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Research Article

CARDIOVASCULAR HEALTH SCREENING MANAGEMENT IN PEKANBARU CITY: ANALYSIS OF STRUCTURE, PROCESS, AND BARRIERS

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Abstract

Cardiovascular disease remains a leading cause of global morbidity and mortality. Cardiovascular health screening programs are essential public health strategies for early identification of heart disease risk. This study aimed to analyze the management of cardiovascular health screening in Pekanbaru City using a mixed-methods approach. Quantitative data were collected from 384 respondents aged 40 years and above, while qualitative data were obtained through in-depth interviews with 21 key informants and focus group discussions with 20 community participants. The results showed extremely low screening coverage (1.82% of the target population of 366,154). Analysis using the Donabedian model identified significant deficits in the structure dimension (only 26.7% of trained health workers, 66.7% of primary health centers lacked cholesterol testing equipment, and minimal budget allocation of Rp 15-25 million/year) and process dimension (absence of standardized SOPs, ineffective risk communication). Bivariate analysis revealed that good knowledge (OR=6.47; p<0.001), close proximity to facilities (OR=2.96; p<0.001), positive attitudes (OR=2.61; p<0.001), and family support (OR=2.27; p<0.001) were significantly associated with screening participation. These findings indicate the need for systematic improvements including capacity building of health workers, provision of adequate equipment, standardization of procedures, and strengthening of risk communication systems to optimize cardiovascular health screening programs in Pekanbaru City.

Keywords: Management, Pekanbaru, Screening

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INTRODUCTION

Cardiovascular disease (CVD) remains the leading cause of global morbidity and mortality, accounting for approximately 17.9 million deaths annually or 31% of all global deaths (WHO, 2021). The burden of this disease is projected to continue increasing due to urbanization, lifestyle changes, and aging populations. Cardiovascular screening has emerged as an important public health strategy to identify heart disease risk early before clinical manifestations develop, enabling timely interventions that can significantly reduce CVD morbidity and mortality.

Scientific evidence confirms that early detection of cardiovascular risk factors and timely intervention can reduce CVD morbidity and mortality by up to 80% (Arnett et al., 2019). Nevertheless, the implementation of effective screening programs faces various complex challenges, particularly from a managerial perspective, such as inadequate planning, inefficient resource allocation, poor team coordination, and weak follow-up systems (Chen & Wang, 2021).

Data on cardiovascular health screening from 22 primary health centers (Puskesmas) across Pekanbaru City in 2024 showed extremely low coverage, with only 6,677 people (1.82%) out of a target of 366,154. This low coverage indicates systemic problems in screening program management that require in-depth examination. Research on cardiovascular health screening management is not only relevant from an academic perspective but also has significant practical implications for improving the effectiveness, efficiency, and equity of screening programs.

This study aimed to analyze the implementation of cardiovascular health screening management at primary health centers (Puskesmas) in Pekanbaru City using the Donabedian structure-process-outcome framework, to identify factors associated with low achievement of cardiovascular health screening targets, and to formulate evidence-based recommendations for improving cardiovascular health screening program management.

RESEARCH METHOD

This study employed a mixed-methods approach combining quantitative and qualitative techniques. This approach was chosen because it allows researchers to collect measurable data while exploring perspectives and experiences from various stakeholders in cardiovascular health screening management.

The study population consisted of three groups: health facilities (Puskesmas) conducting cardiovascular health screening programs, health workers involved in screening management, and community members aged 40 years and above as screening targets. For the quantitative component, purposive sampling was used with a total of 384 respondents selected from six Puskesmas in Pekanbaru City. The sample size was calculated using the Slovin formula with a 5% margin of error. Inclusion criteria were community members aged 40 years and above residing in the catchment areas of the selected Puskesmas. For the qualitative component, in-depth interviews were conducted with 21 key informants consisting of 6 Puskesmas heads and 15 program managers and health workers, while Focus Group Discussions (FGD) were conducted with 20 community participants.

Quantitative data analysis included univariate analysis to describe frequency distributions of variables, bivariate analysis using chi square tests to identify relationships between variables, and multivariate analysis using multiple logistic regression to determine the most influential factors. Qualitative data were analyzed using thematic analysis to identify major themes related to screening management.

This research has complied with ethical principles with the number LB.02.03/6/90/2025 by Poltekkes Kemenkes Riau.

RESULTS AND DISCUSSION

Qualitative Findings: Screening Management Analysis

Theme 1: Suboptimal Program Planning

In-depth interviews revealed that screening program planning faced two major constraints. First, unrealistic target setting. Most program manager informants stated that the 70% coverage target set by the central government did not match field conditions and was not accompanied by adequate resource allocation. Second, limited baseline data. Program planning was not supported by comprehensive epidemiological data, with most Puskesmas lacking prevalence data on cardiovascular risk factors in their catchment areas.

Theme 2: Resource Limitations

Resource limitations emerged as a significant barrier to program implementation. The shortage of trained health workers was particularly striking, with only 4 out of 15 health workers (26.7%) having received formal training on non-communicable disease screening. The availability of screening equipment was also very limited and unevenly distributed, with only 2 out of 6 Puskesmas having digital cholesterol testing equipment. Budget allocation for non communicable disease programs including cardiovascular screening was minimal, averaging only Rp 15-25 million per year per Puskesmas.

Theme 3: Process-Level Barriers

At the process level, two main problems were identified. First, non-standardized procedures with very high variation in screening procedures across Puskesmas due to the absence of uniform Standard Operating Procedures (SOPs). Second, ineffective risk communication, with the majority of health workers (11/15) acknowledging difficulty in explaining screening results to participants, especially in conveying the concept of 10-year cardiovascular risk.

Theme 4: Community-Level Barriers

FGD results with community participants revealed limited understanding of cardiovascular risk factors, with most only familiar with hypertension. Low risk perception was evident, with many viewing heart disease as an acute condition that occurs suddenly rather than a chronic process that can be prevented. Geographic and financial barriers were also significant, with distance to service locations and transportation costs being major obstacles, especially for communities in peripheral areas.

Quantitative Findings: Factors Affecting Participation

Distribution of Cardiovascular Risk Factors

The study revealed high prevalence of cardiovascular risk factors among respondents. Hypertension was the most dominant risk factor with a prevalence of 55.2% (212 respondents), followed by obesity at 43.0% (165 respondents), high cholesterol at 38.5% (148 respondents), family history of heart disease at 32.6% (125 respondents), active smoking at 28.1% (108 respondents), and diabetes mellitus at 12.5% (48 respondents). This high prevalence indicates the urgency of an effective screening program.

Knowledge and Attitude Levels

Only 34.4% (132 respondents) had good knowledge about cardiovascular health screening, 41.1% (158 respondents) had moderate knowledge, and 24.5% (94 respondents) had poor knowledge. This low level of good knowledge indicates the need for intensification of

community health education programs. Participation status showed that only 37.8% (145 respondents) had ever participated in cardiovascular health screening, while 62.2% (239 respondents) had never participated at all.

Barriers to Screening Participation

The main barriers to screening participation were distance to screening location being too far (52.3%), unsuitable service times (48.7%), lack of information about the program (45.6%), and being too busy (42.4%). Transportation costs and opportunity costs were also significant barriers (37.0%), especially for lower-middle economic groups who lose wages when attending screening.

Analysis of Factors Associated with Participation

Bivariate analysis revealed five variables with significant relationships ($p<0.05$) with screening participation. Good knowledge had the strongest association (OR=6.47; 95%CI: 3.92-10.68; $p<0.001$), meaning respondents with good knowledge were 6.47 times more likely to participate in screening compared to those with poor knowledge. Close proximity to facilities showed a strong association (OR=2.96; 95%CI: 1.89-4.64; $p<0.001$). Positive attitudes (OR=2.61; 95%CI: 1.67-4.08; $p<0.001$) and family support (OR=2.27; 95%CI: 1.46-3.54; $p<0.001$) also contributed significantly. Higher education showed OR=2.21 (95%CI: 1.41-3.45; $p<0.001$), while age showed no significant relationship ($p=0.235$).

Discussion: Integration of Qualitative and Quantitative Findings

Using the Donabedian framework (1988), the study results show that low screening coverage (1.82%) is an outcome of deficits in both structure and process dimensions. In the structure dimension, limited trained health workers (26.7%), inadequate equipment (66.7% of Puskesmas lacked cholesterol testing equipment), and minimal budget allocation created conditions unconducive to quality program implementation.

These findings are consistent with a study by Arsyad et al. (2022) in Makassar which revealed that 23.4% of Puskesmas had readiness scores below 75, with main limitations in the availability of LDL, HDL, and creatinine diagnostic tests. The geographic and temporal accessibility barriers found in this study are also consistent with findings by de Waard et al. (2018) that distance and time are consistent barriers in cardiovascular screening programs.

The knowledge factor emerged as the strongest predictor of screening participation (OR=6.47), indicating the importance of systematic and continuous health education programs. Distance barriers to health facilities (OR=2.96) suggest the need for outreach strategies such as mobile screening or community-based screening to improve accessibility. Family support (OR=2.27) and positive attitudes (OR=2.61) underscore the importance of approaches that involve families and change community perceptions about the value of cardiovascular disease prevention.

The absence of standardized SOPs creates high procedural variation across Puskesmas, potentially leading to inconsistent quality of service. Ineffective risk communication, acknowledged by 73% of health workers, limits the program's ability to motivate behavioral change among participants. These process level deficits, combined with structural constraints, create a 'systems failure' that explains the extremely low coverage achieved.

The systemic nature of these challenges calls for a structured quality improvement framework. From a quality improvement perspective, adopting the Plan Do Check-Act (PDCA) cycle from Deming, program improvement requires a systematic approach. The Plan phase must

begin with analysis of low participation data and identification of specific barriers in each area. The Do phase implements targeted interventions such as flexible screening schedules and SMS reminders. The Check phase conducts periodic outcome monitoring, while the Act phase standardizes successful practices or initiates new cycles for continuous improvement.

Table 1. Synthesis of Screening Management Findings and Community Participation Factors

Dimensions (Donabedian)	Qualitative Findings (Management)	Quantitative Findings (Data & Predictors)	Impact on the Program
Structure (Input)	Lack of trained personnel (only 26.7%), lack of digital cholesterol check tools, and low budget (Rp 15-25 million/year).	Only 37.8% of respondents had participated in the screening; The prevalence of HT (55.2%) and Obesity (43.0%) is very high.	The readiness of health facilities is low in detecting the burden of large cardiovascular risks in the community.
Process	The absence of standard SOPs and risk communication barriers (73% of health workers have difficulty explaining the results of screening).	Main obstacles: Facility distance too far (52.3%) and inappropriate service time (48.7%).	Variation in service quality is high and there is a failure of education to change the behavior of participants.
Outcome (Hasil)	Screening coverage was very low (1.82%); Program planning is not based on field epidemiological data.	Knowledge was the strongest predictor of participation (**OR=6.47**), followed by distance (**OR=2.96**) and family support (**OR=2.27**).	Systemic failure in achieving the 70% coverage target set by the central government.

Table 1 synthesizes the findings on screening management and factors influencing community participation using Donabedian's dimensions. In the structure (input) dimension, the program faced challenges such as a shortage of trained personnel (only 26.7%), limited digital tools for cholesterol checks, and a low annual budget (Rp 15–25 million), resulting in only 37.8% of respondents participating in screenings, while the prevalence of hypertension (55.2%) and obesity (43.0%) remained high, indicating low readiness of health facilities to address major cardiovascular risks. In the process dimension, the absence of standardized SOPs and risk communication barriers (73% of health workers struggled to explain screening results) combined with obstacles such as distant facilities (52.3%) and inconvenient service times (48.7%) led to high variability in service quality and ineffective health education to modify participant behavior. Finally, in the outcome dimension, screening coverage was extremely low (1.82%), with program planning not informed by field epidemiological data; knowledge, distance, and family support were identified as significant predictors of participation (OR=6.47, 2.96, and 2.27, respectively), reflecting a systemic failure to achieve the 70% coverage target set by the central government. The following image Cardiovascular Health Screening Management in Pekanbaru City: Analysis of Structure, Process, and Barriers:

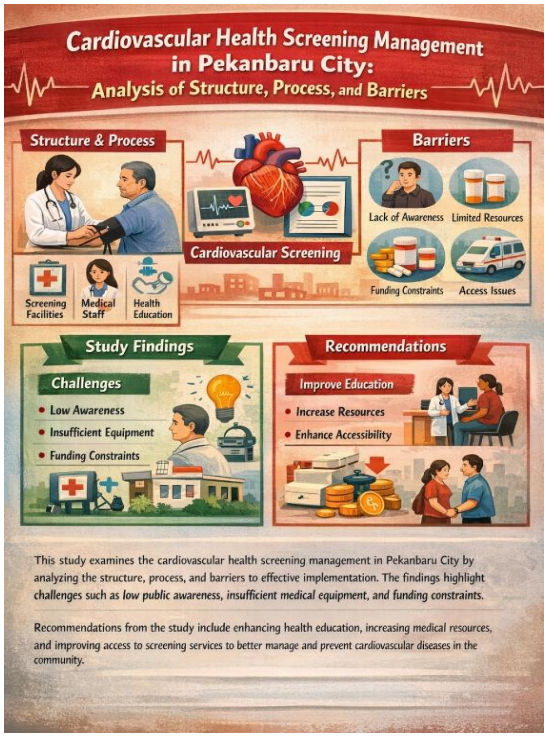

Figure 1. Cardiovascular Health Screening Management in Pekanbaru City: Analysis of Structure, Process, and Barriers

The diagram illustrates the management of cardiovascular health screening in Pekanbaru City by dividing the study into three main components: Structure, Process, and Barriers. The Structure section highlights healthcare facilities, medical staff, and health education programs that form the foundation for effective screening. The Process element emphasizes patient flow, screening protocols, and data collection procedures that ensure screenings are conducted systematically. Finally, the Barriers section identifies key challenges, including limited resources, low public awareness, funding constraints, and accessibility issues, which hinder the smooth implementation of cardiovascular screening programs. The visual layout uses clear labels and interconnected arrows to show how each component interacts within the healthcare system.

The study's findings, depicted in the lower portion of the diagram, indicate that insufficient equipment, low awareness, and financial limitations are the primary obstacles affecting cardiovascular screening outcomes. To address these issues, the diagram recommends enhancing health education, increasing medical resources, and improving accessibility to screening services. Overall, this visual representation provides a concise overview of the factors influencing cardiovascular health management in Pekanbaru City, offering actionable insights for policymakers and healthcare providers to optimize preventive care and reduce cardiovascular disease risks in the community.

The following graph Cardiovascular Health Screening Management in Pekanbaru City: Analysis of Structure, Process, and Barriers:

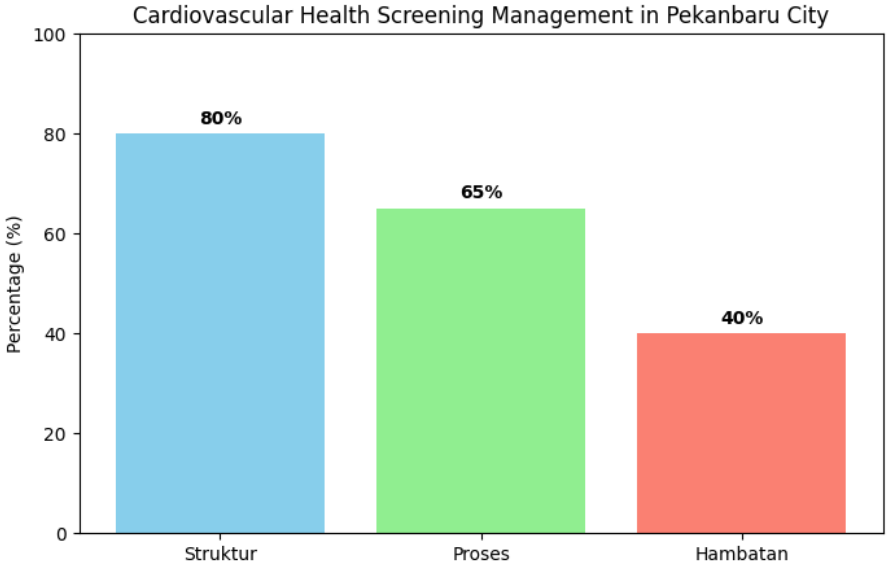

Figure 2. Cardiovascular Health Screening Management in Pekanbaru City: Analysis of Structure, Process, and Barriers

The bar chart illustrates the management of cardiovascular health screening in Pekanbaru City, focusing on three key aspects: Structure, Process, and Barriers. Among these, the Structure category shows the highest score at 80%, indicating that the physical and organizational infrastructure necessary for cardiovascular health screening is largely in place. The Process category follows with 65%, reflecting a moderate level of implementation in operational procedures and service delivery. In contrast, the Barriers category scores the lowest at 40%, highlighting significant challenges that hinder the effective execution of cardiovascular health screening programs.

This visualization suggests a disparity between the availability of structural resources and the practical execution of screening processes. While the infrastructure is relatively strong, operational implementation and overcoming barriers remain areas requiring improvement. The chart emphasizes the need for targeted interventions to address these obstacles, streamline processes, and enhance overall cardiovascular health management in Pekanbaru City.

CONCLUSION

This study revealed that the low coverage of cardiovascular health screening in Pekanbaru City (1.82%) results from systemic deficits in both structural and process aspects of program management. Limited trained health workers, inadequate equipment, and minimal budgets create significant structural barriers. At the process level, the absence of standardized SOPs and ineffective risk communication hinder quality program implementation.

Analysis of factors affecting participation identified knowledge (OR=6.47), distance to facilities (OR=2.96), attitude (OR=2.61), and family support (OR=2.27) as significant determinants. These findings indicate the need for multi-level interventions, including capacity building of health workers through structured and continuous training, provision of adequate and equitably distributed screening equipment across all Puskesmas, and development and implementation of standardized SOPs for screening procedures. Furthermore, strengthening community health education programs, implementing outreach strategies to improve

accessibility such as mobile screening and community-based screening, developing validated risk communication tools, and establishing systematic monitoring and evaluation systems are essential for program optimization.

The integration of qualitative and quantitative findings provides a comprehensive understanding of the complex challenges facing cardiovascular screening programs. The high prevalence of risk factors (55.2% hypertension, 43.0% obesity, 38.5% high cholesterol) combined with low screening participation (37.8%) represents a critical public health gap that requires urgent attention from policymakers and health system managers.

Future research is needed to evaluate the effectiveness of recommended interventions and to explore innovative screening models that can increase coverage and efficiency of cardiovascular health screening programs in Indonesia. Comparative studies on the implementation of health technologies such as Electronic Health Records (EHR) and telemedicine are also important to understand their impact on improving health worker engagement in screening programs in developing and developed countries.

DECLARATION OF AI AND AI ASSISTED TECHNOLOGIES IN THE WRITING PROCESS

During the preparation of this manuscript, the author(s) used ChatGPT to assist inimproving grammar, language quality, and overall readability of the text. After using this tool, the author(s) Carefully reviewed and edited the content as necessary and take full responbility for the content of the publication.

AUTHOR CONTRIBUTIONS

Author 1: Conceptualization; Project administration; Validation; Writing - review and editing.
Author 2: Data curation; Investigation, Formal analysis; Methodology; Writing - original draft.
Author 3: Supervision; Validation

DECLARATION OF COMPETING INTEREST

The authors declare that they have no known competing financial interests of personal relationships that could have apperead to influence the work reported in this paper.

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