PROMISE
Preparing for RSV Immunisation and Surveillance in Europe

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Preparing for RSV Immunisation and Surveillance in Europe

WP2.1 – WP Preparation for future RSV product assessment

D2.1 Open-access online tool to continuously measure RSV awareness

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Definitions

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  2. **UMCU**. Universitair Medisch Centrum Utrecht (Netherlands)
  3. **UA**. Universiteit Antwerpen (Belgium)
  4. **Imperial**. Imperial College of Science, Technology and Medicine (United Kingdom)
  5. **UOXF**. The Chancellor, Masters and Scholars of the University of Oxford (United Kingdom)
  6. **THL**. Terveyden Ja Hyvinvoinnin Laitos (Finland)
  7. **RIVM**. Rijksinstituut voor Volksgezondheid en Milieu (Netherlands)
  8. **NIVEL**. Stichting Nedelands Instituut voor Onderzoek van de Gezondheidzorg (Netherlands)
  9. **TUCH**. Varsinais-Suomen Sairaanhoitopiirin Kuntayhtymä (Finland)
  10. **TEAMIT**. TEAM IT Research, S.L. (Spain)
  11. **ReSViNET**. Stichting Resvinet (Netherlands)
  12. **SSI**. Statens Serum Institut (Denmark)
  13. **SERGAS**. Servizo Galego de Saúde (Spain)
  14. **PENTA**. Fondazione PENTA - For the treatment and care of children with HIV and related diseases - ONLUS (Italy)
  15. **FISABIO**. Fundación para el Fomento de la Investigación Sanitaria y Biomédica de la Comunitat Valenciana (Spain)
  16. **MLU**. Martin-Luther-Universitaet Halle-Wittenberg (Germany)
  17. **SP**. Sanofi Pasteur, S.A. (France)
  18. **GSK**. GlaxoSmithKline Biologicals, S.A. (Belgium)
  19. **JANSSEN**. Janssen Pharmaceutica, N.V (Belgium)
  20. **Novavax**. Novavax, Inc. (United States)
  21. **Pfizer**. Pfizer Limited (United Kingdom)
  22. **AZ**. AstraZeneca AB (Sweden)

- **Grant Agreement**. (Including its annexes and any amendments) The agreement signed between the beneficiaries of the action and the IMI2 JU for the undertaking of the PROMISE project (Grant Agreement No. 101034339).
- **Project**. The sum of all activities carried out in the framework of the Grant Agreement.
- **Work plan**. Schedule of tasks, deliverables, efforts, dates and responsibilities corresponding to the work to be carried out, as specified in Annex I to the Grant Agreement.
- **Consortium**. The PROMISE Consortium, comprising the above-mentioned participants.
- **Consortium Agreement**. The agreement concluded amongst PROMISE participants for the implementation of the Grant Agreement. The agreement shall not affect the parties' obligations to the Community and/or to one another arising from the Grant Agreement.

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Abstract

Respiratory syncytial virus (RSV) imposes a significant disease burden on a global level. Understanding public awareness of RSV is important to support preventive interventions and educational activities. To effectively address this issue, it is crucial to measure public awareness of RSV and provide support through preventive measures and educational initiatives. In pursuit of this objective, we aimed to create an easily accessible online tool that continuously measures RSV awareness by utilising the internet search volume as our primary data source. Specifically, we employed Google Trends, an application that has been established as a valid tool for measuring fluctuations in public awareness. By analysing internet search behaviour data, Google Trends offers valuable insights into both temporal and geographical trends. Additionally, we incorporated data from Wikipedia Pageviews, which tracks the number of visits to the RSV Wikipedia page from visitors worldwide. Both these data sources are freely accessible, ensuring the long-term sustainability of our online tool. To make the tool comprehensible, informative texts were added as well as visual adjustments to make the tool visually attractive and user-friendly. Ultimately, we integrated this online awareness monitoring tool into the ReSViNET website, expanding its reach and accessibility to a wider audience.

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1. Introduction/Theoretical framework

In light of the recent successful developments in the preventive and therapeutic interventions for Respiratory syncytial virus (RSV) (European Medicines Agency, 2023), it has become increasingly important for the general population to have knowledge about the risks and prevalence of RSV infections. Mass media awareness campaigns play a crucial role in increasing public awareness of health risk factors and infectious diseases, including RSV. These campaigns aim to distribute information about the disease, educating the public about its risks, symptoms, and preventive measures. By increasing awareness, individuals are better equipped to make informed decisions and actively participate in efforts to combat RSV. Thus, the ultimate goal of raising awareness is public engagement as this leads to active participation and is vital in the ongoing battle against RSV. Active participation can manifest in various ways, such as recognising early symptoms, adopting preventive measures like vaccination, and offering support to foundations or charitable organisations working towards RSV prevention and treatment.

The ReSViNET RSV Patient Network organises an annual RSV awareness week in November, the last two were under the PROMISE consortium. During this week, campaigns, interviews, videos, patients' and parents' experiences, and more are shared with the general public through different channels to increase RSV awareness. Besides the awareness week, webinars on RSV are organised for the general public to raise awareness and provide education. A lot of effort are invested in these RSV awareness campaigns, and it is important to understand and analyse the yields. In addition, RSV received increased media attention in the spring and summer of 2021 due to a delayed RSV outbreak. This delay was most likely caused by COVID-19 restrictions, which were relaxed again at the beginning of 2021(Garg et al., 2022) Furthermore, novel RSV preventative and therapeutic interventions are being introduced which will possibly have a huge impact on RSV awareness.

Measuring the impact of RSV awareness campaigns and changes in RSV seasonality is of great importance for our understanding of the current state of public awareness of RSV. Traditional methods that have been used to measure public awareness, e.g., questionnaires, are expensive, time-consuming, and restrict measurements to only a few time intervals. As a solution to this, various studies have demonstrated the potential of internet-based measurements of awareness levels of disease-related topics as a proxy for public awareness (Cervellin et al., 2017; Ortiz et al., 2019; Paguio et al., 2020) Online tools for public awareness measuring allow for continuous awareness monitoring and have a large scope. Examples of online tools are Google Trends, Wikipedia Pageviews, and costly social listening tools. These online tools have the common feature that they mine qualitative or quantitative internet data. This data reflects a certain aspect of online behaviour. Examples of this data are the number of mentions of a subject in social media posts, the internet search behaviour of a topic, or the number of views of specific web pages. Since the data sources utilised by each online tool are different, each tool potentially reflects a different dimension of public awareness. In addition, sensitivity and precision might differ substantially between tools, depending on the scope and domain from which the data is derived. The validity of different online awareness tools as a proxy for public awareness must be carefully considered since a gold standard for measuring public awareness is lacking. A recent study compared Google Trends data to social listening tools. The authors concluded that in terms of sensitivity and precision, as well as practical aspects, Google Trends is the preferable tool for measuring online public awareness of RSV (Schuurman & Bont, 2022).

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2. Goals and objectives

For this deliverable, we aimed to develop an open-access online tool to continuously measure RSV awareness, reflected in online search volumes, using the internet and social media as our database. The goal is to measure and map RSV interest and awareness in the general public over time and analyse the effect of different aspects of the campaigns and changes in the RSV field. This tool aimed to provide an assessment of the current state of public awareness and the level of awareness over time. Our goal was to design this tool to possess the following properties: durable, open-access, informative and comprehensible.

The data presented in this tool represents the time trends of global (online) public awareness of RSV, which allows for continuous public awareness monitoring. By combining different types of online data, namely Google Trends and Wikipedia Pageviews, we aimed to give a well-rounded, multi-dimensional representation of online public awareness. ReSViNET's social media pages (LinkedIn and Facebook) both have a much smaller follower base and reach compared to Google and Wikipedia. Therefore, we did not regard the social media page traffic data of ReSViNET pages as valuable in terms of measuring public awareness and chose not to include it as a data source.

The development of this tool was set across a fixed timeframe, which is shown in the Gantt chart below, see Figure 1.

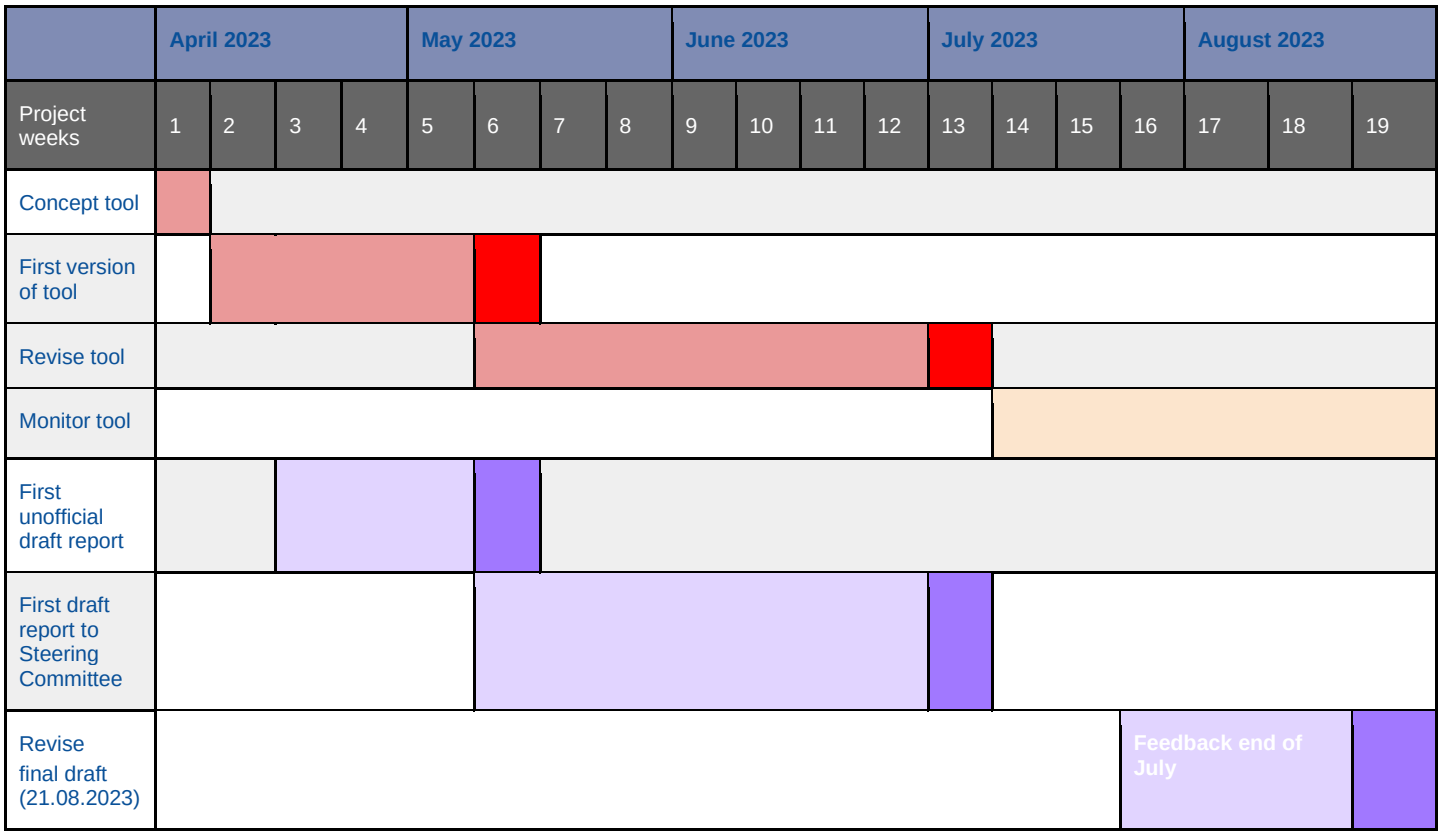

Figure 1. *Gantt chart development of online awareness monitoring tool.*

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3. Methods

Google Trends data

Relative search volume data was retrieved from https://trends.google.com. Google Trends was used as one of the sources of data for this tool. Google Trends is a free and open-access tool that allows for the collection and analysis of web queries made globally via the Google search engine and Google's partner websites (e.g., YouTube). The output is relative search volume with values ranging from 0 to 100, where 100 represents the peak in the number of web queries to which all other values are compared. Hence, no absolute data on the number of web queries is shown or available. The results are calculated according to the chosen time period and can be exported to CSV format, shared via social media, and embedded on websites. The time frame can be chosen anywhere between 2004 and the present. Google Trends analyses relative search volume for either a specific entered keyword or a "topic". A topic is an umbrella term that contains all search keywords related to the subject of interest (Choi & Varian, 2012) The topic chosen for this tool was "Respiratory syncytial virus". Terms included within this topic were, for example, the commonly used abbreviations "RSV", "RS virus" or "RSV vaccine". Furthermore, the search volume data generated by Google Trends includes search queries in all languages, meaning that it is not restricted to English search terms only. Additional functions for Google Trends are interest per region (including a geomap), compared breakdown by region (when you use 2 or more search terms), related queries, and related topics. In the geomap, the popularity of a search term is calculated as the proportion of queries of the keyword compared to the total number of queries in a country. Popularity is then compared between countries and given a value between 1 and 100, where 100 is the country with the highest popularity. This is then visualised in the geomap as shades of blue, with the darkest shade representing a relative popularity of 100. We also included data from these additional functions for the disease topic (see Figure 4 for reference).

Google Trends offers the possibility to embed charts on a chosen website page by copying and pasting the HTML code into the body of the web page builder. When choosing a pre-set timeframe, Google Trends offers the functionality to update the chart on the website automatically, meaning that the data shown will always be live. Google Trends does not offer any insight into the demographics of people using Google (e.g. positive versus negative attitudes, age, etc).

The chosen time frame was the pre-set time frame from the beginning of the PROMISE project (i.e., November 2021) to the present. This allows the website visitor to compare relative search volume data from before and after the PROMISE project. For the geographical scope, we chose worldwide. Google Trends does have the option to organise the data by continent.

Wikipedia Pageviews data

The second source of data for this tool was Wikipedia Pageviews. We extracted Wikipedia Pageviews data from https://pageviews.wmcloud.org/. Wikipedia Pageviews is a free open-access, online tool that allows the user to track the number of views of a specific, chosen Wikipedia page on all platforms (desktop, mobile app, mobile website), in all languages, over time (from 2015 until the present). We chose the "Respiratory syncytial virus" Wikipedia page. We set the time frame to five years, and we chose daily data as the data frequency. We chose "user" as an agent, as the other options "spiders"

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and “automatic” do not represent actual human visitors of Wikipedia. We extracted the data with a CSV file, which we then processed into an interactive chart that was embedded on the website.

Tool design

We wanted the tool to be both interactive and informative, as well as straightforward, comprehensible and sustainable. We used WordPress as a program to design the web page on the ReSViNET website, www.resvinet.org. To make the tool comprehensible, we added informative texts that explain the charts and data. As for colours, we chose the ReSViNET colours for the background. We could not adjust the colours and appearance of the Google Trends charts since they were embedded on the website.

To make the tool more visually attractive and user-friendly, we chose to distribute the data in different tabs, namely a Wikipedia pageviews graph showing the number of visits over time; a graph of Google Trends relative search volume over time, which included the disease topic; a Google Trends geomap, which shows the distribution of relative search volume over different countries; and a Google Trends-related queries tab. We also added two sections above and underneath for further clarification, namely, “Why is it useful to track search volumes of RSV?” and “Disclaimer of the RSV Awareness Tool”. These two sections were added for users to gain more insight into the information and scope that the search volume data can provide and how they can be interpreted. Likewise, the disclaimer was added to address the limitations and careful conclusions that should be made when interpreting such data.

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4. Results and overview of tool

To see the final tool which was implemented on the ReSViNET website, please go to the following link (not publicly available yet): **RSV Awareness Online Tool - ReSViNET.**

Figure 2 and 3 provide global trends regarding the awareness and interest in “Respiratory syncytial virus”. Figure 2 exhibits the absolute number of global visits to the virus's Wikipedia page over the past five years. Figure 3, in contrast, illustrates the relative search volume for this term since October 2021 in Google Trends. Figures 4 and 5 further elaborate on the data from the Google Trends. Figure 4 presents the country-wise relative search volumes for "Respiratory syncytial virus" over the past five years, highlighting geographic patterns of public interest and awareness. Figure 5, meanwhile, lists the most frequent topics and queries associated with this term on Google.

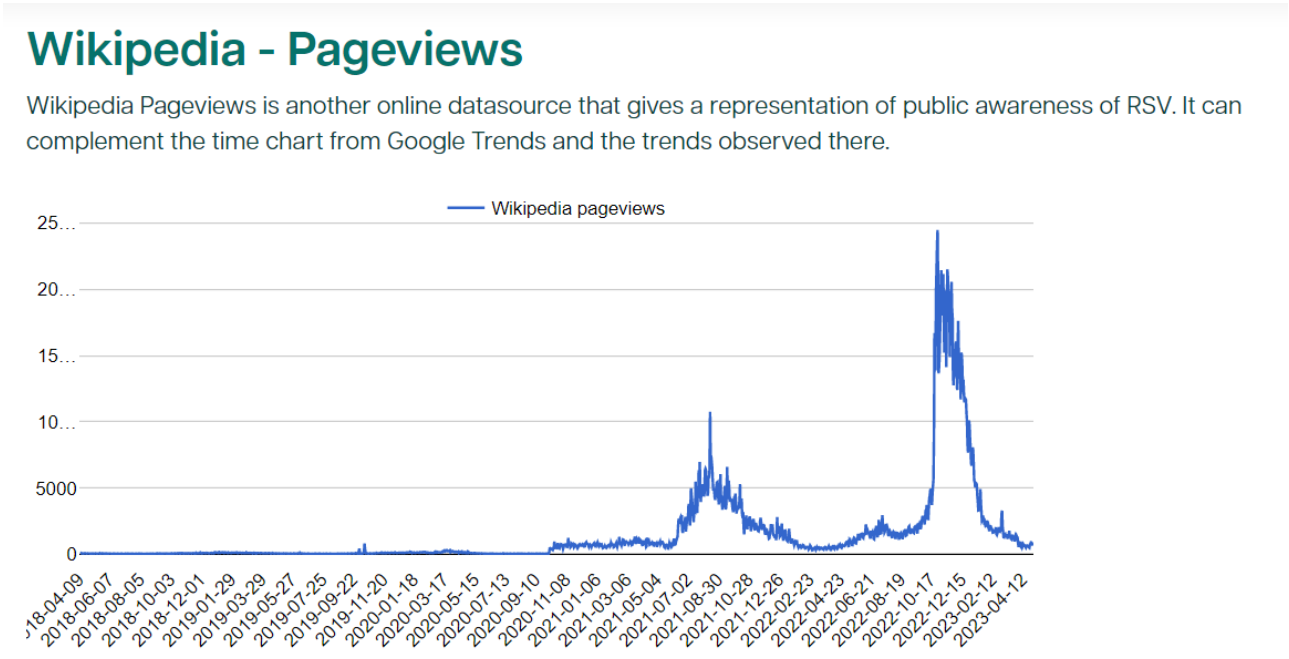

***Figure 2**. The graph shows the absolute number of times the "Respiratory syncytial virus" Wikipedia page is visited by web users worldwide over the last five years.*

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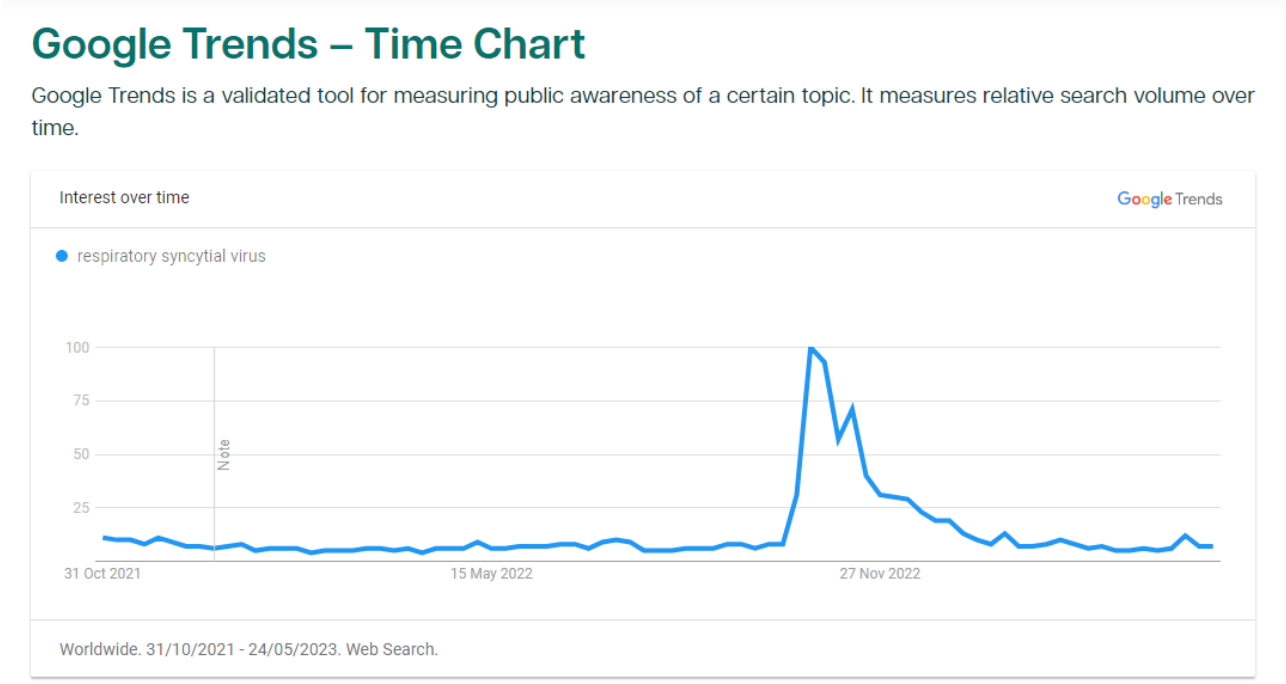

Figure 3. *Relative search volume for "Respiratory syncytial virus" is shown since October 2021.*

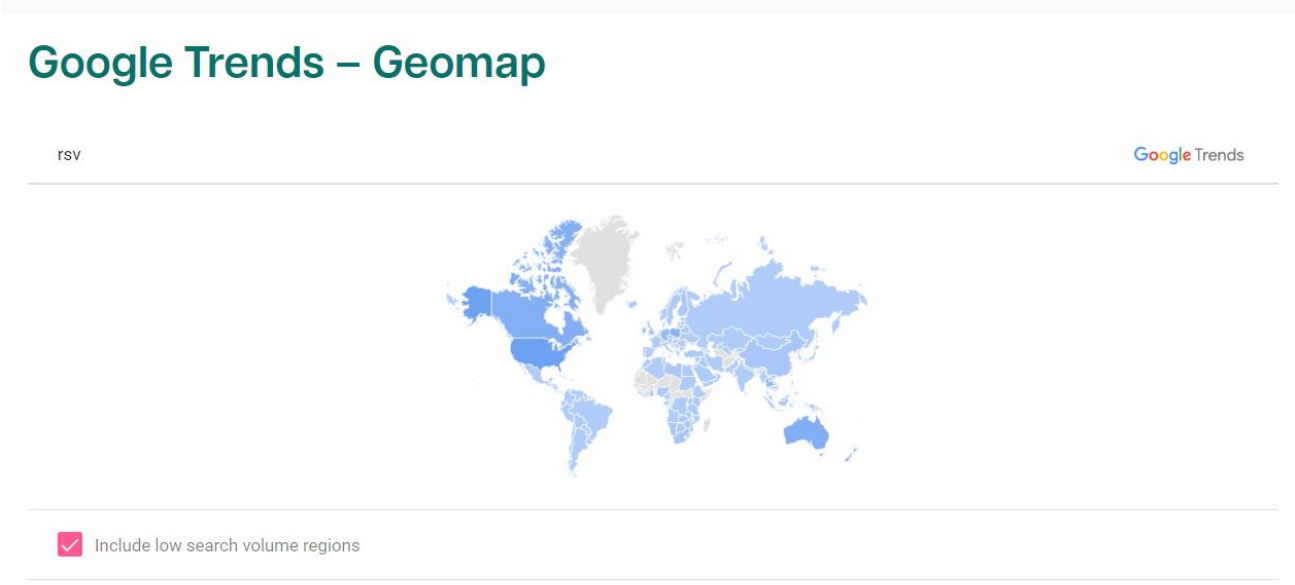

Figure 4*. Relative search volume data from Google Trends shown per country over the last five years.*

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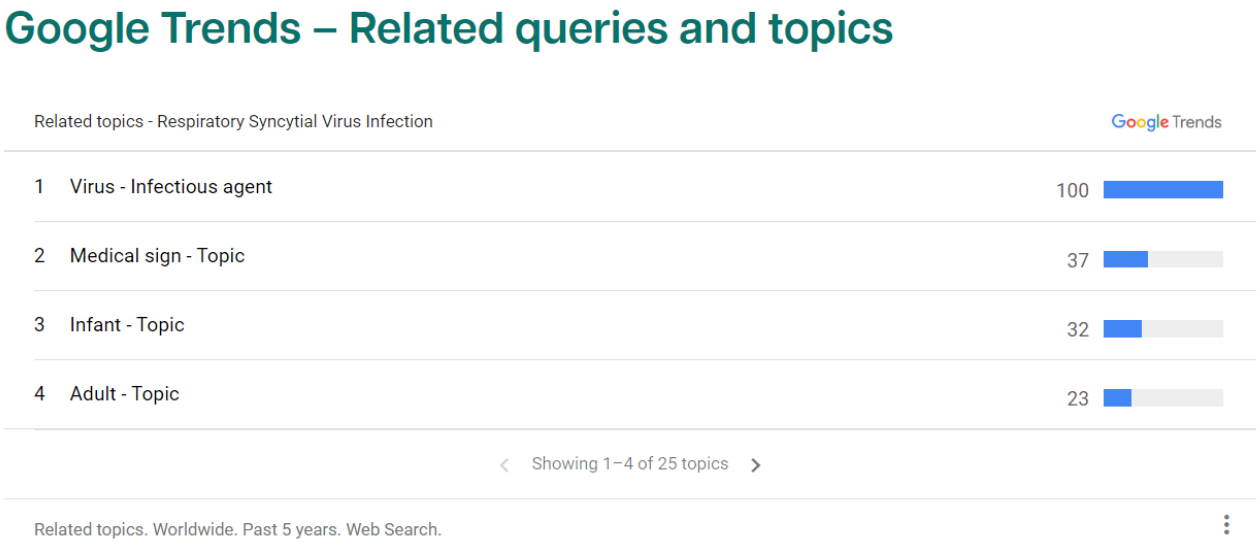

Figure 5. *The topics and queries most often searched for by Google users who also searched for "Respiratory syncytial virus".*

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5. Discussion

In this report we have provided an overview of the development process of the RSV Awareness Online Tool, whereby search volumes from Google Trends and Wikipedia Pageviews data were integrated. Below, we have provided a breakdown of the advantages and disadvantages associated with each type of data utilised in our platform.

Google Trends has several advantages. Firstly, it is free of charge which is very convenient given there was no financial budget for developing this tool and it ensures sustainability for years to come. Secondly, the utilisation of Google Trends has been extensively employed in similar research inquiries, establishing its validity as a reliable tool for measuring public interest in RSV. Consequently, numerous articles containing guidelines and protocols on utilising Google Trends data for various purposes are readily available (Mavragani & Ochoa, 2019; Nuti et al., 2014). Additionally, Google Trends offers a comprehensive historical dataset dating back to 2004, ensuring access to long-term information alternatives. Monitoring search volume can help identify potential outbreaks or spikes in RSV cases. A significant increase in searches related to RSV symptoms or treatments can indicate a surge in cases, allowing public health officials to respond promptly and allocate appropriate resources. It also enables analysis of search volumes geographically, which provides insights into the regions where RSV is most prevalent or where awareness levels are low.

To add to the informativeness and comprehensiveness of the tool, and to make it more well-rounded in terms of representing actual public awareness, we added Wikipedia Pageviews data. Similar to Google Trends, Wikipedia Pageviews is free of charge and user-friendly and offers historical data dating back to 2015. Wikipedia is the largest and most-read online encyclopedia (Kopf, 2022) and was ranked the 7th most popular web page in 2023 (Top Websites Ranking - Most Visited Websites in June, 2023) which makes it a valuable source to represent public interest and awareness. However, it does not include a function for chart embedment like Google Trends does, which means the data does not update automatically and has to be extracted manually and processed into a chart. Furthermore, similar to Google Trends, one could question whether the number of views of a Wikipedia page is a representative sample of actual public awareness. By including both Google Trends data and Wikipedia Pageview data in our tool, we hope to offer the viewer a more detailed representation of public interest in RSV.

Both Wikipedia and Google Trends offer global data. Global data is interesting regarding global public awareness of RSV, but most likely not sensitive enough to measure the local impact of RSV awareness campaigns, such as the awareness week organised by ReSViNET. More likely, the changes in public awareness shown in both tools represent the impact of global changes in RSV seasonal incidence. One can see that public awareness of RSV appears to have grown over time. As explained earlier, this might be due to extra attention after COVID-19 restrictions were released, which changed the timing of the RSV season and caused the number of RSV infections to be exceptionally high (Garg et al., 2022). Furthermore, due to COVID-19, there might be an increase in general public attention to viruses and their detrimental effects on global health.

There are several general limitations to using online data in our RSV Awareness Online Tool. Google Trends and Wikipedia Pageviews data shows the search interest for RSV, which if increased, does not necessarily imply an increase in actual disease incidence or public awareness. It is important to consider other factors, such as media coverage, awareness campaigns, introduction of RSV interventions or seasonal variations, that could influence search behaviour. To gain a more comprehensive understanding, it is beneficial to combine Google Trends and Wikipedia Pageviews

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data with other relevant data sources, such as official disease surveillance data, news reports, social media trends, or expert insights. Furthermore, when using online awareness as a proxy for global awareness, we assume equal internet access and usage for the entire population. Although the internet is increasingly accessible worldwide, internet use is not evenly distributed globally (Obando-Pacheco et al., 2018). The increase in social media coverage of the delayed RSV outbreak could be limited to high-income countries and, as a result, the observed increase in online awareness was an underestimation of the true increase in public awareness globally. Therefore, the measurements might be an underestimation of actual public awareness. By keeping these considerations in mind, researchers and public health professionals can effectively interpret Google Trends data and gain valuable insights into public interest and awareness related to specific diseases like RSV. Lastly, as opposed to social listening tools, Google Trends does not offer any insight into the user demographics of Google. Therefore, we cannot draw any conclusions on positive versus negative attitudes regarding RSV.

While acknowledging its limitations, we consider online data to be one of the most innovative and informative resources for assessing public interest and awareness. Traditional methods like questionnaires may be regarded as the benchmark for measuring public awareness, but attempting to gather data at the same frequency and scale would be impractical and prohibitively costly. Therefore, ensuring the longevity of our platform is a key objective. By offering a cost-free and automatically updated platform, we guarantee sustainability and availability in the future while requiring minimal maintenance. This approach ensures durability and long-term usability, distinguishing it from other alternatives.

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6. References

RSV Awareness Online Tool: RSV Awareness Online Tool - ReSViNET

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