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BETWEEN SILENCE AND SPIKES: AN INFODEMIOLOGIC STUDY OF PUBLIC AWARENESS OF STEALTHING

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Abstract: *This study uses infodemiology methods to examine public engagement with stealthing, or non-consensual condom removal, through Google Trends data spanning 2020 to 2025, especially whether public search interest corresponded with legislative developments and how terminology may influence awareness. National and state-level search patterns were analyzed using relative search volume (RSV) data for the terms: "stealthing," "condom removal," and "non-consensual condom removal." Findings reveal that search activity was episodic and closely aligned with policy events, particularly in California and Washington, while other states showed little or no relation between legislation and public search patterns. Regional differences emerged, with some subregions demonstrating RSVs three standard deviations above the national average, while others showed little to no engagement. Furthermore, the analysis highlights a disconnect between colloquial and formal terminology where the term "stealthing" consistently generated search interests while the more descriptive legal phrase yielded minimal results. These findings underscore the importance of aligning legal and public health communication with accessible language to improve population-level awareness and engagement. Infodemiology offers a valuable tool for monitoring public understanding of emerging sexual health issues and informing more responsive policy communication strategies.*

Keywords: *Sexual health, consent, condom removal, communication, health literacy, policy awareness, digital epidemiology.*

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INTRODUCTION

Infodemiology, defined as the science of distribution and determinants of information in an electronic medium with the aim of informing public health and policy (1), has become a valuable tool for understanding public engagement with emerging issues. Commonly applied to infectious disease information surveillance, infodemiology now serves broader functions, offering insight into collective attention, risk perception, and the public salience of emergent health topics. As individuals increasingly turn to search engines for health-related information, the patterns left behind offer a digital footprint of public awareness (2,3). This methodological shift holds particular promise for under-recognized or contested health issues, such as non-consensual condom removal, colloquially known as "stealthing."

Stealthing is defined as the removal of a condom before or during sexual intercourse without the partner's consent (4). Despite recent recognition of this act as a form of sexual violation, many are unable to articulate or recognize such an experience as violations due to the lack of knowledge or awareness of the terminology (5,6), as well as limited legal recognition (4). In recent years, four U.S. states (California, Vermont, Maine, and Washington) have passed or amended their existing laws to recognizing stealthing as a civil offense, and federal legislation has also been introduced as well (7). As such, this growing body of literature and legislative actions can putatively bring to light this new form of sexual violation, in turn gaining public attention and further survivor-support advocacy. However, to understand the future of stealthing-related research and legislative action, understanding the public's perception is key.

This study uses infodemiology to examine how the public has engaged with stealthing-related terms over time through Google Trends™ data, both nationally and within the four states that enacted stealthing legislation. In doing so, it contributes to a growing body of scholarship examining how legal and public health systems can better align to foster improved population engagement with emergent health issues.

METHODS

Data tool and collection

This study used Google Trends™ to examine public interest in non-consensual condom removal, known as "stealthing," within the United States over time. Google Trends™ is a publicly accessible tool that captures the relative frequency of search terms entered into the search engine. The platform reports search interest as a Relative Search Volume (RSV) on a scale from 0 to 100, where 100 indicates the peak popularity of a search term within the specified time and location. A value of 0 denotes that the term was not searched enough to generate data for that time-period. Such a tool has been increasingly used in population health research to assess public awareness of emerging health issues and behavioral trends.

To capture public engagement with stealthing, three commonly related search terms were analyzed: "stealthing," "condom removal," and "non-consensual condom removal." Each term was entered into Google Trends™ to assess how often they were searched over time and whether they followed similar or distinct trajectories. The inclusion of both colloquial and legally descriptive phrases was intentional, allowing for an examination of how terminology may influence public recognition and engagement with this form of sexual boundary violation. Further, for each primary search term (e.g., stealthing, condom removal), Google Trends™ related queries feature was reviewed, when data was available, to identify additional terms the public frequently uses.

The Google Trends™ tool was set to display data from the five years preceding July 26, 2025. This period includes the passage of California's stealthing law in 2021, the first in the United States, and subsequent legislation passed in states such as Vermont, Maine, and Washington. Searches were limited to the United States, and the category filter was set to "all categories" with the search type limited to "web search" in order to reflect general public interest rather than interest tied to a particular domain such as news or YouTube.

While national-level analysis was intended to provide a foundational understanding of how and when the public searches for information on stealthing, it also served as a baseline for subsequent comparative analyses at the state level to assess whether public interest corresponds to legislative activity within specific jurisdictions. As such, individual datasets were collected for each of the four U.S. states that have enacted legislation related to non-consensual condom removal: California, Vermont, Maine, and Washington. For each state, separate searches were conducted using the Google Trends™ tool for the terms "stealthing," "condom removal," and "non-consensual condom removal." The geographic filter was set to the specific state, while the time frame and search category remained set to "all categories" and limited to "web search" for consistency with the national data.

Data analysis

For each term that resulted in search outcomes, the data were downloaded in CSV format. These files provided month-by-month RSV values across the specified time frame. The data were then reviewed to identify patterns of interest, including peaks and valleys in search activity. Special attention was paid to whether search interest increased following relevant policy events or media coverage, such as the passage of state-level laws involving stealthing.

Next, subregions were grouped into clusters based on natural breaks in RSV values. Cluster-level mean RSVs were then compared to the overall national RSV mean and standard deviation to assess whether each cluster demonstrated lower, higher, or average levels of public search interest. Wyoming, whose RSV was not reported, was not included in statistical analysis. This approach allowed for a more interpretable understanding of regional search behavior, offering both contextual and statistical insight into the observed variation across subregions. For the state-level analysis, five-year search trends for each of the three terms were reviewed individually within California, Vermont, Maine, and Washington. Next, using the custom filter, 12-month search trends were evaluated during the time of active legislative action for each of the four states.

Graphs were created to visualize RSV over time, with particular attention to the months leading up to and following the passage of stealthing-related legislation in each state. This allowed for an examination of whether search interest shifted in proximity to legal developments. By comparing patterns across these jurisdictions, the analysis aimed to identify potential differences in public engagement that may be associated with regional legislative efforts. The state-level trends were also reviewed for any similarities or divergences from the national pattern, providing additional context for interpreting the relation between public awareness and policy action.

This study adheres to the ethical principles of infodemiology research. Because Google Trends™ data are aggregated and anonymized, this research does not involve identifiable private information and was conducted in accordance with institutional guidelines for secondary data analysis.

RESULTS

As shown in Figure 1, relative search volume (RSV) for the term “stealthing” in the United States over the five-year period from July 26, 2020, to July 26, 2025, exhibited a generally low but variable pattern. While search interest remained consistently low throughout most of the timeframe, a modest spike was observed in late 2021. After this peak, interest declined and remained relatively flat, with only minor fluctuations through mid-2025.

Figure 1: Relative Search Volume (RSV) for “stealthing” in the U.S. (2020–2025)

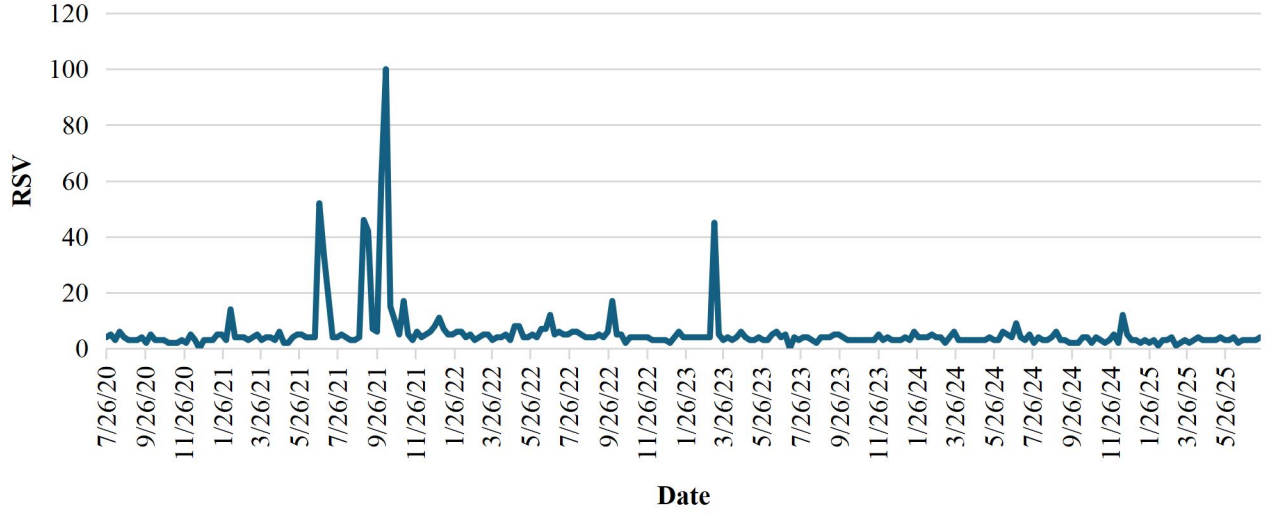


Table 1 displays U.S. subregions grouped by natural breakpoints in RSV for the term "stealthing" during the five-year period from July 2020 to July 2025. Subregions with RSV values between 30.00 and 39.99 were the most numerous, including Mississippi, Oklahoma, and Kansas. As RSV values increased, the number of subregions in each category generally declined. Only one subregion, the District of Columbia, was categorized in the highest tier (RSV = 90-100). Other subregions with relatively high search interest included Rhode Island and Washington (RSV = 80-89.99) and Oregon and Alaska (RSV = 70-79.99). In contrast, southern and midwestern states such as Mississippi, North Dakota, and Oklahoma were grouped in the lower tiers (RSV = 30-39.99), indicating comparatively limited search activity. No subregions with reportable RSV fell below 30; Wyoming was not reported due to insufficient search volume.

Table 1. Subregions grouped by natural RSV breakpoints (2020-2025)

30–39.99 RSV	**40–49.99 RSV**	**50–59.99 RSV**	**60–69.99 RSV**	**70–79.99 RSV**	**80–89.99 RSV**	**90–100 RSV**
Mississippi	Georgia	Maine	Vermont	Washington	Rhode Island	District of Columbia
Oklahoma	New Jersey	Louisiana	Delaware	Oregon		
Kansas	Minnesota	Colorado	Nevada	Alaska		
North Dakota	Idaho	Massachusetts	Maryland	California		
	Florida	Hawaii	South Dakota			
	New Mexico	Nebraska				
	Tennessee	Arizona				
	Texas	New Hampshire				
	Ohio	Utah				
	Montana	Wisconsin				
	Arkansas	Illinois				
	Indiana	New York				
	North Carolina	Michigan				
	Alabama	Virginia				
	Iowa	Connecticut				
	South Carolina	West Virginia				
		Missouri				
		Kentucky				
		Pennsylvania				

The national mean RSV across all subregions was approximately 49.4, with a standard deviation of 13.31. Table 2 presents summary statistics for U.S. subregions grouped by RSV clusters for the term "stealthing" from July 2020 to July 2025. For each group, the table reports representative example states, the difference from the national mean, and the number of standard deviations above or below the national mean.

Subregions in the 30-39.99 RSV cluster demonstrated the lowest relative interest, with RSV values more than one standard deviation below the national average. Subregions in the 40-49.99 and 50-59.99 clusters were within one standard deviation of the national average. The 60-69.99 and 70–79.99 clusters fell slightly above one standard deviation and above the national mean. The 80-89.99 and 90-100 clusters showed the greatest difference the national mean and were over two and three standard deviations higher, respectively.

Table 2. Comparison of RSV Clusters to National Mean and Standard Deviation (SD) for "Stealthing" Searches (2020–2025)				
RSV cluster	Example states	SD from national mean	Difference from national mean	Relative to national mean
30–39.99	Oklahoma, North Dakota, Kansas	-1.08	-14.4	Lower than national
40–49.99	Minnesota, Georgia, Ohio	-0.33	-4.4	Similar to national
50–59.99	Nebraska, West Virginia, Missouri	0.42	5.6	Similar to national
60–69.99	Delaware, Maryland, Nevada	1.17	15.6	Higher than national
70–79.99	California, Alaska, Washington	1.92	25.6	Higher than national
80–89.99	Rhode Island	2.67	35.6	Higher than national
90–100	District of Columbia	3.43	45.6	Higher than national

Google Trends™ suggested top query of "stealthing meaning," and it was used in addition to "condom removal" for further analysis in the same query. "Non-consensual condom removal" did not yield RSV for comparison and thus omitted from further reporting. As shown in Figure 2, Although the terms "stealthing meaning" and "condom removal" each exhibited low overall search volume during the study time-period, a consistent pattern in timing emerged. The term "stealthing meaning" had a national average RSV of approximately 0.42, with a peak value of 23. Similarly, "condom removal" showed an even lower average RSV of 0.08, with a maximum value of 6. Despite these low absolute values, both terms experienced increases in RSV during overlapping time periods. For instance, parallel upticks were observed in September 2021, March 2023, and again in June to July 2024.

Figure 2: Relative Search Volume (RSV) for "stealthing meaning" and "condom removal" in the U.S. (2020–2025)

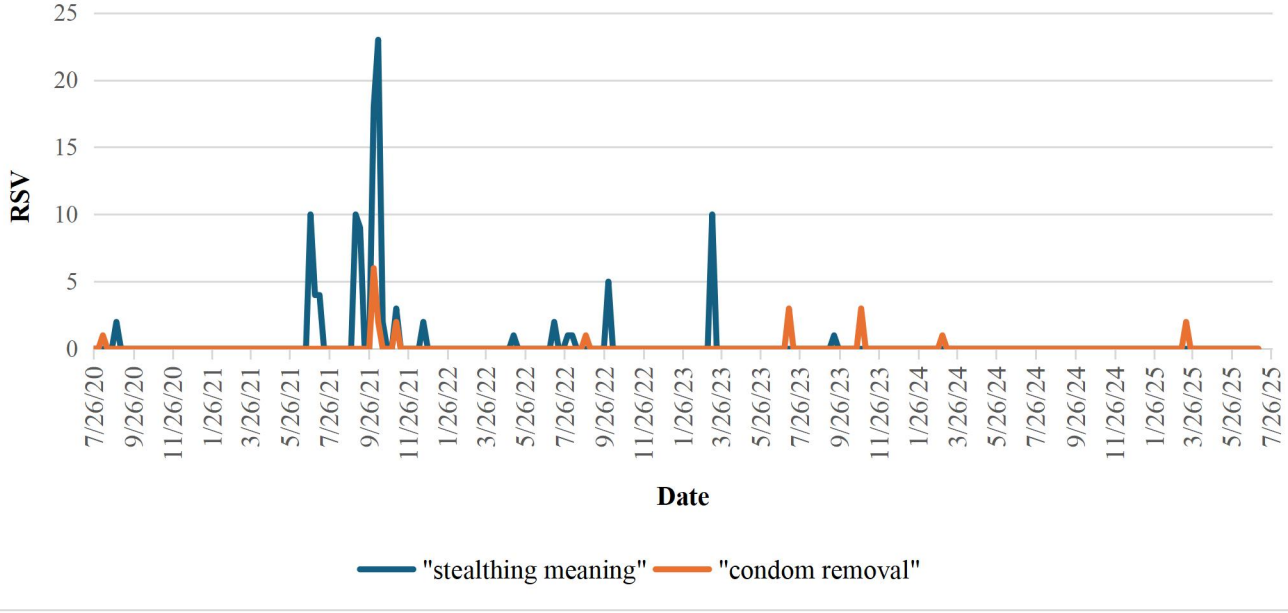


Figure 3 displays the California-specific RSV for the term "stealthing" between study's five-year time-period of analysis. Results show fluctuations, with several key observable peaks. The first occurred in February 2021, followed by highest spikes in search interest between September and early October 2021. Outside of these peaks, RSV values remained low and relatively stable throughout the rest of the period.

Figure 3: Relative Search Volume (RSV) for "Stealthing" in California (2020–2025)

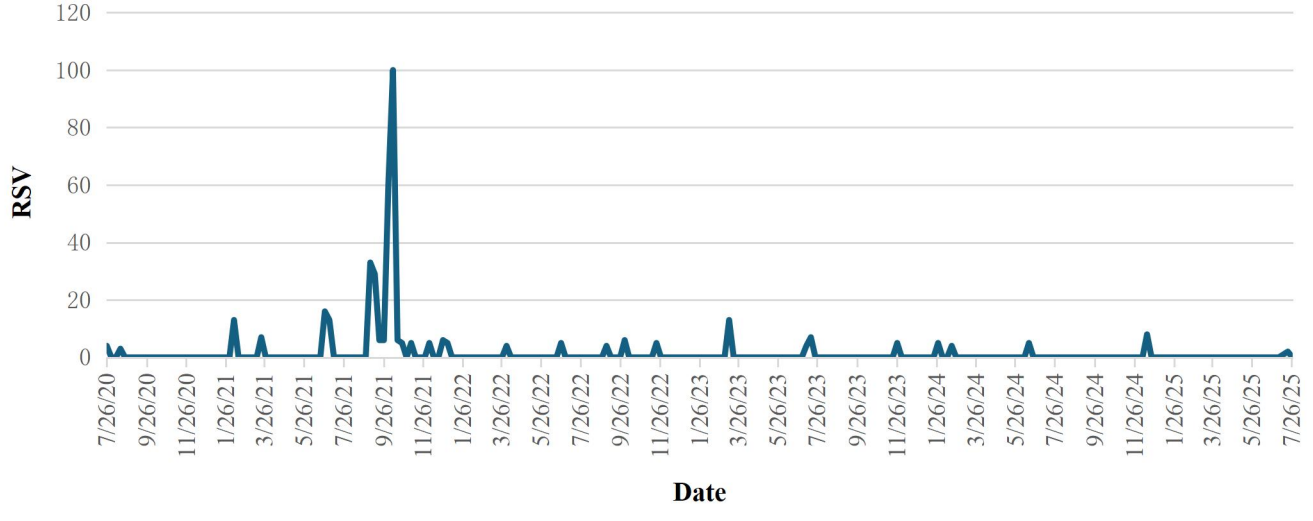
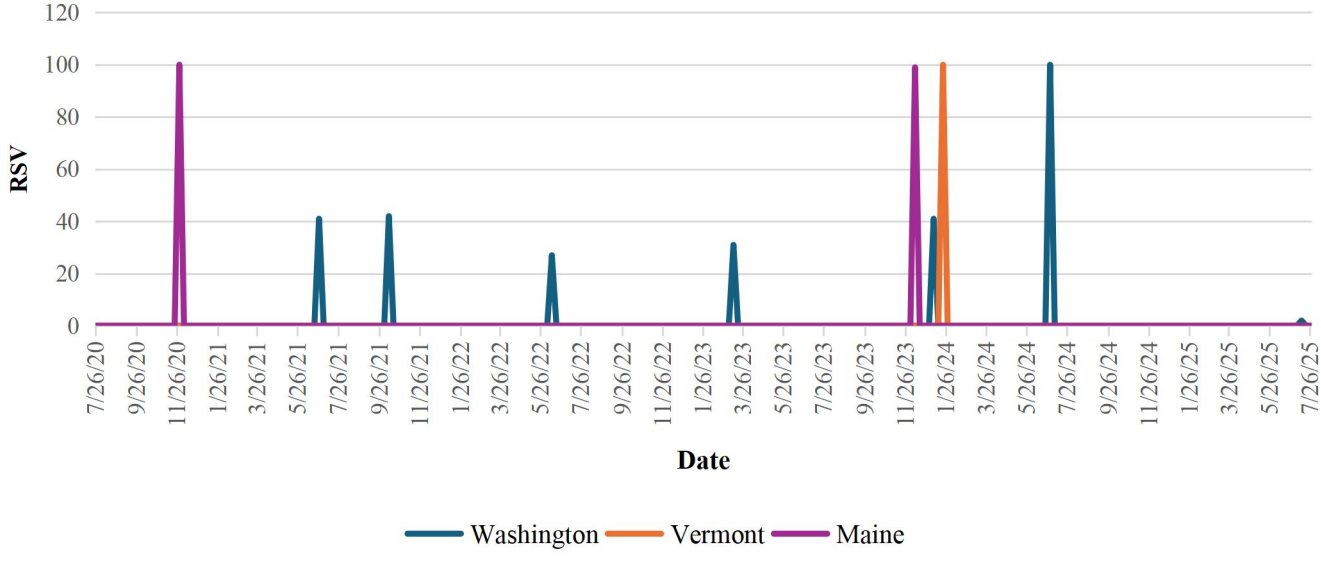


Figure 4 compares the rest of the three remaining states (Maine, Vermont, and Washington) that passed stealthing related laws after California. During the five-year period, the first notable peak in RSV for the term "stealthing" in Washington occurred late June 2021, with an RSV of 41. A subsequent increase was observed early October, 2021 (RSV = 42). Additional peaks followed during early June, 2022 (RSV = 27), early March, 2023 (RSV = 31) and early January, 2024 (RSV = 41). The highest level of search interest occurred most recently, during the end of June, 2024, when RSV reached the maximum value of 100. These periods represent the five most elevated time periods of search activity for the "stealthing" term in Washington.

In Vermont, the highest and first peak in RSV for the term "stealthing" in Vermont occurred towards mid-to-late January, 2021, with an RSV of 100. Aside from this peak, search activity remained minimal across the timeframe, with all other recorded times showing RSV values of 0. Finally, in Maine the highest and first RSV was recorded during late November, 2020, with a value of 100. A secondary peak followed in early December, 2023, with an RSV of 99. The rest of the timeframe demonstrated minimal or no search interest, apart from these two time points.

Figure 4: Relative Search Volume (RSV) for "Stealthing" in states of Washington, Vermont, and Maine in the U.S. (2020–2025)



DISCUSSION

This infodemiology study leveraged Google Trends™ to examine patterns in public search interest related to non-consensual condom removal, commonly referred to as "stealthing," across the United States and in four states that enacted legislation on the issue. Google Trends™ has increasingly been used in population health research to assess real-time trends (8–10). For instance, Brodeur and colleagues used such a tool to track mental health-related searches during COVID-19 lockdowns, highlighting its potential in understanding collective responses to social disruptions (11).

The present study focused on addressing public interest in stealthing (non-consensual condom removal), as measured by relative search volume (RSV), in the United States over a span of five years. Our cumulative results highlight that public interest remains episodic and often event-driven, often closely tied to legislative activities. For example, the most prominent national spike in interest occurred in late 2021, corresponding with California's introduction and passage of the nation's first law explicitly addressing stealthing (12). This clustered pattern suggests that public engagement was tightly linked to legislative milestones, with limited sustained interest beyond that period.

These findings align with previous research demonstrating that public attention often peaks in response to high-profile events and media (including social media) coverage, in turn influencing political, economic, and even health decision-making (13–15). For instance, Kaleem et al. found that search interest in various cancer types spiked following media reports about celebrity cancer diagnoses. In the context of stealthing, similar surges in public interest may be driven by media coverage surrounding legislative developments (16). Likewise, Park et al. noted that individuals who relied on social media or other non-traditional sources for COVID-19 information were less likely to perceive the virus as severe and less likely to report intent to get vaccinated (17). In the case of stealthing, new coverage upon the first legislative action in the nation (18) would help explain such patterns.

However, interest in stealthing, as shown in our results, varied widely across geography, terminology, and time, suggesting complex dynamics in how the public engages with sexual boundary violations online. For example, subregions with the lowest RSV values, including several southern and midwestern states such as Mississippi, Oklahoma, and North Dakota, exhibited search activity more than one standard deviation below the national mean. These findings suggest limited public awareness or engagement in regions where stealthing may be underrecognized or less publicly discussed. In contrast, subregions such as Washington, Rhode Island, and the District of Columbia demonstrated the highest levels of search interest, with RSV values exceeding two or even three standard deviations

above the national average. Notably, Wyoming reported no RSV during the study period, indicating either a complete absence of search activity or volumes too low to register, which may further reflect disparities in awareness or digital engagement around the issue.

Such variations may be influenced by a range of factors, including differences in sexual health advocacy or related education, or even broader cultural and political funding toward sexual health and rights, including consent (19,20). For example, school-based sexual health education in the United States varies significantly, with 14 states mandating abstinence-only instruction, and only 15 states and the District of Columbia requiring that sex or sexually transmitted infection (STI) education include content on consent (21). These contextual differences further reinforce that importance of understanding regional trends for tailoring public health messaging, resource allocation, and policy implementation strategies that are responsive to local levels of awareness and need.

When assessing states with stealthing-related legislative activities, a varied pattern was further noted. For example, in California an event-driven pattern was observed, with search interest peaking in February 2021 shortly after Assembly Bill 453 was introduced (22). A series of subsequent spikes in late summer and early fall of 2021 aligned with media coverage and the bill's signing into law by Governor Gavin Newsom on October 7, 2021. Further, Washington state exhibited the most extended pattern of engagement, with multiple moderate-to-high RSV peaks spanning from mid-2021 through mid-2024. The most prominent surge occurred in June 2024, the passage of House Bill 1958 in March 2024, with enactment date of July 1, 2024 (23). On the other hand, while both Vermont and Maine exhibited highly concentrated spikes in search activity, these did not align with the timing of their respective stealthing-related legislation (24,25).

These discrepancies also raise important questions about the factors that influence public engagement. One possible explanation is that the legislation in these states did not explicitly use the term "stealthing," potentially limiting public recognition and reducing the likelihood that individuals made the connection between the law and the behavior it sought to address. Alternatively, the observed variation may reflect a limitation of the selected search terms; individuals seeking information may have used different or more localized language not captured by the standard terms analyzed.

This is further noted in one of the study's key contributions related to its comparison of search terms. The colloquial term "stealthing" generated far more engagement than the technically accurate but less familiar phrase "non-consensual condom removal," which yielded little to no data. Similarly, while "condom removal" had low RSV, its spikes temporally aligned with those for "stealthing meaning," indicating that individuals may have used alternative terms to search for the same underlying concept.

These patterns align with the concept of information-seeking behavior, where language accessibility strongly influences search behavior and, by extension, perceived public salience. For example, a study by Eysenbach and Köhler showed that internet users often rely on intuitive and recognizable language to locate health information, and that they rarely assess source credibility in depth (26); highlighting how familiar terminology can drive engagement even in the absence of rigorous evaluation. Similarly, research by Chen et al. (27) found that individuals with limited health literacy were more likely to rely on sources such as television, social media, and celebrity blogs for health information, platforms where informal or colloquial language is more prevalent, while showing less trust in information from healthcare professionals.

Such findings underscore the importance of using accessible and recognizable language in both legal and public health communications, further highlighting the need to move beyond individual-level health literacy and toward a more population-level approach (28). While definitions of health literacy have recently expanded to include the role of organizations in shaping how individuals access and use health information (29), they often stop short of addressing broader structural determinants of health, such as legal language, legislative processes, and policy communication. Experts have also noted the importance of bridging the gap between legal and public health literacy, most notably Parmet and Robbins (30), who argue that lawyers should be versed in public health concepts to craft effective policy. However, the relationship between law and public understanding is reciprocal. Just as legal professionals benefit from familiarity with public health frameworks, public health practitioners and communicators must also understand legal discourse and legislative processes. Without this bidirectional fluency, legal reforms may fail to resonate with the public even when well-intentioned and evidence-based.

In the case of stealthing, laws may include precise legal definitions and mechanisms, but if the language and legislative context do not align with how the public engages, searches, understands, or frames issues, the reforms risk remaining invisible. Strengthening public engagement thus requires not only accessible public health messaging but also transparent and understandable legal language, enabling individuals to meaningfully interact with policy changes that affect them. This dynamic illustrates that population health literacy requires not only clear and inclusive messaging, but also a recognition that law and policy are integral components of the information environment shaping public understanding and decision-making.

Limitations and strengths

This study has limitations that merit consideration. First, Google Trends™ data reflect only users who search using Google™ and may not capture the behavior of individuals who rely on other search engines or offline sources. The platform also does not provide demographic information, limiting our ability to assess which populations are engaging with stealthing-related content. Additionally, variations in state-level RSV may be influenced by population size or internet access rather than awareness alone. In addition, high RSV in a region indicates elevated search interest, but low RSV does not necessarily signify a lower need for resources or a lower frequency of the act. Further, in regions with lower engagement, silence may reflect significant social stigma surrounding sexual boundary violations, which can suppress public discourse and individual search behavior. Finally, causality cannot be inferred from the observed associations between search patterns and policy events.

Notwithstanding such limitations, this study has several strengths. It is the first known infodemiology analysis focused specifically on stealthing within the United States, providing timely insights into how digital behavior reflects public understanding of emerging sexual consent issues. By incorporating both national and state-level analyses, the study captures regional differences in public awareness. Further, the integration of multiple terms, colloquial, technical, and derived from user queries, adds analytic depth and enables exploration of how language influences public engagement. Additionally, the comparison of search behavior against legislative timelines offers a novel approach to assessing public receptivity to legal reform. This study contributes methodologically by demonstrating how infodemiology can be applied not only to infectious disease surveillance or mental health tracking but also to under-recognized forms of sexual harm and legal response. As such, it lays important groundwork for future research at the intersection of digital epidemiology, sexual health communication, and policy evaluation.

CONCLUSION

This infodemiology study demonstrates that public interest in stealthing is highly episodic, often spiking around legislative or media events but rarely sustained. Search behavior varied significantly across states, with notable disparities in awareness that appear to align with broader sociopolitical and educational contexts. Crucially, this study finds that the public is far more likely to engage with informal terms like “stealthing” than with legally accurate but less accessible phrases such as “non-consensual condom removal.” These results reinforce the importance of language accessibility in public health and legal communication. Laws alone are insufficient if the public cannot identify or contextualize the issue within their own understanding. Bridging this gap requires that policymakers, health educators, and advocates incorporate population-level communication strategies that reflect how people seek and process information. As legal systems increasingly address nuanced forms of sexual harm, aligning legislative language with public discourse is essential for effective policy uptake and behavioral change. This study positions infodemiology as a powerful tool for anticipating and addressing these gaps, in turn allowing for more inclusive, timely, and responsive approaches to public health and justice.

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