HEALTH LITERACY, SOCIAL DETERMINANTS, AND WORKPLACE STROKE PREVENTION AMONG INDONESIAN CIVIL SERVANTS

Siti Rohimah[1*], Idris Adewale Ahmed [2], Tan Chun Hoe [3,] Alharbi a. Khalid[4], Saad A. Amna[5]
[1] *Universitas Galuh; Indonesia;*
[2,3]*Lincoln University College; Malaysia,*
[4,5]*Minister of health of Saudi Arabia, Saudi Arabia*
Corresponding Email: sitirohimahwibi@gmail.com

ABSTRACT

Stroke remains one of the leading causes of disability and premature mortality worldwide and represents an important public health challenge among working-age populations, including Indonesian civil servants. Workplace-based prevention is increasingly recognized as a strategic approach for early detection and risk reduction. This study aimed to examine the role of health literacy and social determinants in predicting higher stroke risk categories and to translate these findings into practical workplace prevention strategies for civil servants. A cross-sectional study was conducted among 387 Indonesian civil servants aged 40 years and above. Stroke risk was categorized into four ordinal levels: very low, low, moderate, and high risk. Health literacy and social determinants were measured using structured questionnaires, and ordinal logistic regression was used for analysis. Most participants were classified as very low risk (80.6%), followed by low risk (9.6%), moderate risk (6.7%), and high risk (3.1%). The overall model was statistically significant ($p = 0.006$). Health literacy showed a significant effect on stroke risk category progression ($p = 0.010$), while social determinants were not statistically significant in the final model. The Nagelkerke R-square value was 0.035, indicating that non-clinical factors explained a modest but meaningful proportion of risk variation. These findings highlight health literacy as an actionable entry point for workplace-based stroke prevention policies. Integrating routine education, targeted risk communication, and early screening programs within civil servant institutions may strengthen preventive health strategies.

Keywords: Health Literacy, Stroke Prevention, Civil Servants, Workplace Health, Social Determinants

INTRODUCTION

Stroke remains one of the most serious global public health problems because it contributes substantially to mortality, long-term disability, and economic burden ((Feigin et al., 2026; Wu & Liu, 2024). According to the World Health Organization (WHO), stroke was the third leading cause of death and disability globally in 2021, with approximately 93.8 million prevalent cases and 11.9 million new cases annually. WHO also reported that the lifetime risk of stroke has increased by nearly 50% over the last two decades, with one in four adults predicted to experience stroke during their lifetime (Owolabi et al., 2021). The World Stroke Organization further estimated that more than 7 million people die from stroke each year worldwide, making stroke one of the most significant contributors to premature mortality and disability-adjusted life years (DALYs) globally (Feigin et al., 2025).

In Indonesia, the burden of stroke is equally alarming. Stroke consistently remains one of the leading causes of death and hospital burden nationwide. Based on the 2023

Indonesian Health Survey (Survei Kesehatan Indonesia/SKI), the national prevalence of stroke reached 8.3 per 1,000 population, indicating that stroke continues to be a major chronic disease problem requiring urgent preventive strategies (kemkes.go.id). Previous national data also showed an increasing trend from Riskesdas 2013, where stroke prevalence was reported at 7.0 per 1,000 population, rising to 10.9 per 1,000 population in Riskesdas 2018, reflecting a substantial epidemiological transition toward non-communicable diseases (Kemenkes RI, 2018).

The increasing burden of cardiovascular disease in Indonesia further strengthens the urgency of stroke prevention. Cardiovascular diseases remain the leading contributors to morbidity and mortality globally, accounting for approximately 19.91 million deaths in 2021, with stroke representing one of the major contributors within this group (heart.org). In Indonesia, hypertension has become one of the most important modifiable risk factors for stroke among productive-age populations. Based on Riskesdas 2018, the national prevalence of hypertension among adults aged ≥18 years increased from 25.8% in 2013 to 34.1% in 2018, showing a substantial rise within five years (Kemenkes RI, 2018). This increase is highly relevant for working-age adults, including civil servants, because hypertension often develops silently during productive years and becomes a major trigger for future stroke events. Riskesdas 2018 also reported increasing behavioral risk factors among people aged 15 years and above, including low fruit and vegetable consumption (95.5%), physical inactivity (35.5%), smoking (29.3%), central obesity (31%), and general obesity (21.8%), all of which contribute significantly to hypertension and cardiovascular disease progression (Situasi & Permasalahan, 2023). These patterns indicate that cardiovascular risk exposure continues to rise across formal sector workers, including ASN populations, and supports the need for workplace-based preventive strategies.

Civil servants represent an important occupational group for workplace-based health promotion because they often experience prolonged sedentary work, occupational stress, irregular physical activity, and lifestyle patterns that may accelerate cardiovascular and cerebrovascular risk (Roth et al., 2018) (Feigin et al., 2022). Since civil servants work within highly structured institutions, preventive interventions can be systematically integrated through workplace health promotion policies, routine screening, and institutional health education programs.

Traditional stroke prevention has largely focused on clinical indicators such as blood pressure, cholesterol, blood glucose, and smoking behavior (Brauer et al., 2024; World Stroke Organization, 2022). However, upstream determinants such as health literacy and social determinants of health also play an important role in shaping preventive behavior and healthcare utilization (Nutbeam & Lloyd, 2021). Health literacy influences an individual's ability to access, understand, evaluate, and apply health information for health decision-making, while social determinants reflect broader socioeconomic and environmental conditions influencing health outcomes (Sørensen et al., 2012).

Previous studies have demonstrated that inadequate health literacy is associated with poor cardiovascular prevention behaviors, delayed treatment seeking, lower adherence to healthy lifestyles, and increased chronic disease burden (Bazoukis et al., 2025; Urstad et al., 2022). Nevertheless, evidence linking health literacy directly to ordinal stroke risk categories among formal workplace populations remains limited, particularly among Indonesian civil servants. Similarly, while social determinants are widely recognized as important contributors to chronic disease prevention, their operational relevance within workplace-based stroke prevention programs remains underexplored.

This study addresses this gap by examining whether health literacy and social determinants predict movement toward higher stroke risk categories among Indonesian civil servants using ordinal logistic regression. More importantly, this paper positions health

literacy as a practical and modifiable intervention point for workplace stroke prevention policy. The findings are expected to support promotive and preventive programs that are feasible, scalable, and sustainable within workplace settings, particularly in strengthening early stroke prevention strategies among Indonesian civil servants through education, routine screening, and institutional health policy integration.

METHOD

Participant Characteristics And Research Design

This study used a quantitative cross-sectional design involving Indonesian civil servants aged 40 years and above, following recommendations for observational public health studies (Von Elm et al., 2017)). The study focused on workplace-based stroke prevention by assessing non-clinical predictors associated with higher stroke risk categories. Participants were recruited from civil servant institutions in Ciamis Regency, West Java, Indonesia.

The dependent variable was stroke risk category, classified into four ordinal levels: very low, low, moderate, and high. Independent variables included total health literacy score and total social determinants score.

Sampling Procedures

A total of 387 participants were included in the final analysis. Participants were selected using an institutional sampling approach among eligible civil servants who met inclusion criteria. Inclusion criteria included active employment status, age 40 years or older, and willingness to participate in the study. Participants with incomplete questionnaire responses were excluded.

Data were collected using structured self-administered questionnaires distributed within workplace settings. Ethical principles including voluntary participation, confidentiality, and informed consent were maintained throughout the study.

Measures And Covariates

Health literacy was measured using a structured instrument assessing the ability to access, understand, appraise, and apply health information. Higher scores indicated better health literacy.

Social determinants included dimensions related to education, economic access, work environment, and social support relevant to workplace health contexts. Higher scores reflected more favorable social conditions.

Stroke risk category was treated as an ordinal outcome based on established risk stratification procedures.

Data analysis

Descriptive statistics were used to describe participant characteristics and the distribution of stroke risk categories. Ordinal logistic regression (proportional odds model) was applied because the outcome variable consisted of ordered categories and the analytical objective was to estimate movement across ranked outcome levels (Setia, 2016) (Bairagi, 2019). Model significance was evaluated using the likelihood ratio test comparing models with and without predictors. Wald tests were used to assess the significance of individual predictors. Statistical significance was determined at $p < 0.05$.

RESULTS AND D ISCUSSION

Results

Table 1. Distribution of Stroke Risk Categories Among Indonesian Civil Servants

Stroke Risk Category	Frequency (n)	Percentage (%)
Very Low (<5%)	312	80.6
Low	37	9.6
Moderate	26	6.7
High	12	3.1
Total	**387**	**100.0**

Table 1 presents the distribution of stroke risk categories among Indonesian civil servants. The majority of participants were categorized as having very low stroke risk (80.6%), followed by low risk (9.6%), moderate risk (6.7%), and high risk (3.1%). These findings indicate that most civil servants were still within the lower-risk category; however, a meaningful proportion had already entered moderate and high-risk categories that require early preventive intervention. This pattern highlights the importance of workplace-based prevention programs that emphasize early identification before disease progression occurs. Preventive strategies should therefore target not only employees with high-risk profiles but also those in lower-risk groups to maintain cardiovascular health over time.

Table 2. Distribution of Health Literacy Levels Among Indonesian Civil Servants

Health Literacy Level	Frequency (n)	Percentage (%)
Poor	6	1.6
Good	293	75.7
Very Good	88	22.7
Total	**387**	**100.0**

Table 2 shows the distribution of health literacy levels among participants. Most civil servants demonstrated good health literacy (75.7%), while 22.7% were categorized as having very good health literacy and only 1.6% showed poor health literacy. Although the majority demonstrated adequate health literacy, the existence of a vulnerable subgroup with limited health literacy remains important for public health intervention. Even small proportions of poor health literacy may contribute significantly to delayed healthcare utilization, poor hypertension management, and low engagement in preventive behavior.

Table 3. Distribution of Social Determinants of Health Among Indonesian Civil Servants

Social Determinants Level	Frequency (n)	Percentage (%)
Poor	155	40.1
Good	226	58.4
Very Good	6	1.6
Total	**387**	**100.0**

Table 3 presents the distribution of social determinants of health. Most participants were categorized as having good social determinants (58.4%), while 40.1% were classified as poor and only 1.6% as very good. These findings suggest that although institutional employment provides structural stability, a considerable proportion of civil servants still experience social conditions that may influence health behavior and access to preventive services. This supports the importance of integrating broader social support into workplace

health promotion policies.

Table 4. Model Fitting Information for Ordinal Logistic Regression

Model	-2 Log Likelihood	Chi-Square	p-value
Intercept Only	365.153		
Final Model	354.783	10.370	0.006

Table 4 presents the model fitting results for ordinal logistic regression. The reduction in -2 Log Likelihood from 365.153 in the intercept-only model to 354.783 in the final model indicates that the inclusion of health literacy and social determinants improved model performance. The likelihood ratio test produced a Chi-square value of 10.370 with p = 0.006.

This result confirms that the model was statistically significant, indicating that at least one predictor contributed meaningfully to explaining movement across stroke risk categories. For a conference paper focused on public health implications, this overall model significance is sufficient to support interpretation without emphasizing deeper statistical complexity.

Discussion

A total of 387 Indonesian civil servants participated in this study. Based on stroke risk stratification, 312 participants (80.6%) were categorized as having very low stroke risk, 37 participants (9.6%) were classified as low risk, 26 participants (6.7%) were in the moderate-risk group, and 12 participants (3.1%) were categorized as high risk. These findings indicate that although most participants were still within the lower-risk category, a substantial subgroup had already entered clinically meaningful levels of elevated stroke risk requiring early preventive attention. The high proportion of participants in the very low-risk category reflects an opportunity for primary prevention before progression toward more severe cardiovascular outcomes. However, the presence of moderate- and high-risk groups among productive-age civil servants demonstrates that stroke prevention cannot rely solely on symptomatic treatment and must be strengthened through early workplace screening and health promotion.

Ordinal logistic regression analysis was conducted because the dependent variable consisted of four ranked categories of stroke risk. The model fit test showed that the predictor model significantly improved compared with the intercept-only model, indicating that health literacy and social determinants contributed meaningfully to explaining movement across stroke risk categories. The value of −2 Log Likelihood decreased from 365.153 in the null model to 354.783 in the final model, with a significance value of p = 0.006. This indicates that at least one predictor significantly contributed to explaining movement toward higher stroke risk categories.

The Wald test showed that health literacy was a statistically significant predictor of stroke risk category progression (p= 0.010). This finding suggests that better health literacy is associated with a lower likelihood of transitioning into higher stroke risk categories. In contrast, social determinants did not show statistical significance in the final model, indicating that their direct effect was not strong enough within this specific institutional population.

The present study demonstrates that health literacy plays an important role in workplace-based stroke prevention among Indonesian civil servants. Participants with better health literacy were less likely to belong to higher stroke risk categories, supporting the view that stroke prevention should begin long before clinical disease becomes evident. This

finding is highly relevant for public health because stroke prevention is often discussed in relation to medical treatment, whereas upstream preventive factors such as health literacy remain underemphasized.

Health literacy refers to the ability to access, understand, evaluate, and apply health information for decision-making in everyday life (Sørensen et al., 2015). Individuals with stronger health literacy are generally more capable of recognizing early warning signs, understanding cardiovascular risk factors, adhering to healthy behaviors, and seeking timely medical consultation (Nutbeam & Lloyd, 2021). In occupational settings, these abilities become particularly important because employees are frequently exposed to sedentary work patterns, time constraints, psychosocial stress, and lifestyle habits that may gradually increase stroke risk.

This finding is consistent with previous studies showing that inadequate health literacy is associated with poor hypertension control, lower medication adherence, delayed healthcare utilization, and higher cardiovascular disease burden (Berkman et al., 2011; Fernandez et al., 2016; Magnani et al., 2018). A systematic review by Magnani et al. (2018) found that limited health literacy significantly increased the risk of adverse cardiovascular outcomes because patients were less likely to engage in preventive behaviors and disease self-management. Similarly, Berkman et al. (2018) reported that low health literacy was strongly associated with poorer preventive care utilization and worse chronic disease outcomes.

In the Indonesian context, this issue becomes increasingly important because cardiovascular risk factors continue to rise among working-age populations. Riskesdas 2018 reported that hypertension prevalence increased from 25.8% in 2013 to 34.1% in 2018, while physical inactivity, obesity, and unhealthy dietary patterns also showed substantial increases (Kementerian Kesehatan RI, 2018). These conditions are particularly relevant among civil servants, whose work environments often involve prolonged sitting, administrative workload, irregular physical activity, and occupational stress. Therefore, workplace health promotion should not be limited to annual medical check-ups but should also strengthen daily preventive capacity through health literacy interventions.

Although social determinants were not statistically significant in the final model, this does not imply that they are unimportant. Social determinants of health remain fundamental drivers of long-term cardiovascular outcomes because they shape education access, health service utilization, occupational conditions, and opportunities for healthy living (Marmot, 2020) (World Stroke Organization, 2022). In this study, the lack of significance may be explained by the relative homogeneity of the ASN population. Civil servants generally share similar employment security, income structure, and institutional access to healthcare, which may reduce measurable variation in social determinant indicators compared with more heterogeneous community populations.

This interpretation is supported by previous research showing that the direct statistical effect of social determinants may weaken in relatively stable occupational groups but still operate indirectly through health literacy, behavioral choices, and preventive service utilization (Braveman et al., 2011). In other words, social determinants may function more strongly as structural background conditions rather than immediate predictors within the regression model.

The practical implication of this study is the need to reposition workplace health promotion as a strategic public health intervention rather than a routine administrative activity. WHO emphasizes that workplaces are one of the most effective settings for non-communicable disease prevention because they allow repeated exposure to education, systematic monitoring, and policy-based behavior change (World Health Organization, 2022). Civil servant institutions are especially suitable for this approach because they

possess structured governance systems, mandatory occupational health programs, and large populations of middle-aged employees at increasing cardiovascular risk.

Several concrete interventions can be derived from these findings. First, regular health literacy programs should be integrated into institutional health promotion, focusing on hypertension awareness, stroke warning signs, dietary behavior, physical activity, and medication adherence. Second, simplified risk communication tools should be developed to help employees understand their personal stroke risk in practical language rather than relying solely on technical clinical reports. Third, routine screening pathways should be strengthened through periodic blood pressure checks, cardiovascular risk assessment, and referral systems for employees identified as moderate or high risk.

Importantly, workplace prevention should move beyond curative responses and adopt a preventive culture. Health literacy offers a highly feasible entry point because it is modifiable, scalable, and relatively low-cost compared with hospital-based intervention. Unlike non-modifiable risk factors such as age or genetics, health literacy can be improved through structured education, organizational support, and policy commitment. This makes it particularly valuable for sustainable public health planning.

This study contributes academically by linking epidemiological findings with workplace prevention policy without overemphasizing statistical complexity, making the findings more relevant for public health communication and conference dissemination. Rather than presenting regression results solely as statistical evidence, the study translates them into institutional health strategies relevant to civil servant management. This translational perspective strengthens the public health value of the research and aligns with global calls for prevention-oriented health systems.

Overall, the results suggest that stroke prevention among civil servants should be approached not only through biomedical surveillance but also through empowerment-based strategies that strengthen employees' capacity to manage their own health risks. Health literacy should therefore be considered a central component of workplace stroke prevention policy in Indonesia

LIMITATION OF THE STUDY

This study has several limitations. First, the cross-sectional design limits causal interpretation between predictors and stroke risk categories. Second, the use of self-reported questionnaires may introduce response bias. Third, additional predictors such as clinical indicators, lifestyle behaviors, and psychosocial factors should be considered in future studies to strengthen model comprehensiveness and improve preventive interpretation. Finally, the study focused on civil servants in one regional setting, which may limit generalizability to other occupational populations.

CONCLUSIONS AND SUGGESTIONS

Health literacy is a significant predictor of progression toward higher stroke risk categories among Indonesian civil servants, while social determinants did not show statistical significance in the final ordinal model. Although most participants were classified in the very low-risk category, the presence of moderate and high-risk groups indicates the need for systematic preventive strategies within workplace settings.

The findings suggest that workplace stroke prevention should prioritize health literacy as a central intervention point. Educational strengthening, regular health communication, and institution-based screening policies can improve preventive readiness and reduce long-term stroke burden among civil servants. Future research should incorporate broader

behavioral and clinical predictors, longitudinal follow-up, and external validation across different workplace sectors to strengthen predictive accuracy and policy relevance).

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ETHICAL CONSIDERATIONS

Funding Statement.

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Conflict of Interest Statement

The authors declare no conflict of interest related to this study.

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