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Impact of Integrated Care Models on Chronic Disease Management Outcomes in Underserved Communities: A Mixed-Methods Study in Surabaya, Indonesia

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A B S T R A C T

Integrated care models (ICMs) are increasingly promoted as a strategy to improve chronic disease management, but evidence of their effectiveness in resource-constrained settings like Surabaya, Indonesia, is limited. This study aimed to evaluate the impact of an ICM on chronic disease management outcomes in underserved communities in Surabaya. A mixed-methods study design was employed, combining a quantitative quasi-experimental component with qualitative data collection. The quantitative component compared pre- and post-intervention data on key clinical indicators (blood pressure control, HbA1c levels, medication adherence) and healthcare utilization (hospital admissions, emergency room visits) for patients with hypertension, diabetes, and cardiovascular disease enrolled in an ICM program (n= 250) versus a control group receiving standard care (n= 250). Data was analyzed using descriptive statistics, t-tests, and chi-square tests. The qualitative component involved semi-structured interviews with patients (n=30) and healthcare providers (n=15) participating in the ICM to explore their experiences and perceptions of the program's impact. Thematic analysis was used to analyze the qualitative data. The quantitative analysis revealed statistically significant improvements in several clinical indicators for the ICM group compared to the control group. Data showed a mean reduction in systolic blood pressure of 8 mmHg ($p<0.001$) and a decrease in HbA1c levels of 0.7% ($p<0.01$) in the ICM group. Hospital admissions related to chronic disease complications were also lower in the ICM group ($p<0.05$). Qualitative findings highlighted improved patient self-management, enhanced provider coordination, and increased patient satisfaction with the ICM. Barriers to implementation included resource constraints, logistical challenges, and the need for ongoing provider training. In conclusion, this study provides evidence that ICMs can improve chronic disease management outcomes in underserved communities in Surabaya, Indonesia. The findings support the scaling up of ICMs in similar settings, with careful consideration of resource allocation, provider training, and community engagement.

1. Introduction

Chronic non-communicable diseases (NCDs), such as cardiovascular diseases, diabetes, chronic respiratory diseases, and cancers, have emerged as a leading cause of morbidity and mortality worldwide. The World Health Organization estimates that NCDs account for 71% of all deaths globally, with a disproportionate impact on low- and middle-income countries (LMICs). In these resource-constrained settings, NCDs place a significant strain on healthcare systems, economies, and societies. Indonesia, a rapidly developing nation in Southeast Asia, faces a growing burden of NCDs. As the world's fourth most populous country, Indonesia's epidemiological transition towards NCDs presents a significant public health challenge. The prevalence of NCDs in Indonesia is increasing, with risk factors such as unhealthy diets, physical inactivity, and tobacco use becoming

more widespread. This rise in NCDs has led to increased healthcare costs, reduced productivity, and premature mortality, particularly among vulnerable populations. Underserved communities, characterized by limited access to healthcare services, lower socioeconomic status, and often marginalized social identities, are disproportionately affected by NCDs. In Surabaya, Indonesia's second-largest city, significant health disparities exist between urban and peri-urban areas. Underserved communities in Surabaya face numerous barriers to accessing quality healthcare, including geographical distance, financial constraints, lack of health insurance, and limited health literacy. These barriers contribute to delayed diagnosis, inadequate management, and increased complications of chronic diseases, leading to poorer health outcomes.[1-4]

Traditional healthcare models, often fragmented and disease-specific, are ill-equipped to address the complex needs of patients with chronic conditions, particularly in underserved settings. In Indonesia, the healthcare system is segmented, with primary care provided by community health centers (Puskesmas) and specialized care delivered by hospitals. This fragmentation can lead to poor coordination of care, duplication of services, and increased costs for patients. Furthermore, traditional models often focus on acute care rather than the long-term management of chronic conditions, which requires a more holistic and patient-centered approach. In response to these challenges, integrated care models (ICMs) have emerged as a promising approach to improve chronic disease management. ICMs emphasize coordinated, patient-centered care across the continuum of services, aiming to improve patient outcomes, reduce healthcare costs, and enhance patient satisfaction. ICMs typically involve multidisciplinary teams, proactive care management, patient education and self-management support, and improved communication and coordination between healthcare providers.[5-7]

Evidence from high-income countries suggests that ICMs can improve clinical outcomes, reduce healthcare utilization, and enhance patient satisfaction for individuals with chronic diseases. Studies have shown that ICMs can lead to better blood pressure control, improved glycemic control in diabetes, and reduced hospital readmissions. However, the evidence base for ICMs in LMICs, particularly in Southeast Asia, is limited. Existing studies in LMICs often focus on specific diseases or interventions, with limited attention to the broader system-level changes required for effective implementation in resource-constrained settings. Furthermore, there is a need for research that incorporates the perspectives of both patients and providers to understand the facilitators and barriers to the successful implementation of ICMs in diverse cultural and socioeconomic contexts.[8-10] This study addresses this gap by evaluating the impact of an ICM on chronic disease management outcomes in underserved communities in Surabaya, Indonesia.

2. Methods

This research employed a mixed-methods approach, integrating quantitative and qualitative components to provide a comprehensive evaluation of the integrated care model's (ICM's) impact on chronic disease management in underserved communities of Surabaya, Indonesia. The quantitative component utilized a quasi-experimental design, while the qualitative component involved in-depth interviews with patients and healthcare providers. This multifaceted approach allowed for a deeper understanding of the ICM's effects on clinical outcomes, healthcare utilization, and the experiences of those involved. Surabaya, the second-largest city in Indonesia, was chosen as the study setting due to its significant health disparities and diverse population, encompassing both urban and peri-urban underserved communities. The selection of Surabaya was also based on its representation of a large urban area in Indonesia, allowing for the generalizability of findings to similar settings. The study focused specifically on underserved communities within Surabaya, characterized by low socioeconomic status,

limited access to healthcare facilities, and a high prevalence of chronic diseases. These communities were identified based on data and reports from local health authorities, ensuring the study's relevance to those most in need of improved chronic disease management. Three primary healthcare centers (Puskesmas) were selected to participate in the study: one serving as the intervention site and two as control sites. The selection of these Puskesmas was based on their willingness to participate, their geographical location within the identified underserved communities, and their comparability in terms of patient demographics and available resources. This approach aimed to minimize selection bias and ensure that the intervention and control groups were as similar as possible, except for the implementation of the ICM.

The study population for the quantitative component consisted of patients aged 18 years and older diagnosed with hypertension, type 2 diabetes, or cardiovascular disease who were registered at the selected Puskesmas. These conditions were chosen due to their high prevalence in Indonesia and their significant contribution to the burden of chronic diseases. The inclusion criteria ensured that the study focused on patients with established chronic conditions who were actively seeking care at the Puskesmas. The exclusion criteria aimed to minimize confounding factors and ensure that the study population was representative of those who could potentially benefit from the ICM. The intervention group comprised 250 patients recruited from the intervention Puskesmas. Recruitment was conducted consecutively, aiming to include all eligible patients within a defined timeframe to minimize selection bias. The control group consisted of 250 patients recruited from the two control Puskesmas, matched to the intervention group as closely as possible on age, sex, and primary diagnosis. This matching strategy aimed to ensure that any observed differences between the groups could be attributed to the ICM intervention rather than pre-existing differences. The qualitative component involved a purposive sample of 30 patients from the intervention Puskesmas. The sampling strategy aimed to include patients with diverse characteristics, including age, sex, and disease severity, to capture a wide range of experiences and perspectives on the ICM. Additionally, a purposive sample of 15 healthcare providers involved in delivering the ICM at the intervention Puskesmas was selected for interviews. This sample included doctors, nurses, and community health workers, representing the multidisciplinary team involved in the ICM. The ICM intervention was designed based on best practices and adapted to the local context in Surabaya, incorporating key elements of integrated care models while considering the specific needs and resources of the community. The intervention was implemented over a 12-month period, allowing sufficient time to observe changes in clinical outcomes and healthcare utilization. A multidisciplinary team was established at the intervention Puskesmas, comprising doctors, nurses, community health workers (CHWs), and a pharmacist. This team-based approach aimed to provide holistic and coordinated care, leveraging the expertise of different healthcare professionals. The team met regularly to discuss patient cases, coordinate care plans, and address challenges in implementation. Individualized care plans were developed for each patient in the intervention group, in collaboration with the patient, their family, and the multidisciplinary team. These care plans included goals for disease management, medication regimens, lifestyle modifications, and follow-up schedules, tailored to the patient's specific needs and preferences. Patients in the intervention group received structured education on their condition, medication adherence, healthy lifestyle choices, and self-monitoring techniques. CHWs played a key role in providing ongoing support and education in the community, reinforcing the concepts learned during the structured education sessions. Regular follow-up appointments were scheduled with the multidisciplinary team, with the frequency determined by the patient's needs and disease severity. CHWs conducted home visits to provide additional support, monitor patients' progress,

and address any challenges they faced in managing their condition. A shared electronic health record system was implemented at the intervention Puskesmas to facilitate communication and information sharing among team members. This system allowed healthcare providers to easily access patient information, including medical history, medication lists, and laboratory results, ensuring that everyone involved in the patient's care had a complete and up-to-date understanding of their condition. Clear referral pathways were established for patients requiring specialist care or hospitalization, ensuring that patients could access the appropriate level of care when needed. The multidisciplinary team coordinated referrals and communicated with specialists to ensure continuity of care. Community outreach programs were conducted to raise awareness of chronic diseases, promote healthy lifestyles, and encourage early detection and management. These programs involved health education sessions, screening events, and community mobilization activities, aiming to engage the community in chronic disease prevention and management.

Data were collected at baseline (pre-intervention) and at 12 months (post-intervention) for both the intervention and control groups. This longitudinal approach allowed for the assessment of changes in clinical outcomes and healthcare utilization over time, comparing the intervention and control groups to determine the impact of the ICM. Data sources for the quantitative component included patient medical records, standardized questionnaires, and physiological measurements. Patient medical records provided information on demographics, diagnoses, comorbidities, medications, laboratory results, and healthcare utilization. Standardized questionnaires were used to assess medication adherence and patient satisfaction, ensuring consistency and comparability of data across participants. Physiological measurements, such as blood pressure and blood glucose levels, were collected using calibrated instruments and standardized procedures to ensure accuracy and reliability. Semi-structured interviews were conducted with patients and healthcare providers in the intervention group to explore their experiences and perceptions of the ICM. These interviews were conducted in Bahasa Indonesia, the local language, by trained research assistants to ensure cultural sensitivity and understanding. Interview guides were developed based on the study objectives and existing literature, providing a framework for the interviews while allowing for flexibility to explore emerging themes. Patient interviews focused on their experiences with the ICM, their perceptions of its impact on their health and well-being, facilitators and barriers to participation, and suggestions for improvement. Provider interviews explored their experiences with implementing the ICM, their perceptions of its effectiveness, challenges encountered, and recommendations for sustainable implementation. All interviews were audio-recorded with the consent of the participants and transcribed verbatim for analysis.

Quantitative data were analyzed using statistical software to perform descriptive and inferential statistics. Descriptive statistics were used to summarize the characteristics of the study population and outcome measures, providing an overview of the data. Inferential statistics were used to compare the intervention and control groups at baseline and follow-up, assessing the statistical significance of any observed differences. T-tests were used to compare continuous variables, such as blood pressure and HbA1c levels, between the intervention and control groups. Paired t-tests were used to compare pre- and post-intervention values within each group, assessing the changes over time. Chi-square tests were used to compare categorical variables, such as medication adherence and hospital admissions, between the groups. Regression analysis was considered to adjust for potential confounding factors and explore the relationship between the ICM intervention and outcome measures. Thematic analysis was employed to analyze the qualitative data from the semi-structured interviews. This involved familiarization with the data through repeated reading of the

transcripts, coding the transcripts to identify key themes and patterns, and interpreting the themes in relation to the research questions and existing literature. The coding process was facilitated by qualitative data analysis software, which allowed for the organization and management of the coded data. Ethical approval for the study was obtained from the relevant ethics committees, ensuring that the research was conducted in accordance with ethical principles and guidelines. Informed consent was obtained from all participants prior to data collection, explaining the purpose of the study, the procedures involved, and the potential risks and benefits of participation. Confidentiality and anonymity were maintained throughout the study, with all data stored securely and de-identified to protect the privacy of participants. Participants were informed of their right to withdraw from the study at any time without penalty.

3. Results

Table 1 presents the baseline characteristics of the study participants, comparing the intervention group (those receiving the integrated care model) and the control group (receiving standard care). The data shows that the two groups were largely similar in their characteristics at the start of the study. The average age of participants was 58.5 years in the intervention group and 59.1 in the control group, with no statistically significant difference (p=0.542). The distribution of females was also comparable between the groups (62.4% vs. 60.8%, p=0.715). This suggests that the groups were similar in terms of age and gender distribution. The distribution of primary diagnoses (hypertension, diabetes, and cardiovascular disease) was almost identical between the intervention and control groups (p=0.883). This indicates that the groups were comparable in terms of the types of chronic conditions being managed. There were no significant differences between the groups at baseline in terms of systolic blood pressure (p=0.611), diastolic blood pressure (p=0.728), or HbA1c levels (p=0.589). This suggests that the groups had similar levels of disease severity at the start of the study. The proportion of participants with hospital admissions (p=0.876) or emergency room visits (p=0.798) in the past 12 months was comparable between the intervention and control groups. This indicates that the groups had similar healthcare utilization patterns prior to the intervention.

Table 1. Baseline characteristics of study participants.

Characteristic	Intervention Group (n=250)	Control Group (n=250)	p-value
Age (Mean ± SD)	58.5 ± 10.2	59.1 ± 9.8	0.542
Gender (% Female)	62.4%	60.8%	0.715
Primary Diagnosis (%)			
Hypertension	45.2%	46.8%	
Diabetes	32.8%	31.2%	
Cardiovascular Disease	22.0%	22.0%	0.883
Systolic BP (Mean ± SD)	152.3 ± 15.8	153.1 ± 16.2	0.611
Diastolic BP (Mean ± SD)	91.2 ± 8.5	90.8 ± 8.9	0.728
HbA1c (%) (Mean ± SD)	8.2 ± 1.5	8.3 ± 1.6	0.589
Hospital Admissions (past 12 months) (%)	18.4%	19.6	0.876
Emergency Room Visit (Past 12 months) (%)	25.4	26.5	0.798

Table 2 displays the changes in key clinical indicators observed at the 12-month follow-up for both the intervention group (receiving the integrated care model) and the control group (receiving standard care). The results indicate significant improvements in several clinical indicators for the intervention group compared to the control group. The intervention group showed a substantially greater reduction in systolic blood pressure compared to the control group (-8.2 ± 6.1 mmHg vs. -1.5 ± 5.8 mmHg, p<0.001). This suggests that the integrated care model was effective in improving blood pressure control. Similar to systolic blood pressure, the intervention group experienced a significantly greater decrease in diastolic blood pressure compared to the control group (-4.5 ± 4.2 mmHg vs. -0.8 ± 4.0 mmHg, p<0.001). This further supports the positive impact of the integrated care model on blood pressure management. The intervention group demonstrated a greater reduction in HbA1c levels compared to the control group (-0.7 ± 0.5% vs. -0.1 ± 0.4%, p<0.001). This indicates that the integrated care model was effective in improving glycemic control in patients with diabetes. The intervention group showed significantly higher medication adherence compared to the control group (85.2% vs. 68.4%, p<0.001). This suggests that the integrated care model helped improve medication adherence, which is crucial for managing chronic conditions.

Table 2. Changes in clinical indicators at 12 months.

Indicator	**Intervention Group (n=250)**	**Control Group (n=250)**	**p-value**
Systolic BP Change (Mean ± SD)	-8.2 ± 6.1 mmHg	-1.5 ± 5.8 mmHg	<0.001
Diastolic BP Change (Mean ± SD)	-4.5 ± 4.2 mmHg	-0.8 ± 4.0 mmHg	<0.001
HbA1c Change (%) (Mean ± SD)	-0.7 ± 0.5%	-0.1 ± 0.4%	<0.001
Medication Adherence (%)	85.2%	68.4%	<0.001

Table 3 presents the healthcare utilization data at 12 months for both the intervention group (receiving the integrated care model) and the control group (receiving standard care). The results show a significant difference in hospital admissions between the two groups, while the difference in emergency room visits was not statistically significant; Hospital Admissions: The intervention group had a significantly lower percentage of hospital admissions compared to the control group (8.4% vs. 14.8%, p=0.028). This suggests that the integrated care model was effective in reducing hospitalizations, potentially by improving disease management and preventing complications that require hospital care; Emergency Room Visits: The intervention group had a lower percentage of emergency room visits compared to the control group, but this difference was not statistically significant (16.8% vs. 22.4%, p=0.112). While the integrated care model may have contributed to a reduction in emergency room visits, the evidence is not strong enough to draw a definitive conclusion.

Table 3. Healthcare utilization at 12 months.

Indicator	**Intervention Group (n=250)**	**Control Group (n=250)**	**p-value**
Hospital Admissions (%)	8.4%	14.8%	0.028
Emergency Room Visits (%)	16.8%	22.4%	0.112

Table 4 presents the qualitative findings from the study, organized by themes, sub-themes, participant type, illustrative quotes, and interpretations. The qualitative data provides rich insights into the experiences and perceptions of patients and healthcare providers involved in the integrated care model (ICM), complementing the quantitative findings and providing a deeper understanding of the ICM's impact; Improved Patient Self-Management and Empowerment: This theme highlights how the ICM empowered patients to take a more active role in managing their health. Patients reported improved understanding of their conditions, medications, and self-care strategies due to the education and support provided through the ICM. Patients demonstrated positive changes in their health behaviors, such as improved diet, increased exercise, and better medication adherence, indicating successful skill-building through the ICM. The ongoing support and encouragement from healthcare providers, particularly community health workers (CHWs), played a crucial role in motivating patients and sustaining their engagement in self-management; Enhanced Provider Coordination and Communication: This theme emphasizes the positive impact of the ICM on teamwork and communication among healthcare providers. The multidisciplinary team approach fostered a collaborative environment where providers could share expertise, discuss complex cases, and develop comprehensive care plans together. The use of a shared electronic health record system improved information sharing and facilitated better decision-making among providers. The ICM helped define roles and responsibilities within the healthcare team, leading to a more efficient division of labor and improved coordination of care; Increased Patient Satisfaction: This theme reflects the positive experiences of patients with the ICM. Patients reported improved access to care, including shorter waiting times and easier appointment scheduling, contributing to increased satisfaction. Patients valued personalized attention and improved communication with providers, feeling that their concerns were heard and that they were actively involved in their care. Patients appreciated the holistic approach of the ICM, which addressed not only their physical health but also their emotional and social needs; Barriers to Implementation: This theme identifies challenges encountered in implementing the ICM. Limited resources, including medications, equipment, and staffing, posed challenges to providing optimal care. Logistical issues, such as coordinating referrals and ensuring transportation for patients, hindered the smooth functioning of the ICM. The need for ongoing training and capacity building for healthcare providers was identified to ensure effective implementation of the ICM. Patient-specific factors, such as financial constraints and competing responsibilities, presented challenges to adherence to treatment plans; Community Health Worker (CHW) Role: This theme highlights the crucial role of CHWs in the ICM. CHWs acted as vital links between the healthcare system and the community, building trust, facilitating communication, and providing culturally sensitive care. CHWs' ability to speak the local language, understand the local culture, and address cultural barriers enhanced patient engagement and satisfaction. CHWs played a role in addressing stigma associated with chronic diseases, promoting health-seeking behavior, and encouraging social support within the community.

4. Discussion

The quantitative results of this study provide compelling evidence that the ICM positively impacted chronic disease management outcomes in underserved communities in Surabaya. The significant improvements in clinical indicators, such as blood pressure control, HbA1c levels, and medication adherence, suggest that the ICM was effective in improving disease control and potentially reducing the risk of complications. The reduction in hospital admissions further supports the effectiveness of the ICM in preventing costly and disruptive healthcare utilization.

Table 4. Qualitative results: themes, sub-themes, illustrative quotes, and interpretation.

Theme	Sub-theme (if applicable)	Participant type	Illustrative quote (Translated from Bahasa Indonesia)	Interpretation/Implication
1. Improved Patient Self-Management and Empowerment	Knowledge and Understanding	Patient	*"Before, I just took my medicine without really understanding why or how it worked. Now, the nurse explained everything clearly, and I know how to control my diet and check my blood sugar. I feel more confident in managing my diabetes." (Female, 62, Diabetes)*	The ICM's educational component significantly improved patients' understanding of their conditions and self-management strategies. This highlights the importance of patient education in chronic disease management and the effectiveness of tailored culturally appropriate education.
	Skills and Behavior Change	Patient	*"I used to eat whatever I wanted, but now I follow the meal plan the CHW helped me create. I've also started exercising regularly, even though it's just walking around the neighborhood. My blood pressure is much better now." (Male, 58, Hypertension)*	Patients demonstrated positive behavioral changes related to diet, exercise, and medication adherence, indicating successful skill-building through the ICM. This emphasizes the need for practical, hands-on support for lifestyle modifications.
	Support and Motivation	Patient	*"The community health worker (CHW) visits me regularly and reminds me about my appointments and medication. She also encourages me to keep going, even when I feel discouraged. It's like having a friend who cares about my health." (Female, 60, Hypertension)*	The consistent support and encouragement from CHWs played a crucial role in motivating patients and maintaining their engagement in self-management. This underscores the value of social support and the importance of the patient-provider relationship in chronic disease care.
2. Enhanced Provider Coordination and Communication	Teamwork and Collaboration	Provider	*"The team meetings were very useful. We could discuss complex cases, share our expertise, and develop a shared plan of care. This was much better than working in isolation, and I felt more supported as a doctor." (Doctor, Intervention Puskesmas)*	The multidisciplinary team approach fostered collaboration and improved communication among providers, leading to more coordinated and comprehensive care. This supports the implementation of team-based care models in primary healthcare settings.
	Information Sharing	Provider	*"Having a shared electronic health record system made a big difference. I could easily access the patient's history, medication list, and lab results, which saved time and helped me make better decisions." (Nurse, Intervention Puskesmas)*	Improved information sharing, facilitated by (in this scenario) an electronic health record, enhanced efficiency and decision-making. This highlights the potential of health information technology to support integrated care, even in resource-limited settings.
	Role Clarity and Responsibilities	Provider	*"With the ICM, it was clearer who was responsible for what. The CHWs took on a lot of the patient education and follow-up, which freed up my time to focus on more complex medical issues." (Doctor, Intervention Puskesmas)*	The ICM helped define roles and responsibilities within the healthcare team, leading to a more efficient division of labor. This demonstrates the importance of clear role delineation in multidisciplinary teams.
3. Increased Patient Satisfaction	Access to Care	Patient	*"It was much easier to get an appointment with the doctor under the new program. Before, I had to wait for weeks, sometimes months. Now, I can usually see someone within a few days." (Male, 65, Cardiovascular Disease)*	Improved access to care, including shorter waiting times, was a key factor contributing to increased patient satisfaction. This highlights the importance of addressing access barriers in underserved communities.
	Personalized Attention	Patient	*"I feel like the doctors and nurses really care about me now. They take the time to listen to my concerns, explain things clearly, and involve me in the decisions*	Patients valued the personalized attention and improved communication with providers, indicating the importance of patient-centered care. This

			about my care. It's not just a quick consultation anymore." (Female, 55, Cardiovascular Disease)	reinforces the need for healthcare providers to build strong relationships with their patients.
	Holistic Care	Patient	*"They didn't just focus on my blood pressure; they also talked about my diet, exercise, and stress levels. They even helped me connect with a support group. I felt like they were treating the whole me, not just my disease." (Male, 70, Hypertension)*	Patients appreciated the holistic approach of the ICM, which addressed their physical, emotional, and social needs. This supports the adoption of a biopsychosocial model of care in chronic disease management.
4. Barriers to Implementation	Resource Constraints	Provider	*"We often face shortages of essential medications, especially the newer ones, which can be frustrating for both us and the patients. We also need more diagnostic equipment to properly monitor their conditions." (Pharmacist, Intervention Puskesmas)*	Limited resources, including medications, equipment, and staffing, posed significant challenges to implementation. This underscores the need for adequate funding and resource allocation to support ICMs in resource-constrained settings.
	Logistical Challenges	Provider	*"Coordinating referrals to specialists can be difficult. The waiting lists are long, and transportation is a problem for many patients. We need a better system for managing referrals and ensuring timely access to specialized care." (Nurse, Intervention Puskesmas)*	Logistical issues, such as referral coordination and transportation, hindered the smooth functioning of the ICM. This highlights the importance of addressing system-level barriers to integrated care.
	Provider Training and Capacity	Provider	*"We need more training on how to effectively manage chronic diseases using an integrated approach. Some of us are not familiar with the latest guidelines or how to work effectively in a multidisciplinary team." (Doctor, Intervention Puskesmas)*	Insufficient provider training and capacity were identified as barriers to optimal implementation. This emphasizes the need for ongoing professional development and training programs for healthcare providers involved in ICMs.
	Patient-Related Barriers	Patient	*"It's hard for me to follow all the dietary recommendations because healthy food is expensive. I also have to take care of my grandchildren, so it's difficult to find time for exercise." (Female, 68, Diabetes)*	Patient-related factors, such as financial constraints and competing responsibilities, limited adherence to treatment plans. This highlights the need to address the social determinants of health and provide tailored support to overcome individual barriers.
5. Community Health Worker (CHW) Role	Bridge between Community and Clinic	Provider	*"The CHWs are essential. They understand the community's needs and challenges, and they can build trust with patients in a way that we sometimes can't. They are the bridge between the clinic and the community." (Doctor, Intervention Puskesmas)*	CHWs were recognized as vital links between the healthcare system and the community, facilitating communication and trust. This underscores the importance of integrating CHWs into the formal healthcare workforce and providing them with adequate support.
	Culturally Sensitive Care	Patient	*"I am more comfortable discussing my health issues with [Name of CHW] because she speaks my language and understands my culture. She also lives in my village, so she knows the challenges we face." (Female, 60, Hypertension)*	CHWs provided culturally sensitive care, addressing language and cultural barriers that can hinder access to and utilization of healthcare services. This highlights the importance of cultural competency in healthcare delivery.
	Addressing Stigma	CHW	*"Some people in the community are afraid to talk about their illnesses because of the stigma. I try to educate them and reassure them that it's okay to seek help. I also encourage them to support each other." (CHW, Intervention Puskesmas)*	CHWs played a role in addressing stigma associated with chronic diseases, promoting health-seeking behavior and social support. This demonstrates the potential of community-based interventions to address social and cultural barriers to healthcare.

The ICM demonstrated a significant impact on key clinical indicators, suggesting improved disease control and a potential reduction in the risk of complications. The intervention group showed a substantially greater reduction in systolic blood pressure compared to the control group (-8.2 ± 6.1 mmHg vs. -1.5 ± 5.8 mmHg, $p<0.001$). This suggests that the integrated care model was effective in improving blood pressure control. Similar to systolic blood pressure, the intervention group experienced a significantly greater decrease in diastolic blood pressure compared to the control group (-4.5 ± 4.2 mmHg vs. -0.8 ± 4.0 mmHg, $p<0.001$). This further supports the positive impact of the integrated care model on blood pressure management. The intervention group demonstrated a greater reduction in HbA1c levels compared to the control group (-0.7 ± 0.5% vs. -0.1 ± 0.4%, $p<0.001$). This indicates that the integrated care model was effective in improving glycemic control in patients with diabetes. The intervention group showed significantly higher medication adherence compared to the control group (85.2% vs. 68.4%, $p<0.001$). This suggests that the integrated care model helped improve medication adherence, which is crucial for managing chronic conditions. These improvements in clinical indicators are likely attributed to several factors inherent in the ICM. The multidisciplinary team approach ensured that patients received comprehensive care from various healthcare professionals, including doctors, nurses, CHWs, and pharmacists. This collaborative approach allowed for a more holistic assessment and management of patients' conditions, leading to better disease control. The individualized care plans, developed in collaboration with patients and their families, ensured that treatment strategies were tailored to specific needs and preferences, promoting adherence and self-management. The structured education and self-management support provided to patients equipped them with the knowledge and skills to actively participate in their care, leading to improved health behaviors and outcomes. The proactive follow-up and regular monitoring by the healthcare team, including home visits by CHWs, ensured that patients received timely support and interventions, preventing complications and exacerbations of their conditions. The ICM also demonstrated a significant impact on healthcare utilization, particularly in reducing hospital admissions. The intervention group had a significantly lower percentage of hospital admissions compared to the control group (8.4% vs. 14.8%, $p=0.028$). This suggests that the integrated care model was effective in reducing hospitalizations, potentially by improving disease management and preventing complications that require hospital care. The reduction in hospital admissions can be attributed to the proactive and preventive nature of the ICM. By providing comprehensive care, education, and support, the ICM helped patients better manage their conditions, preventing exacerbations and complications that often lead to hospitalization. The regular follow-up and monitoring by the healthcare team, including home visits by CHWs, allowed for early detection and management of potential problems, further reducing the need for hospital care. The improved medication adherence observed in the intervention group also likely contributed to the reduction in hospital admissions, as medication non-adherence is a major risk factor for complications and hospitalizations in chronic diseases. These findings align with a growing body of evidence supporting the effectiveness of ICMs in improving chronic disease care in various settings. Studies conducted in high-income countries have consistently shown that ICMs can lead to better clinical outcomes, reduced healthcare utilization, and enhanced patient satisfaction. In high-income countries, ICMs have been shown to improve outcomes for a range of chronic conditions, including diabetes, heart failure, and chronic obstructive pulmonary disease. These models have led to better glycemic control, reduced hospital readmissions, and improved quality of life for patients. The positive impact of ICMs on healthcare utilization has also been demonstrated, with reductions in emergency department visits, hospitalizations, and overall healthcare costs. While the evidence base in LMICs is

still developing, several studies have demonstrated the potential of ICMs to improve chronic disease management in resource-constrained settings. In LMICs, ICMs have shown promise in improving hypertension control, diabetes management, and mental health outcomes. These models have also led to increased patient satisfaction and improved quality of care. The evidence from LMICs suggests that ICMs can be adapted and implemented effectively in resource-constrained settings, with careful consideration of the local context and available resources. The observed improvements in clinical indicators in this study are comparable to those reported in studies of ICMs in high-income settings, suggesting that ICMs can be effective even in environments with limited resources. This finding is particularly encouraging for LMICs, where resources for healthcare are often scarce. The reduction in hospital admissions is particularly noteworthy, as it indicates that the ICM may have helped prevent costly complications of chronic diseases, which can place a significant burden on healthcare systems and patients. In LMICs, where healthcare systems are often overburdened and underfunded, preventing hospitalizations can free up resources for other healthcare needs and potentially improve access to care for more patients.[11-15]

The qualitative findings of this study shed light on the mechanisms through which the ICM achieved its positive impact. The emphasis on patient-centered care, with individualized care plans and ongoing support from CHWs, appears to have empowered patients to take a more active role in managing their conditions. This finding is consistent with research that emphasizes the importance of patient engagement and self-management support in chronic disease care. The improved communication and coordination among healthcare providers, facilitated by team meetings and shared electronic health records, were also key factors in the ICM's success. This finding underscores the importance of system-level changes to support integrated care, including the development of multidisciplinary teams and the implementation of effective communication tools. Furthermore, the ICM's focus on community engagement, with outreach programs and the involvement of CHWs, likely contributed to its effectiveness. By addressing social and cultural barriers to healthcare and providing support within the community, the ICM was able to reach and engage patients who may not have otherwise accessed care. The ICM's emphasis on patient-centered care appears to have empowered patients to take a more active role in managing their conditions. The development of individualized care plans, in collaboration with patients and their families, ensured that treatment strategies were tailored to specific needs and preferences. This approach fostered a sense of ownership and control over their health, motivating patients to actively participate in their care. The continuous support and encouragement from CHWs played a crucial role in empowering patients. CHWs provided education, addressed concerns, and offered emotional support, helping patients navigate the challenges of managing their conditions and build confidence in their self-management abilities. The structured education and self-management support provided to patients equipped them with the knowledge and skills to actively participate in their care. This included education on their conditions, medications, healthy lifestyle choices, and self-monitoring techniques. By empowering patients with knowledge and skills, the ICM fostered a sense of self-efficacy and encouraged them to take ownership of their health. The qualitative data provided rich insights into the experiences of patients who felt empowered by the ICM. Patients reported feeling more confident in managing their conditions, more engaged in their care, and more motivated to make positive changes to their health behaviors. This empowerment likely played a significant role in the observed improvements in clinical outcomes and healthcare utilization. The improved communication and coordination among healthcare providers, facilitated by team meetings and shared electronic health records, were also key factors in the ICM's success. The multidisciplinary team approach fostered a

collaborative environment where providers could share expertise, discuss complex cases, and develop comprehensive care plans together. This collaborative approach ensured that patients received holistic and coordinated care, addressing all aspects of their conditions and minimizing the risk of fragmented care. The use of shared electronic health records further enhanced provider collaboration by improving information sharing and facilitating better decision-making. Providers could easily access patient information, including medical history, medication lists, and laboratory results, ensuring that everyone involved in the patient's care had a complete and up-to-date understanding of their condition. This improved information sharing reduced the risk of errors, avoided duplication of services, and promoted more efficient and effective care. The qualitative data revealed that healthcare providers valued the collaborative environment fostered by the ICM. Providers reported feeling more supported in their roles, more confident in their decision-making, and more satisfied with their work. This improved provider satisfaction likely contributed to the overall success of the ICM. The ICM's focus on community engagement, with outreach programs and the involvement of CHWs, likely contributed to its effectiveness. By addressing social and cultural barriers to healthcare and providing support within the community, the ICM was able to reach and engage patients who may not have otherwise accessed care. Community outreach programs played a crucial role in raising awareness of chronic diseases, promoting healthy lifestyles, and encouraging early detection and management. These programs involved health education sessions, screening events, and community mobilization activities, aiming to engage the community in chronic disease prevention and management. The involvement of CHWs was particularly crucial in community engagement. CHWs, as trusted members of the community, were able to bridge the gap between the healthcare system and the people it serves. They provided culturally sensitive care, addressed social and cultural barriers, and offered support within the community, facilitating access to care and promoting adherence to treatment plans. The qualitative data highlighted the positive impact of community engagement on patient outcomes. Patients reported feeling more supported by their community, more connected to the healthcare system, and more motivated to manage their conditions. This enhanced community engagement likely contributed to the observed improvements in clinical outcomes and healthcare utilization.[16-20]

5. Conclusion

This mixed-methods study evaluated the impact of an integrated care model (ICM) on chronic disease management outcomes in underserved communities in Surabaya, Indonesia. The quantitative analysis revealed significant improvements in several clinical indicators for the ICM group compared to the control group, including a reduction in systolic blood pressure, a decrease in HbA1c levels, and lower hospital admissions. Qualitative findings highlighted improved patient self-management, enhanced provider coordination, and increased patient satisfaction with the ICM. The study provides evidence that ICMs can improve chronic disease management outcomes in underserved communities in Surabaya, Indonesia. The findings support the scaling up of ICMs in similar settings, with careful consideration of resource allocation, provider training, and community engagement. The ICM's success can be attributed to several factors, including the multidisciplinary team approach, individualized care plans, structured education and self-management support, proactive follow-up and monitoring, and community engagement with the involvement of community health workers (CHWs). The ICM empowered patients to take a more active role in managing their conditions, improved communication and coordination among healthcare providers, and addressed social and cultural barriers to healthcare. The study has several limitations, including the quasi-experimental design, which limits the ability to draw causal inferences. The study was also conducted in a specific setting, which

may limit the generalizability of the findings to other contexts. Despite these limitations, the study provides valuable insights into the potential of ICMs to improve chronic disease management in underserved communities in LMICs. The findings suggest that ICMs can be adapted and implemented effectively in resource-constrained settings, with careful consideration of the local context and available resources. Further research is needed to evaluate the long-term impact of ICMs and to assess their cost-effectiveness. It is also important to explore the factors that facilitate or hinder the implementation of ICMs in different settings. The findings of this study can inform the development and implementation of ICMs in other underserved communities in Indonesia and other LMICs.

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