EFFICIENCY ANALYSIS OF HEALTH SERVICES AND IMPROVEMENT EFFORTS BASED ON ISO 9001 IMPLEMENTATION
Analisis Efisiensi Pelayanan Kesehatan dan Upaya Peningkatannya Berdasarkan Implementasi ISO 9001

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Abstract

As an effort to improve services to the community, public organizations are required to provide effective and efficient services. The government policy has been established for the implementation of the quality management system standard, that is expected to increase service efficiency. The limited research that analyzes the relationship between ISO 9001 implementation and the efficiency level of public health center services makes this research important to do. The aim of this research is to analyze the efficiency value of community health centers in South Jakarta and identify efforts that can be used to increase the efficiency value. The data used are primary and secondary data from 10 sub-district level *Puskesmas* and combined with information about the scope of certification. By using Data Envelopment Methode (DEA).Several analyzes were carried out, including analysis of the value of efficiency, projected input and output, strategies for improving the performance of the *Puskesmas*. The results of these study shows that inefficient health centers are still found even though they have implemented ISO 9001.
Keywords: ISO 9001, efficiency, community health center, Data Envelopment Analysis (DEA), strategy

Abstrak

Sebagai upaya peningkatan pelayanan pada masyarakat, organisasi publik dituntut untuk menyediakan pelayanan yang efektif dan efisien. Kebijakan pemerintah DKI Jakarta telah ditetapkan untuk penerapan standar sistem manajemen mutu (SNI ISO 9001), yang diharapkan dapat meningkatkan efisiensi pelayanan. Terbatasnya penelitian yang menganalisis hubungan antara penerapan ISO 9001 dengan tingkat efisiensi pelayanan puskesmas menjadikan penelitian ini penting untuk dilakukan. Penelitian ini bertujuan untuk menganalisa efisiensi pelayanan Kesehatan di Puskesmas wilayah Jakarta Selatan dan mengidentifikasi upaya yang dapat dilakukan untuk meningkatkan efisiensi organisasi. Data yang digunakan adalah data primer dan sekunder dari 10 Puskesmas tingkat kecamatan dan dikombinasikan dengan informasi mengenai ruang lingkup sertifikasi. Dengan menggunakan metode Data Envelopment Analysis (DEA), dilakukan analisis terhadap nilai efisiensi, proyeksi masukan (input) dan keluaran (output), strategi peningkatan kinerja Puskesmas. Hasil penelitian ini menunjukkan bahwa masih ditemukan puskesmas yang tegolong inefisien meskipun telah menerapkan ISO 9001.
Kata kunci: *ISO 9001, efisiensi, Puskesmas, Data Envelopment Analysis (DEA), strategi*

1. INTRODUCTION

Organizations are usually classified into private organizations and public organizations, based on their ownership. The specificity of public organizations stems from their provisions to meet public needs and public order (Aykac & Metin, 2012). Nowadays, an increasing population, level of education, the need for diversification of employment opportunities, as well as the improvement of social welfare, leading to the availability of public services are increasingly required. Demand for the services of public organizations continues to increase both in quantity and quality. (Kamarni, 2011).

Public services are a series of activities to serve and fulfill the needs of every citizen for goods and services. The trust issue is an important factor in reaching the consumer demand and their rational expectation on public services. (Ranerup *et al.*, 2016).

Health service organizations as part of public organizations are required to provide effective and efficient services because their fulfillment cannot be delayed (Maniagasi, 2018). The goal of public health is to improve the health and well-being of the population through disease prevention and health promotion (Strand *et al.*, 2016). Such organizations need to work towards achieving extraordinary results and prove efficient. It is necessary to apply the theory of the New Public Management which focuses on

results. The resulting output needs to be monitored to assess the success of an organization (Matei & Antonie, 2014).

Quality management in an organization is needed to ensure a systematic organization in ensuring the efficiency of the process so that organizational goals are achieved (Taylor and Pearson, 1994). One of the ways can be done with consistency in the implementation of ISO 9001. Implementation of this standard will result in more effective and efficient activity procedures so that as the accumulation it is expected that an increase in organizational performance will occur (Ekowati, 2007). The implementation of quality management system standards in the field of public service is supposed to increase efficiency, correct errors, and improve service. This tool is effective for increasing organizational competitiveness for the main reasons (Priede, 2012):

- Well-defined and documented procedures that improve consistency of outputs.
- Quality is measured constantly.
- Procedures ensure corrective action is taken whenever damage occurs.
- Decreased damage rate
- Product failures are recognized from the start, so the repair process does not require a large amount of money
- Documented procedures are easier for new employees to follow
- The organization maintains or increases market share, increases sales or revenue
- Lower production costs

Many public organizations in the world have obtained ISO 9001 certification, and this is due to the relationship between the implementation of ISO 9001 and the implementation of new public management (Nurcahyo et al., 2019). In Indonesia, DKI Jakarta is one of local government which has applied the ISO 9001 requirements in public health services.

Measuring the effectiveness and efficiency of implementing ISO 9001 is usually carried out in the manufacturing industry. There are often difficulties when measuring the benefits of implementing ISO 9001 in the service industry (including health centers). This study analyzes the relationship between the implementation of ISO 9001 and the level of efficiency produced by health centers in South Jakarta.

1.1 Performance Measurement of Community Health Centers (*Puskesmas*)

The concepts of input, output and outcome are closely related to performance aspects consisting of the economy, efficiency and effectiveness. Efficiency relates to the process of input into output. In simple terms, efficiency is the ratio between output and input. An organization can be said to be efficient if the organization: (1) produces greater output by using certain inputs; (2) produces a fixed output with a lower input than it should be; (3) produces production that is greater than its resources; (4) achieve results at the lowest possible cost. There are 3 (three) variables to be able to assess efficiency, namely input, output and efficiency standards (Rai, 2008).

Puskesmas performance appraisal is an effort to evaluate work results/achievements. The scope of the assessment includes an assessment of the achievement results from health service delivery, health center management and service quality. The stages of implementing the *Puskesmas* performance appraisal begins with an independent assessment by the *Puskesmas* as a form of introspective activity based on the targets that have been formulated in the planning, and then the results of the assessment are reported to the District/City level (Departemen Kesehatan, 2006).

1.2 Data Envelopment Analysis

Data Envelopment Analysis (DEA) is a technique developed by Chames, Cooper and Rhodes in 1978 to evaluate public and non-profit sector organizations (Sherman & Zou, 2006). DEA is a linear program-based method for evaluating the performance efficiency of organizational units which is then called the Decision Making Unit (DMU) (Ramanathan, 2003). Lindlbauer et al., (2016) used DEA to measure the efficiency of hospitals in Germany. Alviya (2011) has also used the DEA as a method to calculate the efficiency level of a plywood company in Indonesia. Xie et al., (2016) calculate the environmental management efficiency of the industry. Jain et al., (2011) propose a two-model DEA approach that can be applied to the assembly industry and the wafer industry (batch production).

The first step in implementing DEA is to determine the DMU (decision making unit), determine input and output, compile a mathematical model, and solve it using software assistance (Cooper *et al.*, 2007). The performance of the DMU which is measured using the DEA uses the concept of efficiency or

productivity, namely the total output per total input. The estimated efficiency is relative efficiency, that is, relative to the most efficient DMU. The most efficient DMU is the DMU which has a score of 100%, and the performance of other DMUs varies from 0% to 100% relative to the most efficient DMU (Ramanathan, 2003).

The DEA model can be input orientation and output orientation. The choice of orientation is based on the extent of the DMU's ability to control the input and output variables. The input orientation model is defined as using existing inputs while controlling the resulting output. In the input-oriented model, the inefficient unit is made efficient by reducing the input where the amount of output is fixed. Meanwhile, in the output orientation model, the existing output is multiplied or expanded as far as possible while controlling the input. In the output orientation model, inefficient units will be made efficient by increasing the output while the input does not change. Inefficient DMUs can be made efficient by projecting the frontier (Ramanathan, 2003).

The basic DEA model is known as the CCR model introduced by Charnes, Cooper, and Rhodes. This CCR model uses the assumption that the increase in input value will result in a proportional increase in the output value, or in other words, the ratio of output to input is always constant (constant return to scale). In DEA the terms input orientation and output orientation are known. Here are the general mathematical equations of the CCR model:

INPUT ORIENTATION CCR

$$\max z_0 = \sum u_r y_{r0}; \quad \text{..} \quad (1)$$
$$subject\ to\ \sum_{r=1}^{s} u_r y_{rj} - \sum_{i=1}^{m} v_i x_{ij} \leq 0$$
$$\sum_{i=1}^{m} v_i x_{i0} = 1$$
$$u_r \geq 0, r = 1,2,\dots,s;\ v_i \geq 0, i = 1,2,\dots,m$$

OUTPUT ORIENTATION CCR

$$\min q = \sum_{i=1}^{m} v_i x_{i0} \quad \text{..} \quad (2)$$

$$subject\ to: \sum_{i=1}^{m} v_i x_{ij} - \sum_{r=1}^{s} \mu_r y_{rj}$$
$$\sum_{r=1}^{s} \mu_r y_{r0} = 1$$
$$u_r \geq 0, r = 1,2,\dots,s;\ v_i \geq 0, i = 1,2,\dots,m$$

The most important extension of the original CCR model was introduced by Banker et al. In 1984, adding the constraint $\sum_{j=1}^{n} \lambda_j = 1$. This constraint allows for a variable scale (variable return to scale), where a positive λ value indicates the most optimal solution. This model measures technical efficiency as a convexity constraint and ensures that the composite unit is the same scale measure as the unit being measured.

INPUT ORIENTATION BCC

$$\min \theta_0; \quad \text{..} \quad (3)$$
$$subject\ to\ \sum_{j=1}^{n} \lambda_j y_{rj} \geq y_{r0}, r = 1,2,\dots,s$$
$$\theta_0 x_{i0} - \sum_{j=1}^{n} \lambda_j x_{rj} \geq 0; i = 1,2,\dots,m$$
$$\sum_{j=1}^{n} \lambda_j = 1;\ \lambda_j \geq 0, j = 1,2,\dots,n$$
$$\theta_0\ unlimited\ free$$

OUTPUT ORIENTATION BCC

$$\max \theta_0; \quad \text{..} \quad (4)$$

$$subject\ to\ \sum_{j=1}^{n} \mu_j y_{rj} \geq \theta_0 y_{r0}$$

$$\sum_{j=1}^{n} \mu_j x_{rj} \leq x_{i0}$$

$$\sum_{n=1}^{N} \mu_j = 1; \ \mu_j \geq 0$$
$$\theta_0 \ unlimited \ free$$

Information:

j	: DMU; j = 1, 2, 3, …, n
y_{rj}	: output value from r to j of DMU; r = 1, 2, 3, …, s
x_{ij}	: input value from I to j of DMU; i = 1, 2, 3, …, m
v_i	: the input value weights; i = 1, 2, 3, …, m
μ_r	: the output value weights; r = 1, 2, 3, …, s

1.3 Previous research

Efficiency is associated with the performance of an organization because it reflects the comparison between the inputs used and the outputs of production. In the health sector, there are several studies that carry out related to efficiency measurements (Table 1). From several studies found, the method used for measuring relative efficiency is Data Envelopment Analysis (DEA).The DEA was developed for performance measurement. This method has been used successfully to assess the relative performance of a series of firms that use identical inputs producing identical outputs (Ramanathan, 2003). DEA has been widely used in previous studies to evaluate the performance of various entities involved in several types of activities in many countries. One of the reasons is that the DEA has been shown to open up the possibility to solve cases that cannot be solved by other approaches because of the complex (often unknown) relationship between multiple inputs and multiple outputs involved in many frequent activities reported in non-equivalent units (Cooper et al., 2007).

Table 1 Previous Research Related to Efficiency Measurement in Healthcare Services.

AUTHOR	RESEARCH OBJECT	METHODE	RESULT
(Alonso et al., 2015)	Health centre in Madrid	DEA	New public manajemen hospitals are more efficient than traditionally managed ones.
(Grosskopf et al., 2004)	Teaching hospital in US	DEA and regression analysis	Teaching hospitals have a higher level of efficiency without sacrificing teaching intensity.
(Goñi, 1999)	Primary health care team from Navarre Spain	descriptive	Human resources that function properly cause the degree of performance satisfaction to increase so that efficiency increases
(Lee et al., 2008)	Hospital in Korea	DEA and multiple regression analysis	Hospitals that are more specialized (specialty) are more efficient.
(Chang et al., 2004)	Hospital in Taiwan	DEA	Public hospitals are less efficient than private hospitals.
(Osei et al., 2005)	Hospitals and community health centers in Ghanna	DEA	The flexibility of the DEA in measuring inefficiencies. Planning and financial resources are needed to monitor productivity and efficiency growth
(Akazili et al., 2008)	Health centers in Ghana	DEA and model regresi logistik	Inefficiencies were identified in health services and found that many resources could be saved. Incentives for puskesmas were found to be the main motivating factor for efficiency promotion.

AUTHOR	RESEARCH OBJECT	METHODE	RESULT
(Ramírez-Valdivia et al., 2015)	First level health center in Chile	DEA and SFA	The use of the two methods resulted in differences in efficiency values for health centers located in urban and district areas.
(Garcia-Lacalle & Martin, 2010)	Health service center in Spanyol	DEA and multi dimensional scaling	Hospitals in rural and urban areas have the same efficiency value.
(Lindlbauer et al., 2016)	Hositals in Jerman	Bootstrapped DEA and second-stage truncated regression	hospital efficiency is negatively related to ISO 9001 certification and positively related to KTQ certification.
(Zavras et al., 2002)	Public health center of Greek general insurance	DEA	Health centers with laboratory technology infrastructure and/or radiographic examinations have a higher efficiency value.
(Campos et al., 2016)	Public health services in Spain	DEA	Proving that the DEA is able to measure the level of efficiency of the health sector, and provide recommendations for improvements in economic, social and policy terms to improve efficiency.

From the summary above, it is still rare to find research that analyzes the relationship between the implementation of ISO 9001 and the level of efficiency of public health center services, so researchers are interested in conducting this research.

2. RESEARCH METHODS

This research was conducted in 2 stages, the first stage was calculating the value of efficiency using data obtained from the Public Health Office, and the *Puskesmas*, which were then processed using engine deaos.com. The second stage is analyze the strategies for *Puskesmas* to increase efficiency services.

The input and output variables in the DEA method are unique for each case. In this study, the determination of the input variables is based on clause 7.1 of ISO 9001, which is related to resources, while the output variables are determined based on clause 9.1 of ISO 9001, which is the realization of products, consisting of performance indicators from public health center programs which are the scope of ISO 9001 certification. These variables include:

a. Total of medical personel: doctors, midwives and nurses (input).
b. The number of pharmaceutical staff: pharmacist and pharmacist assistant (input).
c. The amount of visits, is the number of outpatient visits (output).
d. Total of services for family planning participants and immunization, is the number of active family planning participants and the number of complete immunization services for baby. (output).

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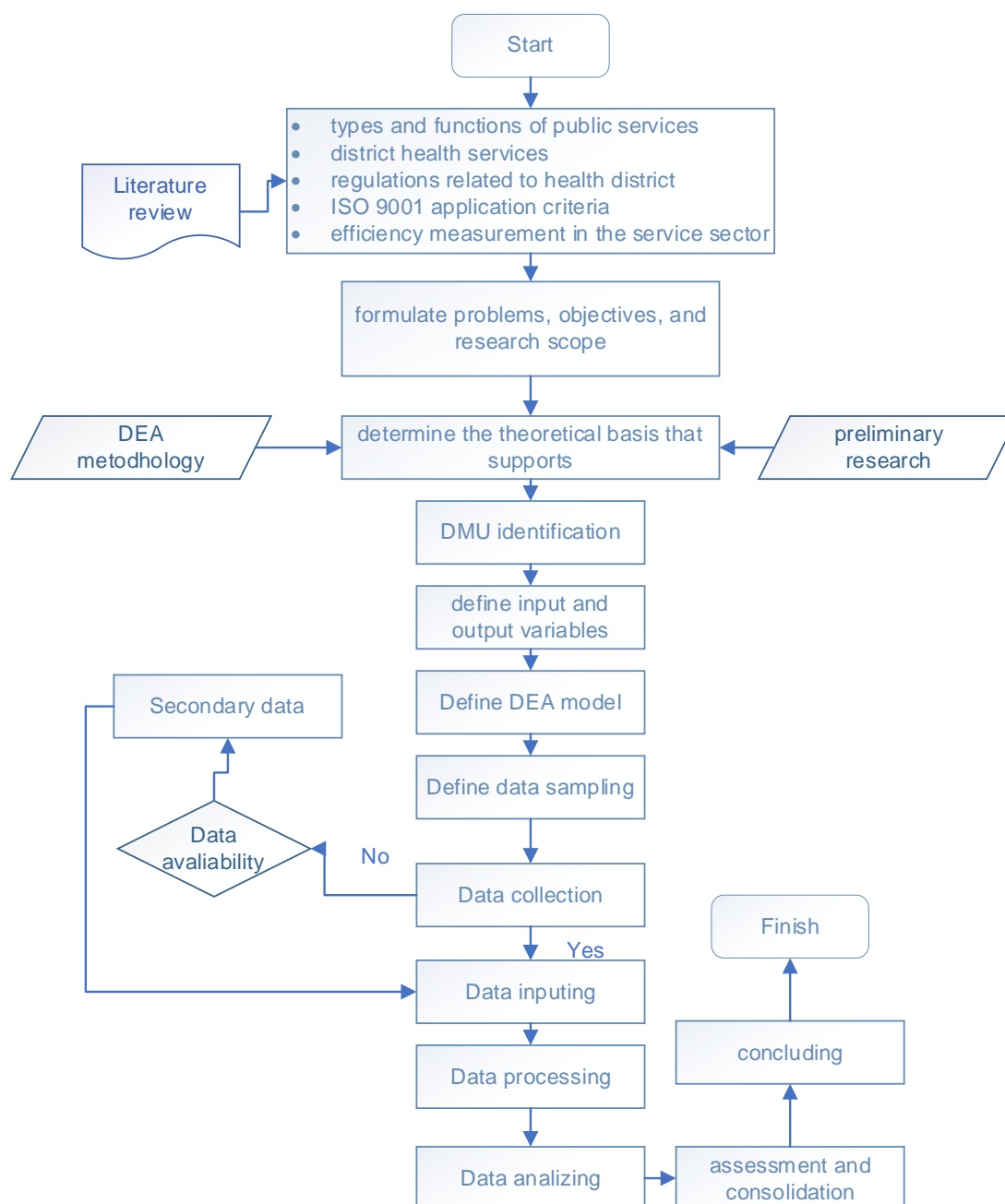
Figure 1 Research thinking framework.

The determination of the DEA model is carried out by taking into account the ability of the DMU to control the input and output variables. In this study, the model used is output-oriented DEA (DEA BCC-O). I use the BCC model with output orientation because the Puskesmas cannot directly control the input variables without approval from the government.The data used is the 2015 report data because in that year, ISO set a new version of the ISO 9001 standard.

This research focuses on health centers, hereinafter referred to as DMU which has been ISO 9001 certified in the South Jakarta area. The total sample size is ten health centers which is the total number of sub-district level P*uskesmas* in the area. Data processing was performed using engine.deaos.com, and data analysis was performed using descriptive analysis.

The next step is to conduct interviews with experts to formulate strategic for increasing the value of efficiency.

3. RESULTS AND DISCUSSION

3.1 Value of efficiency

Efficiency values that range from 0% - 100% or 0 - 1 describe the level of efficiency of each DMU. DMU with an efficiency score of 100% or 1 means

that the DMU is in the efficient (best) category, which means that no other DMU in one analysis can produce output values that exceed the efficient DMU by using the same input value.

Figure 2 describes the resulting efficiency value based on input and output data from the DMU. It can be summarized that the efficiency value ranges from 37% - 100% and there are 7 out of 10 DMUs that have inefficient values.
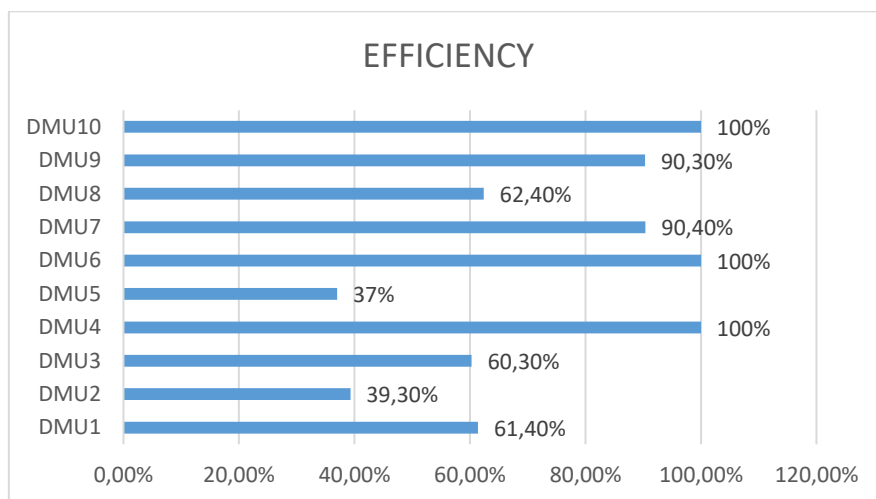

Figure 2 The level of efficiency of the DMU.

The results of calculations using DEA also identify improvement strategies for less efficient DMUs, and for efficient DMUs, improvement strategies depend on several factors. An inefficient DMU can improve its performance so that it becomes an efficient DMU by using an efficient DMU profile as a benchmark. The number of inputs and the number of outputs owned by the comparator DMU can be used as a guide to improving the level of efficiency. This study uses an output approach model because the DMU's ability is greater in controlling the amount of output than input, so minimizing the number of inputs is difficult to control, so the inefficient DMU can focus on making performance improvements based on output projections.

Table 2 Projections of the performance of input and output variables.

	number of medical personnel and medical assistants	number of pharmacy staff	number of outpatient visits	number of family planning participants and number of immunizations
DMU1	70 to 70	10 to 4.585	57541 to 93757.129	26267 to 42799.369
DMU2	90 to 90	9 to 4.932	22970 to 112830.411	21829 to 55517.671
DMU3	61 to 61	7 to 3.342	33752 to 76473.945	22685 to 37628.644
DMU4	55 to 55	11 to 11	132938 to 132938	29864 to 29864
DMU5	95 to 95	10 to 5.812	45852 to 123956.47	21563 to 58293.496
DMU6	73 to 73	4 to 4	91518 to 91518	45031 to 45031
DMU7	81 to 81	8 to 8	123053 to 136078.066	24372 to 44627
DMU8	93 to 93	8 to 8	90299 to 144747.223	20082 to 53015
DMU9	89 to 89	13 to 4.877	55157 to 111576.74	49594 to 54900.808
DMU10	49 to 49	6 to 6	93570 to 93570	25257 to 25257

Source: research result

The projection value for each input and output variable of each DMU is displayed (Table 2). This value can be used as a consideration to determine the strategy for improvement efforts, so that the performance of each DMU is efficient.

3.2 Analysis of service improvement strategies

The preparation of this analysis is based on data obtained from interviews with experts. The strategy to increase output can be done by increasing the quality of the DMU service itself. One of the ways to achieve this is with the consistent implementation of ISO 9001, because the quality management system focuses on the consistency of work processes. This often includes several levels of documentation against work standards. Feedback from the community is used to determine follow-up actions to improve service quality. Some of the complaints that were caught directly from health center customers, including medical examinations that were not given enough attention by health workers, length of service time, staff skills, facilities, and waiting time to get services. All of this feedback needs to be a focus in efforts to improve the quality of service so as to increase the number of patient services.

a. Strategies for Increasing the Number of Outpatients

In an effort to increase the number of patient visits, puskesmas can develop health services that are not provided by other puskesmas, for example: provision of acupressure services, etc. Health promotion activities are very important to introduce the advantages of the puskesmas. The following are recommendations for health promotion activities in an effort to increase the number of visits by puskesmas patients.

Table 3 Efforts to Increase the Number of Outpatients.

TYPE OF SERVICE	RECOMMENDATION
Insite building	1. Increase the provision of information to the public, by creating more attractive promotional media and information. 2. Improve the application of 5S culture (sort, sustain, standardize, shine, set in order). 3. Increase the competence of officers so that they can provide decisive answers to patients.
Outside building	1. Increase the provision of information to the public about health in the form of attractive media. 2. Increase the maximum use of vacant land to provide education to the community. 3. Improve cleanliness and comfort in the provision of supporting services for patients, such as canteens, worship places, toilets.

b. Efforts to Improve Family Planning Services

The low number of family planning participants who use *Puskesmas* services is due to several reasons, for example: the lack of knowledge of PUS (fertile age couples); lack of personnel who have received family planning training; no media information about family planning is available; no special fund allocation for family planning outreach; there is no implementation of counseling on family planning. Table 4 provides recommendations for improving family planning services.

Table 4 Efforts to Improve Family Planning Services.

GOAL	RECOMENDATION
Promotion and education	1. Target setting 2. Increase family planning education for husbands 3. Increase the provision of information and education on the target by involving the community and religious leaders

GOAL	RECOMENDATION
Number and competence of medical personnel	1. Increase the frequency and type of training 2. Increase efforts to recruit family planning cadres 3. Allocating funds for training of family planning cadres

c.   Efforts to Improve Infant Immunization Services

The success of the mandatory immunization program for babies cannot be separated from the level of parent motivation to give immunizations to their children. Until now, some parents do not want to immunize their children for many reasons, so the most important effort is how to provide proper education to parents regarding the importance of basic immunization for children. Another effort is to increase the availability of vaccines, good and friendly services. The competence of officers in providing immunization is friendly, safe and correct, so it does not cause trauma for babies and parents. Another effort that can be recommended is to increase the provision of information to parents regarding the conditions of follow-up after immunization and how it is handled.

Education can also be done by utilizing information technology and social media to remind immunization schedules and motivate parents by providing important information about immunization. In this effort, friendly officers who are capable of immunization are needed, so that parents get the correct information about immunization.

3.3   Analysis of the Relationship between the Implementation of ISO 9001 and the Value of Efficiency

The essence of implementing ISO 9001 is continuous improvement that makes every organization required to set improvements in all lines gradually in accordance with the PDCA concept (Plan - Do - Check - Action). Sometimes, the careful planning that has been prepared since the beginning is not easy to be implemented for several reasons. This study found the factors that caused the implementation of ISO 9001 implementation did not run smoothly at the *Puskesmas*, including: lack of commitment from management; no involvement from employees; lack of coordination between departments; limited time; limited human resources; lack of socialization and communication.

4.   CONCLUSION

In this study, the measurement of the efficiency level due to the implementation of ISO 9001 was carried out at 10 Puskesmas in the South Jakarta area. The results show that there are only 3 (30%) *Puskesmas* that have efficient scores, the rest are inefficient. The difference in the level of efficiency indicates that the implementation of ISO 9001 does not always provide the same efficiency value.

Some strategies that can be formulated by *Puskesmas* to improve service efficiency include the provision of information media inside and outside the building. In addition, the cleanliness and attitude of employees also need to be improved. The other efforts to improve family planning services are increase promotion and education, as well as the competence of health workers.

This study has several limitations. First, in the input variable, a combination of the number of professions is carried out, for example the number of medical personnel is a combination of the number of doctors, midwives and nurses. It is also for the number of pharmaceutical personnel consist of the pharmacist and pharmacist assistant. This condition may result in inaccuracy calculation of efficiency values. To answer this, the next research can be done with the elaboration of the input variables, so that it can be seen the effect of the number of health workers in detail on the efficiency value.

Second, to determine the benefits of implementing ISO 9001, the study did not compare between certified and uncertified health centers. Third, this study does not investigate changes in the quality of *Puskesmas* services caused by certification, so that the results presented are the benefits of certification on efficiency and no conclusions can be drawn about the quality of care.

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