

THE IMPACT OF COMMUNITY SERVICE ON EARLY DETECTION OF CONGENITAL ANOMALIES OF THE KIDNEY AND URINARY TRACT AND CONGENITAL HEART DISEASE IN CHILDREN AT PRIMARY HEALTH CARE SOBO, BANYUWANGI, INDONESIA

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ABSTRACT

Congenital anomalies of the kidney and urinary tract (CAKUT) and congenital heart disease (CHD) represent significant global public health challenges, contributing substantially to childhood morbidity and mortality. This study aimed to determine the impact of the community service on CAKUT and CHD early detection conducted by Universitas Airlangga, Surabaya, Indonesia, at Puskesmas Sobo, Banyuwangi Regency. This pre-test post-test design study was conducted among health cadres, parents of students, and the elderly in Puskesmas Sobo District. The subjects' knowledge was assessed by comparing pre- and post-test scores, which included 10 questionnaire questions. We conducted an early detection program for children in grades 4-6 of elementary school, which included weight, height, blood pressure, saturation, heart sound screening, and a complete urine dipstick examination. 62 subjects participated in the community service, with Pre-Test Scores of 62.9 ± 16.5 and Post-Test Scores of 71.7 ± 20.2 . There were 25 children examined in our community service, with 100% regular heart examination and 76% with trace proteinuria; systolic blood pressure 90 ± 11.7 mmHg and diastolic blood pressure 59.4 ± 11.6 mmHg. This community service initiative demonstrated its dual impact on enhancing health knowledge and facilitating the early detection of potential congenital abnormalities in children. The findings underscore the critical need for more systematic, comprehensive screening programs for kidney and heart health in children across the region.

How to cite:

Prasetyo, R. V., Hakim, A. R., Putri, F., Susianto, S. C., Budiarto, A., Kurniawan, M. R., Soemyarso, N. A., Noer, M. S., 2025. The Impact of Community Service on Early Detection of Congenital Anomalies of the Kidney and Urinary Tract and Congenital Heart Disease in Children at Primary Health Care Sobo, Banyuwangi, Indonesia. Journal of Community Medicine and Public Health Research. 6(2): 159 - 166.



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ARTICLE HISTORY

Received: July, 02, 2025

Revision: September, 04, 2025

Accepted: September, 18, 2025

Online: November, 21, 2025

doi:

10.20473/jcmphr.v6i2.75284

KEYWORDS

Congenital anomalies of the kidney and urinary tract;
Congenital heart disease;
Community Service;
Early Detection;

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Highlights:

1. This study highlight the importance for thorough screening programs for children's kidney and heart health.
2. Community service is crucial to raising health awareness and facilitating early diagnosis of certain disorders.

INTRODUCTION

Congenital anomalies of the kidney and urinary tract (CAKUT) and congenital heart disease (CHD) are major global public health issues that contribute significantly to childhood morbidity and mortality. CAKUT, which results from disturbance during fetal kidney and urinary tract development, is the most prevalent cause of kidney failure in children globally. Its global prevalence varies, from 4 to 60 per 10,000 live births, accounting for 20-50% of all birth defects^{1,2}. Furthermore, CAKUT disorders contribute to a substantial 20% of end-stage renal disease (ESRD) in adults. The variety of manifestation of CAKUT is extensive, encompassing from relatively benign conditions, such as mild transient hydronephrosis, to severe abnormalities, including posterior urethral valves³.

Similarly, among non-communicable diseases, congenital heart disease (CHD) is acknowledged as the primary cause of mortality among newborn and young children. CHD is one of the most prevalent birth abnormalities, affecting approximately 1% of live globally. Over 4.18 million children under five worldwide had CHD in 2021, a 3.4% rise from 1990¹. Significant disparities still exist with poor and low middle socio demographic index region having the highest prevalence and mortality rates despite improvement in surgical treatment and notable decline in CHD-associated mortality worldwide (56.2% from 1990 to 2021)^{1,4}.

Early detection of congenital anomalies of the kidney and urinary tract and heart defect is crucial for improving patient outcomes and preventing irreversible complications. Several congenital kidney anomalies, including hydronephrosis, can be identified prenatally through ultrasound; however, not all cases require postnatal treatment^{2,5}. In contrast, significant conditions such as ureteropelvic junction stenosis, vesicoureteral reflux, and posterior urethral valves, if undiagnosed, can lead to serious kidney injury, recurrent urinary tract infections (UTIs), and progressive renal impairment. Similarly, undiagnosed or untreated congenital heart disease (CHD) can result in severe long-term effects, including congestive heart failure, endocarditis, irregular heartbeats (arrhythmias), stroke, and significant developmental delays^{1,2}. Children with more severe form of CHD often exhibited delayed growth and development, facing challenges in neurodevelopment, academic performance, and psychosocial well-being.

Community service play important role to strengthening public health systems, particularly by improving access to care and promoting the early identification of health conditions. Volunteers provides for supporting healthcare delivery by alleviating administrative workloads, enhancing patient experiences through emotional and social support, and cultivating a collective responsibility for community well-being⁶. Community health initiatives, often led by community health workers (CHWs), are especially important

in reaching underserved populations. These programs help reduce health disparities by offering preventive services, advocating for marginalized groups, and fostering community participation in health promotion. As trusted individuals embedded within their communities, CHWs are uniquely positioned to bridge cultural, linguistic, and trust-related divides between patients and health-care providers⁷.

Banyuwangi Regency, located in East Java, Indonesia, is a densely populated with an estimated population of 1.79 million in mid-2024 and is notable for its ethnic diversity. This area continues to face significant public health challenges. Although global and national data on congenital kidney and heart abnormalities are available, region-specific prevalence data for Banyuwangi Regency remain limited. Considering the central role of Primary Health Care in maternal and child health services, alongside the demonstrated effectiveness of community engagement in health promotion and early detection, Primary Health Care Sobo in Banyuwangi Regency offers an appropriate setting to explore the impact of community service on identifying these conditions.

This study aimed to exhibit the impact of community service on the early detection of CAKUT and CHD conducted by Universitas Airlangga at Primary Health Care Sobo, Banyuwangi Regency, Indonesia.

MATERIALS AND METHODS

This pre-test-post-test design study was conducted among health cadres, parents of students, and the elderly in Primary Health Care Sobo District in June 2025. We conducted a pre-test consisting of

10 questions on the early detection of CAKUT and CHD in Primary Health Care Sobo's hall. The test had a minimum score of 0 and a maximum score of 100. The questionnaire consisted of questions about the tools, examination, definition in CAKUT, and CHD detection. The subjects were kept at least 50 cm apart and were not allowed to communicate with each other. The subjects were provided with material on the early detection of chronic kidney disease in children, congenital anomalies of the kidney and urinary tract, and congenital heart disease in the form of a one-hour presentation by a board-certified pediatrician and cardiovascular thoracic surgeon, followed by time to ask questions. All subjects consented to be included in this community service. Subjects were also assessed for the effects of providing the material through a post-test, which included 10 re-administered questionnaire questions.

Besides providing materials to health cadres, parents, and the elderly, we also conducted early detection directly with children in grades 4–6 of elementary school in the Primary Health Care Sobo work area, including weight, height, blood pressure, saturation, heart sound screening, and complete urine examination using dipstick. Weight was measured using a standardised digital scale in kilograms, while height was measured using a stadiometer with a limit of 2 meters (centimetres). Subjects were asked to remove their shoes and socks and stick to the wall for the examination. Blood pressure was manually checked using a needle tensiometer (OneMed, Indonesia) placed on the subject's arm, and systolic and diastolic pressures were measured in mmHg. Heart sounds were examined by a paediatrician and evaluated at the aortic, pulmonic, tricuspid, and mitral valves for any murmurs, using the same paediatric

stethoscope (Littman 3M, Indonesia). Blood saturation was measured using a pulse oximeter (Elitech, Indonesia). The clean-catch technique for urine collection involves collecting a midstream urine sample after cleaning the genital area, with the urine collected directly into a sterile container during urination. A complete urine examination was performed using a dipstick urinalyzer (Verify, Indonesia).

All data were processed using SPSS version 20.00 (IBM Tech, New York, America). Data were described in tables and diagrams.

RESULTS

Sixty-two subjects participated in the community service and completed both the pre-test and post-test. Pre-test scores ranged from 10 to 90, with a mean of 62.9 ± 16.5 . Post-test scores ranged from 20 to 100, with a mean of 71.7 ± 20.2 . Notably, 11 percent of participants showed a decrease in value compared to the pre-test (Figure 1). A total of 25 children were examined as part of our community service, with the results presented in Table 1. Notably, many of them had proteinuria $\pm$ (19.2%) and a regular heart examination without any murmur or gallop.

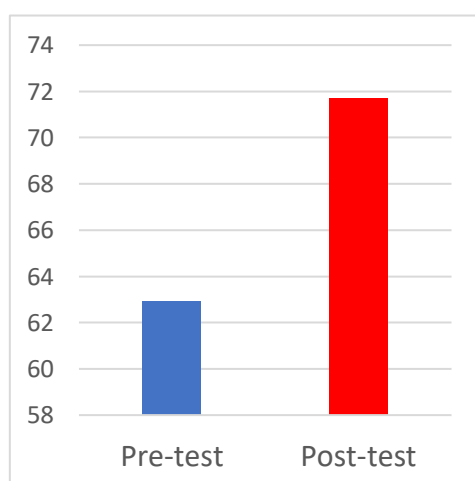


Figure 1. Pre and post-test scores of the subject

Table 1. Characteristics of twenty-five subjects in 4-6 grades in elementary school

	Mean $\pm$ SD / n (percentage)	Minimum	Maximum
Weight (kg)	39.1 $\pm$ 12.6	22	75
Height (cm)	142.4 $\pm$ 9	119	160
Blood pressure			
Systole (mmHg)	90 $\pm$ 11.7	40	74
diastole (mmHg)	59.4 $\pm$ 11.6	80	120
Oxygen saturation	97.1 $\pm$ 1.6	93	99
Heart examination	25(100%)		
Normal	0 (0%)		
abnormal			
Proteinuria			
+1	5(19,2%)		
$\pm$	19(76%)		
negative	1(4,8%)		

DISCUSSION

The pre- and post-test scores among the 62 subjects demonstrated a positive shift in knowledge, with the mean score increasing from 62.9 ± 16.5 to 71.7 ± 20.2 . The observed improvement indicates that the educational aspect of the community service, particularly the use of presentations, effectively enhanced participants' comprehension of the health topic discussed. This findings support the recognized role of community service initiatives and health workers in advancing health literacy and awareness among populations through education and community involvement. However, the 11% decline in post-test scores for a subset of participants merit further examination. Possible contributing factors may include variations in individual understanding, test-related anxiety or the phrasing and difficulty of the assessment items, underscoring the challenges of achieving consistent knowledge transfer and retention in community based-programs⁸. Future initiatives may benefit from incorporating mor adaptive educational approach or

diversified assessment technique to promote uniform learning gains among participant.

The clinical assessment of 25 elementary school children (grades 4-6) produced noteworthy results. All 25 children (100%) exhibited normal cardiac findings, with no evidence of murmurs or gallops upon examinations. This outcome is encouraging, given the estimated incidence of congenital heart disease (CHD) in Indonesia approximately 9 per 1,000 births. Nevertheless, it is important to recognize that while basic physical examination serve as valuable preliminary screening tools, they may not identify all types of CHD, particularly mild, asymptomatic, or complex cases that require advanced diagnostic evaluation, such as echocardiography. The observed mean oxygen saturation ($97.1 \pm 1.6\%$) further supports the absence of clinically apparent cyanotic heart conditions among the examined participants⁹.

In contrast, the urinalysis results revealed a potentially concerning finding related to proteinuria. A notable proportion of the examined children demonstrated the presence of protein in their urine proteinuria: 19.2% showing a +1 result, 76% exhibiting $\pm$ (trace) result, and only 4.8% testing negative. Proteinuria serves as an imortante marker of renal dysfunction and may indicate congenital anomalies of the kidney and urinary tract (CAKUT). Although trace proteinuria ($\pm$) can occasionally be benign or transient, persistent +1 proteinuria carries clinically significant and necessitates further evaluation to exclude underlying renal pathology. The elevated rate of proteinuria in these subjects underscores the potential value of community-based screening programs in identifying children at risk for

kidney abnormalities who might remain undetected. Proteinuria in children is frequently asymptomatic yet can signal significant renal pathology, with prevalence rates reported between 2.3% to 16.1% across different populations and screening approaches¹⁰⁻¹². Large-scale urine screening programs, particularly among school-aged children, have proven effective in detecting persistent proteinuria and early-stage chronic kidney disease (CKD)^{12,13}. However, it is recommended that Puskesmas reassess the findings, as false positives may arise from conditions such as dehydration, infection, or other transient factors. Dipstick urinalysis continues to represent the cornerstone of initial renal screening. Persistent proteinuria has been associated with nephropathies such as focal segmental glomerulosclerosis (FSGS) and IgA nephropathy^{11,14}. Additionally, children with chronic conditions - such as sickle cell disease (SCD) and unilateral renal agenesis (URA) - are at higher risk and would benefit from regular urine testing as part of ongoing clinical surveillance^{15,16}.

The anthropometric data and blood pressure measurements offer a general overview of the screened children. The mean blood pressure readings (Systole 90 ± 11.7 mmHg, Diastole 59.4 ± 11.6 mmHg) fall within normal ranges for this age group – an encouraging finding, given that hypertension can emerge as a long-term complication of undiagnosed kidney disease. Pediatric hypertension is increasingly recognized, with reported prevalence ranging from 1.9% and 15% depending on the population characteristic and diagnostic criteria^{17,18}. It is both an independent risk factor for adult cardiovascular disease and contributor to

the progression of CKD in affected children¹⁹.

Strengths and Limitations

This study, however, present several limitations. The sample size (25 children) restricts the generalizability of findings related to the prevalence of congenital abnormalities. Furthermore, the screening methods used -basic physical examination for heart conditions and urine dipstick for proteinuria- serve as preliminary diagnostic methods and may not detect all abnormalities. More advanced diagnostic tools such as echocardiography, detailed urinalysis, and serum kidney function testing, would be required for a comprehensive assessment evaluation and confirmation of suspected cases. The limited age range (4-6 grade elementary school) means that conditions manifesting earlier in life or during adolescence may not have been captured. Long-term cohort studies indicate that early detection of hypertension can slow progression to end-stage renal disease and reduce cardiovascular morbidity^{19,20}.

Despite these limitations, this study illustrates the value of community service initiatives in enhancing health literacy through education presentations and facilitating early identification at risk for congenital kidney abnormalities in a primary healthcare setting. Future research should incorporate larger sample sizes, utilize more definitive diagnostic modalities and establish clear referral pathways to ensure timely evaluation and management of children with suspected abnormalities. These findings provide valuable localized evidence to inform regional public health strategies aimed at reducing the burden of congenital anomalies in Banyuwangi Regency, Indonesia.

CONCLUSION

This community service initiative conducted Primary Health Care Sobo, Banyuwangi Regency, effectively demonstrated its impact in improving community health knowledge and supporting the early identification of potential congenital abnormalities among children. Future efforts should aim to expand the scope of such program through larger-scale studies, the integration of more definitive diagnostic methods, and the development of structured referral systems to ensure appropriate follow-up and timely management of identified case.

ACKNOWLEDGMENT

We thank the health cadres and healthcare personnel at puskesmas for their valuable assistance and support throughout conduct of this study.

CONFLICT OF INTEREST

All authors have no conflict of interest.

ETHICAL CONSIDERATION

This research was conducted as part of a community service activity; therefore, ethical approval was not required.

FUNDING

LPPM Universitas Airlangga funded this research through “Pengabdian Kepada Masyarakat 2024” program.

AUTHOR CONTRIBUTION

All authors were actively involved in every stage of the research processes including study design, data collection, manuscript preparation and final approval for publication.

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