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Research Article

Using Low-Dose Aspirin in the Prevention of Pre-eclampsia and Screening for High-risk: An Assessment of Health Workers' Knowledge and Practices in South-western Uganda

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ABSTRACT

Background: Pre-eclampsia is a major contributor to maternal and perinatal mortality and morbidity worldwide particularly in low-income countries like Uganda. The World Health Organization recommends screening and initiating all pregnant women at high risk for pre-eclampsia on low-dose Aspirin. However, it is not known whether health workers in Uganda are aware of its application and whether they use the drug use in preventing pre-eclampsia.

Aim of the study: The study aimed at assessing the knowledge and self-reported practices of health workers on the use of low-dose aspirin in preventing pre-eclampsia among high-risk pregnant women in two districts in Western Uganda. Additionally, the study aimed to establish alternative approaches health workers use to prevent pre-eclampsia in high-risk pregnant women.

Methods: The study employed a descriptive cross-sectional study design. Data were collected using a participant self-administered questionnaire from 136 health workers in Mbarara and Bushenyi districts. Data were analysed using SPSS version 18.

Results: The majority of participants (63%) were aware that pre-eclampsia is preventable. However, only 18% of participants reported having ever prescribed low-dose aspirin for pregnant women at high risk for pre-eclampsia. Participants reported using various drugs methyldopa, nifedipine, magnesium sulfate, and others to prevent and manage pre-eclampsia.

Conclusion: This study was done in 2018. The study identified significant knowledge gaps on pre-eclampsia prevention, low-dose aspirin prescription, and screening for pregnant women at risk for pre-eclampsia among health workers in South-western Uganda. Health workers reported using other drugs that are not recommended in the prevention of pre-eclampsia.

Keywords: Pre-eclampsia prevention; Low-dose aspirin; High-risk assessment; Pre-eclampsia screening

INTRODUCTION

Pre-eclampsia is a leading cause of maternal and prenatal mortality globally [1]. The condition manifests as hypertension that develops at about 20 weeks of pregnancy in a woman who was previously normotensive that is accompanied with proteinuria [2]. Hypertension is a systolic blood pressure of 140 mmHg or more and a diastolic blood pressure of 90 mmHg or more measured on two separate occasions at least at an interval of 4 hours [3]. Although a rise in diastolic blood pressure equal or greater than 15 mmHg or systolic blood pressure equal or greater than 30 mmHg from the initial antenatal booking values is considered very significant [4]. Pre-eclampsia ranks second among the direct maternal causes of death in Mbarara district in Uganda [5]. Although the exact cause of pre-eclampsia is still unclear, there is compelling evidence that links the placenta to the pathogenesis of this condition, since it also occurs in molar pregnancy where the foetus is absent and in ectopic pregnancy where the placenta implants outside the uterus [6]. This theory is further supported by evidence that shows that

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patients recover quickly after delivery or removal of the placenta [7,8]. The origin of pre-eclampsia has been postulated to have a link with reduced blood supply to the placenta due to failure of the cytotrophoblast to remodel the uterine spiral arteries to adapt to the normal physiological restructuring required for pregnancy to proceed [4,9]. The conversion of small, high-resistance muscle arteries into large, capacitance vessels is then impaired by failed remodelling, which results in decreased placental perfusion [4]. Progressively, poor placental perfusion and placental ischemia cause a widespread maternal endothelial dysfunction that triggers inflammatory responses, the clotting system and other pre-eclampsia symptoms observed on the maternal side [4]. Maternal endothelial dysfunction is also known to provoke an increase in vascular sensitivity to angiotensin II, endothelin synthesis, thromboxane A2 production and a decrease in formation of vasodilators such as prostacyclin and nitric oxide [10]. The resultant imbalance in thromboxane A2 and prostacyclin causes an increase in the levels of the circulating thromboxane A2 which leads to vasoconstriction, intravascular clot formation and premature uterine contraction [10].

Prostacyclin and thromboxane A2 are formed from a common precursor known as arachidonic acid by the action of the cyclooxygenase enzyme [2]. Aspirin works by causing an irreversible inhibition of the cyclooxygenase enzyme that breaks down arachidonic acid into thromboxane A2 and other inflammatory mediators [2]. Inhibition of thromboxane A2 synthesis causes a balance between prostacyclin and thromboxane A2 thereby maintaining the blood pressure within normal limits which fosters sufficient blood flow to the fetus and also prevents events of unnecessary clot formation and premature uterine contractions [7,11].

If not managed early, pre-eclampsia progresses into eclampsia which damages the brain and manifests as seizures in the pregnant or post-partum mother [12]. Other complications include liver failure, formation of multiple clots in the circulating blood, acute kidney failure, pulmonary edema, placenta abruption and stroke [13]. Unmanaged pre-eclampsia is also associated with intra uterine growth restriction, chronic fetal distress, prematurity, intra uterine fetal death and early neonatal death [14]. Delivery has remained the only curative treatment for pre-eclampsia where consideration has to be made between the maternal risks of continuing with the pregnancy and the fetal risks associated with induced preterm delivery [4,12].

Pre-eclampsia is responsible for 10% to 15% of the direct maternal deaths worldwide [3]. 16% of all maternal deaths in developing countries have been attributed to pre-eclampsia [15]. A woman in a low-income country is said to be seven times more likely to develop pre-eclampsia compared to a woman in a high-income country [16]. Once she develops pre-eclampsia, she has 3 times greater chances of progressing into eclampsia. If the condition progresses into eclampsia, she is 14 times more likely to die due to complications, even in hospital settings [16]. Therefore, the risk of dying as a result of pre-eclampsia and eclampsia is estimated to be 300 times higher for women in developing countries compared to those in developed countries [16,17]. According to the World Health Organization (WHO), the majority of deaths due to pre-eclampsia are avoidable through provision of timely and effective care to women including early detection of potential cases, use of aspirin for prophylaxis, early management and early referral respectively [18]. Respectively, the WHO regards a woman to be at high risk if she has any one or more of the conditions that include; previous pre-eclampsia, chronic hypertension, diabetes, multiple pregnancies, renal disease and autoimmune disease [18]. To identify women at high risk, the United States Preventive Services Task Force (USPSTF) suggest that; a detailed medical history should be taken, the gestational age established, baseline blood pressure measured, urine protein estimated, platelet count measured, blood creatinine measured and liver function tests done [7].

In Uganda, pre-eclampsia is the second major cause of maternal death contributing up to 9.1% to the maternal mortality rate [14]. Pre-eclampsia accounts for 14.4% of all maternal deaths in Mbarara Regional Referral Hospital (MRRH), the main referral hospital in South-western Uganda [5]. Mbarara district reports 226 cases of pre-eclampsia each year (Mbarara district health Records, 2017). The WHO recommends use of aspirin 75 mg daily to be initiated as early as 12 weeks of gestation and taken up to 37 weeks by all women regarded to be at high risk for pre-eclampsia [18]. In addition, the WHO further guides that all women who suffer from this condition should be properly counselled to prevent recurrence [18]. Over the years, a number of clinical trials have demonstrated increasing benefit in using low dose aspirin to prevent onset of pre-eclampsia in women at risk of developing the disease [2]. Most of the meta-analyses from these clinical trials have shown that low-dose aspirin can reduce the incidence of pre-eclampsia, eclampsia, and premature delivery associated with pre-eclampsia from as low as 10% to as high as 71% in high-risk mothers [2]. Importantly, the majority of these trials reveal that the success of low-dose aspirin depends on doses over 75 mg, beginning treatment before 16 weeks of pregnancy, and taking the medication consistently at the same time every day [11,19].

Despite substantial evidence of its potential to reduce the incidence of pre-eclampsia and WHO recommendations for its use, aspirin is not frequently used as a medication of choice for preventing pre-eclampsia in many developing countries with Uganda inclusive. In addition, medical professionals often lack the confidence to prescribe a drug that is not included in the Ministry of Health's clinical guidelines [12]. Consequently, the majority of at-risk women are not enrolled on aspirin prophylaxis despite its low-cost, effectiveness and easy accessibility [20]. Most times women are enrolled on drugs like nifedipine, methyldopa, vitamin C, food supplements and heparin to prevent the progression of the disease [21,22].

Much as the WHO recommends screening and prescribing low-dose aspirin for women at risk, this intervention is not included in the current Uganda Clinical Care Guidelines for the prevention of pre-eclampsia (UCCG, 2016). Therefore, it was not known whether health workers in Uganda were knowledgeable on screening and prescription of low dose aspirin to pregnant women at risk for pre-eclampsia. This condition is likely to remain a big problem in Uganda if health workers are not able to correctly identify the pregnant women at risk and initiate them on prophylactic therapy. Despite the numerous studies that have been done in this area, there was a paucity of literature relating to health worker's knowledge regarding pre-eclampsia high risk screening and use of low-dose aspirin in its prevention in Africa thus the need for this study.

MATERIALS AND METHODS

Design, study site and population

This was a quantitative study that used a descriptive cross-sectional design. The design ensured that we collected data on both the independent and dependent variables at the same time. The study was conducted among health workers in both private and public health facilities including hospitals and health centres at levels III and IV within two districts in South-western Uganda that is; Mbarara and Bushenyi districts. The study targeted health workers involved in providing care to pregnant women in any trimester of pregnancy. The study participants included obstetricians, post-graduate medical residents, medical officers, intern doctors, medical clinical officers, registered comprehensive nurses, registered midwives, enrolled comprehensive nurses and enrolled midwives. All facilities at the level of the hospital were included in the study. Two districts were used to increase the generalizability of the study results. The study included private health facilities because it is generally believed that health workers at these facilities deliver higher-quality services and may have more exposure to new information and skills than their counterparts in public health facilities.

Sampling, sample size, and participant's recruitment

A priori power analysis determined a total sample of 113 participants for a logistic regression model to detect an odds ratio of 3 at a $\propto$=0.05, with an actual power of 80%. Therefore, a sample size of 113 was required to obtain a significant result. 23 participants (20%) were added to cater for missing data that yielded a total of 136 participants. Sampling was done at various stages depending on; the type of health facility (private or public), level of health facility (hospital or health centre) and cadre of the health workers within a particular health facility. A subtotal of 108 health workers was recruited from the 8 hospitals contributing 80% to the total sample. Mbarara regional referral hospital contributed 41 participants while 67 of them were drawn from the other hospitals that included; Mayanja memorial hospital, Community Hospital, Devine mercy hospital, Ruharo Hospital, Mbarara military hospital, Kampala international teaching hospital, and Adventist Hospital from Bushenyi district. We used total population sampling inside each hospital since we enlisted all available medical personnel who were on duty at the time of data collection.

We used simple random sampling to choose the health centre IVs, IIIs from those that were available. Then stratified random sampling was used to select health workers from these facilities. Strata were created according to the number of cadres at that particular facility and participants were recruited into each stratum to ensure representation of all cadres of health workers. From the list of all private clinics, we used convenience sampling to recruit health workers from the health facilities which were accessible to the researchers. From the sampling done, 3 health center IVs, 3 health center IIIs and 7 clinics were identified yielding 14%, 5% and 5% respectively. With this background, 136 participants were tenable from a total of 401 eligible health workers in the two districts. All health workers who provided care to pregnant women that consented to participate in the study were included. The study excluded health workers who met the inclusion criteria but were not on duty at the time of data collection. All the health workers that participated in this study were above 18 years of age.

Data collection methods and tools

Data were collected using a participant self-administered semi-structured questionnaire that was specifically developed for this study. The participants filled the questionnaire after providing written consent. The questionnaire focused on establishing the knowledge of the participants regarding pre-eclampsia prevention, low-dose aspirin use for its prevention, other drugs that the health workers were using to prevent the disease and screening for pre-eclampsia high risk. Other questions in the tool were informed by literature from published articles plus guidelines and recommendations on pre-eclampsia prevention by the WHO.

The study questionnaire was reviewed by experts from the American College of Obstetricians and Gynaecologists (ACOG) in the United States and senior obstetricians in Uganda to validate the content in relation to the study objectives. The questionnaire was pre-tested on a group of ten health workers in a different district with five participants drawn from public health facilities and the other five from private health facilities. To further improve the validity and reliability of the tool, consideration for all the different health worker cadres was made during the pilot testing of the tool to ensure clarity, uniformity, appropriateness of content and ability to collect data that was relevant to the study. Adjustments were made to the tool after the pilot study accordingly to suit the study purpose. Two Research assistants were trained for one day on how to administer the questionnaire.

The process of data collection lasted one month. Each participant was given the questionnaire and the research assistants collected the completed questionnaire immediately after. Each questionnaire that was received back was checked for completeness, clarity and accuracy. All questionnaires that were issued out were returned well-filled yielding 100% response rate. Data clean-up and cross-checking were then done before it was entered into the analysing software. All completed questionnaires were kept under lock and key and were only accessible to the researcher.

Data management and analysis

Data were cleaned and entered into an Excel spreadsheet. This was later imported and analysed using the Statistical Package for the Social Sciences (SPSS) version 18. Data were analysed using descriptive statistics and are reported in the following chapter using frequencies and percentages.

Health workers knowledge on pre-eclampsia, preventive interventions and screening was measured by summing the value of correct answers to the knowledge questions. Health workers knowledge about the use of aspirin in pre-eclampsia prevention was analysed as a dichotomous variable; the health worker either knew or did not know that low-dose aspirin is the recommended drug of choice in preventing pre-eclampsia.

A chi-square test was used to test for differences in the practice of prescribing aspirin for high-risk cases between public and private based health workers.

Ethical considerations

Ethics approval was obtained from the Mbarara University research ethics committee, approval number ref-MUREC 1/7. Administrative clearance to conduct the study was received from

the District Health Officers of Mbarara and Bushenyi districts and the Hospital Director of Mbarara Regional Referral Hospital. Permission was received from the in-charges of the health facilities that were selected to participate in the study. Informed consent was obtained from participants who met the criteria for inclusion into the study before administering the questionnaire. Participants were assured of confidentiality, anonymity and their right to withdraw from the study without any undue consequences.

RESULTS

Participant characteristics

A total of 136 health workers from public and private facilities participated in the study. The majority of the participants were enrolled midwives at certificate level contributing 32% to the total. There were more females than males (Ratio 1:2.3). The age of the participants ranged from 21 years to 60 years with the mean age being 33 years (SD=9.0). The mean work experience of all participants was X=8 (SD=8.1) (Table 1).

Table 1: Demographic characteristics of participants (N=136).

Variable	Frequency (n)	Percentage (%)
Type of facility		
Public	60	44.1
Private	76	55.9
Age (years)		
21-28	56	41.2
29-36	43	31.6
37-44	23	16.9
45-52	5	3.7
53-60	9	6.6
Gender		
Female	95	69.9
Male	41	30.1
Work experience (years)		
01-08	93	68.4
09-16	27	19.9
17-24	7	5.1
25-32	6	4.4
33-40	3	2.2
Cadre/profession		
Enrolled midwife	44	32.4
Enrolled comprehensive nurse	20	14.7
Registered midwife	23	16.9
Registered comprehensive nurse	4	2.9
Medical clinical officer	8	5.9
Intern doctor	8	5.9
Medical officer	6	4.4
Post graduate medical resident	15	11
Obstetrician	8	5.9

Participants' responses to the definition of pre-eclampsia

More than two-thirds of the study participants (69.9%) identified the correct definition of pre-eclampsia which is; a condition that presents with a high blood pressure of 140 mmHg/90 mmHg or above with proteins in the urine of 0.3 g in 24 hours after the 20th week of pregnancy (Table 2).

Table 2: Participants responses to the definition of pre-eclampsia.

Variable (Responses)	Frequency (n)	Percentage (%)
Condition presenting with high blood pressure, fits and edema in pregnancy	7	5.1
Sudden rise in blood pressure during pregnancy which presents with severe headache, blurred vision, palpitations and edema	20	14.7
Blood pressure of 140 mmHg/190 mmHg or above with proteins in Urine greater than 0.3 g in 24 hours after the 20th week of pregnancy	95	69.9
Toxemia during pregnancy is characterized by edema, high blood pressure and proteins in Urine	14	10.3
Total	**136**	**100**

Is pre-eclampsia preventable?

The majority of the study participants (63%) were aware that pre-eclampsia is preventable (Table 3).

Table 3: Participants responses to whether pre-eclampsia is preventable (N=136).

Variable	Frequency (n)	Percentage (%)
Pre-eclampsia is preventable	85	62.5
Pre-eclampsia is not preventable	51	37.5
Total	**136**	**100**

Participants who correctly responded that pre-eclampsia is preventable by cadre, N=85

Enrolled midwives (19%) demonstrated more knowledge on the concept of pre-eclampsia prevention in comparison to the other cadres (Table 4).

Table 4: Participants who correctly responded that pre-eclampsia is preventable by cadre (N=85).

Variable (Cadre)	Percentage (%) correct
Enrolled midwife	19.1
Enrolled comprehensive nurse	11.8
Registered midwife	11.8
Post graduate medical resident	5.1
Medical clinical officer	4.4
Obstetricians	3.7
Medical officer	2.9
Registered comprehensive nurse	2.2

Intern doctor	1.5
Total	**62.5**

Note: N=Full sample size.

Drug of choice in preventing pre-eclampsia

The majority of the study participants (63%) correctly stated that pre-eclampsia is preventable. Very few of them (15%) identified low-dose aspirin as the ideal drug for pre-eclampsia prevention. Most of the drug choices made were primarily associated with the treatment of pre-eclampsia rather than prevention. A significant percentage of participants (24%) did not select any drug (Table 5).

Table 5: Drug of choice in preventing pre-eclampsia.

Variable (Drug of Choice)	Frequency (n)	Percentage (%)
Magnesium sulphate	30	22.1
Methyl dopa	42	30.9
Low-dose aspirin	21	15.4
Vitamin C	11	8.1
No drug	32	23.5
Total	**136**	**100**

Knowledge difference about aspirin as a drug of choice for preventing pre-eclampsia between public and private health workers (N=21)

Health workers in public facilities (8%) demonstrated slightly more knowledge about low-dose aspirin as the preferred drug in preventing pre-eclampsia as compared to health workers in private facilities (7%) (Table 6).

Table 6: Knowledge difference about aspirin for pre-eclampsia prevention between public and private health workers (N=21).

Variable	Frequency (n)	Percentage (%)
Type of health facility		
Public	11	8.08
Private	10	7.4
Total	**21**	**15.4**

Prevalence of low-dose aspirin prescription for high-risk cases

A few of the medical professionals (18%) prescribed low-dose aspirin to patients who were at risk of developing pre-eclampsia. The most common drugs used by health workers in the region were; methyldopa (24%), nifedipine (16%) and magnesium sulphate (13%). A significant number of health workers (11%) were not using any drugs to prevent pre-eclampsia. Other drugs mentioned included; hydralazine, vitamin C, calcium, furosemide, diazepam, low molecular weight heparin, zinc sulphate, labetalol, vitamin B, vitamin E, folic acid, propranolol and multivitamins (Table 7).

Table 7: Prescription of low-dose aspirin for high-risk cases (N=136).

Variable (drug)	Frequency (n)	Percentage (%)
Low-dose aspirin	25	18.4
Methyldopa	33	24.3
Magnesium sulfate	18	13.2
Nifedipine	22	16.2
Hydralazine	7	5.1
Vitamin C	7	5.1
Others	9	6.6
No drug	15	11
Total	**136**	**100**

Comparison between public and private facilities regarding aspirin utilization

Out of the 25 health workers who prescribed low-dose aspirin for high-risk cases, 11% were from public facilities and 7% from private facilities. Pearson's chi-square tested the differences in low-dose aspirin prescription between public and private health workers and showed no statistically significant difference $\chi^2(8)=10.57$, P=0.227 (Table 8).

Table 8: Comparison between public and private facilities regarding aspirin utilization.

Variable	Frequency (n)	Percentage (%)
Aspirin prescription		
Public	15	11.03
Private	10	7.35
Total	**25**	**18.4**

Participant's knowledge on conditions that contribute to high risk

Nearly half of the research participants (40%) were able to name three to four out of the six conditions that can put a woman at high risk for pre-eclampsia which include; previous history of pre-eclampsia, autoimmune disorders, chronic hypertension, type 1 and type 2 diabetes mellitus, multiple pregnancy, and kidney diseases. Out of the six risk conditions, 25% of the participants were able to name five to six of them (Table 9).

Table 9: Participants knowledge on conditions that contribute to high risk.

Variable		Frequency n (Percentage %)
Number of risk factors mentioned	1-2	47 (34.6)
	3-4	54 (39.7)
	5-6	34 (25)
	None	1 (0.7)
	Total	**136 (100)**

Participant's knowledge on the criterion used in identifying high-risk cases

About 2/3rd (64%) of the study participants were able to identify four out the seven parameters that are used to screen pregnant women for pre-eclampsia high risk which include; taking a detailed medical history, blood pressure measurement, establishing the gestational age, urine protein estimation, platelet count, creatinine concentration, and liver function tests. No participant correctly identified all the seven parameters. Most of the participants (30%) were only able to identify three of the parameters (Table 10).

Table 10: Knowledge on criterion used to screen for high-risk cases (N=136).

Variable	Frequency n (Percentage %)
Number of parameter mentioned	
5	4 (2.94)
4	87 (64.0)
3	41 (30.1)
2	4 (2.94)
1	0 (0)
Total	**136 (100)**

DISCUSSION

Prevalence of low-dose aspirin utilization in pre-eclampsia prevention

The knowledge of health workers regarding pre-eclampsia prevention using low-dose aspirin is vital for ensuring its appropriate prescription and adherence. However, several studies have reported gaps in knowledge and implementation of evidence-based practices, especially in low-income countries. In our study, we realized that the majority of the participants (63%) were aware that pre-eclampsia could be prevented. However, 85% of all the participants were not aware that low-dose aspirin is the current drug of choice in preventing pre-eclampsia. Most of the drugs that were stated for this purpose were mainly drugs used in the treatment of hypertension in pre-eclampsia. This was probably due to the perception most health workers held that "pre-eclampsia is not preventable but only treatable" which was stated, by some health workers on the questionnaires. However, consistency in knowledge about the prevention of pre-eclampsia using low-use aspirin was noted among the obstetricians (63%). This could be attributed to the higher level of their training and specialization in the area of obstetrics as compared to the other cadres in the study. Additionally, the study involved different levels of cadres with different qualifications, therefore the interpretation of the questions might have been also different hence the inconsistencies noted in responses to the questions. The knowledge gap identified in this study is similar to that reported by Mwampagatwa et al., (2020) who noted knowledge deficiencies in knowledge among health workers caring for pregnant women in the study to assess knowledge on the prevention and management of pre-eclampsia and eclampsia in Dodoma, Tanzania [23]. Our findings are almost similar to what was found in a study done in Canada where 56% of the obstetricians and only 38% of the physicians were knowledgeable of the recommendations on low-dose aspirin for pre-eclampsia prevention by the United States Preventive Task Force [24]. This finding was quite similar to that of Sheikh et al., (2016) who reported that healthcare providers in Pakistan lacked knowledge of the best options for preventing pre-eclampsia even in the presence of a national policy supporting pre-eclampsia programs [11].

Although the World health organization and many clinical care guidelines across the world recommend the use of low-dose aspirin for pre-eclampsia prevention in all at-risk cases, this study established that only 18% of the health workers in Mbarara and Bushenyi districts were prescribing low-dose aspirin to potential cases for prophylaxis. This low level of practice could be attributed to the fact that preventive interventions such as the use of low-dose aspirin are not included in the Uganda clinical care guidelines therefore health workers felt unsafe to practice what was not recognized by the Ministry of Health. This outcome is similar to that of Olaoye et al., (2019) who found gaps in the practice of prescribing low-dose aspirin to women at risk of pre-eclampsia in Nigeria. In addition, Olaoye et al., also observed low knowledge regarding the management of this disease among health workers in Nigeria which was attributed to lack of written clinical guidelines and refresher trainings [25]. These results are quite similar to those revealed by a survey done in the United States of America where it was found that only 48% of the obstetricians prescribed low-dose aspirin as per the recommendations of the American Council of Obstetricians and Gynaecologists [24]. Some of the factors noted to have influenced the knowledge and practice in their study included lack of familiarity with the guidelines, lack of knowledge of the risk assessment criteria, concerns about the effectiveness and safety of the drug and lack of education materials for patients.

However, the findings from our study differ from the results of a survey done in Brazil where 95% of the physicians prescribed low-dose aspirin to pregnant women at risk [26]. Comparing the maternal mortality ratios of Uganda and Brazil; 343 per 100,000 live births and 56 deaths per 100,000 live births respectively, it is clear that the practice of prescribing low-dose aspirin, proper counselling of women on drug adherence and lifestyle modification could help in reducing mortality and morbidity in low-income counties [16,26]. Based on these findings, it is very important to improve the knowledge and skills of health workers regarding pre-eclampsia prevention using low-dose aspirin through refresher trainings and dissemination of guidelines. It is also important to involve pregnant women in shared decision-making by providing them with clear and accurate information on the benefits and risks of adhering or not adhering to low-dose aspirin. By using these strategies, health workers can help reduce the incidence of pre-eclampsia and improve maternal and neonatal outcomes.

Other preventive interventions used by health workers

The preventive drugs that health care workers were using at the time included drugs like; methyldopa (24%), nifedipine (16%) and hydralazine (5%). However, the World health organization and the American College of Obstetricians and Gynaecologists recommend these drugs for treatment of severe hypertension in pre-eclampsia rather than prevention [8,18]. A significant number of participants mentioned magnesium sulphate (13%) as a preventive drug for pre-eclampsia though this drug is recommended for prevention of eclampsia and not pre-eclampsia [4]. Some health professionals in our study were using calcium supplements for pre-eclampsia prevention. This is supported by the recommendation by WHO in which calcium supplements are advised for pregnant women who live in areas with low calcium in the diet [8]. Some participants were using vitamin C in these cases though this drug had been evaluated in the national referral hospital of the same country and found to have no impact in preventing pre-eclampsia [21]. Health care professionals were also using vitamin E, vitamin B, zinc sulphate, folic acid, multivitamins, furosemide, diazepam, low molecular weight and heparin to prevent the disease. However, Lambert et al., (2014) in his comprehensive study of prevention and management of pre-eclampsia observed that nutritional supplements, diuretics and low molecular weight heparin were not effective in preventing pre-eclampsia [4]. It is important to note that 11% of the health workers were not using any drug to

prevent pre-eclampsia which could be explained by the perception of some of the participants who claimed that pre-eclampsia was not preventable or they probably lacked knowledge on the best drug option for pre-eclampsia prevention.

Health worker's knowledge on screening for pre-eclampsia high risk

Screening for pre-eclampsia is crucial to identify women who are at risk and provide them with preventive therapy. Therefore, health workers are required to have adequate knowledge in identifying these women using locally available or acceptable methods.

In this study, only about 30% of the participants knew how to screen for pre-eclampsia risk which implied that 70% of the health workers in Mbarara and Bushenyi districts could not identify a woman who is at risk which therefore increased the chances of these women being missed. This could be attributed to a lack of regular refresher training for health workers and could be overcome by fostering regular continuing professional education. This also could be attributed to the lack of screening protocols in antenatal units which can be overcome by incorporating a screening tool for pre-eclampsia on the antenatal cards. The results of this study are similar to the study done in Port Said hospitals in Cairo by Mohamed A. et al., (2013) who noted that health workers lacked knowledge of the risk factors that predispose women to pre-eclampsia and therefore could not ably screen out these women [27]. The results of this study are almost in agreement with those from a study done in Zanzibar where it was observed that nearly half of the health workers who worked in antenatal care clinics did not have adequate knowledge on screening and providing appropriate care to women at risk of pre-eclampsia [28]. The same study identified some factors that facilitated knowledge to include; working in a higher-level health facility, having received refresher trainings on pre-eclampsia, having vast experience of working in an antenatal care unit and being a medical doctor or assistant medical doctor. Screening pregnant women for pre-eclampsia is an important component of antenatal care that requires sufficient knowledge and skills. Therefore, health workers need to be regularly updated on current evidence and guidelines for pre-eclampsia screening and management to improve their performance.

STUDY LIMITATIONS

This study was conducted in only two districts of South-western Uganda. Therefore, the outcomes may not be representative of the national wide picture. Different regions and districts are likely to have different levels of knowledge about the prevention of pre-eclampsia which is not explored in this study. We included different cadres in our study, and this may have influenced our findings in terms of knowledge which we did not cater for in the analysis.

The study did not include very remote health facilities, where the level of knowledge could be even lower due to lack of exposure and continuous professional training compared to peri-urban areas. Having a sample size that includes health professionals from remote areas could have given a truer understanding of professionals' knowledge about the use of low-dose aspirin to prevent pre-eclampsia. The study was also limited in its scope and did not collect data from a wider area of South-western Uganda to give a broader perspective on knowledge about pre-eclampsia prevention.

Based on the above limitations, a nationwide study should be done in future to inform the Ministry of Health on the level of knowledge and practice of health professionals about the use of low-dose aspirin in preventing pre-eclampsia. Further studies could compare the knowledge levels of health professionals working in remote areas with those in urban or peri-urban settings. In addition, it is important that future studies focus on a particular cadre in the healthcare system to enhance consistency in the results.

RECOMMENDATIONS

The Ugandan Ministry of Health needs to conduct further studies to establish the feasibility of using low-dose aspirin in pre-eclampsia prevention amongst the local population so as to adopt this intervention in the Uganda clinical care guidelines.

We strongly advise every country to issue national clinical care guidelines that include routine screening of all pregnant women for risk of pre-eclampsia and initiation of low-dose aspirin to those found at risk. In addition, there is a need to consider pre-eclampsia as a dangerous condition contributing to high maternal mortality and thus be given adequate attention in the national health policies. This may be done by ensuring that health professionals are continuously trained and a screening protocol for pre-eclampsia integrated in the antenatal cards.

Lastly, we recommend that all developing countries identify their specific risk factors for pre-eclampsia and empower health workers with adequate knowledge in screening and prevention. It is also important to educate communities on basic information such as risk factors, signs and symptoms, complications, timely antenatal care and referral. The Village Health Teams (VHTs) could play a substantial role in encouraging pregnant women to seek early antenatal care.

CONCLUSION

The majority of the health professionals in Mbarara and Bushenyi districts (Uganda) had little knowledge on the concept of pre-eclampsia prevention. Very few of them knew that low-dose aspirin was the preferred medication for preventing pre-eclampsia, thus explaining why very few health professionals were prescribing it to their clients.

The prevalence of aspirin use was established at 18%, which was very low, and all other therapies used by healthcare providers to prevent pre-eclampsia were either ineffective or had no clinical impact.

This study noted that health care professionals in Mbarara and Bushenyi districts in South-western Uganda had low knowledge on the conditions that predispose pregnant women to pre-eclampsia and also knowledge on the screening criteria for this condition was very low.

DECLARATIONS

Ethics approval and consent to participate

The study was approved by the Research and Ethics Committee (REC) of Mbarara University of Science and Technology Ref. Number: MUREC 1/7 however, REC did not influence the outcomes of this study. An informed consent was obtained from the participants before taking part in the study. All methods were carried out in accordance with the guidelines and regulations stated in the Helsinki declaration.

Consent for publication

Not applicable.

Availability of data and materials

Data for this study is available from the corresponding author on request.

Conflict of interest

The authors declare no conflict of interest.

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AUTHOR'S CONTRIBUTIONS

Dr. Prisca Asiimwe, conceptualized study, collected data, analyzed data, interpreted data, prepared the main manuscript. Dr. Laura Brennaman, overseer of concept, selected appropriate methods, helped in data analysis and interpretation, reviewed the first version of the manuscript and gave constructive feedback. Dr. Diana Mbatudde, helped in; preparing the first version of the manuscript, organizing the tables and provided continued writing support. Dr. Justus Asasira, helped in; preparing the first version of the manuscript, editing, organizing the tables and provided continued writing support. All authors reviewed the manuscript.

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