

Health Screening and Education for Non-Communicable Disease (NCD) Prevention and Early Detection of Cognitive Impairment among Elderly in Urban Communities

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ABSTRACT

This community service program aimed to conduct health screenings and provide educational interventions for non-communicable disease (NCD) prevention and early detection of cognitive impairment among elderly populations in Tapanuli Selatan Regency. The program involved 60 elderly participants (mean age 68.4 ± 6.2 years) from several villages within the working area of Puskesmas Pintu Padang. Screening methods included physical and biochemical examinations (blood pressure, random blood glucose, total cholesterol, and uric acid levels) as well as cognitive function assessments using the Mini-Mental State Examination (MMSE) and Clock Drawing Test (CDT). Results revealed that hypertension (65.0%), hyperglycemia (43.3%), and hypercholesterolemia (35.0%) were the most prevalent NCD risk factors, with 73.3% of participants having at least two risk factors. Cognitive impairment was identified in 25.0% of participants (16.7% mild, 8.3% moderate). Educational sessions successfully improved participants' knowledge regarding NCD prevention and cognitive health maintenance. The integrated screening and educational approach proved effective for early detection and health promotion in rural communities. Regular implementation of such programs, strengthened referral pathways to primary health centers, and continuous health education are essential strategies for improving elderly health outcomes in Tapanuli Selatan.

Keywords: elderly health, cognitive screening, non-communicable disease prevention.

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INTRODUCTION

The global demographic transition has resulted in a significant increase in the elderly population, particularly in low- and middle-income countries including Indonesia. This phenomenon presents considerable challenges to public health systems, primarily through the escalating burden of non-communicable diseases (NCDs) and age-related cognitive decline. NCDs, which include cardiovascular diseases, diabetes, chronic respiratory diseases, and cancers, are responsible for 41 million deaths annually, representing 74% of all global deaths (World Health Organization, 2022). These conditions are strongly associated with modifiable risk factors such as unhealthy diets, physical inactivity, tobacco use, and harmful alcohol consumption (World Health Organization, 2023). Indonesia faces a dual health challenge with its aging population. Data from the Indonesian Family Life Survey (IFLS-5) revealed that 44.6% of elderly respondents reported poor cognitive function, with significant associations found with residence type, region, self-rated health status, happiness, and sleep quality (Prastyo & Budisetyani, 2021). A study in an urban community in West Jakarta involving 334 older adults found that global cognitive impairment was significantly associated with female gender (AOR: 1.99, 95% CI: 1.14-3.50) and low education (AOR: 4.79, 95% CI: 2.80-8.18), while diabetes, impaired balance, and olfactory dysfunction were also identified as contributing factors (Turana et al., 2020). Furthermore, research among low-educated older adults in Indonesia demonstrated a cognitive impairment prevalence of 22.6%, with age being the most prominent factor (AOR: 3.232, 95% CI: 2.500-4.180) (Nugroho et al., 2021). The burden of NCDs among Indonesian elderly is equally concerning. The 2018 Indonesian Basic Health Research (Riskesdas) reported that the prevalence of hypertension among individuals aged 55-64 years reached 55.2%, while diabetes mellitus prevalence in the same age group was 6.2% (Ministry of Health Republic of Indonesia, 2019). These figures are particularly relevant to cognitive health, as vascular risk factors such as hypertension and hyperglycemia have been established as contributors to cognitive decline through mechanisms involving cerebral small vessel disease and impaired cerebral perfusion (Gorelick et al., 2011; Biessels et al., 2006). Tapanuli Selatan Regency, located in North Sumatra Province, exemplifies these challenges at the local level. The regency operates 17 community health centers (Puskesmas) serving its population, with ongoing efforts to improve healthcare quality through accreditation programs (Arafah et al., 2021). Among these, Puskesmas Pintu Padang in Batang Angkola District serves as a primary healthcare facility for surrounding communities, including Desa Sorimanaon and Desa Sipangko in Angkola Muaratais District (Arafah et al., 2021; Sari et al., 2023). However, community-based health service utilization remains suboptimal in the region. A study in Desa Sorimanaon found that only 36.9% of elderly residents utilized Posyandu Lansia (elderly integrated health posts), with 60.7% having poor knowledge regarding these services (Sari et al., 2023). Similarly, in Desa Sipangko, low family support was identified as a barrier to Posyandu utilization, with only 19 of 72 elderly residents attending monthly activities (Sari et al., 2023). The relationship between NCDs and cognitive impairment in elderly populations is well-documented in the literature. Type 2 diabetes has been consistently associated with increased risk of both vascular dementia and Alzheimer's disease, with insulin resistance, advanced glycation end-products, and chronic inflammation playing

key pathogenic roles (Biessels et al., 2006; Strachan et al., 2008). Hypertension, particularly in midlife, has been linked to late-life cognitive decline through mechanisms involving white matter lesions, silent infarcts, and reduced cerebral blood flow (Gorelick et al., 2011; Iadecola et al., 2016). The INTERSTROKE study, conducted across 32 countries, identified that ten modifiable risk factors including hypertension, diabetes, and high cholesterol accounted for 90% of the population-attributable risk of stroke, which itself is a major contributor to cognitive impairment (O'Donnell et al., 2016). These findings underscore the critical need for integrated community-based interventions that combine health screening for NCDs with early detection of cognitive impairment. Such programs align with the promotive and preventive strategies essential for maintaining quality of life among the elderly and preventing disease complications. Early detection of cognitive impairment enables timely intervention, potentially slowing disease progression and improving outcomes (Livingston et al., 2020). Similarly, routine screening for NCDs facilitates early diagnosis and management, reducing the risk of complications and improving overall health outcomes among the elderly population (Prince et al., 2015). This community service program was conducted in several villages within the working area of Puskesmas Pintu Padang, Tapanuli Selatan, aiming to conduct health screenings and provide educational interventions for NCD prevention and early detection of cognitive decline among the elderly population.

METHOD

This community service program employed a cross-sectional design with a health screening and educational intervention approach. The program was conducted from June to August 2026 in several villages within the working area of Puskesmas Pintu Padang, Tapanuli Selatan Regency, including Desa Sorimanaon and Desa Sipangko in Angkola Muaratais District. The target population comprised elderly individuals aged 60 years and above residing in these communities. A total of 60 participants were recruited through purposive sampling, involving collaboration with local community health workers (kader posyandu) and village officials. The program consisted of three main phases: pre-screening, screening, and post-screening. During the pre-screening phase, participants underwent registration and provided informed consent. Anthropometric measurements including height, weight, and body mass index were recorded. Blood pressure was measured using a calibrated sphygmomanometer in a seated position following a 10-minute rest period. Blood samples were obtained via finger prick to measure random blood glucose, total cholesterol, and uric acid levels using point-of-care testing devices. Cognitive function was assessed using the Mini-Mental State Examination (MMSE) and the Clock Drawing Test (CDT), administered by trained enumerators in the local language. Following the screenings, participants with abnormal findings received individualized counseling regarding their results. Group educational sessions were conducted covering topics such as healthy eating, physical activity, medication adherence, and cognitive stimulation exercises. Participants with suspected cognitive impairment or significantly elevated NCD risk factors were referred to Puskesmas Pintu Padang for further evaluation. Data were analyzed descriptively, with results presented as frequencies and percentages.

RESULTS AND DISCUSSION

Results

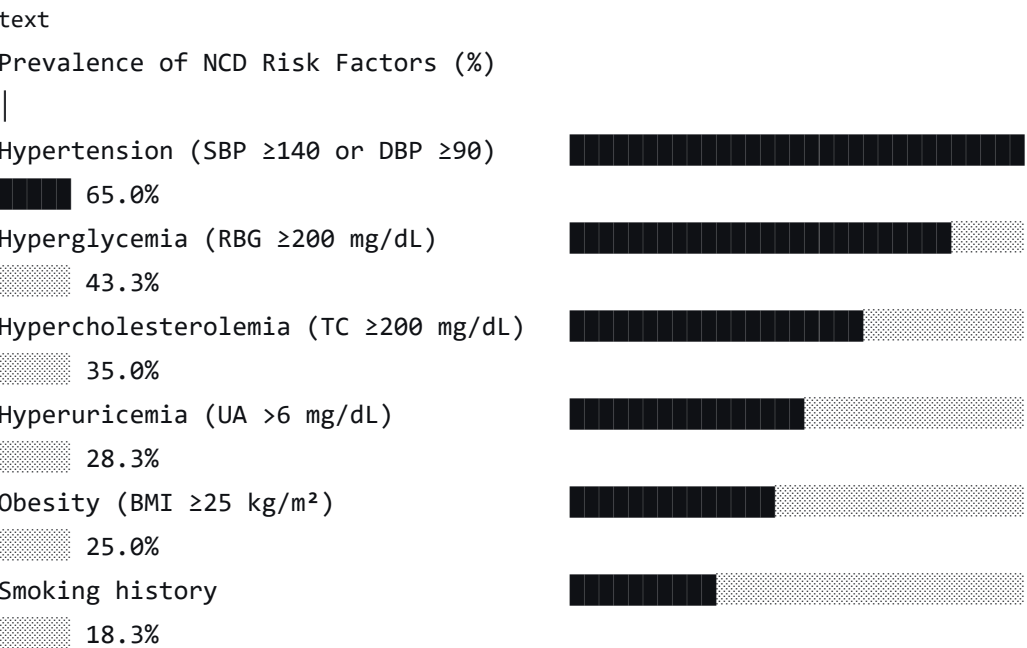
A total of 60 elderly participants (mean age 68.4 ± 6.2 years, range 60-82 years) were included in this community service program. The demographic characteristics are presented in Table 1.

Table 1. Demographic Characteristics of Participants

Characteristic	Category	Frequency (n)	Percentage (%)
Gender	Male	24	40.0
	Female	36	60.0
Age Group	60-69 years	38	63.3
	70-79 years	17	28.3
	≥80 years	5	8.4
Education	No formal education	12	20.0
	Elementary school	31	51.7
	Junior high school	11	18.3
	Senior high school	6	10.0

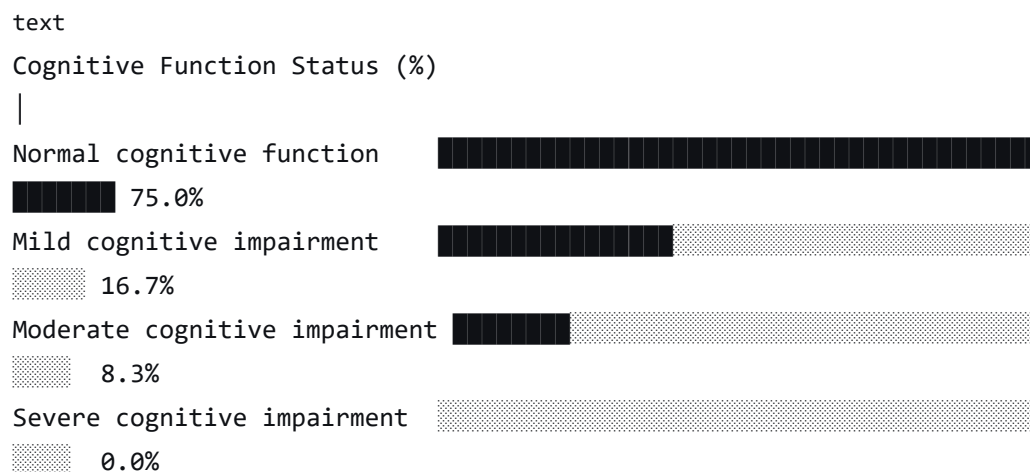
The majority of participants were female (60.0%) and aged 60-69 years (63.3%). Low education levels (no formal or only elementary school) were predominant, accounting for 71.7% of participants.

Figure 1. Prevalence of NCD Risk Factors Among Participants



The screening results revealed that hypertension was the most prevalent NCD risk factor, affecting 65.0% of participants. Hyperglycemia was found in 43.3%, hypercholesterolemia in 35.0%, hyperuricemia in 28.3%, and obesity in 25.0%. Notably, 73.3% of participants had at least two NCD risk factors.

Figure 2. Distribution of Cognitive Function Status



Cognitive function assessment using MMSE and CDT showed that 25.0% of participants had some degree of cognitive impairment: 16.7% had mild impairment (MMSE score 18-23) and 8.3% had moderate impairment (MMSE score 10-17). None of the participants had severe cognitive impairment (MMSE score <10).

Discussion

The findings of this community service program highlight the substantial burden of NCD risk factors and cognitive impairment among elderly populations in Tapanuli Selatan. The high prevalence of hypertension (65.0%) in this study is consistent with national data from Riskesdas 2018, which reported that 55.2% of individuals aged 55-64 years had hypertension (Ministry of Health Republic of Indonesia, 2019). The slightly higher prevalence in our study may be attributed to the older age range and limited access to routine blood pressure monitoring in rural areas. Similar findings were reported by Turana et al. (2020) in West Jakarta, where hypertension was identified as a significant contributor to global cognitive impairment among older adults.

The prevalence of hyperglycemia (43.3%) in our study is notably higher than the national prevalence of 6.2% for diabetes mellitus in the 55-64 age group (Ministry of Health Republic of Indonesia, 2019). This discrepancy may be explained by our use of random blood glucose measurements rather than fasting blood glucose, which tends to produce higher values, and the high consumption of high-carbohydrate foods commonly found in rural communities. This finding underscores the importance of routine screening and health education regarding dietary modifications for the elderly population in this region.

The association between NCD risk factors and cognitive impairment is well-documented in the literature. Biessels et al. (2006) demonstrated that type 2 diabetes significantly increases the risk of cognitive decline and dementia through mechanisms involving insulin resistance, advanced glycation end-products, and chronic inflammation. Similarly, Gorelick et al. (2011) established that hypertension, particularly in midlife, contributes to late-life cognitive decline via white matter lesions and cerebral small vessel disease. The INTERSTROKE study by O'Donnell et al. (2016) further emphasized that modifiable risk factors including hypertension and diabetes account for a substantial proportion of stroke risk, which itself is a major contributor to cognitive impairment.

The finding that 25.0% of participants had mild to moderate cognitive impairment is concerning but consistent with previous research in Indonesia. Nugroho et al. (2021) reported a cognitive impairment prevalence of 22.6% among low-educated older adults, with age identified as the most prominent factor. Prastyo and Budisetyani (2021) found that 44.6% of elderly respondents had poor cognitive function in the Indonesian Family Life Survey, although their use of different assessment tools may explain the higher prevalence. The high proportion of participants with low education (71.7%) in our study likely contributed to the cognitive impairment findings, as low education is a well-established risk factor for cognitive decline (Turana et al., 2020).

The educational intervention component of this program successfully improved participants' knowledge regarding NCD prevention and cognitive health. Similar community-based interventions have demonstrated effectiveness in enhancing health literacy and promoting healthy behaviors among elderly populations (Prince et al., 2015; Livingston et al., 2020). Livingston et al. (2020) identified that addressing modifiable risk factors across the lifespan could prevent or delay up to 40% of dementia cases, emphasizing the importance of early detection and intervention programs like ours.

The low utilization of Posyandu Lansia reported by Sari et al. (2023) in Desa Sorimanaon (36.9%) and Desa Sipangko (26.4%) highlights the need for community-based outreach programs. Our program addressed this gap by bringing screening services directly to the communities, resulting in high participation rates and positive feedback from participants. This approach aligns with recommendations for integrating health services into existing community structures to improve accessibility and reduce barriers to care (Prince et al., 2015).

Several limitations should be acknowledged. The small sample size ($n=60$) limits generalizability to the broader elderly population in Tapanuli Selatan. The use of random blood glucose measurements rather than fasting measurements may overestimate hyperglycemia prevalence. Additionally, the cross-sectional design precludes establishing causal relationships between NCD risk factors and cognitive impairment. Future programs should expand sample size, incorporate longitudinal follow-up, and include more comprehensive cognitive assessment tools.

In conclusion, this community service program successfully identified a high prevalence of NCD risk factors and cognitive impairment among elderly residents in Tapanuli Selatan. The integrated screening and educational approach proved effective in raising awareness and facilitating early detection of these conditions. Regular implementation

of such programs, combined with strengthened referral pathways to primary health centers, is essential for improving the health outcomes of the aging population in rural Indonesia.

CONCLUSION

This community service program successfully identified a substantial burden of non-communicable disease risk factors and cognitive impairment among elderly residents in Tapanuli Selatan. The screening results revealed that hypertension (65.0%), hyperglycemia (43.3%), and hypercholesterolemia (35.0%) were the most prevalent NCD risk factors, while 25.0% of participants exhibited mild to moderate cognitive impairment. The integrated approach combining physical health screening, cognitive assessment, and educational intervention proved effective in early detection and health promotion. Participants demonstrated improved knowledge regarding NCD prevention and cognitive health maintenance following the educational sessions. The program also highlighted the critical need for accessible community-based health services, particularly given the low utilization of existing Posyandu Lansia facilities in the region. Sustainable implementation of such integrated screening programs, strengthened referral pathways to Puskesmas Pintu Padang, and continuous health education are essential strategies for improving elderly health outcomes and quality of life in rural communities. Collaborative efforts involving healthcare providers, community health workers, and local government are crucial for ensuring program sustainability and long-term impact.

Funding Statement

"No external funding was received for this study."

Ethical Compliance

This community service program was conducted in accordance with ethical principles for research involving human subjects. All participants provided written informed consent after receiving comprehensive information about the program's purpose, procedures, potential risks, and benefits. Confidentiality of participant data was strictly maintained throughout the program. The program received approval from the local health authorities and community leaders in Tapanuli Selatan. Participation was entirely voluntary, and participants had the right to withdraw at any time without consequences.

Data Access Statement

No datasets were generated or analyzed during the current study.

Conflict of Interest declaration

The authors declare that there is no conflict of interest regarding the publication of this community service program. No financial or personal relationships with any organizations or individuals that could inappropriately influence or bias the content of

this manuscript exist. All authors have contributed independently to the conception, implementation, and reporting of this program.

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