

## Vital Health Indicator Screening for Early Detection of Non-Communicable Diseases in Sigapiton Village, North Sumatra

Muh. Arfah<sup>1\*</sup>, Cut Saura Salmira<sup>2</sup>, Andi Muh Zulfikar<sup>3</sup>, Nasrilia Rahmadina<sup>4</sup>, Yuan Pariasi<sup>5</sup>, Mahani Datita Sitepu<sup>5</sup>, Teresia Talantan Kondolele<sup>6</sup>

<sup>1</sup> Universitas Sunan Gresik

Jl. Kiai H. Syafi'i, Dahanrejo, Kebomas District, Gresik 61124, Indonesia

<sup>2</sup> Institut Kesehatan Helvetia Medan

Jl. Sumarsono No. 107, Helvetia, Sunggal District, Deli Serdang Regency, North Sumatra 20124, Indonesia

<sup>3</sup> Sekolah Tinggi Ilmu Kesehatan Sumber Waras

Jl. Kyai Tapa No. 1, Grogol Petamburan, West Jakarta, Special Capital Region of Jakarta 11440, Indonesia

<sup>4</sup> Universitas Sebelas Maret

Jl. Ir. Sutami 36A, Surakarta, Central Java 57126, Indonesia

<sup>5</sup> Universitas Lambung Mangkurat

Jl. A. Yani Km. 36, Banjarbaru, South Kalimantan 70714, Indonesia

<sup>6</sup> Universitas Tamalatea Makassar

Jl. Perintis Kemerdekaan Km. 12, Tamalanrea, Makassar, South Sulawesi 90242, Indonesia

### Article Info

#### Article history:

Received April 20, 2026

Revised May 5, 2026

Accepted May 21, 2026

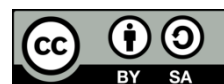
#### Keywords:

Health Screening, Non-Communicable Diseases, Blood Pressure, Blood Glucose, Cholesterol, Uric Acid, Health Education

### ABSTRACT

Non-communicable diseases (NCDs) pose a growing global health burden, including in rural Indonesia. This community service program conducted vital health indicator screenings—covering blood pressure, blood glucose, uric acid, and total cholesterol—alongside structured health education on NCD prevention and control for residents of Sigapiton Village, Ajibata District, Toba Regency, North Sumatra. The program applied a community-based health screening approach with a quantitative descriptive design combined with a health education intervention. A total of 87 participants were enrolled (mean age  $46.3 \pm 12.7$  years; 43.7% male, 56.3% female). Screening findings revealed hypertension in 34.5%, elevated blood glucose in 18.4%, hyperuricemia in 27.6%, and high total cholesterol in 31.0% of participants. Pre-post test evaluation demonstrated a mean knowledge score improvement of 27.5 points (from  $52.3 \pm 9.1$  to  $79.8 \pm 7.4$ ), with the greatest gains in knowledge of modifiable NCD risk factors (+35.2 points) and the benefits of routine health check-ups (+31.6 points). Notably, 72.4% of participants had never undergone any preventive health examination in the past year, underscoring the critical diagnostic gap in this rural setting. The high prevalence of hyperuricemia—exceeding the national average—reflects local dietary patterns rich in high-purine foods common in the Lake Toba region. Community-based health screening combined with contextual health education proved effective as an early detection and prevention strategy for NCDs at the village level. Routine integration of such programs into the existing primary health care system is recommended.

This is an open access article under the [CC BY-SA](https://creativecommons.org/licenses/by-sa/4.0/) license.



### Corresponding Author:

Muh. Arfah

Universitas Sunan Gresik

Email: [muh.arfah.lecturer@usg.ac.id](mailto:muh.arfah.lecturer@usg.ac.id)

## INTRODUCTION

Non-communicable diseases (NCDs) currently represent the greatest health burden worldwide, including in Indonesia. According to the World Health Organization (WHO, 2023), NCDs account for more than 74% of deaths globally each year. The WHO's Global Status Report on NCDs (2022) warns that without comprehensive intervention, NCD-related mortality is projected to rise to 52 million deaths per year by 2030. This trend is not confined to high-income countries; it is increasingly prevalent in developing nations, particularly in rural areas with limited access to preventive health services.

In Indonesia, the 2018 National Basic Health Research (Riskesmas) published by the Ministry of Health recorded significant increases in the prevalence of hypertension, diabetes mellitus, hyperuricemia, and dyslipidemia. Hypertension was reported in 34.1% of adults, diabetes mellitus in 10.9% based on blood tests, while dyslipidemia was found in a substantial proportion of the working-age group. A national study by Mihardja et al. (2019) confirmed that NCD risk factors have spread widely to the lowest socioeconomic strata, including rural communities.

Sigapiton Village, located in Ajibata District, Toba Regency, North Sumatra, lies on the shores of Lake Toba. Geographically, it is relatively isolated from centralized health services. The majority of residents work in agriculture and fishing, with limited health literacy. A study by Hasibuan et al. (2020) on rural communities in North Sumatra found that more than 60% of residents had never undergone preventive health check-ups in the past year, a profile consistent with findings from the team's preliminary survey of Sigapiton Village.

Community-based health screening is a proven public health intervention for the early detection of NCD risk factors, enabling identification of at-risk individuals before disease progresses to more serious conditions. Vasan et al. (2018) demonstrated in a large-scale study published in *The Lancet* that community-based NCD screening in developing countries reduced cardiovascular complication rates by up to 22% over three years when followed by appropriate management. Furthermore, health education accompanying screening activities has been shown to improve health knowledge, attitudes, and behaviours (Notoatmodjo, 2012).

Based on this background, the community service team organised vital health indicator screening—encompassing blood pressure measurement, blood glucose, uric acid, and total cholesterol—combined with health education on NCD prevention and control through healthy lifestyle practices. This initiative is intended to serve as an initial step toward early NCD detection while enhancing health awareness and self-care capacity among Sigapiton Village residents.

## IMPLEMENTATION METHOD

### Program Design

This program employed a community-based health screening approach with a quantitative descriptive design combined with a health education intervention. The quantitative descriptive design was selected to objectively and measurably portray the distribution and prevalence of NCD risk factors in the target population. The educational intervention component was designed using health belief model principles (Rosenstock, 1974) to maximise changes in participants' knowledge and motivation for healthy behaviour. The program was non-experimental and did not involve a control group.

### Time and Location

The program was conducted in November 2025 at the Sigapiton Village Hall, Ajibata District, Toba Regency, North Sumatra. The site was selected based on findings from a preliminary survey indicating minimal community access to preventive health screening and a high rate of unaddressed health complaints.

### Target Participants

Target participants were all Sigapiton Village residents aged  $\geq 18$  years who were willing to participate voluntarily in all program activities and who signed an informed consent form. Participant recruitment was conducted through coordination with the village head and local health cadres using purposive community sampling. A total of 87 individuals met the inclusion criteria and participated. Demographic characteristics are presented in Table 1.

### Equipment and Materials

Equipment used included: (1) a digital sphygmomanometer for blood pressure measurement; (2) a glucometer and blood glucose test strips; (3) a portable uric acid meter with reagent strips; (4) a portable total cholesterol meter with reagent strips; and (5) weighing scales and a stadiometer for Body Mass Index (BMI) calculation. All equipment was calibrated prior to use and met clinical measurement standards.

### Procedure

The program was conducted in three main stages. First, the preparation stage involved site surveys, coordination with village officials and the local Community Health Centre (Puskesmas), development of the knowledge assessment instrument (a Guttman-scale pre-post test questionnaire), and preparation of equipment and materials. Second, the screening stage began with informed consent and pre-test questionnaire completion, followed by measurements of body weight, height, blood pressure, and capillary blood sampling for random blood glucose, uric acid, and total cholesterol. Third, the health education stage was delivered in an interactive format using flip charts and leaflets, covering the definition and types of NCDs, modifiable risk factors, early signs and symptoms, and practical guidelines for healthy living. Participants completed the post-test questionnaire after the session.

### Data Analysis

Screening data were analysed using descriptive statistics including frequency distribution, percentage, mean, and standard deviation (SD). Demographic characteristics were reported as mean  $\pm$  SD for continuous variables and frequency (%) for categorical variables. Screening results were cross-tabulated with sex and age group to identify the highest-risk subgroups. Clinical reference values were based on Ministry of Health Indonesia guidelines and international consensus: systolic  $\geq 140$  mmHg and/or diastolic  $\geq 90$  mmHg (hypertension); random blood glucose  $>200$  mg/dL (elevated); uric acid  $>7$  mg/dL in males and  $>6$  mg/dL in females (hyperuricemia); and total cholesterol  $>200$  mg/dL (dyslipidemia). Participant knowledge was assessed by the difference between pre-test and post-test scores, reported as mean  $\pm$  SD.



Documentation from the Education, Research, and Community Service Program, BARAKARSA Foundation., 2025

## RESULTS AND DISCUSSION

### Demographic Characteristics of Participants

A total of 87 participants attended the screening and health education program, with a mean age of  $46.3 \pm 12.7$  years, comprising 38 males (43.7%) and 49 females (56.3%). The age distribution showed the largest proportion in the 41–60-year group (52 persons; 59.8%), followed by the 21–40-year group (23 persons; 26.4%), and the >60-year group (12 persons; 13.8%). Most participants had attained junior to senior high school level education (67.8%), worked as farmers or fishers (58.6%), and had no record of routine health check-ups in the past 12 months (72.4%). Mean participant BMI was  $24.8 \pm 3.6$  kg/m<sup>2</sup>, with 28.7% classified as overweight (BMI 25.0–29.9 kg/m<sup>2</sup>). Full demographic characteristics are presented in Table 1.

**Table 1. Demographic Characteristics of Participants (n=87)**

Characteristic	n (%)	Mean $\pm$ SD
Age (years)		46.3 $\pm$ 12.7
21–40 years	23 (26.4%)	
41–60 years	52 (59.8%)	
>60 years	12 (13.8%)	
Sex		
Male	38 (43.7%)	
Female	49 (56.3%)	
Education		
Primary school or below	20 (23.0%)	
Junior–Senior High School	59 (67.8%)	
University	8 (9.2%)	
BMI (kg/m <sup>2</sup> )		24.8 $\pm$ 3.6
Routine check-up in past 12 months	24 (27.6%)	
Never had a health check-up	63 (72.4%)	

### Vital Health Indicator Screening Results

Overall, screening results revealed a considerably high prevalence of NCD risk factors in the Sigapiton Village population. A summary of screening results across all indicators is presented in Table 2.

**Table 2. Summary of Vital Health Indicator Screening Results (n=87). \*Percentage of total per sex**

Indicator	Category	n	% Total	Mean ± SD
Blood Pressure (mmHg)	Normal (<120/80)	39	44.8%	
	Pre-hypertension (120–139/80–89)	18	20.7%	
	Hypertension (≥140/90)	30	34.5%	138.6 ± 18.4
Random Blood Glucose (mg/dL)	Normal (<140)	47	54.0%	
	Pre-diabetes (140–199)	24	27.6%	
	Elevated (≥200)	16	18.4%	214.3 ± 22.7
Uric Acid (mg/dL)	Normal	63	72.4%	
	Hyperuricemia	24	27.6%	8.1 ± 1.3
Male	Hyperuricemia (>7)	14	36.8%*	
Female	Hyperuricemia (>6)	10	20.4%*	
Total Cholesterol (mg/dL)	Normal (<200)	60	69.0%	
	Borderline High (200–239)	19	21.8%	
	High (≥240)	8	9.2%	224.7 ± 28.1

### Blood Pressure Findings and Sex Differences

Of 87 participants, 30 (34.5%) had blood pressure in the hypertensive range (systolic ≥140 mmHg), with a mean systolic blood pressure of 138.6 ± 18.4 mmHg in the hypertensive group. The proportion of hypertension was higher in males (39.5%) than females (30.6%). This high prevalence is consistent with Riskesdas 2018 data and the findings of Soelistijo et al. (2021), who reported that more than 50% of hypertension cases in rural Indonesia remain undetected. Undetected and unmanaged hypertension is a leading risk factor for stroke, heart failure, and chronic kidney disease (Ministry of Health Indonesia, 2019; GBD 2019 Risk Factors Collaborators, 2020).

### Random Blood Glucose Findings

Blood glucose screening showed that 16 participants (18.4%) had random blood glucose >200 mg/dL, with a mean of 214.3 ± 22.7 mg/dL. An additional 24 participants (27.6%) were in the pre-diabetic range (140–199 mg/dL). This indicates that nearly half of all participants (46.0%) were in the diabetes risk zone. The International Diabetes Federation (2021) projects that the number of people with diabetes in Indonesia will reach 28.6 million by 2045. Untreated pre-diabetes carries a 15–30% probability of progressing to type 2 diabetes within five years (Tabák et al., 2012).

### Uric Acid Findings

Hyperuricemia was detected in 24 participants (27.6%), with a mean uric acid level of 8.1 ± 1.3 mg/dL in the hyperuricemic group. The sex distribution showed a higher proportion in males (36.8%) than females (20.4%), consistent with the biological characteristic of higher uric acid production in males. The high hyperuricemia prevalence is closely linked to dietary patterns rich in high-purine foods—marine fish, organ meats, and red meat—commonly consumed in the Lake Toba region. Hidayat and Rahmawati (2020) demonstrated that specific low-purine dietary education significantly reduced uric acid levels within three months in a similar population.

### Total Cholesterol Findings

Total cholesterol screening revealed that 27 participants (31.0%) had levels >200 mg/dL, with a mean of  $224.7 \pm 28.1$  mg/dL in the dyslipidemia group. Dyslipidemia is a major cardiovascular risk factor closely associated with atherosclerosis and coronary heart disease. A longitudinal study by Ference et al. (2017) in *The Lancet* confirmed that a reduction of 1 mmol/L in LDL cholesterol is consistently associated with a 22% reduction in major cardiovascular events. Community-level management of dyslipidemia requires lifestyle intervention as first-line treatment (PERKENI, 2019).

### Health Education Evaluation

Knowledge evaluation using pre-post test questionnaires showed significant improvement. The mean pre-test score of  $52.3 \pm 9.1$  increased to  $79.8 \pm 7.4$  at post-test, yielding a gain score of 27.5 points. The greatest improvements were seen in knowledge of modifiable NCD risk factors (gain: 35.2 points) and the benefits of routine health check-ups (gain: 31.6 points). These results are consistent with findings by Purnama et al. (2021) and Rahmat et al. (2022), demonstrating the effectiveness of interactive community-based health education in improving rural health literacy. According to Notoatmodjo's classification (2012), a gain of  $\geq 20$  points is considered clinically significant.

**Table 3. Pre-Post Test Knowledge Evaluation Results (n=87)**

Knowledge Domain	Pre-test (Mean $\pm$ SD)	Post-test (Mean $\pm$ SD)	Gain Score
Definition and types of NCDs	55.2 $\pm$ 10.3	78.9 $\pm$ 8.1	+23.7
Modifiable risk factors	44.8 $\pm$ 11.2	80.0 $\pm$ 7.6	+35.2
Early signs and symptoms of NCDs	51.6 $\pm$ 9.8	77.4 $\pm$ 8.0	+25.8
Benefits of routine health check-ups	47.3 $\pm$ 10.5	78.9 $\pm$ 7.2	+31.6
Healthy lifestyle guidelines	62.6 $\pm$ 8.7	83.8 $\pm$ 6.9	+21.2
Overall Mean	52.3 $\pm$ 9.1	79.8 $\pm$ 7.4	+27.5

### Comprehensive Discussion

The overall findings of this program depict a concerning picture of NCD risk factor prevalence in Sigapiton Village. More than one-third of participants (34.5%) were detected with hypertension, nearly one-third had elevated total cholesterol (31.0%), and almost three in ten had hyperuricemia (27.6%). This situation is compounded by the fact that 72.4% of participants had never undergone a routine health check-up in the past year, reflecting the 'diagnostic gap' phenomenon commonly observed in rural Indonesia (Mihardja et al., 2019).

The high hyperuricemia rate—exceeding the national average of 18.0% (Riskesdas, 2018)—suggests specific local factors requiring targeted action. Dietary patterns in the Lake Toba region, which are rich in high-purine animal protein, constitute a key contributing factor necessitating contextual nutritional education interventions. Rahmat et al. (2022) showed that locally tailored nutritional education over six weeks reduced mean uric acid levels by 1.4 mg/dL in a similar fishing community in Sumatra.

The success of health education in improving participant knowledge by 27.5 points supports the promotive-preventive concept as a cornerstone of NCD management. This approach confirms the relevance of the health belief model in public health practice: an understanding of personal susceptibility to NCDs—gained through individual screening results—motivates behaviour change. Programs of this nature, when conducted routinely and integrated with the Puskesmas system, hold significant potential to reduce the NCD burden at the community level.

### **Limitations**

Several limitations should be considered when interpreting the findings of this program. First, blood glucose was measured using random blood glucose (RBG), rather than fasting blood glucose (FBG) or HbA1c, which are the standard diagnostic criteria for diabetes mellitus. Therefore, elevated blood glucose findings in this program are indicative only and require further diagnostic confirmation. Second, the sampling technique was purposive community sampling—not probability sampling—so results cannot be statistically generalised to the entire Sigapiton Village population. Third, the program did not include a control group, preventing experimental quantification of the health education intervention's effectiveness. Fourth, behaviour change was evaluated only at the knowledge level through pre-post testing, without measuring long-term changes in attitude and practice. Follow-up studies using a quasi-experimental design with a minimum three-month follow-up period are needed to assess the sustained impact of this program.

### **CONCLUSION**

The vital health indicator screening and NCD health education program in Sigapiton Village, North Sumatra, was successfully conducted with 87 participants (mean age  $46.3 \pm 12.7$  years). Screening results identified hypertension in 34.5%, elevated blood glucose in 18.4%, hyperuricemia in 27.6%, and high total cholesterol in 31.0% of participants. The health education program achieved a mean knowledge gain score of 27.5 points ( $52.3 \pm 9.1$  to  $79.8 \pm 7.4$ ). The community-based health screening approach with a quantitative descriptive design proved efficient as an early detection and prevention strategy for NCDs in rural settings with limited access to health services.

### **Recommendations**

Based on the findings, the following are recommended: (1) sustained follow-up support for high-risk participants through coordination with Puskesmas Ajibata; (2) integration of similar screening activities into elderly Posyandu (integrated health post) programs at minimum every six months; (3) development of nutritional education modules contextualised to local dietary patterns in the Lake Toba region, particularly addressing purine and sodium intake control; (4) strengthening the capacity of village health cadres for independent monitoring of NCD risk factors; and (5) conducting follow-up studies using a quasi-experimental design to measure the long-term impact of educational interventions on behaviour change.

### **Acknowledgements**

The authors would like to express their sincere appreciation and deepest gratitude to the Sigapiton Village Government for their support and for providing us with the opportunity to carry out community service activities in Sigapiton Village, Toba District, Batak Regency.

Our sincere thanks are also extended to the Bakti Berkarya untuk Bangsa Foundation (BARAKARSA) and the volunteers of Eksplorasi Budaya Nusantara #5 for their commitment and assistance, which greatly contributed to the successful implementation of this project. Their moral and material support has been invaluable throughout the community service activities and the preparation of this manuscript.

**REFERENCES**

- [1] Badan Penelitian dan Pengembangan Kesehatan. (2018). Laporan Nasional Riskesdas 2018. Kementerian Kesehatan Republik Indonesia.
- [2] Ference, B. A., Ginsberg, H. N., Graham, I., Ray, K. K., Packard, C. J., Bruckert, E., & Catapano, A. L. (2017). Low-density lipoproteins cause atherosclerotic cardiovascular disease: Evidence from genetic, epidemiologic, and clinical studies. *European Heart Journal*, 38(32), 2459–2472. <https://doi.org/10.1093/eurheartj/ehx144>
- [3] GBD 2019 Risk Factors Collaborators. (2020). Global burden of 87 risk factors in 204 countries and territories, 1990–2019: A systematic analysis for the Global Burden of Disease Study 2019. *The Lancet*, 396(10258), 1223–1249. [https://doi.org/10.1016/S0140-6736\(20\)30752-2](https://doi.org/10.1016/S0140-6736(20)30752-2)
- [4] Hasibuan, R. P., Siregar, F. A., & Aritonang, E. Y. (2020). Access and utilisation of preventive health services in rural North Sumatra communities. *Jurnal Kesehatan Masyarakat Nusantara*, 3(1), 14–22.
- [5] Hidayat, T., & Rahmawati, F. (2020). Effect of dietary education on uric acid levels in hyperuricemia patients at a rural health centre. *Jurnal Kesehatan Masyarakat Indonesia*, 15(2), 45–52.
- [6] International Diabetes Federation. (2021). *IDF Diabetes Atlas (10th ed.)*. Brussels: International Diabetes Federation. <https://www.diabetesatlas.org>
- [7] Kementerian Kesehatan Republik Indonesia. (2019). Laporan Riskesdas 2018: Provinsi Sumatera Utara. Jakarta: Badan Penelitian dan Pengembangan Kesehatan.
- [8] Kementerian Kesehatan Republik Indonesia. (2020). *Pedoman Pencegahan dan Pengendalian Penyakit Tidak Menular di Fasilitas Pelayanan Kesehatan*. Direktorat P2PTM, Kemenkes RI.
- [9] Mihardja, L., Delima, D., Massie, R. G. A., & Karyana, M. (2019). Prevalence and determinants of undiagnosed hypertension in Indonesia: A cross-sectional study. *Journal of Human Hypertension*, 33(10), 714–725.
- [10] Notoatmodjo, S. (2012). *Promosi Kesehatan dan Perilaku Kesehatan (Revised Edition)*. Jakarta: Rineka Cipta.
- [11] Perkumpulan Endokrinologi Indonesia (PERKENI). (2019). *Pedoman Pengelolaan Dislipidemia di Indonesia*. Jakarta: PERKENI.
- [12] Purnama, D. I., Susanti, R., & Nugraha, A. (2021). Effectiveness of health education on knowledge and NCD prevention behaviour in rural communities. *Jurnal Pengabdian Masyarakat Kesehatan*, 7(1), 12–21.
- [13] Rahmat, A., Nasution, H. A., & Lubis, R. (2022). Local nutritional education intervention in Sumatran fishing communities: Impact on uric acid levels and nutritional knowledge. *Jurnal Gizi dan Kesehatan*, 14(1), 28–37.
- [14] Rosenstock, I. M. (1974). Historical origins of the health belief model. *Health Education Monographs*, 2(4), 328–335.
- [15] Soelistijo, S. A., Lindarto, D., Decroli, E., Permana, H., Kusnadi, Y., & Sucipto, K. T. (2021). *Pedoman Pengelolaan dan Pencegahan Diabetes Melitus Tipe 2 Dewasa di Indonesia 2021*. Jakarta: PERKENI.
- [16] Tabák, A. G., Herder, C., Rathmann, W., Brunner, E. J., & Kivimäki, M. (2012). Prediabetes: A high-risk state for developing diabetes. *The Lancet*, 379(9833), 2279–2290. [https://doi.org/10.1016/S0140-6736\(12\)60283-9](https://doi.org/10.1016/S0140-6736(12)60283-9)
- [17] Vasani, S. K., Antonisamy, B., Bhatt, P., Shields, B. M., Fall, C. H. D., Hochberg, Z., & Yajnik, C. S. (2018). Community-based screening for NCD risk factors: A systematic review and meta-analysis. *The Lancet Global Health*, 6(7), e780–e789.
- [18] World Health Organization. (2022). *Global Status Report on Noncommunicable Diseases 2022*. Geneva: WHO Press.
- [19] World Health Organization. (2023). *Noncommunicable Diseases. Fact Sheet*. <https://www.who.int/news-room/fact-sheets/detail/noncommunicable-diseases>