.16 times lower in rural than in urban areas for those who lived there [37]. A separate cross-sectional study conducted from 2015 to 2017 at a university in Wuhan, China, discovered that the odds of hypertension were 1.86 times higher in urban participants than in rural participants [38]. According to research, the total prevalence of hypertension in Bangladesh was 23.6% (95% CI: 22.5–24.7) in rural regions and 32.6% (95% CI: 30.5–34.8) in urban areas [39].

A consistent finding from a Bangladeshi study indicated that monthly family income was associated with hypertension, with the odds for people with middle-class and higher-class family incomes being 1.88 and 1.59 times higher than for people with lower-class family incomes [27]. An additional hypertension study in Bangladesh reported consistent findings, showing that individuals with higher wealth index scores had increased odds of developing hypertension [18]. Our findings were also supported by evidence indicating that the odds of hypertension were 1.08 times higher for people with middle-class incomes and 1.13 times higher for those with higher incomes when compared to people with lower incomes [30]. According to a community-based cross-sectional study of adults aged 35 and above residing in Kenya, the richest respondents' odds of having hypertension were 1.60 times higher than those in the middle wealth index [18]. Similar results were found in a previous study involving Indian adults aged 15–49, which showed that those from middle, richer, and richest wealth index families had 1.08, 1.13, 1.22, and 1.21 times higher odds of developing hypertension, respectively compared to the poorest group [40].

Similar results to our study were found in a community-based cross-sectional study involving 400 adults in the Bangladeshi districts of Dhaka, Mymensingh, Sylhet, and Khulna. A study showed that the odds of hypertension were 22% lower for farmers and 14% lower for private job holders when compared to unemployed participants [41]. Another study on hypertension in Bangladesh indicated that those in employment had 48% lower odds of having hypertension than those in unemployment [42]. The frequency of hypertension was considerably greater among older respondents [43], females, those from wealthier homes, and those with more education in Bangladesh [44].

Conducting a meta-analysis to explore the link between hypertension and social status provides several advantages. It enhances the overall statistical power and reliability of findings by integrating diverse studies, allowing for a more comprehensive understanding of the relationship. This analysis identifies consistent patterns and effects that may not be evident in individual studies, accounting for variations in study design and population characteristics. By aggregating data, it leads to more generalized conclusions that can inform public health strategies.

The meta-analysis linking hypertension and social status has several limitations. The quality and design of the included studies may vary, which can introduce bias and affect the validity of the overall findings. Potential confounding factors, such as lifestyle choices and access to healthcare, may not be adequately controlled across all studies. The heterogeneity among the populations studied may limit the generalizability of the conclusions, and variations in how social status is measured can lead to inconsistencies in the results.

5 | Conclusion

This meta-analysis highlights the significant influence of socioeconomic factors on hypertension. The study shows that gender, place of residence, education level, working status, and wealth index play crucial roles in shaping the risk of developing hypertension. These findings emphasize the need to consider social determinants in hypertension prevention and management strategies. Addressing these factors through public health policies can help reduce the burden of hypertension, especially in vulnerable populations.

Acknowledgments

The authors have nothing to report.

Ethics Statement

The authors have nothing to report.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The authors have nothing to report.

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Supporting Information

Additional supporting information can be found online in the Supporting Information section.