HHS Public Access
Author manuscript
Int J Inj Contr Saf Promot. Author manuscript; available in PMC 2022 February 22.

Published in final edited form as:
Int J Inj Contr Saf Promot. 2019 September ; 26(3): 294–301. doi:10.1080/17457300.2019.1594952.

Motorcycle taxi program is associated with reduced risk of road traffic crash among motorcycle taxi drivers in Kampala, Uganda

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Abstract

SafeBoda is a transportation company that provides road safety training and helmets to its motorcycle taxi drivers in Kampala. We sought to determine whether risk of road traffic crash (RTC) was lower in *SafeBoda* compared to regular (non-SafeBoda) motorcycle taxi drivers during a 6-month follow-up period. We collected participant demographic and behavioural data at baseline using computer-assisted personal interview, and occurrence of RTC every two months using text messaging and telephone interview from a cohort of 342 drivers. There were 85 crashes (31 in *SafeBoda* and 54 in regular drivers) during follow-up. Over the six-month follow-up period, *SafeBoda* drivers were 39% less likely to be involved in a RTC than regular drivers after adjusting for age, possession of a driver's license, and education (RR: 0.61, 95% CI: 0.39–0.97, p=0.04). These findings suggest that the *SafeBoda* program results in safer driving and fewer RTCs among motorcycle taxi drivers in Kampala.

Keywords

crash; injury; boda-boda; road safety

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Contributors
All authors conceived the question and study design. KM and OK were involved with data collection. KM, BG, and JPH conducted statistical analysis. All authors were involved with writing the document. All authors read and approved the final version of the manuscript for publication.

Declaration of interest statement
The authors declare no competing interests.

Data availability statement
The data that support the findings of this study are available from the corresponding author, [KM], upon reasonable request.

Introduction

Motorcycles are a popular mode of transportation in many low-and middle-income countries (LMICs) such as Uganda because they are relatively affordable, convenient for short distances and poor roads, and are efficient for navigating heavy traffic in many developing cities.[1–6] Despite these benefits, motorcycles are involved in a substantial number of road traffic crashes (RTCs)[a] and injuries in LMICs.[7–10] In the past two decades, many studies have reported increasing involvement of motorcycle drivers and their passengers in RTCs, as the number of motorcycles exploded in Africa.[3,6,7,11–13]

In Uganda, motorcycle taxis, known locally as boda-boda[b], are a major form of transportation.[14–16] In the city of Kampala alone, the number of boda-boda drivers is estimated to be between 50,000 and 80,000.[15] Boda-boda drivers are the second largest road user category involved in RTCs in Uganda. They were involved in 28.2% of RTCs and represented 23.5% of road traffic injuries in 2015.[8] According to the 2018 Road Safety Performance Review report, road fatalities involving boda-boda drivers doubled between 2011 and 2016.[17] Risky riding behaviours such as speeding, unsafe overtaking, driving under the influence of drugs, failure to wear protective gear (e.g., helmet and reflective jacket), driving towards oncoming traffic, and distracted driving (e.g., mobile phone use) are believed to account for the high crash and injury rates in this road user group.[2–5,17–27] Other factors include limited training for boda-boda drivers, poor road conditions, poor vehicle conditions (e.g., faulty brakes and bad tires) and weak enforcement of traffic regulations (e.g., on driver licensing) by the police.[2,3,5,17–25]

In recent years, road safety-conscious companies such as *SafeBoda* and *Taxify* have cropped up to formalize the boda-boda sector in Uganda and to address the issues around poor riding behaviors through training and provision of protective gear.[28,29] *SafeBoda* is a transportation company that takes an innovative approach to providing motorcycle taxi services using a trained community of drivers in an effort to increase safe riding behaviours and reduce crashes and injuries. The company provides multiphase road safety training, helmets, vehicle maintenance, and basic first responder training to its drivers. It also provides hairnets to passengers who are concerned about contracting skin diseases from a shared helmet.[28] Initially, the training for the drivers was provided by the Uganda police and the Uganda Red Cross Society. However, this has since been transitioned to a team of *SafeBoda* trainers (part of the *SafeBoda* academy) who were trained by the Global Road Safety Partnership and the Uganda police and Red Cross. Newly recruited drivers are trained on traffic signs and symbols, traffic regulations, the *SafeBoda* code of conduct, emergency response, customer care, and how to use the *SafeBoda* app.[28,30,31] *SafeBoda* drivers undergo regular refresher trainings. As of January 2019, *SafeBoda* has over 8000 drivers in Kampala.[31] At the time this study commenced, *SafeBoda* was the only company of its kind operating in Kampala.

[a]RTCs are defined here as incidents where a motorcycle taxi driver collided with another vehicle (e.g., car, motorcycle, and bicycle), pedestrian, animal, or stationary object (e.g., tree or pole). Injury is defined as any wound or bruise due to a road traffic crash involving a motorcycle taxi driver on a public road.

[b]This term originally referred to bicycle taxis that operated at the Uganda-Kenya border. However, it is now a generic term for bicycle and motorcycle taxis in East Africa. In present use, boda-boda increasingly refers to motorcycle taxis.

Since that time, additional companies (e.g., *UberBoda*, *Taxify*, and *Dial Jack*) have started to provide similar services in the city.

There is inconclusive evidence on whether road safety programs geared towards motorcycle drivers in LMICs are associated with increased safe riding behaviours and reduced incidents of RTC and injuries.[3,10,32–34] Moreover, no studies have been conducted in Uganda looking at the role of recent start-ups (e.g., *SafeBoda, Taxify, and UberBoda*) on road safety in the motorcycle taxi sector. Therefore, we sought to determine whether the risk of self-reported RTC is lower in *SafeBoda* drivers than in regular drivers. In addition, we wanted to determine whether road traffic knowledge mediates the hypothesized relationship between the *SafeBoda* program and risk of RTC. In this study and throughout this paper, regular drivers refer to boda-boda drivers who were not identified as part of the *SafeBoda* program.

Materials and methods

We recruited 342 drivers (171 *SafeBoda* and 171 regular drivers) between October 2017 and January 2018 from boda-boda stages across the five administrative divisions of Kampala. A stage is a location where a boda-boda driver is generally stationed when not out driving a passenger or looking for one. The majority of the drivers (n=330) included in this study were recruited from a separate cross-sectional study on safe riding behaviours conducted by our team in Kampala.[35]

Sample size, sampling methodology, and recruitment

We estimated that 15% of regular boda-boda drivers would have a RTC during the 6-month follow-up period. Since there were no estimates on this measure from previous studies in Uganda, this estimate was based on police reports. According to the 2015 police report, boda-boda drivers were involved in 28.2% of all RTCs in Uganda that year.[8] We assumed that over a 6-month period, the risk of involvement in RTC would be 15%, about half of the 28.2% reported for boda-boda drivers for 2015. Therefore, with a type I error rate of 0.05 using a χ^2 test, we needed a sample of approximately 342 drivers (accounting for 15% attrition) to have 80% power to detect a risk ratio of RTC of 0.35 comparing *SafeBoda* drivers to regular drivers.[36] We used a purposive and convenience sampling method (i.e., targeting areas with boda-boda stages with at least one *SafeBoda* driver) to recruit boda-boda drivers to the study. This method has previously been used to recruit boda-boda drivers in Kampala.[2] We recruited a maximum of 4 drivers from each stage by enrolling the first 4 who were willing to consent to be in the study. This limit was used to avoid overrepresentation of any one stage in the study. Drivers were eligible to be in the study if they were 18 years or older, able to communicate in English or Luganda (a widely spoken language in Uganda), and had been working as a boda-boda driver for at least 6 consecutive months at the time of recruitment. The choice of 6 months was to help us to accurately ascertain covariate information such as past crash history. In addition, consenting drivers must have had a functioning mobile phone. This was to facilitate the collection of RTC and injury data via text messaging and a telephone interview (for those who reported a crash and/or injury). We asked participants to provide a secondary contact number to facilitate easy follow-up in the event of the participant losing their phone, incapacitation, or death.

Data collection

We collected data using four tools: a) computer-assisted personal interview (CAPI) questionnaire, b) road traffic knowledge questionnaire, c) SMS/text-based questionnaire, and d) telephone interview questionnaire.

CAPI questionnaire—Eligible and consenting drivers were administered a 15-minute questionnaire (Figure S1) in a reasonably quiet location near the recruitment stage. The questionnaire was available in English and Luganda and contained questions on demographic and personal characteristics (e.g., age, education, income, years of boda-boda experience, and hours worked per day) and on riding behaviours (e.g., helmet use, possession of a reflective vest, and alcohol and mobile phone use). A complete list of the variables in the questionnaire can be found in the supplementary materials (Figure S1).

The exposure (*SafeBoda* status) was ascertained through self-report and/or by observing presence or absence of a *SafeBoda* branded jacket at the time of the interview. All variables were measured through self-report or direct observation. The CAPI questions were derived from previous studies and discussions within the study team. Previous studies in sub-Saharan Africa have successfully used self-report to collect similar data.[2,3,12,13,18,23,37]

Road traffic knowledge questionnaire—In addition to the CAPI, we administered a 10-item knowledge questionnaire of common traffic signs and laws (taken from the Uganda Highway Code) to all cohort participants (Figure S2). Each item in the knowledge questionnaire had an equal score (10 points) for a total possible score of 100.

SMS/text-based questionnaire—We collected data on occurrence of RTC and/or injury via a text message every two months. We used a reputable company with experience in bulk text messaging in Uganda to facilitate the data collection process.[38] Enrolled participants received a text message on their 60th, 120th, and 180th day of follow-up asking: “In the past 2 months, were you involved in a road traffic crash while driving your motorcycle? In the past 2 months did you sustain any injury from a road traffic crash while driving your motorcycle?” Participants were requested to respond either “yes” or “no” by text message. After 24 hours, participants with ambiguous responses and those who had not responded to the text message were followed up via a telephone call to their primary and secondary contact numbers. For participants reported as incapacitated or dead, data on any RTC or injury during the two-month interval were collected from the secondary contact or boda-boda peers from the participant’s stage. Given the possibility of multiple occurrences of RTC in the two-month interval, data were only collected for the most recent occurrence of RTC (i.e., one crash per interval for participants who reported a crash in an interval).

Telephone interview questionnaire—For participants who reported a crash and/or an injury in the SMS/text-based questionnaire, we conducted a follow-up telephone interview to collect more detailed data on the reported RTC/injury (e.g., location of crash, severity of injury, and hospitalization). For non-responders or participants reported as incapacitated or dead, the same follow-up procedures outlined for the SMS/text-based questionnaire were followed.

Analysis

All analyses were conducted in the statistical package R (version 3.5.1).[39] We used Pearson's chi-square with continuity correction (for categorical variables) and Student's t-tests (for continuous variables) to compare baseline variables (e.g., helmet use, net weekly income, and age) between *SafeBoda* and regular drivers and to identify correlates of RTC during the follow-up period. For the correlates, RTC was defined as one crash per participant at any interval during the 6-month follow-up period.

We used generalized estimating equations (GEE) models to test whether the *SafeBoda* program was associated with lower risk of road traffic crash during the six months of follow-up. The adjusted model included a minimum set of potential confounders (age, education, and possession of a driver's license) selected from a causal diagram of hypothesized variable relationships. For the GEE models, we assumed exchangeable covariance structure (i.e., uniform correlations cross time), which we thought was reasonable for our data. Nonetheless, to minimize the risk of invalid inference from a misspecified covariance model, we fitted models using robust standard errors. The unadjusted and adjusted models were fitted using the *gee* package in R.[40] We conducted an additional GEE analysis by including a lagged RTC variable as a predictor to investigate whether having a crash in a previous 2-month interval was associated with crash risk in a subsequent interval.

We used the *mediation* package in R to estimate the total, direct, and indirect effects of the *SafeBoda* program-RTC relationship in the mediation analysis. The *mediation* package uses the counterfactual (potential outcomes) framework that allows the decomposition of the total effect into direct and indirect effects even in the presence of interaction and non-linearity.[41] We fit two regression models with cluster robust standard errors to estimate the various effects: a linear model for the effect of the *SafeBoda* program on knowledge score, adjusting for age, education, and possession of a driver's license; and a Poisson model for the effect of the *SafeBoda* program on RTCs, conditioning on knowledge score, age, education, and possession of a driver's license. The RTC variable was defined as the total number of crashes that occurred during the 6-months of follow-up. The *mediation* package allowed us to use a Markov Chain Monte Carlo approach to conduct 1000 simulations in order to estimate the average direct and indirect effects by averaging over each possible exposure and confounder values.

Since we collected exposure/*SafeBoda* program data only at baseline, we conducted an intention-to-treat (ITT)-like analysis, without regard for cross-overs that may have occurred during the follow-up period.

Sensitivity analyses

Our GEE analysis assumed missingness to be completely at random (MCAR). We ran a multiple imputation model using variables associated with RTC (e.g., age, education, history of road safety training, years of boda-boda experience, and possession of a driver's license). We used the *mice* package in R to impute missing data.[42] We imputed missing RTC data for participants lost to follow-up as well as any missing data in the other variables in the analytic model (i.e., age, education, and possession of a driver's license). The outcome (RTC) was modeled using logistic regression. All models used 10 imputation rounds and 30 iterations. We re-ran the GEE models using the imputed data. This was to gauge how robust our findings were to the MCAR assumption. We then compared the pooled risk ratio from the imputation to the estimate from the complete case analysis.

We conducted two additional sensitivity analyses: a) we assumed everyone that was lost to follow-up had a RTC in the intervals in which they were lost, b) we assumed everyone that was lost to follow-up did not have a RTC in the intervals in which they were lost.

Ethical approval and consent

Approval for the study was granted by University of Washington, Makerere University, and the Uganda National Council for Science and Technology. Participants provided verbal consent to be interviewed and were compensated for their time.

Results

We enrolled a total of 342 boda-boda drivers in our cohort, among whom the mean age was 32.8 years, mean weekly net income was 23.5 US dollars, and mean years of working in the boda-boda sector was 6.7 years. In addition, the 342 boda-boda drivers had a mean of 8 years of schooling and the majority (86.4%) reported previously attending a road safety training. The drivers worked a mean of 12.4 hours and made 18.5 trips per day. Overall, 89.2% of the drivers reported always wearing a helmet while driving in the past 30 days although 96% said they owned a helmet which they had had for a mean of 15 months. The most frequently observed helmet type was full-face (68.5%). The majority of boda-boda drivers (73.3%) took less than 10 weeks from learning to drive to carrying a passenger. Sixty-three percent learned how to drive through a friend, relative or peer.

Among the 171 *SafeBoda* and 171 regular drivers who completed the CAPI questionnaire, compared to regular drivers, *SafeBoda* drivers had more years of boda-boda experience, were more educated, and made more money per week (Table 1). For instance, at enrollment compared to regular drivers, *SafeBoda* drivers were more likely to report safe riding behaviours (e.g., they were more likely to report having a driver's license (65.9% vs 34.5%, $p<0.001$) and wearing a reflective jacket (100% vs 49.1%, $p<0.001$). They were also less likely to report having been involved in a road traffic crash in the 6 months prior to their enrollment in the study (RR: 0.68, 95% CI: 0.48–0.97, $p = 0.03$). Detailed results comparing safe riding behaviours at enrollment and occurrence of road traffic crashes, injuries, and hospitalizations 6 months prior to enrollment in *SafeBoda* and regular drivers are reported elsewhere.[35]

Risk of road traffic crash during the 6-month follow-up period

At the first follow-up, 337 (98.5%) drivers provided data on occurrence of RTC during the initial 2 months of follow-up. At 4 months, follow-up was successful for 334 (97.7%) drivers and at 6-months, 330 (96.5%) drivers completed follow-up. Over the course of the study, 12 (3.5%) drivers were lost to follow-up. There were 24 RTCs during the first 2 months of follow-up, 32 RTCs during the next 2 months of follow-up, and 29 RTCs during the last 2 months of follow-up. Overall, 69 unique RTCs (i.e., only one crash per driver for those who reported a crash during the follow-up) occurred over the entire follow-up period. Two drivers reported having 3 RTCs during the follow-up period (i.e., one RTC during each 2-month interval) and 14 drivers reported having at least 2 RTCs during the follow-up period (Figure S3).

Based on the unadjusted GEE model, there was a 43% lower risk of RTC during the 6-months of follow-up among *SafeBoda* compared to regular drivers (RR: 0.57, 95% CI: 0.36–0.89, p = 0.02) (Table 2). After adjusting for potential confounders (i.e., age, possession of a driver's license, and education), *SafeBoda* drivers were 39% less likely to be involved in a road traffic crash than regular drivers during the 6 months of follow-up (RR: 0.61, 95% CI: 0.39–0.97, p = 0.04).

Types of crashes, severity of injuries, and hospitalization during the 6-month follow-up period

The majority of the 85 crashes (31 in *SafeBoda* vs 54 in regular drivers) reported during the follow-up period involved either a collision with another motorcycle (27.1%) or a car (63.5%). Speeding (10.6%), faulty brakes (7.1%), distracted driving (4.7%), and slippery surface (4.7%) were the most frequently mentioned causes of the reported crashes. For the 85 crashes, 69 (81.2%) resulted in injury to the driver and 56 (81.2%) of these driver injuries required a visit to a health facility. Of the injuries that required a visit to a health facility, 13 (23.2%) required in-patient care (admission). The median hospitalization time for injuries requiring in-patient care was 3 days with a range from 1 day to 30 days.

Correlates of road traffic crash during the 6-month follow-up period

Occurrence of road traffic crash during the follow-period was statistically significantly associated with age, ever use of alcohol, driving into oncoming traffic in the past 30 days, number of years working as a boda-boda driver, having had a crash in the 6 months prior to enrollment in the study, and ownership of a reflective vest. However, having had a crash in a previous 2-month interval was not statistically significantly associated with a crash risk in a subsequent interval (RR: 1.17, 95% CI: 0.58–2.35, p = 0.66), although the study was underpowered to detect such an association.

Mediation analysis

The mean road traffic knowledge score for all drivers was 86.3 (87.7 for *SafeBoda vs* 84.8 for regular drivers), with a statistically significant mean difference of 2.9 points (95% CI: 0.5–5.3, p=0.02). However, we did not find evidence of a statistically significant mediation effect of road traffic knowledge on risk of road traffic crash (Table 3). The effect of the *SafeBoda* program over the 6 months of follow-up through pathways involving road traffic knowledge was an increase of 1.36 crashes per 1,000 drivers (95% CI: −0.002 to 0.010) in *SafeBoda* drivers compared to regular drivers (p = 0.53), while the effect through pathways other than road traffic knowledge was a reduction of 43.0 crashes per 1,000 drivers (95% CI: −0.084 to −0.010s, p = 0.03). The total effect of the *SafeBoda* program on risk of RTC (irrespective of pathway) was a reduction of 41.6 crashes per 1,000 drivers compared to regular drivers (95% CI: −0.081 to −0.010s, p = 0.03).

Sensitivity analyses

Compared to the effect size based on the complete case analysis (adjusted RR: 0.61, 95% CI: 0.39–0.97, p = 0.04), we found a similar estimate for risk of RTC (adjusted RR: 0.62, 95% CI: 0.39–0.98, p = 0.04) from the multiply imputed data (Table 2). Models assuming all participants lost to follow-up either had a RTC or did not have a RTC in the intervals in which they were lost, found similar effect estimate (data not shown). Moreover, we found little missingness (Table 4) in our data (i.e., 1.5% for RTC in the initial 2 months of follow-up, 2.3% at 4 months, and 3.5% at 6 months).

Discussion

Our findings suggest that drivers in the *SafeBoda* program are not only more likely to engage in safe riding behaviours (e.g., wearing a helmet and a reflective vest while driving and not carrying more than one passenger at a time), but also have fewer RTCs than regular drivers.

There are multiple mechanisms that may explain the observed higher frequency of safe driving behaviours and reduced risk of RTC among *SafeBoda* drivers. Plausible mechanisms include the self-selection of more safety conscious drivers into the *SafeBoda* program, the provision of road safety training, bike maintenance, and protective equipment by the program to its drivers, the program's code of conduct that includes penalties (e.g., re-training, suspension, and dismissal) for unsafe driving behaviours, and the sense of community among *SafeBoda* drivers. *SafeBoda* drivers undergo a rigorous road safety training and are trained to view themselves as a community of drivers that self-regulate as they drive. Anecdotal evidence indicates that they are more likely to stop at traffic stops than regular boda-boda drivers, not only because they are trained to obey traffic regulations but also because they know other *SafeBoda* drivers are watching them (there are penalties for drivers reported to have engaged in unsafe behaviours (e.g., running a traffic stop) and poor customer care. In this study, we investigated how one of these mechanisms (changes in road traffic knowledge due to road safety training) might impact occurrence of road traffic crashes but were unable to find evidence that the effect of the *SafeBoda* program is mediated through traffic safety knowledge. It is plausible this null result is due to the relatively high road traffic knowledge score for regular drivers (84.8). A high proportion (73%) of regular boda-boda drivers reported having received road safety training in the past (which might explain the high knowledge score), however, these trainings seemed to have had limited effect on their riding behaviours and risk of RTC.

Our findings corroborate those of previous investigators that found safer riding behaviours and reduced risk of RTCs and injuries among motorcycle drivers who have undergone road safety training.[2,3,32,43,44] For example, an evaluation of a road safety program (the Asia-Pacific Honda Safety Riding Program) in Thailand, reported 29% lower odds of road traffic injuries in the trained group of motorcycle drivers compared to the controls (who did not receive road safety training).[32] Similarly, an evaluation of the *Tukbodabike* program (a boda-boda-led training initiative in Western Kenya) found 6% lower incidence of RTCs among trained drivers compared to untrained ones.[3] Other studies have however found no evidence of reduced risk of RTCs and injuries upon undergoing road safety training.[10,33,34]

Our study has some limitations. First, we relied on self-report for the majority of variables in the analysis, including the main outcome (road traffic crash) and confounders (e.g. possession of a driver's license). This may have introduced measurement error into our study estimates, especially if social desirability bias in reporting occurrence of road traffic crash differed in *SafeBoda* and regular drivers. It is possible that *SafeBoda* drivers may be less likely to report a RTC compared to regular drivers. Moreover, reporting of RTCs may be biased towards more serious crashes (with less serious crashes being unreported), so our estimates are likely to be underestimates. The fact that 81.2% of those who had a crash were injured reinforces this possibility. However, reliance on self-reports was unavoidable because there are currently no comprehensive national crash and injury registries in Uganda.

Second, since we did not use probability sampling to recruit participants into the study, the generalizability of our findings to the whole boda-boda population in Kampala might be limited. However, it was not possible to use probability sampling due to the lack of a sampling frame for boda-boda stages in Kampala and the study's focus on stages with at least one *SafeBoda* driver.

Third, we conducted an intent-to-treat analysis without regard for cross-overs that may have occurred during the follow-up period. Given that the *SafeBoda* program expanded dramatically during the study period (i.e., from about 1,200 drivers at the time of recruitment to over 4,000 drivers at the time the follow-up period ended), it is plausible that some regular drivers in our cohort may have become *SafeBoda* drivers during the follow-up (however, we did not collect any data on cross-overs). This would bias our findings towards a null association especially if a large number of regular drivers crossed over to the *SafeBoda* program during the follow-up period.

Lastly, our mediation analysis relied on the potential outcomes framework and required that certain causal inference assumptions be met in order to identify the true causal effect. (e.g., well defined intervention, no unmeasured exposure-outcome confounders, no unmeasured mediator-outcome confounders, and no unmeasured exposure-mediator confounders). These assumptions may be too strong to apply to a multi-component intervention such as the *SafeBoda* program and a dataset from an observational study.

Despite these limitations, our findings suggest that the *SafeBoda* program is associated with increased safe riding behaviours and reduced risk of road traffic crash among boda-boda drivers. The reduced risk of RTCs was shown both in terms of past and future risk of RTC with similar magnitude (at least 30% reduction) and the association was robust to sensitivity analyses. Given these findings, we believe the model of the *SafeBoda* and other similar programs (e.g., *Taxify* and *UberBoda*) should be used to inform injury prevention policy (especially around training and licensing of boda-boda drivers). In addition, our findings show that these programs may be worth scaling up in order to accelerate adoption of safe riding behaviours in boda-boda drivers in Uganda and globally.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

The authors are grateful to Grace Magambo, Joseph Mugisha, and Simon Okurut for their support throughout the study.

Funding

This work was supported by the Fogarty International Center of the National Institutes of Health under Grant [#R25 TW009345]. However, the content of this publication is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.

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Table 1

Comparison of baseline characteristics of *SafeBoda* and regular boda-boda drivers in Kampala

Characteristic	*SafeBoda* drivers N = 171	Regular drivers N = 171
Age (years)	33.3 (7.1)	32.4 (7.3)
Education (years)	8.2 (3.7)	8.0 (3.6)
Weekly net income (in USD)	24.4 (13.5)	22.6 (12.4)
Number of trips per day	18.0 (8.1)	19.0 (7.9)
Hours worked as boda-boda per day	12.6 (2.3)	12.1 (1.9)
Has a driving license	112 (65.9%)	59 (34.5%)
Has other job	60 (35.1%)	67 (39.2%)
Used a phone while driving in past 30 days	34 (19.9%)	84 (49.1%)
Alcohol use in past 2 hours before driving in past 30 days	3 (11.1%)	22 (41.5%)
Reported always using a helmet in past 30 days	169 (98.8%)	136 (79.5%)
Own a helmet	169 (98.8%)	158 (92.4%)
Helmet cost (in USD)	27.6 (10.5)	10.1 (7.5)
Has a reflective jacket	171 (100%)	84 (49.1%)
Has ever received a road safety training	169 (100%)	124 (72.9%)
Has driven on a pedestrian sidewalk in past 30 days	12 (7.0%)	74 (43.3%)
Has driven towards oncoming traffic in past 30 days	7 (4.1%)	78 (45.6%)
Carried more than one passenger in past 30 days	16 (9.4%)	134 (78.4%)
Years working as a boda-boda driver	7.1 (4.4)	6.4 (4.3)

Note: Continuous variables are reported as mean with standard deviation (in parenthesis), while dichotomous variables are reported as count with percent (in parenthesis). Some observations have missing data.

Table 2

Crude and adjusted RTC risk associated with the *SafeBoda* program (results from the GEE & mediation models)

		Unadjusted model (95% CI)	Adjusted model (95% CI)*	Imputed unadjusted model (95% CI)	Imputed adjusted model (95% CI)*	Adjusted mediation model (95% CI)*
		Risk ratios (RR)				Risk difference (RD)
Type of boda-boda driver	**Regular**	Ref	Ref	Ref	Ref	Ref
	SafeBoda	0.57 (0.36–0.89)	0.61 (0.39–0.97)	0.55 (0.35–0.87)	0.62 (0.39–0.98)	−0.04 (−0.08, −0.01)

*adjusted for age, education, and driver's license

Table 3

Summary of results from the mediation analysis

	Mediation (RD scale, 95% CI)
Average direct effect, ζ	−0.0430 (−0.0840, −0.0100)
Average indirect effect, δ	0.0014 (−0.0023, 0.0100)
Total effect, τ	−0.0416 (−0.0806, − 0.0100)

Table 4

Reasons for dropout from the study among participants lost to follow-up

Reason for dropout from study	Number (%)
Left the country or study area	4 (33.3%)
Died from non-study-related causes	2 (16.7%)
Could not be reached/not found at the stage	6 (50%)
Total	12