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Efficiency of maternal health services in East Java Province

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A B S T R A C T

This study aims to determine the level of efficiency of maternal health services, to explain the factors that cause inefficiency in the districts/cities of the province of East Java. Using data envelopment analysis (DEA). The results showed that the variable return to scale (VRS) test results were better than constant return to scale (CRS), there was a change from relatively inefficient using VRS to efficient regions using VRS. The results of partial regression test AAB affect inefficiency, TPM and TTU do not affect. Meanwhile, simultaneously AAB, TPM and TTU affect the inefficiency of health services. So that it can increase the improvement of AAB access to reduce inefficiency

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INTRODUCTION

The implementation of regional autonomy and the decentralization system has given authority to the regions to manage and regulate all government affairs outside the affairs that are under the authority of the central government (Sulila, 2015). This has led to the emergence of wider autonomy for local governments to regulate and manage their own regions. Regions are considered to understand more about the problems, challenges and potentials that exist so that they are expected to be able to manage them optimally. Local governments have different development priorities, because they depend on the potential and situation of the region. The economic consequence of choosing to prioritize regional development is the allocation of resources to support the program. Local government resources or budget allocations directly support selected and strategic sectors (Solihin, et al. 2017).

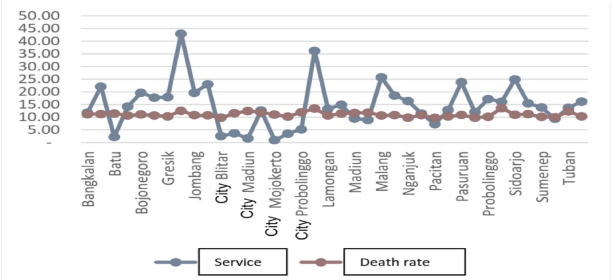
The larger the portion of the budget allocated for health sector spending, the higher the probability that the selected sector will be able to achieve its targets efficiently. Efficiency is closely related to productivity because of the effect of using input variables on the output involved (Sari & Medina, 2020). This means that the amount of expenditure allocation in the health sector should also have a big influence on public health in East Java.

East Java province has a major problem in the field of basic health, namely the status of maternal mortality which is still high. Programs to reduce maternal mortality that are carried out are health service programs through increased visits (K4), provision of tetanus injections (T2plus), provision of regional-enhancing vitamins during pregnancy, assistance from health workers during childbirth and health services for postpartum mothers.

Different facts show that there are still births assisted by traditional birth attendants, not all postpartum mothers have received quality services, not all neonates have received quality services and the utilization of MCH books has not been optimal, there are still pregnant women who do not have MCH books. In addition, low access to nutritious food, low intake of vitamins and minerals, and poor diversity of food and animal protein sources as well as low access to health services including access to sanitation and clean water are factors that cause malnutrition and stunting problems in East Java.

The high maternal mortality rate can be explained by Figure 1. The maternal mortality rate for eleven years (2009-2019) in 38 districts/cities in East Java is at an average of 14.70 deaths per year. There are 20 regions that are below the average and another 18 districts/cities are above the average. The maternal mortality rate consists of the mortality rate during pregnancy, the mortality rate during childbirth and the mortality rate during the puerperium. Meanwhile, for maternal services, it is relatively fluctuating and an average of eleven years shows an increase.

Figure 1
Graph of BPD Efficiency Performance in Indonesia for the period 2011 - 2017



Source: East Java Provincial Health Office 2009-2019

Inequality between expectations and reality, Increasing the number of maternal health services that are not followed by the ability to reduce maternal mortality. It can be interpreted as a condition where the input of allocation of health services does not have a significant impact on improving the output of the health sector. Similar conditions have occurred in Pakistan, where government spending in the health sector did not have a significant impact (Asghar, et al. 2012).

Different research results presented by (Gupta, et al. 1998) who conducted a study with a sample of 118 developing countries stated that government spending on the health and education sectors can have a positive effect on human resources which in turn, increases economic growth while promoting equity. and reduce poverty. Furthermore, Doryan (2001) explains that when the government has used the benefits of economic growth to finance basic health care and access to education for all, it will bring multiple benefits to the poor; they are healthier and better educated, and they will increase their consumption.

The above conditions attracted the attention of researchers to analyze the causes of the high maternal mortality rate. The research findings are expected to offer an alternative for improving the management of health service resources which is an investment to achieve community welfare (Welfare Society) (Stuckler, et al. 2009), so that it should be the main concern of the government as a public service provider (Saltman, et al. 1997).

Most research on efficiency related to public services uses the input of government budget allocation which is assumed to be the only input. In health services, researchers see a more complex space where budget allocations are passed on to health service programs that have a direct influence on the efficiency of health services that reduce the mortality rate of pregnant women, mothers giving birth and the postpartum period. Researchers also adopted the results of Cordero-Ferrera, et al. (2011), and Emrouznejad & Dey, (2011) where environmental factors in the form of infrastructure have a role in the efficiency of creating health.

This research approach uses the limit of production possibilities formed by the combination of technically efficient outputs that can be achieved by producers. In cases where a DMU fails to reach an efficiency level of 100 it is said to be inefficient. So, if the production limit can be determined, the performance of a unit can be evaluated by comparing its behavior with the ideal efficiency benchmark (Worthington, 2004).

The Frontier Efficiency Methodology has been used rigorously in recent years. Data Envelopment Analysis (Charnes, et al. 1978, Emrouznejad & De Witte, 2010, (Emrouznejad, et al. 2008) proved to be a useful tool in measuring the efficiency and productivity of hospitals and health care related units (Hollingsworth, 2003, O' Neill, et al. 2008). So the researchers used this method to analyze the technical efficiency of health services in the districts/cities of East Java province (2009-2019).However, what makes this research different is the use of multi-stage DEA, as has been done by DEA. 'Inverno, Carosi, & Ravagli, (2018) to find out changes in efficiency scores from each addition of different inputs.

The inputs in this study are the number of visits by pregnant women (K4), the number of pregnant women receiving tetanus (IT2), the number of pregnant women receiving vitamins (MFE), the number of pregnant women receiving assistance from health workers during childbirth (MdN), the number of mothers

receiving health insurance during the puerperium (MYN). Meanwhile, the outputs in this study are maternal mortality rate during pregnancy (AKIH), maternal mortality rate during childbirth (AKIB), and maternal mortality rate during childbirth (AKIN).

METHODOLOGY

The method used is Data Envelopment Analysis (DEA), which is a non-parametric linear programming technique model to measure the level of efficiency. In addition, this study uses a panel regression technique to see the factors that influence the level of inefficiency of maternal health services.

There are two models, namely the DEA model and the Regression model. DEA, there are 2 approaches, namely the CCR and BBC models. The CCR model (Banker, et al. 1984) assumes that the comparison of the inputs and outputs of a company does not affect the productivity that may be achieved, namely constant return to scale (CRS). The technical efficiency of maternal health services is structured according to the equation below.

$\min {}^{e}{}_{0} = \mu_1 AKIH + \mu_2 AKIB + \mu_3 AKIN$

c

$V_1 KK4 + V_2 IT2 + V_3 MFE3 + V_4 BdN + V_5 MYN$

$\mu_1 AKIH_i + \mu_2 AKIB_i + \mu_3 AKIN_i$

$- V_1 KK4_1 + V_2 T2_2 + V_3 MFE3_3 + V_4 Bdn_4 + V_5 MYN_5 \leq 0$

$\mu(_{1,2,3,}) V_{1,2,3,4,5} \geq 0$

Information:

AKIH : percentage of maternal deaths during pregnancy
AKIB : percentage of maternal deaths during childbirth
AKIN : percentage of maternal mortality during puerperium
IMR : percentage of infant mortality rate
LBW : percentage of babies born with low weight
KK4 : percentage of visits by pregnant women K4
IT2 : percentage of immunization of pregnant women T2 plus
MFE3 : percentage received F3/iron tablets
BdN : percentage of births assisted by health workers
MYN : percentage of health care providers during childbirth

μ_1, 2, 3: weights for output AKIH, AKIB, AKIN

V_1,2,3,4,5: weights for input KK4, IT2, MFE3, BdN, MYN, individual units (district/city)

The next approach is BCC with a variable returns to scale (VRS) is used because of imperfect competence, limited funds and others. This causes the DMU to be unable to operate optimally. The DEA – CRS model can be easily developed in the DEA – VRS model by simply adding the convexity function (Convexity Constraint. The Variable Return to Scale (VRS) model according to the following equation;

$\min {}^{e}{}_{0} = \mu 1\, AKIH + \mu\_2\, AKIB + \mu\_3\, AKIN + \mu\_0$

constraint:

$V_1 KK4 + V_2 IT2 + V_3 MFE3 + V_4 BdN + V_5 MYN = 5$

$\mu 1 AKIH_i + \mu_2 AKIB_i + \mu 3 AKIN_i - V_1 KK4_1 + V_2 IT2_2 + V_3 MFE3_3 + V_4 BdN_4 + V_5 MYN_5 \leq 0$

$\mu_{1,2,3}\ V_{1,2,3,4,5} \geq 0$

Description of convexity:

μ_0; a piece that can be positive or negative

I; individual unit (district/city)

The second model uses panel data regression. The model analysis uses two analyzes: Simultaneous significant test (F test) and partial significant test (T test). The hypothesis used in the F test is as follows:

$H\_0 : \beta\_1 = \beta\_2 = ...\beta\_k = 0$

$H\_1 =$ at least one of is not equal to zero. The rejection region is limited by the critical point (F-table). The critical point value is based on the magnitude of and the degree of freedom, where the magnitude is determined by the numerator (k-1) and denominator (n-k). The equations used to determine the value of F-statistics are as follows: F = (R^2/(k-1))/((1-R^2)/(n-k)) (Gujarati & Porter, 2009).

The t-test was used to determine the significance of the individual independent (independent) variables affecting the dependent variable. The hypotheses used in the simultaneous or partial test of this significance are:

H0 : βi = 0

H1 : β1≠0

then the t test performed is a two-sided t test.

The t-statistical test can be done by comparing the t-statistical value with the t-table (critical point) with degrees of freedom of n-k and a confidence interval of 1-α. The value of t-statistics is obtained from the following equation:

t (βk-βk)/(se(βk). Where β^k is the value of the parameter k, _k is the value of the null hypothesis, se(βˆ_k) is the standard error of the parameter ˆ_k, n is the number of observations, and k is the number of independent variables.

RESULT AND DISCUSSION

Technical efficiency analysis is an analysis that measures the level of efficiency between input variables and output variables with an input orientation approach. The value of technical efficiency is used to see the extent to which health service programs organized by districts/cities in East Java Province can be enjoyed by pregnant women, women in labor and postpartum and have an impact on reducing mortality rates for pregnant women, women in labor and postpartum women. In the first part of the analysis of the technical efficiency of health services using the CRS assumption.

Efficiency of maternal health services analysis table 1. Shows the value of efficiency of maternal health services in 38 districts/cities of East Java Province in 2009-2019. The results of the analysis show that none of the regions that have consistently achieved efficiency for 11 years (efficiency = 100) in providing services, however, there are areas that almost every year achieve efficiency, namely Jember Regency, followed by Jombang Regency, and Surabaya City.

Jember Regency from 2009-2014 has always been efficient, but in 2015 it became inefficient with an efficiency value of 70.75, then in the following year 2016-2019 sequentially it became efficient. The city of Surabaya was efficient in 2009-2010, but in 2011 it became inefficient with a value of 47.17 and then again efficient in 2012-2016, in 2017 it was again inefficient with a value of 79.02 and again efficient in 2018, but again inefficient in 2017. 2019 with a score of 98.68.

Table 1
Value of Efficiency of Maternal Health Services Analysis of DEA with CRS Assumptions

DMU	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Bangkalan	30.42	32.79	30.21	25.8	54.78	29.76	29.25	80.98	100	49.82	87.59
Banyuwangi	100	38.72	41.1	58.5	79.48	65.91	96.34	69.87	75.8	66.36	69.01
Batu	16.02	6.82	6.95	18.3	61.97	7.99	61.00	9.50	16.11	1.30	6.68
Blitar	58.06	55.5	56.66	50.8	41.43	74.78	0.64	65.04	20.31	28.90	81.65

Bojonegoro	38.95	57.97	54.95	51.2	62.41	32.41	44.86	79.01	69.66	94.68	85.01
Bondowoso	73.17	68.58	69.22	100	55.55	48.1	50.32	84.3	39.64	71.26	33.61
Gresik	62.42	59.69	50.95	37.7	56.13	86.07	31.85	58.48	46.33	65.64	58.92
Jember	100	100	100	100	100	100	70.75	100	100	100	100.00
Jombang	100	54.47	44.59	54.8	61.95	100	100	100	100	100	37.57
Kediri	87.25	100	100	100	76.81	48.14	32.61	61.83	37.11	60	51.10
Kota Blitar	33.02	22.43	6.76	27.9	18.93	9.41	4.88	34.78	1.16	22.00	34.98
Kota Kediri	21.30	8.23	7.95	26.4	20.57	8.10	13.93	18.14	15.09	11.5	0.78
Kota Madiun	13.06	27.98	18.81	13.8	20.15	26.87	0.43	4.5	0.91	0.94	5.20
Kota Malang	90.72	39.85	38.49	95.1	48.17	47.86	28.61	42.07	61.22	36.28	39.15
Kota Pasuruan	14.67	19.77	11.87	0.99	18.26	14.45	22.57	15.72	9.81	41.38	11.24
Kota Probolinggo	28.17	26.04	21.30	16.1	18.28	21.34	9.01	21.97	13.72	11.86	12.00
Kota Surabaya	100	100	47.17	100	100	100	100	100	79.02	100	98.68
Kota Mojokerto	10.59	13.31	0.65	9.00	8.26	2.62	7.82	4.36	1.50	4.49	7.41
Lamongan	62.06	67.49	54.05	36.8	40.13	26.14	52.04	54.26	35.07	27.48	52.13
Lumajang	33.43	34.6	32.55	22.2	62.69	48.05	50.67	65.72	27.80	57.28	46.96
Madiun	21.53	27.70	28.38	100	33.54	24.19	8.73	46.46	51.08	20.82	50.40
Magetan	24.67	34.15	33.64	10.9	24.62	27.6	22.33	29.13	41.80	43.97	22.36
Malang	93.86	100	100	76.8	86.6	84.25	99.98	96.01	76.41	100	100.00
Mojokerto	52.24	38.03	43.19	51.6	68.05	45.36	44.09	87.44	89.88	66.89	62.59
Nganjuk	57.36	62.13	57.25	84.1	100	52.43	31.7	41.71	78.25	61.85	38.40
Ngawi	47.45	29.59	29.13	36	62.12	31.62	27.36	56.53	29.94	79.87	54.35
Pacitan	18.56	36.14	39.56	35.4	25.62	100	53.96	100	29.7	100	100.00
Pamekasan	36.48	51.79	50.46	67.7	100	41.33	13.11	76.64	100	96.87	56.18
Pasuruan	60.20	99.63	65.63	58.2	68.95	77.07	87.31	100	57.17	99.00	78.58
Ponorogo	33.86	40.14	39.58	8.9	87.99	54.83	13.34	65.26	93.06	63.49	29.33
Probolinggo	53.42	36.28	36.26	54.8	59.85	70.99	41.88	69.48	38.7	37.45	77.12
Sampang	85.09	71.02	73.93	47.7	48.55	58.06	23.06	80.92	55.74	66.96	32.73
Sidoarjo	72.44	68.65	67.06	100	75.02	73.59	79.60	81.5	100	82.42	47.70
Situbondo	80.54	37.32	37.5	69.3	56.62	52.41	39.87	81.91	28.53	41.94	50.16
Sumenep	86.4	100	88.63	28.1	31.31	27.55	100	100	27.97	43.26	29.62
Trenggalek	43.62	28.51	24.47	27.8	23.97	28.86	37.08	25.31	39.83	26.72	24.16
Tuban	42.29	37.39	36.72	48.3	29.79	26.82	17.49	42.74	21.72	25.7	66.93
Tulungagung	45.71	47.93	44.96	40.7	70.14	43.91	43.78	74.4	67.7	100	100

Jombang Regency achieved efficiency in 2009, papa in 2010-2013 became inefficient with a successive value of 54.47; 44.59; 54.81; 61.95; in the following year 2014-2018 became efficient and again inefficient in 2019 with a value of 37.57. Malang Regency was inefficient in 2009 with a value of 93.86; efficient in

2010-2011 and then again inefficient in 2012-2017 with a successive value of 76.79; 86.6; 84.25; 99.98; 96.01; 76.41 and efficient again in 2018-2019. Pacitan Regency for 11 years only achieved efficiency for 4 years (2014, 2016, 2018 and 2019). Kediri Regency is only efficient in 2010-2013 and inefficient in the following year. Sumenep Regency and Kediri Regency are only efficient for three years (2010, 2015 and 2016). The regencies of Pamekasan, Sidoarjo and Tulungangung both achieved efficiency only 2 times. Bangkalan, Banyuwangi, Bondowoso, Madiun, Nganjuk, Pasuruan regencies have only achieved efficiency once for 11 years. Meanwhile, for the next 22, it becomes inefficient for maternal health services.

In general, it can be concluded that in 2009 there were 4 regions, namely Banyuwangi Regency, Jember Regency, Jombang Regency and Surabaya City. In 2010 there were 5 regions that achieved efficiency, namely Jember Regency, Kediri Regency, Surabaya City, Malang Regency and Sumenep Regency. In 2011 there were only 3 efficient regions, namely Jember Regency, Kediri Regency and Malang Regency. In 2012 there were 6 regions, namely Bondowoso Regency, Jember Regency, Kediri Regency, Surabaya City, Madiun Regency, and Sidoarjo Regency. In 2013 there were 4 regions, namely Jember Regency, Surabaya City, and Pamekasan Regency. In 2014 there were 4 regions, namely Jember Regency, Jombang Regency, Surabaya City and Pacitan Regency.

In 2015 there were only 3 regions, namely Jombang Regency, Surabaya City, and Sumenep Regency. In 2016 there were 6 regions, namely Jember Regency, Jombang Regency, Surabaya City, Pacitan Regency and Sumenep Regency. In 2017 there were 5 regions, namely Jember Regency, Jombang Regency, Pamekasan Regency and Sidoarjo Regency. In 2018 there were 6 regions, namely Jember Regency, Jombang Regency, Surabaya City, Malang Regency, Pacitan Regency, and Tulungangung Regency. In 2019, there were 4 regions, namely Jember Regency, Jombang Regency, Surabaya City, Malang Regency, Pacitan Regency, and Tulungangung Regency.

In the second part of the technical analysis of costs using the assumption of a return to scale (VRS) variable with an input orientation approach. The analysis with the assumption of VRS produces 5 regions that are always efficient in maternal health service programs (input) to reduce maternal mortality (output) in their regions for eleven consecutive years. There is one area that is almost efficient every year, namely Jember Regency.

By using the assumption of CRS and regional VRS that produce efficiency in eleven years, there is a significant difference. Using the VRS assumption results in more efficient areas than using CRS as shown in Table 5.2. DEA analysis with VRS assumptions for each district/city is presented in detail in Table 2 below.

Table 2
Value of Efficiency of Maternal Health Services Analysis of DEA with VRS Assumptions

DMU	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Bangkalan	93.43	98.81	94.01	93.35	93.53	90.45	90.15	100	100	100	100
Banyuwangi	100	94.52	100	91.97	93.30	94.53	98.41	96.75	92.58	94.31	100
Batu	98.70	93.21	96.40	97.39	100	88.16	100	93.32	96.18	92.66	100
Blitar	88.38	91.76	95.26	89.48	96.15	98.90	90.81	98.97	99.78	100	91.95
Bojonegoro	91.33	95.93	93.33	81.79	87.23	87.04	96.35	98.51	100	100	100
Bondowoso	98.62	99.69	100	100	89.69	91.85	100	100	97.14	96.57	100

Gresik	100	100	93.30	88.73	92.93	100	95.28	98.25	96.10	97.81	89.22
Jember	100	100	100	100	100	100	100	100	100	100	96.49
Jombang	100	100	94.90	87.30	96.42	100	100	100	100	100	90.61
Kediri	98.39	100	100	100	91.65	92.35	91.43	96.85	91.31	97.67	90.06
Kota Blitar	90.48	93.36	95.48	99.39	100	99.20	100	96.09	99.64	100	100
Kota Kediri	91.58	89.22	92.55	100	94.81	90.27	95.40	95.35	90.99	91.49	90.63
Kota Madiun	96.79	100	93.75	80.44	93.71	100	85.90	88.18	85.25	86.82	100
Kota Malang	100	99.09	97.50	100	92.71	94.75	95.17	96.26	94.68	92.93	90.48
Kota Pasuruan	100	100	100	96.76	100	99.94	98.91	97.26	92.80	94.78	95.53
Kota Probolinggo	100	96.73	93.85	87.97	88.00	89.85	91.37	93.44	93.33	90.74	92.56
Kota Surabaya	100	100	100	100	100	100	100	100	91.88	100	97.41
Kota Mojokerto	86.96	89.49	92.45	94.46	87.56	84.94	100	90.05	90.42	87.08	97.67
Lamongan	92.27	100	98.31	81.71	86.84	88.56	91.75	89.80	87.16	87.78	97.67
Lumajang	94.62	92.38	92.41	79.67	87.35	91.32	94.89	93.45	88.59	90.22	100
Madiun	90.28	91.84	94.57	100	92.05	94.67	91.25	95.70	94.41	94.25	93.46
Magetan	89.17	92.11	91.87	91.10	88.79	92.05	89.30	91.51	92.63	91.38	91.10
Malang	100	100	100	88.86	98.11	94.64	100	96.33	94.10	100	100
Mojokerto	88.86	90.28	100	96.40	98.25	100	100	100	96.52	96.97	95.06
Nganjuk	100	100	100	97.52	100	100	100	100	100	100	88.69
Ngawi	90.70	90.62	95.28	83.85	94.40	95.23	92.97	96.66	95.70	100	93.93
Pacitan	85.82	93.36	97.10	96.89	93.14	100	100	100	100	100	92.55
Pamekasan	100	100.0	100	91.13	100	96.20	88.27	96.64	100	98.18	91.19
Pasuruan	99.88	100	97.45	94.82	91.90	90.81	98.32	100	90.63	99.22	92.19
Ponorogo	100	99.61	100	94.44	100	96.50	96.12	97.86	100	100	90.45
Probolinggo	89.06	90.27	93.17	92.20	95.00	95.70	94.10	100	93.63	91.13	88.79
Sampang	100	100	100	100	92.16	100	92.22	99.84	92.16	96.93	90.08
Sidoarjo	97.81	94.23	99.27	100	89.78	91.20	99.78	94.15	100	95.95	95.82
Situbondo	100	98.86	99.51	100	100	100	93.40	96.92	92.21	94.82	92.94
Sumenep	100	100	100	98.07	88.87	91.49	100	100	97.16	89.25	94.65
Trenggalek	100	100	100	87.05	87.65	93.73	93.83	93.09	95.95	96.65	89.89
Tuban	89.36	91.64	93.19	85.92	87.32	88.50	89.36	90.97	89.12	91.42	90.46
Tulungagung	95.15	93.60	94.72	87.38	95.79	92.32	96.79	96.94	100	100	99.42

The VRS model assumes that each DMU cannot operate at an optimal scale, where the ratio of the addition of inputs and outputs is not always the same, so that if there are n additional inputs, the output will not always increase n times (constant return to scale), even can be more or less (decrease back to scale) than n times. In this VRS model there is also an assumption that the scale of production can affect the productivity achieved. Technology is one of the factors that affect VRS, thus allowing the scale of production to affect.

The results of the DEA analysis with the VRS assumption show that there are areas that are consistently efficient from 2009-2019, namely Jember Regency and then followed by Surabaya City and Nganjuk Regency but there is 1 year that is inefficient, namely in 2017 (value 97.52 Surabaya City) and 2012 (score 97.52 Nganjuk Regency). Jombang Regency was efficient in 2009-2010, inefficient in 2011-2013 with successive scores of 94.9; 87.3; 96.42 and then again efficient in 2014-2018, but again inefficient in 2019 with a value of 92.00. Malang Regency was efficient in 2009-2011, inefficient in 2012-2014, efficient in 2015, inefficient in 2016-2017 and again efficient in 2018-2019. The efficient achievement of 6 times was also achieved by Pacitan Regency in 2014-2019. There are 4 regions with 4 times efficient performance, namely

Pamekasan Regency, Ponorogo Regency, Sampang Regency and Sumenep Regency. There are 6 regions with 4 times efficiency, namely Bangkalan Regency, Bondowoso Regency, Blitar City, Pasuruan City, Mojokerto Regency and Situbondo Regency. There are 4 regions with 3 times efficient performance, namely Gresik Regency, Kediri Regency, Trenggalek Regency, and Tulungangung Regency. There are 8 regions with 2 times the efficiency achievement, namely Banyuwangi Regency, Batu City, Blitar Regency, Bojonegoro Regency, Madiun City, Malang City, Pasuruan Regency, and Sidoarjo Regency. There are 7 regions with efficiency only 1 time, namely Kediri City, Probolinggo City, Mojokerto City, Lamongan Regency, Madiun Regency, Ngawi Regency, Probolinggo Regency and Regency. Meanwhile, Lumajang Regency, Magetan Regency and Tuban Regency were inefficient regions during 2009-2019.

In general, it can be concluded that in 2009 there were 6 efficient areas, namely Jember Regency, Surabaya City, Nganjuk Regency, Jombang Regency, Malang Regency, Pacitan Regency, Pamekasan Regency, Ponorogo Regency, Sampang Regency, Sumenep Regency, Pasuruan City, Situbondo Regency, Gresik Regency, Trenggalek Regency, Banyuwangi Regency, Malang City and Probolinggo City. In 2010 there were 15 efficient areas, namely Jember Regency, Surabaya City, Nganjuk Regency, Jombang Regency, Malang Regency, Pamekasan Regency, Sampang Regency, Sumenep Regency, Pasuruan Regency, Gresik Regency, Kediri Regency, Trenggalek Regency, Madiun City, Pasuruan Regency, and Lamongan Regency. In 2011 there were 14 efficient areas, namely Jember Regency, Surabaya City, Nganjuk Regency, Malang Regency, Pamekasan Regency, Ponorogo Regency, Sampang Regency, Sumenep Regency, Bondowoso Regency, Pasuruan City, Mojokerto Regency, Kediri Regency, Trenggalek Regency, and Banyuwangi Regency. .

In 2012 there were 10 efficient regions, namely Jember Regency, Surabaya City, Sampang Regency, Bondowoso Regency, Situbondo Regency, Kediri Regency, Malang City, Sidoarjo Regency, Kediri City, and Madiun Regency. In 2013 there were 9 efficient areas, namely Jember Regency, Surabaya City, Nganjuk Regency, Pamekasan Regency, Ponorogo Regency, Blitar City, Pasuruan City, Situbondo Regency and Batu City. In 2014 there were 10 efficient areas, namely Jember Regency, Surabaya City, Nganjuk Regency, Jombang Regency, Pacitan Regency, Sampang Regency, Mojokerto Regency, Situbondo Regency and Madiun City. In 2015 there were 12 efficient areas, namely Jember Regency, Surabaya City, Nganjuk Regency, Jombang Regency, Malang Regency, Pacitan Regency, Sumenep Regency, Bondowoso Regency, Blitar City, Mojokerto Regency, Batu City and Mojokerto City. In 2016 there were 11 efficient areas, namely Jember Regency, Surabaya City, Nganjuk Regency, Jombang Regency, Malang Regency, Pacitan Regency, Sumenep Regency, Bangkalan Regency, Bondowoso Regency, Mojokerto Regency, Pasuruan Regency, and Probolinggo Regency.

In 2017 there were 10 efficient areas, namely Jember Regency, Nganjuk Regency, Jombang Regency, Pacitan Regency, Pamekasan Regency, Ponorogo Regency, Bangkalan Regency, Tulungangung Regency, Bojonegoro Regency and Sidoarjo Regency. In 2018 there were 13 efficient areas, namely Jember Regency, Surabaya City, Nganjuk Regency, Jombang Regency, Malang Regency, Pacitan Regency, Ponorogo Regency, Bangkalan Regency, Blitar City, Tulungangung Regency, Blitar Regency, Bojonegoro Regency and Ngawi Regency. In 2019, there were 9 efficient regencies, namely Jember Regency, Surabaya City,

Nganjuk Regency, Malang Regency, Pacitan Regency, Bangkalan Regency, Blitar City, Tulungangung Regency, and Blitar Regency.

The most inefficient maternal health services during the study period, the results of the DEA analysis assuming VRS are shown in table 6.1. The most inefficient areas are Tuban Regency, Lumajang Regency, Lamongan Regency and Mojokerto City with an average achievement of below 95.25 during 2009-2019. The results of the analysis in 2009 Mojokerto City became the most inefficient area due to the gap between actual achievements and service targets which reached an average of 39.26%. The highest gap in the number of pregnant women who received tetanus immunization was more than 100%. This condition occurs because the tetanus immunization given to pregnant women does not have to be done during pregnancy but to women of childbearing age (WUS).

Next, the achievement of visiting pregnant women four times during pregnancy there is a gap of 11.52%, pregnant women receiving blood-boosting vitamins have a gap of 13.40%, giving birth assisted by a doctor there is a gap of 12.82%, during the postpartum period receiving health services there is a gap of 12.75. So to achieve efficiency, adjustments are needed between actual and target conditions. For tetanus immunization, it is necessary to adjust the report so that the data on pregnant women who receive immunization can be separated from the data of WUS who are immunized. For the services of visiting pregnant women, giving vitamins, helping midwives during childbirth and health services during the puerperium, the targets need to be adjusted to the actual conditions of the mother's needs. To see other areas that have the characteristics of efficient input and output management, DEA gives examples of Nganjuk Regency, Sampang Regency and Pamekasan Regency.

Mojokerto City is an area that has the highest inefficiency. Each year is relatively the most inefficient area (table 5.3). In 2017 Lamongan Regency became the area with the lowest efficiency value, namely 87.16. This means that the achievement of service targets is still lower than the need for services, so it is necessary to increase service targets such as the provision of vitamins by 15.27%, Midwife Aid of 12.84%, visits by pregnant women 12.29% and immunization of pregnant women 46.87% in order to reduce the mortality rate of pregnant women and the number of pregnant women. maternal death died during childbirth. To see examples of other regions that have efficient input and output characteristics, DEA referred to Jember Regency and Bangkalan Regency.

Table 3
The Most Inefficient Regions in Maternal Health Services assuming VRS

DMU	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Tuban	89.36	91.64	93.19	85.92	87.32	88.5	89.36	90.97	89.12	91.42	99.42
Lumajang	94.62	92.38	92.41	79.67	87.35	91.32	94.89	93.45	88.59	90.22	89.89
Lamongan	92.27	100	98.31	81.71	86.84	88.56	91.75	89.8	87.16	87.78	90.08
Kota Mojokerto	86.96	89.49	92.45	94.46	87.56	84.94	100	90.05	90.42	87.08	88.79

In 2012 Lumajang Regency had the lowest inefficiency value during the research period, which was 79.67. The maternal mortality rate during childbirth

shows the highest gap, which is followed by the maternal mortality rate during childbirth, while the maternal mortality rate during pregnancy is relatively small. If you look at the input conditions, it can be seen that delivery services assisted by midwives provide the most influential contribution (23.06%), then the provision of vitamins (22.05%) next is health insurance services during childbirth (19.53%) and four visits during pregnancy (18.59%). These gaps need to be minimized or eliminated by increasing service achievement targets. The results of the DEA analysis provide examples of regions with efficient input and output characteristics, namely Jember and Madiun.

In 2015, Tuban Regency also had the lowest inefficiency value during the research period, which was 89.36. The maternal mortality rate during postpartum, during childbirth, and during pregnancy has reached its lowest condition (there is no gap between the target and the actual condition of output achievement). However, what becomes inefficient is the achievement of the input target which is too low to achieve efficiency. The target of visiting pregnant women needs to be increased by 9.99%, the immunization target for pregnant women needs to be increased by 6.26 percent, the target for providing vitamins for pregnant women needs to be increased by 9.82%, the target for assistance from health workers during childbirth needs to be increased by 10.32% and the health service guarantee for postpartum mothers is increased by 11.13%. The results of the DEA analysis provide examples of regions that have been efficient in managing their inputs, namely Pacitan Regency, Bondowoso Regency, Blitar City and Mojokerto City.

The results of the regression test of factors that affect the efficiency of maternal health services. Access to clean water AAB, food processing facilities TPM and healthy public places have an effect or not on maternal mortality can be seen in table 4. The results of the t test using SPSS 20.0 show the AAB factor with a significance level of 95% (α = 0.05).

Table 4
Partial Influence of AAB, TPM and TTU Factors on Maternal Mortality

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-41.996	5.508		-7.625	.000
	AAB	.784	.155	.926	5.072	.000
	TPM	.099	.206	.118	.477	.636
	TTU	-.075	.140	-.075	-.540	.593

a. Dependent Variable: Death_Number

The significance number (P Value) for the AAB factor is 0.000 <0.05, so the comparison of the AAB factor can partially affect the maternal mortality rate. On the TPM factor with a significance level of 95% (α = 0.05). The significance number (P Value) for the TPM factor is 0.636>0.05, so the comparison of the TPM factor partially cannot affect the maternal mortality rate. On the TTU factor with a significance level of 95% (α = 0.05). The significance number (P Value) for the TTU factor is 0.593 > 0.05, so the comparison of the TTU factor cannot partially affect the maternal mortality rate.

Simultaneously it is known from the results of the F test in table 6. The F-count value is 193.108 with a significance number (P-value) of 0.000, with a

significance level of 95% (α = 0.05). The significance number (P-value) is 0.000 < 0.05. So based on the comparison of factors in public places (TTU), clean water (AAB) and places to eat (TPM) have a significant influence together on maternal mortality.

Table 5
The Effect of AAB, TPM and TTU Factors on Simultaneous Maternal Mortality

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2809.045	3	936.348	193.108	.000[a]
	Residual	164.860	34	4.849		
	Total	2973.905	37			

a. Predictors: (Constant), TTU, AAB, TPM
b. Dependent Variable: Angka Kematian

CONCLUSION

From the results of the research that has been done, it can be concluded that based on the assumption of constant return to scale (CRS) during the 2009-2019 period, maternal health services are relatively inefficient. There are only 2 areas that are almost efficient, namely Jember Regency and Surabaya City, while the other 36 regions are inefficient. The least efficient area with an average value of 7.61% is Pasuruan City. While the results of the variable return to scale (VRS) assumption during the 2009-2019 period, maternal health services are relatively inefficient. There is only one efficient area, namely Jember Regency and 2 almost efficient areas, namely Surabaya and Nganjuk City, while the other 35 regions are inefficient. The least efficient area with an average value of 90.20% is Mojokerto City.

Based on the results of the partial regression test (T-test) the AAB factor can partially affect efficiency, TPM partially cannot affect efficiency, and TTU partially cannot affect inefficiency. Meanwhile, based on the results of the simultaneous test regression (F-test) it shows that there is a significant influence between the factors of access to public places (TTU), ownership of access to clean water (AAB) and access to healthy food processing places (TPM) on inefficiency.

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