Facing an infodemic: How Ireland has communicated evidence-informed responses to COVID-19 on social media?

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Key points:

- Social media platforms have become a critical communication tool for generating and disseminating information, and are key public communication strategy misinformation.

- Government leaders and institutional Twitter accounts generally reacted to the spread of Covid-19 with the sharing of scientific evidence, mostly in line with WHO's interim guidelines.

- The Covid-related content of the Twitter accounts analysed suggested each institution/actors have different approaches and roles, related to the difference between public communication and political communication.

Introduction[1]

The rapid spread of the Covid-19 virus challenges governments to act quickly and effectively through policy responses. In addition, governments around the world have to combat the massive 'infodemic', an overabundance of information, such as unproven medical treatments, miraculous prevention techniques, false statistics that are often completely made up, making it hard for people to find trustworthy sources and reliable guidance (WHO 2020a). During the pandemic, people's adherence to public measures to control the spread of the disease is of extreme importance, and plenty of attention has been placed on the role of communication tools to inform citizens and build up trust. In the context of the pandemic, social media platforms have become a critical communication tool for generating and disseminating information, and are at the forefront of public communication strategies against Covid-19 misinformation.

The first confirmed case of Covid-19 in Ireland was announced on 29th February 2020 and since then, Ireland has faced a number of coronavirus pandemic waves.[2] Ireland acted towards the waves of infections with measures to contain and mitigate the spread of the virus with strict lockdowns, cancellation of large public events and school shutdowns. The pandemic's impact on the economy and on daily life was severe, as was the wave of

disinformation, which not only generates distrust and distress among the population, but has the potential to undermine policy responses to control the pandemic.

Delays by governments to communicate decisively often leaves space misinformation to proliferate, so it is key that scientific advice is presented clearly, even if evidence is still emerging (OECD 2020). Scientific information on Covid-19 has been mandated in decision-making regarding the pandemic, which in turn are often sustained and justified by the recommendations by WHO (World Health Organisation). Evidence-informed policy making has made progress and traction in the past years, relying on transparent use of sound evidence and contributing to balanced policies and legitimate governance(Head 2016). However, the pandemic response has frequently been politicised, and ideological factors can weaken evidence-informed practices.

Since the onset of the health crisis, we are witnessing the rise of ideas that contradict robust findings by epistemic communities, such as: anti-vaccine or anti-vaxx (Hotez 2020; Megget 2020; Pullan and Dey 2021) anti-mask beliefs (He et al. 2021); and pseudoscientific measures (Escolà-Gascón et al. 2020; Mostajo-Radji 2020). The spread of unfounded information by both members of the public and sometimes prominent politicians has brought to attention the critical communication role of government leaders and institutions in transmitting public health measures to media audiences to encourage responsible behaviours and increase counter-disinformation practices.

Recent research has shown Twitter is a powerful tool to world leaders to mount effective public health measures in response to Covid-19 (Rufai and Bunce 2020), while at the same time being a two-sided sword in battling the pandemic (van Dijck and Alinead 2020), with official accounts becoming a critical resource of information to the public and the prevalence of links to low credibility information (Yang, Torres-Lugo, and Menczer 2020). We understand Twitter as a fast communication channel which is easily accessible and used by government representatives and institutions as part of their strategy to convey public health messages. In this article, we conduct an exploratory analysis and describe how key political actors disseminated WHO's evidenced-based health policy recommendation measures via Twitter. More specifically, the first objective is to explore how government leaders and institutional Twitter accounts conveyed those messages. The second is to examine whether their online communication discourse was aligned with the international scientific evidence on coronavirus proposed by WHO around five main Covid-related themes: 1) hand and respiratory hygiene, 2) mask wearing, 3) physical distancing, 4) test and contact tracing and 5) vaccination.

We draw from the Academic Twitter API for Academic Research. We collected a total of 9,212 tweets on the first year of the pandemic in Ireland, from 29th of February 2020 to 31st of March 2021, paying attention to the public health communications content in four key Twitter accounts: Leo Varadkar (Taoiseach between 14th of June 2017 and 26th of June 2020) and Micheál Martin (Taoiseach from 26th of June and currently in office), HSE (Health Service Executive) and Department of Health (Roinn Sláinte). We used R Studio to collect

and to analyse the data, relying on open-source libraries (Christopher Barrie, Justin Chun-ting Ho, and Justin Chun-ting Ho 2021; Kearney, Heiss, and Briatte 2020; Benoit et al. 2018; Hadley Wickham et al. 2020; Garnier et al. 2021). For the text analysis we remove all the URLs, numbers, punctuations, symbols, stop words in English and lowercase all the texts in the Tweets.

Examining what government leaders and health authorities were saying

We analysed tweets of two government leaders and two institutional accounts, as explained above, aiming to examine whether they were using social media as a strategy of informing the population about Covid-19. The selected Twitter accounts reach a reasonably wide public if we take into account the number of followers these accounts have (see Table 1). Because Ireland had two different administrations during the first year of the pandemic, it is possible to compare how the two Taoiseachs conveyed messages on Twitter. During the four months in office since the first confirmed case in Ireland, former Taoiseach Leo Varadkar tweeted relatively the same amount of tweets (396) as his successor Micheál Martin (394) during nine months from his first day in office until the end of March 2021. It is important to note that Leo Varadkar has also an expressively higher number of followers compared to the other accounts and therefore he is more likely to reach a broader audience.

Table 1 - Summary of Twitter accounts analysed.

Twitter Account	Name	Period collected	Number of tweets collected	Number of followers (as of June 2021)
@LeoVaradkar	Leo Varadkar	From 29/02/2020 to 26/06/2020	396	420.3K
@MichealMartinTD	Micheál Martin	From 27/06/2020 to 31/03/2021	394	139.6K
@HSELive	Health Service Executive	From 29/02/2020 to 31/03/2021	5,213	187.8K
@roinnslainte	Department of Health	From 29/02/2020 to 31/03/2021	3,209	127.5K

Source: Authors' elaboration.

The data extracted from Twitter is very comprehensive in the sense that it includes all those four accounts have posted in the period, including replies to other accounts and retweets. We therefore focused only on public health, Covid-related content. As expected, the institutional accounts are more active online than private accounts, even the accounts of government representatives. The HSE and the Health Department Twitter account appear to have the general purpose of guiding the population specifically on public health issues. The HSE account is continuously replying to all sorts of queries related to measures to

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prevent the spread of the coronavirus. This account has the highest rate of tweets replying to other users among our sample (41%). While for the other three accounts analysed the proportion of replies is at most 2%. Looking at the distribution of the tweets through time, we can notice that they vary during the year (Figure 1). Most of the 'peaks' (high quantity of tweets in the same week) occur on the same time period across the four accounts.

Figure 1 - Tweets collected by week.
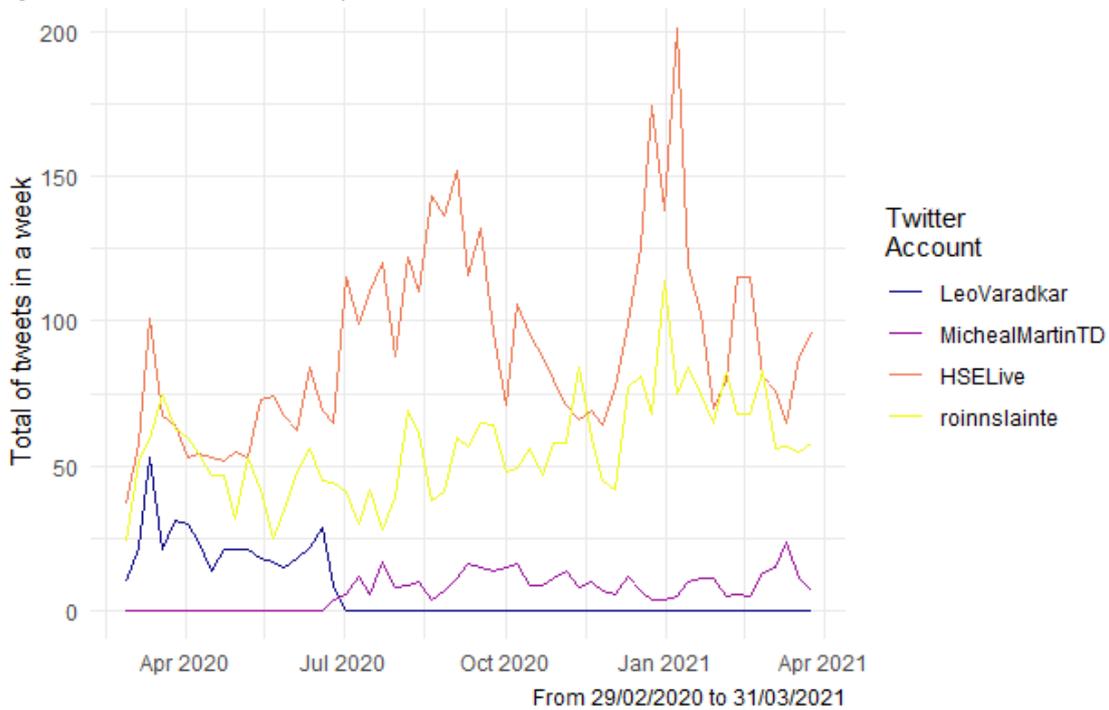
Source: Authors' elaboration.

The peaks of tweets appear to happen exactly at the time and afterwards the announcements of new Covid-related restrictions. We now move to examine three of those peaks. The first peak occurred in mid-March 2020, after WHO declared the coronavirus outbreak as a pandemic and alongside Ireland's implementation of its first national lockdown (Merrion Street 2020). It can be seen in Leo Varadkar's post about the new restrictions starting with the following tweet:

Figure 2 - Tweet from former Taoiseach Leo Varadkar at the start of the first lockdown in Ireland

Source: https://twitter.com/LeoVaradkar/status/1238077402493923328

Since the start of the pandemic there has been some level of concern about disinformation, as expressed by Leo Varadkar on this tweet: "I am urging everyone to please stop sharing unverified info on What's app groups. These messages are scaring and confusing people and causing real damage. Please get your info from official, trusted sources. Follow @HSELive @hpscireland @WHO @merrionstreet @dfatravelwise" (from March 16th 2020[3]). The other three accounts also expressed preoccupation with the fake news and misinformation shared on social media, as exemplified in this tweet by the HSE enforcing the importance of checking the source of information.

Figure 3 – Tweet from the HSE on how to spot Fake News.

Source: https://twitter.com/HSELive/status/1252902465495695360?s=20

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The second peak of tweets occurred between end-August and mid-September, when new restrictions were announced by the Irish government (Department of the Taoiseach 2020a). Alongside the announcement, it was observed a concern to also inform the public about the rationale behind the new lockdown, as illustrated by the tweet below from the Department of Health.

Figure 4 - Tweet from the Department of Health about new restrictions in August 2020.

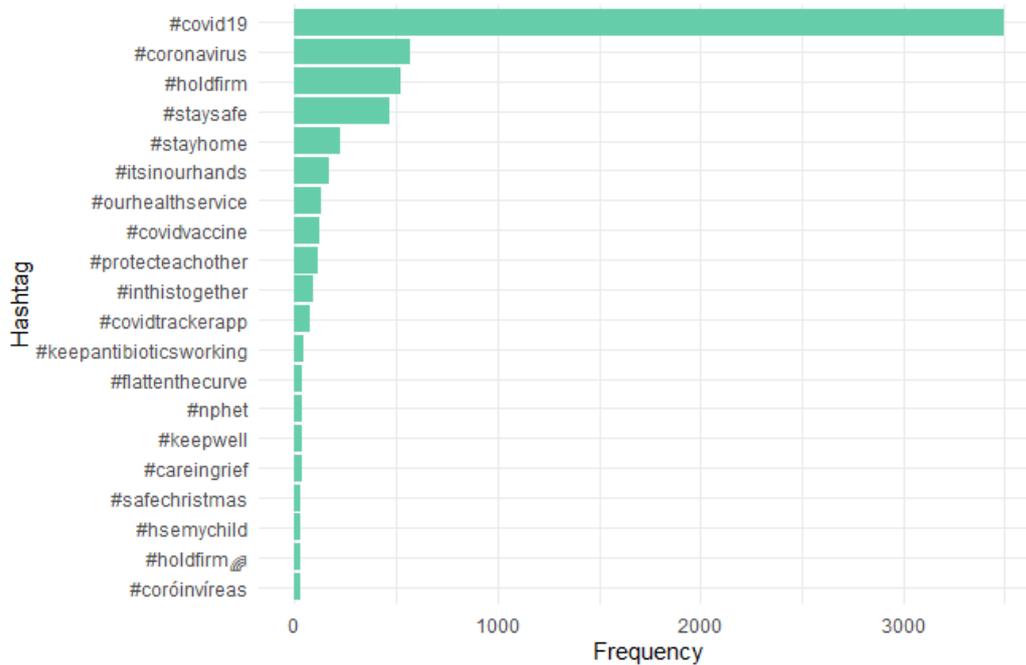Source: https://twitter.com/roinnslainte/status/1296140781821071360

Many HSE's tweets focused on clarifying the public's doubts about the need to self-isolate and international travel restrictions. This account had a high level of replies to users on how they should proceed, as well as making recommendations about washing hands and wearing face masks.

The next peak of tweets is the highest among our data, and occurred from mid-December to mid-January, when the government announced a full level 5 restrictions (Department of the Taoiseach 2020b) in parallel to news on the availability of Covid vaccines (RTE, 2020). HSE made use of Twitter to inform procedures on how to act when experiencing Covid symptoms and along with information on how all the medicines, including vaccines, are tested for safety and effectiveness, conveying the message that the population can trust these health measures. Here we can also see the concern in debunking fake news thorough specialists informing about the vaccines, as expressed in this tweet by the Department of Health: "FACT CHECK: Evidence shows #COVIDvaccines are safe in pregnancy and do not impact fertility. Obstetrician/ Gynaecologist @climurphy debunks #COVIDvaccine misinformation and provides latest advice. #COVID19 | #vaccine | #fertility | #pregnancy | #IVF | @RCPI_news"[4]. The account from the Health Department was often used to inform

about the epidemiological situation of Covid-19 in Ireland, with frequent updates on the recent official number of confirmed cases and related deaths.

In summary, all accounts were used to call for compliance with the health measures taken, especially related to stay-at-home restrictions. Analysing the content in general, not surprisingly, messages related to COVID were prevalent across the four analysed accounts. The word cloud below compares the most used words for each of the four accounts.

Figure 5 - Word cloud with the main 100 words comparing the four accounts.

Source: Authors' elaboration.

The content about Covid-19 overtook their communication on Twitter. In addition, when ranking the top 20 most used Twitter hashtags in the period, those are all related to the pandemic (Figure 6), which is a reflection of our sample collected during the first year of the pandemic. But overall, it is interesting to observe that the messages to `motivate' the public, such as 'hold firm', 'protect each other' and 'in this together' show that these government leaders and institutional Twitter accounts shared content as a stimulus to enforce Covid recommendations through a sense of collective responsibility. Generally, as suggested by the word cloud (Figure 5) and Twitter data, the two Taoiseach accounts were particularly focused on sharing positive, motivational content to spread awareness and hope; while the two institutional accounts focused on sharing facts and updated information on status of the pandemic. At this point it is important to test for similarities among the four accounts, and that is what we do next.

Figure 6 - Top 20 most used hashtags in the period by the 4 accounts.

Source: Authors' elaboration.

To assess how similar texts are we use a metric called 'cosine similarity', which measures the similarity between two documents regardless of their sizes. It varies from zero (most different) to one (most similar)[5]. In the graph below (Figure 7) we compare the similarity scores computed about the tweets by the four accounts.

Figure 7 - Similarity scores across the Tweets from the four accounts.
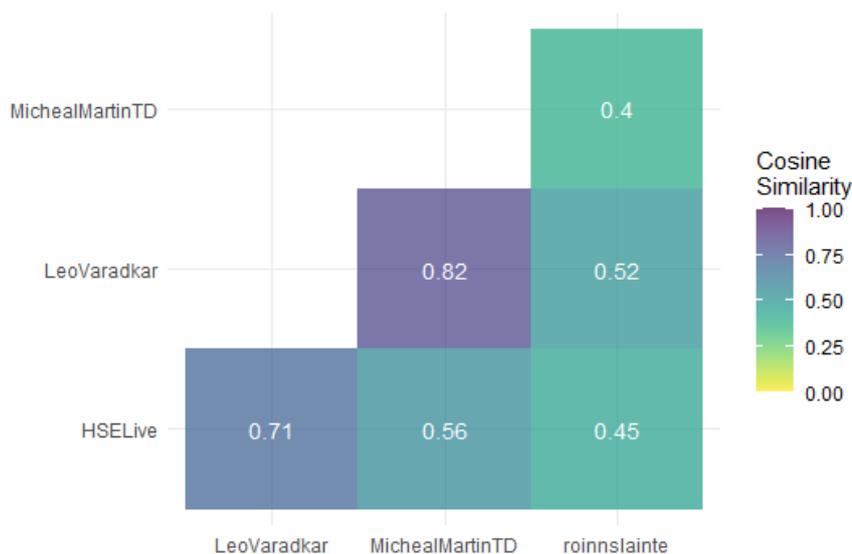
Source: Authors' elaboration.

Even though Leo Varadkar and Micheál Martin are from different administrations in the time period analysed and were tweeting in different stages of the pandemic, they showed the highest score of similarity (0.82). The second most similar were Leo Varadkar and HSE tweets (0.71). Surprisingly, the HSE and the Department of Health have a relatively low similarity score (0.45), given that they are both institutional accounts in the area of health policy. By looking at the main features from each one (word cloud on Figure 5) we can see that they were used in a slightly different sense. While HSE gave direct recommendations when experiencing symptoms, for example, and how to get a Covid test or to self-isolate, the Department of Health used twitter frequently to update information related to surveillance and to share scientific evidence. Considering these variations on their tweets, we explore now to which extent this means of communication was used to convey specific covid-related responses messages.

Covid-19 Irish government responses on Twitter

Facing a new virus, researchers all over the globe have dedicated themselves to provide the best evidence on how governments could act to flatten the curve of contamination. This new scientific evidence has been used to inform health policy-making and it has been constantly reviewed and updated, not always without contradictions. Because of the possible variation on these recommendations until the evidence is consolidated, we focus on the recommendations published by the WHO, more specifically on guidelines to be followed by national governments published during the period analysed. We identified five main themes among their publications named 'interim guidance': 1) respiratory and hand hygiene, 2) mask wearing, 3) physical distancing, 4) test and contact tracing and 5) vaccination.

To analyse how the WHO recommendations are related to the tweets from the four accounts we developed a dictionary of Covid-19 responses. We qualitatively identified keywords and rare words used in the context of each one of the five groups of WHO guidelines and adapted for the context of Ireland based on the main hashtags ranked in Figure 5. For example, we placed the 'covidtrackerapp' in the context of test and contact tracing for the Irish context. The evidence-informed guidelines utilised and the words contained in each theme in our dictionary are detailed in the Appendix 1.

This dictionary was applied to the Tweets collected, which in practice meant to count the words that matched each one of those five topics. One important factor that can explain the variation among these topics is the time period of the pandemic. The health measures were recommended and implemented in different stages, according to the available scientific evidence and the epidemiological scenario in Ireland. To visualise the occurrence of words related to each theme in the tweets throughout the year, we used regression lines. The following five graphs show variation among the four Twitter accounts across time, according to each theme.

Figure 8 - Theme Respiratory and Hand Hygiene across time by each Twitter account
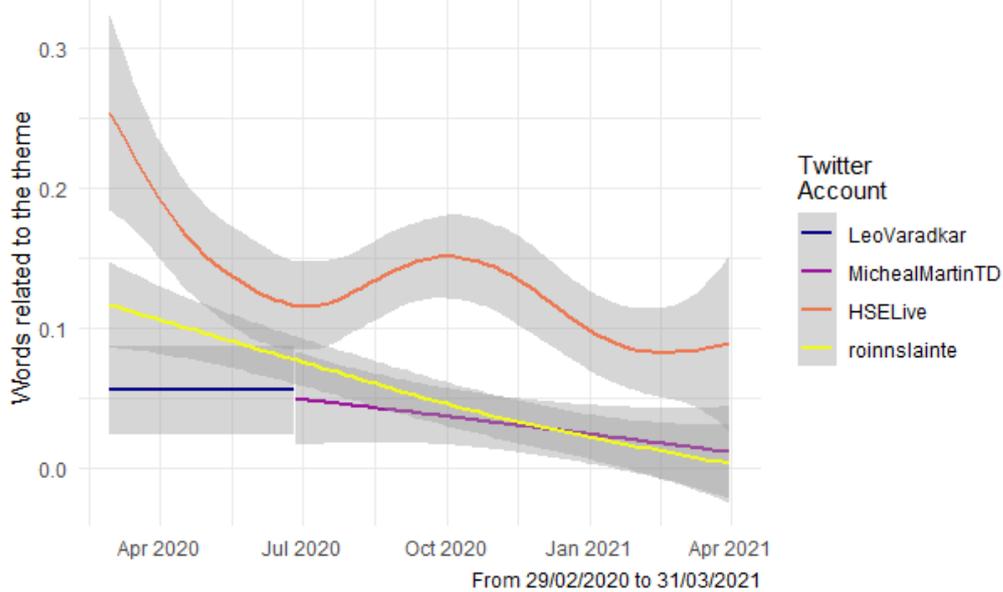
Source: Authors' elaboration.

Figure 8 shows that HSE was the account that tweeted the most about respiratory and hand hygiene, especially at the outset of the pandemic. The Department of Health also tweeted more about it in the start and then decreased its attention to it. The only account that did not vary relatively the attention dedicated to the theme was Leo Varadkar in the short period we are looking at his tweets. Micheál Martin decreased slightly the attention the words related to the topic.

Figure 9 - Theme Mask Wearing across time by each Twitter account.
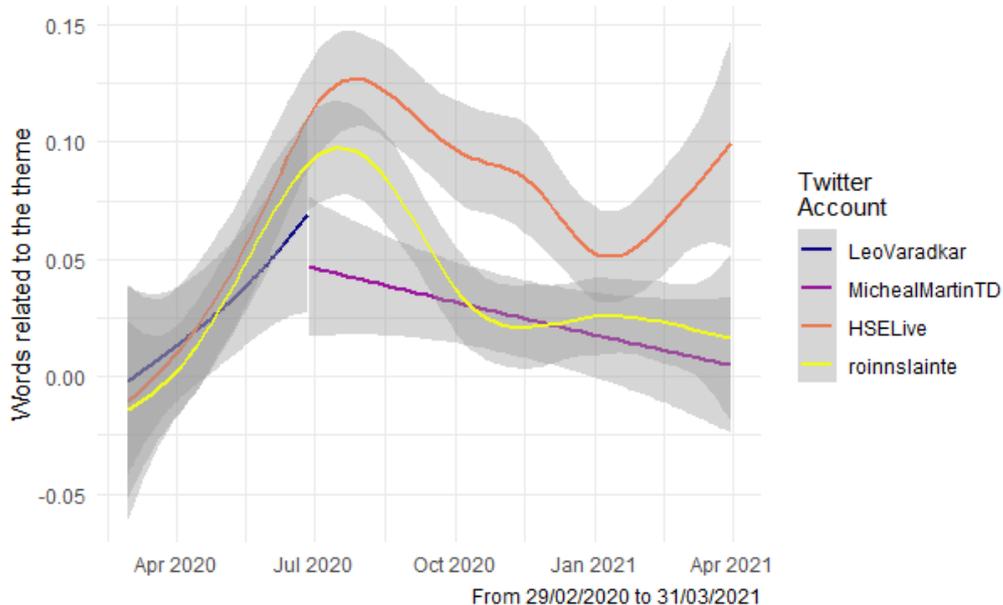
Source: Authors' elaboration.

When looking at the theme about Mask Wearing on Figure 9 it is interesting to notice that the peak occurred was after June 2020. The wide use of masks was still not supported by evidence in the interim guidance from April (WHO 2020b), then WHO updated their guidance in June and started to encourage the general public to wear masks depending on the context as a part of strategy to contain the transmission of Coronavirus (WHO 2020c). In July 2020, face coverings were enforced by law in Ireland (Health Act 1947 2020b, 2020a). Around this period there were more words related to mask wearing among the four accounts (Figure 9).

Figure 10 - Theme Physical Distancing across time by each Twitter account.
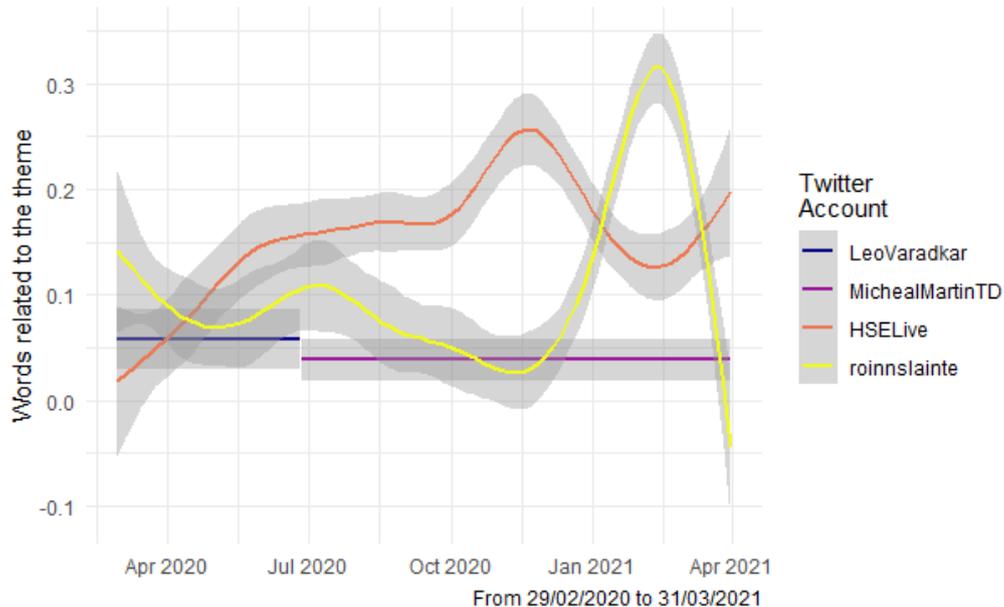
Source: Authors' elaboration.

The use of words related to physical distancing (Figure 10) by both Irish leaders did not vary significantly in relation to their attention dedicated to the theme. The HSE predominantly tweeted more about physical distancing, except for the period between December 2020 and February of 2021 when the Department of Health dedicated more attention to this theme in specific. This increase of physical distancing tweets by the Department of Health is likely to be related to the high numbers of cases and deaths during the Third wave of the virus. Along with updates on the high number of cases, messages to incentivise stay-at-home restrictions were frequent.

Figure 11 - Theme Test and Contact tracing across time by each Twitter account.
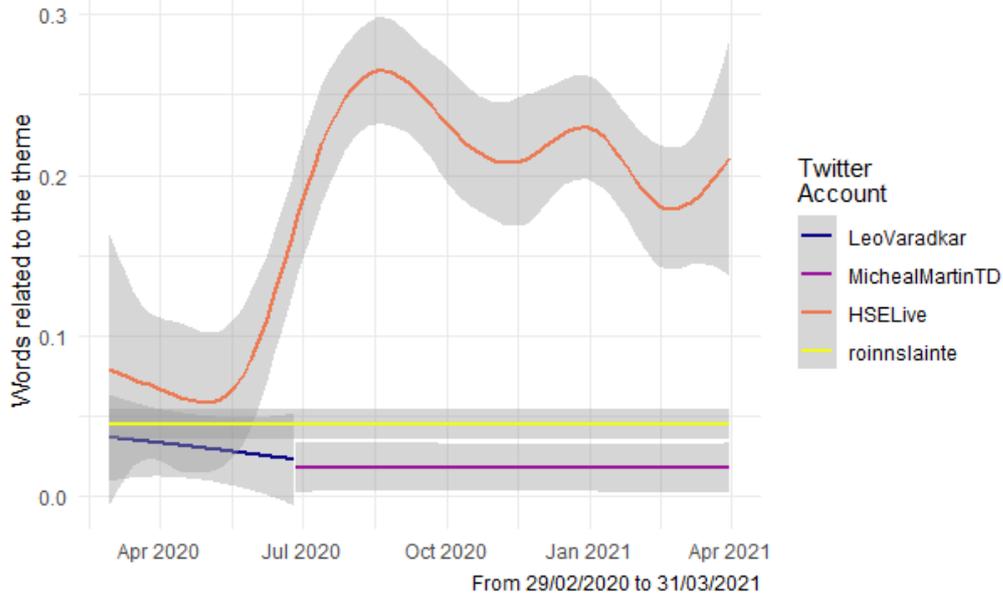
Source: Authors' elaboration.

The theme Test and Contact tracing (Figure 11) was tweeted the most by the HSE throughout the year, with a significant increase after May 2020, as this account kept a high level of attention to it. Leo Varadkar decreased on a small scale the attention from March 2020 to June 2020 and Micheál Martin kept it constant during the analysed period. The Department of Health also kept the same level of words dedicated to the theme during the year.

**Figure 12 -** Theme Vaccination across time by each Twitter account.
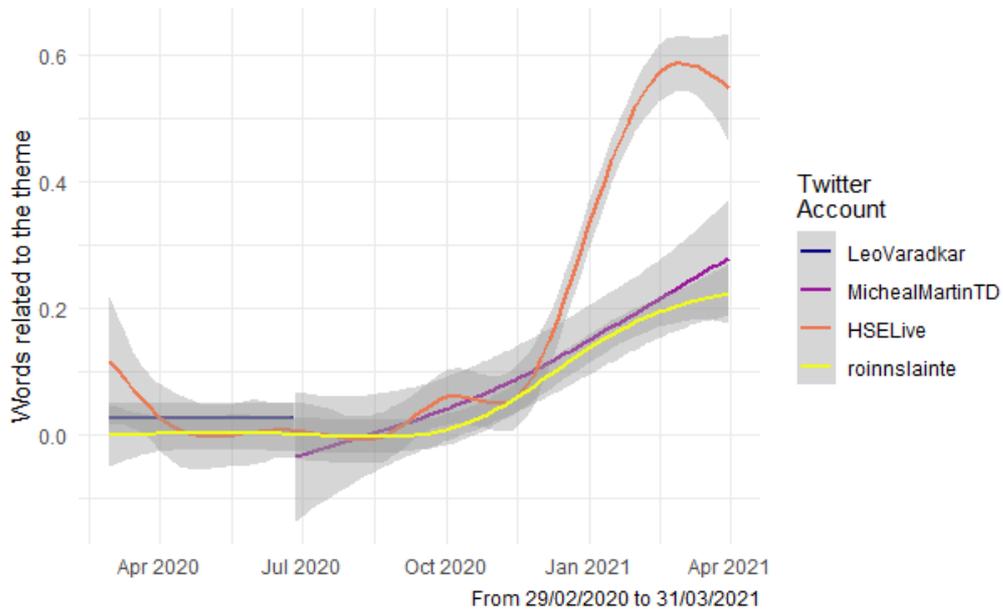
Source: Authors' elaboration.

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Figure 12 looks at the occurrence of the theme vaccination. It is noticeable that the attention to vaccines escalated after December 2020, when the first Covid-19 vaccines were approved by the European Medicines Agency on 21 December 2021 (RTE, 2020) and the first person was vaccinated on 30 December 2021 (HSE, 2020). Since then, HSE was the account most frequently tweeting about that, providing guidance to the general public on how to get the vaccine and informing about its safety and efficacy. Micheál Martin, as the Taoiseach of the period, has increased significantly his attention to the topic, similar to leaders and political authorities from other countries. All four accounts registered an increase of tweets from October 2020, when more concrete news about new Covid-19 vaccines started to be published. The department of Health in particular increased the attention since the vaccination started in Ireland offering also the constant updates on the level of immunisation in the country.

Figure 13 demonstrates the proportion of attention dedicated to the theme by each account related to the total of words their own accounts have tweeted in the period.

Figure 13 - Proportion of words related to each Covid-19 response theme tweeted.
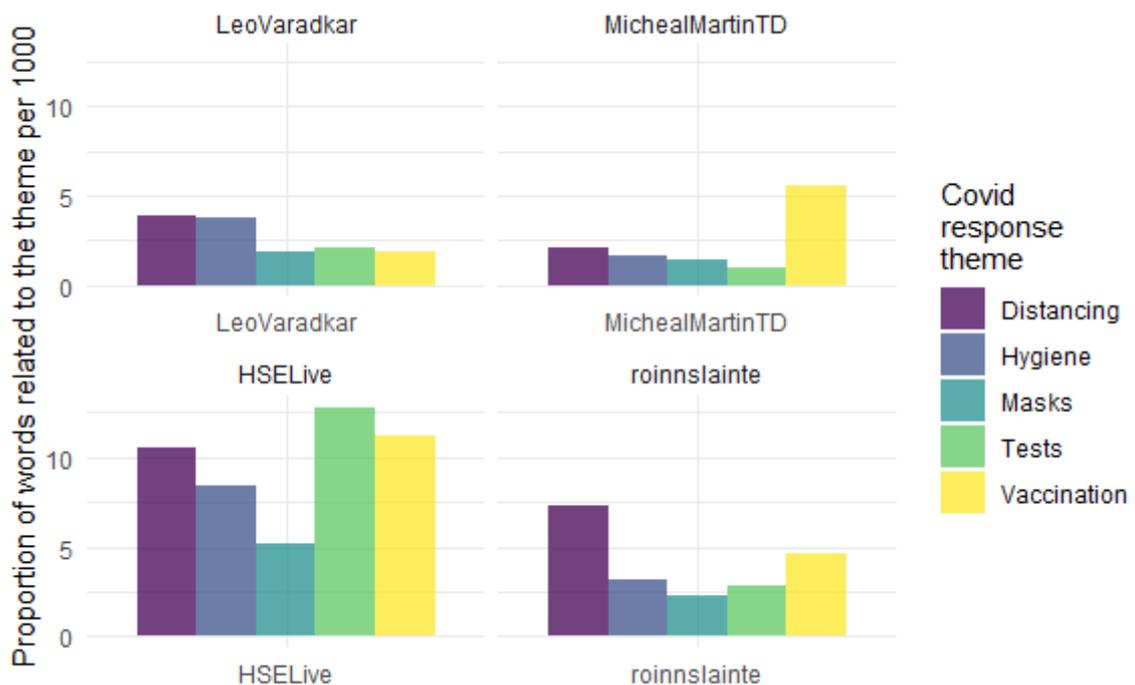
Source: Authors' elaboration.

Leo Varadkar dedicated more attention to the themes physical distancing, and hygiene-related recommendations on Twitter, which were the first measures recommended at the beginning of the outbreak, as seen in the interim guidance (detailed in Appendix 1). In turn, Micheál Martin focuses more on vaccination, which coincides with his term in office and

the period of vaccine approval and distribution at the end of 2020. Along with messages about the status of vaccination in Ireland, we can notice more content motivating the public and also enforcing the compliance to other measures, as exemplified in the Tweet below.

Figure 14 - Tweet from current Taoiseach Micheál Martin on Vaccination in Ireland.

Source: https://twitter.com/MichealMartinTD/status/1351193672709234688?s=20

Here we note that despite the already well-established safety and efficiency of vaccines for disease control, some political leaders, such as Republicans in the U.S. and the president of Brazil, publicly declared their scepticism in relation to the vaccination against coronavirus and suggested people should consider not to take the vaccine (Daniels 2021; Silva 2021; The Economist 2021). These actions feed even more the anti-vaccine groups and collaborate to the spread of vaccine hesitancy and low vaccination rates.

Figure 15 - Tweet from the HSE on contact tracing in Ireland.

Source: https://twitter.com/HSELive/status/1317156961142644737

The Department of Health focuses more on Physical Distancing guidance among the five topics, as seen in Figure 10, at the end of 2020 and start of 2021, when Ireland faced an

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increase of Covid cases. The topic the HSE dedicated more words on twitter was Tests and Contact tracing, which we see by their attention to reply queries specifically each situation when there is a need to self-isolate or to contact a GP to order a covid-test. The example in Figure 15 illustrates how the HSE has paid attention in this strategy, as they are direct responsible for this health service and offer the correct guidelines about it.

Conclusion

This study showed the political leaders and health authorities' accounts in Ireland made use of Twitter to communicate health measures and how those accounts approached themes related to covid from the perspective of WHO health policy guidance supported by scientific evidence. From the analysis, we found that those accounts reacted to the spread of Covid-19 with the sharing of scientific evidence and generally in line with WHO's interim guidelines. An effective public communication to gain public trust should disseminate accurate and timely information to counteract misinformation (OECD, 2020). This communication approach is aligned with what we found, especially in relation to Tweets peaks that occurred more frequently after announcements of new health restrictions, informing the public through high quality information and specialists clarifying the importance of the new adopted measures.

We also found that the four accounts had different approaches: the politicians focused more on positive, motivational messages based on sound evidence and the institutional accounts mostly concentrated on the sharing of Covid-19 information, health recommendations and facts, also in alignment with WHO's recommendations. We can relate this to the role of each institution and the difference between public communication and political communication. For example, while the current Taoiseach Micheál Martin demonstrated significant attention to Vaccination among his Tweets, he deals with other subjects that are also important to communicate online, such as the Brexit (as we can see in the word cloud in Figure 5). The akin approach on Twitter by both Taoisigh was also demonstrated quantitatively with the cosine similarity between them, the highest in our sample (Figure 7).

Research shows that specific communication on social media is also needed to help to ease the negative sentiments that come with experiencing a pandemic, relieving people's anxiety (Tsao et al. 2021). The employment of upbeat hashtags that projects a better future (Figure 6), along with emotional messages appealing to a sense of collectiveness, enforces this perspective. This was observed across all accounts, but this especially in the case of political leaders' accounts.

Related to the Covid-related responses, we pointed out that the HSE communicates more directly to users through Twitter answering queries about covid-related recommendations, especially about test and contact tracing, but quantitatively more than the other accounts across all five topics analysed. Mask Wearing was tweeted more by all accounts about after June 2020 when WHO updated their guidance and was not the top of attention for any of the accounts analysed in the period based on our selected words

for the dictionary. The Department of Health use their official account to provide information about the epidemiological scenario related to Covid and to make recommendations related to all measures, especially about physical distancing. Among the WHO recommended topics, Leo Varadkar focused more on social distancing and respiratory and hand hygiene, while Micheál Martin in Vaccination, aligned with the availability of evidence on Covid-related recommendations.

Those findings are important because they demonstrate the role of public communication for good governance based on solid scientific evidence to (re)build citizens' trust via effective online communication. Overall, it seems Ireland answered positively to the claims from researchers (Rufai and Bunce 2020; Tsao et al. 2021) to use social media to tackle infodemic and misinformation sharing health information and advice.

It is unclear, however, whether the alignment among the four accounts indicate public trust in government decisions or how government's usage of social media affects behaviour toward covid restrictions. While our findings suggest an evidence-based pandemic governance in Ireland, recent research has pointed to the lack of transparency around how decisions were made and a lack of accountability (Eustace, Hamill, and Mulligan 2021). This type of analyse is out of the scope of this paper, but we do recognise the need for more research on the role of transparency and accountability the building of public trust. In addition, we invite other researchers to use the dictionary created for this study (see Appendix 1), which can be adapted and used for exploring other social media actors in different contexts in future research.

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[1] This preliminary research is part of Marina Schenkel's Summer Research Internship Programme activities hosted by UCD Geary Institute, conducted under the supervision of and collaboration with Dr Valesca Lima.

[2] Wave 1 - 01/03/2020 to 01/08/2020, Wave 2 - 02/08/2020 to 21/11/2020 and Wave 3 - 22/11/2020 to July 2021. See Lima (2021) for a comparison among the three waves in Ireland. At the time of the writing, Ireland is entering a fourth wave. See https://www.irishtimes.com/news/health/fourth-wave-of-pandemic-beginning-in-ireland-holohan-1.4609212

[3] Source: https://twitter.com/LeoVaradkar/status/1239505182221905924?ref_src=twsrc%5Etfw

[4] Source: https://twitter.com/roinnslainte/status/1369013561587023887?s=20

[5] The cosine similarity is calculated using the angle between two vectors containing word counts of two documents. Because it focuses on the words they have in common, it is not sensitive to the lack of the same word (zeros), it is considered a good way to compare different documents. To know more see for example: https://www.sciencedirect.com/topics/computer-science/cosine-similarity.

Appendix 1 - Dictionary of Covid-19 evidence-informed responses

Table 1 - Dictionary of Covid responses

Theme of recommended public health measures	Related words
Respiratory and Hand Hygiene	hygiene, wash*, handwashing, cover, nose, mouth, tissue, sanitiz*, clean*, resistinfection, soap, alcohol-based, gel, elbow
Mask Wearing	mask*, covering*, shield*, ppe, ffr, respirator, n95, ffp2, ffp3
Physical Distancing	stay-at-home, distanc*, isolat*, quarantine, stayhome, staysafe, metre*
Test and Contact tracing	test*, tracing, tracker, covidtrackerapp, screening, case-finding, triage
Vaccination	vaccin*, covidvaccin*, astrazeneca, janssen, moderna, pfizer, sinopharm, sinovac, efficacy, immunization

* The word could finish with any suffix and still would count for our dictionary.

For each theme the WHO publications that we utilised are detailed below.

1. Respiratory and Hand Hygiene

Recommendations to Member States to improve hand hygiene practices to help prevent he transmission of the COVID-19 virus: Interim guidance, 1 April 2020: https://www.who.int/publications/i/item/recommendations-to-member-states-to-improve-hand-hygiene-practices-to-help-prevent-the-transmission-of-the-covid-19-virus

Responding to community spread of COVID-19: Interim guidance, 7 March 2020: https://www.who.int/publications/i/item/responding-to-community-spread-of-covid-19

2. Mask wearing

Advice on the use of masks in the context of COVID-19: interim guidance, 6 April 2020: https://apps.who.int/iris/handle/10665/331693

Advice on the use of masks in the context of COVID-19: interim guidance, 5 June 2020: https://apps.who.int/iris/handle/10665/332293

Mask use in the context of COVID-19: Interim guidance, 1 December 2020: https://www.who.int/publications/i/item/advice-on-the-use-of-masks-in-the-community-during-home-care-and-in-healthcare-settings-in-the-context-of-the-novel-coronavirus-(2019-ncov)-outbreak

3. Physical distancing

Overview of Public Health and Social Measures in the context of COVID-19, 18 May 2020: https://www.who.int/publications/i/item/overview-of-public-health-and-social-measures-in-the-context-of-covid-19

Critical preparedness, readiness and response actions for COVID-19: interim guidance, 7 March 2020 (also related to hand and respiratory hygiene and test and contact tracing): https://apps.who.int/iris/handle/10665/331422

4. Test and Contact tracing

Contact tracing in the context of COVID-19: Interim guidance, 10 May 2020: https://www.who.int/publications/i/item/contact-tracing-in-the-context-of-covid-19

Contact tracing in the context of COVID-19: Interim guidance, 1 Feb 2021: https://www.who.int/publications/i/item/contact-tracing-in-the-context-of-covid-19

COVID-19 diagnostic testing in the context of international travel Scientific brief, 16 December 2020: https://www.who.int/publications/i/item/WHO-2019-nCoV-Sci_Brief-international_travel_testing-2020.1

5. Vaccination

WHO SAGE values framework for the allocation and prioritization of COVID-19 vaccination, 14 September 2020: https://apps.who.int/iris/handle/10665/334299

Preparing countries for COVID-19 vaccine introduction, 21 September 2020-: https://www.who.int/publications/i/item/WHO-2019-nCoV-Vaccine-introduction-2020.1

Evidence to recommendations for COVID-19 vaccines: Evidence framework, 10 December 2020: https://www.who.int/publications/i/item/WHO-2019-nCoV-SAGE-Framework-Evidence-2020-1

COVID-19 advice for the public - Getting vaccinated: https://www.who.int/emergencies/diseases/novel-coronavirus-2019/covid-19-vaccines/advice