Comparing the Implications of Midwifery-Led Care and Standard Model on Maternal and Neonatal Outcomes during Pregnancy, Childbirth and Postpartum

Azam Bagheri (PhD)[1], Masoumeh Simbar (PhD)[2,3], Mansooreh Samimi (MD)[4], Fatemeh Nahidi (PhD)[5], Hamid Alavimajd (PhD)[6], Zohre Sadat (PhD)[7]

[1] Assistant professor, Department of Midwifery and Reproductive Health, Kashan University of Medical Sciences, Kashan, Iran
[2] Professor, Midwifery and Reproductive Health Research center, Shahid Beheshti University of Medical Sciences, Tehran, Iran
[3] Department of Midwifery and Reproductive Health, School of Nursing and Midwifery, Shahid Beheshti University of Medical Sciences, Tehran, Iran
[4] Associate Professor, Department of Gynecology and Obstetrics, medical school, Kashan University of Medical Sciences, Kashan
[5] Associate professor, Department of Midwifery and Reproductive Health, School of Nursing and Midwifery, Shahid Beheshti University of Medical Sciences, Tehran, Iran
[6] Professor, Department of Biostatics, Shahid Beheshti University of Medical Sciences, Tehran, Iran
[7] Associate Professor, Trauma Nursing Research Center, Kashan university of medical sciences, Kashan, Iran

ARTICLE INFO	ABSTRACT
	Background & aim: Considering importance of developing maternal care, the present study was designed to compare the implications of a midwifery-led care (MLC) and standard model on maternal and neonatal outcomes during pregnancy, childbirth and postpartum. ***Methods:*** This clinical trial performed through quasi- experimental method on 200 pregnant women referred to health centers of Kashan, Iran, between 2014 and 2017. Participants were randomly assigned to MLC and standard model of care group (each 100). Data on maternal and neonatal outcomes were collected using self-structured questionnaires and checklists. The validity and reliability of tools were evaluated through content validity and also test-retest and observer reliability. The collected data were analyzed using SPSS version 21 by T test, chi-square and Mann-Whitney. ***Results:*** The implementation of MLC resulted in improved outcomes including decrease in cesarean section, increase in spontaneous delivery, increase in physiological delivery, increased participation in preparatory classes for labor, decrease in induction, decrease in hospital stay, decrease in the number of prenatal visits, decrease in ultrasound, and increase in mean gestational age at admission ($p <0.05$). The results also pointed to increased lactation and decreased hospitalization due to jaundice ($p < 0.05$). There was no statistically significant difference in terms of anesthesia, narcotic use, postpartum hemorrhage, curettage, episiotomy, postpartum infection and postpartum depression. No maternal mortality was observed in two groups. ***Conclusion:*** Midwifery-led care can lead to improved maternal and neonatal outcomes at least in low-risk pregnant women. More chance of physiological delivery, spontaneous labor and less cesarean section, induction and augmentation were significant.

Introduction

The midwifery-led care model is a model in which the leaders of the care team are midwives that its used is increased recently (1). The midwifes are the ones who set the program of care for pregnant women and create the conditions which all women receive the possible

* *Corresponding author:* Masoumeh Simbar, Professor, Midwifery and Reproductive Health Research center, Shahid Beheshti University of Medical Sciences, Tehran, Iran. Tel: 00989121777672; Email: msimbar@yahoo.com

best care (2). In this care model, midwives have an active participation in interaction with pregnant women; moreover the pregnant women actively participate in leading care, being responsible, evaluating their needs, programming the care and doing refer. The philosophy of the midwifery care model is that all women have a natural ability to experience childbirth without any or minimum intervention (3, 4).

In midwifery-led models, care includes several aspects and making comprehensive continuity is the most important section such as continuous care, communication with provider from pregnancy to postpartum, educating, informing and management (5-7). It means the continuous monitoring of physical, mental, spiritual, and social health of women and their families during pregnancy and childbirth. This is done through the provision of services and individual education, counseling, pre-birth care, continuous presence during and after childbirth, support after childbirth, and prevention of unessential interventions. These care models have mostly been followed with the purpose of continuity in care during a period (8, 9).

One of the important sustainable development goals of this model is ending preventable maternal and neonatal mortality and morbidity(2, 10, 11). Numerous studies have shown that midwifery-led care has desirable effectiveness, cost and safety leading to less intervention in labor and delivery including labor induction and augmentation, electronic fetal monitoring, consumption of sedatives, epidural anesthesia, and consumption of narcotic analgesics, C-section, instrumental delivery and less episiotomy. The rate of C-section and neonatal outcomes has sometimes been equal and ultimately, mothers' satisfaction, especially satisfaction with care during pregnancy has been higher in midwifery care models than that in other models of mother's care (4, 12-19). In midwifery-led care models, women exhibit more preparation for childbirth, more self-confidence and self-esteem and lower rate of postpartum depression. Lower costs for service provision and better neonatal outcomes have also been mentioned as the advantages of midwifery-led models (20-25).

Like many other places in the world, midwives in Iran are the main providers of

primary care for pregnancy and childbirth in the first level of the Primary Health Care system (4, 26). In Iran, access to midwifery services is provided for people even in poor and distant communities. Therefore, there is perfect opportunity to access midwifery-led care models in the health system. In Iran, care of pregnant mothers is merged in the PHC system and midwives have provided first level services to pregnant women in the health centers of urban and rural societies for many years (26). Although care is done by midwives, specialists are responsible for all stages of maternal care for both high and low risk women. As a result of sudden changes during pregnancy, sometimes care is not provided consistently (25, 27). Despite the fact that one main purpose is the continuous provision of care, its fulfillment has not been reviewed adequately and women usually complain of the low quality and inconsistency of care during pregnancy, childbirth and postpartum. In some studies, discontinuing of mother's care in the delivery step has been mentioned as a factor in selecting C-section (28, 29).

Today, many health systems changed their care model to a continuous one in which women can consistently receive care from a known midwife. In Iran, a so-called "family doctor project" is recently practiced. Developed by the health care system, the project aims to promote natural childbirth by accompanying midwifes in physiological delivery (30). However, evidence shows that the continuation of care and the its consistency before and after pregnancy are quite problematic and in some cases, the project has not been executed well, covering only a certain time interval. Studies reviewing continuous midwifery care models from pregnancy to after childbirth have rarely been carried out. Therefore, considering the high potential of midwifery-led care, a team of midwifery-led care program was designed. This study was performed with aim to compare the implications of a midwifery-led care and standard model on maternal and neonatal outcomes during pregnancy, childbirth and postpartum.

Materials and Methods

This randomized clinical trial study was conducted from 2014 to 2017. This study has

confirmed in ethical committee of Shahid Beheshti University of medical sciences as IR.SBMU.PHNM.1395.515 number and its IRCT code is IRCT201408318801N9. Continuous midwifery care model during pregnancy, childbirth and post was executed as a clinical trial in the fields under the authority of Kashan University of Medical Sciences and its consequences were compared with the standard model in the current system in Iran.

Multistage sampling was used to randomly select the participants. First, the Kashan city was divided based on the regions covering the health care centers and considering the ratio of the population covered in each region. Then, the size of all sub-samples was decided for these regions. In the next stage, in each region, a list of health care centers was prepared and some centers were randomly selected. In the last stage, in the selected centers, the sample size was selected through convenience and non-probability sampling. The minimum sample size in each group was 94 according to the percentage of currently reported cesarean section rate, the World Health Organization expects for Iran, the results of similar studies and some other variables such as induction of labor, delivery augmentation, accompanying presence and etc. using the following relation:

$$n \geq \frac{\left\{ z_{1-\alpha/2}\sqrt{\left[2\overline{P}\left(1-\overline{P}\right)\right]} + z_{1-\beta}\sqrt{\left[P_1\left(1-P_1\right)+P_2\left(1-P_2\right)\right]} \right\}^2}{\left(P_1-P_2\right)^2}$$

Finally, 100 samples were determined in each group. Considering the sample loss, 240 women were registered as participants (120 in the continuous care group, 120 in the control group).

Pregnant women were firstly evaluated by the PHC center midwife. In case If the subjects had including criteria were selected as the sample. Including sample was categorized in low risk pregnancy, gestational age under 14 weeks, maternal age of 18- 35 years, no history of high risk pregnancy and infertility, gravida <3, no history of cesarean or abdominal surgery. Risk categorization of mothers was performed as confirmed scale that merged in PHC system. If they had any high risk criteria during pregnancy they were excluded from the study.

The selected mothers were cared using the designed continuous care model as the study intervention in continuous care center including:
1. Maternal care performed by a team (a responsible midwife, a scientific midwife on call, a substitute and trainee midwife for preparing physiologic delivery) while her husband was present
2. Mothers' access to responsible midwife, every time, through every method that was needed such as phone, presence of midwife and so on. Continuity of care and care provider was the original goal.
3. Presence of responsible midwife during delivery, informing to specialist on call and performing delivery if there was no risk
4. Presence of responsible midwife until 2 hours after delivery to care of mother and baby and connect to the mother's family
5. Home visit was done if the mother wanted.
6. Responsible midwife performed maternal and neonatal care until 4 weeks after delivery and referred to PHC system to continue caring.
7. Whenever needed, women were referred to specialist during prenatal, delivery and postpartum.

For each pregnant woman in the sample group, a pregnant woman of the same center was selected as the control group that was cared by standard model in PHC. Two groups were matched in terms of body mass index, age, and gravid.

Data collection tools included three questionnaires and two check-lists filled out in several stages from the time of pregnancy to one month after childbirth in order to follow the maternal consequences during labor, childbirth and postpartum. Several criteria were evaluated including demographic information (maternal age, parity, education, residency, economical status), maternal outcomes in prenatal care (the number of visits and sonography, hospitalization, fetal death), labor and delivery (using induction, augmentation, narcotics, analgesia and duration of labor, delivery type, episiotomy) postpartum (perineal pain, depression, back pain, breast feeding) and neonatal outcomes (low birth weight, Apgar score, NICU, prematurity)

In order to confirm the validity of the interview forms and the content validity of the check-lists, they were reviewed and confirmed using the opinions of 20 experts and faculty members of Shahid Beheshti University of Medical Sciences and Kashan University of Medical Sciences. Reliability of the check-list was determined using the test-retest method. The forms were filled out by the researchers for 10 pregnant women in two stages at two times (one week interval). Then, the correlation of the data was calculated and the reliability was confirmed. Data were analyzed using appropriate descriptive and comparative statistical methods such as t-test, chi-square, ANOVA and Mann-Whitney by the SPSS software (version 21) with 95% confidence level.

Results

a) Demographic characteristics

Among the 240 studied women (120 in the continuous care group and 120 in the control group), some were excluded from the study due to limitations in distance, transportation, unwillingness and living conditions. After screening, 112 women remained in the continuous care group and 109 remained in the control group. The mean age of women (27.84 versus 27.04 years) and that of their husbands (32 versus 31.31 years) showed no statistical significant difference between the two groups (Table 1).

Table 1. Frequency and comparison of some demographic characteristics in the two groups

Demographic characteristics	Continuous care	control	P value
Mother's age (mean)	27.84±4.54	27.04±5.23	0.20
Husband's age (mean)	32±5.16	31.31±5.83	0.30
BMI (%) normal (19.8-25)	66(59.8)	67(60.55)	0.30
Mother's education (%)			
University	63(56.3)	50(45.9)	0.10
Diploma	35(31.3)	40(36.7)	
other	14(12.4)	19(17.4)	
Husband's education (%)			
University	45(40.2)	34(31.2)	0.09
Diploma	45(40.2)	43(39.4)	
other	22(19.6)	32(29.4)	
Gravidity (%)			
1	63(56.3)	58(53.2)	0.40
2	37(33)	32(29.4)	
3	12(10.7)	19(17.4)	
Job (%) (house keeper)	89(79.5)	93(85.3)	0.10
Residency status (%) (home owner)	67(59.8)	63(56.9)	0.19

Also, frequency distribution of the mother's education, husband's education, gravidity, job, habitat, body mass index and economic conditions were similar in the two groups (p>0.05).

b) Comparing maternal consequences before childbirth

Among a total of 221 selected subjects, 100 women of the continuous care group and 104 of the control group had low risk birth. 12 of the continuous care group and 5 of the control group were excluded from the study because of abortion, uncontrolled hypertension and diabetes.

Table 2. Frequency of disease during pregnancy in the two groups

Groups	No (%)	Yes (%)			Total (%)	Chi-square test
		Anemia	Hypothyroidism	Diabetes		
Continuous care	83(83)	3(3)	12(12)	2(2)	100(100)	
Control	63(60.6)	7(6.7)	29(27.9)	5(4.8)	104(100)	P=0.006
Total	146(71.6)	10(4.9)	41(20.1)	7(3.4)	204(100)	

Based on the results of the study, there was no significant difference between the two groups in terms of risk conditions, hospitalization and hemorrhage during pregnancy (p>0.05).

Analysis showed significant difference between the two groups in term of diagnosis and treatment of diabetes, anemia and hypothyroidism during pregnancy (p=0.006, Table 2).

According to the results of the study, the two groups showed significant difference in terms of participation in the majority of prenatal visits and in childbirth preparation classes (P<0.0001).

Table 3. Comparing frequency of some prenatal outcomes in the two group

Maternal Outcomes	Continuous care (%)	Control (%)	Total (%)	P-Value
participation in visit				
Always	49(49)	19(18.3)	68(33.3)	<0.0001
Sometimes	51(51)	85(81.7)	136(66.7)	
participating in classes				
Yes	63(63)	14(13.5)	77(37.7)	<0.0001
No	37(37)	90(86.5)	127(62.3)	
Number of visits				
<9	62(62)	16(15.4)	78(38.2)	
9-12	31(31)	30(28.8)	61(31.9)	<0.0001
>12	7(7)	58(55.8)	65(31.9)	
Number of ultrasound				
1-2 times	37(37)	22(21.2)	59(28.9)	
3 times	60(60)	70(67.3)	130(63.7)	0.002
>3 times	3(3)	12(11.5)	15(7.4)	
Delay as minute				
<15	89(89)	23(22.1)	112(54.9)	
15-30	5(5)	11(10.6)	16(7.8)	<0.0001
>30	6(6)	60(67.3)	79(37.3)	

The continuous midwifery care group had more participation in prenatal visits and childbirth preparation classes (Table 3).

The results also showed that the number of visits during pregnancy in the control group was significantly higher (Table 3). The majority of the continuous care group (62%) had less than 9 visits during pregnancy; whereas the majority of the control group (58%) had more than 12 visits during pregnancy (p<0.0001).

The number of the ultrasounds was significantly higher in the control group (p=0.002). The two groups were significantly different in terms of delay in visit session (p<0.0001) and the mean of delay was higher in the control group (Table 2).

c) Comparing maternal consequences during labor and postpartum

The results of the study showed that most women (61%) in the continuous care group had gestational age of > 39 weeks; whereas, most women (55.8%) in the control group had gestational age of <39 weeks at the time of hospitalization (Table 4).

The most common reason for hospitalization at the end of pregnancy in the continuous care group (49%) was the spontaneous beginning of childbirth; whereas, the most common cause of hospitalization in the control group (47%) was the end of pregnancy. Chi-square test showed that the causes of hospitalization at the time of pregnancy were significantly different between the two groups (P<0.001).

Ultimately, mean time of hospitalization for labor (P<0.0001) and duration of hospitalization in the continuous care group (23.91±11.45 hours) was significantly shorter than the control group (32.66±25.81hours) (p=0.002). The results also indicated that the frequency of postpartum low back pain was significantly higher in the control group (Table 4).

Table4. Frequency of some maternal outcomes in the two groups during labor and postpartum

Maternal Outcomes	Continuous care (%)	Control (%)	Total (%)	P Value
Gestational age at hospitalization				
<39	39(39)	58(55.8)	97(47.5)	0.01
39-40	31(31)	29(27.9)	60(29.4)	
>40	30(30)	17(16.3)	47(23)	
The reason of hospitalization				
Labor pain	49(49)	36(34.9)	85(41.7)	<0.0001
Induction	23(23)	47(45.2)	70(34.3)	
PROM	10(10)	17(16.3)	27(13.2)	
Others	18(18)	4(3.8)	22(10.8)	
Duration of hospitalization				
Mean /hour	23.91±11.45	32.66±25.81	-	0.002
Postpartum low back pain				
Yes	16(16)	28(26.9)	44(21.6)	0.04

The results showed that the prevalence of C-section was significantly lower in the continuous care group (p=0.025); even though most of the women in both groups (86% in the continuous care group and 74% in the control group) had fidence interval (Table 5).

natural delivery. Based on the results of the study, midwifery continuous care during pregnancy reduces 46% of the risk of C-section with probability of 95% in the 0.3-0.9 co

Table 5. Frequency of some delivery outcomes in control and experimental groups

Maternal outcomes	Continuous care (%)	Control (%)	Total (%)	P Value and Risk Ratio
Mode of delivery				
Natural Delivery	86(86)	77(74)	163(79.9)	P=0.025
C-section	14(14)	27(26)	41(20.1)	RR=0.46
Induction				
Yes	44(44)	73(70.2)	117(57.4)	P=0.0001
No	56(56)	31(29.8)	87(42.6)	RR=0.40
Spontaneous				
Yes	57(57)	25(24)	82(40.2)	P<0.001
No	43(43)	79(76)	122(59.8)	RR=1.67
Physiological Delivery				
Yes	35(35)	13(12.5)	48(23.5)	P<0.001
No	65(65)	91(87.5)	156(76.5)	RR=1.63
Total	100(100)	104(100)	204(100)	

Based on the results, significantly more women in the control group (70.2%) needed induction to start childbirth than those in the continuous care group (44%) (P<0.001). Continuous care during pregnancy reduces 40% of the risk of induction with the probability of 95% in the 0.5-0.8 confidence interval (Table 5).

Data analysis related to the spontaneous labor showed that there was a statistically significant difference between the two groups (p<0.001). Labor started spontaneously in 57% of women in

the continuous care group and 24% of those in the control group. Continuous care during pregnancy

increased spontaneous beginning of labor as 67% with the probability of 95% in the 0.4-0.7 confidence Interval (Table 5).

Moreover, 35% of women in the continuous care group and only 12.5% in the control group experienced physiological childbirth; this difference between the two groups was statistically significant (p<0.001). Continuous care during pregnancy increased the physiological childbirth as 67% with the

probability of 95% in the 0.5-0.8 confidence interval (Table 5).

The results also indicated no statistically significant difference between the two groups in terms of the consumption of anesthesia (p=0.28), narcotic analgesics (p=0.29), postpartum hemorrhage (p=0.49), curettage (p=0.74), episiotomy (p=0.40), mastitis (p=0.13), and postpartum depression (p=0.24).

There was no maternal mortality in the two groups.

d) Comparing maternal consequences during child care

Data analysis revealed that until one month after delivery, most neonates were solely breast-fed (98% in the continuous care group and 89% in the control group). As shown in Table 6, the observed difference was statistically significant in types of feeding (p=0.002).

Table 6. The frequency of types of feeding in the two groups

Feeding	Continuous care (%)	Control (%)	Total (%)	P Value
Breast feeding	98(98)	89(85.6)	187(91.7)	
Formula	2(2)	15(14.4)	14(6.1)	0.002
Total	100(100)	104(100)	204(100)	

According to the results of the study, 19% of neonates in the continuous care group and 34% of the neonates in the control group were hospitalized after delivery; the most common cause was neonatal jaundice in both groups

(17% and 27.9%, respectively as shown in Table 7). Inferential analysis showed that there was a significant difference between the two groups in the prevalence of neonatal hospitalization (p = 0.03).

Table 7. Frequency distribution of neonatal hospitalization in the two groups

hospitalization	Continuous care (%)	Control (%)	Total (%)	P Value
Yes				
neonatal jaundice	17(17)	29(27.9)	46(22.5)	
other	2(2)	5(4.9)	7(3.5)	0.03
No	81(81)	70(67.3)	151(74)	
Total	100(100)	104(100)	204(100)	

Also, the results showed no significant difference between the two groups in the mean weight of neonates, neonatal age, 5th minute Apgar score, neonatal intensive care unit and fetal mortality before week 28; no mortality was observed in the two groups (p>05).

Discussion

The results of the study indicated that maternal outcomes during pregnancy, childbirth and postpartum and also neonatal outcomes significantly improved in the continuous midwifery care group with no increase in adverse consequences and mortality rate. These results confirmed the previous related findings including a large meta-analysis done by Sandal et al. (25). In this study, women in the two groups didn't significantly differ in their risk conditions. Women in the control group who received more specialist-controlled care were

significantly more likely to receive treatment for diabetes and thyroid disease. Some other studies have indicated over-treatment and over-diagnosis in specialist-centered care(31)

There are differences among gynecologists and endocrinologist in the guidelines for the treatment of gestational diabetes and thyroid dysfunction during this study. Therefore, it is suggested that comprehensive guidelines be prepared in this regard. The implementation of midwifery continuous care model improved many outcomes in the present study. The current practice of some unnecessary interventions with limited scope of midwifery function, especially in Iranian medical centers and teaching hospitals, makes it difficult to achieve such goals.

As also shown in similar studies on pregnant women, those who received ongoing midwifery care in the current study were more likely to participate in childbirth preparation classes,

leading to more self-esteem and confidence in delivery and more satisfaction(15, 20, 32, 33). Along with timely hospitalization, shorter hospital stays, and fewer cesarean surgeries, this will definitely result in lower costs with ongoing midwifery care programs as other studies have reported (32, 34, 35). In this study, the mean gestational age at delivery was higher in the continuous care group, making the length of labor and hospital stay shorter. Some studies have reported longer labor in the midwifery care group (20, 35). The shorter length of labor for the continuous care group in this study may be due to their timely referral. The results of the present study showed that midwifery continuous care can lead to a decrease in cesarean section, induction and other unnecessary interventions during childbirth confirming the previous studies(18). It should be noted that some studies have not shown the effects of midwifery continuous care on caesarean section, induction and augmentation (25, 36). The prevalence of caesarean section was decreased in our study because of the implementation of a continuous midwifery care model, it was in our community about 50% which was beyond the standard. In this study, the women in the continuous care group were significantly more likely to attend childbirth preparation classes; mean gestational age at admission was significantly higher than the control group and the most common reason for their referring was the onset of actual labor pains. In contrast, the majority of the women in the control group were hospitalized for pregnancy termination. These are interconnected issues that need to be considered for increased physiological, normal delivery and decreased cesarean section.

While many studies report that midwifery continuous care can lead to less episiotomy, fewer analgesic consumption, and less preterm labor (18, 25, 34, 36), the use of continuous midwifery care in this study was not effective on the use of anesthesia and analgesia, episiotomy, postpartum infection, persistent low back pain, postpartum hemorrhage, perineal rupture, incontinence, preterm labor, mastitis, and subsequent depression. Further studies with a larger sample size can clarify these findings.

No maternal mortality or serious morbidity was reported in the two groups of the present study indicating that the safety of the midwifery continuous care model can lead to its cost-effectiveness. Other studies examining the impact of midwifery care models also confirm this result (25, 31, 36, 37). A large-scale study by McLachlan et al. also showed that continuous midwifery care compared to other models of care resulted in a significant reduction in neonatal intensive care (18). It can be concluded that under the prevailing conditions of the Iranian society, providing continuous care to low-risk pregnant women can have positive effects on increased lactation and reduced hospitalization due to neonatal jaundice. It is worth noting that the prevalence of jaundice is influenced by several factors, requiring further research.

Conclusion

Continuous midwifery care during pregnancy, delivery and postpartum in low-risk mothers can lead to the improvement in many maternal and neonatal indicators especially reduced risk of C-section and increased risk of physiologic delivery which is one of the problems in our country today. It has no effect on the increase of adverse maternal and neonatal outcomes. Therefore, it is recommended that continuous midwifery care be provided for all pregnant women, especially low-risk women to promote Iranian women's right to satisfactory maternal and neonatal indicators and to overcome the creeping problem of cesarean section. It is also suggested that community-based services be integrated into the health care delivery system since the infrastructure of health networks is ready even in remote areas. In line with the mission of the Health Ministry, it is essential that qualified midwives be trained to provide continuous care in public, private, and collaborative health centers. We hope that this model of care will help to improve the maternal conditions in the country.

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Conflicts of interest

Authors declared no conflicts of interest.

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