Non-Communicable Disease is Associated with Productivity Loss of Indonesian Urban Workers

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Abstract. Non-communicable diseases (NCDs) represent a significant health burden, particularly among the working-age population in urban settings. This study investigates the association between NCDs and productivity loss among Indonesian urban workers. 11,542 respondents aged 19 to 64 years from Indonesian Family Life Survey wave 5 were included in this study. The primary variable was the presence of NCDs, including hypertension, diabetes, stroke, cancer, liver disease, heart attack/coronary heart disease, and arthritis/rheumatism, identified through self-reporting. The outcome variable, productivity loss, was measured through absenteeism. The study employed analysis of covariance (ANCOVA) to assess the association between NCDs and absenteeism, adjusting for age, work hours, and nutritional status. Results indicated a significant association between NCDs and higher absenteeism (p=0.000), with NCD-affected individuals showing nearly double the absenteeism rates compared to those without NCDs. This association underscores the need for targeted workplace health interventions to prevent NCDs and their impact on productivity outcomes.

Keywords: Absenteeism, non-communicable disease; productivity loss; urban workers.

1 Introduction

Non-communicable diseases (NCDs) have emerged as a significant public health challenge globally, particularly in low- and middle-income countries (LMICs) such as Indonesia. These diseases, including cardiovascular diseases, diabetes, and chronic respiratory conditions, are now responsible for a substantial proportion of morbidity and mortality in these regions [1,2]. The burden of NCDs is exacerbated by rapid urbanization and the associated lifestyle changes, which contribute to unhealthy behaviors such as smoking and poor dietary choices [3,4]. This health burden is not only a medical concern but also has profound economic implications, as it affects the productivity of the working-age population [5]. In Indonesia, the rapid urbanization has further complicated the NCD crisis, leading to a significant impact on the workforce, particularly in urban settings where unhealthy lifestyle choices are more prevalent [6].

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The economic consequences of NCDs are substantial, with studies indicating that the costs associated with managing chronic diseases can lead to significant productivity losses and disrupt family economies [5,7]. This is particularly relevant in the context of urban workers in Indonesia, many of whom are engaged in informal employment and therefore lack adequate health benefits and protections [8]. Consequently, the interplay between health and economic productivity is critical, as healthier workers are inherently more productive and contribute more positively to the economy [9].

The increasing prevalence of NCDs among urban workers in Indonesia presents a significant public health challenge, particularly in the context of the country's economic development. NCDs are not only a leading cause of death but also a major contributor to productivity loss due to illness-related absenteeism and reduced work capacity [1,2]. Despite the recognition of this issue, there remains a gap in understanding the specific relationship between NCDs and productivity loss, especially within the urban workforce of LMICs like Indonesia.

Addressing the burden of NCDs in urban populations requires a multifaceted approach that includes preventive measures, improved healthcare access, and policies aimed at promoting healthier lifestyles [10]. While various studies have explored the general impact of NCDs on health and economics, there is a need for targeted research that specifically examines the productivity losses attributable to NCDs within urban worker populations in Indonesia. Such research is crucial for informing public health strategies and policies that aim to mitigate the economic impact of NCDs in urban settings.

Recent studies have highlighted the urgent need for interventions that address the health challenges posed by NCDs in urban environments. Research has shown that urbanization is closely linked with lifestyle changes that increase the risk of NCDs, such as increased tobacco use, unhealthy diets, and physical inactivity [3,4]. For instance, the availability of facilities that promote smoking has been directly correlated with the prevalence of smoking among female workers in urban areas, illustrating the direct impact of urban living conditions on health outcomes [6].

Furthermore, the economic implications of NCDs are profound. The cost of managing chronic diseases not only strains healthcare systems but also leads to significant productivity losses, particularly among individuals engaged in informal employment sectors that lack sufficient health coverage [5,8]. The importance of a healthy workforce in driving economic productivity has been well-documented, with studies indicating that investments in health can lead to improved economic outcomes [9].

The global health landscape has shifted, with NCDs now accounting for a larger share of the disease burden compared to communicable diseases. This shift underscores the need for a reevaluation of health policies and resource allocation to effectively address the rising prevalence of NCDs, particularly in LMICs where the healthcare infrastructure may be less equipped to manage these chronic conditions [10].

Despite the growing body of literature on the impact of NCDs, there is a noticeable gap in research specifically addressing the relationship between NCDs and productivity loss in urban workers in Indonesia. While studies have explored the general economic burden of NCDs and their impact on health, few have focused on the specific context of urban workers, who are increasingly at risk due to the pressures of urbanization and lifestyle changes [3]. This gap

highlights the need for research that not only quantifies the productivity losses associated with NCDs but also examines the specific factors contributing to these losses in urban settings.

The objective of this study is to examine the association between non-communicable diseases and productivity loss among urban workers in Indonesia. This research is novel in its focus on the specific context of urban workers, a demographic that is often overlooked in studies of NCDs despite being disproportionately affected by these diseases due to urbanization and associated lifestyle changes [4,6]. The scope of the study lies within the field of nutritional epidemiology, with a particular focus on how lifestyle factors associated with urban living contribute to the burden of NCDs and their impact on productivity. This study aims to fill the research gap by providing empirical evidence on the relationship between NCDs and productivity loss in urban Indonesia, thereby informing public health strategies and policies designed to mitigate the economic impact of NCDs in urban environments.

2 Methods

2.1 Sample and data

This study utilized secondary data from the Indonesian Family Life Survey (IFLS) Wave 5. The analysis focused on respondents aged 19 to 64 years who participated in Wave 5, excluding individuals with missing data for the variables under study. The IFLS is a comprehensive longitudinal survey that provides valuable data on the socioeconomic, demographic, and health conditions of the Indonesian population, making it a robust source for analyzing the impact of non-communicable diseases (NCDs) on productivity loss. Our final sample is 11,542 respondents.

2.2 Variables

Main variables. The main variable in this study was the presence of NCDs. NCDs included hypertension, diabetes, stroke, cancer, liver disease, heart attack/coronary heart disease, and arthritis/rheumatism. NCD status was determined based on self-reports. Specifically, respondents were classified as having an NCD if they answered affirmatively to the question, "Has a doctor/paramedic/nurse/midwife ever told you that you had any of these conditions?" This self-reporting method is consistent with previous research that has utilized similar approaches to identify NCD prevalence in population studies [11].

Outcome variables. The outcome variable was productivity loss, operationalized as absenteeism (%). Absenteeism was calculated by dividing the number of work hours lost due to health conditions by the total expected work hours over a one-week period, then multiplying by 100. This approach to measuring productivity loss aligns with established methods in occupational health research, where absenteeism serves as a key indicator of the economic impact of health conditions on workforce productivity [12,13].

Covariates. The study included several sociodemographic factors: sex, age (years), marital status (single, married, divorced), education level (unschooled, primary school, junior high school, senior high school, tertiary), work hours per week, nutritional status (severely underweight, underweight, normal, overweight, obesity), physical activity (inactive, active), and smoking status (yes, no). Nutritional status was calculated based on body mass index (BMI), a

standard metric for assessing weight categories in relation to health outcomes [14]. Among these covariates, only age, work hours per week, and nutritional status were included in the analysis of covariance (ANCOVA) due to their significant influence on both NCD prevalence and productivity loss.

2.3 Statistical analysis

The statistical analysis was conducted in two main stages. First, the Mann-Whitney U test was used to examine differences in the characteristics of respondents with and without NCDs. This non-parametric test was chosen due to its robustness in handling non-normally distributed data, making it suitable for comparing the sociodemographic characteristics between the two groups.

Second, the relationship between NCDs and productivity loss was analyzed using analysis of covariance (ANCOVA). ANCOVA was employed to adjust for the potential confounding effects of age, work hours per week, and nutritional status on the relationship between NCD status and absenteeism. This method allowed for the control of these covariates while assessing the independent effect of NCDs on productivity loss, providing a clearer understanding of the impact of NCDs on workforce absenteeism. The results from ANCOVA provide insights into how NCDs contribute to productivity loss, accounting for the influence of key sociodemographic factors.

3 Results and Discussion

Table 1 summarizes the characteristics of the study population, comparing participants with non-communicable diseases (NCDs) to those without. The data show that individuals with NCDs were significantly different from those without NCDs across several demographic and lifestyle factors. The mean age of participants with NCDs was 44.0 years, notably higher than the 36.5 years average of those without NCDs, indicating a strong association between age and the prevalence of NCDs. Gender differences were also apparent, with a higher proportion of females in the NCD group (51.3%) compared to the non-NCD group (40.2%). Furthermore, a significant difference was observed in marital status, where 83.5% of individuals with NCDs were married compared to 77.8% in the non-NCD group.

In terms of educational level, the NCD group had a higher percentage of participants who had only completed primary school (28.3%) compared to the non-NCD group (22.4%). Nutritional status was another critical factor, with obesity being more prevalent among those with NCDs (32.9%) than among those without (19.4%). The study also found that individuals with NCDs were more likely to be physically inactive (92.3%) and exhibited higher rates of absenteeism (10.8%) compared to their healthier counterparts.

The findings from this study align with existing literature, which consistently demonstrates a strong correlation between NCDs and various demographic and lifestyle factors such as age, gender, education, and physical inactivity. Similar to this study, global research shows that older adults are more susceptible to NCDs due to cumulative exposure to risk factors over their lifetimes [15]. Additionally, the observed higher prevalence of NCDs among women in this study mirrors findings from other regions, where gender disparities in health outcomes are influenced by biological, social, and behavioral factors [16,17]. For instance, the impact of lifestyle factors such as diet and physical inactivity has been shown to contribute significantly

to the development of NCDs, particularly among women, who may face different societal pressures and barriers to maintaining a healthy lifestyle [18,19].

Table 1. Subject characteristics.

Characteristics	Non-NCD[1] [n (%)]	NCD[1] [n (%)]	Total [n (%)]	p-value[2]
Sex				
Male	5658 (59.8%)	1009 (48.7%)	6667 (57.8%)	0.000
Female	3811 (40.2%)	1064 (51.3%)	4875 (42.2%)	
Age (years)[3]	36.5 ± 0.1	44.0 ± 0.2	37.8 ± 0.1	0.000
Marital status				
Single	1566 (16.5%)	136 (6.6%)	1702 (14.7%)	
Married	7368 (77.8%)	1731 (83.5%)	9099 (78.8%)	0.000
Divorced	535 (5.7%)	206 (9.9%)	741 (6.4%)	
Educational level				
Unschooled	161 (1.7%)	61 (2.9%)	222 (1.9%)	
Primary school	2119 (22.4%)	586 (28.3%)	2705 (23.4%)	
Junior high school	1638 (17.3%)	336 (16.2%)	1974 (17.1%)	0.000
Senior high school	3688 (38.9%)	667 (32.2%)	4355 (37.7%)	
Tertiary	1831 (19.3%)	418 (20.2%)	2249 (19.5%)	
Work hours/week[3]	45.1 ± 0.2	44.2 ± 0.5	44.9 ± 0.2	0.007
Nutritional status				
Severely underweight	127 (1.3%)	15 (0.7%)	142 (1.2%)	
Underweight	747 (7.9%)	85 (4.1%)	832 (7.2%)	
Normal	5448 (57.5%)	931 (44.9%)	6379 (55.3%)	0.000
Overweight	1308 (13.8%)	360 (17.4%)	1668 (14.5%)	
Obesity	1839 (19.4%)	682 (32.9%)	2521 (21.8%)	
Physical activity				
Inactive	8601 (90.8%)	1914 (92.3%)	10515 (91.1%)	0.031
Active	867 (9.2%)	159 (7.7%)	1026 (8.9%)	
Smoking status				
Yes	4327 (45.7%)	777 (37.5%)	5104 (44.2%)	0.000
No	5142 (54.3%)	1296 (62.5%)	6438 (55.8%)	
Absenteeism (%)[3]	5.6 ± 0.1	10.8 ± 0.4	6.5 ± 0.1	0.000
Total	9469 (82.0%)	2073 (18.0%)	11542	

[1] NCD = Non-communicable disease
[2] Based on Mann Whitney test
[3] Data is presented in mean ± standard error

Moreover, the higher obesity rates among individuals with NCDs in this study are consistent with the global trend of increasing obesity, which is a major risk factor for NCDs [20,21]. This pattern is observed in both developed and developing countries, where rapid urbanization and changes in dietary habits contribute to rising obesity levels and associated health conditions [22,23]. The significant correlation between lower educational levels and higher prevalence of NCDs in this study further highlights the role of social inequities in health outcomes, as lower education often limits access to health information and resources needed to prevent and manage NCDs [24,25].

Furthermore, addressing the social determinants of health, such as education and income inequality, is crucial for reducing the burden of NCDs. Public health policies that focus on improving access to education and healthcare services, particularly for disadvantaged populations, could help mitigate the risk factors associated with NCDs [26,27]. These findings

also suggest that gender-specific interventions may be necessary to effectively address the disparities in NCD prevalence, particularly among women, who may face unique challenges related to social and economic inequities [19,28]. The study emphasizes the need for comprehensive public health strategies that not only focus on individual lifestyle changes but also address the broader social and economic factors contributing to the rise of NCDs. Such strategies could significantly reduce the economic impact of NCDs on the workforce and promote a healthier, more productive society in Indonesia.

Table 2 presents the association between NCDs and productivity loss, as measured by absenteeism. The results indicate a significant difference in absenteeism rates between individuals with and without NCDs. In Model 1, which is adjusted for age, individuals with NCDs had an adjusted mean absenteeism rate of 10.4%, compared to 5.7% among those without NCDs. This difference is statistically significant with a p-value of 0.000. In Model 2, which further adjusts for work hours per week and nutritional status, the absenteeism rate among individuals with NCDs slightly increases to 10.6%, while the rate for those without NCDs remains relatively stable at 5.8%. The 95% confidence intervals do not overlap, further confirming the robustness of these findings.

Table 2. Association between non-communicable disease (NCD) and productivity loss (absenteeism)[1].

NCD status	n	Adjusted mean	SE[2]	95%CI[2]	p-value
Model 1[3]					
Non-NCD	9469	5.7	0.1	5.4-6.0	0.000
NCD	2073	10.4	0.3	9.8-11.0	
Model 2[4]					
Non-NCD	9282	5.8	0.1	5.5-6.1	0.000
NCD	2039	10.6	0.3	10.0-11.2	

[1] All analyses were conducted using analysis of covariance (ANCOVA)
[2] SE = standard error; CI = confidence interval
[3] Adjusted for age
[4] Adjusted for age, work hours/week, nutritional status

The findings from this study reinforce the significant association between NCDs and productivity loss, specifically absenteeism. This relationship is consistent with prior research that has demonstrated how NCDs such as diabetes and cardiovascular diseases significantly impact workforce productivity, leading to increased absenteeism [12,29]. The present study's observation that individuals with NCDs have a higher absenteeism rate than those without NCDs is in line with evidence from Namibia and South Africa, where similar trends have been noted among formal sector workers [29,30].

The variation in absenteeism rates between individuals with and without NCDs also reflects broader patterns observed in other regions, where socioeconomic factors, including education and access to healthcare, exacerbate the impact of NCDs on workforce productivity [31,32]. Moreover, the adjustment for work hours and nutritional status in Model 2 of this study underscores the complex interplay between lifestyle factors and NCDs, which is a recurrent theme in global health research. For instance, workplace interventions that address these lifestyle factors have been shown to reduce absenteeism, as seen in studies conducted in Vietnam and Bangladesh, where improved access to health services and education significantly mitigated the impact of NCDs on work attendance [33,34].

The relationship between NCDs and productivity loss can be understood through several theoretical frameworks that highlight the multifaceted impact of chronic illness on individual and economic well-being. One of the central theories is human capital theory, which posits that health is a critical component of human capital that influences an individual's productivity and economic potential. Becker [35] emphasizes that health directly affects the capacity to work, as healthier individuals are generally more productive and less likely to miss work due to illness. In the context of NCDs, chronic conditions diminish this human capital by reducing an individual's ability to perform work-related tasks efficiently, thereby increasing absenteeism and decreasing overall productivity.

Another important framework is the concept of health-related quality of life (HRQoL), which is often diminished in individuals with chronic illnesses. HRQoL encompasses physical, mental, and social well-being, all of which are adversely affected by NCDs [36]. Chronic diseases often lead to physical limitations, psychological distress, and social isolation, which collectively reduce an individual's ability to maintain consistent work attendance and perform effectively when present. This reduction in HRQoL directly correlates with increased absenteeism, as seen in this study and supported by other research that links lower HRQoL scores with higher rates of work-related absenteeism [37].

Furthermore, the theory of education and health provides additional insight into the relationship between NCDs and productivity loss. This theory suggests that education plays a pivotal role in determining health outcomes and, consequently, economic productivity [38]. Higher educational attainment is associated with better health literacy, healthier lifestyle choices, and improved access to healthcare resources, all of which contribute to the prevention and management of NCDs. Conversely, lower educational levels are linked to poorer health outcomes, including a higher prevalence of NCDs, which, as evidenced in this study, lead to greater productivity loss due to increased absenteeism.

The interplay between human capital, HRQoL, and education explains why NCDs are strongly associated with productivity loss. Chronic illnesses undermine the health component of human capital, reduce the quality of life, and are more prevalent among less educated populations, all of which contribute to higher absenteeism and decreased work performance. This theoretical understanding underscores the need for targeted public health interventions that improve health outcomes and protect productivity in the workforce.

The implications of these findings are critical for both public health policy and workplace management. The strong link between NCDs and absenteeism highlights the urgent need for comprehensive workplace health programs that target the prevention and management of NCDs. Such programs could include regular health screenings, nutritional guidance, and initiatives to promote physical activity, which have been proven to reduce the incidence and impact of NCDs in various contexts [13,39]. The effectiveness of these interventions is supported by evidence from other countries, where workplace health initiatives have successfully lowered absenteeism rates among employees with NCDs by addressing key risk factors [11,40].

Furthermore, the study's findings underscore the importance of tailoring public health strategies to address the specific needs of the workforce, particularly in urban settings where the burden of NCDs is often higher due to lifestyle and environmental factors [41]. Policymakers should consider these results when designing interventions that aim to reduce the economic impact of NCDs on productivity. By focusing on both preventive measures and the management of existing conditions, these strategies can help enhance workforce health and productivity, ultimately contributing to more sustainable economic growth [30,31].

4 Conclusion

The findings demonstrate a significant link between the presence of NCDs and increased absenteeism among urban workers in Indonesia. Individuals with NCDs consistently exhibited higher absenteeism rates compared to those without these conditions, even when controlling for relevant sociodemographic factors. This relationship underscores the substantial impact that NCDs have on workforce productivity, reinforcing the importance of public health initiatives aimed at preventing and managing NCDs to reduce their economic burden and enhance overall productivity.

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