MIDWIVES' KNOWLEDGE OF OXYTOCIN USE DURING SPONTANEOUS LABOR: A QUASI-EXPERIMENTAL STUDY IN FIVE BASIC MATERNITY UNITS IN KINDU, DEMOCRATIC REPUBLIC OF CONGO

Bakangana Mungu Alain*[1], Rosebella Onyango O[2], Malin Bogren[3], Kitingi Katumba[4]

**Corresponding Author: -*

Abstract

The purpose of this study was to assess midwives' knowledge of oxytocin use during spontaneous labor. It was a quasi-experimental study conducted with a comprehensive sample of 14 midwives from five basic maternity hospitals in Kindu, divided into two groups: an intervention group and a control group. To assess the level of knowledge, we developed a two-part knowledge test (the first part was composed of socio-demographic characteristics and the second part consisted of 10 questions on knowledge). We referred to the threshold of Debesse and Milalaret (1968) below:

- Less than 60% = low level of knowledge;
- From 60 to 79,99% = average level of knowledge and;
- 80% and more = high level of knowledge

The data were processed and analyzed using STATA 14 software. The data grouped into classes were scored on a maximum of 20 points and analyzed using the central tendency and dispersion indices. After analysis, it was found that the performance of midwives in the Kindu base maternity units on a knowledge test on the use of oxytocin during spontaneous labor was inadequate before the training (43%), well below the 60% threshold for average performance. In other words, the training improved midwives' knowledge of oxytocin use during spontaneous labor by increasing performance from 43% to 79.28%.

1. Introduction

The administration of oxytocin during spontaneous labor is a frequent practice in obstetrics worldwide, in the Democratic Republic of Congo and in particular in the basic maternity units of the city of Kindu.

Acceleration of labor usually involves the use of intravenous oxytocin infusion or artificial rupture of the amniotic membranes. While it can be beneficial in preventing prolonged labor, its inappropriate use can be harmful (WHO, 2015). The World Health Organization castigates the behavior of practitioners who, over the past 20 years, have multiplied unnecessary and even dangerous interventions during childbirth. It points the finger in particular at the use of oxytocin to accelerate labor or the use of episiotomy sometimes still systematic (WHO, 2018). More than 60% of women in the world receive oxytocin to accelerate labor and thus reduce its duration (Cécile Thibert, 2016). In France, for example, 64% of women received oxytocin during labor and artificial rupture of membranes in 51% of women in spontaneous labor. (Belghiti *et al*, 2010). The rates of oxytocin use during labor in Brazil was 59.5% (Vogt *et al*, 2011). 92, 7% of women in Chile had undergone obstetrical interventions of artificial rupture of membranes, oxytocin and epidural analgesia (Binfa *et al,* 2016). High frequencies of oxytocin use during effacement, dilation, and expulsion were also observed in Africa. In three urban areas in Africa, oxytocin was used in more than 20% of deliveries (Pierre Buekens, 2011).

The administration of oxytocin is not without danger, this product presents many maternal and fetal adverse effects: hyperkinesia of frequencies and intensities, uterine hypertonia, fetal suffering. However, the major complication remains maternal namely uterine rupture (Rousseau and Burguet, 2016). The use of oxytocin during labor was associated with an increased risk of postpartum hemorrhage with a dose-dependent effect, a risk of uterine hyper stimulation, exposing the mother and fetus to a risk of hypoxia and cesarean section during labor, and exposes the mother and fetus to adverse effects that can have short and possibly long-term consequences. (Belghiti *et al*, 2013, Satin et al, 2012 and Dupont *et al*, 2017).

In spite of all the evidence mentioned above, the use of oxytocin remains excessive, even commonplace in the basic maternity units of the city of Kindu in order to shorten the duration of labor, even for parturients in spontaneous labor. This abusive and non-consensual use of oxytocin is becoming dangerous and can cause harmful effects on the health of the woman and her birth experience. This constitutes, in our humble opinion, a serious reproductive and perinatal health problem that requires adequate solutions.

Throughout the health system in the Democratic Republic of Congo, studies on the use of oxytocin during spontaneous labor are almost nonexistent, and the medical literature has focused much more on the risks and complications of childbirth and the prevention of pregnancy-related deaths.

In the absence of reliable data in the country in general and in Maniema Province in particular on the use of oxytocin in the delivery room, a study was conducted in the maternity wards of the city of Kindu to determine the share of oxytocin use to accelerate labor among the interventions performed at delivery. This study showed that 35.72% of women received oxytocin during their labor. This study suggested strategies that could reduce the extent of these dangerous interventions during labor and delivery, including further training of midwives on the judicious use of oxytocin, popularization of the World Health Organization's recommendations on intrapartum care for a positive birth experience, and sensitization of all health care providers on adherence to evidence-based medicine (Bakangana *et al*, 2021).

2. Objective

To assess midwives' knowledge of oxytocin use during spontaneous labor in basic maternity units in the city of Kindu

3. Methodology

We conducted a quasi-experimental study consisting of two groups: an experimental group composed of midwives involved in the training of five maternity hospitals targeted by the study: Kasuku II, Lumbulumbu, Basoko, Mikelenge and Kama II maternity hospitals. We conducted a pre-test before the training to see the level of knowledge of the midwives in the two groups and a post-test after the training to determine the effect of the training on the intervention group.

This can be summarized in the table below:

Table 3.1 Quasi-experimental study of midwives' knowledge of the judicious use of oxytocin

Group	Observation before	Treatment	Observation after
Experimental	Pré-test	Training on the use of oxytocin	Post-test
Control	Pré-test	No training	Post-test

Legend:

- Experimental group: midwives involved in the training
- Control group: Midwives not involved in the training
- Pre-test: First assessment of knowledge in both groups before the training
- Treatment: Training organized for the experimental group
- Post-test: Second assessment of knowledge after the training of the experimental group

To assess the level of knowledge we developed a knowledge test consisting of two parts (the first part composed of socio-demographic characteristics and the second part composed of 10 questions on knowledge); to evaluate the level of knowledge of the midwives we referred to the educational threshold of Debesse and Mialaret (1968)

- Less than 60% = low level of knowledge;
- From 60 to 79.99% = average level of knowledge and;
- 80% and more = high level of knowledge.

The variables age, gender, level of education and length of service were retained. The data collected were encoded on Excel sheets and exported to the STATA 14 software. To describe the quantitative variables related to knowledge, the data grouped into classes were scored on a maximum of 20 points and analyzed using the central tendency and dispersion indices. This allowed us to calculate the standard deviation, the coefficient of variation, the arithmetic mean and the yield. The following formulas were used:

The arithmetic mean (for data grouped into classes)

$$\overline{X} = \frac{\Sigma\, ni\, xi}{n}$$

Standard deviation found by first calculating the variance

$$SD^2 = \frac{\Sigma(xi-x)^2}{n} \quad ou \quad \frac{\Sigma\, ni\, xi^2}{n}$$

Standard deviation = $\sqrt{SD^2} = \sqrt{\Sigma x^2/n}$

Coefficient of variation: $CV = \frac{SD}{\overline{X}}$

We determined the level of knowledge of our respondents in terms of performance by the following formula:

$$Performance : Rdt\ in\ \% = \frac{\overline{X}}{Max} \text{ x } 100$$

Finally, we used the Student's t-test to compare the means

$$t = \frac{|\ \overline{X}_1 - \overline{X}_2\ |}{\sqrt{\frac{S1^2}{n1} + \frac{S2^2}{n2}}}$$

Legend

t = Observed student's t

$\overline{X}_1$ = Mean of first test before training

$\overline{X}_2$ = Mean of second test after training

$s1^2$ = Square of difference between midwives' scores on the first training test

$s2^2$ = Square of difference between midwives' scores on the second test

n1 = Sample size in the first training event

n2 = Sample size at the second round of training

4. Results

Table 4. 1: Individual characteristics of midwives

Individual characteristics	f	%
Age		
20 - 34 years old	3	21,43
35 years and over	11	78,57
Total	**14**	**100**
Gender		
Male	2	14,29
Female	12	85,71
Total	**14**	**100**
Level of study		
Graduate	1	7,14
Licence	13	92,86
Total	**14**	**100**
Seniority		
Less than 5 years	1	7,14
5 to 10 years	4	28,57
More than 10 years	9	64,29
Total	**14**	**100**

The most represented age group was 35 years and above (78.57%) and their average age was 41.6±8.1 years with extremes of 32 and 51 years. The vast majority of midwives were female (85.71%) and had a bachelor's degree (92.86%) with more than 10 years of service (64.29%).

To describe the level of knowledge of midwives on the use of oxytocin before and after the training, we first calculated the mean, standard deviation, coefficient of variation, variance and finally the yield according to the above formulas.

The table below clearly illustrates the level of knowledge of the midwives surveyed on the use of oxytocin before and after their training in this area.

Table 4.2: Midwives' overall level of knowledge about oxytocin use before and after training (Pre- and Post-test)

Statistics / Tests	n	Max	$\overline{X}$	SD	S²	P	Rdt	D	CV
Before training	14	20	8,57	3,37	11,35	14	43	3	.39
After training	14	20	15,85	2	4	18	79,28	11	.13

t obs = 6,80 > t tab (α=.05, dl = 26) = 2, 056

Legend:
n = Number of subjects (midwives)
Max = Maximum points
$\overline{X}$ = Arithmetic mean
SD = Standard Deviation
S² = Variance
P = Highest score
Rdt = Yield (%)
D = Lowest score
CV = Coefficient of variation

The above results show that the average score ($\overline{X}$) obtained by midwives before training was 8.57 out of 20 points and 15.85 out of 20 points after training.
It should be noted that the standard deviation (SD) is a dispersion value that indicates the difference in mean between one individual and another in the same group in a distribution. The above results also show that there are 3.37 units between one midwife and another in the same group, i.e. before training and 2 units between one midwife and another in the same group after training.
Based on our calculations for the two groups of midwives, pre-training and post-training, their coefficients of variation are .39 and .13 respectively.
In other words, the coefficients of variation before training are .39 or 39%, higher than .15 or 15% (39% > 15%), the dispersion of the data relating to the acquisition of knowledge on the use of oxytocin by midwives in the maternity hospitals of Kindu is more pronounced: this group is heterogeneous, i.e. in this group (midwives before training) the individual results of the test are very dispersed around the mean, as shown by the standard deviation of this group (3.37).
On the other hand, the coefficient of variation for midwives after training is .13, i.e. 13% below 15% (the threshold used to calculate the CV), specifically 13% < 15%. This means that the dispersion of the data on the acquisition of knowledge on the use of oxytocin by midwives in the maternity hospitals of Kindu is low or less pronounced. This group is homogeneous, i.e. in this group the individual results are not widely dispersed around the mean, as shown by the standard deviation of this group (2) which is lower than that of the pre-training group (3.37).

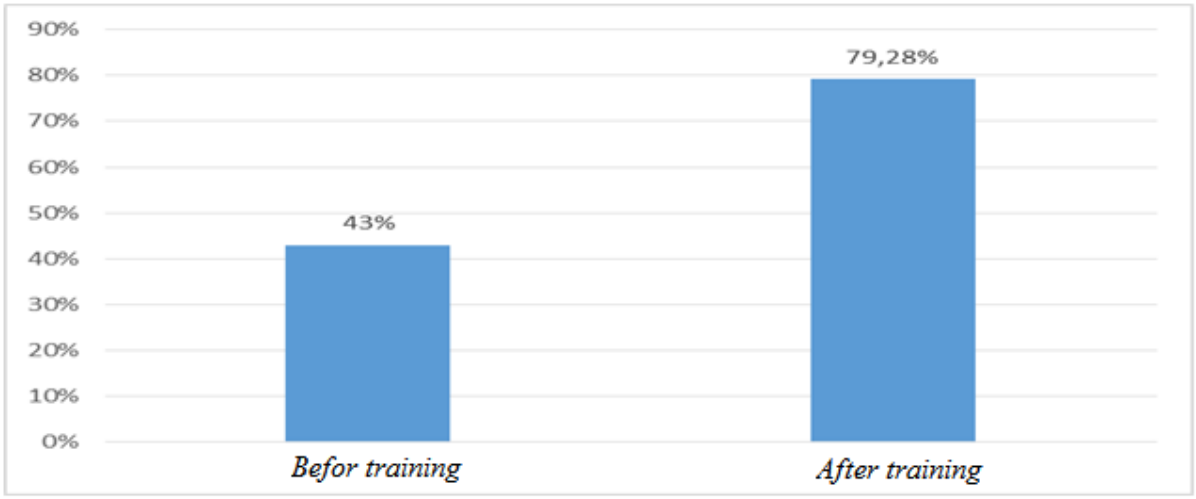

Figure 4.1: Midwives' overall level of knowledge of oxytocin use before (pre-test) and after (post-test) training.

In order to assess the level of knowledge achieved by the midwives we referred to Debesse and Mialaret's (1968) pedagogical threshold which indicates either that the midwives have mastered the subject (80%) or that they have an average performance (60%).
We calculated the midwives' performance before and after the oxytocin training in order to situate them in relation to these pedagogical thresholds.
The results above show yields of 43% and 79.28% for pre- and post-training midwives respectively. We see that the level of knowledge of pre-training midwives is below the 80% threshold for mastery and even below the 60% threshold for average performance.
As for the performance of the "post-training" midwives, it is 79.28%, which means that, if we take into account our 80% pass threshold, the performance of these midwives on oxytocin use is higher than that obtained by the pre-training

midwives. Of course, a performance of 79.28% is almost lower than 80% despite the fact that it is within the range of the average performance threshold (60% to 79.99%).

Statistically, these results show a significant difference, which means that the training significantly influenced the midwives' knowledge of oxytocin use during spontaneous labour. In other words, there is a relationship between midwives' training and their knowledge of oxytocin use during spontaneous labour.

Table 4.3: Overall level of knowledge by age of midwives on the use of oxytocin

Age group	n	Max	D	P	$\overline{X}$	SD	CV	Rdt
20 - 34 years	3	20	11	18	14	2,4	.17	70
35 years and over	11	20	11	18	15,6	2,3	.14	78

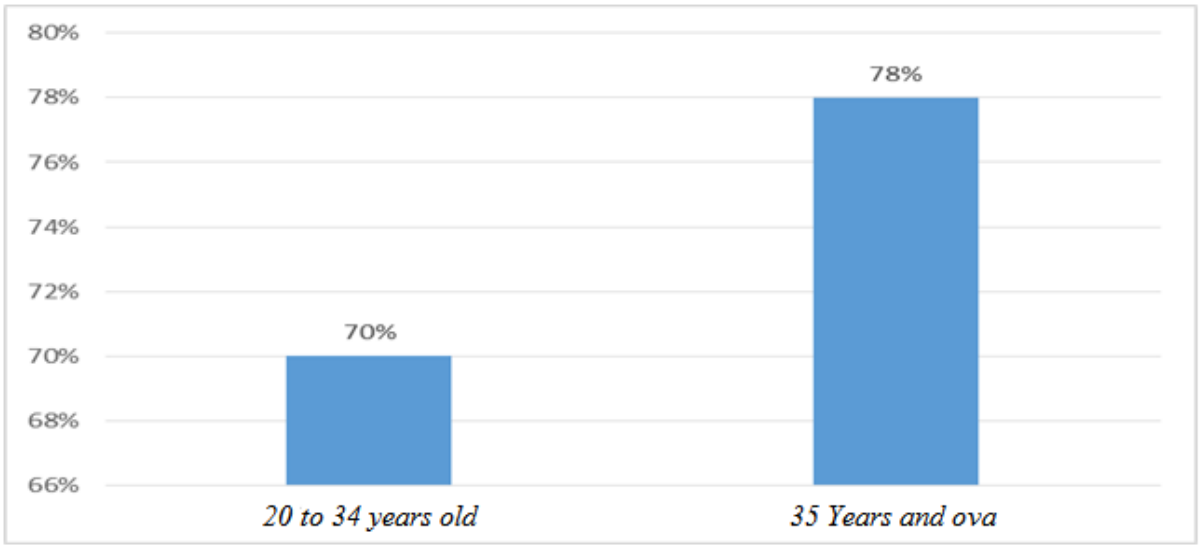

Figure 4.2: Overall level of knowledge by age of midwives about oxytocin use

This table indicates that overall the level of knowledge of midwives is sufficient in both age groups after training, although relatively higher among midwives aged 35 years and above.

It further indicates that the respective returns of 70% and 78% increase with the age of the respondents.

Since the coefficient of variation for midwives aged 20-34 years is .17 or 17% higher than 15% (CV threshold), we say that the dispersion of the data on midwives' knowledge of oxytocin use is pronounced; this group is homogeneous, i.e. in this group the individual results are not widely dispersed around the mean, as shown by the standard deviation of this group (2.4 units). As for the midwives whose age is 35 years and older, their coefficient of variation is .14 or 14% < 15%; we say that the dispersion of the data related to the acquisition of knowledge on the use of oxytocin by midwives is low or less pronounced, this group (35 years and older) is also homogeneous, i.e. in this group the individual results are not very dispersed around the mean, as shown by the standard deviation (2.3 units).

Table 4.4 Overall level of knowledge by gender of midwives

Gender	N	Max	D	P	$\overline{X}$	SD	CV	Rdt
Male	2	20	15	16	15,5	1,5	.10	78
Female	12	20	12	18	15,8	2.3	.15	79

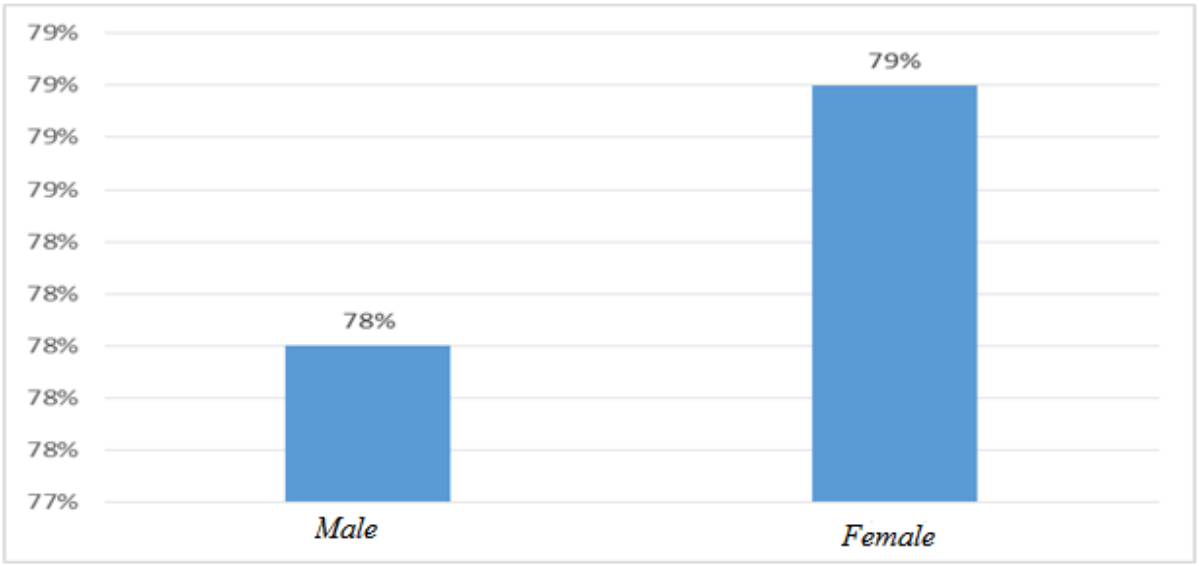

Figure 4.3: Overall level of knowledge by gender of midwives

This table indicates that the overall level of knowledge is sufficient in both gender after training, although relatively higher among female midwives.
It also indicates that the respective returns of 78% and 79% increase with the gender of the respondents.
After our calculations, we observe a coefficient of variation of .10 or 10% for male midwives that is less than 15% (the reference threshold for CV), we say that the dispersion of data related to the acquisition of knowledge on oxytocin use by midwives is low or less pronounced. This group is homogeneous, i.e. the individual results are not very pronounced around the mean (15.5), as shown by the standard deviation of this group (1.5 units). As for the female midwives, the coefficient of variation is .145 or 14.5% is less than 15%; we can say that the dispersion of the data regarding the acquisition of knowledge on the use of oxytocin by female midwives is low or less pronounced.
This group is also homogeneous, i.e. in this group the individual results are not very scattered around the mean (15.8), as shown by the standard deviation (2.3 units).

Table 4.5: Overall level of knowledge of midwives by level of education

Level of education	n	Max	D	P	$\overline{X}$	SD	CV	Rdt
Graduate	1	20	12	12	14	2	.14	70
Licence	13	20	12	18	15,8	2,2	.14	79

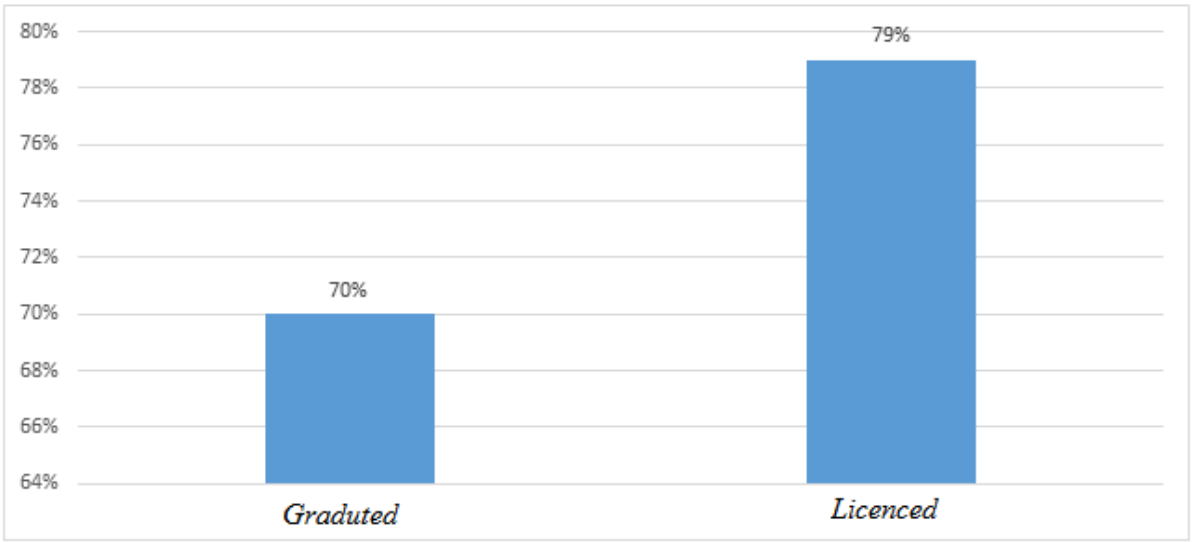

Figure 4.4: Overall level of knowledge of midwives by level of education

This table indicates that the overall level of knowledge is sufficient in both educational groups after training, although relatively higher for bachelor midwives.
It further indicates that the respective returns of 70% and 79% increase with the level of education of the midwives.
After our calculations, we observe a coefficient of variation of .14 or 14% for the graduate midwives which is less than 15% (the reference threshold of the CV), we say that the dispersion of the data related to the acquisition of knowledge on the use of oxytocin by the graduate midwives is low or less pronounced. This group is homogeneous, i.e. the individual results are not very pronounced around the mean (14), as shown by the standard deviation of this group (2 units). As for the licensed midwives, the coefficient of variation is .14 or 14% is less than 15%; we can say that the dispersion of the

data related to the acquisition of knowledge on the use of oxytocin by licensed midwives is low or less pronounced. This group is also homogeneous, i.e. in this group the individual scores are not widely dispersed around the mean (15.8), as shown by the standard deviation (2.2 units).

Table 4.6: Overall level of knowledge of midwives according to seniority

Seniority	n	Max	D	P	$\overline{X}$	SD	CV	Rdt
Less than 5 years	1	20	13	17	17	4	.24	85
5 to 10 years	6	20	11	17	14,8	2,5	.17	74
More than 10 years	7	20	12	18	16	2	.13	80

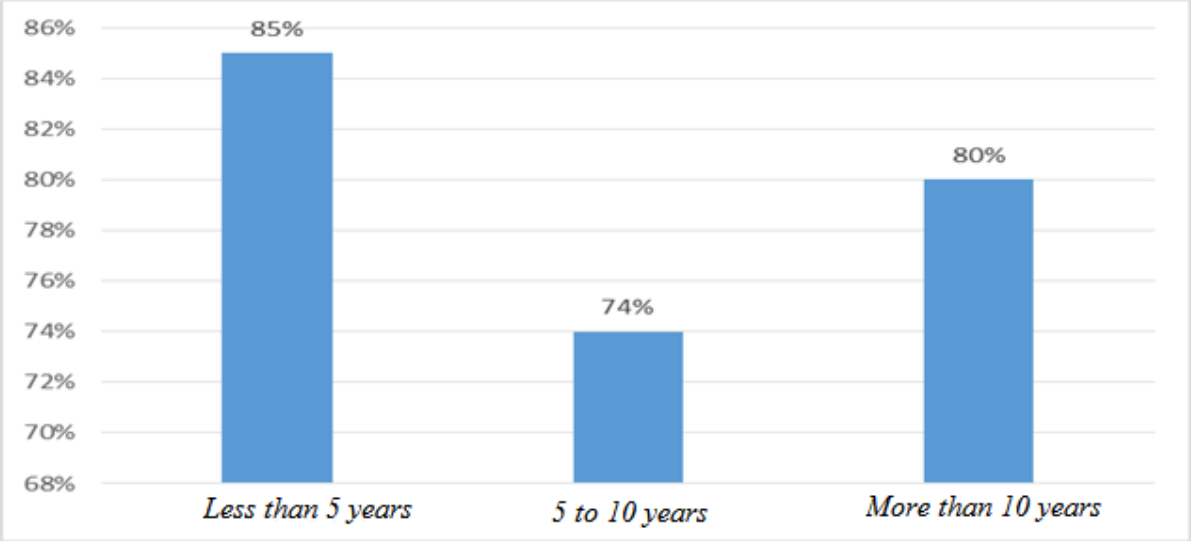

Figure 4.5: Overall level of knowledge of midwives by seniority

The data in Table 4.6 above indicates that the level of midwives' knowledge of oxytocin use after training does not increase with seniority but remains sufficient (Rdt =85%, 74% and 80%).

After our calculations, we observe a coefficient of variation of .24 or 24% for midwives with less than 5 years of seniority which is higher than 15% (the reference threshold of the CV), we say that the dispersion of data related to the acquisition of knowledge on oxytocin use by midwives with less than 5 years of seniority is high or very pronounced. This group is heterogeneous, i.e. the individual results are very pronounced around the mean (17), as shown by the standard deviation of this group (4 units). As for the midwives with 5-10 years of experience, the coefficient of variation is .17 or 17% is higher than 15%; we can say that the dispersion of the data regarding the acquisition of knowledge on the use of oxytocin by midwives with 5-10 years of experience is high or very pronounced. This group is also heterogeneous, i.e. in this group the individual results are widely scattered around the mean (14.8), as shown by the standard deviation (2.5 units).

As for the midwives with 10 or more years of service, the coefficient of variation is .13 or 13% is less than 15%; we can say that the dispersion of the data on the acquisition of knowledge on the use of oxytocin by midwives with 10 or more years of service is low or less pronounced. This group is also homogeneous, i.e. in this group the individual results are not widely dispersed around the mean (16), as shown by the standard deviation (2 units).

Table 4.7: Midwives' overall level of knowledge about oxytocin use in the intervention (trained) and control (untrained) groups

Statistics / Tests	n	Max	$\overline{X}$	SD	P	Rdt	D	CV
Intervention group	14	20	15,85	2	18	79,28	11	.13
Control group	14	20	6,85	2,87	13	34,28%	3	.41

Overall, this table indicates that the level of knowledge of midwives in the control (untrained) group about the use of oxytocin during spontaneous labour is low (mean score of 6.85 out of a maximum of 20 points) compared to 15.85 in the intervention (trained) group.

Note that the standard deviation (SD) is a dispersion value that indicates the difference in mean between one individual and another in the same group in a distribution. These results above also show that there are 2 units between one midwife and another in the same group, i.e. in the trained group and 2.87 units between one midwife and another in the untrained group.

In terms of our calculations for the two groups of midwives, trained and untrained, their coefficients of variation are .13 and .41 respectively

In other words, the coefficient of variation of the trained group is .13, or 13%, while the coefficient of variation of the untrained group is .41, or 41%. It should be noted that the coefficient of variation for midwives in the trained group is less than .15 or 15% (13% < 15%), the dispersion of data relating to the acquisition of knowledge on the use of oxytocin by midwives trained in the maternity hospitals of Kindu is less pronounced: this group is homogeneous, i.e. in this group (trained midwives) the individual results of the test are not very dispersed around the average, as shown by the standard deviation of this group (2), which is lower than that of the untrained group (2.87).
It should also be noted that the coefficient of variation for the untrained group is .41, or 41% > 15% (the threshold used to calculate CVs). This means that the dispersion of data on knowledge acquisition on oxytocin use by untrained midwives in Kindu maternities is high or very pronounced. This group is heterogeneous, i.e. in this group the individual results are widely dispersed around the mean, as shown by the standard deviation of this group (2, 87) which is higher than that of the trained group (2).

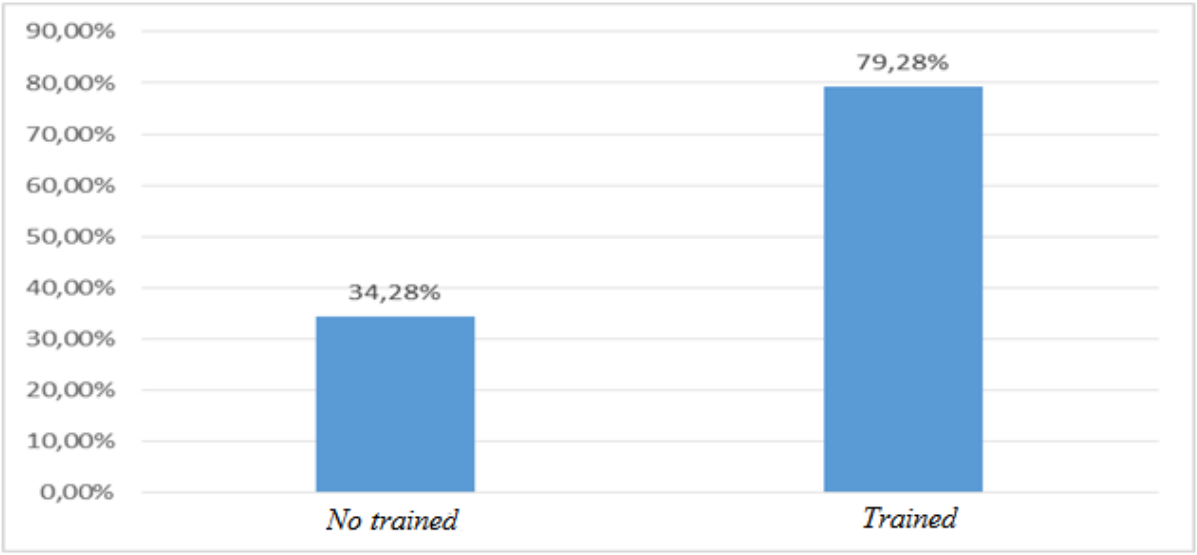

Figure 4.6: Midwives' overall level of knowledge about oxytocin use in the intervention (trained) and control (untrained) groups.
The performance of midwives in the trained group is 79.28%, which means that it is significantly higher than the performance of midwives in the untrained group (34.28%).

5. Discussion
The results of the study indicated that the average score ( ) obtained by midwives before training was 8.57 out of 20 points and 15.85 out of 20 points after training. We also calculated the performance of midwives before and after training on the use of oxytocin in order to situate them in relation to the educational thresholds of Debesse and Mialaret (1968) set at 80% as the threshold of mastery and 60% as that of average performance. The results revealed the yields of 43% before the training largely lower than 60% considered as the threshold of the average performance and of 79,28% after the training largely higher than 43% obtained before the training, but slightly lower than 80% considered as the threshold of mastery. With regard to this performance, the first part of the initial hypothesis according to which the performance of midwives in the basic maternity hospitals of Kindu in a knowledge test on the use of oxytocin during spontaneous labor is insufficient, i.e., less than 60% of the points taken as the threshold of average performance, was confirmed.
Statistically, these results show a significant difference, which means that training significantly influenced midwives' knowledge of oxytocin use during spontaneous labor. In other words, there is a relationship between midwives' training and their knowledge of oxytocin use during spontaneous labor.
Nitya *et al* (2013), in Karnataka, India had reported a lack of consistent and correct knowledge regarding storage, dosing and safe administration of oxytocin by health care providers. They suggested training and other interventions to address the identified knowledge gaps and ensure that providers have up-to-date information regarding oxytocin use.
The same finding was made by Abirami *et al* (2016) in Sierra Leone reporting that lack of knowledge regarding oxytocin use and providers' attitudes regarding the usefulness of uterotonics after normal deliveries as the common barriers reported by providers on oxytocin use.
Sultan *et al* (2020), in Turkey, reported a high level of principles of oxytocin administration by health professionals.
Other authors working on the training of obstetric care providers have found similar results to ours. This is the case of Pazandeh *et al* (2015), in Tehran, Iran had reported overall results of the contributions of training on the performance of beneficiaries; Juhakali *et al*, (2016), in the Democratic Republic of the Congo, had reported that training of providers had improved maternal and fetal prognosis especially with regard to the reduction in the rate of caesarean sections and low Apgar scores.
Boujenah *et al* (2019), in Monaco, France, reported that a protocol redefining the criteria for dystocia and the modality of its correction in a simple and easily applicable manner led not only to a reduction in the use of oxytocin but also to other beneficial effects such as a reduction in fetal heart rate abnormalities, uterine hypertonia/hyperresis and cesarean section.
Lyunn, Theresa Anns, and Danika (2012), in Pakistan had indicated that the evidence in favor of TBA training was limited

but promising for some mortality outcomes. Lazare, Seydou *et al* (2010) in Mali, reported that training community stakeholders improved the quality of deliveries and reduced neonatal mortality.
We agree with Penny and Susan (2000), who recommended that the capacity of maternity care workers to provide services competently and in a timely manner needs to be improved, and continuing education seems to have an important role to play.

Conclusion

The administration of oxytocin during spontaneous labor is a common practice in the basic maternity hospitals of Kindu, but knowledge of it by midwives in the province of Maniema in general and in the city of Kindu in particular is still a problem.

Through this study, we found that the performance of midwives in Kindu's basic maternity hospitals on a knowledge test on the use of oxytocin during spontaneous labor was insufficient before the training (43%), well below the 60% threshold considered to be average performance. In other words, the training improved midwives' knowledge of oxytocin use during spontaneous labor by increasing their performance on a knowledge test from 43% before training to 79.28% after training.
We recommend capacity building for all midwives on the use of oxytocin during spontaneous labor with regular follow-up;

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Competing interests

The authors declare that they have no ties of interest.

Details of the authors

1. Bakangana Mungu Alain, Head of Works at the Institut Higher Institute of Medical Techniques of Kindu and PhD student at the Great Lakes University of Kisumu in Kenya
2. Rosebella Onyango O, Professor at Great Lakes University of Kisumu, Department of Community Health School of Health Sciences
3. Malin Bogren, Professor at Institute of Health and Care Sciences, Sahlgrenska Academy, Gothenburg University, Sweden
4. Kitingi Katumba, Head of Works at the Higher Institute of Medical Techniques of Kindu

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