ACTIVE TRAVEL STUDIES

Sanguinetti, A, et al. 2023. Equipping Active Travel Advocates with Digital Mobility Data and Tools: An Evaluation of a US Trial Program. *Active Travel Studies: An Interdisciplinary Journal*, 3(1): 7, 1–18. DOI: https://doi.org/10.16997/ats.1198

RESEARCH ARTICLE

Equipping Active Travel Advocates with Digital Mobility Data and Tools: An Evaluation of a US Trial Program

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Shared micromobility services that offer bikes and scooters on demand are complementing walking, cycling, and public transport to expand the role of active mobility in urban transportation. However, on-demand services are often introduced at a faster pace than streets are redesigned to protect the safety of users. The lack of safe street infrastructure limits the potential mode shift to micromobility and the associated benefits. Active travel advocacy groups can make a critical difference, but they generally lack access to data resources.

In 2020, Spin, a shared micromobility company, launched an initiative called Mobility Data for Safer Streets (MDSS). This involved equipping six advocacy organizations in five US cities with a suite of mobility data tools to support their efforts to make streets safer. This research sought to understand how access to mobility data can help active travel advocates be more effective and was assessed via interviews with awardees throughout the 15-month program. Access to data improved advocates' effectiveness in working with the local government, garnering community support, supporting underserved communities, and advocating safe streets for all road users in their work. The MDSS model can be replicated to empower advocates or other stakeholders to advance collective understanding of active travel and influence supportive planning and policy.

Keywords: Micromobility; Active transportation; Advocacy; Mobility data; Safety

Introduction

Active travel (AT), including walking and cycling, has long been recognized for its environmental and social benefits (Lee, Sener and Jones, 2017; Smith et al., 2017). Relatively new forms of shared and personal micromobility have expanded some of the benefits of traditional AT. On-demand services with shared docked or dockless fleets of conventional or electric bikes or scooters and privately owned e-bikes, e-scooters, and other light electric vehicles provide additional lower-emissions alternatives to private automobiles for short trips

(Abduljabbar, Liyanage and Dia, 2021), making micromobility accessible to more people (e.g., the elderly and those with disabilities may more easily use an electric bike or scooter than a traditional bike or scooter) (Shaheen and Cohen, 2019; Shaheen et al., 2012; Shaheen et al., 2014), and facilitating connections to public transport and access to jobs and other basic needs (North American Bikeshare Association, 2020; DuPuis, Griess and Klein, 2019; Smith and Schwieterman, 2018).

Traditional AT increased across the globe in the months following the identification of the COVID-19 pandemic (Dingil and Esztergár-Kiss, 2021). Shared micromobility services quickly recovered from initial setbacks due to the pandemic and have been projected to experience increased ridership in the wake of the pandemic (Heineke, Kloss and Scurtu, 2020) and beyond (Chang et al., 2019). Private ownership of light electric vehicles has also increased in recent years, especially since the pandemic, in the United States (it has been popular elsewhere for decades); e-bikes sold annually increased from less than 300,000 to over 1 million between 2018 and 2021, and the boom that occurred during the pandemic has been sustained for e-bikes whereas traditional bike sales have returned to prepandemic rates (Bennett et al., 2022).

This recent increase in AT and new forms of micromobility has drawn attention to inadequate street facilities and created a more supportive climate for investing in safe streets infrastructure. In the United States, institutionalized practices of transport planning, including top-down and slow-moving processes, can tend to favor the status quo of autocentric street engineering with low prioritization of AT facilities (Braun, Rodriguez and Gordon-Larsen, 2019), such as sidewalks, bike lanes, and bike parking, which are now also important to support new forms of micromobility. Though transportation planning education has come to emphasize the needs of users of all transportation modes and public involvement in the planning process (Combs and Pardo, 2021), these goals can be difficult to achieve in practice (Broaddus and Cervero, 2019; Wagner, 2013). During the pandemic, cities have experimented with new public engagement practices, managed to quickly reallocate space previously reserved for autos, and have become more open to AT advocates (Braun, Rodriguez and Gordon-Larsen, 2019).

AT advocates play an important role in promoting maintenance, improvements, and expansions of AT infrastructure through both formal roles and informal relationships with local government and planning agencies (Karner et al., 2020). However, they often lack access to data resources to support case making; they may recruit volunteers to manually collect bike and pedestrian counts or obtain crash and injury rates from their cities (Seskin, Kite and Searfoss, 2015). With the emergence of big mobility data, increasingly used by local governments to aid in transportation planning (Englin and Davis, 2021; Yang, Cetin and Ma, 2020), lack of access to the same data may inhibit advocates from contributing to planning. Subscriptions to emerging mobility data tools can be prohibitively expensive for cities (Koupal et al., 2022; Nelson et al., 2021; Lee and Sener, 2020), let alone not-for-profit advocacy groups. Working with emerging mobility data often requires a high level of data science skills (Nelson et al., 2021), which may limit the degree to which advocates could use the tools even if they had access. Use of multiple tools to complement each other and compensate for relative shortcomings has been suggested (Nelson et al., 2021), which compounds the cost and human resource barriers.

Spin, a shared micromobility company, launched the Mobility Data for Safer Streets (MDSS) Initiative in 2020, which awarded six AT advocacy organizations access to a suite of mobility data tools to support their efforts to improve street safety for AT, broadly defined henceforth in this paper to include new forms of micromobility. The program provided advocates with the leading emerging mobility data tools, removing the cost barrier entirely, and Spin facilitated onboarding and support for the awardees from each of the software platform companies to address the training requirements. It provided a diverse set of tools to be used in combination, including traditional data collection tools.

Spin and Ford (Spin's parent company at the time) enlisted researchers from the University of California, Davis, to evaluate the program. Data for the evaluation were gathered from four rounds of interviews with awardees over the course of the 15-month program. This research draws on those data to understand how mobility data tools can be harnessed by AT advocates to enable them to be more effective in their work toward safer streets and to identify some characteristics of emerging data tools that facilitate or complicate their use among advocates.

Literature review

Cities invest heavily in collecting data on motor vehicles (traffic volumes, safety, and infrastructure) but allocate little for tracking similar data on AT (Nelson et al., 2021). For example, cycling volume data tend to be limited to small areas and short time frames (Roy et al., 2019), cycling safety incidents are grossly underreported (Winters and Branion-Calles, 2017), and cycling infrastructure changes are difficult to track because they are often incremental (Nelson et al.). This dearth of data inhibits AT-supportive planning and policy (DiGioia et al., 2017).

New forms of mobility data can help fill these gaps (Nelson et al., 2021). Lee and Sener (2020) defined emerging AT data to include the concepts of big (Romanillos et al., 2016), crowdsourced (Le Dantec et al., 2015; Fernandez-Heredia and Fernandez-Sanchez, 2020), and passive data (Bonnel et al., 2015), in contrast to traditional travel survey and manual or automated bike-ped counting methods. They divided emerging data into two categories: mode-unspecified and mode-specified. Mode-unspecified data include those gathered passively from smartphone apps that track user location and infer travel mode, while mode-specified data sources specifically monitor nonmotorized modes and include bicycle-tracking apps, fitness-tracking apps, bike-share services, and user-feedback platforms.

StreetLight Data is the leading provider of mode-unspecified data. Using smartphones as sensors, StreetLight infers travel modes and provides historical street-level traffic volumes and speeds and origin and destination trip volumes and durations over user-specified time frames and areas. It also provides inferred contextual data on traveler sociodemographics and trip purpose. Data are visualized in maps and graphs. While StreetLight AT applications are yet few (most focus on motor vehicles, e.g., modeling regional travel demand) (Englin and Davis, 2021; Yang, Cetin and Ma, 2020), there is great potential to use this type of high-volume and granular data to analyze AT (Nelson et al., 2021). One example of a StreetLight AT application is an analysis of walking trips to and from light-rail stations in Sacramento, California, that demonstrated the need for improved connectivity (McCahill, 2017).

Strava Metro, the data service associated with the Strava fitness-tracking app, is a widely used mode-specified mobility data tool. Strava provides cycling and walking trip counts and average times and distances over specified time frames and locations, as well as two general trip purpose categories (commute and noncommute), and traveler gender and age group summaries. A recent review (Lee and Sener, 2021) articulated six Strava use cases for AT analysis and planning: travel pattern identification, travel demand estimation, route choice analysis, infrastructure evaluation, crash exposure control, and air pollutant exposure assessment. However, a criticism of Strava and similar crowdsourced data is that only active subscribers (Strava users tend to be avid recreational cyclists) are reflected in the data, and thus it may not be representative of the broader population (Asad and Le Dantec, 2017). Methods have been developed to correct for the biases (Roy et al., 2019), but it is unclear the degree to which practitioners are using these methods, which require calibrating the data with official counts at many locations; Englin and Davis (2021) describe several Strava AT applications by US state departments of transportation, including some that did and some that did not use bias-correction methods.

In addition to smartphone-enabled passive data and subscriber-based crowdsourced data, shared mobility (including ride-hailing and shared micromobility) service providers are a source of mode-specified big data supplied by their vehicles and users (Ciociola et al., 2017). Cities often require these companies to share data, which they can use to ensure the companies are abiding by operating agreements and to inform transportation planning (D'Agostino, Pellaton and Brown, 2019). This has created a need for data-sharing standards and tools that help cities process and evaluate shared mobility data securely (ensuring the data are sufficiently anonymized to protect personal privacy). Populus has emerged as a leader in this space, providing a tool called Mobility Manager that manages and visualizes (in maps) vehicle and trip data for shared mobility services. Data must be provided by shared mobility companies, and perhaps this is why it has not been leveraged in much research (they have conducted their own studies).

Lee and Sener (2020) described another mode-specified data source they termed "user-feedback inventories," referring to online crowdsourcing platforms where users actively contribute data about AT-related issues such as street infrastructure, safety (crashes and near misses), and proposed solutions. OpenStreetMaps (OSM) is a widely used user-feedback inventory of street infrastructure data. OSM is leveraged in the urban planning tool UrbanFootprint to supplement TIGER roads data from the US Census, particularly to incorporate more granular and specific information on cycling and pedestrian infrastructure. UrbanFootprint contains an extensive ready-to-use library of geospatial data, including population demographics and land use, that draws on many sources, including the US Census.

As previously noted, AT advocates are often a driving force for progressive micromobility infrastructure and policy, yet there is a dearth of research on their needs and uses for emerging mobility data. Asad and Le Dantec (2017) explored cycling advocates' desired uses for hypothetical digital mobility data tools and identified three themes: making cycling visible through geolocation (documenting ridership and routes), making cyclists safe through feedback loops (crowdsourcing data about routes and safety issues), and empowering cyclists through communication (to other community members and decision-makers about cyclists' issues and needs). This research fills a gap in the literature by articulating whether and how emerging data tools can be harnessed by AT advocates to help achieve safer streets.

Methodology

The MDSS program awarded six nonprofit advocacy organizations around the country with access to a set of mobility data tools to gather, analyze, and present data to enhance their work toward making streets safer for micromobility. Advocates' applications to the program described how they intended to deploy these tools in support of at least one specific street redesign project over the course of the project term. Spin provided the following examples to guide applicants: highlight the need for a project based on an understanding of multimodal traffic in a neighborhood, gather critical data to make the case to a city department, or monitor the success of an existing project to ensure the city remains committed. The program began in January 2020 and was originally planned for the calendar year but was extended through March 2021 because of the pandemic.

Awardees

Six advocacy groups applied to the program, and all were awarded (**Table 1**): Sustain Charlotte, Bike Cleveland, Denver Streets Partnership, Walk Bike Nashville, Bike Utah (together with

Table 1: 2020 MDSS Initiative awardees.

Awardee	Location	Website
Bike Cleveland	City of Cleveland, OH	bikecleveland.org
Denver Streets Partnership	City of Denver, CO	denverstreetspartnership.org
Walk Bike Nashville	City of Nashville, TN	walkbikenashville.org
Bike Utah	UT; City of Provo, UT	bikeutah.org; linktr.ee/bikewalkprovo
Sustain Charlotte	City of Charlotte, NC	sustaincharlotte.org
BikeWalk North Carolina	NC	bikewalknc.org

Bike Walk Provo), and BikeWalk North Carolina. The organizations are all not-for-profit and small (one to nine paid staff).

The data tools

Spin procured for each awardee several physical data collection tools and the four software-based emerging data tools overviewed in the literature review section (StreetLight Data, Strava Metro, Populus Mobility Manager, and UrbanFootprint). The physical data-gathering kit included a professional-grade radar speed gun for tracking vehicle speeds, a time-lapse camera for visual tracking of slower changes to the streetscape, and a sensor for counting people walking and cycling on a street segment or at an intersection. Additionally, Gehl urban design consultancy donated access to its Public Space Public Life (PSPL) survey toolkit, which describes methods and provides online templates for observational, survey, and interview research to study the physical and social elements of street design and travel behavior.

Spin purchased the physical tools for the awardees, and awardees were allowed to keep these after the program. Spin came to an agreement with each of the software tool companies to either purchase or have donated limited licenses for the awardees to access data for the duration of the program. Software tool companies hosted an online tutorial session for awardees and provided a contact for technical assistance to support the awardees throughout the program.

Evaluation data collection and analysis

Evaluation methods centered on quarterly, hour-long, semistructured interviews with one or two main points of contact for the program at each organization. Interviews were conducted by virtual conference. These individuals were either the executive director or a program director or coordinator.

Interviewers asked awardees to define and name specific projects for which they were using the provided data tools (e.g., to evaluate usage of a particular bike facility or inform a particular advocacy effort). Most awardees used the tools in support of multiple projects. They asked awardees to discuss each project in terms of goals and objectives, data collection and analysis processes, progress, findings, dissemination methods, and outcomes. Awardees were invited to share and discuss data visualizations. Other topics included data tool usability, the impact of the pandemic on their use of the data tools, the history of micromobility in their cities, and their organizational interest in emerging data.

Prior to the final round of interviews conducted in March 2021, a narrative brief was written for each project that contained the following sections: project goals, process and tool use, outputs and dissemination, and accomplishments and aspirations. Notes and transcripts from the first three interview rounds were referenced to compile these briefs. One coauthor drafted each brief; the lead author reviewed and edited all briefs.

The project briefs formed the basis of an initial inductive analysis for this research. Taking the project as the unit of analysis, the authors derived a set of themes to describe what the data tools enabled advocates to do, or to do better, to increase their effectiveness in advocating safer streets for AT. These themes were identified by assessing commonalities across projects in terms of their goals, accomplishments, and aspirations.

The final round of interviews focused on the emergent themes. Interviewers inquired whether and how access to the data tools changed the types of projects or collaborations possible in relation to each theme (i.e., anything they were able to do that they could not have done otherwise). They also discussed types of data and visualizations they found most effective and how they would advise future MDSS program awardees with respect to each theme. This final interview round was recorded and transcribed for content analysis.

Results

Four themes were identified to describe how access to mobility data tools can make AT advocates more effective in their efforts to improve street safety. The data tools helped advocates more effectively work with local government, garner community support, support underrepresented communities, and advocate safer streets for all. The following sections first discuss general findings in relation to each theme and then describe some of the awardees' projects that exemplify each theme. **Table 2** summarizes all the projects. A final results section discusses the challenges that the awardees experienced with the program.

Table 2: 2020 MDSS Initiative projects.

Awardee	Project	Description	Theme	Tools used
Bike Cleveland	Memorial Bridges Loop	Advocate for a road diet to create a comprehensive bike network	Advocate safer streets for all	StreetLight, Strava
Bike Cleveland	Speeding on High Injury Network	Explore increased speeding during the pandemic and correlation with fatalities	Work with government	StreetLight
Bike Utah	Buffered Bike Lanes	Demonstrate how buffered bike lanes are being used	Work with government	Time-lapse camera
Bike Utah	Informing Master Plans	Provide recommendations for new bike facilities, highlighting the needs of underserved communities	Work with government; Support underserved communities	StreetLight
BikeWalk North Carolina	Safety in the Charlotte Crescent	Document high AT rates in neighborhood perceived by the city as an "AT desert"	Support underserved communities	StreetLight
Denver Streets Partnership	Denver Shared Streets	Evaluate use of temporary shared streets interventions	Work with government	EcoCounter
Sustain Charlotte	Multimodal Connectivity	Identify gaps in multimodal mobility networks	Support underserved communities	Urban Footprint
Sustain Charlotte	Biketoberfest!	Identify most popular bike routes for fundraising event	Garner community support	Strava

(Contd.)

Awardee	Project	Description	Theme	Tools used
Sustain Charlotte	North Davidson Safe Streets	Analyze auto speeds to identify and get support for interventions for safer AT	Garner community support	StreetLight
WalkBike Nashville	Murfreesboro Pike Corridor	Community active travel needs assessment	Support underserved communities	Urban Footprint
Walk Bike Nashville	Traffic Calming Campaign	Document suspected speeding to advocate traffic calming measures	Garner community support	StreetLight
Walk Bike Nashville	Nashville Slow Streets	Study impact of slow streets on auto volumes and speed	Work with government	StreetLight

Working with local government

According to the awardees, cities often lack AT data and make decisions about AT infrastructure based on incomplete data or in a reactive rather than proactive mode. Several awardees described how their long-term mission is to nudge the culture of their local transportation planning to place a higher priority on AT, which includes prioritizing AT-related data collection. Having access to data tools themselves helped them in this general mission; as one awardee observed, "The way to change policy is to fundamentally change how [decision-makers] see transportation and call into question some of the assumptions that are being made. And you do that with data."

Another notable outcome of advocates having access to mobility data was that their cities became more eager to collaborate with them, changing the relationship dynamics, even to the point where cities were reliant on advocates for supplying valuable data. One awardee described it this way: "What [access to mobility data] has allowed me to do is to move from being a participant in the conversation to a leader in the conversation." Another attributed some of this impact to other resources the program provided: "We would not have the skill and ability to dive into this GIS data if it weren't for the grant. The training, the information resources, and the technical support associated with [the MDSS program] allowed us to have a much more intellectual conversation at the state and local level."

The nature of data that awardees were able to access with some tools was also important in changing the dynamic of their interactions with government. Advocates reported that before the program, they were often only able to offer small-scale quantitative data or anecdotal evidence due to limited data resources. They relayed how bringing broad-based, quantitative data to their efforts was useful: "Trying to tell a broader story is more important than trying to advocate for a specific project…. I think that's much more provocative and meaningful. It can actually inform a lot of these more specific projects that you want to complete."

In terms of specific projects that exemplify this theme, Bike Utah worked with multiple Utah cities to provide recommendations for their transportation master plans. For example, it supplied data to inform the Active Transportation Plan for the City of Springville, which is soon to be voted on by the city council.[1] It heavily used StreetLight to document where cycling volumes were highest and compared these insights to current and planned infrastructure.

In another project, Bike Utah used the time-lapse camera to show city engineers that buffered bike lanes (separated from auto lanes by a section of painted white lines) were being used appropriately. City engineers had been under the impression that people were riding

[1] https://springvilleatp.altago.site/.

inside the buffer instead of the bike lane, so the city was considering discontinuing buffered bike lane construction. Bike Utah set up the camera at various locations and put together videos showing that virtually all cyclists and scooter users were using the lanes appropriately. As a result, the city recommitted to continuing to build buffered bike lanes. The awardee observed, "In a lot of cases buffered bike lanes are like the 'gateway drug' to physically protected bike lanes. So if we hadn't won this battle, it would've made future battles impossible—the ultimate goal impossible."

Denver Streets Partnership and Walk Bike Nashville used the data tools (EcoCounter and StreetLight, respectively) to document impacts of temporary shared and slow streets interventions. Implemented in many cities across the world during the pandemic, shared streets involved closing off parts of a street to vehicle traffic to make more safe dedicated space for active modes, and slow streets involved reducing vehicle speeds and/or auto lanes for a similar purpose. Largely because of the advocate's analyses showing increased AT volumes, Denver expanded and extended its Shared Streets program in the near term. Long term, though many of the temporary shared streets were reverted, the city committed to some permanent changes and improved cycling infrastructure.[2] The awardee explained, "Just simple data on how many people walk down a street segment is incredibly valuable because there's such a dearth of that data. Being able to have these more objective data definitely changed the dynamic between us and the city. We became more of a partner working on the projects."

Garnering community support

Awardees reported that safe street redesign projects are sometimes met with resistance or NIMBYism from community members. As active travel advocates, they aim to mitigate any such resistance and encourage community activism by communicating the need for street design projects to improve safety, mobility, and quality of life. They talked about trying to educate and inspire adults and youth in their communities to be more active, take advantage of local AT facilities, and get involved in advocacy. They sometimes also seek financial or other types of support for street redesign projects from the community.

Awardees reported that access to mobility data made them more effective at garnering community support in these various contexts by providing the requisite data and analytic support for case making. They noted that broad-based quantitative data can be useful in validating community members' personal stories and that geospatial data visualizations enabled by some of the tools (as well as simple charts) facilitate telling clear and compelling stories to community members. One advocate observed, "With community members it's important to be able to share the data in a visually accessible way. Your average person's eyes glaze over as soon as you start getting into numbers. So having very visually compelling information is useful."

The tools also provided an opportunity to engage different types of community members in advocacy, as one awardee explained,

> The way data can be helpful with community engagement is by enlisting community members themselves in helping to collect the data. For example, people have so much fun standing on the side of the road with the radar gun. And it engages them in starting to think in a more data-centric way, having more ownership over the stories that

[2] https://www.denvergov.org/Government/Agencies-Departments-Offices/Agencies-Departments-Offices-Directory/Department-of-Transportation-and-Infrastructure/News-Outreach/News/Next-Phase-Shared-Streets.

> come out of the data because they participated in collecting it. It's a little different from the usual ways that people think about getting involved in initiatives, so you can attract different types of people.

In response to community concerns about increased auto speeds during the pandemic, Walk Bike Nashville rejuvenated their ongoing traffic calming campaign. *Traffic calming* refers to interventions to slow the speeds of auto traffic in order to make streets safer for AT. Using StreetLight, they analyzed speeds and volumes on streets with many complaints. Comparing data from spring 2019 (pre-COVID) and spring 2020 (during the pandemic), the analysis confirmed increased speeding. Findings were well received by the neighborhood associations because they validated their concerns; the awardee noted, "[The neighborhood association] loved it because it confirmed what they were seeing, so they were really excited to have the data." In preparation for filing a formal petition to the city in spring 2021 to request funding for traffic calming programs, Walk Bike Nashville is compiling a list of supportive neighborhood associations and asking community members to call their councilperson's and mayor's offices.

Sustain Charlotte used Strava Metro to identify the most popular bike routes in the city of Charlotte, which they used for their Choose Your Own Adventure–themed BiketoberFest community ride and fundraising event. Community members were encouraged to explore the city by bicycle and participate in a scavenger hunt. The advocate observed,

> The [data tools] can be used for fun activities as well. We do events to get folks out on bikes and maybe going places they haven't usually gone on bikes before. Having Strava data, we're able to figure out, in this virtual, pandemic time, where would be the best locations. … It's another form of advocacy and building support for active transportation.

Supporting underserved communities
Access to mobility data tools enabled advocates to investigate issues in areas of their cities that are often overlooked: low-income and minority neighborhoods lacking safe AT infrastructure. Advocates noted that poor infrastructure, despite high demand, is also related to these neighborhoods' lack of political power and representation in transportation planning processes. Broad-based quantitative data, such as that provided in StreetLight, was found to be particularly valuable to help represent these communities because it reflects the behavior of most street users, including groups not represented at planning meetings or in data provided by subscription-based crowdsourcing tools like Strava.

In terms of specific projects with this theme, Sustain Charlotte worked with a coalition of community leaders in neighborhoods throughout the economically and racially segregated "Crescent" area (neighborhoods in East, North, and West Charlotte) to map travel times to basic needs for non-auto modes in UrbanFootprint to identify gaps in mobility networks and connectivity solutions. The project equipped community leaders with compelling data to use in advocating their needs and highlighted common patterns across the neighborhoods, which empowered the coalition to pool their advocacy efforts in support of shared goals.

Walk Bike Nashville used UrbanFootprint to visualize crash data (from the police department) in relation to economic data from the US Census. The analysis revealed a strong correlation between lower-income census tracts and pedestrian fatalities. They planned to use this analysis to advocate improved AT infrastructure around Murfreesboro Pike, a multilane arterial road in South Nashville. The advocate explained why the area is so dangerous: "We see a lot of people biking to the bus station to get to work from South Nashville, which has no bike lanes. We also see a lot of people walking there on some of our streets with no sidewalks in really busy traffic."

While consulting on the Active Transportation Master Plan for the City of Provo, the Bike Utah advocate described stumbling onto compelling equity-related insights in StreetLight regarding where most cycling was occurring in the city:

> That was actually one of the mind-blowing experiences, when it matched up almost perfectly with where most of the Latinx folks were living, and also low-income folks. But then I was in a meeting [with] all middle class white people … asking for recreational facilities [to be included in the master plan]…. I showed them all the [StreetLight data] visualizations and that kind of just snowballed into me creating more visualizations [for other cities] because [I realized] there's a case to be made beyond Provo…. [As a result, the city] changed their request for proposals that they were putting out to consultancies [to work on the master plan], pretty drastically, to be more about utilitarian cycling.

Advocating safer streets for all

Awardees used mobility data tools to analyze multiple travel modes, including AT, automobiles, and public transport. They took advantage of the breadth of available data to highlight how street redesign projects that facilitate AT can promote safety for all modes. Advocates stressed the value of data related to safety (examples they gave were vehicle speeds and crashes) as being a uniting force to garner support for projects:

> A lot of times when we communicate around a project it isn't just about making the roadway safer for people biking and walking, but it's about making it safer for everybody…. People can argue all day, "I don't want a bike facility on this roadway because I want to be able to park" or "I want to be able to get through as fast as I can"; but it's tough for people to argue against safety. Leading with, "This isn't just about bikes, this is about safety," it's tough for people to say no.

For example, Bike Cleveland used multiple data tools in its advocacy for a comprehensive network of AT facilities around the city. Specifically, it hopes to connect existing infrastructure in different areas (the Lorain Avenue Cycle Track and the protected bike lane on Detroit Superior Bridge) by adding protected bike lanes to the connecting roads (Huron Road and Ontario Street) via road diets. A *road diet* is a street design intervention involving the removal of an auto lane to make room for protected bike lanes. To help make the case, Bike Cleveland used data from StreetLight and Strava in conjunction with crash data from the local department of transportation to highlight how the streets in focus are unsafe for cyclists.

Strava route data revealed that on a particular stretch of Ontario Street heading into downtown, cyclists were avoiding the motor vehicle and bicycle shared lane and instead traveling on the sidewalk. In Cleveland, as in many US cities, cycling on the sidewalk is not legal, as it can make the sidewalk less safe for pedestrians. The advocate explained, "People are actually foregoing the most direct route and hopping up on the sidewalk, which technically is illegal… But they're doing it because they don't feel comfortable mixing with four lanes of traffic all heading into downtown."

Further, Bike Cleveland used Strava and StreetLight to illustrate high AT volumes and relatively low auto volumes on those roads, prepandemic, indicating a road diet could be achieved without major negative impact on auto traffic and with improved safety for all. The advocate summarized, "The data can help confirm a lot of the ideas that we have, and show that on some roadways [auto] traffic volumes are really low…. You can remove a lane of traffic to create a safer place for other users."

Another aspect of this theme is the equitable prioritization of safety for all micromobility users regardless of travel purpose (utilitarian or recreational). As previously mentioned, Bike Utah used mobility data to demonstrate that there was more utilitarian cycling in the cities than recreational, correcting a common misperception that the reverse is true. BikeWalk North Carolina was particularly passionate about not only dispelling that myth but also emphasizing that trip purpose should not matter when it comes to road safety. The advocate observed that the needs of recreational travelers are often not considered mainstream traffic engineering concerns and compared this to the idea that one should only fasten one's seatbelt when driving for utilitarian purposes.

Challenges

Challenges for the MDSS program included issues related to the data tools, the pandemic and other natural disasters, and difficulty achieving concrete outcomes within the 15-month program. Regarding the latter, advocates' analyses, however compelling, did not often result in near-term concrete impacts on street design and policy within the program term. Advocates explained how infrastructure projects can be slow to manifest, even once they have approvals and funding. Add to that the pandemic, which shifted cities' priorities and pushed back project timelines, and a devastating tornado in Nashville that demolished part of the street that was a focus of Walk Bike Nashville's proposed project.

Shelter-in-place directives were in place during much of the program, precluding staff and volunteers from deploying the physical data collection tools and implementing the Gehl survey. Additionally, travel behavior data collected during this time would not be representative of typical conditions. As a result, however, advocates had more time than expected to engage with the software-based tools. Most awardees had to pivot from their original plans in some ways, though some found opportunities to use the data tools to measure pandemic-related changes in travel behavior.

Challenges with the data tools included usability and human resource issues, and the two were sometimes related. The learning curve for some of the tools (StreetLight in particular) was steep. Some awardees enlisted new staff or student interns with GIS expertise from local colleges, and some pursued additional (including in-person) tutorials beyond the onboarding that was provided. Another barrier to using cycling ridership data from the software tools was a lack of official data for calibration purposes, and awardees were limited in collecting their own counts since they were given only one bike-ped sensor (in addition to the pandemic-related data validity issue).

Awardees did not use all the provided tools. Gehl PSPL and Populus were particularly underutilized. A major reason advocates did not use Gehl PSPL was because it required more staff to implement data collection than they had available. Advocates were interested in Populus, but because they only had access to data from vehicles operated by Spin, and not the other shared micromobility operators in their respective cities, they felt it would provide an incomplete picture and thus findings might not be compelling.

Discussion

This research explored whether and how access to emerging mobility data tools can help AT advocates be more effective in their efforts to improve street safety. Consistent with prior suggestions (Nelson et al., 2021), the resources required to use the tools (i.e., skill level and time investment) created challenges for awardees, but nearly all were able to overcome the barriers with a modest amount of program support (i.e., tutorials for the tools and a support contact at each company). Advocates demonstrated a wide array of use cases for the tools and predominately used the emerging data tools (more than the physical data tools they were given). The pandemic and shelter-in-place directives contributed to this outcome because advocates had more time at their desks and computers to learn the software-based tools and they were unable to gather valid data with the physical tools for many of their planned projects since travel behavior was drastically altered.

This research identified four themes to describe how AT advocates can use emerging mobility data tools. Regarding the first two themes, access to data tools improved awardees' effectiveness in working with local government (to influence civil and traffic engineering projects or legislative efforts) and garnering community support (e.g., encouraging cycling and activism through informal and organized social events), which are central missions of AT advocates (Asad and Le Dantec, 2017). These findings are consistent with the concept of digitally supported advocacy, whereby computing technologies enhance existing advocacy strategies as opposed to transforming the nature of practices (Asad and Le Dantec, 2017).

Consistent with prior research (DiGioia et al., 2017; Nelson et al., 2021; Roy et al., 2019; Winters and Branion-Calles, 2017), awardees reported that their cities and states do not prioritize collecting AT data. Until institutional changes result in higher prioritization of AT within transportation planning, advocates empowered with mobility data can "speak the language" of city engineers and planners to help fill the gap; this shared language can positively change the dynamics between advocates and local government. In some cases, cities sought out the advocates and enlisted them to collect or supply data. This exemplifies the concept of digitally supported *enhanced* advocacy, when advocates take on a service provider role to fill gaps where public institutions lack capacity (Asad and Le Dantec, 2017).

Access to mobility data tools supported community engagement, education, and fundraising—the foundational elements of advocacy (Asad and Le Dantec, 2017). The data tools enabled advocates to investigate community concerns and to put individual experiences in a wider context, creating stories that could be both personal and reflective of wider trends (Asad and Le Dantec, 2017). The tools also facilitated a new form of community participation—engaging community members in data collection and analysis.

The other two themes, supporting underserved communities and advocating safer streets for all, may be historically less central or less universal (or at least more difficult to achieve) among AT advocacy missions (Ciociola et al., 2017). These are examples of data-driven advocacy, whereby access to data makes it possible to address issues and advance concerns to local officials, leading to new practices designed to influence social or political change (Asad and Le Dantec, 2017). Access to the data tools helped advocates represent and empower underserved communities by revealing high levels of AT and inadequate infrastructure in low-income and minority neighborhoods. They were able to assess and sometimes challenge local governments' assumptions, which helped strengthen decision-making and provide better outcomes for all stakeholders. Projects with this theme were particularly compelling, thus another paper delves deeper into the use of emerging data to advocate equitable safe streets (Sanguinetti and Alston-Stepnitz, 2023).

StreetLight was the most popular and most used tool despite having the steepest learning curve. Awardees pointed to the usefulness of its geographically broad-based, multimodal, quantitative, and historical data in supporting the four themes described above. Prior research suggests mobility data tools are more powerful in combination (Nelson et al., 2021), but employing multiples of the provided tools in a single project was rare. However, most advocates used more than one tool during the program across their different projects, consistent with the prior suggestion that multiple tools are desirable to meet different user requirements and goals (Asad and Le Dantec, 2017).

Limitations and future research

Limitations of the present research include the small sample size of active travel advocates and the chance that they are not necessarily representative of all such organizations in the United States and beyond. In fact, it is possible that the deficits awardees felt in terms of the human resources to get the most out of the data tools may be an even bigger hurdle for similar organizations that did not apply to the program. The suite of data tools provided, though diverse, also lacked the capacity to collect some types of emerging mobility data, such as data explicitly reflecting safety (e.g., crashes) and public attitudes (Nelson et al., 2021; Lee and Sener, 2020). Future research with more advocates that includes tools with different types of emerging data would help create a more complete account of the full potential for promoting safer streets by equipping advocates with data tools.

This research lacks methodological detail regarding how advocates used the data tools because evaluators' time with the awardees was limited and they were not provided with access to the data or tools. This limits the usefulness of the project descriptions as guidance for prospective data tool users. Further research should map the tools and data types they provide to more specific use cases, such as those articulated in Lee and Sener (2021) for Strava (e.g., travel pattern identification, travel demand estimation, route choice analysis, and infrastructure evaluation) and/or use cases based on targeted street design interventions to help guide future users with similar aims. There is also more to consider regarding usability and user experience with the specific tools.

This project did not estimate the monetary value of the data tools provided to the advocates. As previously mentioned, licenses for some emerging data software tools can be very expensive (Koupal et al., 2022; Nelson et al., 2021; Lee and Sener, 2020; it should be noted that Strava made their Metro platform free halfway into the MDSS program term). In this pilot program, the project sponsors bore the cost. As these were private companies, this could have presented a source of bias; however, this independent program evaluation study did not find that data analysis efforts or outcomes favored the project sponsors. Future similar efforts should attempt to estimate program value and explore best practices for funding mechanisms, e.g., government grant programs that could support active travel data collection efforts and eligibility for non-profit advocacy groups to have access.

The future of the MDSS Initiative

A recently completed subsequent round of the MDSS program involved awardees across five municipalities: Arlington County, Virginia; City of Omaha, Nebraska; City of Baltimore, Maryland; City of San Jose, California; and City of Seattle, Washington. This round offered only software platforms (no physical tools), including several repeats from MDSS 2020 (i.e., StreetLight Data, Urban Footprint, and Populus) as well as several new tools (i.e., Numina, Kurb.io, and Ford Safety Insights) with additional types of data. Unfortunately, two of these (Kurb and Safety Insights) were discontinued shortly after program launch, so awardees did not get a chance to use them. The rapidly changing market for these tools is an important consideration for future rounds and similar programs.

Several other changes were made for the second round based on lessons learned from the first year. Rather than providing all tools to all teams, awardees received access to two or three tools they specifically proposed to use. This was based on the findings that no team in the 2020 program used all the provided tools; in fact, there were some tools that were not used by any team. The idea for the 2021 program was that the applicants would be more likely to use all the provided tools if they had fewer and were able to choose the tools. Analyses of this round are ongoing, but it is safe to foreshadow that it was not always the case that applicants used all provided tools for several reasons: some tools were discontinued; for another tool, there were political issues and bureaucratic hurdles that made implementation difficult; and the teams did not always fully understand the capabilities of tools at the time of selection.

Based on the findings that most teams expressed a need for more technical assistance with tool use and data analysis and had difficulty achieving concrete impacts on street infrastructure or policy, Spin required 2021 program applicants to include partnerships involving universities and/or local government stakeholders for generally more robust analytical capabilities and to bring timely findings to bear on current policy-making agendas, respectively. Program applications were mainly led by universities with city and/or nonprofit advocate partners; no selected teams were led by advocacy organizations. This very different context promises to yield additional lessons learned and contribute to a richer understanding of best practices for different mobility data user groups. It will also be particularly interesting to see how local governments, as partners in these efforts instead of audiences to convince, will be able to leverage findings. Their involvement suggests investment in AT in contrast to the institutionalized autocentric approaches many advocates in the 2020 program confronted as a barrier.

Conclusion

Smartphones and shared mobility services offer a new wealth of mobility data that cities are only beginning to leverage to better understand pedestrian and micromobility use patterns and identify safety issues. As cities and mobility operators discuss how to use these emerging data, active travel advocates are likely to be left out of the conversation because they lack access. Moreover, applications to understand active travel patterns and needs may go underutilized in transportation planning departments' adoption and use of emerging data tools since mainstream planning practices prioritize auto traffic, including in investments in data.

These considerations inspired Spin, a shared micromobility company, to launch the Mobility Data for Safer Streets (MDSS) Initiative to put emerging data tools in the hands of advocates who are often a driving force for improving pedestrian and micromobility infrastructure. For the six participating active travel advocacy organizations in the inaugural round of the program, access to emerging data tools increased their effectiveness in working with local government, garnering community support, supporting underserved communities, and advocating safer streets for all road users by supporting existing advocacy strategies, which also led to enhanced and new practices.

The MDSS Initiative model—granting data resources to advocates—can be replicated in other mobility contexts and with other industries entirely. Particularly when progressive change can be difficult to achieve politically, this collaborative data-based model of influencing decision-making can invite new participants into the conversation and empower those participants with the technical resources to advance collective understanding. Data can empower advocates to tell a compelling story to busy decision-makers who are often inundated with information and perspectives.

Acknowledgements

This research was made possible by the important work of individuals who participated in the MDSS program. The researchers are grateful for their time and insights. The authors would also like to thank Cindy Ross for her vital project management support.

Funding Information

Funding for this research came from Spin and Ford Motor Company (Spin's parent company during the 2020 MDSS program).

Competing Interests

The authors have no competing interests to declare.

Author Contributions

The authors confirm they contributed to the paper in the following ways: study conception and design: A. Sanguinetti, A. Broaddus, E. Alston-Stepnitz, N. Dessouky; data collection: A. Sanguinetti, E. Alston-Stepnitz, N. Dessouky; data analysis: A. Sanguinetti, E. Alston-Stepnitz, N. Dessouky; interpretation of results: A. Sanguinetti, M. Ruhl, A. Broaddus; literature review: A. Sanguinetti, M. Ruhl, A. Broaddus. All authors reviewed the results and approved the final version of the manuscript.

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How to cite this article: Sanguinetti, A, Alston-Stepnitz, E, Ruhl, M, Dessouky, N and Broaddus, A. 2023. Equipping Active Travel Advocates with Digital Mobility Data and Tools: An Evaluation of a US Trial Program. *Active Travel Studies: An Interdisciplinary Journal*, 3(1): 7, 1–18. DOI: https://doi.org/10.16997/ats.1198

Submitted: 19 October 2021 **Accepted:** 14 November 2022 **Published:** 09 March 2023

Active Travel Studies: An Interdisciplinary Journal is a peer-reviewed open access journal published by University of Westminster Press.