Technology: Role in Maternal and Infant Mortality Ratios. Midwives and Nurses Perception in Cameroon-West Africa. A Cross-sectional Quantitative Survey.

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Abstract

Background:
Glocal efforts to curb the maternal/infant mortality ratio have not reached a satisfactory level with Sub-Saharan countries accounting for 86% (25400) of the global maternal death in 2017. However, technology has enhanced prompt management of preventable maternal/infant deaths via remote obstetric consultations/care along the whole continuum of pregnancy, childbirth, and postnatal care.

Aim:
The survey aimed at assessing midwives' and nurses' perceptions on the role of tele-obstetrics in improving maternal/infant mortality in Africa and the significance of educational qualification and years of work experience on perception.

Methodology;
The survey employed quantitative and non-probability convenient sampling techniques to select 138 midwives and nurses. Data collection tool was used to collect data in two phases; phase-I as web-base (22nd-28th February 2021) and phase II, self-administered (1st-5th March 2021) using questionnaire then descriptive and inferential statistics were computed at 95% Confidence Interval on Statistical Package for Social Sciences version 20 and presented in the form of tables, pie charts, and bar charts.

Results:
The respondent rate was 86% (118/138), and at a mean score of 1.31(0.043)±0.466, 68.6% (81/118) of participants perceived tele-obstetrics vital to curb maternal/infant mortality. Among those with positive perception, 43.2%(35/81) [chi-2=6.3(33.3%)0.27] had a bachelor of science in midwifery/nursing. Within those with ≤5years experience, 74.6%(47/63) [chi2=4.9(37.5%)0.17] supported technological application in midwifery care.

Conclusion:
Midwives and nurses recognize tele-obstetrics capable of improving maternal/infant health, and this recognition is not so different amongst the different cadre of Midwives/Nurses although those with few years of work experience support tele-obstetrics than those with many years of work experience.

Recommendation:[a]
It is recommended for all United Nations member states to create a platform that encourages the implementation of tele-obstetric systems in all healthcare settings and midwifery curriculum as midwives and nurses will be willing to improve care via the use of technology.

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1 Background of the study

Inline to improve maternal and infant health outcomes**,** there is the global transformation of the healthcare sector by Information and Communication Technology as echoed by the World Health Organization (WHO) as an opportunity to resolve the problem of scarce human resources and a way to breach the gap of unevenness in the distribution and delivery of equitable healthcare (Grassl *et al.,* 2018). This technological innovation has been found useful in obstetrics as unpin by the American College of Obstetricians and Gynaecology (ACOG, 2020) to have the ability to enhance obstetric outcomes thereby improving maternal and child health when compared to face-to-face obstetric care which has always been the ideal. Although the implementation of telemedicine in obstetric (tele-obstetrics) care has been minimal, quite a range of obstetrical services has been offered using telemedicine as an option by some medical centers (Weigel *et al.,* 2020). Tele-obstetrics has been found useful in both low and high-risk pregnancies as the best way to provide convenient and cost-effective specialty healthcare (Lowery, 2020). Compared to developed countries, relatively little published evidence exists about tele-obstetrics with extensive work known to occur in developing countries (Scott *et al.,* 2012).

Globally, an estimated 287 000 maternal deaths occurred in 2010 with most found to be from low and middle-income countries with limited specialist care (Say *et al.,* 2014). Most African countries still have a high maternal and child morbidity and mortality ratio of 86% (2017) and 49.8% (2018) respectively. This value has recorded a rise to 50.09 infant death/1000 live birth by 2021 (Infant Mortality Rate - The World Factbook, n.d.). With this global rate, 34% occurs in Nigeria and India alone (Ope, 2020). According to the World Health Organization (WHO) in the year 2019, the Maternal Mortality Ratio (MMR) of Nigeria is 814 per 100,000 live births, and 782 maternal death per 100.000 live birth (Trends in Maternal Mortality, n.d.) These values stand at 74.8 infant death per 1000 live birth in Cameroon (Cameroon Health, 2019). It was identified by Ope in 2020 that evidence suggesting a reason for this high rate in Africa is connected to the three forms of maternal delay as postulated by Thaddeus and Marine which include; delay in decision-making to seek health care; delay in locating and accessing the medical facility, and delay in receiving skilled and quality care; with the last two being most significant. To address these challenges some studies like that of Egbe *et al.,* recommend improving the three "as" of accessibility, availability, affordability of quality care by a more comprehensive care model that can bridge the above gaps as a means to curb the high rate of neonatal and maternal mortality in Buea-West Africa.

The fight to decrease maternal and infant mortality has long been a global health priority and is a target in the UN Millennium Development Goals (MDG) framework and a key interest of the Global Strategy for Women's and Children's Health launched by the UN Secretary-General in 2010, it is yet to achieve a satisfactory result. Meanwhile in a low-risk pregnancy, i.e. pregnancy that is expected to proceed without major complications, Lowery writes that some clinics have introduced a care model that is capable of avoiding in-person appointments by using technology, especially in situations where face-to-face is impossible. According to Lowery, pregnancy outcome has proven to be similar between those who engage in the face-to-face prenatal visit and those with tele-obstetric prenatal visits though remote visits have added advantage to be time-saving and to lower visit-related cost. In high-risk pregnancy, that is pregnancy with previous or ongoing conditions such as diabetes, high blood pressure, venous thromboembolism, substance abuse, psychiatric disorder, or history of genetic disorder which may threaten the life of the mother and the baby, tele-obstetrics have been seen particularly beneficial as rural practitioners can manage high-risk pregnancy why working remotely with a specialist (Ob/Gyn). This is so beneficial with the scarcity of specialist practitioners. The application of high-risk obstetric telemedicine program has been noted to be operational at the University of Arkansas for Medical Sciences (UAMS) not just to provide obstetric care but also Antenatal and neonatal Guidelines, education, and learning system to combat rural health disparities.

In midwifery practice, tele-obstetrics has not gained ground in obstetric care in most parts of the world, especially in developing countries. In Africa, telemedicine initiatives have always received tons of press coverage and after the trial levels, only a few are sustained and integrated into the existing health system (Tchoa *et at.,* 2019). In the event of this, there is also very diminutive published data

on their operation (Mars and Maurice, 2013). In this paper, we assess midwives' and nurses' perceptions on the role of ICT in improving maternal and infant mortality in West Africa and how this perception varies between the different categories and experiences of maternity health professionals. This assessment can serve as a base for its implementation.

2 Methodology:

Study design:

A cross-sectional descriptive study design was used to demonstrate the cause and effect relationship of different variables. The aim of a cross-sectional approach was to unpin the extended deviation and distribution of some social characteristics especially, training/educational background and number of years of work experience influence observed behavioral patterns in relation to the objective of the survey. A quantitative method was implied as the purpose was solely to provide factual figures by quantifying the findings of the survey than understanding individual points of view.

Study setting:

The study was purely a hospital-based survey involving midwives and nurses at maternity areas of all the hospitals of the Cameroon Baptist Convention Health Services (CBCHS) found in 09 of the 10 regions of Cameroon-West Africa. These hospitals include; Banso Baptist hospital (BBH), Mbingo Baptist Hospital (MBH), and Nkwen Baptist Hospital (NBH); all in the Northwest Region, Mboppi Baptist Hospital Douala (MBHD) and Bonaberi Baptist Hospital Douala (BBHD)] both found in the Littoral Region, Ekoumdoum Baptist Hospital Yaounde (EBHY)]; in the Center Region, Baptist Hospital Mutengene (BHM); found in the Southwest Region, Bafoussam Baptist Hospital in the West Region, Baptist Hospital Banyo (BHB) and Meskine Baptist Hospital-Maroua (MBHM); base in the Adamawa and Far-North Regions respectively. The study areas are summarized in figure 1.0.

The CBCHS is a Faith-based non-profit-making health care organization that was born in 1949 as a missionary healthcare facility at a small village called Mbem in the Donga-Mantung Division, North West Region of Cameroon. It has over 80 health facilities spread over nine of the ten regions of the country and keeps on adding up to meet the health demand of the population of Cameroon including a pharmaceutical procurement and distribution department and a training school for health personnel, a center for clinical pastoral education and social services (CECPES), a center for persons with disabilities and a comprehensive AIDS care and prevention program and many more. It is the second-largest health care organization in the country after the Government with over 5.000 health workers.

Study population

The survey was implicated for all midwives and nurses (census 213 as per field investigation in 2021) offering maternity care services at all maternity areas of the CBCHS hospitals.

Sampling Methodology

Sample Size Determination

Sample size determination from the population size (N) of 213 midwives and nurses (at confidence level of 95%, expected frequency of 50%, accepted margin of error of 5%) was computed using the StatCal-Sample Size and Power for a population/descriptive survey function of Epi Infor7 with result of 138 samples. This value was confirm by the 1967 Yamane's formula for sample size calculation

$$n = \frac{N}{\left(1+N(e)^2\right)}$$

N

Where;

n =desired sample size,

e = the desired level of precision at 5% (0.05) at 95% confidence interval.

N = is the total population size of desired characteristics (midwives and nurses at maternity service areas at CBCHS Hospitals) = 213

n=138 participants.

Sampling Procedure

A non-probability convenient sampling method was employed, were by all 138 midwives and nurses who consented to participate in the survey where eligible to participate. This method eliminated any intended or unintended bias.

Inclusion and Exclusion Criteria

Inclusion Criteria

All midwives and nurses at the maternity care service areas of any of the CBCHS hospitals who were present during the period of data collection and also consented to participate were included in the study.

Exclusion Criteria

The survey excluded all midwives and nurses in maternity care service areas of the CBCHS hospitals who were either absent did not consent to partake in the survey during the period of data collection.

Study Variables

Dependent Variable

Perception of midwives and nurses at maternity care service areas about the role of tele-obstetrics in MMR/IMR at CBCHS hospitals.

Independent Variables

Demographic heterogeneity like age, sex, region of service, educational levels, and a number of years of work experience of midwives and nurses at CBCHS maternity care service areas.

Data Collection tool and Procedure

We designed a 04 point Likert-scale type structured questionnaire on a scale of 44, including population characteristics which were tested and validated at 0.6 significance by the Cronbach's alpha of SPSS 20. The first phase of data collection was remote via Google form questionnaire (https://forms.gle/ZcT6JrNwbeAJP3vN8) which took place within the period from 22nd to 28th February 2021 and was preceded by a self-administered questionnaire with support from trained data collectors within the period from 1st to 5th March 2021. To limit multiple responses, the web-based form only gave a single response choice and the self-administered forms had as instruction " Do not complete this form if you have completed the web-base form".

The sole purpose of employing both methods of data collection was to improve convenience and reach a greater population. Both the online and paper survey questionnaire contained two subgroups:

i. Respondents were demanded to depict their demographic information, such as age, area of work, qualification, years of work experience, and the region of service.

ii. Provide their degree of agreement or disagreement within some areas where technology is perceived usefulness (PU) in improving maternal and infant mortality.

Statistical Methodology

Data Entry And Cleaning

All responded questionnaire on Perceive Usefulness (PU) was first of all scored and re-categorized resulting in two categorical sets of data [Either useful (mean score $\geq$1.5/2) or Not useful (mean scores <1.5/5). Together with all demographic details, data was then entered into Microsoft Excel spreadsheet version 19, and data cleaning was done to eliminate any duplicates.

3 Data Analysis

The stored data on Microsoft excel 19 was then imported into IBM SPSS Version 20.0 were the descriptive statistical tool of frequency, mean, standard deviation, and mean error was used for analysis, and mean at 95% Confidence Interval (95% CI) limit was computed for PU and test of significance computed at P-value <0.05 (95%CI). Cross-tabulation and chi-2 test was used to assess the significant relationship between Number of years of service and PU and between educational qualification and PU

Ethical Consideration

Ethical clearance was sought through recommendations from the Department of Midwifery to the University of Port Harcourt (UNIPORT) Research Ethics Committee. Then authorization to proceed with data collection was obtained from the Institute Review Board (IRB) of the CBCHS Mbingo. A letter of permission was then addressed to all the administrators of the various CBCHS hospital chosen for the project and permission was granted to collect data. Participants' enrollment was strictly voluntary and no individual was forced against their will and no identifying information was collected.

Study Limitation

The survey was without some minor challenges. All uncompleted questionnaires (web-based or self-administered) were disqualified. Also, all responses (especially the web-based) from different institutions or different care service areas than the maternity were not considered. A total of 14 uncompleted, 04 from a different area of service and 02 from institutions not of the CBCHS were identified and disqualified. Figure 2.0. Below summarizes this in a flow chart.

4 Results

Demographic Characteristics of Respondents

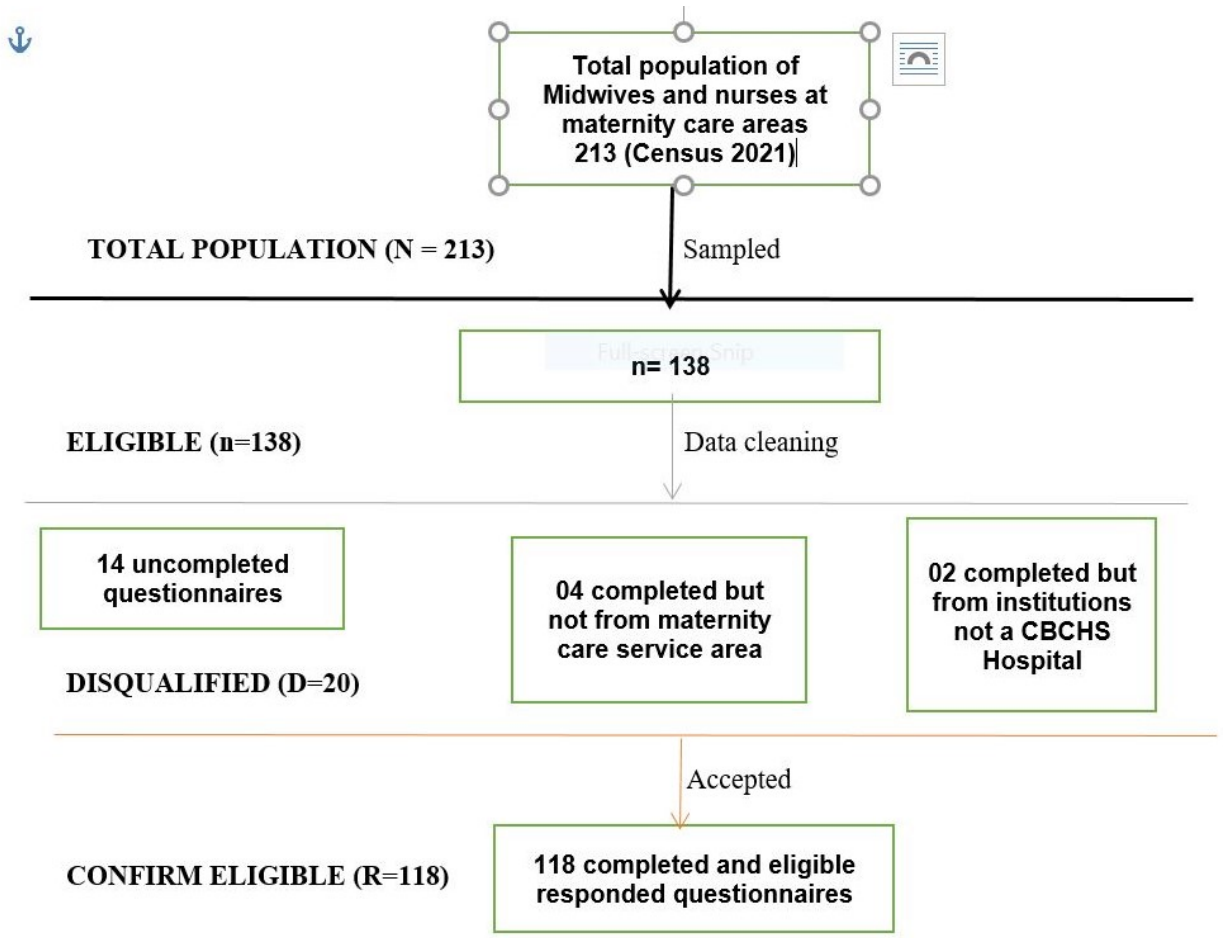

Figure 1. Flowchart of eligibility and confirm eligibility or disqualification.

A total of 138 subjects were recruited from the maternity care service areas of all hospitals under the Cameroon Baptist Convention Health Services (CBCHS) to participate in the survey. The respondent rate was 86% (118/138). The demographic detail of the participants is shown in below. The survey was predominated by a female who made up the majority 62.7% (74/118) of respondents.

At a mean age of 33.42(7.45)±0.68 the age range was between 20 years to 65 years where 52.5% (62/118) of a respondent were between the ages 20-30 years old. Just above average,53.3% (63/118) of the participants demonstrated to have ≤5years of work experience. The qualification of respondents ranged from nurse assistant (NA) to masters of science in nursing/midwifery (MNS/MMW) with the majority 40.7% (48/118) being holders of a degree in midwifery/nursing sciences (BNS-Midwives/Nurse). Only 39/118 nurses participated in the project making a total of 33.1% of the participants. Most 34.7% (41/118) of respondents were serving in the North-West region of the Republic next by the Littoral region at 27.9% (33/118). Meanwhile, only 0.85% (01/118) respondent was registered from the north and none from the East region.

Demographic characteristics of respondents.

Perceived usefulness (PU) of tele-obstetrics in decreasing maternal and infant mortality ratios.

After scoring and categorizing respondents into groups of two; those who perceive tele-obstetrics useful in lowering maternal and infant mortality, and those who do not (02 point scale), it was revealed that at mean score of 1.31(0.043)±0.466 representing 68.1% (30/44) of the maximum point award, 68.6% (81/118) of the respondents perceived tele-obstetric care useful in optimizing health outcome and 31.4% (37/118) perceived it not useful. Figure 4 summarize this finding.

Variables	N⁰ of respondents (118)	Percentage (%)
Sex		
Male	44	37.3
Female	74	62.7
Age		
20-30	62	52.5
31-40	47	39.8
41-50	08	06.8
51-60	01	00.8
Qualification		
MNS	13	11.0
BNS-MIDWIFE	48	40.7
SRN	23	19.5
APNA-OB	13	11.0
HND	03	02.5
NA	18	15.3
Years of work experience		
<5	63	53.4
6-10	42	35.6
11-20	10	08.5
21-30	03	02.5

Figure 2. Note: NA=Nurse Assistant, HND=Higher National Diploma, APNA-OB=Advanced Practicing Nurse Assistant in obstetrics, SRN=State Registered Nurse, BNS=Bachelor of Science in Nursing and MNS=Master in Nursing Sciences.

Perception of the role of technology in midwifery care (tele-obstetrics) by the various Categories of midwives and nurses

Some categories of midwives and nurses were identified to share a common orientation on the role of tele-obstetric care and its added value to maternity care and maternal/infant mortality ratio. Among the categories that perceive tele-obstetric useful, findings obtained as summarized below in figure 5 unpin that BNS-midwives/nurses 43.2% (35/81), SRN 21.0% (17/81) and NA 16.0% (13/81) at chi-2 of 6.3(33.3%)0.27, P>0.05 share the view than other categories of maternity health workers. Unexpectedly, more than 21.6% (8/37) of those with a Masters's degree do not perceive the application of technology in midwifery care as an innovation that will help curb down maternal mortality ratio/infant mortality ratio (MMR/IMR) as to 6.2% (5/81) of those who agree.

Perception per the different category of maternity health workers

Perception of the role of technology in improving MMR/IMR by maternity health workers based on their number of years of work experience

The survey revealed a weak inverse relationship between the number of years of work experience and perception of the role of technology in reducing maternal and infant mortality ratios. At chi-2=4.9(37.5%)0.17; (P>0.05)] within those with ≤5 years of work experience 74.6% (47/63) agreed that tele-obstetrics had a positive contribution in maternal and infant health Vs 25.4% (16/63) in disagreement. All those 100% (03/03) with >21years of work experience belief maternal and infant health outcome has its hopes on technological innovation. Figure 6 below present these differences among the different experienced midwives and nurses.

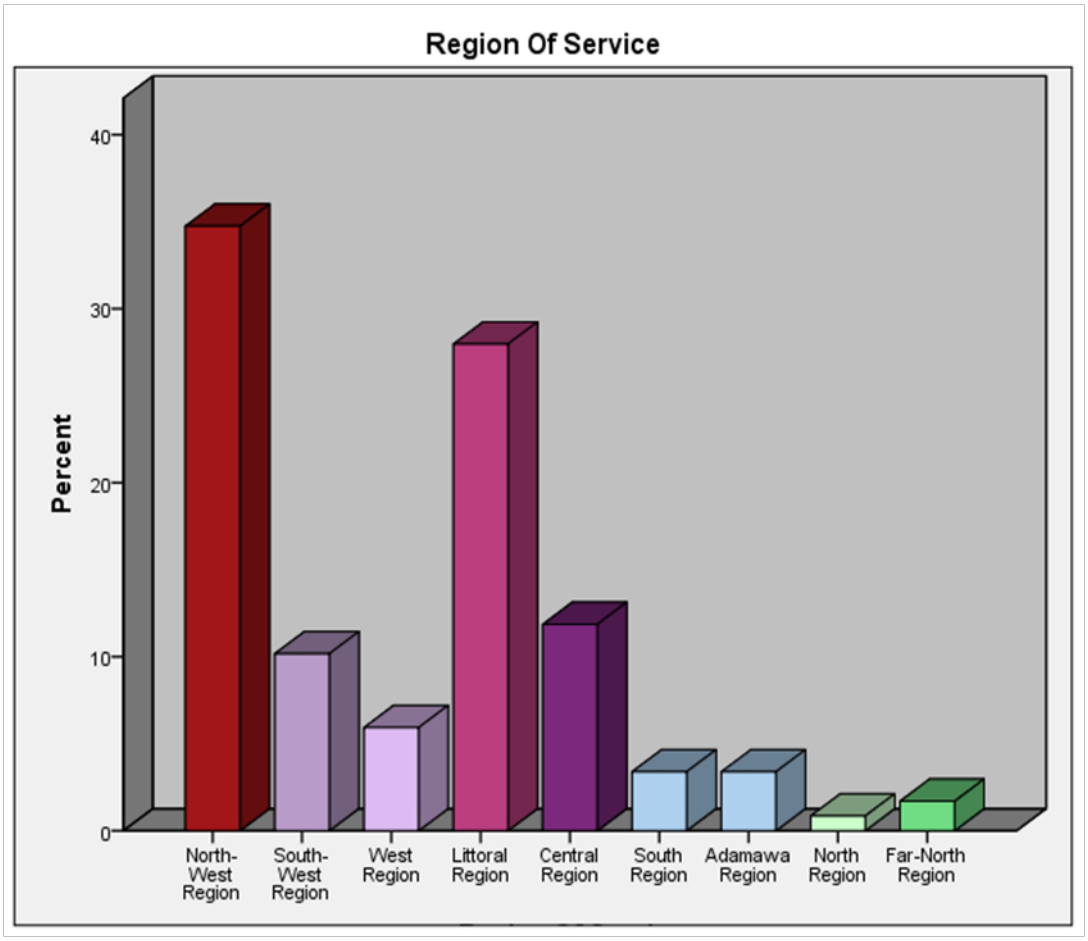

Figure 3. Regional distribution of participants in percentages (%)

Perception of the role of technology in curbing down MMR/IMR by maternity staffs base on their number of years of work experience.

5 Discussion.

Only a few midwives and nurses recognize technology as an important tool in midwifery practice especially in decreasing maternal and infant mortality ratios. This limited number may be due to a lack of knowledge of technological applications in midwifery. Patterning to the perception of the role of technology in midwifery, the different cadre of midwives and nurses (grouped based on level of training and years of work experience) seems to have an insignificant contribution to individualized perception. In Africa, the perception of midwives and nurses at maternity care areas seems to provide the best decision on its implementation. Unfortunately, in midwifery and nursing care processes, very little or no exploitation seems to exist.

Midwives' and nurses' perceptions and lack of knowledge as identified by other scholars, Biruk & Abetu, and Abodunrin & Akande, (2009) could just be a barrier to technology advancement in midwifery. Technology has been rather identified by some health workers as a threat to their job and career not as a compliment. Lots of attributes exist about the reservations that have been identified to adopting technological innovations in the health sector. We choose to test the contribution of training level and work experience as determinants of these perceptions. According to figure 3.1 above, a good number 68.6% (81/118) of the participants recognize the role of tele-obstetric as a technological innovation in improving maternity care for both mother and child thereby curbing the high incidence of mother and infant deaths. This outcome is supported by the survey of Lanssens et al, (2019) where 77% of midwives thought that tele-obstetrics as a technological innovation in obstetrics will improve high-risk pregnancies outcomes. Segrelles-Calvo et al, (2015) also found that 77% of those in another discipline (pulmonologist) have also shown similar perception in their area of practice. In other

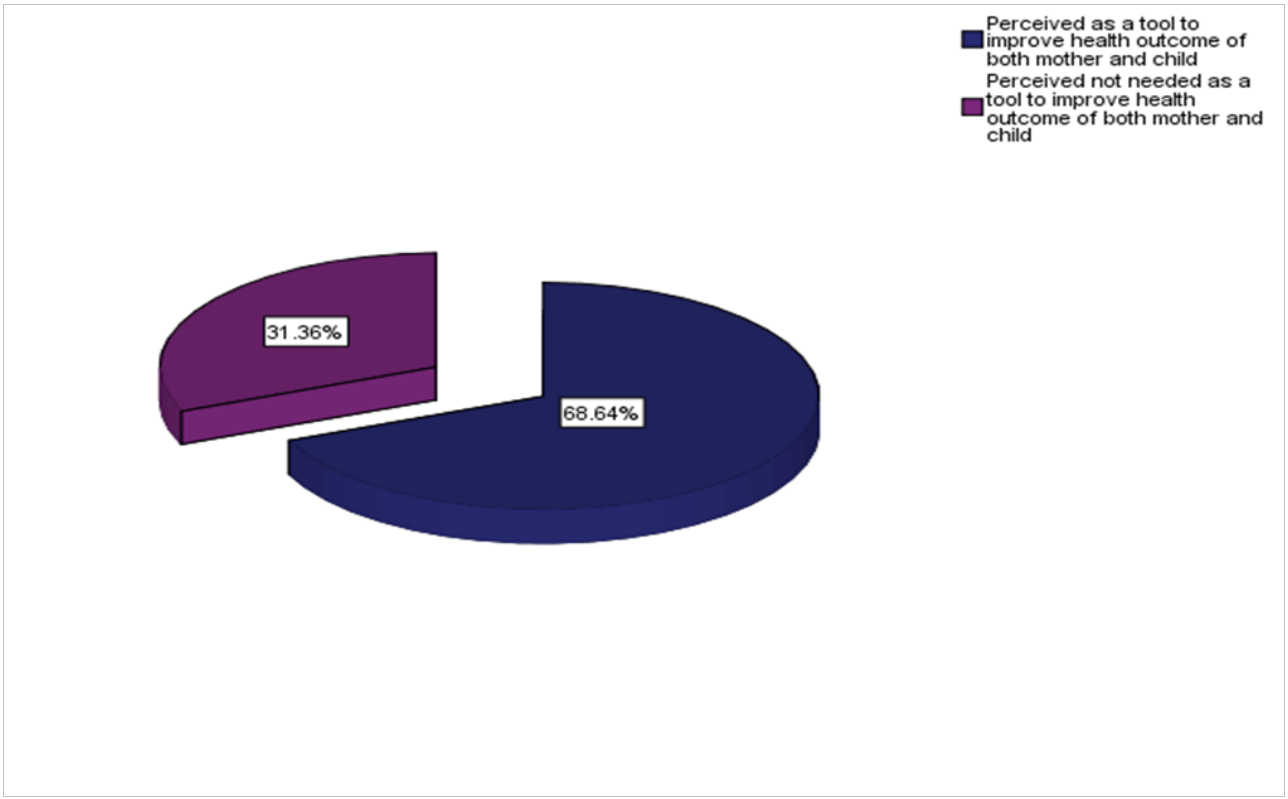

Figure 4. Degree of perceive role of technology in improving maternal and infant health outcome.

Variables PERCEPTION		PU (%)	PNU (%)	TOTAL (%)
QUALIFICATION	MNS	06.20	21.60	11.00
	BNS-Midwife	43.20	35.10	40.70
	SRN	21.00	16.20	19.50
	APNA-obs/gyn	11.10	10.80	11.00
	HND	02.50	02.70	2.500
	NA	16.60	13.50	15.30
TOTAL			100.0	

Figure 5. Note: PU=Perceived Useful and PNU=Perceived Not Useful, NA=Nurse Assistant, HND=Higher National Diploma, APNA=Advanced Practicing Nurse Assistant, SRN=State Registered Nurse, BNS=Bachelor of Science in Nursing and MNS=Master in Nursing Sciences.

Variables				
PERCEPTION		PU (%)	PNU (%)	TOTAL (%)
YEARS OF WORK EXPERIENCE	<5 years	74.6	25.4	100.0
	6-10 years	57.1	42.9	100.0
	11-20 years	70.0	30.0	100.0
	21-30 years	100.0	00.0	100.0
TOTAL				100.0

Figure 6. Note: PU=Perceived Useful and PNU=Perceived Not Useful

studies, Vickery et al, (2020) say midwives acknowledge the potential benefits of eHealth and health technologies in improving maternal and infant welfare thereby reducing morbidity and mortality rates. This role was echoed in the study result of Moyo & Madziyire in 2020 where 96.1% of health care providers reported that remote visits improve access to care especially during the peak of covid-19 with a subsequent drop in maternal and infant morbidity and mortality rates. The result is antonymous to that obtained by Ologeanu-Taddei et al, (2015) where only a few, 32% of midwives and 30% of nurses identified telemedicine in their practice as a useful tool to improving diagnosis, treatment, and follow-up of their clients. This revelation is also sounded in a survey by (Bradford & Penny, 2016), where over 80% of midwives and nurses do not think telemedicine will improve their respective practices. None medical staff and clients on the other hand acknowledge the role of technology in obstetric management wherein 63% were medical secretaries and 71% pharmacists (bid). The survey reveals that technological adoption in the practice of midwifery care is somewhat similar to that in the adoption of technology in any other field or as a means of socialization. Many turn to adopt and use technology in their service by personal conviction and identified value. Our survey unpin and evident this theory. The phenomenal of technological adoption is null of education levels as well as the duration of service (work experience) within maternity health care professionals. It shows that, although there is a diminishing degree of agreement on the perceived role of technological application in midwifery as the period of work experience increases, it is statistically insignificant at P-value=0.17 indicating that long-term (ancient) maternity workers value ICT application in midwifery like short-term (novel) maternity staff. The result of the study revealed this as there was no tangible or linear difference as experience change among those within ≤5years; 74.4% (47/63), 6-10years; 57.1% (24/42), 11-20years; 70.0% (7/10), and >21-30; 100% (3/3). No survey has been conducted nor has there been similar or contrary results identified in any literature to the best of our knowledge. As such this stands as a novel. Qualification (category) was also shown to share a similar trend at P-value=0.27. The level of training in midwifery/nursing was not recognized as a determinant in the perception of the role of technology as a tool to complement/improve service delivery and subsequent health outcome. This trend is shared by the findings of the survey. Compared to master degree holders, degree holders perceive tele-obstetrics as a tool that improves maternity care services. Different categories of midwives and nurses demonstrated different levels of understanding as well as perception on the role of technological application in midwifery as to whether it improves maternal and infant health or not. Heterogeneity in the knowledge obtained at various levels of training or other attributes could be a contributing factor. Unfortunately, there seems not to be a significant direct relationship

between positive perception and advance in professional training. The phenomenon shows that, whether a maternity staff is more experienced than another or not those determine their perception of technology as an important tool in improving health outcomes of maternity clients. The trend is not observed to vary considerably down the educational ladder and is not statistically significant as well.

The survey informs the scientific community interested in implementing tele-obstetric in their setting about compliance rate and expectations from impending users after implementation. This is very important as it prevents wastage of resources. Also, the survey indicates that implementing such innovation (tele-obstetrics) in midwifery training/seminars should target all levels of maternity health care workers similarly. Considering the small size of the sample population, more comprehensive research involving a large population may be required to draw the inference.

6 Conclusion:

Despite the perceived significant benefits of technology (tele-obstetrics) in enhancing obstetric care, midwives and nurses at maternity care service areas still share an ambivalent view on its ability to curb maternal and infant mortality ratios (improve maternal and infant mortality health outcomes). Therefore a more comprehensive approach that does not discriminate the various cadre of midwives/nurses or their clinical experience but reinforces processes needed to ensure compliance after implementation seems plausible.

Recommendation

Though perception does not determine what the future holds in the application of technology in midwifery care, it commands the need for implementation both in the midwifery curriculum and at all levels of the health care setting to overcome current doubt.

7 Funding.

The research project was personally funded.

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B Map of Republic of Cameroon showing the locations of the CBCHS Hospitals

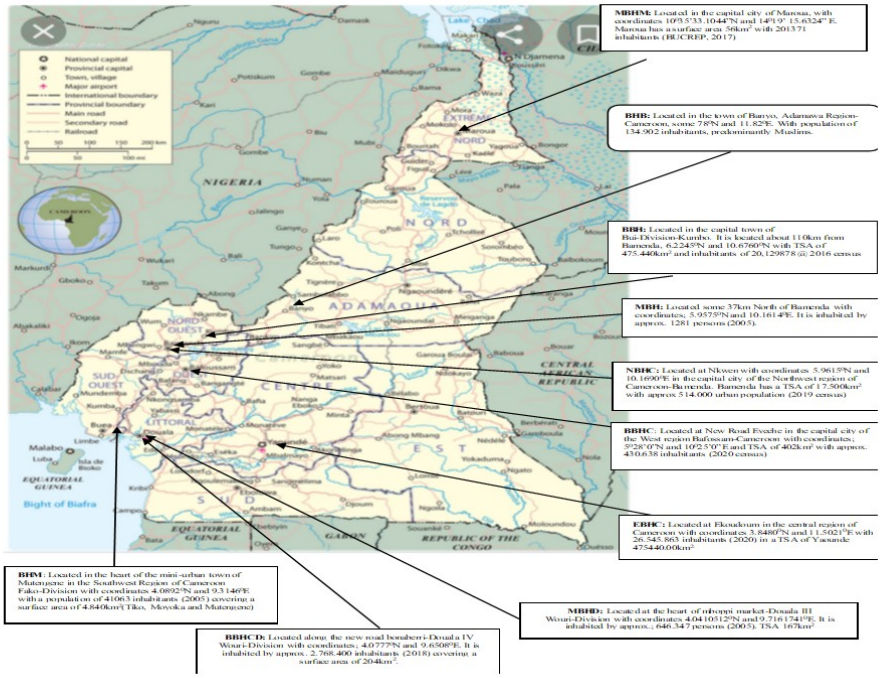

Figure 7. Map of Republic of Cameroon showing the locations of the CBCHS Hospitals