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Research Article

Household-based Antenatal Care Monitoring Model (An Intervention Study in the Coastal Area of Palu City)

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Abstract

Background and Objective: There are two indicators can be used for measuring the quality of health service pregnant women are going well, namely antenatal care coverage and delivery by health workers trained. In Palu City, the achievement was that both this question on the national level have been done. But it is not followed by successive down maternal mortality. In order to ensure the implementation of the standards of the antenatal care (ANC) are going well, this study build a model of mentoring students against pregnant women and families. In this model, students do the monitoring through guidebooks. The general objective of this research was to obtain monitoring model of household-based ANC (pregnant women and families) through mentoring by students. The study centered in the coastal areas of Palu City. **Materials and Methods:** The research design used was a quasi experiment with nonequivalent control group design. To know more about the meaning, also conducted qualitative study through in depth interview. The research was conducted on 12 urban villages located in Palu City of Midle Sulawesi, where 6 urban villages (43 pregnant women) as intervention villages and 6 subdistricts (with 43 samples of pregnant women) as control villages. **Results:** The result of this research showed that the influence of the students' assistance toward the implementation of the ANC standard and early detection of high-risk of pregnancy and the influence of age, education and antenatal frequency on the implementation of the ANC standard ($p < 0.005$) and gravid (pregnancy 0) have an effect on early pregnancy risk high dose (< 0.005). This research also produced an implementation model of household-based the ANC (pregnant and family mothers) through a student mentoring approach. **Conclusion:** Monitoring model of household-based ANC (pregnant women and family) through mentoring students effective enough in improving the implementation of the standards of the ANC as well as early detection of high-risk pregnancy.

Key words: Household-based ANC, ANC standards implementation, antenatal frequency and risks pregnancy

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Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

Efforts to improve maternal health have become the top priorities of the government, even before the Millennium Development Goal's 2015 is set¹. Maternal mortality rate (along with Child Mortality Rate) is one of the major indicators of a country's health status of Ministry of PPN¹ and Anonymous². The MMR also indicates the ability and quality of health services, health service capacity, quality of education and community knowledge, quality of environmental health, social culture and barriers to access to health services^{1,3}.

There are two indicators that can be used to measure the quality of maternal health services is running well, i.e coverage of antenatal care (K1 and K4) and delivery by skilled health personnel⁴. Good ANC coverage indicates that the midwife contact process pregnancy, education and information and recording of pregnant women's examination result in the MCH (Mother and Child Health) book have been running well^{5,6}. The function of the MCH Book is as information and recording tool to analyze the health condition of pregnant mother⁷. With complete and accurate recording of pregnant woman's health in the MCH book, if analyzed its data can be as early warning to high-risk pregnant women threat, 3 T (late detection, late referral, late handling)^{7,8}. Midwives should be familiar with high-risk pregnancies/abnormalities and if abnormalities are found, midwives are able to take the necessary action and refer to subsequent actions^{5,8,9}. While delivery by skilled health personnel shows that mothers have received health services from educated personnel and meet the standards of Chamberlain and Morgan⁵ Manuaba *et al.*⁷ and Ministry of Health¹⁰.

In Palu City, antenatal care checks are well underway. This can be seen from the high coverage of K1 and K4 coverage from year to year (K1 104% in 2015 and K4 97.5% in 2015)¹¹. Similarly, delivery assistance by trained health personnel increases annually (90% in 2014 and 97.5% by 2015)¹¹. However, this achievement was not followed by maternal mortality, which actually increased (111/100,000 KH in 2014 and 365/100,000 KH in 2015)^{11,12}.

There are three analyses that can be done on the gap between coverage of antenatal care and maternal mortality rate in Palu City. First, an analysis of the midwives' technical competence in performing antenatal care. This technical competence is related to the ability of health care providers (midwives) to follow antenatal care standards that have been determined. Second, the analysis of the availability of facilities and the availability of health facilities in providing quality health services. Third, the analysis of the health officer's

compliance level in implementing the antenatal service standard that has been determined^{8,13,14}.

The results of interviews with the midwife coordinator at Public Health Center showed that antenatal care had not been performed according to standard (10 T) due to low compliance level, either obedience of midwife in following antenatal care standard or maternal obedience to follow midwife instruction. Monitoring and evaluation of the implementation of antenatal care standards has not been performed. The Public Health Center only evaluate quantity aspect (number of contacts indicated by coverage K1 and K4), often forget quality aspect. The MCH books are expected to be a means of communication between midwives and pregnant women are not running properly. Pregnant women do not feel that each midwife's notes in the MCH book describe the development and risks of pregnancy experienced. Similarly, early detection of high-risk of pregnancy. The Rochyati Pudji's scorecard that the midwife has used for early detection is understood only by the midwife himself. Pregnant women do not consider that the analysis in the scorecard is for mother's early awareness. This study will be very benefit since there has not been implemented yet and the results indicated a positive method and achievable to be implemented.

On the basis of this, the research was conducted to create a model of household-based antenatal care (pregnant women and families). This program will be able to transfer pregnancy responsibilities from midwives to pregnant women. So the midwife will only serve as the examiner and counselor. The pregnant woman is self-aware of her pregnancy risk factors, knows the right antenatal care checks she needs to obtain from the midwife and consciously visits the midwife or Public Health Center for examination and counseling. This activity requires an independent group but understanding health issues and done consistently. One of the resources that can perform consistent monitoring (through assistance) is a group of students, especially health students. They are an independent group that knows health issues and can be mentored by lecturers on campus¹⁵⁻¹⁸.

MATERIALS AND METHODS

The research design used in this research is quasi experimental considering not all variables (symptoms that appear) and experimental conditions can be arranged and controlled strictly, with nonequivalent control group design¹⁹. Qualitative design is done through depth interviews of some respondents pregnant women and some key informants²⁰.

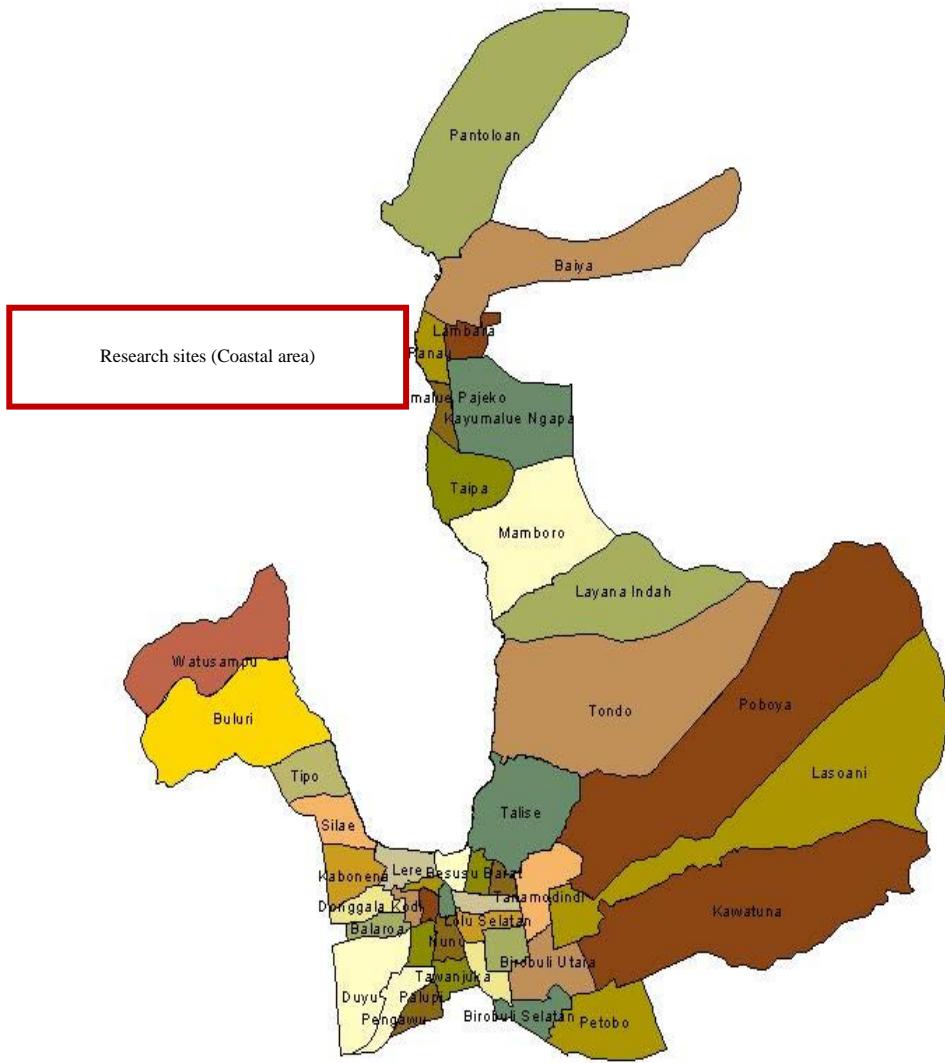


Fig. 1: Research sites

This study was conducted on 12 subdistricts located in the coastal areas of Palu City, where 6 subdistricts included: Tipe, Buluri, Ujuna, Lere, Baiya and Pantoloan subdistricts as an intervention subdistrict and 6 subdistricts included: Watusampu district, Barru, Taipa, Mamboro, Kayumalue Pajeko and Panau as the control of district (Fig. 1).

Using the sample formula for two mean one population²¹:

$$n = \frac{\sigma^2 [Z_{1-\alpha} + Z_{1-\beta}]^2}{[\mu_0 - \mu_1]^2}$$

Where:

n = Large sample

σ = Standard deviation

$Z_{1-\alpha}$ = Level of significance

$Z_{1-\beta}$ = Power

μ_0 = Means before intervention

μ_1 = Means after intervention

Obtained number of samples of 86 pregnant women (43 pregnant women in the intervention region and 43 pregnant women in the control areas) from 515 pregnant women in the research areas. The sample of each district was calculated proportional random sampling with the formula²¹:

$$ni = \frac{Ni}{N} \times n$$

Where:

ni = Number of sample in each strata

Ni = Number population in each health centre

N = Total number of population of pregnant women trimester II-III in Palu City

n = Magnitude

Pregnant women who were respondents in the study should meet the inclusion criteria, pregnant women stay at the study site, 4-6 months of gestation in September 2016 (TW 2), previous contact history with the midwife, willing to be a research respondent from start to finish data collection. While the exclusion criteria when the mother gave birth at the age of 7 months of pregnancy (pre-mature). For qualitative study, we interviewed 12 pregnant women respondents selected from 12 subdistricts, 6 informants from midwives and Public Health Center midwives and 2 key informants from the Health Department of Palu City.

Statistical analysis: Statistical analyses were performed using Statistical Package for Social Science (SPSS) version 21.0 (IBM Corp., Armonk, NY, USA). Proportion of ANC was computed. Bivariate and multivariate logistic regression analyses were

used to examine the factors associated with the outcome variables of ANC. Then continue to Mann-Whitney Test and MANOVA.

RESULTS

To test the antenatal care monitoring model and early detection of high-risk household-based pregnancy with student counseling approach in each pregnant and family mothers, the following studies and analysis were carried out:

Univariate analysis

Characteristics of respondents: Based on the results of data analysis, the distribution of respondent characteristics are, age, education, occupation, pregnancy (gravid) and age of the first ANC, as the Table 1.

Bivariate analysis: Bivariate analysis was conducted to determine the effect of student assistance on the implementation of antenatal care standards and early detection of high-risk of pregnancy independently.

Table 1: Distribution of respondents based on characteristics in the treatment group and control group in Palu City

Characteristics	Groups					
	Treatment		Control		Total	
	N	%	N	%	N	%
Age (years)						
17-25	25	58.0	20	47.0	45	52.0
26-35	15	35.0	19	44.0	34	40.0
36-45	3	7.0	4	9.0	7	8.0
Education						
Primary school	10	23.0	6	14.0	16	19.0
Junior high school	14	33.0	11	25.0	25	29.0
Senior high school/vocational school	16	37.0	21	49.0	37	43.0
Diploma III	1	2.0	3	7.0	4	4.5
Strata one	2	5.0	2	5.0	4	4.5
Job						
Housewife	35	81.0	33	77.0	68	79.0
Private	6	14.0	7	16.0	13	15.0
Civil servants	2	5.0	3	7.0	5	6.0
Gravid (pregnancy)						
1st pregnancy	13	30.0	16	37.0	29	34.0
2nd pregnancy	13	30.0	10	24.0	23	27.0
3rd pregnancy	7	17.0	9	21.0	16	19.0
4th pregnancy	9	21.0	4	9.0	13	15.0
5th pregnancy	0	0.0	3	7.0	3	3.0
6th pregnancy	1	2.0	0	0	1	1.0
7th pregnancy	0	0.0	1	2.0	1	1.0
First ANC age						
0-12 weeks (TW 1)	30	70.0	28	65.0	58	67.0
13-24 weeks (TW 2)	13	30.0	15	35.0	28	33.0
Total	43		43		86	

Effect of student assistance to the implementation of the ANC standard of pregnant women: To assess the impact of student counseling on the implementation of the ANC standards in pregnant women, there are several conditions measured. Differences in the implementation of the ANC standard before and after the intervention in the treatment group (Table 2). Differences in the implementation of the ANC standard between treatment and control groups, before and after intervention in the treatment group (Table 3).

The results of the research also showed that before the student's assistance, from 10 antenatal care standards to be received by pregnant women every time the control to health services, there are three antenatal care standards that have not been consistently implemented the standard 8 (examination by laboratory), standard 9 (counseling) and standard 10 (case management), as in Table 4.

Table 2: Differences in the implementation of the ANC standard before and after intervention in the treatment and control group in Palu City

Variables	Intervention	Mean±SD	Different mean	*p-value
Treatment group (Scale 0-10)	Before	7.7±1.9	2.1	0.000
	After	9.8±0.3		
Control group (Scale 0-10)	Before	7.9±1.6	1.1	
	After	9.0±1.0		

*uji wilcoxon

Table 3: Differences in the implementation of the ANC standards between treatment and control groups, before and after intervention in the treatment groups in Palu City

Conditions	Groups	Mean±SD	Different mean	*p-value
Before intervention	Treatment	7.7±1.9	0.2	0.584
	Control	7.9±1.6		
After intervention	Treatment	9.9±0.3	0.9	0.000
	Control	9.0±0.9		

*Mann-Whitney test, Source: Results of the analysis, 2017

Table 4: Mean value of implementation of standard antenatal care (ANC) on respondents in Palu City

Standard ANC (score 0-10)	Treatment		Control	
	Pre-test	Post-test Mean±SD	Pre-test	Post-test Mean±SD
			Mean±SD	
Standard 1	0.98±0.15	1.00±0.00	1.00±0.00	1.00±0.00
Standard 2	0.98±0.15	1.00±0.00	1.00±0.00	1.00±0.00
Standard 3	0.98±0.15	1.00±0.00	1.00±0.00	1.00±0.00
Standard 4	0.90±0.29	1.00±0.00	0.98±0.15	1.00±0.00
Standard 5	0.86±0.35	1.00±0.00	0.81±0.39	1.00±0.00
Standard 6	0.77±0.47	1.00±0.00	0.74±0.44	0.91±0.29
Standard 7	0.90±0.29	1.00±0.00	0.91±0.29	0.98±0.15
Standard 8	0.42±0.49	1.00±0.00	0.56±0.50	0.74±0.44
Standard 9	0.58±0.49	0.95±0.21	0.49±0.50	0.77±0.43
Standard 10	0.42±0.50	0.93±0.26	0.44±0.50	0.67±0.47

Source: Results of the analysis, 2017

Influence of the student assistance to early detection of

high-risk pregnancy independently by pregnant mother:

To determine the effect of student counseling on the ability of early detection of high-risk of pregnancy independently by pregnant women, there are several conditions that are measured. Different implementation of early detection of high-risk of pregnancy independently before and after intervention, in the treatment group (Table 5). Different execution of early detection of high-risk of pregnancy independently between treatment and control group, before and after intervention in treatment group (Table 6).

Multivariate analysis: Multivariate analysis was conducted to determine the effect of student assistance on the implementation of antenatal care standard and early detection of high-risk of pregnancy independently, after controlled by pregnant mother characteristics (age, education, occupation, gra5vid, ANCfirst and ANCfrequency). The results are shown in Table 7.

Antenatal care monitoring models based on the household

(pregnant and family mothers) through mentoring by

students: The results showed that antenatal care checks in accordance with the standard (10 T) could be performed well in the area of assistance. Qualitative studies show that pregnant women are greatly assisted by the presence of students. As the results of the following depth interviews:

- On the consumption of added tablets of blood, students often remind pregnant women or pregnant women feel more responsible because they better understand the benefits of taking tablets plus blood

Table 5: Differences in the implementation of early detection of high-risk of pregnancy before and after intervention in the treatment and control group in Palu City

Variables	Intervention	Mean±SD	Different mean	*p-value
Treatment group	Before	0.5±0.5	0.4	0.000
Scale (0-10)	After	0.9±0.2		
Control group	Before	0.3±0.5	0.1	0.044
Scale (0-10)	After	0.4±0.5		

*uji wilcoxon

Table 6: Differences in the implementation of early detection of high-risk of pregnancy between treatment and control groups, before and after intervention in the treatment group in Palu City

Conditions	Groups	Mean±SD	Different mean	*p-value
Before intervention	Treatment	0.5±0.5	0.2	0.079
	Control	0.3±0.5		
After intervention	Treatment	0.9±0.2	0.5	0.000
	Control	0.4±0.5		

*Mann-Whitney test, Source: Results of the analysis, 2017

Table 7: Effect of student assistance on the implementation of the ANC standard and early detection of high-risk of pregnancy after controlled by mother characteristics (age, education, occupation, gravid and frequency) in Palu City

Variables	Mean square	F	*p-value
Age			
Standard ANC	0.996	1.047	0.001
Detection of risk	0.007	0.144	0.866
Job			
Standard ANC	0.021	0.194	0.825
Detection of risk	0.051	1.133	0.332
Education			
Standard ANC	0.780	0.720	0.005
Detection of risk	0.010	0.208	0.932
Gravid			
Standard ANC	0.075	0.689	0.604
Detection of risk	0.015	0.013	0.000
ANC age			
Standard ANC	0.252	2.479	0.123
Detection of risk	0.040	0.885	0.352
Frek, ANC			
Standard ANC	0.352	1.479	0.003
Detection of risk	0.040	0.085	0.052

*uji MANOVA, Source: Results of the analysis, 2017

- Counseling activities that have been rarely performed by midwives due to time constraints have been assisted by students

Similarly, early detection of pregnancy independently. During this early detection performed by the midwife by filling the Pudji Rochyati's scorecard. Pregnant women consider that early detection is only the responsibility of midwives to plan their delivery. Since student counseling and taught to fill in pregnant women's manuals (including early checklist of early detection of pregnancy risk factors). Pregnant women are better understood and more responsible for managing and caring for her pregnancy.

Key informants from municipal health office of Palu City agreed to continue mentoring program by students as approach of household-based antenatal care (pregnant and family).

DISCUSSION

Influence of student assistance on the implementation of the ANC standard of pregnant women: Antenatal care is a program consisting of examination of health, observation and education to pregnant women in a structured and planned to get a process of pregnancy and childbirth safe and satisfactory^{7,8,10}. Regular and comprehensive antenatal care can detect early abnormalities and risks that may arise during pregnancy. So that these disorders and risks can be resolved quickly and precisely^{5,8}. Antenatal care is assessed to be of quality if the antenatal care meets the government's 10 T standards including¹⁰: (1) Measurement of height and weight weighing, (2) Measurement of blood pressure, (3) Measurement of upper arm circumference/LiLA, (4) Measurements high uterine fundus, (5) Determination of fetal location (fetal presentation) and the calculation of fetal heart rate, (6) Determination of immunization status of Tetanus toxoid (TT), (7) Administration of Fe tablets, (8) Laboratory examination, (9) Counselling and (10) Case management/handling.

For Palu City antenatal care coverage (K1 and K4) data is quite high but there is no data on the implementation of the ANC standard (10 T) by the midwife. There are several points of concern in the implementation of antenatal standards (10 T) among others:

- Midwives' technical competence in implementing antenatal care concerning the knowledge and skills of health care providers. Technical competence also relates to the way healthcare providers adhere to predetermined health service standards which include compliance, truth and consistency. Uncompleted technical competencies can lead to deviations from health care standards, declining quality of health services
- Compliance of health personnel (midwife) in implementing of the ANC standard (10 T). With student assistance, the midwife's compliance level in implementing antenatal examination standards increased (mean 7.7-9.8) or from adherence level 77-98%. The result of this research is in line with the research conducted by Guspianto²² which shows that the midwife compliance

level in applying the ANC standard is still low that is 74.28% is still below the minimum standard which is 80%. The results of the depth interviews with the coordinator midwife indicate that the issues in health personnel are in compliance and consistency in following existing antenatal care (10 T) standards. This compliance and consistency can be improved through regular monitoring and evaluation of standardized antenatal care practices. Student assistants indirectly assist in the monitoring process

- Availability of the facilities and infrastructure supporting antenatal care, including examination room, examination bed, medical device (stethoscope, tensimeter, doppler/monoscope instrument, Lila tape, thermometer), tape measure, scales, TT vaccine, iron tablet, Hb examination, MCH books, antenatal cohort and antenatal manual. The result of the research shows that there are limited infrastructures if antenatal check is done at Posyandu or Poskesdes
- The role of pregnant women for pro-active pregnancy checking seeking information through MCH books and communicating with health workers (midwives)

The results showed that there was a difference of standardized antenatal implementation (10 T) in the treatment and control group after giving intervention in the form of mentoring by students to pregnant women ($p<0.005$). The results of depth interviews on key informants (midwife coordinator) said that indirectly companion students become "supervisor" on the implementation of antenatal examination by the midwife. So the midwife is more disciplined to implement the existing standards. On the other hand, the students also help monitor the compliance of pregnant women following the instructions of health workers. The results also show that there are three standards antenatal care that can not be done consistently that is standard 8 (laboratory examination), standard 9 (counseling) and standard 10 (case management). However, after the assistance the 3 standards have increased significantly. The study also showed that maternal compliance level in consuming Fe tablets was still low in the control group (mean = 0.58) compared with treatment group (mean = 0.97). That is there are still about 42% of pregnant women in the control group and 3% of pregnant women in the treatment group who did not consume Fe tablets regularly.

Several studies have found that maternal non-adherence is a significant factor in the failure of supplementation of Fe

tablets^{23,24}. Compliance is an important thing in order to develop habits that can help in following the daily schedule. Some of the literature defining adherence to treatment is a behavior that indicates the extent to which individuals follow advice related to health or disease. Compliance occurs when the rules in consuming prescribed medications and their gifts are followed correctly.

Impact of student counseling on early detection of high-risk of pregnancy independently:

In the modern obstetric there is a notion of potential risk in which a pregnancy and childbirth can always lead to the possibility of low risk and high-risk of death⁷. The risk approach begins with the idea that risk measures are a feature of more intensive service needs, where this need actually exists before the predicted event occurs. The introduction of high-risk pregnant women is done through early screening/early detection of risk factor pro-active in all pregnant women^{5,7,10}. This activity has been done by the midwife during the antenatal care check by charging the Pudji Rochyati's scorecard and installing the P4K sticker. But the results will be different if pregnant women themselves who do early detection of high-risk pregnancy through charging Pudji Rochyati's score, accompanied by students. The pregnant women are more responsible in managing their pregnancy, when they know the condition of pregnancy.

In the study, pregnant women themselves who are trained through assistance by students to recognize the risk factors it has through the filling check list. As a result, pregnant women in the treatment group had the ability to perform early detection of high-risk pregnancies independently by filling the check list ($p<0.005$) compared with pregnant women in the control group ($p>0.005$).

Influence of the pregnant women's characteristic on the implementation of the ANC standard and early detection of high-risk:

The results showed that maternal characteristics included, maternal age, education and antenatal frequency had a significant effect ($p<0.005$) on the implementation of standardized ANC. Age and education show a person's self-maturity. There are several factors that influence knowledge, such as the level of education (the higher the better the better), the information (the more information will increase knowledge), experience (something ever done or experienced such as the second pregnant women or third or after several pregnancy checks) and age (getting older should be more mature)^{25,26}.

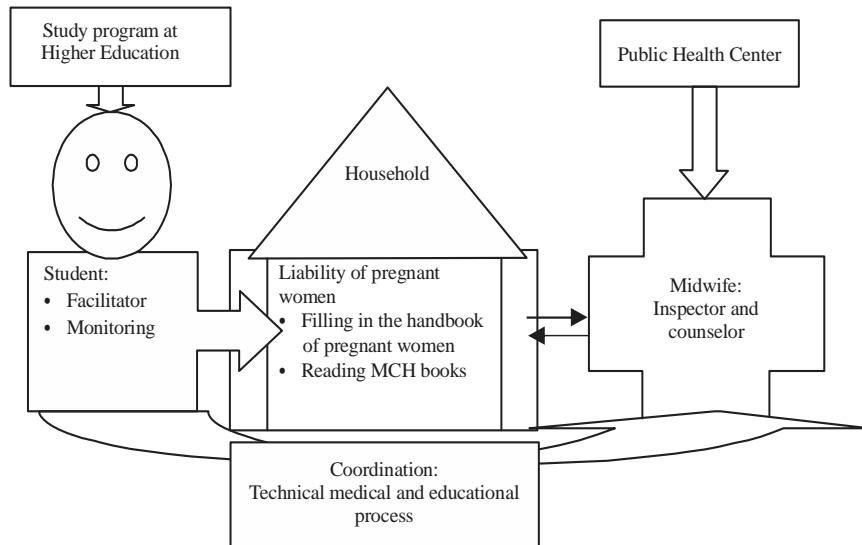


Fig. 2: Model of network monitoring in household-based antenatal care

Antenatal care monitoring models and early detection of high-risk pregnancy and pregnancy-based pregnant women: The antenatal care examination is a tupoksi from the midwife of the Public Health Centre. So midwives in the field "chase" with the ANC coverage scores including K1 and K4. Pregnant women become the object of midwife efforts to meet the demands of the ANC coverage. Though the examination of quality antenatal care is the right of pregnant women. The pregnant women are entitled to quality health care for themselves and their babies. They are entitled to participate in determining the future of the baby they contain. They are the subject of antenatal care. This awareness is to be built into a household-based antenatal care approach (pregnant women and families). The involvement of pregnant women and families in the antenatal care process is the key word. To achieve this then the empowerment of pregnant women becomes a necessity. Pregnant women are made empowered to manage their pregnancies (managing, caring and planning childbirth). Families are also made powerless to help expectant mothers manage their pregnancy. It takes human resources that act as facilitator as well as monitor the empowerment process.

Antenatal care monitoring model based households involving public health students who have been given training mentoring expectant mothers and families on campus. Health students as the accompaniment of pregnant women and families have the task as, 1) The

facilitator tasked to educate, encourage, mobilize and motivate pregnant women and families to make behavioral changes in "manage" pregnancy. Pregnant women are expected to have an understanding of pregnancy and the risks of each pregnancy. Pregnant women can understand their rights and obligations. Finally, pregnant women can independently check list of 10 antenatal care service standards that they must obtain, self-monitoring Hb examination, self-monitoring of the TPB consumption, discuss with counselor or midwife about pregnancy and risks (counseling) and can do high-risk early detection pregnancy independently, 2) Monitoring, in charge of monitoring the development of pregnant women through pregnant women handbook (antenatal care result and early detection of high-risk) for entry in information system of MCH. Indirectly also monitor the compliance of health personnel (midwives) in providing antenatal care services that meet the standards. Village midwives are more focused as examiners and counselors. The results of the ANC midwife examination on MCH book will be used by pregnant mother to fill the handbook of pregnant mother independently as shown in Fig. 2.

As for monitoring the implementation of flow-based antenatal care of pregnant women and families that began with the training of students by tertiary institutions as well as co-operation with health services and community health centre (Fig. 3).

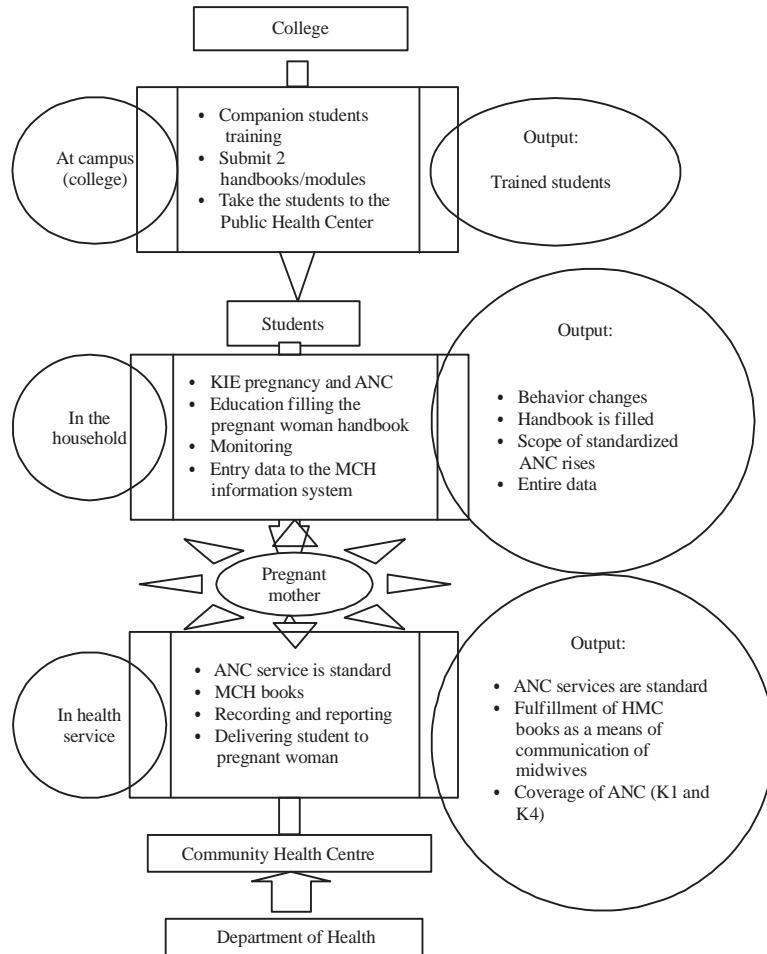


Fig. 3: Flow of activity on the model of antenatal care monitoring of household-based

CONCLUSION AND RECOMMENDATION

A household-based antenatal care monitoring models with a student mentoring approach to pregnant women and families provides significant results for the implementation of quality antenatal care (as per ANC standards) as well as the implementation of early detection of high-risk independently by pregnant women.

Recommendation in these studies are:

- Student facilitation activities towards pregnant women and families need to be continued with wider areas and targets and involvement of Health Universities in Palu City
- Built memorandum of understanding between the Higher Education, Palu City government and the Independent Community in the mentoring program. For the Universities involved to be considered on the

academic agenda. For Palu City government (especially Department of Health) to be considered reward for student of companion as well as support data (target). For independent parties to prepare IT-based information system that can be utilized in decision making by all parties

SIGNIFICANCE STATEMENT

This study discovered that the students' assistance toward the implementation of the ANC standard and early detection of high-risk of pregnancy is very necessary and significantly good outcome. This research also produced an implementation model of household-based the ANC (pregnant and family mothers) through a student mentoring approach. It may help all administrative and decision maker to set the priority program in ANC process and outcome.

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