

## Innovative blood sugar monitoring in Karonsih, Semarang: Bridging comfort and accuracy

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### ABSTRACT

This community service activity aimed to promote health awareness by measuring blood sugar levels among residents of Karonsih, Semarang, using both invasive and non-invasive methods. The project, led by the Physics Department of Universitas Islam Negeri Walisongo in collaboration with the Ngabdi Neliteni Ngabekti (N3) community organization, provided free blood sugar screenings to 19 residents, two of whom showed elevated blood sugar levels and received feedback on lifestyle modifications to help maintain healthy glucose levels. The non-invasive prototype blood sugar monitoring device used in this study showed an average error rate of 47.08% compared to standard invasive measurements, suggesting areas for improvement in accuracy. However, the resident's enthusiasm and the device's environmental benefits indicate the potential for further development. This project underlines the importance of community health education and highlights the role of innovative technology in creating accessible and sustainable health monitoring solutions.

#### Keywords:

Innovative blood sugar monitoring; Karonsih; Comfort and accuracy; Health screenings.

### Introduction

Routine health screenings play a vital role in identifying potential health issues early, helping to prevent them from advancing into more severe conditions. One of the critical examinations is the measurement of blood sugar levels. Blood sugar, or glucose, is a vital energy source for the body's cells, but abnormally high levels can lead to serious health issues such as diabetes. Therefore, regular monitoring of blood sugar levels can help prevent and manage such conditions (American Diabetes Association, 2002).

Traditionally, blood sugar levels are measured using invasive methods, such as pricking the finger to obtain a blood sample. This method often causes discomfort and increases the amount of medical waste generated. To overcome these challenges, various non-invasive devices have been developed, providing a more comfortable and environmentally friendly alternative. One such innovation is a non-invasive blood sugar monitoring device developed by lecturers and students from the Physics Department of Universitas Islam Negeri Walisongo (Sumarti et al., 2022).

Community service activities have been conducted in Karonsih, Semarang, utilizing a blood sugar monitoring device developed by lecturers and students from the Physics Department of Universitas Islam Negeri Walisongo. This community service was carried out by the faculty and students of the Physics Department, along with members of Ngabdi Neliteni Ngabekti (N3). This activity aimed to provide free health services, including both invasive and non-invasive blood sugar level measurements.

### Methods

This community service project consists of three stages: preparation, implementation, and evaluation.

#### *Stage I: Preparation*

A location survey was conducted in Karonsih, Semarang City, to determine the appropriate site for the health examination activity. The community service team, consisting of lecturers, students, and members of the Ngabdi Neliteni Ngabekti (N3) research-based community organization, sent a notification letter to the local neighborhood head (RT) to ensure smooth coordination. In preparation for the event, the team gathered tools to measure invasive and non-invasive blood sugar levels and prepared pamphlets containing detailed information about the examinations and the tools used (Figure 1).



**Figure 1.** Blood sugar level measurement tools: (a) Invasive method and (b) Non-invasive method

### *Stage II: Implementation*

On Saturday, March 9, 2024, from 3:00 PM to 5:00 PM WIB, a community service event was held at the RT Hall on Jl. Karonsih Selatan VIII, Rt. 05 Rw. 06, Ngaliyan, Semarang City. The activities included examining blood sugar levels using both invasive and non-invasive methods. Lecturers from the Physics Department of Universitas Islam Negeri Walisongo Semarang explained the differences between these methods. Residents were informed about the non-invasive nature of the device and its potential error margin and provided informed consent before testing. There was a discussion on the examination results and preventive measures to maintain healthy blood sugar levels.

### *Stage III: Evaluation*

Feedback sessions were conducted with residents who underwent the examination to provide them with the results of their blood sugar level measurements. These results provided information on preventive measures and ways to maintain normal blood sugar levels. This approach aimed to enhance the community's understanding of managing their health and the benefits of non-invasive monitoring methods for regular health checks. This evaluation phase was crucial in assessing the effectiveness of the community service activity and ensuring that residents could apply the knowledge gained to improve their health outcomes.

## **Results and Discussions**



**Figure 2.** Community service team members

This community service activity was carried out by a committee of students and lecturers from the Physics Department of Universitas Islam Negeri Walisongo Semarang, along with members of N3. The event began once all participants were present, with an opening speech by the head of the Karonsih neighborhood association. The program started with explaining the procedures and principles of blood sugar level examinations, both invasive and non-invasive (Figure 3(a)). Following this, blood sugar levels were measured using both methods, and the results were recorded (Figure 3(b) and (c)).



**Figure 3.** Implementation of blood sugar level measurement: (a) Explanation of the tools, (b) Measurement process, and (c) Recording process

Table 1 presents the blood sugar level testing results conducted invasively and non-invasively on 19 residents. Two residents showed levels above the threshold and received feedback to lower and maintain their blood sugar within a normal range. Like previous initiatives, residents with high blood sugar levels were guided on maintaining healthy practices, such as a balanced diet and exercise (Astutisari et al., 2022). Diabetes education plays a crucial role in a team-based approach, as it helps patients understand their condition, its progression, and potential complications while also providing them with guidance and motivation to make proactive, risk-reducing decisions for optimal health (Kent et al., 2013).

**Table 1.** Results of blood sugar level measurement using invasive and non-invasive methods

No	Blood Sugar invasive (mg/dl)	Temporary blood sugar threshold (<200 mg/dl)	Blood Sugar non-invasive (mg/dl)	Error (%)
1	129.00	Normal	156.00	20.93
2	100.00	Normal	154.00	54.00
3	106.00	Normal	155.00	46.23
4	129.00	Normal	153.00	18.60
5	89.00	Normal	146.00	64.04
6	83.00	Normal	153.00	84.34
7	72.00	Normal	155.00	115.28
8	129.00	Normal	152.00	17.83
9	95.00	Normal	153.00	61.05
10	200.00	High	152.00	24.00
11	168.00	Normal	154.00	8.33
12	103.00	Normal	155.00	50.49
13	91.00	Normal	156.00	71.43
14	96.00	Normal	151.00	57.29
15	101.00	Normal	154.00	52.48
16	365.00	High	155.00	57.53
17	142.00	Normal	154.00	8.45
18	99.00	Normal	153.00	54.55
19	119.00	Normal	152.00	27.73
Mean	127.16		153.32	47.08

Although the non-invasive device showed a high error rate (47.08%), the device demonstrated potential due to residents' enthusiastic response. Thus, further development to enhance the device's accuracy is warranted. Like the community engagement activity conducted by Trisnayanti et al. (2021), residents were enthusiastic and appreciative of the opportunity, providing valuable insights into their health.

## **Conclusion**

The community service initiative in Karonsih, Semarang, successfully provided residents with accessible blood sugar monitoring services and raised health awareness. This study identified two individuals with elevated blood sugar levels through invasive and non-invasive testing, prompting feedback on lifestyle changes to prevent potential health complications. Despite the non-invasive device's significant error rate of 47.08%, residents showed high interest in this technology, suggesting community readiness for sustainable health monitoring solutions. The findings emphasize the need for continued refinement of non-invasive devices and the value of community engagement in promoting preventive health and diabetes education.

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