

Breathing together: A global hashtag analysis of #LungHealth on platform X (formerly Twitter)

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Abstract

Background: The X platform has gained popularity in healthcare, with posts among physicians increasing by 112% over five years. In the context of pulmonology, #LungHealth is used for engagement, spreading awareness, and disseminating information on respiratory diseases, yet its impact remains unexplored.

Objective: We aim to analyze #LungHealth by measuring outreach and quantitative engagement metrics associated with #LungHealth.

Methods: We conducted an analysis of #LungHealth posts over social media platform X (formerly Twitter) using Fedica, an analytic tool over 2 years from 1st May 2022 to 1st May 2024. This analysis studied quantitative metrics such as the number of posts, likes, views, user's geographical distribution, and co-occurring hashtags.

Results: This hashtag analysis of #LungHealth for 2 years resulted in a total of 13,824 posts. The study showed that these posts were generated by 6100 active users producing over 80 million impressions. The posts garnered 1116 replies and 19,006 likes. Geographical distribution showed the posts spanning across 105 countries. The top 10 countries with the highest number of posts were the USA, India, UK, Canada, Australia, Nigeria, Belgium, Netherlands, Switzerland, and Kenya. Common co-occurring hashtags identified were #COPD, #COVID19, #Lungcancer, and #Asthma. The top 10 influencers consisted of six Indian media outlets, one health company, one educational institution, one Arabic media outlet, and one American journalist.

Conclusion: This is the first study that provides a unique perspective on utilizing #LungHealth as a tool for global engagement in promoting lung health awareness and reaching various audiences on a global scale.

Keywords

Lung health, hashtag analysis, X platform, Twitter, social media

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Background

The X platform has increased its popularity among medical professionals to reach audiences in healthcare, with posts among physicians increasing by 112% across 5 years.¹

X (formerly known as Twitter) allows users to create online communities for health education by posting brief messages which it used to refer to as posts and connecting posts through a hashtag.^{2,3} One such example was a descriptive analysis conducted by Taylor J et al., analyzing #LCSM and #Lungcancer on how people affected by lung cancer use social media as channels for patient engagement and support. Posts focusing on sharing information (64%) about lung cancer were more common than those offering social support (29.1%).⁴ Hashtag analysis studies on #hearthealth, #diabetes, and #migraines have identified that social media posts allow for better patient health literacy than traditional medical sources.⁵

In the field of pulmonology, #LungHealth is used to disseminate information about respiratory diseases, awareness, and discussions between healthcare providers and patients using the X platform. However, despite the growing lung health-related discussions on social media, the impact of this hashtag is yet to be studied on any social media platform. This study aims to analyze #LungHealth by measuring quantitative data including the number of views, posts, reposts, and frequently used terms and hashtags associated with this community. By understanding the nature of knowledge-sharing related to lung health, there is a greater potential to devise new strategies for public health awareness and tackling misinformation on a global scale.

Methods

This is a cross-sectional study that analyzed the growth of #Lunghealth on the social media platform X over a period of 2 years from 1 May 2022 to 1 May 2024. Given the conflicting opinions during SARS Cov2 pandemic, hashtags associated with COVID-19 vaccination were excluded from this analysis and primarily focused on #LungHealth. The analysis was performed using the Fedica (formerly known as Tweepstmap) analytic tool. Fedica is an all-in-one AI-driven publishing, follower analysis, listening, and analytics platform for social media⁶ and it measures hashtags, posts, and engagement rates on X alongside the user demographics. The details of all posts shared with #LungHealth in the study period were analyzed by the Fedica tool and directly exported in Excel which was used for further analysis without filtering or further cleaning of data.

We analyzed the total number of posts (texts, images, videos, or links), reposts, and engagement metrics to measure user interaction (likes, comments, or shares). Reach distribution was assessed (the distribution of users who posted according to their number of followers). Additionally, we

examined other variable metrics such as co-occurring hashtags, and top influencers (top 10 influencers based on the number of followers and the category field).

Influencer's exact number of followers and name or initials were kept confidential and user's geographical locations were identified using the Fedica analytic tool. Additionally, the content of posts from the top 10 influencers was analyzed and categorized according to the themes of their posts. The timeline activity was also received which was then further analyzed using Microsoft Excel to create the figures and graphs for a more detailed understanding of the trends.

Results

Global outreach

A 2-year period longitudinal hashtag analysis of #LungHealth by Fedica yielded a total of 13,824 posts, generated by 6100 active users, accumulating over 80 million impressions, out of which 7735 were original posts and 5738 were reposts.

Activity timeline

Fedica was also used to analyze the trend activity timeline of #LungHealth over 2 years (Figure 1).

From May 2022 there is an increasing trend in posting frequenting September 2022 with 380 posts, which then followed by a drop of 194 posts from November to December 2022.

After that, the number of posts decreased until a slight increase in October 2023 with 364 posts, followed by the major surge in 21 November 2023 then with a significant drop of 531 posts in December 2023.

The highest peak with 682 posts was observed on 21 November 2023, whereas the second peak was during the month of September with 380 posts, followed closely by October with 364 posts. On the contrary, 26 December 2022 had the lowest number of 85 posts.

Top countries

The study also revealed that the origin of posts reflected a worldwide reach, spanning 105 countries (Figure 2). Countries with the top three highest numbers of posts were the United States, with 5119 (37.2% of all posts), India with 3260 (23.7% of all posts), and the United Kingdom with 1877 (13.6% of all posts), followed by Canada ($n=685$), Australia ($n=329$), Nigeria ($n=287$), Belgium ($n=161$), Netherlands ($n=156$), Switzerland ($n=153$), and lastly Kenya with 135 posts (Figure 3).

Reach distribution

The posts were predominantly in the English language (97.5%) and garnered 1116 replies, 19,006 likes, and 499

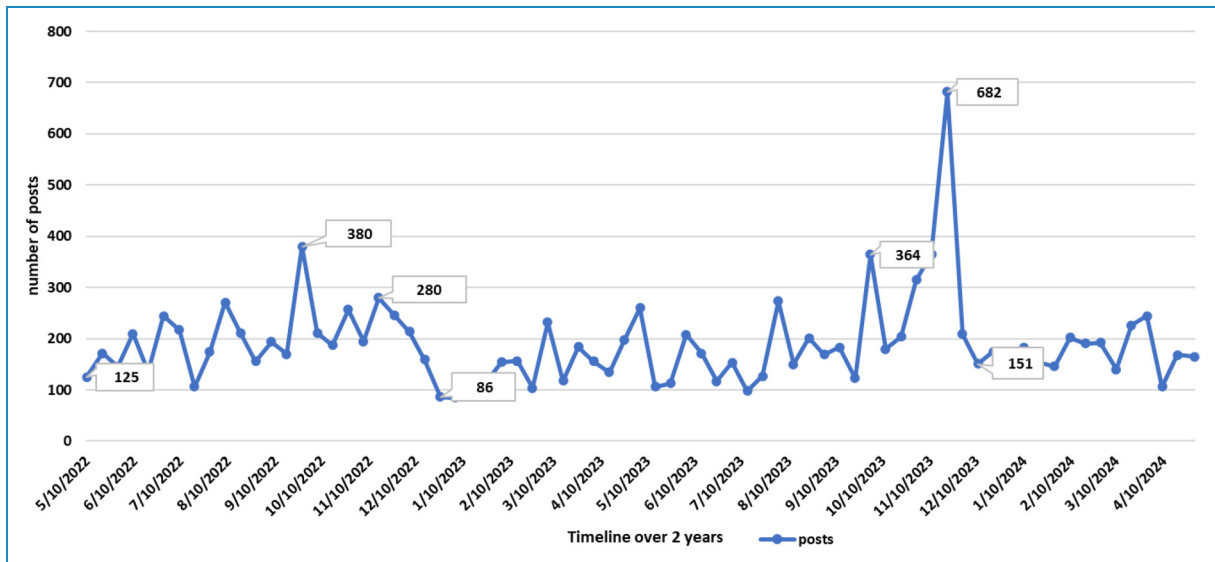


Figure 1. Timeline #LungHealth posting over 2 years.

quotes. The study has identified the reach distribution of the users who posted according to their number of followers. For instance, 1% of users had 0 and above 50,000 followers, 4% had 10,000–50,000 followers, 27% had less than 100 followers, 28% had 1000–10,000 followers, and 39% of users had 100–1000 followers (Figure 4).

Co-occurring hashtags

The most frequently co-occurring hashtags accompanying #LungHealth were #COVID19 #COPD, #Asthma, #union-conf2023, #lungcancer #WorldLungDay, #tuberculosis, #keepbreathing #airquality, and #airpollution. Reposts primarily focused on themes of raising awareness of the importance of lung health, advocating for universal access to care, and early screening for lung cancer.

Top influencers

Furthermore, the study identified that the top 10 influencers based on a number of followers were including six Indian media outlets (TV channels, magazine), one health company, one institution, one Arabic media outlet, and one American journalist.

On analyzing the top influencers, key themes identified included alternative medicine, awareness of lung health, and education in promoting respiratory health.

Factors affecting engagement rates

A regression analysis was conducted to examine factors influencing engagement (defined as the sum of reposts, likes, and quotes) on #LungHealth posts. Results indicated that the number of followers of the posting account was a significant positive predictor of engagement ($p = 0.011$), with an estimated

increase of ~ 0.78 interactions per additional 1000 followers. In contrast, post type had a significant negative impact, with Reposts ($\beta = -3.1453$, $p < 0.0001$) and Replies ($\beta = -1.1352$, $p = 0.002$) receiving significantly lower engagement compared to original posts. These findings suggest that while audience size positively impacts engagement, reposts and replies generate significantly less engagement than original posts (Table 1).

Discussion

We conducted a longitudinal hashtag analysis of #LungHealth over the span of 2 years which identified 6100 users generating 13,824 posts with English being the predominant language. The posts are distributed across 105 countries and among these countries, the top 10 countries based in ascending order were the United States, India, the United Kingdom, Canada, Australia, Nigeria, Belgium, Netherlands, Switzerland, and Kenya. The top co-occurring hashtags were #lungcancer, #COPD, #tuberculosis #COVID19, #Asthma, #keepbreathing, and #airpollution.

Timeline activity

The result of the timeline activity from 1 May 2022 until 30 April 2024 shows the fluctuations of the posts activity corresponding to the specific related awareness months. For example, the highest peak was observed on 21 November 2023, with 1547 posts cumulatively during the whole month of November, coinciding with Lung Cancer and Chronic Obstructive Pulmonary Disease awareness months.^{7,8}

The second peak was found on 27 September 2022 two days after World Lung Day accumulating 380 posts. “Lung health for all” was the theme for World Lung Day on 25 September 2022, advocating for equitable capacity,

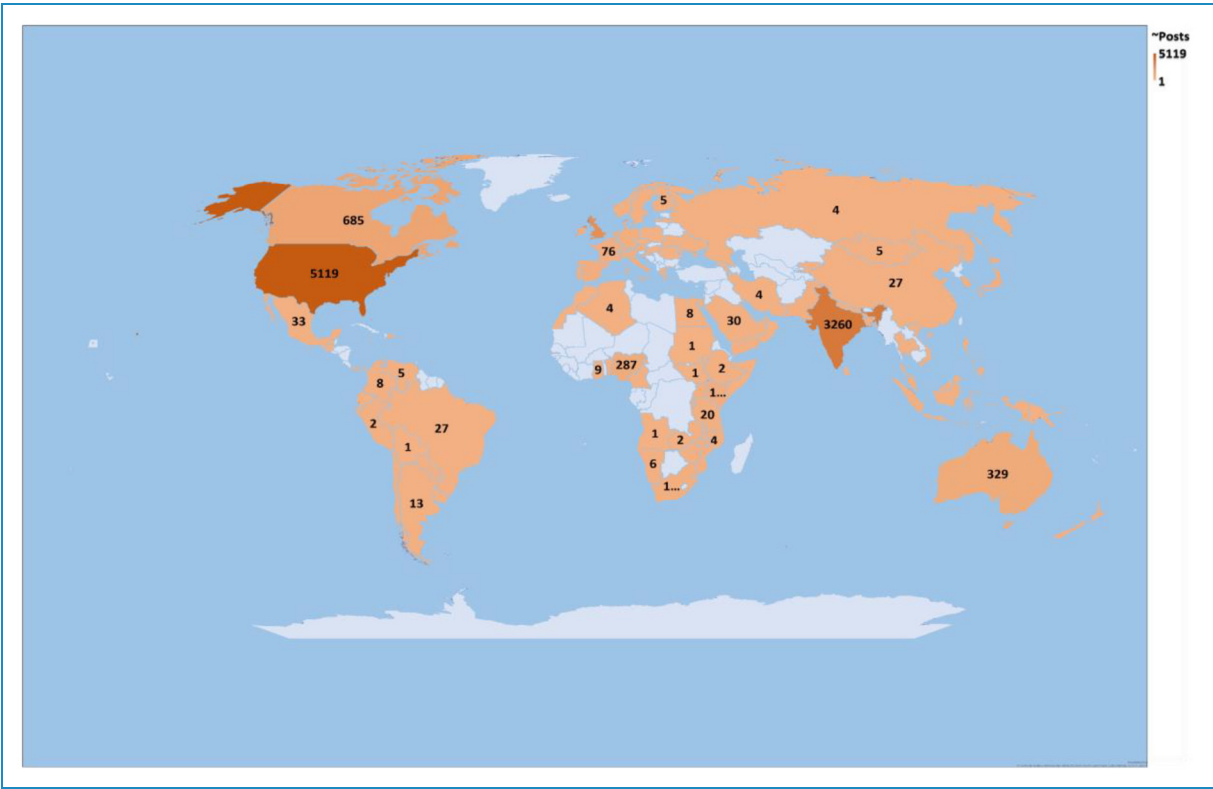


Figure 2. Map chart distribution.

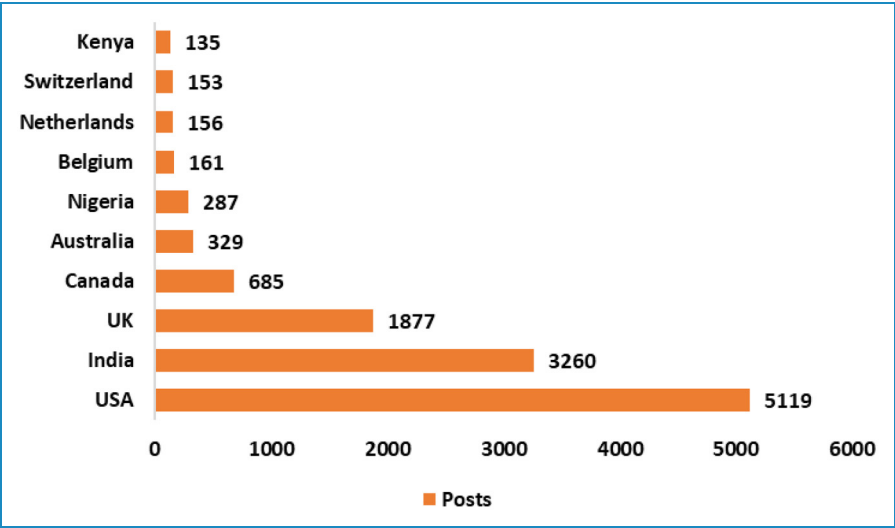


Figure 3. Regional popularity of #LungHealth.

infrastructure, and resources utilizing X as a pivotal tool to reach its audiences, with the main focus of raising awareness of the importance of lung health and ensuring that everyone has access to the care they need.⁹ This was followed closely by 2 October 2023 with 364 posts aligning with Healthy Lung Month, accumulating an overall 668 posts during that month.¹⁰

At the same time, October being a winter month in India, when the country experiences the peak of pollution levels¹¹ could potentially be one of the reasons for the increase raising awareness as the air quality deteriorates. However, time-series analysis and Granger causality tests did not indicate a direct causal relationship between awareness months and post activity, suggesting that while these peaks align

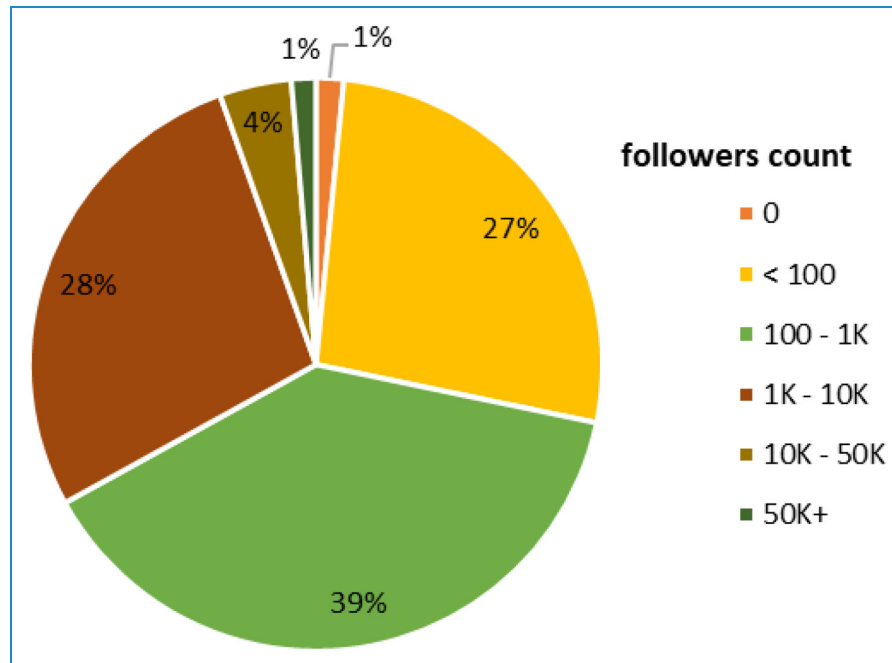


Figure 4. Reach distribution of #LungHealth.

Table 1. Descriptive examples of de-identified types of posts.

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1.	The X user shared a message emphasizing the significance of lung health in recognition of a day dedicated to lung cancer awareness. Highlighted was the value of early detection through routine medical check-ups and promoted a smoke-free lifestyle as key preventive measures. The post concluded with a hopeful note, encouraging collective efforts to combat lung cancer.
2.	The X user encouraged followers to support their lung health by incorporating a daily routine involving a natural mixture intended to help reduce phlegm and mucus. They also invited readers to explore additional natural remedies by accessing a complimentary resource titled "25 Top Home Remedies that Really Work."

with key health observances, other external factors such as campaign efforts, media coverage, and seasonal variations may contribute to engagement fluctuations.

On the other hand, the lowest point was observed on 26 December 2022 with only 85 posts likely reflecting a shift in discussion patterns during holiday season.¹² These findings imply that while targeted social media campaigns can effectively raise awareness about respiratory diseases, the relationship between specific awareness events and post activity is complex and influenced by multiple external factors. This also shows that such campaigns and social media conversations around important topics like lung health can be short-lived in the online space.

Top countries

Notably, the majority of top countries using #LungHealth are high-income with the exceptions of India, Nigeria, Kenya, South Africa, Pakistan, and Uganda, which are

low and lower-middle-income economies, and South Africa being the only upper-middle-income country.¹³ This suggests the possibility of a digital divide in economic resources, infrastructure, internet access, and overall health-care access.¹⁴ This pattern, with the USA, India, United Kingdom, Canada, and Australia emerging as top countries, aligns with findings from a previous study by Nawaz et al. on #Psychtwitter where the researchers found that the United States had the largest number of users (54.3% of all users), followed by the United Kingdom (10.4% of all users), Canada (4.9% of all users), India (2% of all users), and Australia (1.8% of all users).¹⁵ The plausible reasons why the hashtag #LungHealth is more widely used in these countries may be due to the higher prevalence of chronic respiratory diseases, with Global Burden of Disease study reporting that in 2019, the USA, UK, and Australia had the three highest rates of chronic respiratory diseases among all countries.¹⁶ According to the American Thoracic

Society, respiratory disease causes an immense problem, with 235 million people suffering from asthma and 200 million from COPD, and lung cancer being the most common cause of cancer death.¹⁷ This substantial burden is influenced by factors such as industrialization, which tend to be higher in high-income countries¹⁸ indicating higher levels of respiratory disease, which inevitably translates to increased advocacy in promoting lung health awareness on social media, especially on platform X.

Variations in healthcare policies¹⁹ may affect the inequalities surrounding #LungHealth discourse on X, such as the private health access implemented in the US, where issues like socioeconomic challenges include lack of health insurance, financial constraints, and limited access to preventive care services. Additionally, geographical disparities arise in rural populations including limited access to healthcare facilities which could contribute to delayed diagnosis and treatment and exacerbate lung health disparities.²⁰ Therefore, access to lung care particularly necessitates utilizing X as a platform for policy reforms, stressing the inequalities in obtaining treatment for prevalent lung health issues. This aligns with our findings where it was identified that raising awareness of the importance of lung health, advocating for universal access to care, and early screening for lung cancer were among the most common themes of reposts. This is further suggested by the American Lung Association which underscores the significance of advocacy in enhancing lung health by promoting participation in online action alerts and petitions to influence policymakers.²¹

In contrast to the US, where private healthcare predominates, countries like Nigeria with mixed healthcare systems (a combination of private and public funding) demonstrated evidence of leveraging Twitter space to advocate for health.²² Another issue faced by the country is the underdiagnosis of lung cancer and the prevalence of other respiratory diseases.²³ Health professionals and organizations use X to raise awareness about underdiagnosed conditions like lung diseases.²⁴ These stakeholders aim to bridge the information gap by sharing educational content and patient stories, encouraging early diagnosis, and advocating for improved healthcare services.

Countries with universal health access might have utilized X for lung health awareness campaigns through government-backed campaigns, covering discussions on preventative care, smoking cessation, or air pollution policies like those observed in India.²⁵ For example, India's National Tobacco Control Programme (NTCP), launched in 2007–2008, aims to raise awareness about the harmful effects of tobacco consumption and reduce its usage through public education and cessation support.²⁶ Moreover, leveraging X to assess the air quality in India offers valuable insights into public responses to air quality issues in urban areas particularly, New Delhi.²⁷

This indicated that analyzing posts related to health-based government schemes can provide insights into public perceptions and the effectiveness of these programs.

Despite the fact of being a lower middle-income country and the 3rd most polluted country globally,²⁸ India came second with the highest number of posts and the 3rd largest number of X users worldwide in 2024.²⁹ New Delhi, its capital, is among the most polluted cities globally³⁰ yet has the highest engagement rate, suggesting a growing initiative in promoting the environmental impact on lung health.

Co-occurring hashtags

#COVID19 is among the most common co-occurring hashtags align as observations in a previous study by Awoyemi et al., ranking as the second most common frequent hashtag appearing (6.82%) highlighting the impact of COVID-19 on clinically extremely vulnerable group.³¹

Similarly, in a study by Pratiwi et al., #sarscov2 was found to be a popular hashtag with 127 posts.³² The observed similarities could be attributed to COVID-19 as a recent global pandemic, emphasizing the role of social media X in amplifying concerns and sharing information during pandemic.³³ Another finding by Pratiwi et al. showed that #copd emerged as the most common co-occurring hashtag with 71 posts potentially, due to the similarity of symptoms perceived by the users.³²

Overall the co-occurring hashtags with #LungHealth that have been identified in this study, cover the five major respiratory diseases that contribute significantly to global burden, such as #COPD #Asthma #lungcancer #tuberculosis and #COVID19 representing acute respiratory infections.³⁴ This signifies the role of social media in shaping public perceptions on respiratory health issues. This was further supported by #keepbreathing and #airpollution which points to a broader concern for respiratory health and its association with environmental factors such as pollution. Another interesting hashtag is #unionconference, which is one of the biggest conferences focusing on lung health. The theme “transforming evidence into practice” was highlighted during the event that took place from 15–18 November 2023³⁵ as observed through an increasing peak in the timeline activity figure.

The large spike observed during the annual union conference signified the pivotal role of conferences in driving public engagement and advancing scientific discourses on X, as evidenced by #unionconference being among the most common themes of reposts found in this study. Moreover, X use at the conferences has also grown in popularity as shown with the yearly increase of content specific hashtag from critical care medicine annual congress from 2014 to 2020.³⁶

Top influencers

With more than 80 million engagements overall, our analysis identified the top 10 influencers in the #LungHealth

conversation, with 6 of them being Indian media outlets, suggesting the role of journalism in influencing healthcare. This is in contrast to previous studies that have shown news reporters, journalists, and individuals to be the top contributors to hashtags related to respiratory health conditions like asthma and lung cancer. For example, a study by Sutton et al. on the #lungcancer hashtag found that individuals accounted for 84% of the retweets, followed by media and organizational accounts.³⁷

The advantages of reposts enhance the spread of content across different user networks and improve the reach and visibility of posts therefore it allows us to understand the direction of posts. While potential disadvantages could include the presence of bots which could significantly promote misinformation,³⁸ and spamming which could lead to inaccurate measures of the amplification of content.

Similarly, the study on #Asthma found that news reporters and journalists were the top contributors, followed by government and healthcare institutions.³² In contrast, the current findings where media outlets were significant influencers, comprising more than 60% of the top 10 influencers, highlight the unique dynamics of the #LungHealth conversation compared to other respiratory health-related hashtags.

Strength and limitations

The study has its strengths and limitations. This is the first study analyzing the impact of hashtag #LungHealth. However, the study did not assess the quality of the content or evidence-based practice. Rather, we conducted an analysis of global outreach and engagement patterns on platform X therefore, it adds to the understanding of the role of social media in shaping the perceptions of various respiratory diseases together and their psychosocial impact.

The data analyzed also catered to a large sample size used over a longitudinal period of 2 years. The findings of our study help to understand the burden of various respiratory diseases and how social media and influencers can help to increase engagement, raise awareness, and influence public perceptions of lung health.

Since this study is focusing on hashtag analysis on X (formerly Twitter), #LungHealth on other platforms of other social media such as Instagram, and Meta (Facebook) was out of the scope of this study.

Our study lacked the sentiment and emotional analysis of the posts and the inclusion of posts in a language other than English. Thus, future studies could focus on extracting qualitative themes to identify underlying emotions and behaviors that drive public opinion regarding health awareness issues on X.³⁹ Future studies could also include the temporal relationship between post frequency and highly publicized instances where a media personality may be diagnosed with a lung condition that might influence the posting frequency of others. Furthermore,

incorporating all native language posts can aid in comprehending a patient's emotional experiences and concerns, without any language hindrance. Moreover, incorporating future analyses could provide a more comprehensive understanding of global engagement patterns such as a cross-platform analysis of #Lunghealth across different social media platforms such as Instagram, YouTube, TikTok, and Meta (Facebook) to understand how different social media platforms shape health communication and public engagement.⁴⁰

Conclusion

#LungHealth trends on the X platform over the past two years revealed significant timeline activity and geographical variations. This study emphasizes the growing importance of lung health, especially post COVID-19, and offers insights for enhancing outreach strategies and targeting areas needing increased focus, thereby improving global lung health interventions.

Moreover, this work underscores the crucial role of digital platforms like X in shaping global health awareness, particularly in the context of lung health.

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Statements and declarations

Ethical considerations

This study is exempt from ethical approval since it is based on available pre-existing data and does not involve active data collection from human participants. We have kept the users' credentials anonymous, and this study does not mention any information related to the users' X accounts.

Contributorship/CRedit

MR and SG analyzed the data into Excel sheets, writing the manuscript, SS helped in writing discussion and conclusions sections, AG analyzed the data, MM, ZA, FN, and RK reviewed, edited, and approved the final manuscript. All authors contributed to the article and approved the submitted version.

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Conflicting interests

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