Stewarding Data for Safe & Inclusive Cities

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Introduction

Historically, the concept of citizen safety has been paternalistic in nature and has often meant that exclusion or segregation was imposed on women, minorities or the poor for their supposed benefit (Wilson, 1992; Moser and McIlwaine, 2004). While the approach to women's safety has evolved over the past two decades, in some respects, this framework of protectionism persists. It often manifests in the provision of gender-segregated services, safety apps with panic buttons, increase in CCTV presence or hike in policing of certain areas deemed 'risk-prone'. While there are occasional positive outcomes of such initiatives in the short run, limited evidence exists on whether they contribute to more equitable access and ability to navigate public spaces for women (Perez, 2019).

A rights-based approach, instead, frames safety as a determinant to access social and economic opportunities—where a lack of safety prevents women from fully exercising their right to the city. These differences invite us to unpack the concept of women's safety and recognize that it is likely influenced by a range of factors that are subjective, physical, environmental and technological (Whitzman, 2011). With this in mind, safety should not be viewed as a static or simple goal but an evolving commitment to gender equity that must be acted upon through broader policies and practices, often referred to as gender-mainstreaming. At a higher level, this involves the institutionalization of gender concerns and greater empowerment and inclusion of women in decision-making bodies.

One of the policies that has emerged from the translation of gender-mainstreaming by international organizations and NGOs is gender analysis which requires the collection of sex-aggregated data and gender analytical information (Moser, 2012). Considering this, a part of the solution towards women's safety may lie in the unlocking, collection and sharing of gender-specific data. This information and data can nuance our understanding of how women navigate the city and public transport compared to their male counterparts and also uncover bias and highlight how

the design and architecture of cities mimic and perpetuate certain gender-based inequalities (Eliasson, 2017). However, four broad challenges exist with respect to data for women's safety: availability, access, accountability and agency.

The lack of available and reliable administrative data has resulted in a gender data gap which has broader implications for women's well-being and mobility: without necessary statistical or anecdotal evidence, citizens and communities have limited substantiation to hold their governments accountable. Existing data collected by the public sector, companies and civil society can often be inaccessible or stored in silos (Data2X, 2019). These concerns are compounded by stakeholders possessing different incentives for sharing data that may also emerge from a lack of trust. This may inhibit collaborative, inter-sectoral approaches required for shaping inclusive cities. Then, without adequate governance or accountability frameworks, the rise in personal and non-personal data extraction without safety barriers by several stakeholders raises privacy concerns. Limited safeguards or guidelines around collection, usage and sharing of data may result in increased surveillance and present new safety threats to women (Ranganathan, 2017). Lastly, women are often not directly aware of or actively involved in processes or initiatives related to data collection. Further barriers to agency emerge due to limited representation of women in decision-making positions in planning or transport departments (Bhatt & Menon, 2015). As the parties that are most affected, women must be adequately enabled to participate in problem definition, solution and governance.

The model of stewardship may be useful in addressing a few of these challenges. In theory, a steward is an intermediary that lies between users and data controllers, and plays a significant role in easing the process of sharing, providing greater control over data and decisions around it to users. In the context of women's safety, a steward can foster effective partnerships with diverse actors including women's organizations, government agencies and private sector companies to unlock and aggregate data or guide responsible data collection. While questions remain on who this steward may be, in order to build these networks, it must possess strong ties to the community—either by enabling the participation of diverse stakeholders within the governance framework or by creating forums of communication that will build trust between players. This necessary first step will emphasize that the responsibility for safer and more inclusive cities rests with stakeholders across the public and private continuum (Shaw, 2008).

However, this is bound to be complicated by stakeholders' varying incentives that can complicate access to data—for instance, where governments may not perceive value in releasing data or may be wary that it could jeopardize their public image if the data paints a picture of inequities in service delivery (Halais, 2020). A steward

may be able to navigate these concerns by supporting government agencies in exploring how data can be channelled into actionable policies. For instance, a safety audit in a city may reveal that certain neighbourhoods are prone to higher rates of sexual violence, but that this also coincides with the presence of 'dark spots' or areas with little to no street lights. In this case, a steward could recommend courses of action that may include addressing this missing infrastructure and also open avenues for consultation with individuals from these communities.

The broader benefits a stewardship model could provide include creating technical and governing mechanisms that would safeguard sensitive personal information, personally identifiable and non-personal data. Currently, forms of data that are specifically collected for the purpose of women's safety, through safety apps or devices, are often accompanied by extremely weak or vague privacy policies. Stewards can not only institute more robust protection mechanisms, but can also enable women to have better control over their data and who they choose to share it with. In this respect, this entity can negotiate access on behalf of women, based on entities they trust. This allows for greater agency over data use and prevents the misuse of data by third parties. While this model of governance may present opportunities to better engage multiple stakeholders, build trust and institute mechanisms for protection, questions remain on how to further facilitate the active participation and inclusion of women within governance processes. This invites us to reflect on the composition of the data steward and to explore participatory models of governance that have proven successful as guiding examples for stewardship in this context.

This paper seeks to explore how data collection and sharing may lend itself to building safer cities for women and how a framework of stewardship can enable this to be carried out along principles of participation, inclusion and agency. Part I provides an overview of the need to collect gender-disaggregated data, associated challenges and how the gender data gap is currently being bridged. Part II outlines existing methods of data sharing and highlights three models with facets which can be referenced as best practices. Lastly, Part III considers the role of a data steward in women's safety and suggests potential principles that can guide its design and on-ground implementation.

PART I

Data for Safe & Inclusive Cities

The need for gender specific & disaggregated data

In 2017, triggered by the molestation of numerous women in Bengaluru on New Year's Eve, as part of the 'I Will Go Out' campaign, thousands of people marched, gathered and protested across thirty cities in India to reclaim women's right to the city (Shukla, 2017). This campaign is among countless other global movements that seek to draw attention towards and demand solutions to prevent sexual and gender-based violence in public spaces such as streets and while accessing public transport. In Bhopal, according to a study by the World Resources Institute (WRI) that evaluated women's use of and experiences with transit services, over 85% of women reported they had faced sexual harassment (Bhatt, 2015). A similar study in Reading, UK, again indicated that the design of public spaces along with the fact that women are disproportionately victims of these crimes contribute to a culture of fear and intimidation that affects their willingness to inhabit and use public spaces (Gill, 1989). This lack of safety, both real and perceived, has severe implications for 'women's ability to access critical services', and educational, social and economic opportunities (UN, 2018). For instance, through surveys, crowdsourced information and map data, it was revealed that women's choice of college was shown to be deeply influenced by their ability to access a safe route of travel (Borker, 2018). Data from studies like these, supported by a corpus of academic literature, reveals women's lived experiences and highlights that the design of cities and public transport is not gender-neutral—a critical factor that inhibits women from fully participating in society and enjoying their right to the city. While this is evolving, there has historically been a general lack of gender-specific data—and this gap has in turn rendered these realities further invisible and been a barrier to creating safe and inclusive cities.

In response, the generation of evidence, through studies and data, to assess the extent of gender-based violence and harassment in public spaces has emerged as a key recommendation by the UN Women's Global Flagship Programme Initiative, "Safe Cities and Safe Public Spaces". In 2010, to implement this effort', UN Women worked with local partners to collect data from 27 cities to map the landscape of sexual harassment and violence, and generate action to address and prevent its occurrence. From this initiative, safety audits and the bottom-up collection of data that prioritize strong local ownership have been highlighted as two potential

methods for gathering accurate, diverse and community-driven data on women and girls in public spaces. In Mexico City, focus group discussions indicated that a majority of women faced sexual violence during their commutes; the city responded by funding support centres, women-only transport services and launching a mobile app for reporting (UN Women, 2015).

Governments are increasingly exploring how to collect gender-specific or gender-disaggregated data and bridge the gender data gap. There is also a growing recognition that data aggregated by gender can shed light on how perceptions on safety may vary between men, women and gender minorities. This information can be used to evaluate the impact of public spending or investment. By recognizing the importance of supportive infrastructure in creating safe spaces, cities can channel funding towards street lights, bus benches and so on or ensure services like childcare and public toilets are located closer to key mobility hubs. For public transport departments, data can inform the tailoring of services to women's needs. For instance, women's travel patterns tend to be more complex, often involving multiple stops and modes of transport (Bellman, Pollack et al, 2019). Transport agencies can use this information to facilitate better multi-modal transport integration, improve communication on trip schedules and enable better journey planning options. In India, women primarily walk, cycle or use public transport to go to work, but make up only 17% of all commuters in urban areas (Goel, 2018). This low figure is attributed to actual and perceived concerns around safety. This data can be leveraged by civil society to advocate better representation of women in transport and action in providing more accessible transport options.

Challenges in unlocking and governing data

In many countries, including India, administrative or official data is not readily available, accessible or reliable. More specifically, Indian transport agencies do not collect gender-disaggregated data (Bhatt, 2015). This reflects a global pattern: a study by Women Deliver (2019) indicated that data collection on issues concerning women and girls isn't prioritized, which may be due partly to a lack of capacity and political will. Experts also trace this to a severe lack of women's representation in many government departments and transit agencies, where there isn't even a framework that acknowledges unique challenges women may face. Recognizing these concerns, and as part of the Sustainable Development Goals on economic, social and environmental inclusion, the UN has recommended the co-production of gender-disaggregated data by establishing partnerships with multiple stakeholders: local authorities, researchers, police and grassroots women's organizations. This aligns with the growing recognition that safety in cities must be conceived as

a shared responsibility and addressed through partnerships and multi-sectoral collaboration (Klodawsky, Whitzman et al, 2013). According to this view, a critical component of addressing women's safety can be achieved if stakeholders are better enabled to collect and share information.

It is also important to note that while there is a dearth of administrative data from the public sector, there has been a rise in collection of sensitive, personal and non-personal data on citizens by the private sector and civil society. Private sector data often remains in silos that render it inaccessible for key stakeholders, such as the government and civil society organizations. Data2X argues that "big data yields the most powerful gender insights when combined with traditional data sets but, given its granularity, scale and collection over time, harbours significant risks to the privacy of women and girls if adequate legal and technical measures are not imposed to regulate it" (Vaitla, 2019). Social enterprises and experts in this space, such as Jillian Kowalchuk, founder of Safe & the City, argue that partnering with companies to access data can help in classifying information and establishing benchmarks that can support determining a range of solutions.

While models for effective local data collection are beginning to emerge and be adapted for local contexts, the governance of data—how it is stored, used and shared – often lacks transparency and accountability. It is important to address this, as there are unique individual and community-level drawbacks that can emanate from overcollection and lack of responsible governance on data storage, usage and sharing with third parties. Even non-personal data, which may appear to harbour fewer concerns, can result in biased generalizations about under-represented groups or portray certain communities as unsafe. For instance, in some cases, crowdsourced data that aims to indicate 'safe' and 'unsafe' spots in cities has also created negative spatial associations linked to certain communities, in which an architecture of fear leads to stigma and abandonment of neighbourhoods. Such an architecture of fear, though created inadvertently, can devalue property and lead to government neglect and thus impact residents negatively (Sampson and Raudenbusch, 2004).

The governance and accountability of data must similarly be reflected upon as there is an increase of data being extracted from safety apps by mobility service providers, platforms and other companies. This is most evident in the context of safety apps that are developed by private companies and put into use by governments as a solution. In 2015, the Hyderabad police department launched an app called Fightback, developed by Tech Mahindra. It provided women an SOS feature by which they could alert authorities if they required assistance. A study two years after its launch found the SOS feature had not been used at all

(Buddi, 2015). Anja Kovacs (2017) also argues that "most of the women's safety apps that are currently flooding app stores undermine women's autonomy while taking valuable focus away from more sustainable and empowering solutions". This is further complicated by the fact that many safety applications collect detailed location, voice, audio and other types of data, but often come with weak or non-existent privacy policies. Similarly, in some instances, experts on women's safety like Kalpana Viswanath argue that CCTV footage can and has been used by government agencies to perpetuate moral policing. Particularly for vulnerable groups like women, there are risks that these types of data could be used to further monitor, control, stalk and inflict forms of violence online and offline (D'Cunha, 2019). This necessitates designing safeguards that prevent data from being accessed by parties that women do not consent to, and give greater control over who they choose to share it with. These challenges highlight that we must recognize the numerous ways in which digital technology, particularly applications, can extend surveillance and provide further scope to harass, control or monitor women. Considerations of privacy and accountability must be at the forefront of these discussions on women's safety. It is imperative that necessary safeguards be put in place to ensure that data corresponding to particularly vulnerable communities, who are already at risk of technologically facilitated violence, is secure.

Governing third-party access is also critical for consideration, as private companies are beginning to adopt solutions for 'women's safety' that often share data with third parties. Limited transparency exists around how these entities protect or use this information, and further concerns arise to how these parties could be held accountable in cases of data breaches, leaks or unconsented sharing. For instance, in response to concerns around incidents of sexual harassment and violence, and frequent demands from federal and law enforcement officers to share data that relates to these crimes, Uber has released a transparency report and instituted a Safety Toolkit – a set of features and measures riders can use to better ensure their safety. The features include a panic button, which sends location and other relevant data to 911 dispatchers through an emergency platform provided by a company called RapidSOS. If users choose to activate this feature, voice data from the call, active location data, and other information like car make, model and colour are shared with law enforcement. While RapidSOS claims to delete this information after 180 days and retain only de-identified data, Uber keeps these records indefinitely or as long as feasible under law (Uber, 2020). The website also mentions that neither Uber nor RapidSOS records or makes transcripts of calls—but aside from these remarks, users are granted no redressal mechanism or security that this will not take place.

Similarly, in some markets, like Brazil, Mexico and, most recently, India, one of the features that is being piloted is in-ride audio recordings. According to Uber's policies, while the audio files of recordings are encrypted and stored on users' devices, neither the rider nor driver has access to recordings. This is only accessible to Uber which possesses the key for decryption and can provide this data to law enforcement upon request. This pilot feature has raised many concerns on the part of riders who emphasize that there is potential for confidential information discussed in-ride or on calls to be misused. In some states in the U.S., another programme is testing dashcam recording in partnership with AI analytics company Nauto Inc. In contrast to audio recordings which Uber is in control of, Nauto Inc stores video footage while claiming to regularly delete it. It offers access to both drivers and riders to view footage upon request, which is granted on condition that faces are blurred and audio is muted. Only Uber is able to view videos in raw form, after a request is submitted by a driver or rider (Conger, 2019). These examples are illustrative of the concerns around privacy, lack of control over data and limited accountability mechanisms that emerge when data is shared with a third party. It becomes relevant to consider, for this reason, how a steward can enable greater transparency and provide individuals power to make informed decisions on how their data is shared and for what purposes.

PART II

Existing approaches to data collection and governance for Women's Safety

While stewarding of data for women's safety is an evolving field, new methodologies have emerged for the unlocking, collection and aggregation of data. In most cases, these efforts have been spearheaded by civil society organizations, social enterprises and public-private partnerships. For this paper, three models that showcase a few best practices and demonstrate potential for further stewardship were selected: Safetipin (India), the Data Collaborative for Women's Mobility (Chile) and Winnipeg Safe City (Canada). While these models are not all-encompassing in their ability to enable participation, extend agency, be inclusive in approach and safeguard privacy, they offer guidance on how data can be responsibly stewarded for women's safety.

1 Safetipin

Stewarding the collection of diverse bottom-up data

In this model, Safetipin acts as a steward of women's safety data and in principle is a good example of how to approach safety from a participatory approach by negotiating and building trust with governments, civil society and at a community level. Its success is evident in Safetipin's ability to scale its activities across 50 cities in India, along with international cities like Bogota, Nairobi and Jakarta (Safetipin, 2020). In 2014, Safetipin was selected as one of the 'Know Your City' grantees by Cities Alliance for its innovative approach to data collection that has facilitated informed and inclusive policymaking for cities (Cities Alliance, 2018). It is now frequently approached by international organizations to partner in and carry out audits for public safety. This in part is owed to the audit methodology Safetipin employs, which empowers women to take ownership of public spaces and participate in local decision-making (Safetipin, 2019). This framework has also been proven to be conducive in a range of geographical contexts given the flexibility in aligning local partners and carrying out audits in online and offline capacities.

Kalpana Viswanath, founder of Safetipin, argues that women's safety must be defined in the context of the right to access public spaces and have freedom of movement. This rights-based lens also translates into Safetipin's approach to data collection. Through a participatory tool, referred to as the Women's Safety Audit, data is collected to enable women to make safer choices concerning transit that can help them navigate cities. In many cases, Safetipin reaches out to a range of women through local partners to audit the city—in some cases this includes college students or women from rural communities. Data captured through these audits is then actively shared with local authorities and governments to improve infrastructure, critical to making public spaces safer and more gender-responsive. The Safety Audit collects data on nine parameters: "lighting, openness, visibility, people density, security, walk path, transportation, gender diversity and feeling" (Safetipin, 2019).

This is based on a methodology proposed by the Metropolitan Toronto Action Committee on Violence Against Women and Children in 1989 which assumes that users of a space are best placed to understand its safety (Women in Cities International, 2008). In contrast to many platforms that collect incident-specific data on forms of gender-based and sexual violence, Safetipin emphasizes that a combination of physical infrastructure and social usage data is relevant to building long-term solutions for safer spaces.

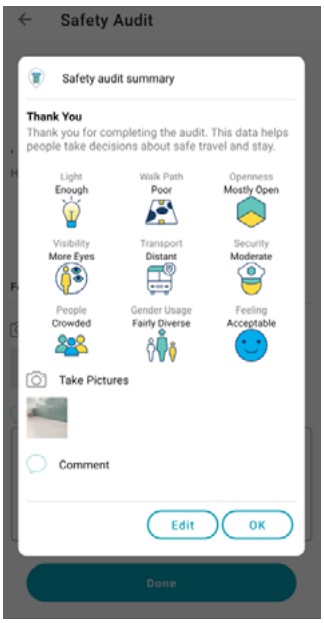

Figure 1 – Screenshot of the 'My Safetipin' app showcasing the interface for users to assess spaces based on parameters like 'feeling' and 'openness'

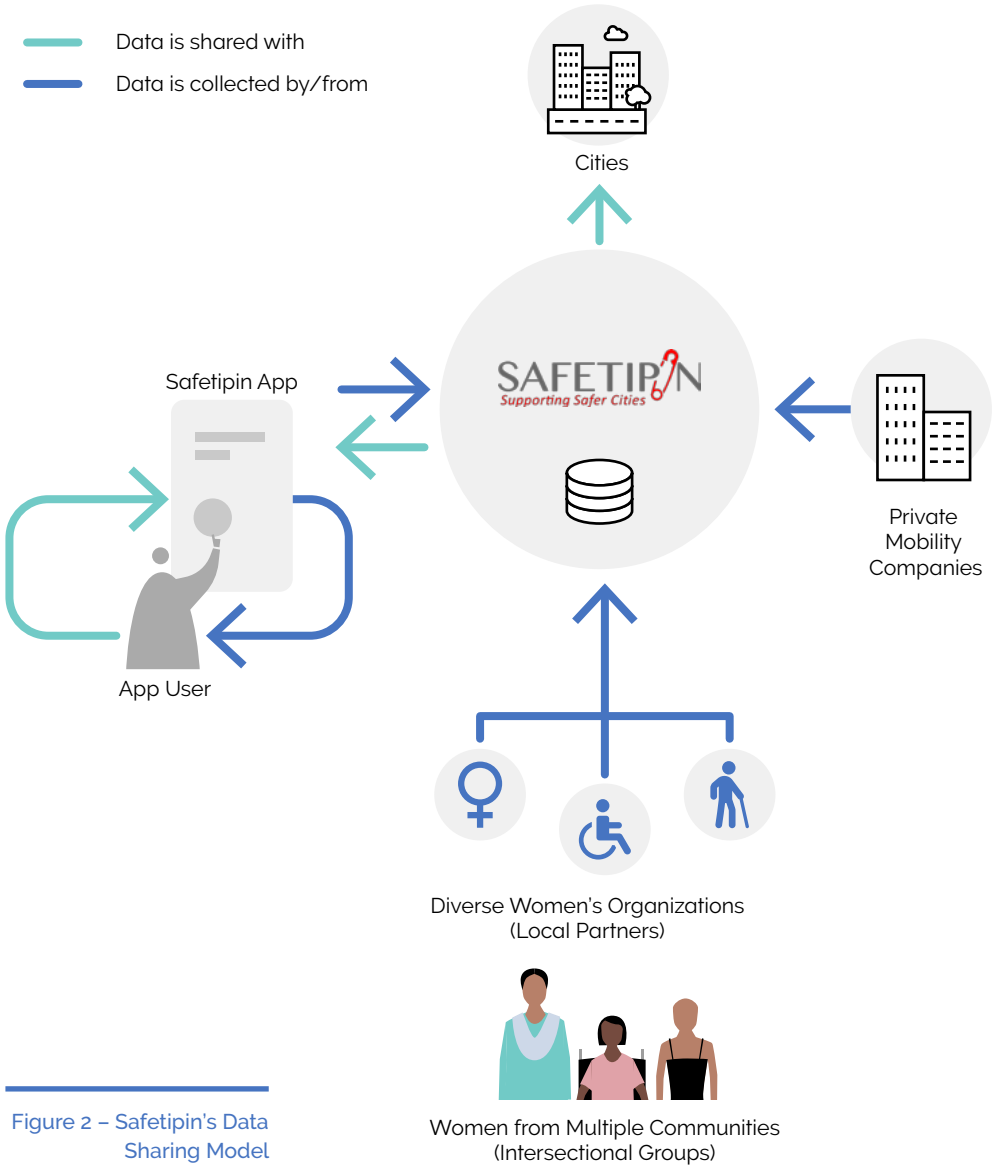

Figure 2 – Safetipin's Data Sharing Model

How is data collected?

Multiple types of data are collected by Safetipin, which are user-generated, crowdsourced or collected with the support of on-ground partners that include civil society organizations and private sector companies. Audit data is dependent on a range of qualitative and quantitative data aligning with the nine parameters of 'My Safetipin'. Through this app, data may be collected from users in three ways: personal information for registration (name, email, age, trusted contact details), incident information, and location information (if users choose to use the tracking feature).

For women who may not be able to access the application, local partners and volunteers carry out both online and offline forms of data collection, in order to adequately reflect the lived experiences of women across the socio-economic divide. In Bihar, for instance, Safetipin partnered with a local organization and college girls volunteered to manually map spaces in their own communities. To supplement this data, Safetipin also partners with mobility companies like Uber to collect additional information on visibility of city spaces at night. This involves a phone being mounted on the dashboard of a car which collects images every 50 to 100 metres which are then shared through their secondary 'SafetipinNite' app. Safetipin now has data on over 30 cities in India and carries out audits for several others globally (Manazir, 2019).

As illustrated in Figure 2, collected data is made available to stakeholders either directly through partnerships with cities, through the Safetipin app and in coordinates that correspond with widely used Geographic Information System formats. This format is conducive to visualizing data through a map, pictured in Figure 3.

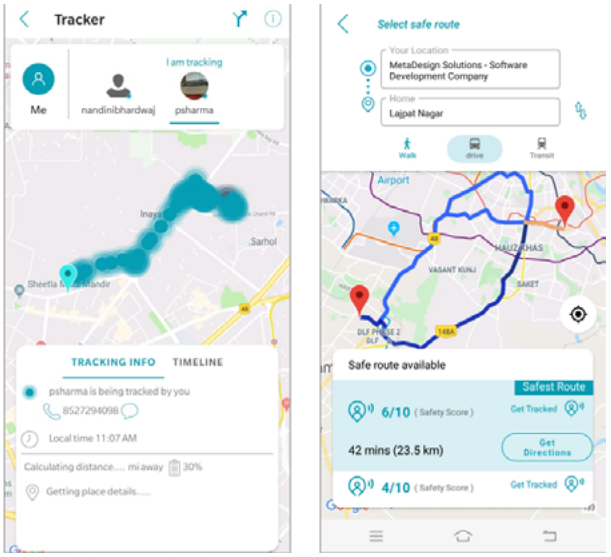

Figure 3 – Screenshots of SafetiPin's tracking and Safe Route features (L-R). In the first image, location details are securely shared only with the user's trusted contact. The second image visualizes the safety score in an area and a potentially safe route to take.

The Safetipin app provides users with a safety score and map that indicate the safety of areas based on nine indicators. Safety scores are calculated as an aggregate of users' responses to the nine parameters.

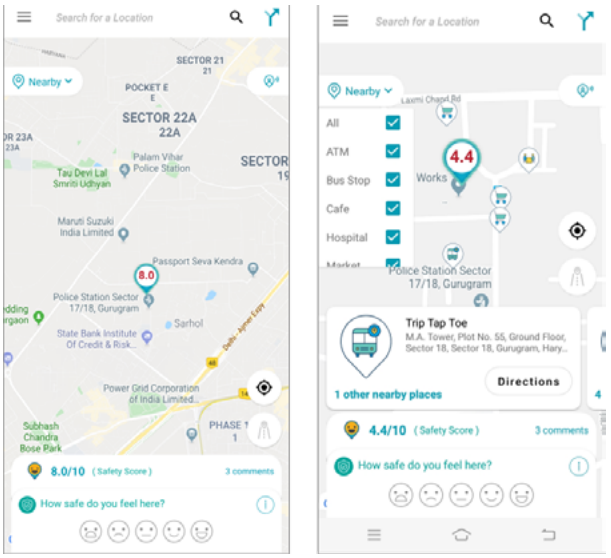

Figure 4 – A Screenshot of a sample safety score and map available to users on the Safetipin app

How is third-party sharing facilitated?

With governments, Safetipin often signs data sharing agreements that enable the company to share a range of aggregate data and recommendations based on the specifics of their partnership goals (Cities Alliance, 2019). For instance, in 2016, for the Delhi government, Safetipin identified 7,000 dark spots or areas with low lighting, through data captured via the Safetipin and SafetipinNite apps. In 2019, after remapping the areas, only 2,000 dark spots remained and this data was once again shared with local authorities to upgrade street lighting in those areas. Similarly, in Bogota, with the aim of facilitating women's greater use of public spaces, Safetipin's audit captured points around the city that they found women frequented to channel infrastructure like bike racks to encourage further usage.

What accountability and technical mechanisms are instituted to govern and protect data?

Safetipin's privacy policy outlines that data collected on users during registration is not associated with pins that users drop on the app, as users have the option to report anonymously. Where user data is captured it is de-identified at the source. As part of its location tracking feature, Safetipin retains data on users' last two locations in cache, which is stored securely and deleted once users reactivate the feature. Other forms of qualitative data collected through surveys, focus group discussions

and interviews are similarly stored without personal identifiers. For users who wish to access information acquired through surveys, aggregate and anonymous results are shared via email upon request. Captured data is stored either on Safetipin's local servers or hosted on a cloud platform. Standard access permissions along with in-built technical measures from Amazon web services protect data from being accessed by unauthorized parties (Safetipin, 2020).

Evaluation and emerging best practices

Safetipin plays an important role by aggregating and analyzing data from multiple partners (civil society and the private sector) and making this accessible in multiple forms. This is carried out by an in-house data analytics team that processes and derives key insights for governments; for instance, where action-oriented data is shared to indicate what steps can be taken to tangibly improve public safety. The company also routinely consults and interacts with local NGOs and grassroots organizations to vocalize new and emerging considerations on building gender-responsive cities and how this should reflect in data collection practices.

Additionally, while perhaps not formally institutionalized through policies or measures, Safetipin acknowledges and attempts to minimize individual and community-level harm that emerges from data collection. At an individual level, on the principle of data minimization, it limits the collection of personal data to reduce the potential for stalking or tracking. To prevent negative spatial association that may emerge from certain communities being indicated as 'bad' or 'unsafe', it works with communities to equip them with the tools to use this data to advocate for change in their communities. Lastly, unless indicated in a data sharing agreement, Safetipin does not share raw or de-identified data with third parties.

While this model has been widely adopted in several cities in India and globally, there are certain limitations it presents. First, when data is collected through crowdsourced or open-source models, there is limited verifiability or validity of the data collected as it can be recorded anonymously. Second, unless bolstered by a larger campaign or vote of support by local governments, there may be limited incentives for women to use the app to mark parts of the city based on the parameters provided. To overcome this, Safetipin supplements its data gathering with data collection from private sector partners like Uber and continues to explore new partnerships that can unlock data of value.

Opportunities for responsible stewardship of women's data

As Safetipin continues to partner with stakeholders from the private sector to unlock data relevant to women's safety, there are further opportunities to build both technical and accountability mechanisms around the collection, storage and sharing of data. While it recognizes the unique harms associated with overcollection of data, it can formalize these considerations by instituting certain accountability mechanisms or employing technology such as standard encryption in the handling and storage of data.

Moreover, while Safetipin currently chooses to restrict the collection of personal data or de-identifies data at the source, it is relevant to acknowledge and safeguard against the potential harms that can flow from the collection of non-personal data. For instance, while the organization seeks to overcome potential negative implications of a poor safety score in neighbourhoods by working with governments to address gaps in infrastructure such as damaged sidewalks or dark spots, the likelihood still exists that such scores can yet result in women avoiding certain neighbourhoods. As a remedy, it may be relevant for Safetipin to continue considering how to equip and empower citizens to communicate and narrativize the data for better accountability from local government bodies.

2 Gender and Urban Mobility Data Collaborative: Telefonica, Data2X, UN Women

Unlocking unconventional data

As one of the grant winners from Data2X's Big Data for Gender Challenge in 2017, GovLab, UNICEF, Universidad del Desarrollo, Telefonica R&D, ISI Foundation and DigitalGlobe established the Gender and Urban Mobility data collaborative for a year to uncover and explore gender gaps in Urban Mobility (Darabi, 2017). More extensive in collaborative scope than a simple public-private partnership, a data collaborative seeks to amass and unlock multi-sectoral data for social value. The objective of this collaborative was two-fold: first, to understand how gender influences mobility trajectories, and, second, to further assess whether transport services were accessible considering other socio-demographic factors. To do so, this study relied on gender-disaggregated large-scale data derived from Call Detail Records (CDR) along with census data, public transportation data sets in General Transit Feed Specification (GTFS) format and OpenStreetMap for points of interest. This approach

was adopted as typical mobility studies often depend on data from surveys that can be too time-consuming and expensive to carry out frequently. Moreover, it has been found that mobile phone data is granular enough to provide insight into mobility patterns at scale (Gauvin et al, 2020).

How was data collected?

Three different types of data were either collected or sourced from the partners of the data collaborative: CDR, census data, transport data and map data. Census data from 2017 was also available publicly, provided by the Instituto Nacional de Estadistica, the National Institute of Statistics. Map data was accessed from OpenStreetMap, a platform that provides aggregated aerial imagery and GPS data through an open-source licence (Gauvin et al, 2020).

However, this study primarily relied on CDR data that was collected and then selectively released by Telefonica R&D to researchers. To start with, an initial set of two billion call detail records was collected over three months and anonymized in-house by Telefonica R&D. Anonymization was carried out using a hashing technique which utilized the SHA-3 algorithm. Records were further filtered by selecting only registered phone numbers that had placed at least an average of one call a day and those who had travelled to more than one unique location in the time span of the study. A total of 315,844 users were defined based on these conditions, which were further aggregated by a binary gender value they had ascribed to the telephone provider.

Based on these user profiles, further information on their socio-economic status was ascertained through payslips. Researchers were able to also arrive at the home location of users which was inferenced via the associated cell tower calls were made from during the window of 7 pm to 8 am—a methodology referred to as 'time constrained home detection' (Gauvin, 2020).

How is third-party sharing facilitated?

Telefonica's data department granted researchers access to data through a platform created for the pilot. Depending on the researcher requirements, data sets were first de-personalized, anonymized, aggregated and then shared by Telefonica. Researchers were then able to gain a partial view of the data by timeframe or area. To explore and analyze this data, researchers were granted a certain amount of

credits to use tools on Telefonica's online platform. Aside from verified researchers from the partner organizations in the data collaborative, no other entity was provided access to call detail records, even in anonymized aggregate form.

What accountability and technical mechanisms are instituted to govern and protect data?

Since Call Detail Records are collected over a period of time, they can be leveraged for important insights around mobility given the detailed information that can be gathered about locations from where calls are placed and at what time. However, this can also reveal intimate details about citizens and their lives (Valentino-devries, Singer, Keller, & Krolik, 2018). Recognizing these concerns, researchers involved in the data collaborative were careful to minimize the risk to the greatest degree by considering a range of data techniques and 'privacy by design' measures. To start with, data collected from cell towers was spatially aggregated.

This means that the geographical coordinates linked to the particular record could not be associated with a specific cell tower. Similarly, researchers argued that "even at the finest level of granularity (the antenna), devices are never connected to the same antenna all the time, but rotate according to antenna demand (peak vs. regular times), time-of-day (some antennas get turned off at certain times), azimuth, etc. which makes it extremely hard to identify a single user" (Gauvin, 2020). Other standard privacy measures included the use of anonymization and restriction on sharing or attempting to link any individual user with third-party data for the purpose of re-identification.

Evaluation and emerging best practices

The data collaborative model presents several advantages in collecting data on women's safety. To start with, instead of undertaking potentially cost-prohibitive studies, surveys or data collection efforts to better map gendered experiences of using public transport, this study leveraged existing unconventional gender-disaggregated data that is already generated by telecom companies. It was able to do so by incentivizing Telefonica to share data without compromising the privacy of its clients or competitive interests. This was possible as the data accessed by researchers never left Telefonica's servers. The Telefonica R&D team ensured that researchers were only able to access aggregate and anonymized data to eliminate the potential for re-identification.

Moreover, given the granularity of the CDR, the study was able to be fairly representative of the population—accounting for socio-economic diversity and those living across the city's 52 quarters. This was possible while maintaining anonymity and preventing the re-identification of users through anonymization and spatial aggregation of data.

Opportunities for responsible stewardship of data

While this model is unique in its ability to unlock large-scale data sets at relatively low cost, it was possible, in part, because Telefonica was willing to be an active member of the data collaborative. This invites us to question the potential scalability of such a model in other regions or with alternative companies. In order to build similar partnerships with the private sector to unlock data to better understand women's safety, a steward could play the role of a neutral intermediary who would be responsible for building multiple reciprocal relationships for data.

In this case, the control over the call detail records was vested entirely in Telefonica. While this enabled the company to institute technical mechanisms to protect the data, it might limit stakeholders' ability to access the data in the long term—or beyond the project's duration. Stewards could take responsibility by securely hosting data while instituting similar technical mechanisms to protect it, thereby enabling greater transparency in data governance processes. This framework is likely to bring greater sustainability in the collection, aggregation and sharing of data relevant to women's safety, but might be met with initial resistance by companies.

3 Winnipeg Safe City, Canada

A participative approach to data collection

As part of the UN Women's Global Initiative, "Safe Cities and Safe Public Spaces", in 2013 Winnipeg was one of the first cities in North America to adopt a set of policy measures to reduce sexual harassment, improve reporting of Sexual and Gender Based Violence (SGBV) and enable greater freedom of movement for women. The initiative was spearheaded by the Manitoba Status of Women, but included partnerships with police, community health centres, UN Women, University of Winnipeg and Ka Ni Kanichihk, an Indigenous organization. The initiative included four streams of work: diverse data collection to represent lived experiences of women; establishing partnerships with a range of stakeholders for public safety,

gender equity, crime prevention and urban planning; awareness campaigns with communities on sexual violence; and strengthening capacity to address gender-based issues (UN Women, 2013).

For the purpose of this paper, this model was selected not for its governance of data, but rather as it demonstrates a range of participatory governance mechanisms around the design and implementation of data collection initiatives. In Winnipeg, the Safe City Initiative began with establishing a Steering Committee that included members of the community (often those who were victims of gender-based violence in public spaces), representatives from local government, health, law enforcement and public safety organizations. The intention was for this Committee to both possess insight and understanding around violence that women and girls face, and knowledge on how these experiences are further impacted by intersections like age, gender, race and ethnicity. Members were chosen on the basis of whether they had previously worked with communities and had demonstrated a range of impact on their lives. The Committee actively engages four times a year to assess how they can continue to build relevant partnerships and guide initiatives around the creation of safe and inclusive cities (Winnipeg Safe City Committee, 2016).

At the outset of the programme, the Steering Committee was responsible for defining goals and guiding principles for the research that were to be informed by broader values of equality, participation and ownership. For instance, a core priority for the Committee was to ensure Indigenous-led research and voices were engaged and focused on at all stages of the programme. In a similar vein, it also recognized the disproportionate effect of sexual violence on sexual and gender minorities and acknowledged that any policy response must be cognizant of these experiences (Winnipeg Safe City Committee, 2016).

Principles that guided their work also included understanding sexual violence as a continuum that, for example, may begin with harassment and in more extreme cases lead to homicide. Another principle includes the recognition of "historical and ongoing colonization for Indigenous women and girls and their experiences of sexual violence by prioritizing Indigenous-led reclamation, reconciliation and resource allocation within interventions and outcomes" (Manitoba Status of Women, 2016). Further, their work must be necessarily inclusive of women with diverse abilities, and cultural and socio-economic backgrounds. Lastly, as one of the objectives of the initiative is to improve reporting, another principle they grounded their work in was to determine causes of low reporting through the analysis of quantitative data.

How was data collected?

Considering these principles, the Steering Committee carried out a scoping study that was led by women's organizations and supported by the Winnipeg Police Service and community partners to arrive at a strategy to prevent sexual harassment and violence. For this, the scoping study involved the gathering or analysis of existing administrative data (surveys, census reports), qualitative data (interviews, focus group discussions) and statistical data from the 'Winnipeg Police Service CrimeStat'. Conversations with the community were seen as an important and valuable source of data, particularly those with Indigenous women. Qualitative data was collected from two areas of intervention, sites that were reported in police data to have higher incidents of sexual assault.

These focus group discussions elicited experiences of a diverse set of women, who also provided several solutions and recommendations that could facilitate greater mobility and make them feel safer in navigating the city. Recommendations included better security measures, greater awareness of how to access their rights, cultural and consent-based education, and diversity in law enforcement officers.

Findings from the scoping study highlighted that more data needed to be collected about specific populations and there was a need for Indigenous-led programmes to tackle sexual violence. In 2016, the Winnipeg Police Service proposed it would further support the initiative by owning an aspect of targeted data collection and continuing consulting with the Steering Committee. It created a set of metrics to assess this intervention which included: 'number of meetings attended, number of data files shared and number of initiatives to reduce sexual violence against women in public spaces' (Winnipeg Police Service, 2016). The inclusion of the Safe City Program in their activities is part of their larger effort towards "minimizing the risks to vulnerable citizens" which as an action includes "Continu[ing] counter-exploitation efforts with focus on building trusting and meaningful relationships between the police, sexually exploited persons, and the community" (Clunis, 2016). Creating and leveraging existing partnerships were noted as key mechanisms to accomplish this. Since this announcement in 2016, limited information exists on how the police aim to collect data, what data has since been captured and what mechanisms they employ to govern it.

Evaluation and emerging best practices

This model illustrates how a variety of stakeholders, particularly affected women from marginalized communities and different cultural backgrounds, can be included

in the process of data mapping and collection. The principles of inclusion, diversity and participation are relevant to explore when considering the design of a steward. It can be argued that the Steering Committee also represents a mechanism for accountability; however, it is unclear whether the community is granted access to the data or has the ability to request data on communities collected for their benefit.

Similarly, the model does not focus on or share details on the governance of data or indicate who hosts this information; it also lacks transparency around what measures, if at all, have been put in place to secure the information. Further concerns emerge from the greater control and ownership of the initiative by the Winnipeg Police Service in 2016. The insensitivity of police and general reservation women had in reporting were among the main takeaways from focus group interviews carried out in the scoping study. If the police in this context now act as a steward for the collection of data, it might inspire a lack of trust on the part of communities in complying with or participating in the process. Moreover, care must be employed to ensure women are granted agency in these initiatives, so that there isn't a shift towards protectionism, where the police end up implementing solutions for women's safety that don't reflect the needs or recommendations suggested by the latter.

Opportunities for responsible stewardship of data

The Steering Committee that was established by the Winnipeg Safe City programme represents an important start towards building a more robust governance framework for data. A steward could bring greater transparency, accountability and capacity to the work of this Committee. In practice, this could mean that the Committee works closely with the steward to co-define governance principles and assess and implement safeguards for the protection of community or individual data. Similarly, a steward could routinely consult with the Committee and organizations that it partners with like Ka Ni Kanichihk to design a consent-based framework around third-party access. As a hypothetical case, in the interest of privacy an Indigenous organization might be interested in sharing data that corresponds to its community with select stakeholders only. The steward can develop relationships with members of the Committee to identify these nuances and build corresponding technical and governance mechanisms to ensure access to data is protected and conditional.

There are also opportunities for the steward to forge relationships with new partners to unlock and gain access to data relevant to women's safety from new sources. This could diversify the data pool and foster conversations on women's safety

with a wider audience. Lastly, a steward may be able to provide individuals and communities greater access to data they have contributed through visualizations, dashboards or other channels. In this respect, the steward could empower citizens to play a more active role in wielding data to enhance safe access to the city and public transport.

PART III

Principles and Recommendations for a Data Steward for Safe & Inclusive Cities

Based on an analysis of the three models, the following design principles for a steward for women's safety recommend themselves: participation, inclusion and agency. Participation refers to the mechanisms by which an incentive structure is created for diverse stakeholder participation, from governance to evaluation. In order for women's safety to be tackled holistically, it is necessary that multiple public, private and civil society stakeholders be involved in unlocking data and setting benchmarks across industries. In this respect, it may be relevant for a steward to bring on board members from women's organizations, transit agencies, start-ups, social enterprises, urban planners, telecom companies, and so on.

Inclusion refers to the scope for a range of women of varying socio-economic status, abilities and religious/ethnic communities to be represented and included in the formulation of data governance, design for data collection and capture of data on-ground. Through an inclusive and guided approach, it's likely that data collection can be more representative of multiple marginalities and nuances. Similarly, this inclusion grants the community greater pathways for accountability—where they can determine what degree of granularity is collected and at what frequency, and better dictate the outcome of its usage.

Agency refers to the control women have on collected data's storage, usage and sharing – most importantly, who the data is shared with, and how it is visualized and made actionable for communities and decision-makers. Embedding agency in the process empowers women to make choices over their data, instead of it being used in a protectionist manner for their alleged benefit. This approach acknowledges that it is often those who are impacted who are best placed to proffer potential solutions.

These principles also offer some guidance into who a steward for women's safety could be—though this is likely to differ in practice based on local context and objectives for establishing a steward. However, there are a few conceptualization choices that can be considered. In order to facilitate greater participation and agency, the steward must be representative of or responsive and accountable to the needs of the community. If the steward is located within the community, it may be better placed to understand the unique context or situation. Alternatively, stewards can report to and be held accountable by a steering committee composed of women and members from community organizations, similar to the model adopted in Winnipeg.

In the context of women's safety, stewards can play a range of roles, which can often be determined and guided by the community, necessary use cases and requirements. Based on models highlighted in the paper, a few such responsibilities have emerged where stewards can provide support:

Defining women's safety and developing a set of corresponding indicators that can guide data collection. This definition must be guided by a rights-based approach and adopt a lens of equity and diversity. This can be arrived at through consulting with multiple stakeholder groups to reach a contextual definition that reflects local context. For instance, UN Habitat outlined how these conceptions of safety can vary across safe spaces, freedom from poverty, financial security and autonomy, healthy communities and self-worth. This definition of women's safety can guide the steward towards forging partnerships with relevant stakeholders and assessing what data may be relevant to collect.

Bringing gender expertise and lending capacity to government to generate insights and provide basis for gender-based policies and investment. Given the limited representation of women in decision-making roles in local government and planning organizations, a steward can be an important avenue where women's voices can be amplified or brought to the fore. On a technical front, even where gender-disaggregated data is collected, governments and local agencies are often unaware of how to effectively leverage it towards more inclusive or gender-responsive policies. In part, this is due to limited technical capacity required for the analysis of big data. In these cases, stewards can fill this gap by possessing necessary technical expertise and skill sets to analyze and draw out insights for these stakeholders.

Aggregating sources of data and building pathways for reciprocal sharing. The development of partnerships with community, government and private sector players has emerged as a core recommendation when concerned with women's safety (Viswanath, 2015). This holds true even in terms of collating and governing of data – where cities stand to benefit from more comprehensive, representative and diverse data that emerges from multiple stakeholders across sectors. While progress has been made on this front with civil society and social enterprises sharing information with cities and governments, more limited examples exist of how this engagement looks with the private sector. Regardless of stakeholder, it is critical that stewards act as a 'go-between' for different actors to enable the exchange of information, best practices and data which would likely spark innovative ideas on how safety can be conceptualized and implemented in public spaces.

This includes negotiating with private sector companies to gain access to big data relevant to women's safety. Often, companies are concerned that the release of data on women's safety might damage their public image. Stewards can position safety as a shared responsibility, and highlight the value and importance of participation by

a range of stakeholders. Based on a consent-driven process, stewards can also be equipped to negotiate with a range of companies or partners to assess what data will be shared and on what terms.

Opening up access to data for multiple stakeholders while ensuring privacy safeguards that protect women and other gender minorities. Whether it concerns women's experiences in public transport, while walking on streets or merely inhabiting public spaces, several factors influence both the real and perceived safety of a particular location. Assessing this safety requires the responsible collection of both quantitative and qualitative data that exists in a variety of forms. For instance, map data, survey data, and images of neighbourhoods. Given the diversity of data sources and lack of comprehensive standards or benchmarks in compiling data, stewards can aggregate, make sense of the data and transmit relevant insights back to stakeholders to encourage continued engagement. To serve as a basis for more inclusive policies, and to guide spending around infrastructure, awareness, education or service delivery, gender-disaggregated data along with gender-specific qualitative and quantitative data must be made available to relevant stakeholders such as city authorities, transport agencies, women's organizations, law enforcement, and the like. Stewards can ensure that data that is aggregated is made available in a range of forms conducive to the requirements of these entities.

If carried out responsibly, in a way that is grounded in the principles of inclusion, agency and participation, data can represent an effective tool combined with other approaches to address women's safety in cities. Insights derived from a diverse set of data can inform policy, guide necessary infrastructure and serve as a basis for designing community awareness and education campaigns around gender and safety. Similarly, when communities are empowered with their data, it can be leveraged to demand equitable service provision and, more importantly, the right to access the city. Currently, there are barriers that inhibit the access and collection of data. These include the lack of representation of women in decision-making roles in cities and transit agencies, limited accountability around existing forms of data collection (by both state and non-state actors) and the lack of common standards to guide and safely share data among relevant stakeholders. The framework of stewardship may play a potential role in overcoming existing challenges in the collection and sharing of data and may be particularly helpful in building trust between stakeholders—which is necessary if safety is the objective through a shared and collaborative approach.

This paper has analyzed three existing models where data is stewarded, albeit through different methodologies, for women's safety: Safetipin's Safety Audits, the

Gender and Urban Mobility data collaborative in Chile, and Winnipeg's Safe City programme. Learnings from these models highlighted different design choices and practicalities that must be considered when exploring how a steward for women's safety may be envisioned on-ground. Best practices that emerged from these models include: unlocking data from a variety of sources to supplement the lack of reliable administrative data, and involving communities in guiding the design and collection of data. Other learnings point to the efficacy of unlocking data from unconventional sources, as a low-cost and highly scalable model to nuance our understanding of women's safety across domains. While these models represent innovative means of involving women and collecting data in diverse ways, questions remain on how this data can be effectively secured and access can be limited through accountability and technical measures. While standard features like encryption, de-identification and obfuscation may present solutions, there is merit in exploring how privacy can be secured—particularly for vulnerable communities. There is also potential to carry out further research, through interviews with women's organizations and social enterprises to better understand what mechanisms can be employed to grant women greater control over their data. This would involve understanding how consent could be secured and managed by the steward through a dynamic process.

Broadly, however, a steward can formalize processes of accountability and set in place mechanisms to grant women greater participation and agency in data collection and governance. This may vary in how it can be implemented: a steward in a data trust model would possess a fiduciary responsibility in ensuring that the data contributors' information is safeguarded and their rights upheld. While this may not currently exist in practice, a similar set of informal practices is carried out by women's organizations or social enterprises like Safetipin or Safe & the City. This is in contrast to a data collaborative, similar to what was put in place in Chile, where there is a more informal set of principles around the governance of data and a greater priority for fostering relationships to unlock data. Regardless of the model employed, future data collection and governance of data for women's safety must be responsibly and securely carried out. Data is one tool among many approaches that can aid the objective of creating inclusive cities—but it must empower, not further subjugate, the communities it aims to support, and this requires further consideration on how it can be employed, shared and managed in a just and responsible way.

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