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ANALYSIS OF THE EFFICIENCY OF MATERNAL AND CHILD HEALTH SERVICES (MCH) AT PUBLIC HEALTH CENTERS IN THE BANYUMAS DISTRICT

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ABSTRACT

Maternal and Child Health (MCH) service programs as an indicator of the status of community's health status are available at every Public Health Center (PHC) in Banyumas District. However, these services are still inadequate to improve the health status of mothers and children. The condition of the COVID-19 pandemic in early 2020 caused several MCH services not to run as previously planned. This study aimed to describe the implementation and efficiency of MCH services in PHC in Banyumas Regency. The method used in this study was a quantitative approach using secondary data on health workers and the output of MCH services at the PHC. Data were analyzed using the Data Envelopment Analysis (DEA) method, with the unit of analysis being aggregate data at 10 selected PHCs using a purposive sampling technique. The results showed that 60% of the PHCs were technically efficient (VRS value 1.0), and 40% of the PHCs were technically inefficient (VRS value < 1.0). The analysis's findings indicated there were differences between efficient and inefficient PHCs in terms of the input (health personnel) and output (service use). The inefficiency of the PHC is caused by the less optimal utilization of health workers and the low utilization of PHC health services by the community. Additionally, to meet the coverage of service criteria set by the government, MCH services at the PHC in the Banyumas Regency region have been provided following the current standard operating procedures. Public Health Centers must maximize the utilization of health personnel to improve technical efficiency and condition service activities during the pandemic by adjusting regional policies while still complying with health protocols.

Keywords: efficiency, maternal and child health, public health center

Introduction

Public Health Centers (PHC), referred to *Puskesmas* is a technical implementation unit for the Health Service. PHC is responsible for administering community and individual health service efforts in its working area.¹ As a community-based health service center in Indonesia, PHC is also responsible for providing maternal and child health services, which is an indicator of community health status (National Academy of Sciences 2014). Hence, initiatives to enhance mother and child health require special consideration. Although PHCs currently have decent access to healthcare, maternal and infant mortality rates are still high.² Every PHC in Banyumas District offers services for maternal and child health care. Antenatal Care (ANC), vaccinations, family planning, and community-based Integrated Management of Childhood Illness (IMCI) are among the MCH services provided at the PHC in question. However, these services are still inadequate to improve the health status of mothers and children.

The Maternal Mortality Rate (MMR) in the Banyumas Regency in 2019 was 38 per 100,000 live births. Compared to 2018, the Maternal Mortality Rate (MMR) had greatly decreased where previously it reached 67.54 per 100,000 live births. Despite this, the MMR in Banyumas Regency has reached the target set by the National Medium Term Development Plan (referred to *Rencana Pembangunan Jangka Menengah Nasional* or RPJMN) from 2015 to 2019 of 306 per 100,000 live births. The Infant Mortality Rate (IMR) in Banyumas Regency in 2019 was 7.41 per 1000 live births. This coverage has exceeded the RPJMN target IMR of 24 per 1000 live births. Meanwhile, the under-five mortality rate in 2019 was 9.17 per 1000 live births, exceeding the RPJMN target of 23 per 1000 live births.³ Poor prenatal and postpartum health services, delays in dealing with risky circumstances and the referral system, discrepancies in health services, and a lack of suitable health resources and accompanying equipment are all likely contributors to this condition.^{2,4,5}

Various program strategies have been implemented to reduce maternal mortality, infant mortality, and under-five mortality. Various efforts to suppress MMR and IMR in Banyumas Regency were carried out through the Integrated ANC EMAS (Expanding Mother and Newborn Survival Expansion) Program, Optimizing Midwives, Optimizing MCH Books, Optimizing antenatal care visits (ANC-1 and ANC-4), optimizing Birth Planning and Complication Prevention Program (referred to *Program Perencanaan Persalinan dan Pencegahan Komplikasi* or P4K) with stickers and high-risk detection, Village Optimization Standby and village health forums, and other initiatives, such as routine coffee morning meetings every 2-3 months at the Regent's Hall which involve cross-sectoral involvement.^{3,6}

The COVID-19 pandemic circumstances in early 2020 prevented some maternity and child health service programs from operating as expected. To minimize contact between health professionals and patients who might contract COVID-19, a few home visits were also made. The number of active family planning participants has also decreased as a result of people's

apprehension about accessing family planning services.⁷ This condition affected on meeting the target coverage of maternal and child health services at the PHC.⁸ Further analysis is needed to see the efficiency of maternal and child health services during the COVID-19 pandemic.

Efficiency analysis using Data Envelopment Analysis (DEA) is one method that can be used to see the efficiency of health services based on available inputs and outputs. The DEA method can measure relative efficiency based on the number of medical personnel and the output of PHC services, such as the number of patient visits, reduction in disease cases, and coverage of other health services at the PHC.⁹ The findings of the efficiency study of health services could be used by policymakers and decision-makers to monitor the technical efficiency of health services and urge them to continually improve their quality and utilization.¹⁰ Additionally, we might evaluate how healthcare organizations might set service levels based on their operational or strategic qualities by employing the DEA technique.¹¹ Data envelopment analysis extends the scope of tools used to analyze primary care functioning which can help health economic studies that assess the efficiency of primary care. Setting outputs and inputs and choosing a model that is best suited for the variety of goods and services offered by the primary healthcare sector are the main problems.¹²

Using the DEA approach, this study examined the relative efficiency of the maternal health services provided at the Public Health Centers in the Banyumas district. Based on the comparison of the effectiveness of various healthcare systems, this study advances the practice of healthcare management and help to increase operational efficiency in the healthcare sector. The study's findings were intended to provide planners of programs and policies targeted at improving health status in Banyumas Regency with an extensive understanding of how successfully maternal and child health services are implemented.

Methods

The quantitative method was used in this cross-sectional longitudinal method was used in the quantitative study to acquire an overview of the effectiveness of MCH services at the PHC based on input and output components. Efficiency is one of the performance metrics that, in theory, drives an organization's total performance. Efficiency is the ability to accommodate the greatest output from a number of existing inputs. Efficiency in the health sector is typically correlated with the relation between resource inputs and outputs of health services. Data were analyzed using the Data Envelopment Analysis (DEA) method with the unit of analysis for aggregate data at 10

health centers selected using a purposive sampling technique with inclusion criteria, namely the health center with the highest infant mortality rate, the health center with the highest maternal mortality rate, the health center with the lowest total coverage of antenatal care, the health center with the lowest coverage of active family planning participants, the health center with the lowest coverage of postpartum family planning participants and the health center with the lowest coverage

of complete postpartum visits. The data used in this research was data from 2020 – 2021. Data on the number of health professionals and the output of MCH services, including coverage of ANC-1 and ANC-4, coverage of immunization, and coverage of active family planning participants, were provided as the secondary data source for this study.

The data is then processed using the data envelopment analysis (DEA) method to see the value of the efficiency of the input variables (health workers) and output (coverage of MCH services) as the analysis unit. Data input and output variables are formulated using the assumption of a variable return to scale (VRS), which is oriented toward output maximization. The relative efficiency score is the outcome of the DEA, a non-parametric linear programming system that weighs the input to the output of each production unit (Decision-Making Unit, DMU). The DEA model's efficient measurement yields a score that ranges from 0 to 1. The DEA model score calculation formula used is as follows:

$$\text{Max } Z_k = \theta_k - \varepsilon \left(\sum_r S_r^+ + \sum_i S_i^- \right) \text{ Subject to : } -X_{ij} + \sum_i X_{ij}\lambda_j + S_i^- = 0$$

$$\theta_k Y_{ij} - S_r^+ - \sum_i X_{ij}\lambda_j = 0$$

$$\sum_j \lambda_j = 1$$

$$\lambda_j, S_i^-, S_i^- \geq 0$$

Explanation:

Z_k = efficiency of DMU_k

S_r^+ = The slack value of the output (health services coverages)

S_i^- = The slack value of the input (number of health professionals)

θ_k = value of h_k (relative efficiency)

λ_j = variable load per DMU

When a PHC is evaluated for efficiency and receives a score of 1, it is deemed an efficient PHC with best practices. Furthermore it also serves as a benchmark for other PHCs (benchmarking). Nonetheless, the PHC was deemed an inefficient PHC if the findings of testing its efficiency yielded a score between 0 and 1. The score of the efficiency measurement results determines the relative efficiency level of the PHC. This research has received a permit from the

Health Research Ethics Commission, Faculty of Health Sciences, Jenderal Soedirman University, with Ethical Approval No 469/EC/KEPK/VI/2021.

Results

Table 1 shows the characteristics of the selected PHC as a sample based on input and output data for MCH services:

Table 1. Characteristics of PHC

Name of Public Health Center	Input		Output (%)			
	General Practitioners	Midwives	Coverage of 4th Antenatal Visit (ANC-4)	Active Family Planning Participants Coverage	Coverage of Postpartum Family Planning Participants	Coverage of Complete Postpartum Visits (PNC-3)
Jatilawang	4	24	90,6	7,8	45,5	99,4
Sokaraja I	3	19	90,7	72,7	18,9	96,2
Sokaraja II	2	16	96,6	74,5	35,5	98,9
Purwokerto Timur I	2	7	92,5	123	79,5	90,5
Purwokerto Timur II	8	8	85,5	11,2	13,5	90,9
Gumelar	3	17	95,2	76,8	41,7	97,7
Baturaden II	3	13	94,1	4,4	72,4	96,8
Purwokerto Selatan	9	7	90,9	77,3	67,1	100
Kembaran I	2	17	88,2	95,2	32,1	92,8
Purwokerto Barat	2	18	95,1	54,9	12,5	95,7

All sample PHCs have general practitioners and midwives responsible for providing MCH services at the PHC. Even so, 40% of the sample PHC had 2 doctors, and 20% of the sample PHC had 7 midwives. As much as 20% of the sample PHC have ANC-4 coverage below the national standard (90%). 30% of the sample PHC had active family planning participant coverage below the national standard (61,78%). 70% of the sample public health centers had postnatal family planning participant coverage below the national standard (61,78%).

The results of the secondary data descriptive analysis indicated the input and output factors for MCH services at the 10 selected health facilities using a purposive sampling method. The following table displays the analysis's findings.

Table 2. Results of Descriptive Analysis of Input and Output Variables

Variables	Mean	Minimum	Maximum	SD
Input				
General Practitioners	3,8	2	9	2,4
Midwives	14,6	7	24	5,4
Output				
Coverage of Antenatal Visits 4 (ANC-4)	91,94	85,5	96,6	3,3
Active Family Planning Participants Coverage	66,68	4,4	123	33,9
Coverage of Postpartum Family Planning Participants	41,87	12,5	79,5	23,0
Complete Coverage of Postpartum Visits (PNC-3)	95,89	90,5	100	3,2

We could conclude from table 2 that the average number of doctors at the public health center was 3,8, and the midwife at the PHC was 14,6. The average coverage for antenatal visits was 91,94%; coverage for active family planning was 66,68%; coverage for postpartum family planning was 41,87%; and coverage for complete postpartum visits was 95,89%. Table 3 below shows the scores of the technical efficiency test results using the output-oriented DEA variable return to scale (VRS) model.

Table 3. Scores of Public Health Center Technical Efficiency Test Results using Output-Oriented DEA VRS

Name of the health center	Variable return to scale	Efficiency Level
Jatilawang	0,977	Inefficient
Sokaraja I	0,667	Inefficient
Sokaraja II	1,000	Efficient
Purwokerto Timur I	1,000	Efficient
Purwokerto Timur II	0,875	Inefficient
Gumelar	0,833	Inefficient
Baturaden II	1,000	Efficient
Purwokerto Selatan	1,000	Efficient
Kembaran I	1,000	Efficient
Purwokerto Barat	1,000	Efficient
Mean	0,935	
SD	0,1013283	

The results of the DEA VRS analysis found that 6 PHC (60%) have technically efficient services, and 4 PHC (40%) have technically inefficient services. The average difference in the use of inputs and output results between efficient and inefficient PHC is shown in Table 4 below

Table 4. Average Difference between Input and Output Variables

Variables	Mean			
	Efficient PHC	Inefficient PHC	Gap	%
Input				
General Practitioners	3,3	4,5	(1,2)	26,70
Midwives	13	17	(4)	23,52
Output				
Coverage of Antenatal Visits 4 (ANC-4)	92,9	90,5	2,4	2,65
Active Family Planning Participants Coverage	49,85	29,9	19,95	6,67
Coverage of Postpartum Family Planning Participants	71,55	59,37	12,18	20,51
Complete Coverage of Postpartum Visits (PNC-3)	95,78	96,05	(0,27)	0,28

This study analysis found that from the input side, there is a difference in the number of doctors by 26,70% and the number of midwives by 23,52% between efficient and inefficient health centers. In contrast, there is a 20,51% difference in postpartum family planning coverage on the

output side. According to calculations of the average input and output variables of PHC, inefficient PHC differ greatly from efficient PHC.

Discussion

The DEA VRS method's technical efficiency test revealed that 40% of PHCs are technically inefficient, whereas 60% of PHCs effectively deliver services for maternal and child health. Maternal and child health care are one of the PHC services that are technically inefficient. The number of visits, the coverage of under-fives being weighed, the coverage of deliveries attended by health staff, the coverage of basic immunization, and the coverage of active family planning are the output variables that indicate service inefficiency.⁹ The average number of doctors and midwives in the four inefficient PHCs is higher than in the four efficient PHCs, with a difference of 1.2 on average (see Table 4). Thus the difference between the average input (general practitioners and midwives) is not proportional to the output. According to the principle of service efficiency, a given amount of input can yield an optimal amount of output, or a given amount of input can result in a given amount of output.^{13,14}

This study proved that technically inefficient health service facilities are caused by the underutilization of PHC or excessive capacity as primary health facilities. Sources of health service inefficiency include low utilization of health facilities, use of substandard or counterfeit medical services, inappropriate and ineffective use of services, excessive use of health products and services, and inappropriate collaboration of health workers.¹⁵ The inefficiency of the PHC was predicted to occur due to the not optimal use of variable inputs. The number of health workers was also a source of inefficiency at PHC.¹⁶

The delivery of quality services is also a factor affecting the efficiency of healthcare providers. Including quality in efficiency, measurement can produce valid efficiency values.¹⁷ This study examined the achievement of maternal and child health services according to standards. The observations at the research location showed that maternal and child health services were provided less than optimally given the covid-19 pandemic, which caused people to be reluctant to visit the PHC. Studies show restrictions during covid-19 pandemic had negative effects on several visitations to health care services. In the early stage of the pandemic, there was a general reduction in every service's use as well as barriers to access it. It keeps decreasing until about a third during the pandemic.¹⁸⁻²⁰ The pandemic made it difficult for the healthcare industry to continue providing outstanding services. During this time, healthcare showed low levels of efficiency in managing resources.²¹

Research in China reported differences in the level of efficiency models in each service in various regions. The study showed the positive trend of China's PHC institution service efficiency over the decade, but the efficiency was generally at a low level.²² As revealed by a previous study, each model's level of efficiency between regions reveals a clear disparity. Short-term output (health

rates) health services are much more unequal than long-term output (life expectancy). When comparing city-level regions to district areas, the efficiency level computation revealed that the city-level regions had a relatively lower degree of efficiency. Each year, the usage of inputs in district districts and medium efficiency categories changes significantly.²³

Other studies have stated that misplacement in the number and composition of health workers has proven to reduce the efficiency of health services. Lack of access to services due to limited providers is the biggest obstacle to adequate and timely health care.^{24,25} Other factors such as the characteristics of rural and urban areas. The demand for health services is increasing along with the increasing number of rural people who want to take advantage of health services in urban areas.²⁶ As is known, the number of health service providers in this study has been fulfilled by the PHC. To enhance the output of maternal and child health care, however, the utilization of inputs, particularly health personnel, must be increased. Previous research revealed that managers could identify the outcomes to be reached as well as the levels of resources required to deliver effective care with the use of data envelopment analysis. Depending on the specified factors, different perspectives could be attained.²⁷ According to the other studies, the five most frequently used inputs were the number of beds, medical personnel, non-medical staff, medical technician staff, and operational costs, while the most frequently used outputs were the number of inpatients, surgeries, emergency visits, outpatient services, and days of inpatient care. In the DEA application, these characteristics are frequently utilized to determine how efficient hospitals are.²⁸⁻³⁰ By using efficient health centers as standards, it is possible to evaluate how inefficient health centers might enhance their technological efficiency. At inefficient health centers, DEA analysis can be utilized as a foundation for suppressing input and optimizing output to improve the efficiency of the services offered.

Making efficient PHC a benchmark for comparison is one way to increase the efficiency of inefficient PHC services.³¹ Increasing the value of technical efficiency at the PHC could be implemented by increasing the output based on the calculation results of the data envelopment analysis.³² The number of visits or the number of utilizations of inefficient PHC services is increased by referring to the utilization of services at efficient PHC. Increasing the utilization of services is carried out through outreach activities regarding the health center facilities concerned.³³⁻³⁵ Setting targets to be more efficient and achievable is carried out by increasing the number of nurses, increasing the number of midwives, increasing the number of diarrhea patients, increasing the number of births, and carrying out socialization activities regarding the health center facilities concerned.³⁶ This study shows the results of a specific analysis related to the efficiency of maternal and child health services at the Public Health Centers in Banyumas Regency. However, the analyses' findings did not demonstrate the efficiency of maternal and child health services as a whole inclusion because its reflected relative efficiency data based on DEA calculation using only

health worker data as input data and health service coverage as output data. Further research needs to be conducted to look at the efficiency of maternal and child health services in a comprehensive manner using other source input and output data.

Conclusion

According to the data envelopment analysis, 60% of PHCs were technically efficient, while 40% of PHCs were not. Overall, PHC is inefficient since the community uses its health services less frequently and health staff are not utilized to their full potential. Making the PHC more efficient as a benchmark for comparison to increase the number of visits or utilize the PHC's essential health services is one way to increase the value of their efficiency. Optimizing the performance of health workers at the PHC, both doctors and midwives, is expected to increase the utilization of maternal and child health services at the PHC.

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Conflict of Interest:

The authors declare that they have no conflict of interest.

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