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Authors

Powell, Eron
Ellis, Jeremy R
Marcheskie, Rachel L
et al.

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Trends in Public Interest Towards Car-Free Urbanism: A Decade of Google Trends Analysis (2013–2022)

Eron J. Powell,
The University of Utah, Salt Lake City, Utah, United States

Jeremy R. Ellis,
Johns Hopkins University School of Medicine, Baltimore, Maryland, United States

Rachel L. Marcheskie,
Johns Hopkins Bloomberg School of Public Health, Baltimore, Maryland,
Health and Government Operations Committee, The Maryland General Assembly,
Annapolis, Maryland, United States

Mckay Muhlestein
Department of City and Metropolitan Planning, The University of Utah, Salt Lake City, Utah,
United States

Abstract

Car-free urbanism is being adopted by a growing number of cities to enhance walkability, reduce pollution and combat climate change, and improve public health. One of the major challenges facing these initiatives is public sentiment and distrust. However, little research has been done to track public interest in this movement over time. Using Google Trends, this research report analyzed 20 search queries related to car-free urbanism and tracked their relative search volume between January 1, 2013, and December 31, 2022. The authors found a moderate rise in public interest in the United States for search terms that were highly specific to car-free urbanism. Among low-specificity search terms, no clear pattern was established.

Summary of practical implications

Urban designers should note the growing public interest in car-free urbanism, as revealed by Google Trends. Emphasizing walkability, 15-minute cities, and pedestrian-friendly areas aligns with increasing online searches. However, challenges persist and understanding evolving sentiments aids in effective communication and project implementation. This awareness may facilitate public support for initiatives combating pollution, enhancing health, and addressing climate change, fostering a positive impact on mental well-being in urban environments. The authors posit that Google Trends is useful as an indicator of widespread public interest.

Introduction

Numerous cities in the United States have adopted strategies to augment urban walkability as a cost-effective, long-term approach to mitigate pollution, improve citizen health, and address climate change (Baobeid et al., 2021; Chlond, 2012). This paradigm shift is exemplified by an increasing number of cities planning to become partially or entirely car-free, focusing prominently on the reduction of private car usage within city centers (Nieuwenhuijsen & Khreis, 2016). The car-free city movement is grounded in the recognition that reducing reliance on private automobiles contributes not only to environmental sustainability but also to public health and well-being. Urban planning initiatives emphasize the creation of walkable communities, higher population densities, and sustainable mobility options, such as public transport systems, to enhance both environmental and individual health outcomes (Baobeid et al., 2021). Furthermore, car-free cities are recognized for their potential benefits in reducing air pollution, noise, heat island effects, and fostering an increase in physical activity (Allam et al., 2022; Baobeid et al., 2021). However, a critical inquiry arises regarding the congruence of this urban planning evolution with public awareness and support for pedestrian-friendly solutions.

Google Trends is a service provided by Alphabet Inc, Mountain View, California, that analyzes the popularity of search queries across various regions and languages. It allows users to explore the relative frequency of specific search terms over time, providing insights into the changing interests and trends of online users. By visualizing the data, users can identify patterns, spikes, or declines in the search volume of topics. Google Trends is a valuable tool for marketers, researchers, and individuals seeking to understand the dynamics of public interest and track the popularity of specific keywords or topics (Cohen et al., 2021; Doepker et al., 2022; Han et al., 2024; Motosko et al., 2018; Ward et al., 2018). The platform offers features such as longitudinal data, geographic distributions, and related queries to enhance its utility for diverse purposes. The authors use Google Trends analysis, focusing on a specific set of keywords and phrases related to walkability and car-free urbanism. The objective of this report was to quantify and analyze the trajectory of public interest in these initiatives over the preceding decade.

Background

The modernist urban ideals that dominated the twentieth century focused on city planning and infrastructure which supported the suburban, car centric lifestyle archetypal of post-World War Two America (Garde, 2020). As early as the 1960s, critics of modernism questioned the sustainability of these practices. In a seminal 1961 book entitled The Death and Life of Great American Cities, Jane Jacobs criticized modernism for not respecting the needs of the average city dweller and argued that for neighborhoods to be fiscally sustainable, healthy, and robust a renewed emphasis should be placed on the pedestrian (Jacobs, 2002). This movement came to be known as new urbanism.

Academically, new urbanism has become associated with three broad urban design ideals: mixed use zoning, car-free infrastructure, and compact urban planning (Garde, 2020; Grant, 2015; Fuler, 2016). Mixed use zoning stands in contrast to the conventional single use zoning tradition and the benefits of such are readily apparent. Not only does mixed use zones reduce urban sprawl, it also reduces travel time increasing the ease by which city dwellers can move away from cars and towards public transportation, bicycling, or walk-only lifestyles (Coupland, 1996). Car-free infrastructure is a broad category that includes all ways cities can reduce their car dependence including pedestrian friendly infrastructure, bicycle infrastructure, and increasing public transit options (Khreis & Nieuwenhuijsen, 2016; Priyank Patel et al., 2016). Not only do such projects reduce car related emissions, but they have also been positively correlated with the physical and mental health of community members, increased interpersonal

trust, and reduced road maintenance costs (Glazener et al., 2022; Qi et al., 2024). Lastly, compact city planning involves increasing urban density and promoting smaller, more human focused street and building design (Dempsey, 2010). Such projects do not come without their downsides. Many studies into successful mixed-use zoning have also found problems including increasing residential noise, reducing affordability, and excluding low socioeconomic status families and individuals (Angotti & Hanhardt, 2001; DeLisle & Grissom, 2013; Moos et al., 2018).

The impact of a person's lived environment on their overall health, including mental wellbeing, is an area of extensive research. Car-free cities, characterized by walkable infrastructure, extensive green spaces, and reduced pollution, provide an idealized setting for improved health outcomes (Baobeid et al., 2021; Chlond, 2012). The absence of cars reduces air and noise pollution, which can both lower the incidence of respiratory issues and stress-related conditions (Buckeridge et al., 2002; Burr et al., 2004; Glazener et al., 2022).Walkable environments encourage physical activity, reducing the risk of obesity, cardiovascular diseases, and other lifestyle-implicated conditions (India-Aldana et al., 2023; Lang et al., 2022; Paulo dos Anjos Souza Barbosa et al., 2019; Slater et al., 2013). Improvements in overall safety are another benefit, as reduced traffic lowers the risk of accidents, making transit routes safer for pedestrians and cyclists. Further, the land previously reserved for vehicle infrastructure can be transformed into green spaces offering residents places to exercise, relax, and engage in social activities (Croeser et al., 2022; Xia et al., 2021). Explicit in the car-free city design is the facilitation of more face-to-face interactions among residents, which strengthens community bonds, and leads to more robust support networks (Peters et al., 2010; Qi et al., 2024). These elements collectively create a healthier, more connected, and safer urban environment.

New urbanist pedagogy has struggled to establish in colleges and universities (Arefi & Triantafillou, 2005; Kelbaugh, 2000; Salama, 2021). Likewise, progress on implementing these ideals in practical settings has been slow in part due to public distrust (Weitz, 2008). Many car-free projects face opposition because city councils and their constituents are fearful of longer transport time (Ewing & Cervero, 2010), less ease of access to businesses (Alam et al., 2015; Ewing & Cervero, 2010), and attachments to their motor vehicles (Rasca & Saeed, 2022). Interestingly, many people are aware of the effects of driving a car on pollution and CO2 emissions but are unlikely to feel capable of making the switch away from cars (Gundlach et al., 2018; EPIC, 2023).

As an ever-increasing number of cities are implementing car limiting or car-free projects (Nieuwenhuijsen & Khreis, 2016) it is reasonable to assume that public interest in these ideals will increase. To date however, there has been limited research into this area. Attitudes towards car free cities remain largely hostile, especially in America (Altman, 2014). Furthermore, there have been very few comprehensive studies dealing with the United States public interest in the car free movement over time. With this in mind, we wanted to explore if Google search trends showed a rise in interest in the car-free movement in America over the last ten years.

Methods

Google Trends examines the popularity of search terms within a designated time and location, offering insights into public interest. The quantification of search-term use over time is expressed through relative search volume (RSV), a normalized metric ranging from 0 to 100. An RSV of 100 represents the peak of a search term's popularity within a specified location and date range. The authors used the Google Trends to search 9 search terms which were determined to have high specificity for the car free movement: (walkable city + walkable

neighborhoods), (15 minute city + 15 min city), (pedestrian city + pedestrian friendly + pedestrian friendly city), new urbanism, car free movement, car free city, zero-emission city, "smart cities with no cars", and "urban mobility without cars". Additionally, the authors included 11 search-terms which had low specificity to this movement: car dependency, walkability, (bicycle friendly city + bicycle friendly), green urbanism, “traditional neighborhood”, streetcar suburb, "culture of permanence", "living streets", "green urban design", "car-free living”, and “eco-friendly urban development". Search term selections were reviewed by an expert in urban planning (M.M.), as well as an expert in public health (R.L.M.). They gathered the monthly Relative Search Volumes (RSVs) for these search terms from January 1, 2013, to December 31, 2022, along with subregional geographic data of each monthly RSV.

Google Search Protocol for Institutional Website Prevalence

For a more robust picture of increasing interest in urban transformation, we included a quantitative analysis of websites related to car free cities restricted to .gov, .org, or .edu top level domains using google search. Three queries were conducted using the following search terms determined by M.M. and R.L.M. filtered between the dates of January 2013 and December 2022. Searches were performed via “Incognito” mode which blocked location tracking, browsing data, and cleared cookies. The query was entered into the search bar, advanced tools were selected, and a custom date range was chosen. The total number of results was recorded. Note that because this analysis included a smaller group of pooled websites, as well as being specific for government, organizations, and educational websites, we utilized additional terms not used in the initial analysis that M.M. described as being more professional/technical oriented terms. Query search terms were pooled together based on a subjective analysis of shared categorization. Query 1 included the search terms derived from the high specificity terms above (High Specificity Terms). Query 2 was more technical/professional oriented (Technical Terms). Query 3 was derived from low specificity terms above (Low Specificity Terms). Some search terms were repeated in different queries.

High Specificity Terms:
("Walkable cities" OR "Walkable neighborhoods" OR "15-minute city" OR "15 min city" OR "Pedestrian city" OR "Pedestrian friendly city" OR "Pedestrian friendly" OR "New urbanism") (site: .us OR site:.gov OR site:.org OR site:.edu)

Technical Terms:
("Urban Density" OR "Placemaking" OR "Missing Middle Housing" OR "Transit-oriented development" OR "Mixed-use development”) (site: .us OR site:.gov OR site:.org OR site:.edu.)

Low Specificity Terms:
("Walkability" OR "Bicycle friendly city" OR "Bicycle friendly" OR "Green Urbanism" OR "Car dependency”) (site: .us OR site:.gov OR site:.org OR site: .edu.)

After the queries were completed, the results were organized by year in Table 1.

Data analysis

Google trends search-term queries were filtered between dates of 1/1/2013 to 12/31/2022, all categories were used, and searches were specific to the United States. Monthly RSVs for each keyword were averaged to get an average yearly RSV between the years of 2013 and 2020. Between 2020 and 2022, monthly RSVs were averaged to get four consecutive 6-month averages. To evaluate change in search-term use over time, RSVs were plotted and fitted

through a simple linear regression model. An F-test was undertaken to assess whether the slope of the best fit was significantly non-zero. Statistically significant search-term use increases were determined to be the ones in which the RSVs throughout the ten-year period had a positive linear line of best fit in which the slope was significantly non-zero.

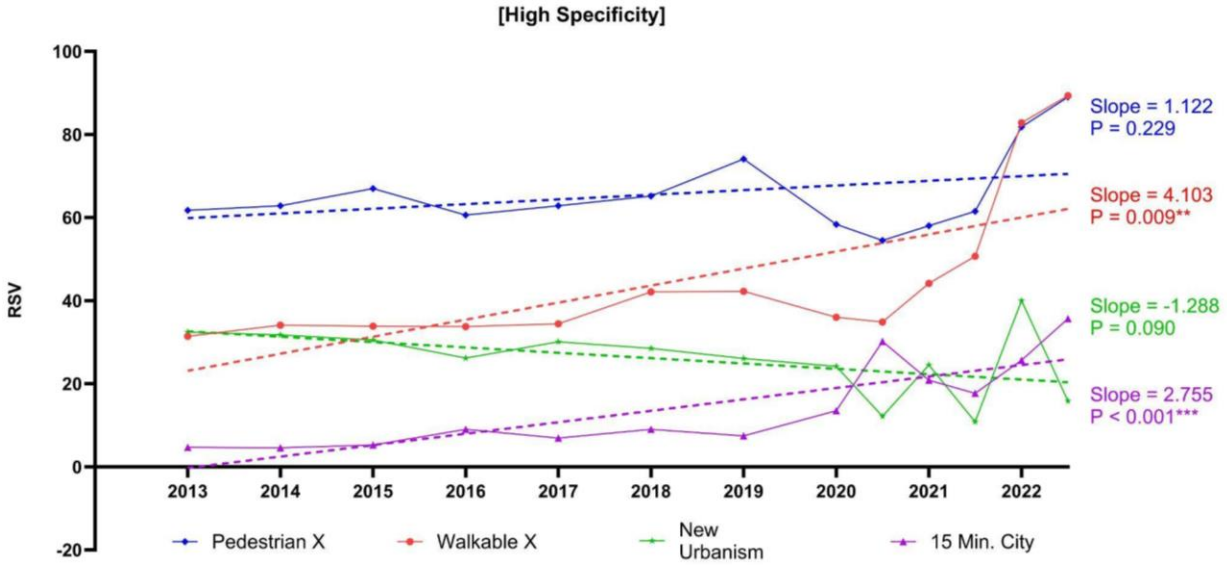
Results

High specificity search terms

The findings reveal notable trends in the popularity of urban mobility-related search terms. The search term "Walkable X" (cities and neighborhoods) demonstrated the greatest annual increase in Relative Search Volume (RSV) of 4.103. This upward trajectory, particularly evident post-2020, is characterized by an RSV surge from approximately 29.8 to 89.5. In tandem, the search term "15-minute city" exhibited an annual increase of 2.755 RSV, with a discernible upward trend over the past three years. Conversely, the search term "Pedestrian X" (city and friendly city) demonstrated a nominal annual increase of 1.122 RSV, lacking statistical significance. Oscillations in this search term ranged from a minimum of 54.5 in the latter half of 2020 to a maximum of 89.0 in 2022. The elevated RSV across all three search terms implies a growing interest in aspects congruent with the objectives of the car-free movement over the previous decade, as discussed later. On the note, the search term "new urbanism" exhibited a negative slope, decreasing by 1.288 RSV annually. However, a marginal resurgence has been observed since 2020, mirroring the trends of the other high specificity search terms (Figure 1).

Figure 1

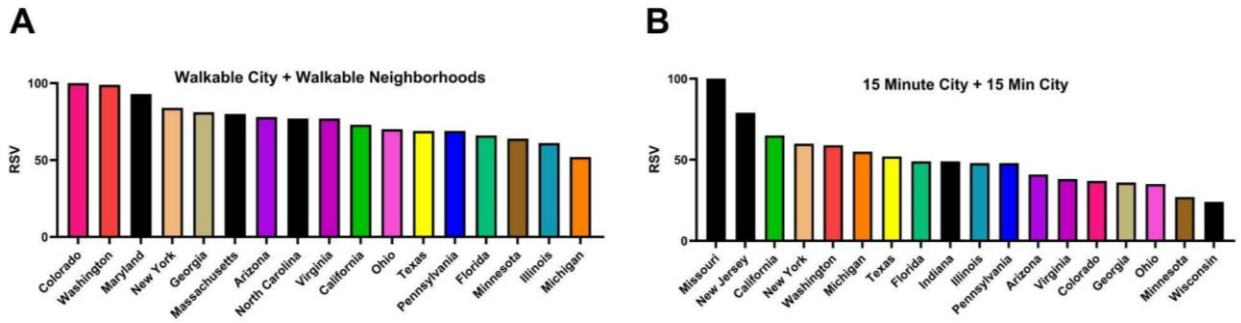
*Relative search volumes for terms highly specific to the Car-Free movement from January 2013 to December 2022. (Pedestrian X refers to the search term "pedestrian city + pedestrian friendly city + pedestrian friendly", Walkable X refers to the search term "walkable city + walkable neighborhoods", 15 Min. City refers to the search term "15-minute city + 15 min city"). Dashed line represents the line of best fit using simple linear regression models (** P < 0.01, *** P < 0.001).*



The two search terms which showed the most marked increase were "Walkable X" (cities and neighborhoods) and "15-minute city" (Figure 1). The top three states pertaining to the highest RSVs for these terms were Colorado, Washington, Maryland (Figure 2A**)** and Missouri, New Jersey, and California (Figure 2B**)**, respectively. The authors also observed significant overlap in

the states that most frequently searched for these two terms, with 14 out of the 18 represented states exhibiting considerable relative search volume (RSV) for both terms (Figure 2 A&B). It is important to note that states not included in this analysis lacked sufficient search volume, as Google Trends only displays data for popular terms; search terms with low volume appear as "0".

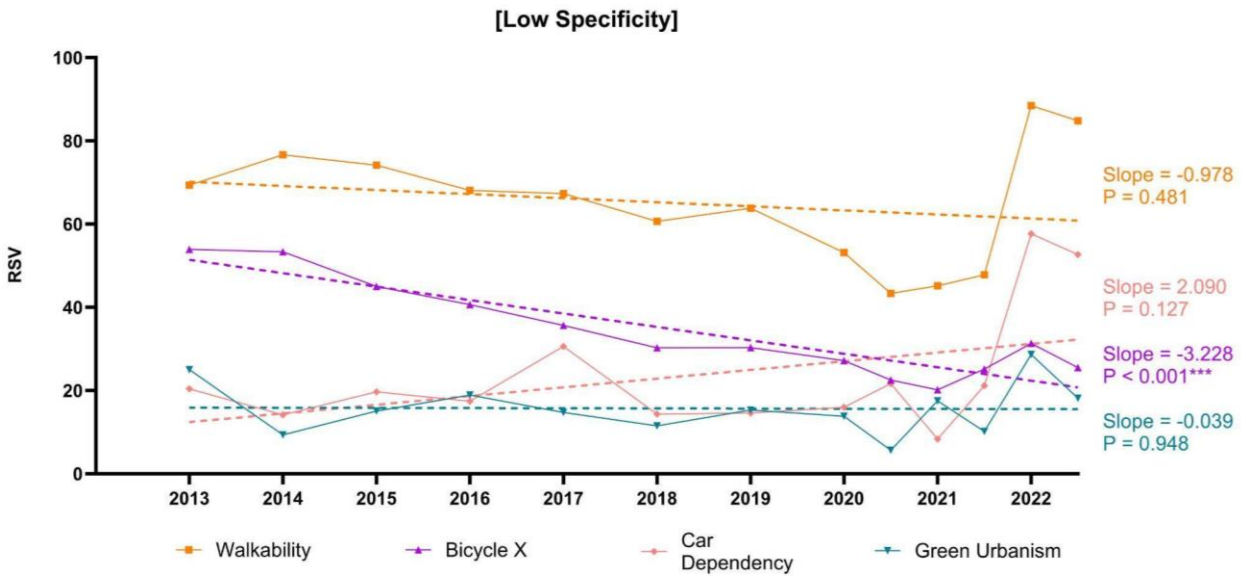
Figure 2
*Relative search volume of the terms "walkable city + walkable neighborhoods" (**A**), and "15-minute city + 15 min city" (**B**) between January 2013 to December 2022 among U.S. states. Black bars represent states that are unique to either search term. Other states which are not included have insufficient search data. Colors correspond to states which overlap in relation to the two search terms.*



Low specificity search terms

Low specificity search terms did not show a clear pattern between the various phrases. The RSV of walkability decreased over the last ten years with an annual decline of -0.978 RSV (not statistically significant.) The greatest annual decline occurred with the "bicycle X" (friendly city, friendly) category which decreased by -3.228 RSV annually over the ten-year period which was statistically significant ($P < 0.001$). "Green urbanism" likewise showed a negligible decrease of -0.039 RSV annually. Only "car dependency" showed an increase in trend for RSV over the last decade going from 20.4 RSV in 2014 to 52.6 RSV by 2022. This corresponds to a non-significant 2.090 overall annual RSV increase (see Figure 3).

Figure 3
*Relative search volumes for terms that have low specificity to the Car-Free movement from January 2013 to December 2022. (Bicycle X refers to bicycle friendly city, bicycle friendly) Dashed line represents the line of best fit using simple linear regression models (*** $P < 0.001$).*



Longitudinal analysis of .org, .edu, and .gov search results

Table 1 includes the results for the quantitative analysis of three google search queries specific to .gov, .org, and .edu websites. For all three queries, there was a definite and consistent year-on-year increase in the number of searches for terms in each query. Noticeably, “Technical Terms” contained the highest volume of websites throughout the span of the search. Although no statistical analysis was conducted, it is marginally apparent that websites corresponding to “Technical Terms” had the largest increase in searches with a 7.00-fold increase, compared to 4.55 for “High Specificity Terms” and 5.59 for “Low Specificity Terms”.

Table 1

Prevalence of Institutional Websites (.org, .edu, .gov) in Search Results for Car-Free City-Related Queries (2013-2022)

Search Query	Jan 2013 - Dec 2013	Jan 2014 - Dec 2014	Jan 2015 - Dec 2015	Jan 2016 - Dec 2016	Jan 2017 - Dec 2017	Jan 2018 - Dec 2018	Jan 2019 - Dec 2019	Jan 2020 - Dec 2020	Jan 2021 - Dec 2021	Jan 2022 - Dec 2022
High Specificity Terms	1,990	2,720	3,100	3,740	3,970	5,010	6,490	7,930	7,780	9,050
Technical Terms	4,160	5,550	7,530	9,840	11,200	13,700	17,300	20,900	21,500	29,100
Low Specificity Terms	2,110	2,610	3,460	4,250	4,740	6,190	8,670	15,600	11,700	12,500

Data limitations

The search terms employed in this study may not encompass all potential terms associated with the car-free movement. Notably, the terms car free movement, car free city, zero-emission city, "Smart cities with no cars", "Urban mobility without cars", “traditional neighborhood”, streetcar

suburb, "culture of permanence", "living streets", "Green urban design", "Car-free living", and "Eco-friendly urban development" lack sufficient search data. Additionally, it is important to note that Google Trends provides data in terms of relative search volume rather than absolute search volume. Search queries might have been used by individuals disinterested or uninformed about the car-free movement. The authors implemented measures to discern regions where this bias could be particularly pronounced, classifying terms into high and low specificity. Nonetheless, there is no assurance that every search using even our highly specific phrases originated from individuals interested in the car-free movement.

While google search trends have been widely used to correlate public interest in search topics, they are necessarily limited to a specific group of google users (Mavragani et al., 2018; Nuti et al., 2014; Rovetta, 2021). This may not be wholly indicative of public backing for car-free cities. It is important to note that the increasing number of search results over time may, in part, be influenced by the overall expansion of the internet, including the growth of digital content, organizational websites, and web indexing capabilities. As more institutions publish online and search engines refine their algorithms, the absolute number of search results for any given query may increase independently of actual shifts in public discourse or policy engagement. This potential bias should be considered when interpreting trends in search result prevalence. Future studies could perform a more focused analysis of how these search trends compare to other publicly available sources of discussion like news coverage, social media conversations, and city council meetings.

Discussion and Conclusion

Urban planning faces a critical challenge in garnering public support for car-free initiatives. Despite the evident advantages of walkable cities, legislative efforts to curb car use and promote public transportation encounter resistance from concerned voters reluctant to relinquish personal freedoms associated with cars (Altman, 2014; Allam et al., 2022; Ewing & Cervero, 2010; Liu & Liddawi, n.d.; Weitz, 2008). This study explores a potential shift in public sentiment by examining Google search trends related to car-free movement over the past decade. The findings reveal a noteworthy increase in searches for key phrases associated with urban walkability. Specifically, Google searches for "walkable city" and "walkable neighborhoods," along with queries related to "15-minute cities," which demonstrated a statistically significant upward trend. Likewise, the total number of websites with the .gov, .org, and .edu top level domains related to car-free urbanism showed a marked increase over the years 2013 to 2022. These results suggest a growing interest and awareness among the public regarding the principles of car-free urban planning, which is seemingly mirrored by governmental and educational institutions.

High specificity phrases saw an overall increase in the last ten years, suggesting that public awareness of car-free movement ideals has increased. Interestingly, “new urbanism”, a term which encompasses many of these ideals, has seen decreasing search traffic in the last decade. A possible explanation is “new urbanism” may be moving towards academia and away from colloquial usage. Consequently, it may not be as popular in areas such as YouTube videos or newspaper articles which are outside strictly academic settings. While more research is needed, this could account for the diverging trend between “new urbanism” and the other high specificity phrases.

Low specificity search terms followed fewer clear patterns when compared to their high specificity counterparts. “Bicycle X” (bicycle friendly city + bicycle friendly), “green urbanism”

and “walkability” showed a decrease in searches over the last decade, although the latter two had no statistical significance. This may be due to the broad nature of the phrases. Only “car dependency” saw a non-significant increase in searches over the last ten years. It remains unclear what can be deduced from either of these trends, but less specific phrases exhibited weaker movement in either direction, accompanied by some randomness in their distribution.

It is worth noting that five of the eight search terms showed a marked increase from 2020 through 2022. While the exact origins of this rise are unclear, it does match the timing of the Covid-19 pandemic. During this time many people limited their commuting and changed their transportation habits (Gupta et al., 2023; Kim et al., 2021; O’Garra & Fouquet, 2022). Further research could explore a possible correlation between these events and the rise in popularity of these search terms.

As societal awareness regarding car-free infrastructure concepts advances, urban planners may encounter diminished opposition during the execution of such initiatives. Public awareness has a dual potential impact. Firstly, individuals who were previously resistant to these proposals may alleviate their opposition. Secondly, heightened political activism advocating for car-free urban planning may emerge, exerting influence on municipal bodies to either endorse novel plans or uphold pre-existing proposals.

This study reveals a moderate rise in public attention directed towards specific phrases associated with the car-free movement. With a growing recognition of the adverse impacts of automobile-centric urban environments on public health, pollution, and climate change (Baobeid et al., 2021; Chlond, 2012; Nieuwenhuijsen & Khreis, 2016), the authors anticipate that municipal councils and urban planners will experience more freedom to advance the development of pedestrian-friendly, car-free infrastructure.

Eron J. Powell <eron@sciencewithsandy.com>, The University of Utah, Salt Lake City, Utah,

Jeremy R. Ellis <jellis44@jh.edu>, Johns Hopkins University School of Medicine, Baltimore, Maryland,

Rachel L. Marcheskie <rmarche5@jh.edu>, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD, USA, Health and Government Operations Committee, The Maryland General Assembly, Annapolis, Maryland,

Mckay Muhlestein <mckaymuhlestein1@gmail.com>, Department of City and Metropolitan Planning, The University of Utah, Salt Lake City, Utah, USA.

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