

Development of Mobile Health Antenatal Care (MHANC) in Improving the Quality of Antenatal Care by Web-Based (Study in Kabupaten Tegal the Area Fourth Health Center)

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Abstract - The most common problem of pregnancy is about mother and child health because of inadequate health services. Some causes of maternal death can be minimized by the quality of antenatal care properly. There are many efforts to solve the problem of AKI, but the efforts are still not maximal yet, so Information Technology really needs in the case of time. The purpose of this research is to develop an innovation of mobile health antenatal care model in improving the quality of antenatal care by midwives of website basic. This research used the True Experimental method, and namely, posttest only controls group design conducted at the Lebaksiu, Adiwerna, Slawi, and Suradadi in Tegal Regency, Central Java, in June 2018. The population of midwives who worked in the health center was 102 midwives, and it was selected for this research with probability sampling, which consisted of 60 midwives according to the inclusion and exclusion criteria. The sample is divided into two groups, namely the control and interventions group. The dependent variable in this research is the quality of the information system. The independent variables in this research are mobile health antenatal care and mother cards, and the confounding variable is age, the time of work, and level of education. The web-based Mobile Health Antenatal Care Model has been developed when it is compared to the classic antenatal model. The information systems from 5 aspects of the antenatal health care model are better. The aspect develops completeness (9.50><7.00), easiness (10.68><5.54), suitability (3.63><2.27), accuracy (13.72>< 7.72), appropriate (3.54><2.31).The achievement of the mobile health care model in improving the quality of antenatal care services by midwives.

Keywords - mobile health antenatal care, system information, antenatal care services.

I. INTRODUCTION

The problem of Maternal and Child Health (MCH) is one of the most common problems. In line with the World Health Organization (WHO), for women aged 15 to 49 years, around 600,000 die each year due to complications of pregnancy and childbirth (World Health Organization (WHO)., 2015). In Indonesia, in the 2015 United Nations International Children Fund (UNICEF) survey, the maternal mortality rate (MMR) and infant mortality rate are still high (United Nations International Children's Education Fund, 2016).

Based on the Directorate of Maternal Health of 2013, the causes of maternal death included 35.1% bleeding, 21.5% hypertension, 7.3% infection, 1.0% prolonged labor, 4.7% abortion, and the other is 40.8%. The probable of this condition is the inadequate quality of health services, conditions of unhealthy pregnant women, and another determinant factor. Some causes of maternal death can be minimized if the quality of antenatal care is properly. The causing problems of unhealthy pregnant women include handling complications, anemia, pregnant women who suffer from diabetes mellitus, hypertension, malaria, and the four problems such as too young <20 years, too old> 35 years, too close for 2 years, and too many children(Kementerian Kesehatan RI, 2014).

Antenatal care service that is not standard will impact poor quality antenatal care and the lack of detection for high-risk pregnancies for all pregnant women. Guspianto stated that the obedience level of midwives in the village for ANC standard is still below the minimum standard of around 74.28%. Some of the factors that influence the obedience level of village midwives towards ANC standards are supervision, knowledge, and organizational commitment (Guspianto, 2012).

There are many efforts to press the number of maternal and child mortality, but the efforts have not been maximal, so that it needs some solution such as the innovation of healthy programs by using Information Technology (IT). Mobile health is one of the interesting ways for doing



health intervention, and it is a new idea from WHO in health care (Derbyshire *et al.*, 2013; Organization, 2016). The socialization of mobile technology that has been applied before in innovation application for overcome the priority of health problems and it has grown up to be a new part of e-Health, it is called mobile health. This sophisticated network provides the speed of data translation that is higher and

stronger to change the service way than the information health is accessed, delivered, and managed. With the increasing accessibility, there is greater personalization and public health that focuses on the society itself (World Health Organization, 2011; Kristjánsdóttir *et al.*, 2013).

The application of two-way health communication technology can send private messages directly for the community in conducting health promotion, direct response of emergencies, and other health support that can be done by nurses or other health workers as the first aid effort (Derbyshire *et al.*, 2013; WHO, 2015).

The government expresses interest in applying mobile health as a complementary strategy for the strength of the health system and achieve the goals of development that are related to health in developing countries (WHO, 2015).

The new system of innovation on the development for mobile health care (MHANC) to improving the quality of antenatal care by web-based midwives that can facilitate to input the data easily system to the processing for sending the health department, and the system utilization can help early detection in high-risk pregnancies when it is the risk of antenatal care and also the monitoring of performance for midwives implement antenatal care service standards with web-based information technology; thus it can maximize the efforts of reducing maternal mortality.

II. SUBJECT AND METHOD

A. Research Design

This research used a true experimental research design that was posttest control only group design. There are two groups, control groups, and treatment groups, then the researcher assessed after the intervention, then the results compared both of them. This research was conducted in Lebaksiu, Adiwerna, Slawi, and Suradadi Public Health Center at Tegal Regency in June 2018.

B. Population and Sample

The population of the research was midwives who worked in the Slawi Public Health Center, Lebaksiu Public Health Center, Adiwerna Public Health Center, and Suradadi Public Health Center in Tegal Regency that consist of 102 midwives. The sample of this research was 60 samples that consist of 30 control groups and 30 treatment groups. The sample selection used *probability sampling* based on inclusion and exclusion criteria.

C. Research Variable

The dependent variable in this research is the quality of the information system (completeness aspect, facilitation

aspect, accuracy aspect, and appropriate aspect. Independent variables in this research are *mobile health antenatal care* and mother card, while confounding variables are age, work time, and education level.

D. Operational Definition

Mobile Health Antenatal Care (MHANC) is an application program and monitoring result of the action that is given to respondents including in the intervention group (midwife), by a data ratio scale. The measuring instrument used in this research was the web-based MHANC. The mother card is a monitoring sheet for the result of the action that has been taken during the pregnancy process, with the ratio scale and measuring instruments for the mother's card. The completeness variable was the completeness of antenatal care data related to the standard of antenatal care services, with an ordinal measurement scale consisting of strongly disagree, disagree, agree, strongly agree with the questionnaire of the measurement tool. The easiness variable was a trust where the application used can be easily understood, with an ordinal measurement scale consisting of strongly disagree, disagree, agree, strongly agree with the questionnaire measuring tool. The suitability variable is suitable data in the application that is used with an ordinal measurement scale consisting of strongly disagree, disagree, agree, strongly agree with the questionnaire measurement tool. The accuracy variable is the accuracy of the data used in the application, with an ordinal measurement scale that consists of strongly disagree, disagree, agree, strongly agree with the questionnaire measurement tool. The appropriateness variable is the timeliness in accordance with the predetermined scheduling, with an ordinal measuring scale that consists of strongly disagree, disagree, agree, strongly agree with the questionnaire of the measurement tool. The age variable was the respondent's age based on the last birthday, the interval measuring scale, the measurement results in the year by using a questionnaire. Variable level of education is the level of education for respondent's perspective from the last education with an ordinal measurement scale and categorized as diploma 1, diploma 3, Diploma 4 / Bachelor, and Master, by using questionnaire measurement. Measurement results in years used questionnaire measuring tools.

E. Data Analysis

Data analysis is frequency distribution for independent variables, while the variable is numerical data based on mean, standard deviation from MHANC and mother cards, and respondent characteristics, namely (age, education level, and work time). The bivariate analysis tested the differences before and after variables gives treatment between two different groups for normally distributed variables by using *T-independent* test; for abnormal distribution, using *Mann-Whitney* test. Multivariate analysis used multiple logistic regressions.

III. RESULT

The research result of confounding variables for the research subject is shown in table 1, and it showed that the average age was the same between the treatment and control group, which means that there was no significant difference for age average between treatment and control group ($p = 0.789$). Sample characteristic is based on education level proved that the average of education level was the same between the treatment and control group, it means that there was no significant difference for the average of education level between the treatment and control group ($p = 0.353$). The characteristic sample was based on the time of work proved that the average work time between the treatment group and the control group, which means that there is no significant difference in work time average between treatment and control group ($p = 0.888$).

Figure 1. Frequency Distribution Characteristics of Respondents by Age, Level of Education, Length of Work in Treatment Groups and Control Groups

	intervention (n=22)	control(n=22)	p-value
	Mean±SD	Mean±SD	
1. Age (year)	30.54±4.615	30.31±5.276	0.789 ¹
2. Education (Strata)	2.136±0.351	2.090±0.294	0.353 ¹
3. Time off work (year)	5.590±3.995	7.227±4.297	0.888 ¹

The research result of the difference analysis for the average aspect, the assessment of information systems in the intervention group and the control group are shown in table 2; the average aspect of completeness before the intervention in the treatment group was 7.09, while in the control group was 6.18. The result of the independent sample t-test was found of significant differences in the average aspect of completeness for the information system assessment before intervention was given between the treatment and control group ($p = 0.029$).

The average aspect of completeness after it gives intervention in the treatment group was 9.50, while in the control group was 7.00. The resulting test of the *Independent t-test* showed that there were significant differences in the average aspects of completeness for the information system assessment after it gives intervention between the treatment group and control group ($p = 0,000$).

The average difference in the aspect of completeness in the treatment group was 2.40, while in the control group was 0.8182. The result of the Mann-Whitney test can be concluded that there was no significant difference in the average difference in completeness aspect between the intervention group and control group ($p = 0.060$). So, there was no effect of giving intervention for the treatment group that is greater than the control group.

In table 2, the average easiness aspect before intervention in the treatment group was 4.77, while in the control group was 4.40. The result of the Independent t-test showed that there were no significant differences in the

average easiness aspect for evaluating information systems before the intervention was given between the treatment and control group ($p = 0.418$).

The average easiness aspect after being given intervention in the treatment group was 10.68, while in the control group was 5.54. The result of the *Independent t-test* showed that there were significant differences in the average aspect of the easiness for evaluating information systems after it was given intervention between the treatment and control group ($p = 0,000$).

The average difference for the easiness aspect in the treatment group was 5.909, while in the control group was 1.136. The result of the Mann-Whitney test can be concluded that there was a significant difference for the average difference in easiness aspect between the intervention group and control group ($p = 0,000$). So, there was an effect of the intervention for the treatment group, which was greater than the control group.

In the table, 2the average suitability aspect before doing an intervention in the treatment group was 1.86, while in the control group was 1.31. The result of the Independent t-test showed that there were significant differences in the average suitability aspect for information system assessment before the intervention was given between the treatment group and the control group ($p = 0.002$).

The average suitability aspect after being given intervention in the treatment group was 3.63, while in the control group was 2.27. The result of the *Independent t-test* showed that there were significant differences in the average suitability aspect for the information system assessment after being given intervention between the treatment group and the control group ($p = 0,000$).

The average difference in the aspect of suitability in the treatment group was 1.772, while in the control group was 0.954. Mann-Whitney test resulting can be a conclusion that there was a significant difference in the average difference in the aspect of suitability between the intervention group and the control group ($p = 0,000$). So, there was an effect of giving intervention for the treatment group, which was greater than the control group.

In the table, 2the average accuracy aspect before intervention in the treatment group was 7.18, while in the control group was 6.09. Independent t-test test results showed that there were significant differences in the average accuracy aspect for information system assessment before intervention was given between the treatment and control group ($p = 0.021$).

The average accuracy aspect after being given intervention in the treatment group was 13.72, while in the control group was 7.72. Independent t-test test results showed that there were significant differences in the average accuracy aspect of the information system assessment after being given intervention between the treatment and control group ($p = 0,000$).

The average difference of accuracy aspect in the treatment group was 6.545, while in the control group was 1.636. The result of the *Mann-Whitney test* can be concluded that there was a significant difference in the average difference of appropriate aspects between the intervention group and

control group ($p = 0,000$). So, it found that there was a significant difference in the average accuracy aspect of information system assessment before intervention was given between the treatment group and control group.

In the table, the average of appropriate aspects before intervention in the treatment group was 1.90, while in the control group was 1.50. The result of the *Independent t-test* test showed that there were significant differences in the average aspects for appropriate information system assessment before intervention was given between the treatment and control group ($p = 0.027$).

The average accuracy aspect after being given intervention in the treatment group was 3.54, while the control group was 2.31. The result of *Independent t-test* test showed that there was significant differences average of appropriate aspect for the information system assessment after being given intervention between the treatment and control group ($p = 0,000$).

The average difference of appropriate aspect in the treatment group was 1.636, while in the control group was 0.8182. The result of the *Mann-Whitney* test can be concluded that there was a significant difference in the average difference of appropriate aspects between the intervention group and the control group ($p = 0.018$). So, there was a significant difference in the average of appropriate aspects for information system assessment before the intervention was given between the treatment group and the control group.

Figure 2. Bivariate analysis Differences in Analysis of Average Aspects of Information System Assessment in Intervention Groups and Control Groups

Variable	Mean±SD		p-value
	intervention	control	
completeness			
Pretest	7.09±1.508	6.18±1.139	0.029
Posttest	9.50±0.801	7.00±2.507	0.000
Selisih	2.40±1.563	0.8182±2.556	0.060
easiness			
Pretest	4.77±1.571	4.40±1.501	0.418
Posttest	10.68±0.994	5.54±2.063	0.000
Selisih	5.909±1.770	1.136±2.531	0.000
suitability			
Pretest	1.86±0.560	1.31±0.567	0.002
Posttes	3.63±0.492	2.27±0.550	0.000
Selisih	1.772±0.812	0.954±0.722	0.000
accuracy			
Pretest	7.18±1.531	6.09±1.540	0.021
Posttes	13.72±1.351	7.72±3.057	0.000
Selisih	6.545±2.132	1.636±2.820	0.000
appropriate			
Pretest	1.90±0.610	1.50±0.511	0.027
Posttest	3.54±0.509	2.31±0.779	0.000
Selisih	1.636±0.789	0.8182±1.097	0.018

IV. DISCUSSION

A. The Aspect of Model Information Quality Assessment Web-Based in Improving the Quality of Antenatal Care Service

In the development of MHANC web-based, the researcher conducted an assessment of quality for information based on the average calculation result in the treatment group and control group of system development. If the average value after the system development was greater than before, and the p-value is <0.05 , it can be concluded that there was an increase of quality generated by the development of the developed system and contrarily. The aspect of quality information must fulfill five things:

B. Completeness Aspect

Based on Bailey and Pearson in Diana Gracia, Smith stated that the completeness aspect of information quality was the completeness content of information produced by the information system (Smith Diana Garcia, 2007). The development of a mobile health antenatal care (MHANC) model to improve web-based antenatal care services in value through completeness aspect includes complete and detailed reporting, distribution of K1 and K4 visits, and midwife performance monitoring.

The result of this research in table 4.2 showed that the average aspect of completeness in the treatment group was 9.50, while in the control group was 7.00 with $p 0.000$. It is showed that the development of a web-based mobile health care model (MHANC) could improve the quality of antenatal care services if it is compared to the old system.

C. Easiness Aspect

The development of a system can make it easier for users to access the system. So it can be easy work of system user, in the process of input the data, the process of searching data and the process of editing data. The result of this research is in table 4.2 that the average easiness aspect in the treatment group was 10.68, while in the control group was 5.54 with a p-value of 0.000. When it was compared to the average value of the treatment group was greater than the average value of the control group.

This is in line with research that is conducted by YaniMahwati in 2009, and she said that there was a positive influence on the easiness of information produced before and after the development of health laboratory information systems for both treatment and control groups with a probability was 0.001. The average value also showed a significant increase. Before the development of laboratory information systems for the average health of information, facilities was 1.24, and after system development increased 3.93 where there was an increase of the system, it was 2.69 (Destiningrum and Adrian, 2017).

This shows that the use of information systems can facilitate officers for recording and reporting. The easiness in question was the easiness of input the data, the easiness of editing data, and the easiness of searching data so it can be shortened work users (the University of Wollongong. Department of Business Systems., Monash University.

School of Computing and Information Technology. and Australasian Association for Information Systems., 2003).

D. Suitability Aspect

The trial of the quality information on the suitability variable is carried out in order to get an overview of the quality information from the aspect of suitability. The data relevance refers to the data that was the information system must be useful for the user. The data can be useful if the data is filled completely and the information generated is useful. In the assessment of this aspect, the researcher assesses the available data whether the need of users who can produce information (Lubis, Murni, and Arfansyah, 2016).

Based on the result of the research is shown in table 4.2 that the average value of the treatment group in the suitability aspect was 3.63 while in the control group 2.27 with $p < 0.000$.

The result of this research is suitable with the research that is presented by HamdanAlamSyah in 2015, and he stated that there is an increase of suitability aspect for information systems before and after development. The average value also shows a significant increase. Before the development of the average variable of suitability was 2.12, and after the development system, it increased of 4.36 where an increase was 2.22 (Hidayat, Suprpto and Akhmad, 2012; Lestari, 2014; Destiningrum and Adrian, 2017)

Based on the result above, the MHANC web-based will produce information that is useful for all information system users.

E. Appropriate Aspect

Based on Bailey and Person in Diana Garcia, Smith said that appropriate is the truth of the information generated by the information system. The information produced can be accounted for the appropriate of information to make a decision (Smith Diana Garcia, 2007). In the aspect of appropriateness, the researcher researches 3 other things, including data entry was not repeated, the data was not same, the right of data processing, and information could be accounted for. Entering/entering non-repetitive data in question enters one patient's data only; for example, it is the identity of the patient so that there is no same data for every patient. This information can be accounted for by the information system.

Based on table 4.2 showed that the average value of the treatment group was 13.72, while in the control group was 6.54 with $p < 0.000$. This result indicated that the user of the information system was developed that can help in producing information so that it is reliable and less of error.

This research related to Ahmad Hidayat in 2015 stated that the average value before development was 1.32 after the development of the system was 3.52. So, it can be concluded that the appropriate after system development is better than before system development. It has difference of 2.20 (Hidayat, Suprpto and Akhmad, 2012).

And also, Person stated that the appropriate data refers to the truth of the data which captured what has been designed. The verification of appropriate data involves or compares then it collected into external reference sources that are known to be valid (Smith Diana Garcia, 2007).

The development of the MHANC web-based system can improve the quality of antenatal care services. Because the information system developed can produce appropriate information, less error-free and accountable.

The quality test for information on the appropriate variable time was conducted for the purpose of obtaining an overview from the result of the information generated by the information system. The speed of information must be supported by the latest technology so that it can process, produce and send it. In this aspect, the researcher examines the speed of the system in presenting the report every time the patient visits (Hidayat, Suprpto, and Akhmad, 2012).

The result of this research showed that the average value of the treatment group was 3.54. At the same time, the control group was 2.31 with the standard wasp 0.000. This result means that the development of an information system with a web-based MHANC model can accelerate the presentation of reports every month when it is compared to the user of the old system so that the developed system was better. The longer process presenting / reporting data will affect the monitoring of pregnant women, and it will have the effect of more midwife workload.

In line with the research conducted by Sri Lestari in 2009, which stated that the timeliness of dental clinic information produced in the development of the system was better than before. The average result of criteria timeliness before development was 5.40, and after development was 10.2, so that there was an improvement of 4.80 (Lestari, 2014).

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