1   **Factors contributing to postpartum blood-loss in low-risk**

2   **mothers through expectant management in Japanese birth**

3   **centres**

4

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12

1   Abstract

2

3   Objective: To describe aspects of expectant midwifery care for low-risk women

4   conducted in midwifery-managed birth centres during the first two critical hours after

5   delivery and to compare differences between midwifery care, client factors and

6   postpartum blood loss volume.

7   Method: As a secondary analysis from a larger study, this descriptive retrospective

8   study examined data from birth records of 4,051 women who birthed from 2001-2006

9   at nine (21%) of the 43 midwifery centres in Tokyo. Nonparametric and parametric

10 analyses identified factors related to increased blood loss. Interviews to establish

11 sequence of midwifery care were conducted.

12 Findings: The midwifery centers provided care based on expectant management

13 principles from birth to after expulsion of the placenta. Approximately 63.3% of

14 women were within the normal limits of blood loss volume under 500 gm. A minority

15 of women (12.9%) experienced blood loss between 500-800 gm and 4% had blood

16 loss exceeding 1000 gm. Blood loss volume tended to increase with infant birth

17 weight and duration of delivery. The total blood loss volume was significantly higher

18 for primiparas than for multiparas during the critical two hours after delivery and for

19 immediately after delivery, yet blood loss volume was significantly higher for

20 multiparas than for primiparas during the first hour after delivery. Preventive uterine

21 massage and umbilical cord clamping after placenta expulsion resulted in statistically

1   significant less blood loss. Identified were two patterns of midwifery care based on

2   expectant management principles from birth to after expulsion of the placenta. The

3   practice of expectant management was not a significant factor for increased

4   postpartum blood loss.

5   Conclusion: These results detail specific midwifery practices and highlight the clinical

6   significance of expectant management with low risk pregnant women experiencing a

7   normal delivery.

8
9   Key words: midwives, expectant management, birth homes, postpartum
10   hemorrhage, post-partum blood loss

1   Introduction

2   Problem: Postpartum blood loss is a major cause of death.

3   What is Already Known: Abnormal bleeding is defined as 500 gm or more within 24

4   hours, and the high-risk period for blood loss volume is within the first two hours after

5   delivery.

6   What This Paper Adds: Under expectant management for low-risk women, 13% of

7   women experienced blood loss between 500-800 gm and 4% had blood loss

8   exceeding 1000 gm.   Blood loss volume was significantly higher for multiparas than

9   for primiparas during the first hour after delivery. Uterine massage and cord cutting

10   after placenta delivery were associated with decreasing blood loss.

11

12   Postpartum hemorrhage continues to be a global concern.[1] Research indicates

13   that 5% of women in resource rich countries experience postpartum hemorrhage of

14   1,000 ml or more),[1,2] accentuating the point that intrapartum hemorrhage is an

15   important and common world-wide issue even in industrialized countries. Calvert and

16   colleagues' systematic review with meta-analysis[3] found that the prevalence of

17   severe PPH (blood loss ≥1000 ml) was highest in Africa at 5.1% and lowest in Asia at

18   1.9%. Yet in Japan, a major industrialized country in Asia, the prevalence of

19   postpartum hemorrhage varies between 2-5% and is a major cause of death.[4] This is

20   striking when compared to the admirable advances of Hong Kong and Singapore

21   where postpartum hemorrhage is no longer a leading cause of maternal death.[5]

1   Imaizumi et al.'s longitudinal epidemiological study[6] within Japan revealed that

2   postpartum hemorrhage varied by geographical area, urban-rural status and mothers'

3   age. Postpartum hemorrhage rates were lower in urban hospitals.

4   To provide some consistency for evaluating postpartum bleeding the Japan

5   Society of Obstetrics and Gynecology, following the WHO standard, defines vaginal

6   blood loss of 500 ml or more within the first 24 hours after birth as primary

7   postpartum hemorrhage (PPH)[7] and it recently defined abnormal bleeding as 800 ml

8   in the first 24 hours.[4] While blood loss is reported for the 24-hour period midwives are

9   particularly concerned about blood loss volume during the high-risk period of the first

10   two hours when the mother's coagulation and fibrinolytic mechanisms rapidly return

11   to normal.[8] Therefore midwifery management practices during this timeframe are key

12   to preventing PPH.

13   Management of third stage labour is paramount in controlling postpartum

14   bleeding.[1] Midwives have several different approaches to managing third stage

15   labour. Definitions of the approaches vary by setting.[9] For the purposes of this paper

16   one approach is termed active management of third stage labour and is found to

17   minimize PPH by using uterotonics, early cord clamping often before pulsation

18   ceases and gentle cord-traction.[10]

19   The second approach, which is the focus of this study, is termed physiological or

20   expectant management, often practiced by midwives in the USA, UK, Ireland

21   Northern European countries, Japan and some developing countries.[9] Expectant

1   management involves such practices as waiting until the cord ceases pulsating

2   before clamping, allowing the placenta to deliver on its own accord often added by

3   gravity and using nipple stimulation from infant's suckling and fundal massage

4   instead of uterotonics to stimulate the uterine contractions to control bleeding.[11] A

5   focus group of 32 midwives from various hospital settings in Sweden identified three

6   important factors for expectant management: (1) 'bring the process under control', (2)

7   'protect normality and women's birthing experiences' and (3) 'maintain midwives'

8   autonomy'. However the researchers found that midwives expectant management

9   practices varied.[12] Another facet of expectant management is the attention paid to

10   mother-infant bonding through early skin-to-skin contact, which may decrease the

11   length of third-stage labour.[13] Kataoka et al.[14] conducted a study of maternal and

12   infant outcomes from low-risk women delivering at midwifery birth centres and

13   midwifery-conducted home-births in Japan. They found midwives encouraged

14   mothers to assume the labouring positions they wanted, had low rates of perineal

15   trauma and episiotomies and 99% of mothers began nursing. Based on the principle

16   that childbirth is a natural process and within the constraints of their scope of

17   practice, Japanese midwives have fused the tradition of expectant management and

18   'natural birth', with evidenced based midwifery.[15]

19   In Japan the Public Health Nurses, Midwives and Nurses law guarantees that

20   midwives can professionally and autonomously provide care for pregnant women and

21   that childbirth that can be legally managed by midwives limited to low-risk

1   pregnancies, deliveries and the postpartum period that progresses without

2   problems.[16] In 2012 midwives practiced as independent midwives in homes (0.2%),

3   midwifery run birth centres (0.9%) and in collaboration with physicians at clinics

4   (47%) and hospitals (52%). About 2% of women chose midwifery managed childbirth

5   centres or homebirth services.[17] A recent study[14] noted that around 70% of women

6   choosing the midwifery birth centres with independent midwives were multiparous.

7   Women choosing the midwifery birth centres were seeking an environment that was

8   perceived as emotionally and physically safe.

9   Therefore, to maintain safe expectant midwifery care the rapid and precise

10   treatment for emergency events such as bleeding is recognized as one of the most

11   important critical aspects working at birth centres where medical care is not 'on-site'

12   and certain treatments such as episiotomies, suturing and use of uterotonics are

13   allowed but only for the emergency cases when the woman and infant are in

14   danger.[16] However, the expectant management practices in Japanese birth clinics,

15   particularly in relationship to third stage blood loss, during the first two critical hours

16   for low-risk pregnancies, have not been researched and specific management

17   practices during the third-stage of labour have not been identified.

18   Accordingly, this study was conducted in order to: (1) describe midwifery practice

19   in midwifery managed birth centres for the first two hours after delivery; (2) provide a

20   description of estimated postpartum blood loss volume and (3) compare midwifery

21   care, client factors and postpartum blood loss volume.

1

2 **Methods**

3 Research Design

4   This mixed methods descriptive study used retrospective data from a larger

5 study[14] using a convenience sample of 19 (40%) of the 46 midwifery birth homes

6 serving women in the urban area of Tokyo. Thus part of this study was a secondary

7 analysis. Interview data were organized by themes using content analysis.

8

9 Setting and Subjects

10   The study locations were a convenience sample of nine Tokyo-based midwifery

11 centres with beds located throughout the urban area of Tokyo. These homes were

12 converted to meet the requirements of the Japanese licensing standards for safe

13 birth.[18]

14

15 Data and data collection

16   Quantitative data were collected from all eligible delivery records of 4,488 women

17 giving birth in the nine midwifery centres during January 2001 to August 2006.

18 Excluded from data analyses were 380 (8.4%) cases where births took place away

19 from one of the nine midwifery centres because of the need for medical treatment

20 related to breech delivery, preterm premature rupture of membrane, weak

21 contractions, weaker fetal heartbeat or in keeping with Japanese tradition returning to

1   their parents' home for the delivery. These 380 cases were not relevant to this study

2   as no third stage care was provided. Another 57 women (1.3%) were transported

3   from the midwifery center to a hospital during the delivery period to the puerperal

4   period due to high risk situations such as primary hemorrhage, placenta accreta or

5   hematoma formation and were also excluded from the study. Thus researchers

6   analyzed 4,051 birth records relating to pregnancy and childbirth.

7   The data items were vetted based on a literature search, and items with high

8   importance were selected to form the minimum data set. These were all items that

9   were expected to be included in the midwifery records.

10   Data were collected from the midwifery generated birth records that included age,

11   primipara or multipara, abnormalities during pregnancy, time and date of delivery,

12   number of weeks, birth weight, Apgar score, birth position, duration of delivery,

13   rupture of membrane time, blood loss volume for the third stage of delivery, at the

14   end of first and second hour, perineal laceration, and abnormalities during birth. Data

15   were hand-copied onto pre-coded data sheets and then aggregated for analysis

16   based on the three study goals, which included: comparison of midwifery care,

17   demographics and post partum blood loss.

18   Data collection included protecting the patient name, address, date of birth and

19   midwifery center name. The researcher carried the handwritten data input sheets

20   back to the research organization, where they selected and entered the necessary

21   items into the master data input sheet.

1   Qualitative data included midwifery care notes, indicating the sequence of care,

2   were extracted from the midwife's records. Midwifery interviews were based on open-

3   ended questions regarding their delivery methods. The midwives enacted the

4   delivery sequence using a birthing simulator doll. The researcher used field notes to

5   document the sequence.

6

7   Data analysis method

8   From the data input sheets, a database was created. Statistical software SPSS

9   ver. 20.0 for windows was used for descriptive statistics, t tests to compare

10   postpartum blood loss volumes and various birth factors and chi-square to compare

11   blood loss volume and selected midwifery care practices as categorical variables.

12   Qualitative data from midwifery interviews and notes were analyzed using thematic

13   content analysis. Verbatim accounts were coded, and then similar codes were

14   categorized in relationship to expectant midwifery care themes. Two expert midwives

15   verified the ensuing codes and categories.

16

17   Ethical considerations

18   Research permission was obtained from the Ethics Research Committee of St.

19   Luke's International University (Approved No. 07-033) in 2007 and

20   dissemination permission was obtained from the Research Ethics

1   Committee of Nagasaki University Graduate School of Biomedical Sciences

2   (Approved No. 15121168) in 2015. The researchers kept the midwives' and clients'

3   information confidential and anonymous.

Results

5   Characteristics of births and midwifery care at midwifery centres

6   The 4,051 women who birthed at the nine participating midwifery centres had the

7   following characteristics: average age 31.7 ± 4.23, parity 1.08 ± 0.93 ($M = 1$, range 0

8   – 8) and gestational period 39.9 ± 1.07 weeks. Time for labour, from stage I to stage

9   III, was 8.7 ± 7.5 hours, and labour stage III was 11.64 ± 9.29 minutes. Delivery was

10   completed by 58.9% of women without perineal laceration and 36.9% had first-

11   degree lacerations. Hgb value was 11.24 ± 1.17 mg/dL (collected between 28 – 30

12   weeks antepartum). Mean infant birth weight was 3,138.8 gm (Table 1).

13   Among the numerous midwifery care practices categorized from the midwifery

14   records and interviews, the following six practices were common at all nine midwifery

15   centres: (1) oxytocin was not used as a precaution; (2) skin to skin contact was

16   started immediately after delivery with no time limitations; (3) umbilical cord clamping

17   and cutting were not performed immediately after birth; (4) natural separation of the

18   placenta was allowed (umbilical pulling to promote placental separation was not

19   performed), (5) umbilical cord pulsation cessation was confirmed and (6) after

20   placental separation the umbilical cord was gently pulled to promote placental

21   expulsion.

1   Content analysis revealed that in addition to the above listed commonalities, two

2   different patterns of care were also present among the midwifery centers. There were

3   four midwifery centres (group one) that waited until the expulsion of the placenta to

4   clamp and cut the cord. This involved the following sequence: (a) observation of

5   placental separation signs; (b) induction of placental delivery and (c) clamping and

6   cutting the umbilical cord. There were five midwifery centres (group two) that

7   clamped and cut the cord before expulsion of the placenta. This sequence involved:

8   (a) clamping and cutting the umbilical cord; (b) checking for placental separation

9   signs and (c) gently supporting the placenta delivery.

10   Blood loss pattern during the first two hours after delivery

11   The total two-hour estimated blood loss volume after delivery was 395.4 ± 284.6

12   gm (range 10 – 3570 gm). As Table 1 shows: the immediate postpartum blood loss

13   volume of 283.9 ± 234.3 gm comprised the largest volume and the majority of the

14   total blood loss volume. The first-hour blood loss volume was 102.9 ± 96.0 gm,

15   followed by a decreased second-hour blood loss volume of 61.3 ± 79.8 gm.

16   Postpartum blood loss volume of 500-800 gm occurred with 524 (12.9%), and 800-

17   1,000 gm with 147 (3.6%) of women. There were 158 (3.9%) women with blood loss

18   exceeding 1000 gm (Table 2).

19   Table 3 shows the comparison of five birth factors for each volume of blood loss. An

20   examination of the five factors of age, gestational period, duration of stages 1-3,

21   duration of stage 3 and infant weight across blood loss volumes of plus-minus 500

1   gm, 800 gm, and 1000 gm indicates that a longer gestational period, longer stages of

2   one through three and stage three and heavier infants were correlated with

3   significantly higher levels of blood loss. Women with blood loss at or over 1000 gm

4   had the longest gestational period, duration of stages one through stage three as well

5   as the heaviest infants. However, the mean age of women in this group was

6   comparable to the rest of the sample at 31.0.   The women losing less than 1000 gm

7   had a significantly higher mean age of 31.8 (t = 2.23, p = .026).

8

9   Subgroup analysis of the third stage of labour management factors effecting blood

10   loss

11   Table 4 shows the blood loss volume trend over the two-hour period for

12   primiparous and multiparous mothers. For primiparas compared to multiparas the

13   immediate blood loss volume was significantly higher (t = 6.90, p < .001). However,

14   the situation was reversed for the one-hour volume, which was significantly higher for

15   multiparas (t = -5.14, p < .001). The second-hour volume was about the same for

16   primiparas (60.3 gm), and for multiparas (61.6 gm). The total two-hour blood loss

17   volume after delivery for primiparas was again significantly higher (t = 3.81, p < .001)

18   when compared to multiparas' blood loss.

19   Difference in blood loss volume related to midwifery care.

20   A small minority (13%) of women received preventive uterine massage to manage

21   blood loss. Chi square analysis revealed that those women had statistically

1   significant less blood loss immediately after birth as well as at the first and second

2   hour compared to those who did not receive massage. See Table 5.

3   No significant difference was found in the two-hour total blood loss and blood

4   loss immediately after delivery between group one with midwives who waited until the

5   expulsion of the placenta to clamp and cut the cord and group two - those who did

6   not wait. However within the two-hour period a different picture emerged. Women

7   from group one, with umbilical cord clamped and cut after expulsion of the placenta

8   showed a statistically significant reduction in the blood loss volume for the second

9   hour and for the total two-hour blood loss volume after delivery compared to women

10   from group two, with clamped and cut cord prior to placental separation, respectively,

11   $t = 2.40$ ($p = .016$) and $t = 2.61$ ($p = .009$) (see Table 4). In addition Chi square

12   analysis indicated that clamping and cutting the cord after expulsion of the placenta

13   was associated with a statistically significant reduction in blood loss volume across

14   all amounts of blood loss (see Table 5).

15

16   **Discussion**

17

18   Characteristics of births at midwifery centres

19   The 4,051 women who birthed at the nine participating midwifery centres had

20   comparable characteristics found in Kataoka's study[14] of home-births and birth center

21   records during 2001-2006 where expectant management was also practiced. Mean

1   infant birth weight was within normal limits. Hgb values exceeded the values set for

2   gestational anaemia[19] and would be expected in this low-risk population. In Kataoka's

3   study[14] the average estimated two-hour blood loss for the majority of multiparous was

4   371.3 gm, and in this study it was 395.4 gm. The blood loss over 500 gm in

5   Kataoka's study was 22.6% compared to this study of 16.5%. While the blood loss

6   over 1000 gm for Kataoka's study was 3.6% and for this study it was 3.9%.

7   Unfortunately the upper limits of blood loss were not identified in either study

8   however Cameron and Robson[20] suggested that most healthy low risk women can

9   sustain a blood loss of up to 1500 ml without decompensating. Perineal lacerations

10   are considered a risk factor for PPH during the third stage.[21] Several estimates

11   indicated that 75-80% of all women giving birth vaginally experience perineal

12   lacerations. [22, 23] However in this study only 36.9% had first-degree lacerations and

13   there were no perineal lacerations for the majority of women (58.9%). These

14   outcomes were very similar to Kataoka's [14] study where 58.3% had intact perinea

15   and most of the other lacerations were first or second-degree. This suggests that the

16   way in which midwives conducted delivery reduced perineal lacerations thus

17   reducing a risk factor for PPH.

18   Midwifery Care Practice in Midwifery Centres

19   The first research question driving this study was to describe the midwifery care

20   factors during the third stage of labour. All nine midwifery centres had in common the

21   implementation of midwifery care based on some but not all of the principles of

1   expectant management because the order of care exhibited two distinct patterns

2   based on the timing of clamping and cutting the cord. Five of the nine centres

3   clamped and cut the cord prior to the expulsion of the placenta. This is more similar

4   to active management.[24] The impact of timing is on the neonate. Neonates blood

5   volume and iron status increases with delayed cord clamping. This benefit may last

6   for up to six months.[13] This may be more relevant particularly for low income

7   countries or for women with poor nutrition. However for infants from developed

8   countries the main concerns were susceptibility to jaundice requiring phototherapy

9   with delayed cord clamping or the development of polycythemia. [25] This may explain

10   the tendency toward early cord clamping even though systematic reviews have found

11   more benefits to delayed cord clamping than risks. [26]

12   However, regardless of the timing of cord clamping and cutting there was no

13   negative effect for the mother on the blood loss volume. The total blood loss and loss

14   immediately after birth, at one hour and during the second hour for the majority of

15   mothers was within the normal range for physiological postpartum blood loss volume

16   for vaginal birth as defined by the Japan Society of Obstetrics and Gynecology[7] for

17   the majority of the women. The differences between groups were significant only

18   within the critical two-hour period. Midwives could give some consideration to cord

19   clamping timing as a factor that might 'tip the scales' during the physiological

20   transition time for either the mother or the infant. [27]

1   In this study the Japanese independent midwives, who by law may not use

2   preventive uterotonics, were effectively using uterine massage as recommended by

3   WHO.[1] Midwives provided a minority of women with preventive uterine massage after

4   placental delivery; yet those who received massage had significantly less blood loss

5   than those who did not and the results were significant in reducing blood loss

6   particularly at birth. With the widespread use of uterotonics most of the research

7   investigating uterine massage has been conducted on women who were also

8   receiving uterotonics. Researchers conducting a Cochrane review found two studies

9   meeting their criteria for examining uterotonics and uterotonics plus preventive

10   uterine massage.[28] In both studies blood loss was statistically less when women

11   received uterine massage. When blood loss exceeded 500 gm and when the woman

12   had received uterotonics the review suggested receiving an oxytocic limited the

13   scope for further reduction in postpartum blood loss. When the sample sizes for

14   blood loss exceeding 500 gm were examined they found inconclusive evidence for

15   encouraging a change of practice regarding uterine massage as studies with larger

16   numbers are needed. Furthermore, the timing of uterine massaged varied

17   confounding their results. Additional research is needed to explore using preventive

18   uterine massage in settings using expectant childbirth approaches and without

19   routine uterotonics. [29]

20   Factors associated with the blood loss volume

1   The present findings suggesting that blood loss tended to increase with

2   increasing infant birth weight and longer duration of delivery were also supported by

3   the findings of Sosa et al.[21] and Magann et al.[30] If the stage III delivery reaches 30

4   minutes or more, the risk of PPH increases six-fold. Blair [31,] Bruckner [32] Bais et al.[33]

5   found that in cases where stage three delivery took 30 minutes or more, the rate of

6   PPH occurrence rose by 11.9 times, and stage three delivery of 30 minutes or more

7   was the highest risk factor for hemorrhage. Therefore for midwives using expectant

8   management the appropriate management of stage three delivery and the two hours

9   after delivery is critical. By shortening stage three delivery, for example with uterine

10   massage, the blood loss during this stage, which comprises a large proportion of the

11   postpartum blood loss volume, could be reduced. As shown in this study blood loss

12   volume immediately after delivery was reduced in the shorter stage three deliveries.

13   Morikawa et al.[34] conjectured that the postpartum blood loss volume was

14   greater for primiparas immediately after birth than for multiparas, because for

15   primiparous, the uterine muscles initially contract strongly after expulsion of the

16   placenta, and then after a short while contract in an atonic manner; on the other

17   hand, for a multipara, the contractions and atonicity repeat like labour pains, so the

18   blood loss volume from the placenta attachment site differs. This most likely explains

19   why the total blood loss volume up to two hours and the blood loss volume

20   immediately after birth were significantly higher for primiparas than for multiparas, but

1   conversely for one hour after birth, blood loss volume was significantly greater for

2   multiparas than for primiparas.

3   There were several limitations with this study. The sample of nine birth centres

4   was small. Given that practices can vary geographically, data needs to be collected

5   from a broader and more representative sample including data on the small

6   percentage of women whose blood loss exceeded 1000 gms. The clinics reported

7   various methods to obtain blood loss estimates; a closer inspection of the procedure

8   is required. In order to increase the validity of the blood loss volume data, the authors

9   recommend that alterations of the clinical procedures so that the blood loss volume

10   can be more accurately measured, and a greater amount of accurate data can be

11   preserved. For precise measurement of blood loss volume, disposable delivery

12   sheets need to be used and replaced directly after the infant is delivered so that

13   mixing of the blood and amniotic fluid can be kept to a minimum, and it is also

14   necessary to standardize the measurement method of the blood loss volume.

15   Additionally even though skin-to-skin contact was the standard practice, specific

16   information about nipple stimulation, birthing positions and preventive uterine

17   massage was lacking. Yet, even with these limitations it was possible to discern

18   some clinically useful patterns of expectant management of labour associated with

19   blood loss. Furthermore this is the first study that provides data on the blood loss

20   outcomes for uterine massage without uterotonics. Future research should include

1 additional details about third-stage midwifery practice particularly about the timing of

2 uterine massage and nipple stimulation.

3

4 **Conclusions**

5   This descriptive study identified midwifery practices for third stage management

6 of labour and made comparisons among management practices and blood loss. The

7 nine midwifery centres in Tokyo provided expectant management from birth to after

8 expulsion of the placenta. Several patterns of care were identified. Late cord

9 clamping and skin-to-skin contact were key practices in both. Both clamping and

10 cutting the cord and uterine massage after placenta delivery were more effective in

11 decreasing blood loss. Preventative uterine massage after expulsion of the placenta

12 was a contributing midwifery practice to decreasing the blood loss volume

13 immediately after birth. As would be expected blood loss volume tended to increase

14 as infant birth weight and duration of third stage of delivery increased. Of note was

15 that the total blood loss volume was significantly higher for primiparas than for

16 multiparas for up to two hours after delivery and for immediately after delivery, it was

17 significantly higher one hour after delivery for multiparas compared to primiparas

18 presumably because of the different mechanism for uterine contractions and atonicity

19 between primiparas and multiparas.

20

21 Acknowledgement

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3

Table 1   Characteristics of births from nine Tokyo midwifery centers

		N(%)	Mean ± SD
Age (year)		4,033	31.7 ± 4.23
Parity		4,051	1.1 ±0.93
Primiparous		1,157(28.6)	
Multiparous		2,893(71.4)	
Gestational period (weeks)		4,040	39.9 ± 1.07
Time required for childbirth *recorded by minutes for stage I –stage III only	-Stage I –Stage III (hours)	4,005	8.7 ± 7.5
	-Rupture of the membranes to deliver of the infant (minutes)	4,051	188.0 ± 570.7
	-Stage III (minutes)	3,377	11.64 ± 9.29
Blood loss by time (gm)	-Total blood loss (up to 2 hours postpartum)	3,357	395.4 ± 284.6
	-Blood loss at birth	3,333	283.9 ± 234.27
	-Blood loss 1-hour after birth	2,379	102.85 ± 96.04
	-Blood loss 2-hour after birth	2,292	61.27 ± 79.78
Perineal laceration (%)	None	2,388 (58.9)	
	> 1 degree	1,496 (36.9)	
	NA	167 (4.1)	
Infant	Male	1,962 (48.4)	
	Female	2,078 (51.3)	
	Birth weight (gm)	4,047	3,138.8 ± 362.7
	Length (cm)	4,042	50.1± 1.6
	Head circumference (cm)	4,042	33.4 ± 1.3
	Chest circumference (cm)	4,042	32.5 ± 1.46

Table 2　Blood loss during delivery

	n(%)
< 500 (gm)	2,524　(63.3%)
500 - 800 (gm)	524　(12.9%)
800 - 1,000 (gm)	147　(3.6%)
≥ 1,000 (gm)	158　(3.9%)
NA	698　(17.2%)

Table 3   Relationship of birth factors with three levels of blood loss

Birth Factors	< 500 (n=2,524)		≥ 500 (n=829)			
	mean	SD	mean	SD	t	P value
Age (year)	31.8	4.2	31.4	4.3	2.18	0.029
Gestational period (weeks)	39.7	1.06	40.0	1.05	-6.38	<0.001
Duration of Stage I – III (hour)	8.4	7.1	9.6	8.7	-3.69	<0.001
Duration of Stage III (minutes)	11.0	6.8	13.2	12.6	-4.42	<0.001
Infant Weight (g)	3,105.4	351.9	3,241.2	380.9	-9.07	<0.001
	< 800 (n=3,048)		≥ 800 (n=305)			
	mean	SD	mean	SD	t	P value
Age (year)	31.8	4.2	31.1	4.4	2.81	0.005
Gestational period (weeks)	39.8	1.06	40.1	1.00	-4.63	<0.001
Duration of Stage I – III (hour)	8.5	7.2	10.6	10.2	-3.44	0.001
Duration of Stage III (minutes)	11.3	7.6	13.9	15.2	-2.79	0.006
Infant Weight (g)	3,123.5	358.7	3,294.0	380.1	-7.87	<0.001
	< 1,000		≥ 1,000 (n=158)			
	mean	SD	mean	SD	t	P value
Age (year)	31.8	4.2	31.0	4.2	2.23	0.026
Gestational period (weeks)	39.8	1.07	40.3	0.94	-6.45	<0.001
Duration of Stage I – III (hour)	8.6	7.3	11.1	11.5	-2.71	0.007
Duration of Stage III (minutes)	11.3	7.9	14.8	17.5	-2.31	0.023
Infant Weight (g)	3,129.3	359.5	3.335.1	397.6	-6.99	<0.001

Table 4 Difference of blood loss by parity and uterine massage

	Primiparous (n=944)		Multiparous (n=2,409)			
	mean	SD	mean	SD	t	P value
Blood loss at birth	329.7	244.7	265.9	227.6	6.90	<0.001
Blood loss 1-hour after birth	87.0	88.5	108.7	98.0	-5.14	<0.001
Blood loss 2-hour after birth	60.3	90.2	61.6	75.5	-0.36	0.718
Blood loss Total	425.9	285.7	384.4	283.0	3.81	<0.001
	No-uterine massage (n=2,913)		Preventive uterine massage (n=440)			
	mean	SD	mean	SD	t	P value
Blood loss at birth	302.1	242.6	165.4	113.5	19.45	<0.001
Blood loss 1-hour after birth	105.0	99.1	93.0	80.0	2.35	0.019
Blood loss 2-hour after birth	63.8	84.6	50.8	54.1	4.01	<0.001
Blood loss Total	409.5	295.1	307.3	174.7	10.25	<0.001
	Cutting cord before placenta (n=1,894)		Cutting cord after placenta (n=1,459)			
	mean	SD	mean	SD	t	P value
Blood loss at birth	289.2	235.3	277.2	232.9	0.77	0.443
Blood loss 1-hour after birth	107.1	102.4	97.8	87.7	1.47	0.142
Blood loss 2-hour after birth	65.4	88.6	56.8	68.9	2.40	0.016
Blood loss Total	399.3	293.5	391.8	272.0	2.61	0.009

Table 5 Difference of blood loss by parity and uterine massage and timing of cutting cord

		Amount of blood loss by parity		Chi-square	P value
		Primiparous (n=994)	Multiparous (n=2,409)		
Blood loss <500	n=2,524	680 (20.3)	1,844 (55.0)	7.42	.006
Blood loss ≥500	n=829	264 (7.9)	565 (16.9)		
Blood loss <800	n=3,048	848 (25.3)	2,200 (65.6)	1.83	.176
Blood loss ≥800	n=305	96 (2.9)	209 (6.2)		
Blood loss <1000	n=3,195	896 (26.7)	2,299 (68.6)	0.41	.524
Blood loss ≥1000	n=158	48 (1.4)	110 (3.3)		

		Blood loss by uterine massage		Chi-square	P value
		No-uterine massage (n=2,913)	Preventive uterine (n=440)		
Blood loss <500	n=2,524	2,137 (63.7)	387 (11.5)	43.74	<.001
Blood loss ≥500	n=829	776 (23.1)	53 (1.6)		
Blood loss <800	n=3,048	2,616 (78.0)	432 (12.9)	32.44	<.001
Blood loss ≥800	n=305	297 (8.9)	8 (0.2)		
Blood loss <1000	n=3,195	2,757 (82.2)	438 (13.1)	20.45	<.001
Blood loss ≥1000	n=158	156 (4.7)	440 (13.1)		

		Blood loss before and after cutting cord		Chi-square	P value
		Before placenta (n=1,894)	After placenta (n=1,459)		
Blood loss <500	n=2,524	1,379 (41.1)	1,145 (34.1)	14.23	<.001
Blood loss ≥500	n=829	515 (15.4)	314 (9.4)		
Blood loss <800	n=3,048	1,711 (51.0)	1,337 (39.9)	1.69	.194
Blood loss ≥800	n=305	183 (5.5)	122 (3.6)		
Blood loss <1000	n=3,195	1,802 (53.7)	1,393 (41.5)	0.21	.651
Blood loss ≥1000	n=158	92 (2.7)	66 (2.0)		