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Can information about "safe places" reduce female victimisation in Honduras? a quasi-experimental evaluation of the safeWalking app

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ABSTRACT

SafeWalking is of a prevention tool that identifies safe areas for women in public spaces in the City of Santa Rosa de Copan, Honduras. The current study examines the effect of using this phone app on users' self-rated information about "safe places," the number of precautionary behaviours, and victimisation. This study also examines its effect on constructs, such as fear of crime, perceived safety, and risk of victimisation. Using a pre-test and post-test design, we find that those assigned in the treatment group (i.e., the app users) experienced a significant increase in self-reported knowledge of the dangerous areas in Santa Rosa de Copan. Despite increased knowledge, there was no statistically significant effect on the number of precautionary behaviours and odds of victimisation of the app users. We discuss lessons learned, implications, and ways to improve future iterations of this and similar crime prevention applications.

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KEYWORDS
crime prevention; risk analysis; violence; crime app; female victimisation

Introduction

Violence against women is a serious social and health issue worldwide. According to the WHO, about one in three women (35%) across the world have experienced physical and/or sexual violence from their partners in their lifetime (García-Moreno et al., 2013). Between 2010 and 2015, an estimated 16% of the people who died violently were women and girls, representing an average of 64,000 victims per year (Small Arms Survey, 2016). Most of those deaths occur in Latin America. According to the Arms Survey (2016), fourteen of the twenty-five countries with the highest femicide rates are Latin American. Central America, specifically the so-called "Northern Triangle" (i.e., Honduras, El Salvador, and Guatemala) is the epicentre of this crisis, with Honduras and El Salvador consistently within the top five countries worldwide in terms of femicide rates.

Given this high risk of victimisation for women, the National Security forces of Honduras created and beta-tested a mobile phone prevention app called *SafeWalking*. This app aimed to provide users with information on "safe" and "high risk" spaces for women in Santa Rosa de Copan, Honduras. The app aimed to provide actionable intelligence so that women can take precautionary measures as they navigate through the city of Santa Rosa de Copan. National Security forces hoped that with the availability of this new information, users would see a significant reduction in their rate of victimisation.

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The goal of this study to evaluate the impact of the *SafeWalking* app on its core goals: 1) users self-rated knowledge of safe and dangerous spaces for women in the city of Santa Rosa de Copan, 2) increase the number of precautionary behaviours users engaged in during the two-month observation period, and 3) reduce the rate of victimisation of its users. In addition to these outcomes, this study examines how using the *SafeWalking* app impacted users' emotional fear of crime, perception of safety in their neighbourhood and city in general, and perceived risk of victimisation in their neighbourhood and the city in general.

The current study is presented in five sections. The first section reviews the potential role phone applications have played in crime prevention tools. The second section provides a detailed description of tools available in the *SafeWalking* app, as well as the entities involved in its design and beta-test. In the third section, we describe our data collection procedures, operationalisation of outcomes, and analytic strategy. The fourth section presents the results of the evaluation. The final section discusses key findings, limitations of research design, and suggestions to improve this and similar phone applications.

Phone apps as crime prevention tools

Nowadays, the use of smartphones has dramatically increased across the world. Along with increases in smartphone usage, phone applications (i.e., apps) have become one of the most popular platforms for information gathering and sharing (Richman & Brinkley, 2014). According to the Pew Research Center (Poushter, 2016), an average of 54% of respondents from 21 emerging and developing countries reported that they use the internet at least sometimes and/or own a smartphone in 2015, which increased from 45% in 2014. Due to its ubiquitous usage, many intervention programmes have relied on smartphone apps to administer the "treatment" (Brendryen & Kraft, 2008; Levine et al., 2008; Patrick et al., 2009). Although not all agreed (Free et al., 2013), interventions using mobile-health technology to affect health behaviour change or disease management have shown positive effects on health-related outcomes (Brendryen & Kraft, 2008; Levine et al., 2008; Patrick et al., 2009).

Interventions using mobile phone technologies have expanded into apps meant to prevent various social problems, including violence that disproportionally affects women, such as sexual assaults, rape, and intimate partner violence. Those mobile phone apps target different types of violence (primarily against women) and users, such as potential perpetrators, victims, or bystanders. For instance, among 205 English-language mobile apps that addressed violence issues, 39% targeted sexual violence, 21% targeted intimate partner violence, and 7% targeted harassment, including stalking and bullying (see Bivens & Hasinoff, 2018). Also, 87% of apps targeted victims, whereas 12% targeted bystanders and 1% targeted perpetrators. Interestingly, most apps targeting victims tended to focus on incident interventions, whereas most apps targeting bystanders focused on education and awareness.

In the U.S., the "Apps Against Abuse" initiative, a nationwide competition, was launched in 2011 to help prevent violence using mobile technology (The U.S. Department of Health and Human Services, 2011). *Circle of 6* and *On Watch* were developed as a result of the challenge, and both apps have two main functions – allow users to easily contact their cycle of supporters when they need them and allow GPS to locate their whereabouts. Similar types of apps have also been developed abroad, such as *HarassMap* in Egypt (Grove, 2015) and *WoSApp* in India (Yadav et al., 2017). Both these apps have similar functions: use social networks and location sharing to help prevent violence against women. It is important to note that many of these apps are reactive, focusing on intervening at the time of criminal acts and/or intervening post events (Maxwell et al., 2020).

To our knowledge, there are no studies that confirm the effectiveness of these apps in preventing violence against women. However, the existing literature does suggest that phone apps may be effective in the prevention of violence. For example, Klick et al. (2012) found a statistically significant relationship between decreases in crime rates and increases in mobile phone technology

in the 1990s. They argue that mobile technologies provide "suitable guardianship" to potential victims, and as the routine activity theory of crime suggests, it deters potential offenders. Additionally, Ceccato (2019) argues that information on crime hotspots could lead users to make more precautionary behaviours, thereby decreasing their odds of victimisation. Based on the spatial and temporal patterns of records collected in Stockholm, Ceccato (2019) found the crime prevention apps were primarily used to take crime-prevention actions such as reporting potential risk in the area or warning of suspicious persons or a crime.

In addition to reducing the risk of victimisation, mobile technologies may also increase the feeling of safety and decreases the fear of crime among users. Studies have found that possessing a mobile phone itself, even without using any sophisticated technology, increases users' feelings of safety. For instance, Nasar et al. (2009) conducted surveys among undergraduate college students. They found that most students said that having a mobile phone made them feel safer walking at night, and as a result, they walked to destinations at night to which they normally would not walk. Similarly, Cumiskey and Brewster (2012) found that female college students tend to worry about their safety in public spaces and considered using their mobile phones as self-defence.

The noted studies underscore the importance of fear of victimisation as an essential outcome of crime prevention apps. The literature points to a number of adverse physical, mental, and health consequences of fear of crime (Stafford et al., 2007; Lorenc et al., 2012). Additionally, fear of crime may lead to economic and social costs, including tangible costs (i.e., health loss) and intangible costs (i.e., losses in quality of life) – see Dolan & Peasgood, (2007). Therefore, efforts to reduce the fear of crime among women through mobile technology must do so without increasing users' fear of crime and jeopardising their physical/mental health and well-being. Fortunately, the literature suggests that mobile apps have potential to reduce the risk of victimisation without adversely impacting users' mental health through increased fear of crime.

The current study

The current study evaluates the impact of a crime prevention app, *SafeWalking*. Designed by Honduras Security Forces, the *SafeWalkig* app aims to inform users of safe and dangerous spaces for women in Santa Rosa de Copan, Honduras. Consistent with Ceccato (2019), SafeWalking aimed to provide actionable intelligence so that women can take precautionary measures and decrease the risk of victimisation.

The goal of the current study to evaluate the impact of the *SafeWalking* app on its core goals: 1) users self-rated knowledge of safe and dangerous spaces for women in the city of Santa Rosa de Copan, 2) increase the number of precautionary behaviours, and 3) reduce the rate of victimisation of its users. Additionally, this study also discusses the effects of using this app on users' emotional fear of crime, perception of safety, and perceived risk of victimisation in their community and the city in general.

This study builds on the existing literature in two specific ways. First, to our knowledge, *SafeWalking* is the first crime prevention app beta-tested in Honduras. Consequently, our results are first to point to the practicality and effectiveness of a prevention app targeting women in objectively one of the most dangerous countries in the world for women. Second, in addition to evaluating the app's core goals, this study also examines the potentially adverse effects of crime prevention apps on fear of crime, perception of safety, other important psychological outcomes. To our knowledge, this is the first study to use a quasi-experimental approach to evaluate the impact of crime prevention mobile app across the noted outcomes. For that reason, this study not only makes a significant contribution to emerging literature but also provides useful information to future iterations of *SafeWalking* and other similar crime prevention apps.

The safeWalking app

SafeWalking has the principal objective of providing users with information on "safe" and "high risk" spaces for women in Santa Rosa de Copan, Honduras. The risk estimates were generated through *Risk Terrain Modelling* (RTM). RTM is a crime forecasting tool that incorporates the spatial features (e.g., bars, pool halls, gas stations, unillumined street segments, etc.) associated with a particular outcome to produce a risk layer over the spatial plane (Caplan et al., 2011). In the case of *SafeWalking*, 20 "crime generators" (i.e., factors that contribute to the existence of crime hotspots) were examined to see how they collocate with female victimisation in public spaces in the city of Santa Rosa de Copan.[1] Once the spatial features predictive of the location of female victimisation were identified, they were used to model the risk of female victimisation across the entire city.[2] This layer presents users with the places where female victimisation was statistically most likely to occur (Figure 1a). In addition to this predictive information, the application also allowed users to see the location of female victimisation incidents in the past six months (Figure 1b). Users could filter the types of crimes they were interested in using (Figure 1c). Furthermore, the SafeWalking app gave users the opportunity to report crimes in the city of Santa Rosa de Copan (Figure 1d).

The *SafeWalking* app and implementation of the programme were organised by three teams. The first team spearheaded the data collection process as well as Risk Terrain Analysis. This team collected information on the location (i.e., coordinates) of female victimisation as well as the location of 20 different crime attractors in the city. The national police provided information the date, location (i.e., coordinates), and details of female victimisation incidents in Santa Rosa de Copan. The second team consisted of computer engineers. They were tasked with the development and maintenance of the application. The third team consisted of the Security Forces of Honduras (*Secretaria de Seguridad*). This team was responsible for convening, training, and being the point of contact to participants during the two-month trial.

Methods

Participants

The Security Forces of Honduras recruited 100 female residents of Santa Rosa de Copa, Honduras. Participants were recruited through various organisations, such as schools, universities, NGOs, and others. The initial goal was to assign participants into treatment and control groups randomly. However, a significant portion of participants did not have smartphones, and others did not have an internet plan. Given these obstacles, participants with a smartphone and interment were given

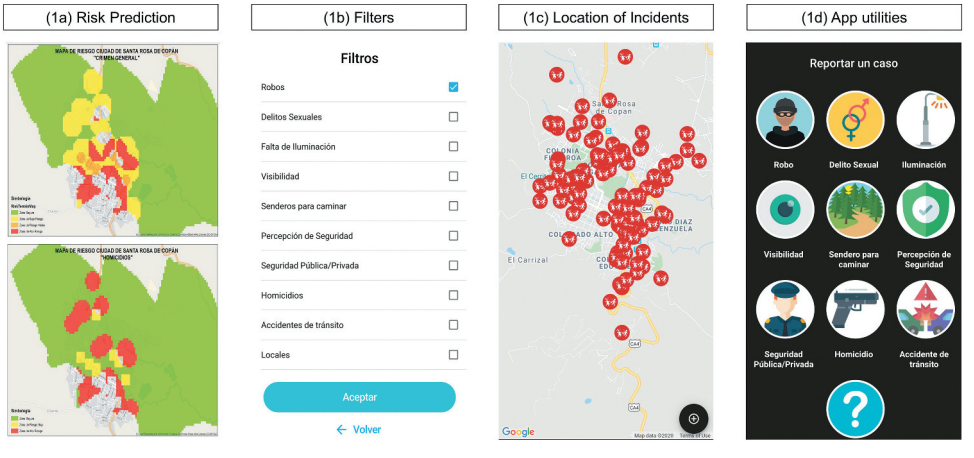

Figure 1. Features of SafeWalking Application.

priority to enter the treatment group (n = 50). Those in the treatment group were given an access code to download *SafeWalking* on their phones and training on how to use the various features of the app and the pre-program survey. Participants in the control group (n = 50) were given the pre-program survey. The treatment group was allowed to use the application for two months. Both groups were convened at the two-month mark for the post-program survey. All subjects were given a 20 USD gift card for their competition of the program.

Table 1 presents the baseline demographics of participants who completed both interviews. Additionally, we report the *p*-values from *t*-and chi-square tests of differences between the treatment and control groups. Participants in the control group are more likely to older, married, and be homemakers. Participants in the treatment group have significantly higher education levels, and not surprisingly, more likely to work in professional jobs. Subjects in the control group are significantly more likely to be Catholic and to attend religious services more frequently than those in Treatment groups. Subjects in the control group are more likely to know someone that been victimised in Santa Rosa de Copan in the last three months. Both the treatment and control groups are balanced across racial/ethnic backgrounds and years of experience. Importantly, there is no significant difference in direct victimisation in the previous three months between control and treatment groups.

Table 1. Summary statistics of control and treatment groups at baseline.

Variable	Control (n = 50)	Treatment (n = 50)	t-test/x^2
Age	30.2(Avg.)	24.7(Avg.)	0.0016***
Education level			0***
Less than High School	11.9%	5%	
High School	81%	55.5%	
Bachelor's Degree	5.9%	40%	
Race			0.38
Mestizo	66.6%	60.8%	
Amerindian	3.7%	4.3%	
Black	0.9%	2.1%	
White	18.5%	9.7%	
Other	14.4%	25%	
Marital status			0.003***
Single	33.3%	21.7%	
Married	22.2%	13.%	
Divorced	40.7%	65.2%	
Widowed	3.7%	0%	
Occupation			0.000***
Homemaker	57.4%	8.7%	
Student	29.6%	58.7%	
Professional	1.8%	21.7%	
Blue-Collar worker	11.1%	10.8%	
Years of experience	6.8(Avg)	7.3(Avg)	0.84
Direct victimisation	9.3%	20%	0.13
Indirect Victimisation	18.8%	34.7%	0.05*
Religion			0***
Catholic	79.6%	38%	
Protestant	9.2%	32.6%	
Other	7.4%	18.4%	
Unaffiliated	3.7%	10.8%	
Religious Services			0.002***
More than once a week	37%	22.8%	
Once a week	22.2%	23.9%	
More than once a month	5.5%	16.3%	
Few times a year	5.5%	18.4%	
Seldom	26.8%	16.3%	
Never	2.7%	2.1%	

*$p \leq 0.05$; **$p \leq 0.01$; ***$p \leq 0.001$

Data collection procedures

Information on participants was collected through a pre-program and post-program survey. This survey measured participants' demographic and background characteristics, as well as constructs such as fear of crime, perceived risk of victimisation, precautionary behaviours they take to avoid victimisation, among other constructs.

Dependent variables

The current study will evaluate the effect of the *SafeWalking* app on a series of attitudinal, self-perception, and behavioural outcomes. Below, we list and operationalised the variables examined in the current study.

Desire for crime information measures participants' appetite for information on the location and types of crimes in Santa Rosa de Copan. This variable is a composite score extracted through Principal Component Analysis (PCA) of the survey items Q13 (4-point Likert scale) "If a crime occurs in Santa Rosa de Copan, I want to know where and when it happened." and Q16 (4-point Likert scale) "Making information about crime easily available to the public is a good thing." Higher values in this index indicate higher levels of desire for more detailed information in Santa Rosa de Copan. We also measure participants' *self-rated level of crime knowledge*. This construct is a measured survey item Q14 "I know which areas in Santa Rosa de Copan are dangerous," where 1 = strongly disagree, 2 = disagree, 3 = agree, 4 = strongly agree.

This study also includes measures of *emotional fear of crime, frequency of fear, magnitude of fear, perceived risk of victimisation*, and *perception of safety* in their block of residence.[3] Following the work of Farrall & Gadd, 2004), Farrall and Gadd (2004, 200b) and Hinkle (2015), e*motional fear of crime* is measured through Q17 "In the last three months, have you felt afraid of becoming a victim of crime in your neighbourhood ?" This is a binary variable with no = 0 and 1 = yes. *Magnitude of fear* is measured through item Q18 "How often did you feel afraid of becoming a victim of crime in your neighbourhood in the last three months?" This is an ordinal-level variable with 0 = did not experience fear, 1 = only a few times, 2 = about once a month, 3 = about once a week, 4 = every day. The *magnitude of fear* item (Q19) asked: "And on the last occasion, how fearful did you feel?" This item provided response options of 0 = not very fearful, 1 = a little bit fearful, 2 = quite fearful, and 3 = very fearful. *Perceived safety* is measured through Q20 "How safe do you feel when walking alone at night on your block?" This is an ordinal level variable with 1 = Very unsafe, 2 = Somewhat unsafe, 3 = somewhat safe, 4 = very safe. *Perceived risk victimisation* is a composite score extracted through PCA of items Q21A-Q21G. These scale questions asked respondents to rate how likely they are to be victims of a series of crimes (murder, armed robbery, assault, burglary, car theft, vandalism) in their block in the next three months. Higher values indicate a greater perceived risk of victimisation. The same measures of *emotional fear, frequency of fear, magnitude of fear, perceived risk of victimisation*, and *perception of safety* were also constructed for the Santa Rosa de Copan in general.

Precautionary behaviours measure how often participants modify their behaviour or a routine to minimise the risk of victimisation. For example, Q27 asks, "In the last three months, how often you had someone (family member or friend) walk or drive your destination because of fear to your safety?"[4] Responses were categorised as 1 = zero times, 2 = one or two times, 3 = three to five times, and 4 = over five times. *Cautionary behaviours* is an additive scale comprised of 22 items (Q27 to Q49) – see appendix for a complete list of questions. Additionally, we include measures of use and user-satisfaction of the *Safewalking* app.

Analytic strategy

Given the pre-test/post-test research design, we use a randomised trial difference-in-difference approach to evaluate the impact of program participation on the outcomes of interest. In the case of linear models, the difference-in-difference estimate of the causal effect of program participation on outcomes of interest, Y_i.

$$Y_i = \beta_0 + \beta_1 G_i + \beta_2 T_i + \beta_3 (G_i \times \ T_i) + \ \ {}^{s}_{=7}\beta_k X_i + \varepsilon_i$$

where $\beta_1 G_i$ an indicator for group assignment where those assigned to the control group were '0′ and those to the treatment group was "1." $\beta_2 T_i$ is an indicator of treatment, where '0′ represents pre-program values, and '1′ indicates post-program scores. The estimate for the causal effect of the program participation is given by the following interaction term between group assignment and pre/post-program indicators $(G_i \times T_i)$. Important to note that we did not rely solely on linear regression models, as some of our outcomes were dichotomous and ordinal. To fit those models, we ran logistic and ordered logistic regression, respectively.

As noted in Table 2, the control and treatment groups are not balanced across a number of baseline characteristics. While random assignment is always ideal, difference-in-difference estimation does not require balance across treatment conditions to produce unbiased estimates.

In difference-in-difference, the treatment effect is calculated as the differences in the outcome between the treatment conditions after the intervention minus the difference before the intervention. If the difference between treatment groups changes between the two time periods (e.g., the difference increases in post-test), we can conclude that the intervention affected the outcome. Because difference-in-difference designs capture the *relative* change in outcomes between units in the treatment conditions over time, it does not require that control and treatment groups have similar baseline means (Daw & Hatfield, 2018).

This is not to say the current study is safe from potential confounders. However, confounders in difference-in-difference are different from cross-sectional research designs. Confounders in difference-in-difference are any variable related to both treatment assignment and the change in the outcome over time (i.e., the trend). In our case, we do not believe that one or multiple characteristics could have systematically impacted the trend for one group. However, to account for such a possibility, we include a vector of control variables (${}^{s}_{=7}\beta_k X_i$) to adjust for imbalances brought about by non-random assignment selection. These independent variables include *race, age, occupation, marital status, religion, and indirect victimisation.*

Results

All 100 selected participants completed both the pre-program and post-program surveys. Table 2 presents summary statistics of dependent variables at baseline. The baseline survey indicates that 57% of participants had experienced emotional fear of crime in the block that they reside. Most participants (57%) experienced fear only a few times in the previous three months. Despite the rarity of these events, the episode themselves seem to be quite significant. 72.3% of participants felt quite scared or very scared. About 43% of participants think their block is somewhat or very safe. We observe a similar pattern for the city of Santa Rosa de Copan. The majority of participants (62%) experienced emotional fear of crime outside of their block Santa Rosa de Copan. These episodes are infrequent, with 60% of the sample experiencing these episodes only a few times in the previous three months. However, these episodes are quite scary. 76% of the subjects reported being quite or very afraid. About 36.5% of participants feel their Santa Rosa de Copan is somewhat or very safe. On average, participants engaged in 51.7 precautionary behaviours to avoid victimisation in the three months before the intervention, and 14% of participants had been victimised in the two months before the program.

Table 2. Summary statistics of dependent variables at baseline.

	Mean(s.d.)/Percent	Percent Missing
Desire for Crime information	0(1.1)	3%
Self-rated crime knowledge		2.4%
Strongly disagree	5.4%	
Disagree	13.8%	
Agree	13.8%	
Strongly Agree	43%	
Emotional Fear of crime in your block		0%
No	43%	
Yes	57%	
Frequency of fear in your block		0%
Only a few times	57%	
About once a month	5%	
About once a week	6.7%	
Every day	30%	
Magnitude of fear in your block		0%
A little bit fearful	27.6%	
Quite fearful	41.5%	
Very fearful	30.7%	
Perception of safety in your block		5%
Very unsafe	26.3%	
Somewhat unsafe	30.5%	
Somewhat safe	26.3%	
Very safe	16.8%	
Perceived risk of victimisation in your block	0(2.1)	24%
Emotional Fear of crime in the city		1%
No	37%	
Yes	62%	
Frequency of fear in the city		0%
Only a few times	60%	
About once a month	4.4%	
About once a week	5.6%	
Every day	29.8%	
Magnitude of fear in the city		0%
A little bit fearful	23.2%	
Quite fearful	50.6%	
Very fearful	26%	
Perception of safety in the city		4%
Very unsafe	25%	
Somewhat unsafe	38.5%	
Somewhat safe	28.2%	
Very safe	8.3%	
Perceived risk of victimisation in the city	0(2.5)	27%
Precautionary behaviours	51.7(17)	4%
Direct Victimisation	14%	0%

Table 3 presents the unstandardised difference-in-difference estimates of the causal effect of program participation on the outcomes of interest. These estimates have been adjusted for demographic, and background characteristics, participants. First, we examine the effects of program participation on subjects' desire for information about location, time, and type of crime in Santa Rosa de Copan. The results indicate that using the application increased interest in information about crime, on average, by 0.83 points, everything else being equal. Similarly, participants who used the *SafeWalking* app experienced a significant 1.16 point increase in their self-rated knowledge of the safe and dangerous areas in Santa Rosa de Copan.

The results indicate that using the *SafeWalking* app did not have a significant impact on the likelihood of experiencing fear in their block/neighbourhoods of residence. However, those who *had* experienced fear in their block/neighbourhood are significantly more likely to experience it more frequently and at a higher magnitude. Everything else equal, subjects who used the application would expect a 2.11 and 1.41 increase in the log-odds of experiencing more frequent and higher

Table 3. Adjusted difference-in-difference estimates of program participation on success indicators.

	Diff. in Diff. Estimates†	95% CI	n
Desire for information about crime[a]	0.83**	[0.14– 1.54]	164
Self-rated level of crime knowledge[c]	1.16*	[0.22– 2.36]	16
Emotional fear of crime in your block[b]	0.52	[−0.73– 1.77]	171
Frequency of fear in your block[c]	2.11*	[0.33– 3.88]	101
Magnitude of fear in your block[c]	1.48*	[0.04– 2.99]	101
Perception of safety in your block[c]	−0.40	[−1.00– 0.20]	164
Perceived risk of victimisation in your block[c]	−0.39	[−1.82– 1.02]	142
Emotional fear of crime in the city[b]	1.54	[0.44– 5.42]	169
Frequency of fear in the city[c]	0.46	[−1.16– 2.01]	105
Magnitude of fear in the city[c]	1.51*	[0.02– 3.01]	114
Perception of safety in the city[c]	−1.15*	[−2.30 – −0.01]	164
Perceived risk of victimisation in city[c]	0.18	[−1.19– 1.56]	146
Precautionary behaviours[a]	−2.29	[−13.39– 9.15]	146
Direct Victimization[b]	0.83	[0.13– 5.21]	171

*p ≤ 0.05; **p ≤ 0.01; ***p ≤ 0.001
†All results are adjusted for demographic, background and previous victimisation characteristics
[a]OLS regression (unstandardised coefficients); [b]Logistic regression (odd ratios); [c]Ordered logistic regression (log of odds)

magnitudes of fear. The use of the application had no significant impact on the perception of safety and perceived risk of victimisation in their block/neighbourhood.

In addition to the block/neighbourhood of residence, we also examine the effects of program participation on incidence, frequency, and magnitude of fear in the city of Santa Rosa de Copan in general. We find that *SafeWalking* app had no impact on the incidence of emotional fear of crime in the city in general and the frequency of those episodes. Program participation, however, did seem to have an effect on the magnitude of fear among respondents who had previously experienced fear of crime. All else being equal, subjects assigned the *SafeWalking* app would expect a 1.51 increase in log-odds of experiencing higher magnitudes of fear. There was also a significant decrease in respondents' perception of safety in the city of Santa Rosa de Copan. All else equal, participants who used the app would expect to see a 1.15 reduction in the log-odds of perceiving the city as a safer place. Similar to the findings above, program participation had no discernable impact on the perception of risk of victimisation in the city.

One of the major goals of the *SafeWalking* app was to provide actionable intelligence to women so that they may adjust their daily routines to minimise the risk of victimisation. However, the results suggest this did not occur. Everything else being equal, the assignment to *SafeWalking* application had no significant impact on the number of precautionary behaviours women engaged in during the two months of observation. Program participation also had no significant effect on their likelihood of being victims of a crime during the two months of implementation

Use and user satisfaction of the safeWalking app

Participants assigned to the treatment group used the *SafeWalking* app a total of 3,117 times during the two-month period. The average participant used it 35 times. On average, participants used the application every other day. Figure 2 presents a histogram of user activity.

In addition to this information, we collected data on user satisfaction with the *SafeWalking* app. The overwhelming majority of users were satisfied with the design (93%) and information (86%) provided by the app. Participants believed the app was users friendly (98%), and the crime information displayed was easily understood (95%). Significantly, participants believed that the data presented in the app facilitated precautionary behaviours (82%) and could prevent future victimisation (98%). The majority of users (88%) thought the *SafeWalking* app changed their perception of safety in the City of Santa Rosa de Copan.

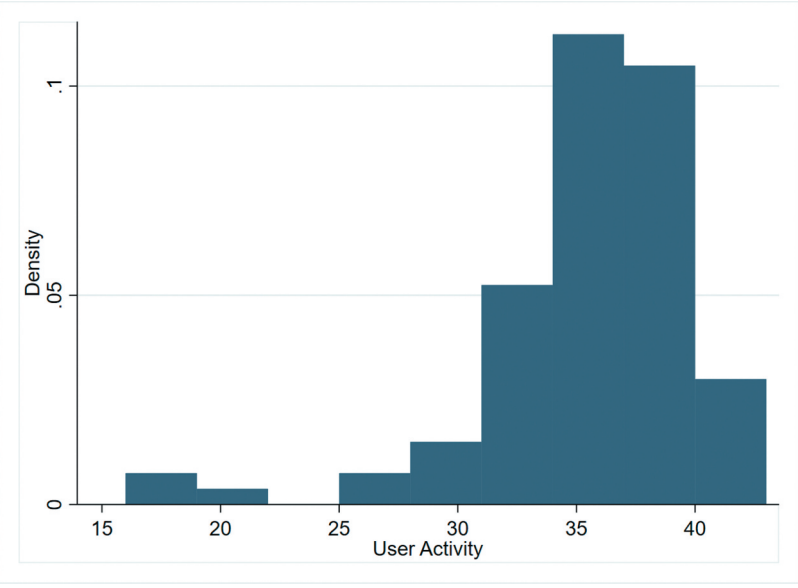

Figure 2. User Activity during Observation Period.

Discussion

Violence against women in Honduras is widespread. Honduras has been rated by the United Nations Office on Drugs and Crime (UNODC) as the country with one of highest feminicide rates in the world (Small Arms Survey, 2016). Unfortunately, their murder is no isolated incident; these victims have had to endure a long string of abuse that often starts with child labour, sexual abuse, domestic violence, human trafficking (Centro de Derecho de Mujeres, 2014). Given this lack of security, government institutions have had to think outside the box to provide citizens, especially women, with the tools to increase public safety. The *SafeWalking* app represents an important innovation in the fight against the victimisation of women and public safety generally. Similar to other crime prevention apps, *SafeWalking* app aimed to provide information of "safe" and "dangerous" places for women in Santa Rosa de Copan. Honduras National Security Forces hoped that armed with this information, women to take precautions when entering dangerous areas, and as a result, reduce their risk of victimisation. *SafeWalking* app represents the first crime prevention mobile application in Honduras.

This study used a difference-in-difference research design to evaluate the impact of *SafeWalking* mobile app on users' self-rated learning of dangerous and safe places in Santa Rosa de Copan, emotional fear of crime, perceived risk of victimisation, precautionary behaviours, and actual victimisation.

The finding indicates that participants who used the *SafeWalking* app increased their interest in obtaining crime information compared to the control group. Similarly, the findings suggest a significant increase in their self-reported knowledge of the dangerous areas in Santa Rosa de Copan. It is important to note that increased self-reported knowledge does not necessarily translate to an objective increase in knowledge. The literature on training programs has consistently shown a lack of correlation between perception measures and actual gains in learning (see Persky et al., 2020). Therefore, we cannot conclude with certainty that those who used the app became more knowledgeable; instead, we can conclude that in the eyes of the users, the app met one of its main goals: bring greater awareness of safe and dangerous places in Santa Rosa de Copan.

This study finds that using the *SafeWalking* app did not decrease emotional fear of crime in the block they reside in or in the city of Santa Rosa De Copan in general. The literature on fear of crime suggests that this is the case because fear of crime is a function of the immediate environment and situation (Lorenc et al., 2012). Therefore, crime information in a vacuum would not be expected to spark an episode of emotional fear of crime. This finding is promising as the application did not aim to increase users' fear of crime. Instead, the *SafeWalking* sought to provide users with information that would help them accurately assess their risk of victimisation and take precautionary behaviours to decrease their risk of victimisation.

Despite not having an impact on fear of crime, using the app significantly increased the frequency and magnitude of fear episodes for *those who already had experienced fear before*. This result is consistent with the academic literature (Heath, 1984; Intravia et al., 2017) that links consumption of crime information via mass media increases the fear of crime. Future iterations of *SafeWalking* app should note these findings and present information in a way that does not negatively impact users who are prone to experience emotional fear of crime. This could be done in a number of ways. First, eliminate the choropleth map as a means to present risk. Although the three-colour scheme (i.e., low = green, medium = orange, high = red) is simple to understand, it may lead some users to underestimate and others to overestimate their risk of victimisation. For example, someone prone to emotional fear of crime might interpret the colour red as a really high risk of victimisation when it really means a relatively high risk of victimisation. Instead, we recommend future iterations to quantify the risk (e.g., odds of victimisation) and present that number instead of a colour. Second, to ensure that users understand the odds or change in odds of victimisation, we recommend comparing those odds to the odds events that users may experience but do not fear disproportionally to their likelihood of occurring, such as the odds of hurricanes or earthquakes. For example, users who are prone to experience fear of crime may be happy to know that the odds of being a homicide victim are 1 in 20,000, which is roughly similar to the odds of being shot by a toddler. Providing the user with the odds of being victimised, as opposed to a map with "red" and "green" zones, and providing context through a comparison to other events with similar odds, may inform the user without causing them to increase emotional fear of crime.

This study also finds that using the *SafeWalking* app did not have a significant effect on respondents' perceived risk of victimisation. This is likely due to the high risk of victimisation for women in Honduras and Latin America in general. As noted, Honduras is consistently within the top five countries worldwide in terms of femicide rates. Given this context, it is warranted for women to have a heightened perception of their risk of victimisation and unlikely for the *SafeWalking* app alone to change it.

This evaluation also finds that the *SafeWalking* app did not affect the number of precautionary behaviours users engaged in during the two months of observation. There are two likely explanations for this lack of effect. First, knowing the information does not mean users will change their routine actives. For instance, users may not have someone to walk them or give them a ride to work. Additionally, users may not know the full range of precautionary behaviours to engage in to reduce their risk of victimisation. A second explanation is that precautionary behaviours are a direct function of situational context more than the risk of victimisation. In other words, users take precautionary behaviours when the situation demands it (e.g., a harassing drunkard) rather than proactively altering their routine activities, which may be costly in time and money when there is not an apparent payoff. Given the absence of a change in the number of precautionary behaviours, it is not surprising that using the *SafeWalking* app did not have a significant impact on their likelihood of being victims of a crime during the two months.

Future iterations and similar applications should incorporate an alert system that warns when users enter locations that significantly increase their odds of victimisation. This alert system may make the risk more apparent and invite them to be more proactive in their safety. Future phone applications should also provide users with tips on a range of precautionary behaviours for different

crimes and settings. Incorporating these tips, as well as daily reminders in the form of a "tip of the day," may, over time, make users more likely to incorporate them into their daily activities.

This study is not without limitations. First, the participants of this study were recruited from the city of Santa Rosa De Copan, Honduras, and thus, the findings of this study cannot be generalised to other Latin American countries. Second, due to limited smartphone/internet usage in Honduras, participants were not randomly assigned to the treatment group and control group, which has led to imbalance between the treatment and control groups. While that difference-in-difference is robust to imbalances across treatment conditions, it is important to note that we do not know for sure if users' characteristics systematically influenced trend for one group. A third limitation is the observation period. Our analysis explored the impact of this app for two months among 100 participants. Future studies should examine whether the impact of the app changes with long-term use. A fourth limitation is gender. Our sample is composed only of women; therefore, our findings may not be generalisable to men. Future research should include men in the sample.

Despite this limitation, this study shows that using mobile technologies to deliver interventions has the potential to help vulnerable populations, especially since the cost would be low compared to other types of intervention strategies. As the first evaluation of a crime prevention app targeting women in Honduras, the results suggest that a well-designed app may inform users of their objective risk of victimisation without adversely affecting users' mental health. This evaluation finds that with improvements and further testing, mobile apps may be an effective tool to increase public safety, share information of crime, and allow citizens to take more ownership of their security.

Notes

1. Abandoned buildings, beauty parlours, banks/ATMs, barbershops, bars/restaurants, mini-markets, parking lots, empty lots, carwash establishments, churches, bus stops, gas stations, government building, hospitals, pool halls, street vendors, schools, hotels/motels, parks, and unillumined street segments.
2. For example, the spatial proximity of churches, mini-markets, bus stops, and density of bars were significant predictors of women victimisation in public spaces.
3. Block of residence is used as a measure of users' neighbourhood.
4. See appendix for description of items for this and all constructs below.

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