TRANSPORT
SCOTLAND
CÒMHDHAIL ALBA

"There's an app for that!"

Women's Safety on Public Transport in Scotland

Contents

Glossary of key terms

App

Short for application, an app is a software program designed to run on a specific device. Apps can be used on both mobile phones and on a web browser.

Crime Prevention Through Environmental Design (CPTED)

Measures taken to reduce crime through the design of the physical environment.

Feminist urbanism

Urban design and planning through a feminist lens.

Gender analysis

Exploring how policies affect women and men differently.

Gender-based violence

Violence directed against someone because of their gender.

General Data Protection Regulation (GDPR)

A set of EU rules on data protection and privacy.

Intimate Partner Violence

Physical, sexual violence or emotional abuse by a current or former intimate partner.

National Performance Framework

A framework outlining Scotland's eleven national outcomes that measure national wellbeing, including economic, social and environmental indicators (Scottish Government, 2023).

Personal safety

How people experience or perceive risk of harassment, intimidation, and sexual behaviour (UK Government, 2021).

Public transport

Forms of transport that are available to the public, charge set fares, and run on fixed routes (e.g., trains, buses).

Public space

Places that are accessible to the general public. It is important to note that it is a contested concept and there are hierarchies of public spaces.

Organization for Economic Cooperation and Development (OECD)

An intergovernmental agency made up of thirty-eight countries, which helps members to formulate economic and social policies.

Sexual harassment

Unwanted conduct of a sexual nature, which has the purpose of "creating an intimidating, hostile, degrading, humiliating or offensive environment" (Equality Act 2010).

Sustainable Development Goals

Seventeen global goals adopted by the United Nations in 2015 to end poverty, hunger, AIDS, and discrimination against women and girls by 2030 (United Nations, 2015).

Violence against women and girls (VAWG)

Physical, sexual and psychological violence including domestic abuse, rape, incest and child sexual abuse, sexual harassment and intimidation at work and in public, commercial sexual exploitation including prostitution, pornography and trafficking and so 'honour based' violence, including dowry-related violence, female genital

mutilation, forced and child marriages and 'honour' crimes (Scottish Government, 2023).

Introduction

In the last decade, there has been a surge in the number of personal safety apps aimed at enhancing the safety of women and girls (McCarthy et al.,2016; Maxwell et al., 2020). Personal safety apps (hereafter apps) have a multitude of uses: alerting others to an emergency, identifying hotspot areas, tracking journeys, collecting audio and video evidence of harassment, raising awareness and signposting users to support organisations (Gekoski et al., 2015). The use of apps to tackle violence against women and girls (VAWG) has been endorsed by both the UK and Scottish governments, however most academic literature has focussed on the use of apps in specific contexts with prominent examples including: to target intimate partner violence and for the use on university campuses. Few studies have looked at the use of apps in the public space, and even less has been written about the use of apps for women on public transport, bar a few notable exceptions (McCarthy et al., 2016; Maxwell et al., 2020).

A 2023 report looking at the experiences of women and girls on public transport in Scotland, found that women reported feeling unsafe 'very often' or 'always,' particularly when travelling at nighttime (Transport Scotland, 2023). Issues around unwanted attention, antisocial behaviour, harassment, verbal abuse, physical assault and being followed were cited as concerns among women (Transport Scotland, 2023). The report produced 10 recommendations, one of which was to raise awareness of the technology that currently exists to enhance the safety of women and girls on public transport (Transport Scotland, 2023).

This follow-up report was carried out as part of an internship with Transport Scotland, Transport Strategy and Analysis. It seeks to explore literature around the use of apps for use in public spaces, particularly on public transport. The intention is not to consider specific apps, rather it is to look at the literature around the availability of apps, their safety features and how they are used. This will help map the current landscape of apps in the UK.

The report has three aims:

- To map the typologies of apps available for women and girls in the public space/public transport.
- To identify current themes in academic literature around the use of apps in public spaces and to identify gaps in literature.
- To consider policy and governance implications arising.

Review of Literature

Literature reviewed for the report was based on a search for key literature produced in the last 10 years in OECD countries. However, significant, large-scale studies involving personal safety apps produced out with this timeframe, or out with the OECD, were also included. The search terms used to generate initial literature are cited below. Keywords were taken from the UK government's definition of public safety.

Resources Searched

- Idox
- KandE
- Knowledge Network
- ProQuest
- National Library of Scotland Catalogue
- Google Scholar
- Google Custom Search

Keywords/Search strategy

- Personal safety app (application)
- Public space
- Women
- Transport
- Harassment
- Unwanted sexual behaviour

Background: Policy context

Violence against women and girls (VAWG) affects nearly one in three women worldwide (WHO, 2021). In 2013, the UN Commission on the Status of Women called on all world governments to take preventative measures to tackle sexual harassment and other forms of sexual violence in public spaces. The Equally Safe strategy (Scottish Government, 2016) recognises that being free from gender-based violence is a fundamental human right and one of the strategy's core objectives is the primary prevention of VAWG. Equally Safe (Scottish Government, 2016) recognises that women experience higher levels of fear for their personal safety in public spaces. Studies have shown that this 'fear or victimisation' (Loukaitou-Sideris, 2014) impacts on women's mobility patterns and in turn their participation in public life (UN Women, 2017).

Scotland's National Transport Strategy 2 (NTS2) (Scottish Government, 2020) recognises that transport plays a key role in the production of equal rights: allowing people to access education, work and participation in public life. The NTS2 aligns with Scotland's National Performance Framework (NPF) and the related Sustainable Development Goals around health and wellbeing, gender equality, sustainable cities and climate change (UN, 2015). The fear and reality of gender-based violence impacts on how women and girls use public transport and tackling VAWG is a key priority for the Scottish government.

Overview of the issue

Gendered mobilities: women's safety and public transport

The #MeToo movement (metoomvmt.org, 2023) was started by US activist Tarana Burke in 2006, to support survivors of sexual violence, and it came to prominence in 2017, following allegations of sexual harassment by TV producer Harvey Weinstein. While the movement has shone a light on sexual harassment in the workplace and on university campuses, less has been written about sexual harassment in public spaces (Ding et al., 2020). Increasing attention is being paid to the gendered aspect of public space (Kelly, 2012, Vera-Gray, 2016; Engender, 2017) and the way in which women experience personal safety. The UK government (2021) defines personal safety as how people experience or perceive risk of harassment, intimidation and unwanted sexual behaviour. Sexual harassment is the most common form of VAWG (House of Commons, 2018) and some argue that it represents a 'spatial expression of patriarchy' (Valentine, 1992: 24). A study by UN Women (2021) found that 71% of women of all ages and 86% of young people aged 18-24 had experienced some form of sexual harassment in a public space. An Opinions and Lifestyle Survey (ONS, 2022) found that 27% of women in the UK had experienced at least one form of harassment in the previous 12 months.

Access to public transport is key to being able to participate fully in society (House of Commons, 2018). Scotland's NTS2 recognises that women have different mobility patterns than men: women use public transport more and their journeys tend to be more complex due to women often combining roles as unpaid carers with uneven work patterns and 'multi-purpose' trips involving childcare, shopping etc (Transport Scotland, 2020). The term 'transit captive' (Yu and Smith 2014), has been adopted to recognise the fact that many women have no other choice but to use public transport.

A UK Government report cited public transport as being a 'hotspot' for sexual harassment and described is as being a 'crime attractor' for sex offenders (House of Commons, 2018). Sexual harassment in public spaces can be verbal, non-verbal or physical (Ceccato and Loukaitou-Sideris, 2022). A recent campaign by Transport for London (Intelligent Transport, 2021) highlighted common examples of sexual harassment on public transport including cat calling, exposing, cyber-flashing, pressing, touching, staring and up skirting. The most common forms of unwanted behaviours on public transport include staring, intimidatingly, sitting or standing needlessly close to someone and verbal abuse (Suzy Lamplugh Trust, 2021). A 2021 survey found that 88% of respondents in the UK had experienced some form of unwanted behaviour on public transport in the past 5 years and 95% of respondents

had experienced some unwanted behaviour on public transport in their lifetime (Suzy Lamplugh Trust, 2021). A survey by Transport Scotland (2022) found that 33% of women surveyed were concerned about personal safety on public transport and 14% had experienced harassment on public transport in Scotland, compared to 9% of men.

Perceptions of crime

Even though women are more likely to walk and take public transport (Transport Scotland, 2023; ONS, 2021), a survey by ONS (2021) found that nearly 50% of women feel unsafe while doing so. For females aged 16 to 34, the figure is higher at 60%. Similarly, a survey by Centre for London (2019) found that women were twice as likely as men to cite personal safety as being a barrier to walking and using public transport. Indeed, a report by Transport Scotland (2023) looking at women's experiences of personal safety on public transport found that almost all women surveyed reported feeling unsafe 'very often' or 'always' when using public transport. The report found that perceptions of crime were influenced by media stories of attacks on women, word of mouth and the general reputation of areas (Transport Scotland, 2023). Studies have shown that the fear of sexual harassment is omnipresent across different cultural contexts also. A study of 13,323 university students across eighteen global cities spanning six continents found that the fear of sexual harassment impacted on behaviour and mobility patterns on public transport (Ceccato and Loukaitou-Sideris, 2022). Female students felt more unsafe on public transport compared their male counterparts across all eighteen cites (Ceccato and Loukaitou-Sideris, 2022). A survey by YouGov (2021) found that 89% of women felt that tougher sentencing for sexual harassment, sexual assault and domestic violence would be the most effective strategy in making women feel safe. Second and third most effective strategies were making the police take reports of sexual harassment more seriously and better lit streets.

While men are more likely to be victims of crime on public transport (Smith 2008; Hsu 2011), women feel more fear of crime. Three possible explanations have been put forward to explain this paradox (Vera-Gray, 2016; Vera-Gray, 2023). Firstly, women, unlike men, are socialised to embrace vulnerability and are more likely to report a fear of crime (Vera-Gray, 2016). Secondly the fear of sexual assault is particular to women and is often under-reported (Gekoski et al., 2015). The third explanation relates to how crimes are defined, the unwanted attention and everyday sexism that women experience is often normalised and not labelled as a crime (Vera-Gray, 2016). Vera-Gray (2023) offers a fourth explanation, suggesting that the fear of crime influences women's behaviour, which in turn reduces the 'amount' of crime they experience. What is evident is that fears about safety influence women's decisions around travel (Gardner et al., 2017; Engender, 2017).

A report by Transport for West Midlands (2022) found that limited transport options impacted on women taking up job and training opportunities and that concern for safety was a significant barrier. It calculated that 3.7% of GDP could be lost because of women's fears in accessing employment. However, studies also show that technology helps enhance the feeling of safety (Maxwell et al., 2020). A study by Transport Scotland (2023), looking at women's experiences of safety on public transport found that women felt vulnerable if they did not have access to their smartphone during travelling, particularly where there was no phone signal. Women often sat next to charging points and chose to share their journey with friends and family. A study by TravelWatch (2021) found that London commuters wanted to see an available panic button to alert drivers to crimes, better Wi-Fi to be able to report crimes, better CCTV and a purpose-built app to report crime.

The underreporting of crime

Sexual harassment on public transport is often under-reported (Gekoski et al., 2015). A survey by Centre for London (2019) found that that almost half of women who had experienced sexual harassment on public transport did not report it. A similar study found that only 14% of respondents had reported incidents of sexual harassment on public transport to the police (Suzy Lamplugh Trust, 2021). Several reasons appear to contribute to this underreporting: the transitory nature of public transport (TravelWatch, 2021; Lewis et al., 2021), the ebb and flow of passengers (Lewis et al., 2021), a lack of awareness of how to report (Transport Scotland, 2023; TravelWatch, 2021; Transport for West Midlands, 2022), a feeling that reporting would not result in any action (Transport Scotland, 2023; TravelWatch, 2021; Transport for West Midlands, 2022) and the unwillingness of bystanders to react (Lewis et al., 2021; TravelWatch 2021). Ding et al (2020) found that social and cultural pressures, embarrassment and not wanting to be re-traumatised in court prevented women from reporting sexual crimes. Transport Scotland (2023:45), found that women did not report verbal abuse because it was deemed to be 'normal' or 'not serious enough'. A report by TravelWatch (2021) found that 64% of passengers would feel more comfortable reporting crimes if they had more information about how to do so.

While there are mechanisms to report crime via apps, websites, through the British Transport Police (BtP) etc, a report by Transport for West Midlands, (2022) found that there was no joined up approach across different modes of transport and a lack of systematic capturing of reporting, which led to underreporting (Transport for West Midlands, 2022). A related issue was that data was not shared across local authorities and the report recommended the need for 'a national intelligence database' across all modes of transport. Underreporting, as well as underestimating crime statistics, makes planning interventions more challenging (Gekoski et al., 2015, International Transport Forum, 2018).

Travel adaptations: embodied safety work

The fear of crime leads to women adopting 'restrictive, avoidance-type behaviours' (Maxwell et al., 2020) where they modify appearance or behaviours on public transport (Gardner, Cui, & Coiacetto, 2017; Engender, 2017). In terms of appearance, women make themselves less visible by wearing sunglasses or headphones (Transport Scotland, 2023), looking down (Dhillon & Bakaya, 2014) or wearing clothes that do not attract unwanted attention (Stark & Meschik, 2018). Women adapt behaviours by sitting near the driver (Transport Scotland, 2023), choosing to sit away from others (Lewis, 2018) or by sitting near other women (Hsu, 2011). Similarly, women adopt time and space-based avoidance strategies (Ding et al., 2020): only travelling at certain times, not travelling alone (Dhillon & Bakaya, 2014) or choosing particular routes (Lewis, 2018). These strategic choices to mitigate against harassment have been termed 'safety work' (Kelly, 2012). These habits become 'embodied principles' (Vera-Gray, 2023: 136) that are invisible and unconscious. This 'safety work' has an economic impact also, where women often rely on more expensive forms of transport like taxis etc (Infante-Vargas & Boyer, 2022; Transport Scotland, 2023).

It is important to note that personal safety is not universal, it means different things for different women (Vera-Gray, 2023). Both the perception of safety, and the 'safety work' that women engage in, are influenced by intersecting characteristics such as age, class, income, sexuality, ethnicity, disability, socio-economic status etc, which impact on how women experience public transport (Engender, 2017). While sexual harassment affects most women, not all women are affected in the same way. LGBTQ+ groups (Suzy Lamplugh Trust, 2021), younger women (Transport Scotland, 2023; ONS, 2021), ethnic minority women (Transport Scotland, 2023) and disabled people (Transport Scotland, 2023; ONS, 2021) have an increased sense of fear in public spaces. Studies by Transport Scotland, (2023) and ONS (2021) found that disabled people felt less safe than non-disabled people on public transport in the UK. A report by Suzy Lamplugh Trust (2021) found that the proportion of respondents who had experienced unwanted behaviours in the past five years was higher among LGBTQ+ respondents and a Transport Scotland (2023) study found that Black and ethnic minority groups were more likely to report verbal abuse.

Improving the safety for women and girls on public transport

Improving safety with environmental design

Crime Prevention Through Environmental Design (CPTED) (College of Policing, 2017) is the idea that improving the environment can reduce the possibility of crime. Small adjustments like transparent bus stops (Ding et al., 2020) or moving bus stops to better lit locations with more natural surveillance can influence perceptions of safety (Beebeejaun, 2017). Other practical aspects of the transport environment that influence the perception of safety in public spaces include: lack of lighting (Gekoski et al., 2015), lack of network coverage (Transport Scotland, 2023), visible staffing (Gekoski et al., 2015, Gray, et al., 2015, Transport for West Midlands, 2022), the ebb and flow of passengers (Gardner, Cui and Coiacetto 2017, TravelWatch, 2021; Transport Scotland, 2023) and the use of CCTV (Lorenc et al., 2013; Loukaitou-Sideris 2009).

While CPTED and urban planning have a part to play in making women and girls feel safer in public spaces, feminist scholars argue that there are limits to how much this can deter sexual crimes. Koskela and Pain (2000) posit that crime needs to be understood in terms of wider structural gender inequalities and patriarchy (Koskela and Pain 2000). Literature around CPTED often negates the fact that women experience public spaces differently than men and some suggest that CPTED needs to adopt a gender lens (Ison & Matthewson, 2023). Feminist urbanism (Hayden, 1980) is a theory that posits that urban planners need to re-think the design of public spaces to make them more inclusive for everyone. Both Glasgow and Edinburgh have been declared 'feminist cities' recognising that gender should be a central aspect of planning, design, policy and budgeting (Engender, 2023). The International Transport Forum (2022) and the World Bank have developed toolkits for transport providers to be able to carry out gender analysis on public transport. However, gender analysis requires that there is gender disaggregated data in the first place. The International Transport Forum (2018) recognises that there is a lack of disaggregated data on public transport and there are also data gaps in how sexual harassment is experienced by different groups (Ding et al., 2020). The use of personal safety apps could potentially help bridge this data gap.

Improving safety with technologies

Technology can play a role in preventing incidents, improving safeguarding, signposting to support organisations, aiding communication, providing reporting mechanisms and information sharing amongst professionals (Transport for West

Midlands, 2022). Technologies to tackle VAWG include the use of body worn cameras for monitoring purposes, the use of real time information to reduce waiting times (Loukaitou-Sideris, 2016; Transport for West Midlands, 2022), passenger assist alarms on trains (TravelWatch, 2021) and publicly available databases on sex offenders (Maxwell et al., 2020). More recent developments include the use of wearable communication technologies (White & McMillan, 2020) and personal safety apps (McCarthy et al., 2016).

Wearable communication technologies

There has been an increase in the number of wearable devices to prevent gender-based violence in recent years (White & McMillan, 2020). Devices like the ROAR panic button or the Athena pin are wearable alarms which, when activated, message the user's location to designated contacts. Other wearable devices include smart jewellery (Inviswear.com, 2023) like the Flare bracelet (Getflare.com, 2023) which acts as a panic alarm to alert emergency contacts. Many of these technologies connect to smartphones like the SPOT wristband which connects to an app and alerts others if they identify a problem (White & McMillan 2020). Smart watch technology is increasingly being used to enhance safety also. The Epowar app was developed by the University of Bath and works in conjunction with smartwatch technology to alert emergency contacts if it detects that a woman is in distress. According to the website, the app can tell the difference between a heart rate increase due to exercise and an adrenaline spike (Epowar, 2023). Other examples include the Spacetalk smartwatch, aimed at families, which has an SOS alert function and a 'safe zones', function which alerts emergency contacts when the user leaves a pre-determined geo-fenced area (Spacetalk, 2023).

Personal safety apps

It is estimated that 94% of adults in the UK own a smartphone (Statista, 2023). The proliferation of smart phone ownership has coincided with a surge in the number of available apps. In the first six months of 2023, there were 77 billion downloads of mobile apps (Statista, 2023). In the last decade, there has been an increase in the number of apps aimed at enhancing the personal safety of women and girls (McCarthy et al. 2016; Maxwell et al., 2020). There appears to have been a spike in interest in the use of apps in the UK over the past few years. In the week following the killing of Sarah Everard in 2021, the WalkSafe app had more than 300,000 downloads, compared to just 2000 downloads in the previous week (WalkSafe, 2021). Increased engagement with apps appears to coincide with high profile media stories involving attacks on women in public spaces.

The purpose of personal safety apps is to enhance the safety of women and girls; however, it is important to note that there is no universal definition because of the

wide variety of apps available. A search on The Apple Store and Google Play in 2022 returned 505 personal safety apps and 243 of these were focussed on public safety (Maxwell et al., 2020). Personal safety apps do not have one universal purpose, rather they have multiple purposes. Some apps are for the use during an emergency to raise an alarm, while others use Global Positioning System (GPS) to track users or to signpost users to support organisations. Apps can also be used for reporting purposes to identify hotspots or to collect audio and video evidence of harassment (Gekoski et al., 2015). Similarly, apps work in conjunction with a variety of different people: some use a network of friends and family, while others connect with centralised control rooms, emergency services, transport providers or a network of volunteers.

The use of apps to tackle VAWG have been supported by organisations like The United Nations Commission on the Status of Women. The British government recommends that women who are experiencing domestic abuse use the Bright Sky App (Hestia.org, 2023), which allows users to record evidence of their abusive relationship and seek help from professionals. Similarly, the Scottish government endorses the use of the FollowItApp (Followitapp.org, 2023), which was developed by Rape Crisis Scotland and the Scottish Women's Right Centre, allowing women to record and keep a secure record of incidents of stalking. The Scottish government, Young Scot and Victim Support Scotland all recommend the use of the Hollie Guard app (Hollieguard.com, 2023), which alerts emergency contacts to the user's location when activated. Despite this proliferation, few apps have been adopted worldwide pointing to a need to be culturally specific and responsive to local contexts (O'Campo et al., 2021). With the exception of the Railway Guardian app, which works across Scotland, Wales and England (National Rail, 2023), personal safety apps have not been rolled out at a national level. At local authority level in England, there are several examples of the use of the personal safety app WalkSafe, which according to its website, has over 500,000 downloads (WalkSafe, 2023). The WalkSafe app was first adopted in Bradford city in 2023 and has since been adopted by the Leeds City Council, allowing users to plan safe routes home and to share their locations with friends and family. The app has also partnered with organisations like Airbnb, Budweiser and Admiral, the largest operator of adult gaming centres (WalkSafe, 2023).

Mapping the typologies of personal safety apps

It is important to note that personal safety apps do not have one universal function. There is an array of apps available to download, for different user groups, to be used in different contexts, for different purposes and with different functionalities. The following section outlines the typologies of apps available, who they are for, the

contexts in which they are used, their purposes, features and functionality. Examples are given below of specific apps currently available at the time of writing. However, it is important to note that this landscape is dynamic, and the following should be understood as illustrating the characteristics of apps encountered during the study period.

Apps for specific users

Some apps are targeted for use by specific groups including lone workers, solo travellers, people who live alone, female runners, university students, families, specific marginalised groups etc. In 2014, Police Scotland, in conjunction with the charity I am Me Scotland, developed a personal safety app called Keep Safe (Police Scotland, 2021), which is designed for disabled people who may feel unsafe while out in the community. It works in conjunction with businesses, cafes, libraries, museums etc, which act as 'safe places' that are mapped out on the app. Users can enter a safe space if they feel threatened and can seek help from staff members.

Apps for use in specific contexts

Not all apps are for universal use in public spaces, some are geographically bound for use in specific contexts like on a university campus, or at a workplace etc. The SafeZone app has been adopted by 25% of universities across the UK (CriticalArc, 2019). The free app, when activated, allows students and staff members to alert campus security teams to an incident using GPS tracking. However, the functionality of the app is lost if students leave the university campus. It is important to note, however, that public space is a contested concept (Low, 2023). Some of this complexity is explained by the fact that public spaces incorporate physical spaces, which introduces questions around how spaces are financed, owned, governed and accessed (Low, 2023).

Apps for particular purposes

A systematic review (Eisenhut et al., 2019) of 171 personal safety apps across Europe, Asia, Africa, and the Americas found that apps fell into five main categories: emergency, avoidance, reporting and evidence building, education and signposting. The study found that most apps were for use during an emergency and for preventative/avoidance purposes (Eisenhut et al., 2019).

Emergency

Emergency apps make up almost half of the apps available (Eisenhut et al., 2019) and their function is to raise an alarm in the event of an emergency. Ford et al.,

(2020) found that 72 personal safety apps in their study were for use during an emergency and a fifth of apps included an alarm system either in the form of a siren or flashing light to attract attention. The 'DigiPolice' app (Google Play, 2023) is an anti-groping app used in Japan. When activated it emits a voice message which shouts 'Stop it!,' while the message 'There is a molester!' appears on the smartphone screen to alert others in the vicinity.

Other emergency apps work by sending an emergency alert to designated contacts, sharing the user's GPS location or by sharing a video/audio recording from the user's phone. In 2011, the Office of the Vice President together with the Office of Science and Technology Policy and the US Department of Health and Human Services (Beaton, 2015) announced a competition called 'Apps Against Abuse' for software developers to develop an app to prevent dating violence and abuse. The winning app was 'Circle of 6' (Devpost.com, 2023), which is now one of the most popular apps in the UK. The app works with a trusted circle of six contacts who can be notified with two taps of a phone. GPS location is shared with emergency contacts and automated messages are sent to trusted contacts including: "I need to talk", "Call and pretend you need me – I need an interruption" and "Come and get me – I need help getting home safely."

Other apps include Soli (formerly SafeUp) (Wearsoli.co.uk, 2023), which connects women with trained volunteers known as 'Super-Solis' (formerly known as Guardians) in their area by video or audio call who will remain on the line until the user reaches their destination. The purpose of 'Super-Solis' is to give users a feeling of safety and company. According to the Soli website, volunteers must be over 18, female, and they have to go through an approval process. Before starting the role, volunteers complete training via the app, by watching several short videos and answering questions. Volunteers do not have access to user's contact details, rather the conversation takes place through the app. According to the Soli website, if the assistance call does not solve the situation, the volunteer can go to the location of the user if it does not pose any danger. The website recommends that if women are in immediate danger that they contact police directly (Wearsoli.co.uk, 2023). Other emergency apps like UMAY (Apple Store, 2023) allow users to contact designated emergency contacts, as well as finding 'safe spaces' in the vicinity where they can seek refuge if they are feeling vulnerable.

Prevention/avoidance

Avoidance apps are for use before a crime happens and their function is to identify hotspots or potentially dangerous areas in order to prevent users finding themselves in unsafe places. Apps include Path Community (Pathcommunity.com, 2023) which encourage users to flag potentially unsafe and unlit sections of streets, underneath

bridges. Other apps like Citizen (Citizen.com, 2023), alert users to incidents and allow real time reporting of incidents.

Reporting and evidence building

Reporting and evidence building apps are used to report and share incidents as they are in progress or after they have taken place via GPS tracking. The FollowItApp (Followitapp.org, 2023) was developed by Scottish Women's Rights Centre and is tailored to Scots Law. It helps women to collect evidence and record a log of incidents of stalking. Righttobe (formerly Hollaback!) (Righttobe.org, 2022) allows users to share their stories of harassment, along with details, photos, and the location of the incident. The HarassMap website (Harassmap.org, 2023) originated in Egypt, encouraging women to anonymously report and geolocate incidents of harassment on public transport and in other public spaces. This information is used by authorities to identify hotspots and potentially problematic areas to avoid (Allen and Vanderschuren, 2016). As well as allowing women to report sexualised crimes, some apps like the Railway Guardian app (BtP, 2023) encourage bystanders to report incidents that they witness on public transport. This is following research that women are more likely to intervene if they witness sexual harassment (UK Government Equalities Office, 2020).

Education

Education apps are used before incidents occur and give users tips relating to self-awareness, and offender behaviour. Examples include the 'MyPlan' app (Myplanapp.org, 2023) which is for university students in the US to devise a personal safety plan. The app provides information about sexual assault, sample scripts for supporting friends who are in potentially dangerous relationships, and it provides signposting to support organisations. The Women's Safety Totem SOS app includes 10 safety tips, a 15-minute self-defence video, as well as listing the nearest police stations and hospitals (Doria et al., 2021). Maxwell et al (2020) looked at use of 67 personal safety apps available on iTunes and Google Play and found that only one of the apps had an educational focus.

Supporting/signposting

Supporting apps signpost and connect users with organisations including legal, psychological, or medical practitioners. These tend to be used more to target intimate partner violence. The Bright Sky app (Hestia.org, 2023) is available in different languages and is for anyone experiencing domestic abuse to find the nearest support centres.

App features

Personal safety apps have a multitude of features as outlined below. These features appear in different configurations, depending on the purpose of the app.

Incident assistance

This feature includes panic buttons and alerts which are sent to trusted contacts at various points. The Red Panic Button app (App Store, 2023), when activated, sends a message to emergency contacts with the user's location. The app allows users to send a 'panic tweet' that shares their location and lets followers know they require assistance. Other apps like the SafeZone app (Safezoneapp.com, 2023) connect directly to security services on university campuses to alert security to an incident.

Evidence capture

This feature allows women to record and keep a secure record of incidents of harassment or stalking, using GPS to log locations and to capture video/audio evidence. Other apps like the Self Evident app (Witnessconfident.org, 2023) allow users to send photo and video evidence directly to police.

Journey features

Some apps provide real-time updates as users move though areas. The Safetipin app (Safetipin.com, 2023) uses GPS tracking to monitor the user's location and provides a safety score based on factors such as lighting, visibility, and proximity to public transportation. Other apps like the SafeLand Personal Safety alarm in Sweden allow users to set a timer that will send an automated emergency message if users do not arrive home at a designated time.

Man down

This feature detects non-movement, falls, or any incidents where the user becomes immobile. This a common feature of lone working apps such as the Peoplesafe (Peoplesafe.co.uk, 2023), which connects to an 'Alarm Receiving Centre' of trained professionals who can help.

Geofencing

This feature allows users to select an area on the map where they intend to be, and emergency contacts are alerted if the user steps out of this area. An example includes Vismo (Vismo.com, 2023).

Tracking

A 'tracking upon alert' feature uses GPS to share the user's location with designated contacts. The SafetiPin app (Safetipin.com, 2023) uses GPS to track users who have turned on the 'Track Me' button. Other apps have a constant tracking feature making the user's location trackable in real-time.

Walk me home

This feature allows women to connect with other women by video/audio call who accompany users until they feel safe. The Soli app (formerly SafeUp) (Wearsoli.co.uk, 2023) was launched in Israel in 2021, allowing women to connect to trained 'Super-Solis' (formerly 'Guardians') who are available 24/7 on video/audio call or in person.

Heatmaps

The user is alerted when a particular area is deemed unsafe based on crowdsourced data. The HarassMap app (Harassmap.org, 2023) started in Egypt and allow users to record stories of sexual harassment online. These are collated and displayed in real time on an online map, warning women of potentially unsafe areas.

Information generation and dissemination

This feature gives users information about how to recognise, manage, or prevent gender-based violence and it provides signposting to relevant support organisations. The Bright Sky app (Hestia.org, 2023) signposts women who are experiencing domestic abuse to contact local support centres.

Functionality

Activation methods

Apps can be triggered via several different ways: shaking, screaming, pushing the power button, going off a planned route etc. Shake2Safety (Google Play, 2023) is activated by pressing the power button four times. Apps like Chilla (Google Play, 2023) are voice activated by screaming. Once activated, a text message, email, location, and audio recording are sent to predetermined contacts. Similarly, bSafe (Apple Store, 2023) is activated by voice activation including screaming which automatically starts live-streaming video/audio to designated contacts. Other personal safety apps like Hollie Guard (Hollieguard.com, 2023) are activated by shaking which send out a high-pitched alarm and a strobe to attract attention. Some

apps like the Guardly app (Devpost, 2023) can make an emergency call when the screen is locked, so it is not obvious to others.

Where alerts go

Alerts can go to several different parties, including friends and family members, Facebook friends, volunteers, control rooms or to emergency services. Most apps send alerts to pre-determined contacts like friends or family. The Silent Beacon app (Silentbeacon.com, 2023) allows users to call, text or email their designated emergency contacts, as well as sending live GPS tracking information. Other apps like the SafeZone app (Safezoneapp.com, 2023) send alerts to university campus security services. Several transport-related apps send alerts to controls rooms or transport security. The Railway Guardian app (BtP, 2023) connects directly to the BtP control room, while the LA Metro Transit Watch app (Metro.net, 2023) allows passengers to anonymously contact metro security by text message or phone call. Other apps connect to a network of volunteers, who are not personally known to the user. The Soli app (Wearsoli.co.uk, 2023) allows users to request a virtual escort as they walk home who will stay on the line until the user feels safe. Some apps work with trusted contacts in the near vicinity, not necessarily pre-determined, using GPS via social media. The Cheeka app (Ananda Kanagaraj, 2013) has a panic button feature which sends an SMS to trusted contacts in the vicinity at various points. It uses GPS and connects to user's Facebook friends who are nearby. Finally, several apps are in direct contact with emergency services, even if the user is unable to speak. The Noonlight app (Noonlight.com, 2023) alerts emergency services to the user's location and works in conjunction with other apps such as Uber and Tinder.

Accessibility features

Apps include several accessibility features to account for the diversity of users. Several apps come with different language options to capture the linguistic diversity in the UK. The Bright Sky app (Hestia.org, 2023) has versions in English, Urdu, Punjabi, Polish and Welsh. For visually impaired users, some apps are compatible with screen readers, have large icons and use colours that are appropriate. Other accessibility features include icons that can be changed so as not to be recognisable and a quick exit function (Hestia.org, 2023), particularly if women are in danger of intimate partner violence.

Personal safety apps on public transport

While there is a plethora of personal safety apps available for download, there are only a few in the UK which have been designed specifically for use on public transport. The following section outlines the personal safety apps that are available in the UK and internationally for use on public transport. It is noteworthy that the use of apps on public transport have been much more prevalent in the Global South and represent relatively new developments in the UK. Most apps on public transport fall into the categories of reporting apps (e.g., Railways Guardian, Safer Transport Northumbria) and preventative/avoidance apps (e.g., StreetSafe).

Reporting apps

Reporting apps on public transport have been around for over a decade and allow uses to report incidents directly to transport officials, as well as uploading photographic evidence. International examples of reporting apps include The See Say smartphone app which was initiated by the Massachusetts Bay Transportation Authority Transit Police in 2012 allowing users to report incidents by text, share pictures and GPS location (Gekoski et al., 2015). In 2014, Metro Vancouver Transit Police in Canada launched their 'See Something, Say Something' campaign, where passengers could report incidents via an app (TransLink, 2015) also. Other examples include the LA Metro which launched a scheme in 2017/2018 where passengers could contact Metro security anonymously via text or phone call and submit photos of incidents. Another example is the Go Miami-Dade Transit app that allows users to report incidents anonymously, which go directly to security officials who monitor transport 24/7. The app allows first responders to be deployed and has a live chat function with passengers in real time (Miami Dade, 2023).

In the UK, reporting apps are a relatively new phenomenon. The Railway Guardian app was set up by the BtP in July 2022 to respond to VAWG on public transport. The app was developed in consultation with other app developers including StreetSafe, HollieGuard, Safe & the City, stakeholders like Transport for London (TfL) and charities like White Ribbon, and the Suzy Lamplugh Trust (BtP, 2023). The app is free, includes both English and Welsh language versions and it can be downloaded from Google Play or the Apple Store.

The aim of the app is to increase awareness of how to report crimes and to increase the reporting of unwanted sexual behaviour. The app allows users to share their journeys with trusted contacts, who can track their journey and who will be notified when the user arrives at their destination. The app also allows users to upload video and photographic evidence of unwanted behaviour, which is sent directly to the BtP control room. The app has educational and signposting functions and it provides

links to charities like Women's Aid, Shelter and ChildLine, as well as the National Rail Journey Planner. In March 2023, the Railway Guardian app partnered with Strathclyde Partnership for Transport (SPT) allowing use of the app on both train and subway networks throughout Scotland (SPT, 2023).

In 2021, Northumbria Police and Crime Commissioner launched a personal safety app called Safer Transport Northumbria, which allows users to report any unwanted behaviour on the bus and metro network in Northumbria. The safety app, in partnership with Moovit, was launched as part of the 'Safer Streets' campaign (Northumbria Police and Crime Commissioner, 2021). The purpose of the app is for users to access up to date travel information for better journey planning and to report any incidents that make users feel unsafe.

Preventative/Avoidance apps

The StreetSafe Police App was developed in conjunction with the Home Office and the National Police Chiefs' Council in 2021. Its purpose is not to report crimes, but it allows users to report areas with poor lighting, abandoned buildings, vandalism, incidents of verbal abuse or other unwanted behaviours (UK Police, 2023). This information is used to make improvements such as improving street lighting, installing CCTV etc. Other initiatives have been funded by the UK Government (2021) to provide more up to date travel information and reduced waiting times for buses. The West Yorkshire Combined Authority were funded in 2021 to launch a 'Train Safety' campaign to promote the access to this improved bus tracking (UK Government, 2021).

In Australia, the She's a Crowd app works in the city of Melbourne, in conjunction with Transport for New South Wales. The app uses social media and influencers to encourage users to share their stories about gender-based violence on public transport in Australia. When women share their stories, they are geotagged and time stamped, and this data is then used to help local governments and urban planners identify hotspot or problem areas. Since launching in 2018, the app has collected 80,000 data points, indicating the potential usefulness of preventative apps to generate smart data. In Canada, an initiative by the Metropolitan Action Committee on Violence Against Women and Children (METRAC) creates transport safety audits, where community members can report on physical infrastructure like lighting and make recommendations for future work (METRAC, 2023).

Discussion: Narrative summary of themes arising

Despite the proliferation of personal safety apps in recent years, there is little academic literature (Eisenhut et al., 2020) and few official reports on the subject. Most research on mobile apps focusses on health and fitness apps (Maxwell et al., 2020), while the majority of research looking at personal safety apps has examined their use in specific contexts: on university campuses (McGrath, 2016) or to tackle intimate partner violence (Doria et al., 2021). Much less has been written about the use of apps in public spaces including public transport. It is important to note that public space is a contested concept and there is no universal definition (Low, 2023). The following section outlines the themes arising from the literature search including: the likelihood of women to use apps, user experiences of apps to enhance feelings of safety and to increase reporting of incidents, as well as the need for a multi-pronged, joined up approach to women's safety.

The willingness of women to use personal safety apps

Several studies have looked at the willingness of women and girls to use personal safety apps (McCarthy et al., 2016, Potter et al., 2020; Tozzo et al., 2021). Two of the main themes that emerged were a lack of awareness of the existence of apps in the first place, as well as a general willingness to download them. A study in Italy with 1782 university students found that most participants had never downloaded an app and 62.6% of respondents had no awareness of personal safety apps (Tozzo et al., 2021). This echoes the findings of McCarthy et al., (2016), who found that only 1.7% of participants in a study in Ireland reported using personal safety apps, however 79.5% of participants said they would be willing to download an app. McCarthy et al., (2016) found that younger people in their study would be less likely to download an app if it had a cost association. The study also found that females with lower levels of engagement in technology, higher levels of education or those who lived in Dublin city were less likely to consider downloading an app.

A study with 203 students in Johannesburg, S. Africa (Oksiutycz & Lubinga 2021) found that the majority of participants were unaware of the existence of apps but that they would download apps if they were free or recommended by peers. Only 15% of participants in the study used apps and key factors influencing the decision to use apps were credibility, perceived utility, and safety experience (Oksiutycz & Lubinga 2021). A study by Potter et al., (2020) in the US looked at the likelihood of students

to download an app called uSafeUS, designed for university students to raise awareness and to report incidents of violence on campuses. The study found that only 20% of students had heard of the app, and that students were more likely to download the app if their universities were proactive in engaging in conversations about sexual violence on campus. Younger females were more likely to download the app and the reasons cited were to keep themselves safe, to keep their friends safe, and because of the educational features on the app. Of the 80% of participants who had never heard of the app, 50% of respondents said they would recommend it to a friend.

Another study of university students in the US looking at the use and perception of the 'Circle of 6' personal safety app found that two out of three participants reported talking to their friends about the app (Blayney et al., 2018). It is important to note that many smartphones currently have in-built technologies like GPS, real time user information and video and audio (Ford et al., 2022). Indeed, Blayney et al., (2018) found that the reason university students chose not to download the safety app 'Circle of 6' was because its features were already present in their smartphones. In terms of personal safety on public transport, a study by TravelWatch (2021) found that London commuters wanted to see a purpose-built app to report crime and three in four passengers said they would be likely to use an app to report crime on public transport (TravelWatch, 2021).

User experiences of personal safety apps

Doria et al., (2021) conducted a narrative scoping review of literature around personal safety apps for sexualised violence and found that women in all studies reported that the apps were 'user friendly, easy to use and easily accessible' (Doria et al., 2021: 18). Six of the studies found that personal safety apps were 'credible, evidence-based and trauma-informed' (Doria et al., 2021: 19). It concluded that personal safety apps were useful in providing support and information and in helping with emergency planning, which in turn empowered women. Ford et al., (2022) looked at the user reviews from eighty-six apps in the UK and found that over half of the users reported a positive response towards apps. Another study found that personal safety apps with an educational focus helped to validate women's experiences and helped women to recognise violent behaviour through myth debunking (Doria et al., 2021).

Apps impact on the feeling of safety

Apps appear to enhance the feeling of safety for women. A study by Transport Scotland (2023) found that for young people, apps provided 'a sense of pro-actively addressing their own safety' (Transport Scotland, 2023:15). This finding was echoed in a report by the Women's Safety in Public Places Community Improvement

Partnership (Edinburgh City Council, 2022), which found that younger women endorsed the use of personal safety apps like Life 360, particularly those which match the user with someone to walk home with, apps which allow reporting of an incident to police and those with a tracking feature. A study by Ford et al., (2020) looking at user reviews of eighty-six personal safety apps in the UK found that apps provided users with 'peace of mind' and increased confidence. This finding was echoed by Natarajan, (2016) who conducted a study on the use of the mobile phone 'TecSOS' (Tecsos.co.uk, 2013) an initiative developed by the UK police to support survivors of domestic abuse. TecSOS is not an app, rather it is a phone handset with a panic alarm which connects directly to emergency services. A study of its effectiveness found that the TecSOS phone increased the self-confidence of women and deterred further abuse from happening (Natarajan, 2016).

Over half the apps in Ford et al's., (2022) study had a tracking feature and McCarthy et al., (2016) found that females were more likely to download an app if it had a tracking feature. Similarly, a study by Blayney et al., (2018) looking at the use of the personal safety app 'Circle of 6' found that the tracking feature was what users liked the most. A study on a university campus in the US (Vaghela & Shih, 2018) compared the use of a campus-based security app to report incidents, to the WalkSafe app which worked in conjunction with smartwatch technology. It tested a fake emergency pre and post app and found that the WalkSafe app, which included GPS tracking, allowed users to locate the incident and in turn prioritise their own safety. Users preferred being able to use a smartwatch rather than having to rely on a phone.

Several apps work in conjunction with a network of trusted pre-determined contacts. The rationale behind using friends/family as a trusted network is to mitigate the possibility that bystanders will be less likely to intervene (Blayney et al., 2018) and that emergency services may not arrive in time. Blayney et al., (2018) studied the use and perception of the personal safety app 'Circle of 6', which utilises six pre-determined contacts as a trusted network. The study found users liked being able to contact multiple people and that the trusted contacts reported greater intentions to help friends versus strangers. Just and Willis (2019) conducted a laboratory study with thirty participants and recorded their responses to potentially risky scenarios before and after using the app. Participants reported that they would use personal safety apps most often to support "collective" responses, with calls to others for assistance.

Apps and campaigns to increase the reporting of crime

As has been noted above, VAWG on public transport is often underreported (Gekoski et al., 2015). This barrier to reporting may be alleviated by anonymous

reporting apps (Eisenhut et al., 2020). Doria et al., (2021) found that apps reduced the stigma around reporting sexual violence, reducing the shame associated with face-to-face disclosures. A 2019 study by Ceccato looked at the use of the SafeLand app in Sweden to report crime in public spaces. It found that participants used the app mostly to report incidents of crime and to inform others of incidents. The app was used less often to prevent incidents from occurring in the first place (Ceccato, 2019).

It is important to note that apps are often released as part of wider campaigns to tackle VAWG. In 2013, Project Guardian was established in London by the BtP, the Metropolitan Police force and TfL, following a report which found that 15% of women had been sexually harassed whilst using public transport in London (UK Government, 2013). According to TfL (2017), the number of reported incidents doubled from 1,023 in 2012/13 to 2,087 in 2015/16. The following year, TfL launched the 'Report It to Stop It' campaign (2014) to encourage the reporting of sexual harassment to police. TfL (2016) note that it saw an increase in reporting by 6.6% following the campaign, compared to the previous year.

The Railway Guardian app was launched alongside other campaigns including a campaign to increase bystander intervention, following research that women are more likely to intervene if they witness sexual harassment (UK Government Equalities Office, 2020). Campaigns used social media influencers to gain traction on TikTok, Facebook, Instagram and X (formerly Twitter). Although it is not possible to measure the direct impact of the media campaign, the BtP used a public perception tracker of 2,000 train, tram and tube users in England, Scotland and Wales and found that awareness around reporting increased from 81% in June 2022 to 87% in July 2022 and 89% in August 2022 following the campaign (BtP, 2023). Between its launch in July 2022 and June 2023, there were over 50,000 downloads of the app, 35,000 by the general public, and the rest by BtP and train operating companies (College of Policing, 2023). By February 2023, there were 288 text reports and 87 reports of environmental concerns submitted through the app (College of Policing, 2023) indicating the potential usefulness of apps to increase reporting. However, there has been no formal evaluation of the Railway Guardian app.

International examples of campaigns include the 'See Something, Say Something' campaign launched by Metro Vancouver Transit Police in Canada, where passengers could report incidents via an app (TransLink, 2015). Before and after figures of crime recorded by Metro Vancouver Transit Police saw a 28% increase in reporting since the launch of the initiative (Talbott, 2014) and 1,504 police files were created because of text reports (Metro Vancouver Transit Police, 2015). Following an anti-harassment advertising campaign, Massachusetts Bay Transport Authority reported an increase in the reporting of sexual crimes by 32% (Gekoski et al., 2015).

Technologies alone cannot tackle VAWG

VAWG is a complex problem that requires complex interventions. Stand-alone interventions like apps are not enough to tackle the problem in isolation (Gekoski et al., 2015). Indeed, technologies alone cannot address VAWG, rather a solution requires technologies, effective responses, protocols, and awareness raising (World Bank, 2014). Personal safety apps need to be integrated into other interventions (Eisenhut et al., 2020) like digital and print media campaigns, as well as educational events (Ison&Matthewson, 2023).

In 2015, the World Bank and George Washington University launched a campaign in Mexico called "'¡Hazme el paro!" roughly translated as 'Have my back'. The campaign had three components: a marketing campaign to help bystanders intervene if they witnessed sexual harassment; training for bus drivers on how to deal with sexual harassment; and an app for bus users to be able to report violence. The results of the four-month pilot demonstrated changed attitudes towards sexual harassment and an increase of young men wanting to intervene in the event of an incident, indicating the potential usefulness of a multi-pronged approach (World Bank, 2016). Similarly, a 2014 campaign in Brazil called 'Voce nao esta sozinha' ('You are not alone') included three elements: CCTV, staff training and a campaign to encourage victims and bystanders to report VAWG (Ceccato & Paz, 2017). A 'multi-pronged' (Ding et al., 2020) approach to tackling VAWG includes different elements: technologies, urban planning, technologies, education, and outreach campaigns.

Need for a joined-up approach to women's safety

The need for a joined-up approach to women's safety was identified in the literature. A 2022 report commissioned by the UK Department of Transport (DfT) and carried out by the West Midlands Combined Authority's (WMCA) found that there was no joined up approach to public safety across different transport modes in the UK, which was often confusing for passengers. The report called for a 'whole, end to end journey' approach, covering all modes of transport (Transport for West Midlands, 2022). This includes ensuring safety for the 'last mile or kilometre (Loukaitou-Sideris, 2020: 324). While technologies in theory should make a door-to-door approach to personal safety easier to implement (Ceccato et al., 2022), in practice this is problematic because of many different transport systems that exist (Ceccato & Loukaitou-Sideris, 2022). The Railway Guardian app functions on trains in the UK for example, but not on the bus network, or in walking 'the last kilometre' home. Safety interventions needs to account for the complex nature of women's travel patterns (Transport Scotland, 2023) and a joined-up approach is needed between transport

and non-transport settings (Ison&Matthewson, 2023). Equally important is that data is shared between transport providers and local authorities and the WMCA (2022) recommends the need for 'a national intelligence database' across all modes of transport.

Areas for further research

The following sections outlines some noticeable gaps in literature around personal safety apps including: a lack of systematic evaluation; lack of intersectional research on their use; lack of research on how apps fit into public safety messaging; and a lack of understanding of how apps are used in the public space more generally, particularly on public transport. Importantly, there is no centralised platform to find information about the use of recommended personal safety apps on public transport, perhaps limiting the ability of the general public to learn about the existence of apps and to make informed decisions.

Lack of systematised evaluation

Globally, there has been a lack of systematised evaluation of digital technologies to tackle VAWG in both low and high income countries (Jewkes, 2019). Indeed, there has been very little evaluation of the effectiveness of personal safety apps in the UK (Maxwell et al., 2020; Ford et al., 2022). As has been shown in the discussion above, the majority of studies focus on user experiences of apps, rather than evaluating the before and after outcomes via baseline surveys or randomised control trials. This finding has been echoed by other scholars (Gekoski et al., 2015). Indeed, while health apps that promote behaviour change are subject to rigorous evidence-based testing, apps for personal safety do not have the same requirement (Ford et al., 2022). Blayney et al., (2018) suggests that the development of apps is faster than the ability to test them and often apps are developed without considering how they will be used in practice which is common with many new technologies. Evidence of app effectiveness is limited perhaps because personal safety apps are relatively new developments in higher income countries.

Evaluations often require proof of tangible outcomes; however, as Gekoski et al., (2015) note, measuring both short- and long-term success is challenging. Defining the parameters of measurement is not straight forward. Whilst app downloads can be measured, this only indicates a willingness to use an app and does not measure its effectiveness. Measuring a reduction in crime rates is possible, however it is difficult to establish a causal relationship between the use of apps and crime reduction (Ding et al., 2020). There is no universal measurement of VAWG (Doria et al., 2021) and measuring non-verbal sexual harassment like staring or intimidating is particularly difficult. Ison & Matthewson, (2023) argue that the reason for the limited

evaluation of interventions to tackle VAWG is because most interventions are secondary and tertiary in nature, with elements of primary prevention. This 'slippage' they argue accounts for the lack of evaluation of interventions. Apps that have an education or awareness raising focus could be considered primary prevention, however it is difficult to assess the impact of long-term behaviour change (Ison & Matthewson, 2023).

A second issue in evaluation is that there is a plethora of apps available for different uses, some intended for primary prevention of VAWG, but most for secondary or tertiary prevention. Since there is not just one basic typology of app, evaluating the different functionalities is more challenging. As has been noted above, apps have five main purposes. Apps that are for use in an emergency and which rely on friends or family to intervene in the event of an incident are difficult to evaluate as they rely on retrospective reporting, which may be subject to memory bias (Blayney et al., 2018). Preventative/avoidance apps which identify hotspot areas are potentially problematic, as they are based on perceived fear of an area, not actual crime rates. Apps that have the aim to signpost users to organisations similarly are difficult to evaluate as they need the input from third sector organisations and even then, it is difficult to control for other factors which may influence users' decisions to approach certain organisations.

Lack of intersectional research

Most studies looking at user experiences have focussed on Caucasian, heterosexual women. Less work has explored the use of apps by non-heteronormative groups, as well as different ethnic and racial groups (Doria et al., 2021). More intersectional research would be useful to understand how protected characteristics intersect to influence how women use and experience personal safety apps.

Citizen reporting: challenging the status quo

Maxwell et al., (2020) point to a lack of research on the usefulness of alarms to deter criminals and a lack of understanding of how apps that connect with emergency services work in practice (Maxwell et al., 2020). More scholarship is needed to understand how apps fit into the current messaging around dialling 999 in the event of an emergency. Similarly, there are gaps in knowledge about how technology and apps are used for surveillance (Ceccato, 2019). The use of apps to report hotspot areas brings up issues around whose responsibility is it to report crime (Ceccato, 2019). The idea of citizen policing and technologies that crowdsource data challenge traditional hierarchies of power and bring up issues around governance.

Safety apps in public spaces and on transport

There is scant literature looking at the use of apps in public spaces more generally and even less looking at the use of apps on public transport. Apps that rely on Wi-Fi connections may be hindered if they are used on public transport and more research is needed to understand how apps are used in practice on different modes of transport.

Limitations of personal safety apps

While personal safety apps have been shown to bring benefits for women and girls in public spaces, it is important to recognise that they are not value free. Like with all interventions to tackle VAWG, there are limitations to their use, and these are discussed below.

Functionality flaws

New technologies carry the potential for functionality flaws. Most apps offer some incident assistance (Ford et al., 2022) however these are operated in-app which assumes that the user can access these features in an emergency. Maxwell et al., (2020) found that forty-six apps in their study did not work when tested. Claims that the apps were activated by the user running, if the phone was dropped or if earphones were pulled out were not always founded. A study looking at the user reviews from eighty-six apps in the UK found that common issues cited were download failures, issues with registration, and app functionality following software updates (Ford et al., 2022).

Masud et al., (2022) found the following functionality flaws with personal safety apps: not delivering messages on time, issues with social media integration, high battery consumption, app crashes, apps unable to function in the background, audio-video recording malfunctions to name a few. These functionality flaws have the potential to put women in precarious situations (Masud et al.,2022). To mitigate the risk of battery draining, the BtP implemented phone charging points across stations in England, Scotland and Wales (College of Policing, 2023). Another barrier to accessing apps is poor Wi-Fi on trains or underground lines. Users can report offline, and alerts will be automatically sent when Internet access is restored, however this delay means that reliance on the app could pose potential risks.

McGrath (2016) looked at the usefulness of apps to enhance the safety of university students suggesting that there are ten questions which should be posed when assessing the effectiveness of an app including: ensuring it has a robust platform, secure data storage, features that work offline, accessibility features, that the app

does not interfere during an emergency, that it can support users with linguistic barriers and that it has features for community reporting.

Potentially slow response times and inaccurate location sharing

Another functionality flaw relates to response times. A report by Transport Scotland (2023) found some scepticism among the women and girls who took part in the study around the potentially slow response times from the BtP. Similarly, apps that work with a network of pre-determined contacts to intervene in an emergency assumes that the alert will be taken seriously, and that the emergency contact can reach the user in time (Maxwell et al., 2020). Issues around potentially inaccurate location-sharing or the misinterpretation of data can be problematic also (Eisenhut et al., 2020). Indeed, tracking a phone is not necessarily conducive to safety, as the phone may be lost or discarded. Further issues relate to the unintentional triggering of alarms, which can cause undue upset and can also have cost implications (Natarajan, 2016).

Lack of clarity around pricing

Other issues relate to lack of clarity around pricing. While most personal safety apps are free, others have an associated cost ranging from about £18- £25 (20-40 Euros) per year (Tozzo et al., 2020). Free apps can also be monetised via revenue from advertising (UK Government, 2022). Ford et al., (2022) found that 60.5% of apps in their study were completely free of charge, while the remaining apps charged for additional features. Their study found a lack of clarity around pricing also, where some apps marketed themselves as being free, but required payment for additional features. Ford et al., (2022) argue that app developers need to be more transparent about these cost implications.

Issues around accessibility

There are additional concerns around the accessibility of personal safety apps. A study in India tested 50 personal safety apps to check their accessibility features for visually impaired users (Ranganathan, 2017). It concluded that none of the apps were fully accessible with a screen reader, colour contrasts were not accessible, and buttons and text were not large enough to be accessible for visually impaired users (Ranganathan, 2017). Accessibility was a key theme to emerge in Doria et al's., (2021) narrative scoping review, where five studies found that apps could be made more accessible. Suggestions include making navigation functions standard across apps and allowing users to connect with support services directly through the app.

Ison & Mattewson (2023) posit that for apps to be fully inclusive, they need to be co-designed with users (Ison & Mattewson, 2023).

Governance and legislation

Prior to 2022, apps were unregulated and not required to meet any standards (Ford et al., 2022). In 2022, the UK government developed a Voluntary Code of Practice (UK government, 2022) for app developers and app stores containing eight principles to ensure the safety of app users. The Voluntary Code of Practice forms part of the UK's National Cyber Strategy (2022) and states that app developers must ensure that the security of users is prioritised when it comes to malicious apps and that security and privacy information is clearly communicated and accessible (UK government, 2022). Apps are available to download from official app stores like the Apple Store and Google Play, which serve as 'centralised and trusted locations' (UK Government, 2022). App store developers are required to ensure that apps are vetted and that they have appropriate levels of security and privacy in place. In terms of legal compliance, app developers must comply with General Data Protection Regulation (GDPR) regulations as per the Data Protection Act 2018. This is a set of EU rules to ensure data protection and privacy for users. Under the Voluntary Code of Practice (UK Government, 2022), apps developers need to share security and privacy information in a user-friendly and transparent way, and users should be able to disable certain access permissions.

Ethical issues

The use of apps to enhance the safety of women and girls in public spaces is not value free and raises a host of ethical issues. These are outlined below including ethical concerns around the potential for harm or misuse, individualising the problem, devolving responsibility, privacy concerns, the selling of data to third parties and inequity around access to apps.

The potential for harm or misuse

While personal safety apps may make women feel safer, it is important to note that they may not reduce their actual vulnerability to crime (Maxwell et al., 2020). Rather they may give women a false sense of security which could lead to increased risk-taking behaviour (Maxwell et al., 2020). Similarly, apps that constantly track women could lead to 'anxiety and hypervigilance' (Hasinoff, 2017) and the 'normalisation of constant surveillance' (Hasinoff, 2017). Some academics have identified the potential misuse of tracking apps which can be used for stalking or can proliferate controlling behaviours by abusers (Doria et al., 2021). Other potential harms relate to the lack of follow up care for women who are victims of sexual assault or harassment

because of anonymised reporting. Ford et al., (2022) suggest that personal safety apps should be trauma-informed. A final issue related to reporting apps is the potential to profile racial and socio-economic groups (Revier, 2020). While reporting apps allow users to report hotspot areas, this as Maxwell et al., (2020) note, is based on users' perceptions of fear rather than actual crime. Rentschler (2018) carried out an analysis of the Hollaback! Anti-street harassment app, where users report their experiences of street harassment on the app. Once a user comments on an area, others are free to use that information as they wish, so it can be re-interpreted in harmful ways (Wood et al., 2019).

Individualising the problem

Most apps tend to focus on secondary and tertiary prevention (Ison & Matthewson, 2023), which does nothing to change cultural norms or address the root causes of misogyny. Rather, they place the burden of responsibility on women to ensure their own safety and their friends and family to intervene in the event of an emergency. Violence against women and girls is complex and encompasses a range of different individual, relational, community and societal factors (CDC, 2022). Apps tend to individualise the problem, negating the relational, community and societal level responses that are required to tackle it.

Most personal safety apps focus on the use of apps in emergency situations (Eisenhut et al., 2020), however this negates the fact that violence is 'rarely experienced as a one-time individual experience' (Eisenhut et al., 2020: 7). While apps may provide support in an emergency and may collect evidence, apps do not necessarily prevent violence from happening in the first place (Ford et al., 2022). Some suggest that apps reinforce the idea that VAWG is inevitable and that women, or society more generally, can do nothing to stop it from happening (Bivens & Hasinoff, 2018). Others suggest that if apps are to tackle the primary causes of VAWG, they need to include an educational element (Eisenhut et al., 2020) to educate the public around gendered norms.

Who is responsible?

A related issue to individualising responsibility is a wider discussion around accountability and responsibility of personal safety. The use of apps to report hotspot areas brings up issues around whose responsibility is it to report crime (Ceccato et al., 2022). Indeed, the idea of citizen policing and technologies that crowdsource data challenge traditional hierarchies of power and raise questions around the quality of the data produced. As has been noted above, apps tend to individualise the problem of VAWG, devolving responsibility away from emergency services to friends and family to intervene in the event of an emergency. Similarly, interventions that

encourage women to report abuse to transport officials, some suggest, devolve the responsibility from transport officials to women to be responsible for their own safety (Ceccato & Paz, 2017).

Privacy and use of data

Some academics have argued that women must sacrifice privacy in place of personal safety (Hasinoff, 2017). To ensure full functionality, most apps, once downloaded, request access to media files, user contacts and camera/audio (Ford et al., 2022). Some scholars have highlighted the potential privacy issues around location sharing, particularly if alarms are set off unintentionally and audio/video is shared with pre-determined contacts (Hasinoff, 2017). Related to that is the issue of reporting apps that allow users to share photographic evidence of crimes without the owners' knowledge and consent (Ceccato, 2019), particularly if it is inaccurate.

In terms of data management, app developers are legally required to abide by GDPR legislation under the Data Protection Act 2018. However, Ford et al., (2022) found that users raised concern about the collection of personal data, particularly where it required access to photos, user contacts and social media details. While data is required to be stored safely and securely, anonymised data can be sold to third parties if users consent to this. According to GDPR legislation, app developers need to be clear about their intention to sell data when it is first collected. However, a study of 20,000 health apps on the Google Play store found that 28.1% of apps did not provide a privacy policy for users (Tangari et al., 2021). Ford et al., (2022) posit that app developers should be transparent about why access to phone features is required and that users should be able to accept a minimum level of data sharing.

Regulation of apps

While app developers and app stores now have a Voluntary Code of Practice (UK Government, 2022), the full details of how app stores vet apps have not been made public (UK Government, 2022). While some app stores provide extensive details on app permissions, others provide 'nothing that most users would find meaningful' (UK Government, 2022). Indeed, app stores are free to decide what information they provide to users. Even with full transparency in how apps are vetted, the burden of responsibility still falls on the user to ensure that apps are appropriate. It is important to note that in addition to official app stores like Google Play and the Apple store, there are 300 third party app stores worldwide (Businessofapp.com, 2023). Research by RiskIQ (2020) suggests that the top three stores that saw the biggest influx of apps in 2020 were all Chinese based third party app stores, which are not regulated and fall out with GDPR regulations.

Inequity of access

Ethical issues around accessibility come into play, particularly if people are digitally excluded or do not have access to a smartphone. Some suggest that technology that works by crowdsourcing data creates a divide between those that have apps and therefore information to make informed choices and those that do not (Ceccato, 2019). While most apps can be downloaded for free, many require that the user has phone credit to be able to utilise the call or text functions, which could exclude certain groups (Eisenhut et al., 2020). Indeed, some scholars have criticised the commercialisation of women's personal safety (Hasinoff, 2017; White & McMillan, 2020), which profits from existing vulnerabilities in the population and could lead to inequity in access.

Conclusion and recommendations

This report has mapped the current landscape of personal safety apps for use in public spaces in the UK and has identified salient themes and gaps in the current academic literature. Personal safety apps make women feel more confident when using public transport and apps can provide a platform for reporting sexual harassment, helping to address the chronic underreporting of this issue on public transport. Similarly, apps help validate women's experiences of sexual harassment and reduce the stigma that comes from reporting sexual crimes. Personal safety apps have a role in enhancing the safety of women and girls on public transport, however they cannot work alone. Apps need to work in conjunction with other interventions to tackle VAWG including policing, awareness raising, campaigns etc. Indeed, the use of apps is a small part of a larger puzzle to address wider systemic misogyny.

There are clear gaps in the research around how particular groups with protective characteristics use personal safety apps, particularly LGBTQ+ groups, those with a disability and black and ethnic minority groups. More intersectional research is needed to understand how protected characteristics influence the use of apps. There is a clear lack of well-designed and well-thought evaluation of the before and after effects of using personal safety apps, and more evaluations of this type are needed e.g. with a baseline and follow up. Similarly, there appears to be a discrepancy between the desire for women to have apps that are 'credible' and the functionality flaws which impact on women's ability to use such apps in an emergency. There are ethical and legal considerations of using personal safety apps, which have potentially harmful implications for women and girls, so more research is needed to understand how these considerations play out in practice.

More qualitative research is also needed to look at how women experience using personal safety apps (Doria et al., 2021). There is scant literature looking at the use of apps in public spaces more generally and even less looking at the use of apps on public transport. Apps that rely on Wi-Fi connections may be hindered if they are used on public transport and more research is needed to understand how apps are used in practice on different modes of transport.

Recommendations

In light of Transport Scotland's (2023) women's safety report which recommends improved reporting systems on public transport (Transport Scotland, 2023: 45), and based on the main themes from the literature identified in this follow-up report, four recommendations have been made, two short term and two long term. The recommendations are intended for transport providers to improve the safety of women and girls on public transport in Scotland. It is important to note that research in this area is relatively small and underdeveloped, so the recommendations should be seen as a starting point.

This report has shown that there is a lack of awareness of the existence of personal safety apps, as well as a general willingness to use them.

> **Recommendation: Awareness raising around the use of the Railway Guardian app, in conjunction with existing campaigns to tackle VAWG on public transport in Scotland.**

The literature review has shown that there is a lack of systematised evaluations of personal safety apps. While evaluating apps is not an easy endeavour and the multitude of apps available make this problem more pronounced, it is important that more work is done to evaluate the before and after effects of using apps, particularly relating to reporting.

> **Recommendation: A systematic, formal evaluation of the Railway Guardian personal safety app.**

The literature has shown there is a lack of joined up thinking when it comes to women's safety across different modes of transport. While current developments with personal safety apps on public transport are promising, they often work in a siloed manner and there is no national approach to tackling VAWG on public transport. A joined-up approach to women's safety on public transport between transport providers and local authorities would allow for more uniform responses to reporting sexual harassment, better planning, the sharing of best practice and the

sharing of gendered segregated data across Scotland ensuring 'door-to-door' safety for women and girls.

> **Recommendation: Develop a joined-up approach to women's safety between transport providers and local authorities in Scotland.**

This report has shown that the landscape of personal safety apps in the UK is wide-ranging, complex, and ever-changing. It is not a straightforward endeavour to make sense of the multitude of apps available for different users and purposes. A centralised platform would ensure that apps are credible, quality assessed, trauma-informed and that data is processed and stored in a secure manner. A centralised platform would benefit users to be able to make informed choices and it would allow support organisations to be able to signpost users more effectively. It would also allow more transparency from app developers around data processing, privacy issues and clarity around pricing.

> **Recommendation: Consider the development of a centralised platform to capture the range of apps available, signposting those which have been recommended for use by governments, third sector organisations and those which have been developed collaboratively with user groups.**

Limitations

This report focusses mostly on research conducted in high income countries in the English language, negating the technologies that exist in other parts of the world or academic literature that has been produced in different languages. Indeed, there is a large body of scholarship from the Global South which has not been included in this study, which could provide valuable insights into the landscape of personal safety apps.

This report has included literature on apps that are for use in specific contexts, including apps to tackle intimate partner violence. There is currently a small body of research focussing on the use of apps in the public space, and an even smaller body of research in public transport environments, limiting the findings of the study.

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