Research Article ISSN 2639-9342

Gynecology & Reproductive Health

Effect of Training "Boda-boda" Riders on Community-Based Referrals for Maternal Outcome: A Case of Busoga Region, Uganda

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Received: 18 January 2021; **Accepted:** 03 February 2021

Citation: Muluya KM, Mugisha JF, Kithuka P, et al. Effect of Training "Boda-boda" Riders on Community-Based Referrals for Maternal Outcome: A Case of Busoga Region, Uganda. Gynecol Reprod Health. 2021; 5(1): 1-12.

ABSTRACT

Many pregnant mothers miss antenatal care attendance and health facility deliveries despite several interventions either due to knowledge gap on the benefits or lack of transport means to reach the health centre. Therefore, training of "boda-boda" (motor-cycle) riders in Busoga Region in Uganda was conducted to determine its effect on health facility-based deliveries.

The study was a non-randomized control trial with intervention and control groups from selected health centers and communities in Busoga Region. Interventions included the training of boda-boda riders for 5 days to give them knowledge; with a six months follow-up to determine the impact of training. Questionnaires, interviews and focus group discussions were used to collect quantitative and qualitative data. Descriptive statistical analysis was computed for the quantitative data and thematic analysis for qualitative data.

Findings revealed improved knowledge of boda-boda riders on maternal referrals from 49.1% to 79.0% in the intervention arm compared to 43.8% to 45.2% in the control arm. Use of boda-boda transport by mothers improved from 0% to 70.5% in the intervention arm compared to only 0% to 51.2% in the control arm. Also, of the 70.5% of the mothers who used boda-boda transport, 69.4% were transported by trained boda-boda riders and only 30.6% by un-trained boda-boda riders. Apart from age (p=0.000; CI=2.785 – 53.284) and ownership of the motorcycle (p=0.002; CI=0.992 – 8.658), the rest of the socio-demographic determinants of health facility-based deliveries were not statistically significant.

Age of boda-boda riders (25–34 years, p=0.000) and ownership of the play a pivotal role in the improvement of health facility-based deliveries. Training of boda-boda riders and other key stakeholders impacted on the community based maternal referrals in the study area.

Keywords

Training of boda-boda riders, Community-Based Referrals, Health Facility-Based Deliveries.

Introduction

Ideally, pregnant women would have access to evenly spaced visits from the first trimester, with components of care including infection screening, nutrition advice, health education on pregnancy, birth warning signs, and care of the new born. Several interventions have been in place to improve antenatal care (ANC) attendance and health facility deliveries. However, many pregnant mothers still miss out on this level of care. This is either because they have knowledge gap on the early birth warning signs or they have failed to get transport means to reach the health centre in time [1,2].

However, it is particularly difficult for mothers in rural areas to reach health centers [3]. As a result, many maternal and neonatal deaths occur at homes in villages, especially among the poor and the less educated mothers [4]. The available vehicles/motorcycle ambulances and other means of communication are not easily accessed by mothers/husbands/Village Health Teams (VHTs) at the time of maternal referral. This has equally contributed to the low number of deliveries in health centers. According to UBOS (2017), deliveries in health centers were at 52 percent which was low compared to 74 percent at the national level [5].

Generally, the uptake and utilization of motorcycle ambulances in rural communities in the Busoga Region of Uganda is still very low. One motorcycle ambulance is not enough for a sub-county. There is high degree of breakdown of the only available motorcycle ambulances, and with delayed repairs. Motorcycle ambulance riders are not also well motivated to transport mothers from community to health centers.

According to Muluya *et al.* (2019) who cited Ssebunya and Matovu (2016), trainings of VHTs, health workers, and political leaders among other stakeholders on Maternal Child Health (MCH) have been conducted in the past as a strategy to improve MCH but commercial motorcycle riders (locally known as boda-boda) who transport majority of rural mothers from community to health facilities have often been excluded in such trainings. Motorcycle (boda-boda) riders therefore lack knowledge on MCH [2]. According to Raynor (2014), a boda-boda rider is an operator of the motorcycle (boda-boda) with the core value of transporting people including the pregnant mothers. However, the transportation of pregnant mothers to health centres was missed out due to lack of knowledge by the boda-boda riders [2].

Therefore, this study explored the effect of training commercial boda-boda riders to support community-based referrals on maternal outcomes in the selected districts of Busoga Region, Uganda, as an alternative to better the health care system specifically in rural areas to enable expectant mothers reach health facilities in time to deliver. The specific objectives of the study were:

1) To find out whether mothers use the trained boda-boda riders for transport to health centres.
2) To find out the socio-demographic determinants for boda-boda riders to transport mothers to health centres.
3) To determine the socio-demographic factors that predicts deliveries at health centres.
4) To establish the effect of knowledge gained by the boda-boda riders on deliveries at health centres.
5) To determine the fundamental areas of knowledge that predicts the maternal outcome.

Methods and Materials

Research Design

The study used an open 2-arm cluster non-randomized control trial study design; with an intervention and control group from the selected sub counties where some health centers and communities, as the units of non-randomization were selected. Non-randomized trials are interventional study designs which compare a group where an intervention was performed with a group where there was no intervention [6]. This is a prospective study design which puts examines the relationship between the intervention and the outcome [6]. In such a study design, an investigation for outcomes is conducted from the baseline measures and follow up to the study exit in the intervention arm in comparison with the control arm [7]. The study intervention took place for a period of six months.

Study setting

This study was conducted in Busoga Region in Uganda with a population of approximately 5.5 million people according to UBOS and ICF (2017); in the districts of Iganga and Bugiri with a population projected at 1,051,102 people [5]. Specifically, the study was conducted in the sub counties of Nabitende, Nambale, Nawandala and Budaya as the intervention arm where motorcycle ambulances partially operated and where the local motorcycle (boda-boda) groups were mobilised with the aim of having additional means of transport used in referring mothers for further management at the different levels of health facilities. Some sub counties where there was no intervention (control arm) included; Ibulanku, Makuutu and Nawaningi in Iganga district and Nabukalu in Bugiri district. The total populations of sub counties in the intervention and control arms were 158,952 and 129,639 respectively. The study setting covers about 10,000 square kilometers with latitude $00^{0}\ 45^{I}\ 00^{II}$ N and longitude $33^{0}\ 30^{I}\ 00^{II}$E.

Study Population

The main study population consisted of boda-boda riders and pregnant mothers who were in their third trimester in Busoga Region, Uganda.

Sample size selection

Sample selection was derived from a total of 2,231 boda-boda riders according to the boda-boda associations' data (2017) in Iganga and Bugiri districts. The investigators critically assessed the role of boda-boda riders in transporting mothers to the health centers.

Another key category of study participants included expectant mothers whose population was estimated at 14,430 in both the intervention and control arms according to the [8] projection. The investigators aimed at improvement in the utilization of health centres and skilled deliveries.

Upon reaching the health facility with a mother, a motorcycle/ boda-boda rider with the guidance of a health worker filled a form, which the health worker filed and kept at the facility thereafter. 138 health workers in the intervention arm and 112 health workers in the control arm at the different health facilities [9] (un-published data at DHO's office) were also involved in the study. Their role was to conduct health education and selection of eligible mothers for the study during the mothers' ANC visits. They worked in liaison with the VHTs (through telecommunication) to ensure

preparedness at the health facilities by the time boda-boda riders brought mothers to the facilities for delivery and/or other pregnancy related complications. They also helped in the filing of the boda-boda forms when mothers were transported to the health facility.

Recruitment process of boda-boda riders for the training

The recruitment process involved identifying the different boda-boda stages in the different sub counties. Through their stage chairpersons and LCI leaders, boda-boda riders were mobilized for meetings during which they accepted to participate in the training. Consent forms were signed for acceptance of active participation in the study for the 6 months. A total of 100 boda-boda riders were recruited for the training. However, health workers (midwives and VHTs) were also recruited for experience sharing during the time of training.

Training of boda-boda riders to improve community-based referrals

Training of boda-boda riders was one of the channels for the riders to attain knowledge or information for the better management of community referrals. As earlier stated, the study started with community engagement to mobilize and recruit the participants for the training. The boda-boda riders were the key participants for this training. However, other stakeholders (VHTs and the midwives) were invited to the training for experience sharing. Self-introduction of all training participants in order to build rapport was done during training. In the control arm, boda-boda riders, midwives and VHTs were not trained at all.

Training of boda-boda riders on community based referrals took 5 days. Training sessions were conducted at the sub county headquarters. The national training manual/module guide of the ministry of health in line with referral of clients/mothers was used. Key topics of the training were; innovation, communication and technology (the closed caller user group and its mode of operation), fleet management and referral systems, the roles of stakeholders (mothers, boda-boda riders, midwives and VHTs) and prevention and basic management of emergencies. Pre and post training assessment was done to find out if there was knowledge attained amongst the participants.

During the training, the boda-boda riders, midwives and VHTs were tasked to start sensitizing and transporting pregnant mothers to health centres in the four sub counties. Trainers emphasized the rationale for working with boda-boda riders in the struggle to reduce the number of mothers who deliver at home and encouraged the use of boda-boda (commercial motorcycles) as means of transport to go to health facilities during ANC and delivery.

Recruitment process of mothers benefiting from boda-boda transport

Pregnant mothers often visit health centres for ANC services. This is expected from the time of conception. Mothers are expected to have at least 8 visits for the whole gestation period. The study targeted mothers who were approximately 7 – 9 months pregnant for the training. Mothers were randomly selected from the ANC register on their visit in the third trimester. Mothers did not miss out on other ANC services. The services provided on the first visit include; infection screening (HIV and syphilis), nutrition advice (folic acid and other vitamins), health education on pregnancy and birth warning signs and care of the new born amongst others.

The sample size calculation for the pregnant mothers was determined by the formula;

$$n = \frac{2(Z\alpha + Z\beta)^2 P(1-P)}{(P1-P2)^2}$$

From the formula $n = \frac{2(1.96 + 1.28)^2 \times 0.476\ (1-0.524)}{(0.406\ -0.546)^2}$

Therefore, for both groups, the sample size is 534.

Research Instruments

Making a choice among the different data collection tools involves considering their appropriateness and relative strengths and weaknesses. In this study, a combination of tools was used, that is; questionnaires, interview guide and check list. These tools were designed using the key study themes/objectives. There were also other secondary tools which provided data namely; different registers at health facilities and other health management information tools at the district offices.

Data Analysis

Data analysis of descriptive statistics (frequencies, means and standard deviations) was computed using STATA *version* 14 for the quantitative data. The *p*-value set at 0.05 was used to determine the statistical significance of the associations between independent and dependent variables at 95 percent confidence intervals. Difference-in-difference (DID) was used to determine the change effect of training boda-boda riders.

Logistic regression model was also used. A statistically significant relationship ($p < 0.05$) between multi variables prompted the use of logistic regression model to identify the determinants of community-based referral. It derived regression coefficients and p-values which were used to determine which variables impacted on the topic of study. The process of performing regression helped to determine the variables/factors which mattered most, ones ignored and those which affected other variables/factors.

Qualitative data was analysed using a computer based qualitative data analysis software atlas Ti *version* 7. At this stage, the process of analysing data was focused on in-depth analysis of each of the main categories obtained during the key informant interviews, in-depth interviews and focus group discussions. At first, thematic analysis was done for the qualitative data generated by a master sheet analysis tool. The themes were extracted from the conceptual framework. Also, sub themes based on the study objectives were formed to ease cleaning and coding of statements of respondents. Relevant quotations were identified and used to

support each theme/sub theme during the reporting process. To be able to describe the range of the community referral system and motorcycle/boda-boda riders' effect on maternal outcomes, each category was considered for further assignment into subcategories. Using these subcategories gave more insight into the details of the activities in each category. With the use of the subcategories, the data could be described in more detail.

Verifying of the qualitative data is required which involves checking the credibility of the information gathered using a method called triangulation. Triangulation involves using multiple perspectives to interpret a single set of information. This study used triangulation to examine the social and cultural perspectives of uptake of the boda-boda riders as a means of transport to the health facilities for pregnant mothers and its implications on health seeking behaviors. It required the researchers to interview at least three groups of participants: pregnant mothers, health workers and the boda-boda riders. When each participant said the same thing in the interviews, then the information that resulted was considered valid. The transcripts from FGDs, IDIs and KIIs were sorted and analyzed into themes and emerging sub themes which were considered in report writing.

Results and Interpretation

Use of boda-boda transport as a means of referral of mothers to health centers

Means of transport from community to a health centre and between different health centres at the time of referral is a major concern. Locally available boda-boda riders have been thought of as important in enabling mothers to reach health facilities. Initially, boda-boda riders were transporting pregnant mothers for commercial reasons, though their importance in rescuing mothers and babies was not recognised. This study was intended to integrate services of the locally available boda-boda riders in the management of the maternal child health services; specifically in the area of maternal referral.

For the current pregnancy, mothers were asked whether they used boda-boda for transport to the health centres to deliver. None of the respondents in both arms (intervention and control) during the pre-intervention phase had used the boda-boda riders for transport to health centers. However, mothers who had pregnancy related complications, were advised to go to health centers for management. The reason for the lack of mothers using the boda-boda riders before the intervention was that the there was no reason for going to the health center since the pregnancy was at its early stage. In this case most mothers were recruited at 29 weeks of fetal development (7 months).

"There is no reason for me to spend money for transport going to the health centre when I am not having any problem with my pregnancy"... one of the mothers said during an in-depth interview.

In the intervention arm, there was a drastic increase in reports of mothers who used boda-boda transport and delivered from health facilities, from 0.0% in the pre intervention phase to 70.5% in the post intervention phase. In the control arm, mothers registered for using boda-boda transport and delivering from the health facility rose from 0.0% in the pre intervention phase to only 51.2% in the post intervention phase.

Similarly, it was necessary to know the average value of health facility deliveries to determine the change effect or impact in the control and intervention arm as a result of training boda-boda riders to transport mothers to health centers to deliver. Basing on the difference-in-difference (DID) model, there was an improvement in the health facility based deliveries according to the average value of 0.314. This was as a result of training boda-boda riders who transported mothers when in labour to health centers. The improvement in health facility based deliveries was statistically significantly associated with the change effect (p=0.000).

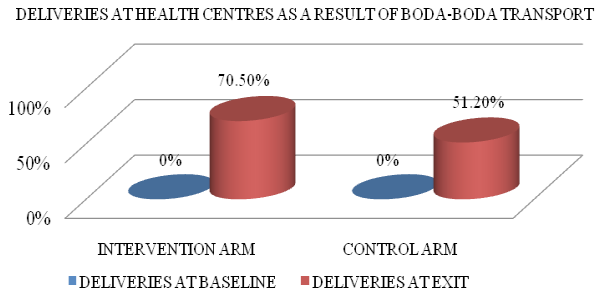

Figure 1: Deliveries at health centres as a result of boda-boda transport.

Further, the study sought to find out whether mothers who delivered from health centres were transported by trained or un-trained boda-boda riders. This was investigated only in the intervention arm where the training of boda-boda riders took place. Results indicated that more of the mothers who delivered from the health centres were transported by trained boda-boda riders as shown in figure 2.

There was a drastic increase in reports of mothers who delivered from health facilities and were transported by trained boda-boda riders from 0.0% in the pre intervention phase to 69.4% in the post intervention phase. However, there were a small number of mothers transported by un-trained boda-boda riders to health centers to deliver. It increased from 0.0% in the pre intervention phase to 30.6% in the post intervention phase as shown in figure 2.

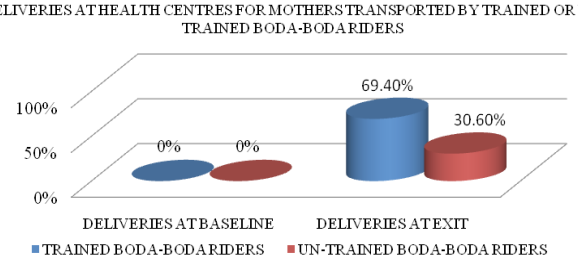

Figure 2: Deliveries at HCs as a result of transport by trained or un-trained boda-boda riders.

Determinants for boda-boda riders to transport mothers to health centers to deliver

Considering results in table 1, determinants for boda-boda riders to transport mothers to health centers when in labour included; age, marital status, level of education, level of income, religion and ownership of motorcycle. These were analyzed using the logistic regression model to determine their relationship with referral processes and delivery at health centers.

The results indicated that 19.0% of the boda-boda riders recruited in the intervention arm were not married and the rest (81.0%) were married as reflected in table 1. In the control arm, 16.3% of the boda-boda riders were not married and 83.7% were married. On regression analysis, marital status had no statistically significant influence on health facility based deliveries.

However, some boda-boda riders who were married shared their experiences and the reasons for having a role in the transportation of mothers to health centers to deliver. In an FGD conducted with the boda-boda riders and mothers, it was noted that boda-boda riders referred to themselves as mature people and were knowledgeable about what mothers experience during pregnancy.

"…We have been missing movers in the management of mothers and more so those in labour. As a married man with three children, I have seen my wife hassle with pain. Therefore, I am going to help mothers whenever contacted."

Of the 100 boda-boda riders administered with questionnaires during the time of training in the intervention arm, 2.0% were below 18 years, 33.0% were between 18 – 24 years and 57.0% between 25 – 34 years and 8.0% were above 35 years as shown in table 1. In the control arm, none of the boda-boda riders was below 18 years. However, 20.7% were between 18 – 24 years, 68.5% between 25 – 34 years and 10.8% were 35 years and above. This implied that majority of the boda-boda riders were between 25 – 34 years in both the intervention and control arms.

The age of boda-boda riders was statistically significant and influenced health facility-based deliveries as seen in table 1. Boda-boda riders who were in the age group of 25 – 34 years had a statistically significant influence on maternal outcomes (p=0.001). Mothers exposed to boda-boda riders who were between the ages of 25 – 34 years were 2.021 times more likely to deliver from health centers compared to other age groups (p=0.001 and CI = 1.388 – 2.989).

In one of the in-depth interviews with boda-boda riders, one rider attached his role in helping mothers to his age. He said (respondent 43, 2019).

"…I am 32 years of age. I am in a better position to understand what mothers go through and initially I was transporting them though not very serious. I am now conscious after the sensitization and training that I will be responding in time when contacted by a mother and this will show my maturity."

Education level determines the ability of boda-boda riders having knowledge of how to read and write and communicate to mothers and health workers. Majority of boda-boda riders attained primary level of education and below both in the intervention and control arms (61.0% and 54.3% respectively). Only 2.0% attained higher education levels in the intervention arm and none in the control arm, and the rest (37.0%) attained secondary level in the intervention arm and 45.7% in the control arm.

The education level of boda-boda riders was statistically significant and influenced deliveries in health facilities. Both primary and secondary levels of education of the boda-boda riders had statistically significant association with health facility based deliveries. Mothers transported by boda-boda riders who had reached secondary level of education were 1.442 times more likely to deliver from health facilities compared to other levels of education (p=0.000 and CI=0.985 – 4.067).

Interestingly, this was not the case in an in-depth interview with one of the boda-boda riders. He refuted being bothered with the work of transporting people due to lack of higher level qualifications.

"…I stopped in primary five. I am not affected at all with my level of education in the transportation of mothers." A boda-boda rider (respondent 41, 2019) stated.

Other boda-boda riders attributed the improvement in facility-based deliveries to knowledge attained during their training which they opted to share with their counterparts.

"…By the fact that you trained us, we have continuously encouraged fellow boda-boda riders to help mothers get transported to health centres to deliver…" stage chairperson of boda-boda riders (respondent 9, 2019) in an intervention sub county stated during a key informant interview.

Concerning religion, 29 percent of the boda-boda riders in this study were Catholics, 33 percent were Protestants, 35 percent were Moslems and 3 percent were of other religions. Other religions included; born again, Jehovah's Witness and seventh day Adventists. In the control arm, 27.2% were Catholics, 53.2% were Protestants, 10.9% were Moslems and the rest belonged to other religions. On regression analysis, health facility based deliveries were not statistically significantly influenced by religion (p=0.211).

Only 42.0% of the boda-boda riders in the intervention arm had low income (could not afford all the basic needs) compared to 53.0% of them with middle income (could afford the basic needs). The rest of the boda-boda riders were of high income (could afford the basic needs and were able to help others with the basic needs). The low income earners being boda-boda riders who could not access basic needs such as food, shelter, clean and safe drinking water, and in the interest of this study, those who could not afford buying the motorcycles. In the control arm, 58.7% of the boda-boda riders

were of low income level, 38.0% middle level and 3.3% high level of income. Similarly, the income level of boda-boda riders had no significant influence on deliveries at health facilities.

"...Like mothers, we boda-boda riders do not have money. Instead, we have good Samaritans giving us motorcycles to engage in boda-boda transport. Many of us owning motorcycles are for loans." One boda-boda stage chairperson narrated in a key informant interview (respondent 9, 2019).

Exactly 54 percent of the boda-boda riders owned the motorcycles and only 46 percent of them were using other people's motorcycles in the intervention arm. Most of the boda-boda riders owned motorcycles with loans of which their capability to clear the loans was questionable. In the control arm, 42.4% had their own motorcycles while 57.6% were riding other people's motorcycles.

Ownership of the motorcycle had a statistically significant influence on the health facility based deliveries. Mothers who got in contact with boda-boda riders who owned the motorcycles were 1.274 times more likely to deliver from health center's compared to when boda-boda riders did not own motorcycles (p=0.002; CI =0.872 – 3.094). Boda-boda riders were encouraged to work hard and own motorcycles.

"...Most riders don't own motorcycles. The owners of the motorcycles want the money paid immediately; it becomes very difficult for mothers who do not possess money at the time." This was a boda-boda rider at Buzaya stage during an FGD. He continued; *"...Many times women and their families cannot or do not pay, even after taking them to the health facility. In such situations, it needs when the motorcycle belongs to you."*

Socio-demographics as predictors for deliveries at health centers

On further regression analysis to determine the predictors for maternal referral, ages of boda-boda riders between 25 – 34 years were statistically significant and influenced health facility-based deliveries. Mothers who contacted boda-boda riders of that age group were 11.351 times more likely to deliver from health centers compared to other age groups (p=0.000; CI=2.785 – 53.284).

Like age, ownership of the motorcycles by the boda-boda riders statistically significantly influenced health facility based deliveries. Boda-boda riders who had their personal motorcycles statistically influenced deliveries at health centers. Mothers who contacted boda-boda riders having personal motorcycles were 3.549 times more likely to deliver from health centers compared to those who had motorcycles of other people (p=0.002; CI=0.992 – 8.658).

Knowledge attained by boda-boda riders during training to improve community-based referrals

Another assessment of the knowledge level was performed on the boda-boda riders before and after training. Boda-boda riders were subjected to pre and post training assessment to find out if there was knowledge attained amongst them. Four fundamental areas

Table 1: Determinants for boda-boda riders on health facility-based deliveries.

Variables	Intervention N = 100 (%)	Control N = 92 (%)	OR (95% CI)	P-value
Age				
<18 yrs	2 (2.0)	0 (0.0)	-	
18 – 24	33 (33.0)	19 (20.7)	*1*	
25 – 34	57 (57.0)	63 (68.5)	2.021 (1.388 – 2.989)	0.001
35 and above	8 (8.0)	10 (10.8)	*1*	
Level of education				
≤ Primary	61(61.0)	50 (54.3)	0.875 (0.662 – 1.237)	0.007
Secondary	37 (37.0)	42 (45.7)	1.422 (0.985 – 4.067)	0.000
Tertiary	2 (2.0)	0 (0.0)	*1*	
Level of income				
Low	42 (42.0)	54 (58.7)	*1*	
Middle	53 (53.0)	35 (38.0)	0.224 (0.083 – 0.697)	0.055
High	5 (5.0)	3 (3.3)	-	
Marital status				
Not-married	19 (19.0)	15 (16.3)	*1*	
Married	81(81.0)	77 (83.7)	3.426 (1.685 – 6.933)	0.102
Religion				
Catholic	29 (29.0)	25 (27.2)	*1*	
Protestant	33 (33.0)	49 (53.2)	0.772 (0.336 – 1.438)	0.067
Moslem	35 (35.0)	10 (10.9)	0.375 (0.228 – 0.919)	0.066
Others	3 (3.0)	8 (8.7)	-	
Ownership of the motorcycle				
Personal	54 (54.0)	39 (42.4)	1.274 (0.872 – 3.094)	0.002
For another person	46 (46.0)	53 (57.6)	*1*	

Note: the italic *1* in the OR is the controlled variable used / result of reference.

Table 2: Socio-demographic factors of boda-boda riders as predictors for deliveries at health centres.

Predictive variable	OR (95% CI)	P-value
Category		
Control	*1*	
Intervention	1.128 (0.133, 7.497)	**0.003**
Age		
<18 yrs	-	
18 – 24	*1*	
25 – 34	11.351 (2.785 – 53.284)	0.000
35 and above	*1*	
Level of education		
≤ Primary	0.225 (0.098 – 1.130)	0.051
Secondary	1.093 (0.546 – 4.437)	0.063
Tertiary	*1*	
Ownership of the motorcycle		
Personal	3.549 (0.992 – 8.658)	0.002
For another person	*1*	

Note: the italic *1* in the OR is the controlled variable used.

Table 3: Boda-boda riders' knowledge assessment on community-based referral.

			Interv. arm	Control arm		
Variables (Fundamentals)	**Questions**		**Pre (posttest) N=100**	**Pre (posttest) N=92**	**DID**	**P-value**
Innovation, communication and technology (CUG).	Do you have knowledge on mama-boda transport connect (**True**)		51% (100%)	14% (25%)	0.195	0.773
Fleet management & Referral systems.	Only vehicle transport mothers (**True**)		45% (4%)	51% (49%)	0.315	**0.000**
	No calling boda when in labour (**True**)		62% (2%)	53% (57%)		
	Community Maternal Referral is the transport of mothers to health centres (**True**)		42% (92%)	55% (53%)		
The roles of the different stake holders (Riders, HWs and VHTs).	Boda riders transport healthy people (**True**)		43% (2%)	44% (46%)	0.294	**0.043**
	Boda-boda riders encourage mothers to save money (**True**)		45% (88%)	34% (40%)		
Prevention and basic management of emergencies.	Bleeding mothers do not sit on boda (**True**)		63% (10%)	56% (54%)	-0.081	0.561
	Pregnancy signs and symptoms (**True**)	Vaginal bleeding	35% (94%)	29% (41%)		
		Long hair	28% (0%)	20% (18%)		
		Red eyes	53% (12%)	52% (49%)		

were considered to test the knowledge of boda-boda riders. These included; innovation, communication and technology (CUG), fleet management and referral systems, the roles of the different stake holders (mothers, boda-boda riders, midwives and VHTs) and prevention and basic management of emergencies. In the control arm, the level of knowledge of boda-boda riders in the pre and post training assessment had no much difference. The average mark of the 92 participants in the control arm was 43.8% in the pre training assessment and 45.2% in the post training assessment. In the intervention arm, the average mark of the 100 participants (boda-boda riders) in the pre-test was 49.1% and 79.0% in the post test. It was reflected that all the boda-boda riders attained knowledge after their training on the different fundamental areas in the intervention arm.

"…What we have learnt today is very important and I am committed to participating in this study to save mothers, even if it means taking them to the health facility on credit and they pay later." One of the participants stated in an interview immediately after the training.

The common questions which were asked in the pre and post training assessments are shown in table 3, these required answering either true or false and each correct answer carried a mark. Therefore, all correct answers carried ten marks and depending on what each person scored, they were marked out of ten. DID model was used to determine the change effect of each fundamental area according to the average value as shown table 3.

Effect of knowledge attained by boda-boda riders during training on maternal outcome (deliveries at health centers)

In this case, deliveries in health facilities were expected to improve as a result of knowledge attained by the boda-boda riders. Knowledge attained was based on four fundamental areas with different guiding questions and used to establish the aspects associated with interaction between the pregnant mothers and the boda-boda riders.

From the results in table 4, knowledge attained by the boda-boda riders had a statistical significant association with deliveries at health facilities. Pregnant mothers who were transported by the

boda-boda riders as a result of the knowledge attained during the training, were 5.373 times more likely to deliver from a health centre compared to mothers who were not transported by trained boda-boda riders (p=0.000; CI=0.189 – 3.626). The more pregnant mothers continued to be transported by trained boda-boda riders who attained knowledge on MCH, the more it impacted on deliveries at the health facilities.

Looking at specific fundamental areas, there was no statistical significant computation of knowledge attained by the boda-boda riders on innovation, communication and technology, as the study was interested in determining the knowledge on the availability of mama – boda-boda transport connects and an improvement in the health facility based deliveries in the intervention area. There was no association and significance at all after the logistic regression analysis.

On fleet management and referral systems, boda-boda riders differently understood which transport means pregnant mothers use to go to health centers. Some thought only vehicles are used to transport pregnant mothers. However, after the training, majority of the boda-boda riders noticed that other than vehicles, mothers can be transported using other means of transport to health centers. Results in table 4 indicate a significant effect of vehicle use as the only means of transport for mothers to deliver at health centers. Pregnant mothers who were transported by boda-boda riders who thought that only vehicles can transport pregnant mothers, were 1.891 times more likely to deliver from a health center compared to boda-boda riders with different ideology (p=0.000; CI=1.051 – 3.401). As mothers got exposed to boda-boda riders who had the mentality that it is a vehicle that transports a pregnant mother to the health facility, the more deliveries were experienced at health centers. In an in-depth interview with a boda-boda rider in the intervention arm, it was different. A boda-boda rider (respondent 36, 2019) said.

"...For my case, I have been already transporting mothers using my motorcycle. As a fact, I will continue transporting mothers using my motorcycle. I know the importance of taking them to health centres."

Majority of boda-boda riders understood after the training that mothers are supposed to call them when labour starts. They were urged to respond very fast as soon as they received the calls. However, there was a possibility that mothers can as well fail to call boda-boda riders. This was evident during the assessment of boda-boda riders. Some boda-boda riders believed that it was correct for mothers not to call boda-boda riders when in labour and it had a significant effect on health facility based deliveries. Pregnant mothers who were transported by boda-boda riders who thought mothers could not call them for transport to health centers when in labour, were 8.176 times more likely to deliver from health centers (p=0.000; CI=3.637 – 18.377). During the baseline interview with one of the boda-boda riders (respondent 32, 2019), he said.

"...A mother in labour is delicate. I fear to transport her on my boda-boda. Anything can happen on the way yet I cannot do anything."

However, after the training, many boda-boda riders became interested in transporting mothers even when they were experiencing labour pains. Interestingly, when the same person was interviewed in the post intervention phase after their training, the rider seemed knowledgeable.

"...Thank you for the training. I did not know that I'm very important in transporting mothers to health centers and saving their lives. This is a rural village with mothers who need to be helped. I can say I am fully available to transport mothers when they contact me for transport."

Majority of boda-boda riders knew that community referral involves transfer of mothers from their homes to health centers. However, it had no statistical significant effect on health facility based deliveries (p=0.767). According to the KII with one of the maternity in-charges (respondent 30, 2019) in a health center III said.

"...Many mothers are being transported by boda-boda riders to this facility. Very few mothers come to the health center without boda-boda means. This has drastically changed ever since boda-boda riders had training. This implies boda-boda riders and mothers have embraced the community referral mechanism."

On the roles of different stakeholders including boda-boda riders, the study wanted to find out if it is only healthy people who are transported by boda-boda riders. It was not necessary for boda-boda riders to transport only healthy people but also mothers with pregnancy related challenges. Interestingly, boda-boda riders transporting only healthy people had a significant effect on deliveries at health centers. Pregnant mothers who were transported by boda-boda riders who believed they transport only healthy people, were 0.245 times more likely to deliver from health centers (p=0.511; CI=0.160 – 0.376). Transportation of only healthy people was protective to pregnant mothers to deliver from health centers. There was no statistically significant effect of knowledge gained by the boda-boda riders and this was evident with the information in the in-depth interview with one of the boda-boda riders in the intervention arm (respondent 39, 2019).

"...But why transport only a healthy person to the health Centre? It has never happened to me. I'm always transporting sick people and pregnant mothers who are in labour to the health centers."

However, he confessed that in the past boda-boda riders were charging patients highly when they wanted their services.

"...I thought the sick people disturb a lot. You do not ride very fast. Secondly, majority will want to have an attendant. This contributes to the consumption of a lot of fuel. But the training we took has greatly changed my thinking."

Boda-boda riders were encouraging mothers to save money for transport and other supplies. It had a statistical significant effect on health facility based deliveries (p=0.001). However, in the entry meetings and recruitment periods, mothers were encouraged to save money for transport fares. This was also encouraged during antenatal care in the health centers.

"…When mothers save money in the boxes, it is good for both of us. That is what they use to pay us. Since riders will be expecting their pay, they will easily run to these mothers when contacted for transport to health centres." One of the boda-boda riders (respondent 40, 2019) said during an in-depth interview in the intervention arm.

On the prevention and basic management of emergencies, bleeding of a pregnant mother calls for urgent attention since it is a pregnancy complication. Interestingly, bleeding of pregnant mothers and their being unable to sit on a boda-boda had statistical significant effect on the health facility based deliveries. Pregnant mothers who were transported by boda-boda riders that thought bleeding mothers cannot sit on a boda-boda, were 2.432 times more likely to deliver from health centers (p=0.003; CI=1.419 – 4.168). This implied that the more the mothers were transported by boda-boda riders with such knowledge, the more deliveries were registered at health centers. However, boda-boda riders did not have any serious challenges in transporting bleeding mothers.

"…A pregnant mother will bleed when she wants to give birth. Maybe when she is not due, the mother has fears for a miscarriage. It is thought by most of us (boda-boda riders) that such mothers cannot sit on boda-boda because the baby may come out unknowingly. Usually, mothers will find means of reaching the hospital. However, very many of the mothers have sat on my motorcycle for transport to the health centre. They cannot access any other means in the rural villages." This was during an in-depth interview with one of the boda-boda riders (respondent 38, 2019) in the intervention arm.

Interestingly, at the end of the training of boda-boda riders, they were able to differentiate the signs and symptoms of pregnancy complications. Vaginal bleeding of mothers was realized by the riders to be one of the signs and symptoms of pregnancy which prompt mothers to go to health centers to deliver. However, statistically, it had no significant association with health facility based deliveries (p=0.800). During the training and post-test assessments, long hair and red eyes were identified not to be signs and symptoms of pregnancy complications. On logistic regression analysis, statistical significant values were not computed. Red eyes had no effect as well on deliveries at health centers.

"…There are very many signs and symptoms mothers face. Next to pressure [hypertension] is vaginal bleeding. Initially, we had no knowledge on this. The training we went through was very important. I am willingly helping mothers to avoid further complications." One of the boda-boda riders (respondent 38, 2019) said during an in-depth interview at the end of the study.

Fundamental areas of Knowledge as predictors of maternal outcome

The effect of knowledge attained during training by boda-boda riders on the use of motorcycles for maternal referrals to improve health facility based deliveries was established using a multiple regression analysis. The points of significance were determined at 0.05 level of acceptable error.

Table 5 shows that there was strong significant effect of knowledge attained by boda-boda riders on health facility based deliveries as a result of training boda-boda riders. By implication, knowledge attained by boda-boda riders explained that pregnant mothers were 1.192 times more likely to deliver from health centers (p=0.000; CI=0.944 – 3.003). Knowledge attained during training by the boda-boda riders statistically significantly predicted deliveries in health facilities as a result of use of boda-boda transport for maternal referrals by mothers.

Table 5 indicates how each of the fundamental areas of knowledge predicted community-based referral and specifically the maternal outcome in Busoga Region. Generally, of all the fundamental areas of knowledge attained by the boda-boda riders, only roles of different stakeholders had statistical significant effect on maternal

Table 4: Effect of knowledge attained by boda-boda riders on health facility-based deliveries.

Variables	Questions		OR (95% CI)	P-value
	Control Intervention		*1* 5.373 (0.189, 3.626)	**0.000**
Innovation, communication and technology (CUG).	Do you have knowledge on mama-boda transport connect (**True**)		-	-
Fleet management & Referral systems.	Only vehicle transport mothers (**True**)		*1*	
	No calling boda when in labour (**True**)		8.176 (3.637, 18.377)	**0.000**
	CMR is the transport of mothers to HCs (**True**)		2.952 (1.650, 5.282)	**0.037**
The roles of the different stake holders (Riders, HWs and VHTs).	Boda riders transport healthy people (**True**)		*1*	
	Boda encourage mothers to save money (**True**)		1.391 (0.831, 2.329)	**0.001**
Prevention and basic management of emergencies.	Bleeding mothers do not sit on boda (**True**)		2.432 (1.419, 4.168)	0.103
	Pregnancy signs and symptoms (**True**)	Vaginal bleeding	8.176 (3.637, 18.377)	0.800
		Long hair	*1*	-
		Red eyes	1.891 (1.051, 3.401)	0.711

Table 5: Predictors of the knowledge attained by boda-boda riders on deliveries at HCs.

Variables		OR (95% CI)	P-Value
Category	Control	*1*	**0.000**
	Intervention	1.192(0.944, 3.003)	
Fleet management and referral systems	Only vehicle transport mothers	*1*	0.680
	No calling boda-boda when in labour	-	
	CMR is the transport of mothers to HCs	0.801(0.278, 2.307)	
The roles of the different stake holders (Riders, HWs and VHTs)	Boda-boda riders transport healthy people	*1*	**0.022**
	Boda-bodas encourage mothers to save money	1.202 (0.042,2.966)	

outcome (health facility based deliveries) as a result of training boda-boda riders to transport pregnant mothers ($p<0.05$) as seen in table 5.

Discussion

Some of the socio-demographic characteristics of the boda-boda riders did not influence deliveries in health centres. These include; religion, education, level of income and marital status ($p>0.05$). It was not different from the eastern study by Ssebunya and Matovu (2016). Here, religion, education, income and marital status of motorcycle ambulance riders did not influence transportation of mothers to health centres. Interestingly, the same socio-demographic characteristics of locally known boda-boda riders did not influence deliveries at health centres.

Literate people tend to pay immediate attention to issues which relate to saving lives. The purpose of education level in this study is that boda-boda riders who are educated are in position to read and write. Hence, given any piece of information, they can read, internalize and follow advice or precautions for better maternal health outcomes. Communication is also very easy to make when dealing with boda-boda riders and women who are literate since English becomes the primary channel of communication. Majority of boda-boda riders attained primary level of education. In line with Moindi *et al.* (2016) and Mazalale (2015) who concurred that higher levels of education were associated with health facility based deliveries; the Busoga Region study revealed that majority of boda-boda riders had attained none or primary level of education, thus, were semi-literate, and did not predict deliveries at health centres. Therefore, it can be argued that for better outcome, majority of boda-boda riders must have achieved higher education levels.

In this case, the training of boda-boda riders was important in creating awareness about the intensity of care required by pregnant mothers. The study established that through training, boda-boda riders are capable of paying immediate attention. The study indicates that following training, boda-boda riders were in position to know some of the signs which require immediate attention to pregnant mothers and such signs included bleeding and general health complications. Other studies have also been used to concretise the relevance of training boda-boda riders to enhance maternal outcomes. Training was necessary for the boda-boda riders who the Busoga Region study found to be semi-literate.

Despite of the importance of training, not much literature was discovered in support of training boda-boda riders on maternal health [10]. Observed that due to lack of adequate information on maternal health, a lot needed to be spread to different stakeholders including boda-boda riders. Patel and others' assertion is that the only solution to the spread of information on maternal health is through training/health education programs to the motorcycle (boda-boda) riders and other key stakeholders in the referral system. The Hunger Project (2017) in Ghana in partnership with the Ghana Health Service (GHS) conducted training of Community Health Nurses (CHN) as midwife assistants in form of workshops, mentorships and coaching for them to have enough information to give mothers, for them to also be able to record properly in registers and report in time. Accordingly, some training interventions of community health workers have yielded results [11]. In eastern Uganda, community health workers' knowledge of MNH improved from 41.3% to 77.4% after training and to 79.9% one year later [11].

However, not much information is directly addressing boda-boda transport and maternal health. Little or nothing was said about training of boda-boda riders. Yet they are the commonest and most available means of transport. This study therefore focused on training the boda-boda riders and orientation of health workers to deliver information to expectant mothers with the aim of having mothers deliver in health centres to reduce on the maternal and infant mortality. In this very study, the knowledge level of boda-boda riders improved from 49.1% to 79.0% after the training and deliveries increased to 70.5 percent in the intervention arm compared to 51.2 percent in the control arm.

Age of boda-boda riders was significantly associated with the maternal outcome (health facility based deliveries) for this study ($p<0.05$). Boda-boda riders at the age of 25 – 34 years were very instrumental in the transportation of mothers to health centres to deliver, with statistical evidence. However, the findings of other studies regarding age group of riders did not concur with the Busoga Region study, apart from Ssebunya and Matovu (2016) where ambulance riders of ages 25 – 34 years and 35+ years transported mothers to health centres to deliver. Namazzi *et al.* (2017) in the eastern study pointed out ages 35 – 44 years of the community extension health workers influencing the outcomes. Community extension health workers are health service providers to the mothers like the boda-boda riders. It is concluded in the Busoga Region study that the best age for boda-boda riders to

respond to maternal referrals is 25 – 34 years. Despite the cognitive theory not speculating the best age of learning [12], the Busoga Region study justified that boda-boda riders learn better when 25 – 34 years of age are. This gap of the cognitive theory therefore, was literally addressed.

Also, ownership of the motorcycle equally statistically significantly influenced the maternal outcome ($p<0.05$). Mothers confessed that they were able to easily access boda-boda riders even at night when boda-boda riders owned motorcycles. Other studies typically discussed availability of motorcycle ambulances. According to Ssebunya and Matovu (2016) and PATH (2013), ownership of the ambulances was communal. However, it was difficult to contact the riders at any one point for transportation especially at night since the motorcycle was stationed in one place and difficult for the rider to access it at night.

Ownership of the motorcycles by boda-boda riders addressed the challenge of delays to transport mothers to health centers when contacted. This was important for the rural mothers to disrupt their failure not to fully deliver from health centers. Several studies [11,13,14] agree on the difficulties experienced by mothers in the rural setting. In the intervention arm where training of boda-boda riders took place, motorcycles were owned by middle income earners. By implication, mothers who could not afford to pay for the transport fares were still transported to health centers to deliver and paid later. Since there was no free boda-boda transport, mothers were advised to save some money in a savings box to pay boda-boda riders who did not own motorcycles.

The attention given to the self-concept for the boda-boda riders to bring out the real picture of an individual including their societal roles, beliefs and values, amongst others [12] as noticed in the Busoga Region study; it requires a committed, married and religious individual of good working memory (cognitive characteristic), and these were the boda-boda riders. Boda-boda riders were called at any one moment including days of worship. The mix of religions (Catholics, Protestants, Moslems and others) did not affect the study differently in the Busoga Region and in line with other studies [12,15]. Much as the majority of boda-boda riders were married; like religion in this study, marital status had no impact on the health facility based deliveries as it implied with other studies [11,16,17]

Conclusion

The socio-demographic characteristics of boda-boda riders, age (25 – 34 years, $p=0.000$) and ownership of the motorcycle (personal, $p=0.002$) play a pivotal role in the improvement of health facility-based deliveries.

It was noted that pregnant mothers used boda-boda transport to go to health centers during time of labour and when they had pregnancy related complications. They even contacted boda-boda riders for transport as a result of trust in them, and riders responded positively.

In addition, training of boda-boda riders and other key stakeholders on the roles of the different stakeholders ($p=0.022$) has impacted on the community based maternal referrals in the study area. It has made the process of referral and transportation of mothers better. The boda-boda riders are able to report the condition of the mother on arrival at the health centers. Midwives are made aware and can prepare to save the mother and baby in an event that there is a complication because of the streamlined communication with the boda-boda riders.

Recommendation

This study needs to be expanded to more sub counties and districts regardless of the inclusion criteria at all levels. The study impact was exhibited in the shortest time of community involvement especially in the area of intervention. This study was in only two districts out of 11 districts in the region.

Massively, boda-boda riders should be encouraged to form associations at their different stages with the intention of helping mothers with transport to health facilities in time to deliver. The associations especially with financial gain will act as an incentive for the boda-boda riders to continuously transport mothers to health centers to deliver and during times of emergencies.

The Implementing Partners (IPs) need to be brought on board to help in branding the interested boda-boda riders for easy identification. T-shirts, aprons, helmets, identity cards amongst others could be used for identification.

Limitations of the study

Some of the boda-boda riders attached to the nearby mothers in some instances did not own motorcycles. Transportation of mothers to health centers was a little difficult. In a few instances boda-boda riders' phones were off.

Ethical clearances

Ethical approval to conduct the study was provided by the Institutional Review Board at Uganda Martyrs University Medical School in Nsambya and Uganda National Council for Science and Technology (UNCST). Voluntary informed consent was then individually obtained from all the study participants.

Authors' contributions

KMM conceived the study idea. JFM, KP, KRK, KMM, AY, and OGO designed the study and wrote the protocol. KMM and DGM designed the data collection tools. KMM and DGM participated in data collection. KMM, DGM, PK and OGO undertook the analysis. KMM, DGM and AY wrote the manuscript. All authors critically revised, read and approved the final manuscript.

Acknowledgements

We would like to thank all the local council I (LCI) and boda-boda stage chairpersons for their support in the recruitment of participants (boda-boda riders) for this study. We are also grateful to the study participants and the centre staff in the study region for their contributions to this study.

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