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Science communication in the media and human mobility during the COVID-19 pandemic: a time series and content analysis

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ABSTRACT

Objectives: The relationship between human mobility and nature of science (NOS) salience in the UK news media was examined.
Study design: This is a mixed-method study.
Methods: A time series NOS salience data set was established from the content analysis of 1520 news articles related to non-pharmaceutical interventions of COVID-19. Data were taken from articles published between November 2021 and February 2022, which correlates with period of the change from pandemic to endemic status. Vector autoregressive model fitting with human mobility took place.
Results: The findings suggest that it was not the number of COVID-19 news articles nor the actual number of cases/deaths, but the specific NOS content that was associated with mobility change during the pandemic. Data indicate a Granger causal negative direction ($P < 0.1$) for the effect of the NOS salience represented in the news media on mobility in parks, as well as the effect of scientific practice, scientific knowledge and professional activities communicated in news media on recreational activities and grocery shopping. NOS salience was not associated with the mobility for transit, work or residential locations ($P > 0.1$).
Conclusions: The findings of the study suggest that the ways in which the news media discuss epidemics can influence changes in human mobility. It is therefore essential that public health communicators emphasise the basis of scientific evidence to eliminate potential media bias in health and science communication for the promotion of public health policy. The present study approach, which combines time series and content analysis and uses an interdisciplinary lens from science communication, could also be adopted to other interdisciplinary health-related topics.

Introduction

Non-pharmaceutical interventions (NPIs), such as travel restrictions, have been the core of COVID-19 policies around the globe.[1] Individual efforts to fight the epidemic were unprecedented during this crisis. 'Responsible transport' policies,[2] which emphasise the collective efforts to mitigate the spread of epidemics, reaffirm the importance of individual responsibilities. In this regard, risk communication is key to engaging with the public on NPIs, as unbiased communication promotes acceptance, compliance and policy support. Mass media, such as newspapers, provide a medium to reach a large audience through mass communication, which can have great influence on not only the general public but also the government and transport operators.[3–5]

While pandemics qualify as a form of health crisis,[6] individuals are neither prepared nor possess knowledge of how to deal with such situations.[7] In addition, to support the guidance from experts and governments, information must be disseminated to mobilise the public. Perceivably useful and trustworthy information is usually based on scientific facts.[8] In the case of a health crisis, one of the objectives of science communication is to raise public awareness of the new aspects of scientific evidence, so that they can adhere to preventive measures.[9,10]

This article aims to contribute to the public health literature by focusing on the scientific aspect of risk communication and its relationship with the public mobility response. In particular, this study focuses on the representation of science from a meta-perspective, often referred to as 'nature of science' (NOS), in risk

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and health communication by defining science as a cognitive-epistemic and social-institutional system.[11–14] NOS refers to different aspects of science. It is a meta-level orientation to describe how science works. In other words, NOS provides a bird's-eye view on science, highlighting its various dimensions such as the characteristics of scientific knowledge.[15] The process of generating scientific knowledge behind communicating pandemic health advice involves various NOS categories[11,16] (Table 1). A recent sentiment analysis[17] revealed that the public generally responded positively to scientific method behind COVID-19 vaccines and treatments in tweets. However, it is not yet known whether these NOS aspects influence the tendency of the public to adhere to NPIs.

This study adopted the NOS framework and characterised scientific aspects of health and risk communication by news media. Focusing on NOS enables risk communication researchers to determine whether news media sufficiently articulates how scientific information is generated in risk communication, for example, in the context of the COVID-19 crisis.

Methods

Aims and contributions of the study

This study had two important objectives, as follows: (1) to investigate scientific information represented in UK news articles related to NPIs, such as travel restrictions, and responsiveness of individual actions to curb the spread of disease; and (2) to explore the relationship between the NOS salience in news articles and human mobility responses. A time series NOS salience data set was established from content analysis, and this was combined with a national mobility data set. To the best of the authors' knowledge, to date, there is no research of this nature in the public health literature, and it is important to explore whether the scientific aspect of risk communication is relevant to health policies and practices. In the empirical study, a time series analysis with VAR models was used. This method converted qualitative data from the content analysis into time series big data and is a promising approach for interdisciplinary public health research.

Content analysis

Two coders manually performed a content analysis of 1520 news articles from November 2021 to February 2022. These news articles were surveyed from four major newspaper outlets that cover the range of the political spectrum (The Guardian, The Times, The Telegraph and The Daily Mail).[18] These news articles were obtained from the news database Factiva.[71] The following keywords were used in Factiva: 'COVID-19', 'coronavirus', 'epidemic', 'outbreak', 'pandemic' or 'SARS-CoV-2'.[18] The results returned a total of 7760 news articles. These articles were then screened, and 1520 articles were selected on the basis that they included scientific information in communicating COVID-19 risks related to NPIs.

Next, the NOS framework[11] was used to analyse the inclusion of NOS in communication of COVID-19 NPIs by news media. The NOS framework enables the articulation of different aspects of science in a nuanced manner such that they can be differentiated and clarified. The framework comprises 11 categories that depict how scientific knowledge is formed, certified and affected by different social-institutional factors: aims and values, scientific knowledge, scientific practices, scientific methods, social values, social certification and dissemination, professional activities, scientific ethos, social organisations and interactions, financial systems and political power structures (see Table 1 for definitions). The salience of these NOS categories in newspapers was examined by content analysis. A deductive coding was carried out according to an existing framework[11] that guides the analysis of NOS included in

Table 1
Nature of science categories, aspects of risk communication and excerpts from eligible news articles.[21]

Category	Definition	Excerpts from news articles
Aims and values	The goals that scientific activities desire to fulfil.	"Professor Graham Medley, chair of the Scientific Pandemic Influenza Group on Modelling (SPI-M) … 'Our job is *to lay out a range of possibilities for the future*…'".[22]
Methods	The systematic approaches used to obtain reliable knowledge.	"However, cases are already running far above the numbers being confirmed by PCR testing and the UK is already *relying on other methods*, such as the Office for National Statistics Infection Survey, to assess levels of prevalence".[23]
Practices	A diverse set of activities, such as modelling and analysing data, that help obtain scientific knowledge.	"A travel ban on Britons means "we are successfully putting the brakes on Omicron" while virologists *estimate* the real number of new variant cases is ten times higher than the official figure of 347"[24]
Knowledge	The status of knowledge, such as its certainty and forms (i.e. theories, models).	"It committed the government to examine international public health *models*, learn from best practice, and *reshape* the health system to ensure 'an agile and well-planned response to future epidemics'"[25]
Social certification and dissemination	The peer review process and quality control of scientific processes and products.	"During the audit the firm was being *assessed* by the UK Accreditation Service (UKAS) *to see whether it could be awarded full accreditation* for processing tests".[26]
Scientific ethos	The set of norms, such as scepticism about claims, that scientists engage with	"Reicher's comments risk further undermining confidence in the political *impartiality of scientists* advising UK politicians on coronavirus strategy".[27]
Social values	A set of values agreed by the public in society, such as protecting the vulnerable, fulfilling personal reasonability and restoring the norm by "living with the virus".	"I think it is the wrong course of action for people to take because we have a serious situation we have got to manage and we encourage *everybody to play their part in addressing that*".[28]
Professional activities	Activities for communicating scientific research, such as attending conferences and publishing papers.	"Speaking at a Downing Street *press conference*, Johnson said anyone arriving in England will be asked to take a PCR test".[29]
Social organisations and interactions	The role of institutions, staff unions and research centres in influencing scientific work.	"O'Leary also said that the National Transport Authority (NTA) had not been responsive to *concerns raised by the union* since the onset of the pandemic".[30]
Financial systems	The role of economics in scientific research and economic impact on business.	"Hit hard by pandemic restrictions on travel, *sales in the eight weeks from 6 December were only 57%* of the equivalent in pre-pandemic 2019, the company said in a trading update".[31]
Political power structures	The role of how different political factors, such as politicians, affect scientific work.	"It is also a sign of desperation in Downing Street to avoid a lapse back into more severe restrictions, such as those the *prime minister was forced to introduce* – with great reluctance – last Christmas".[32]

news articles.[19] Initially, excerpts from COVID-19 news articles published in four news outlets corresponding to each NOS category were extracted by the first and second authors. To mark an instance of NOS, the excerpt should have keywords or phrases mentioning how scientific and health information in the crisis was obtained, for example, how the Prime Minster shapes public scientific advice during the COVID-19 pandemic. The first and second authors discussed whether these excerpts aligned with a specific NOS category, as well as refining the definitions of each NOS category based on the chosen excerpts. Coding was applied to each article, and more than one NOS category could be applied to each article (see Table 1 for examples of excerpts from news articles). In total, 10% of the articles were randomly selected and analysed by both coders (i.e. the first and second authors). Intercoder reliability, reflecting agreement of coding between both authors, was calculated.[19] The final Cohen's kappa coefficient was 0.81, which indicated an acceptable threshold of reliability.[20] The remaining news articles were analysed by both coders independently.

To operationalise content analysis in the time series analysis, the salience of an NOS category was defined as the proportion of codes addressing a specific NOS category per day. The proportion was calculated by dividing the number of codes addressing a specific NOS category by the number of codes on that day. The cumulative daily proportion of the NOS salience always summed to 1. Table 2 presents the mean number of articles addressing an NOS category each day.

Time series analysis

The association of the percentage of daily NOS salience in the UK national media on national-level mobility indicators was examined. Human mobility data were obtained from the community mobility report developed by Google,[33] which has been used in many empirical studies in the literature.[34–36] The data set shows how visits and length of stay at different location categories, including retail and recreation (e.g. restaurants, cafes, shopping centres), grocery and pharmacy (e.g. grocery supermarkets), parks (e.g. parks and public beaches), transit (e.g. public transport hubs), workplaces and residential areas, change compared with a baseline (i.e. the median value for the corresponding day of the week during the 5-week period from 3 January to 6 February 2020). COVID-19 situation data were obtained from the Oxford COVID-19 Government Response Tracker and details can be found in the study by Hale et al.[37] Table 2 presents the descriptive statistic of mobility and COVID-19 situation data.

First, the augmented Dickey–Fuller test (ADF) was used to determine the stationarity of variables and their order of integration. Dickey and Fuller[38] tests determine the presence of a unit root (then, the series can be considered as non-stationary) or not (the series is stationary). The Dickey–Fuller test is testing if $\gamma = 0$ in this model of the data:

$$\Delta y_t = \alpha + \beta t + \gamma y_{t-1} + \delta_1 \Delta y_{t-1} + \delta_2 \Delta y_{t-2} + \ldots$$

where y_t is the time series data. A linear regression of Δy_t against t and y_{t-1} was conducted for testing if γ is different from 0. If $\gamma = 0$, then there was a random walk process, otherwise there was a stationary process.

The null hypothesis for both tests was that the data were non-stationary. The analysis started by applying a unit root test on the variables included in the data set. As can be seen in Table 2, the null hypothesis that each of the variables contains a unit root was rejected at the 10% critical level, except for 'hospitalisation' and 'stringency'. Analytically, the ADF t-statistics for the first difference of the variables were statistically significant, leading to the rejection of the null hypothesis that the first differences are non-stationary. That is, hospitalisation and stringency were characterised by integration of degree one, whereas all the other variables of interest were stationary.

Table 2
Descriptive statistic and unit root test of mobility, NOS salience and COVID-19 situation data.

Variable	Mean	SD	Minimum	Maximum	ADF (levels)			ADF (first differences)		
					t-stat	Critical values	Stationarity	*t*-stat	Critical values	Stationarity
Mobility (location)										
Recreation	−0.14	0.11	−0.87	0.07	−6.007	−2.889	Yes	–	–	–
Grocery	0.01	0.13	−0.88	0.42	−6.808	−2.889	Yes	–	–	–
Parks	0.08	0.14	−0.49	0.42	−7.444	−2.889	Yes	–	–	–
Transit	−0.33	0.10	−0.81	−0.17	−3.946	−2.889	Yes	–	–	–
Work	−0.27	0.16	−0.78	−0.01	−5.736	−2.889	Yes	–	–	–
Residential	0.08	0.04	0.00	0.21	−5.654	−2.889	Yes	–	–	–
Media										
NOS category										
Aims and values	0.03	0.04	0.00	0.17	−10.197	−2.889	Yes	–	–	–
Methods	0.03	0.03	0.00	0.12	−10.920	−2.889	Yes	–	–	–
Practices	0.13	0.06	0.00	0.35	−8.908	−2.889	Yes	–	–	–
Knowledge	0.09	0.06	0.00	0.38	−9.768	−2.889	Yes	–	–	–
Social certification and dissemination	0.03	0.03	0.00	0.17	−9.358	−2.889	Yes	–	–	–
Scientific ethos	0.01	0.02	0.00	0.14	−10.291	−2.889	Yes	–	–	–
Social values	0.12	0.06	0.00	0.29	−9.237	−2.889	Yes	–	–	–
Professional activities	0.10	0.06	0.00	0.29	−10.756	−2.889	Yes	–	–	–
Social organisations and interactions	0.05	0.04	0.00	0.20	−9.994	−2.889	Yes	–	–	–
Financial systems	0.10	0.07	0.00	0.38	−9.401	−2.889	Yes	–	–	–
Political power structures	0.31	0.07	0.14	0.50	−8.467	−2.889	Yes	–	–	–
Daily number of COVID-19 news articles	12.6	6.21	2	32	−6.051	−2.889	Yes	–	–	–
COVID-19 situation										
Cases	82435.62	83359.83	29843	847371	−8.166	−2.889	Yes	–	–	–
Deaths	174.74	137.27	3	1121	−7.470	−2.889	Yes	–	–	–
Hospitalisation	11857.54	4175.40	7251	20062	−0.605	−2.889	No	−4.768	−2.889	Yes
Stringency	44.13	5.05	23.15	48.61	2.062	−2.889	No	−8.162	−2.889	Yes

ADF, augmented Dickey–Fuller; NOS, Nature of science; SD, standard deviation.

If the series presents the same order of integration, a risk of cointegration between variables was possible. Cointegration tests must be undertaken. The existence of a possible cointegration relationship implies that variables must be non-stationary. The Johansen[39] cointegration tests were used to determine the number of cointegration relationships. These tests require the selection of the optimum lags of the VAR model, which were determined with the likelihood ratio, final prediction error criterion, Akaike information criterion, Hannan-Quinn information criterion and Schwarz information criterion. Lag-order selection statistics for VARs were obtained using the 'varsoc' function in Stata/SE 17.0. Then, the lag length (p) was selected through the estimation of an unconditional VAR model (Table 3). Equations of the test are detailed in a study by Khan and Khan.[40]

Results

Mobility at all locations was generally stable throughout the study period, except during the omicron outbreak from mid-December 2021 to mid-January 2022. Residential mobility maintained a slightly higher level than at baseline, whereas mobility at the other locations declined rapidly after the outbreak. Locations categorised as retail and recreation, grocery and pharmacy, and parks sharply increased after a one week time frame, whereas locations of transit and workplace gradually returned to the pre-outbreak levels. From the VAR model, it can be seen that mobility in some locations was associated with mobility in other locations. Transit, being a fundamental location for transport services, was positively associated with all locations, except parks. These results support the usefulness of mobility data in the case of the United Kingdom.

Next, the NOS salience in COVID-19–related news (Table 2) was examined. The political and power structures was the most prominent NOS category in risk communication in COVID-19 news (mean = 0.31); the practices category was the second most prominent (mean = 0.13); and social values was the third most prominent category (mean = 0.12). Scientific ethos was the least prominent among all 11 NOS categories (mean = 0.01). These results suggested that while a great deal of emphasis was placed on the politics in news media whereas the ethos of science, in terms of scepticism and universalism, was overlooked.

Finally, relationships between mobility and the NOS salience were examined. Granger causality tests performed on the VAR models showed that there was instantaneous causality between the media frames and mobility in almost every model for the containment and social frames and Granger causality in some. Table 4 details the coefficients in six models. A Granger causal direction ($P < 0.1$) represents an effect of the NOS salience in news media on mobility and can be seen in public parks, as well as the effect of scientific practice, knowledge and professional activities represented in news media on recreation and grocery. The directions of association were all negative, meaning that higher NOS salience represented in news media contributed to decreased mobility. NOS salience communicated in news media was not associated with mobility at transit, work or residential locations ($P > 0.1$).

Fig. S1 in the supplementary material shows a graphical representation of human mobility, NOS salience and COVID-19 situation indicators over study period.

Table 3
Lag selection.

Lag	FPE	AIC	HQIC	SBIC
0	3.00E-23	7.73824	7.94505	8.24796
1	6.80E-25	3.84369	8.39348	15.0575
2	8.50E-25	3.30045	12.1932	25.2183
3	2.10E-25	−0.508144	12.7276	32.1138
4	1.60E-27	−11.9945	5.58422	31.3315
5	7.e−244[a]	−536.005[a]	−514.084[a]	−481.975[a]

FPE, final prediction error criterion; AIC, Akaike information criterion; HQIC, Hannan-Quinn information criterion; SBIC, Schwarz information criterion.
[a] Optimum lags.

Discussion

This empirical study examined the relationship between NOS salience in news media and public mobility. The results suggest that it is not the number of COVID-19 news articles,[41,42] but it was the amount of NOS content in news media that was associated with pandemic mobility. Specifically, scientific practices and knowledge, which refer to the scientific activities that lead to the generation of scientific knowledge and the sources and forms of knowledge in risk communication, respectively, were associated with decreased time spent in recreation, grocery and park locations, given that the two variables are complementary and therefore tend to be opposite in direction. In other words, it was not the exact number of COVID-19 cases, but the salience of scientific practices (e.g. analysing COVID-19 case data by the government) and knowledge (e.g. uncertainty in trends of COVID-19 cases) related to the COVID-19 situation reported in the media that impacted mobility changes (i.e. decrease in overall mobility and an increase in time spent at home). Meanwhile, the NOS (represented by news media) was highly associated with decreased time spent in park areas. However, the impacts of mobility at transit, work and residence locations were not significantly associated with NOS salience. This could potentially be explained from the transport perspective, in that transit and work are essential trips unless the government implement social distancing practices (e.g. work from home). The findings for the residence location tended to be in the opposite direction to transit and work locations. Recreation, grocery and park locations can be deemed as relatively optional (i.e. non-essential trips). Although most associations were instantaneous (making it impossible to determine the causal direction of effects), the Granger causality tests suggested directional effects of NOS salience in news media on mobility in public parks. The data suggested that it was more likely that the media influenced mobility and not *vice versa*.

Implications

In the 'opening-up' period during the COVID-19 crisis, travel behaviours were mainly driven by public perception of viral risks and uncertainties. Uncertainties perceived by people led them to actively practise social distancing (e.g. to avoid gathering in public areas such as grocery supermarkets, transit areas and workplaces) and shift to more open areas, such as parks.[43–46] As public transport was unjustifiably stigmatised by media, authorities and citizens,[47,48] passengers who were concerned about the risk of infection tended to drive more and avoid public transport,[49,50] which continues in the post-pandemic period.[51]

News media is the major source where the public obtains risk information in the COVID-19 pandemic[52] to make informed decisions. According to risk communication models,[53,54] the public should be informed about risks (health and social) and responses (individual and organisational). Owing to a flow of misinformation in mass media, news plays a role in alerting the public to danger and reassuring the public in the trustworthiness of scientific information.[55] However, risk communication in news media often lacks robust information on the sources and reliability of scientific knowledge.[56,57] In the healthcare pandemic crisis, news media

Table 4
VAR model coefficients.

Independent variable	Dependent variable											
	Recreation		Grocery		Parks		Transit		Work		Residential	
	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error
Mobility (location)												
Recreation	−0.89[a]	0.30	−1.14[a]	0.38	−0.62	0.38	−0.70[a]	0.23	−0.68	0.45	0.01	0.12
Grocery	0.38[b]	0.20	0.30	0.26	0.32	0.26	0.02	0.16	−0.32	0.31	0.12	0.08
Parks	−0.15[b]	0.09	−0.04	0.11	−0.14	0.12	0.08	0.07	0.36[a]	0.14	−0.07[c]	0.04
Transit	1.25[a]	0.34	1.24[a]	0.42	0.34	0.43	1.58[a]	0.26	1.98[a]	0.51	−0.41[c]	0.13
Work	−0.35[b]	0.19	0.01	0.24	−0.05	0.24	−0.16	0.15	0.31	0.29	0.00	0.08
Residential	−0.27	0.84	0.44	1.06	0.17	1.06	1.24[b]	0.66	3.96[c]	1.27	−0.61[b]	0.33
Media												
NOS category												
Aims and values	−0.66	0.47	−0.60	0.59	−2.03[a]	0.59	−0.09	0.36	0.48	0.70	−0.06	0.18
Methods	−0.47	0.46	−0.36	0.57	−1.23[c]	0.58	−0.07	0.36	0.40	0.69	−0.06	0.18
Practices	−0.98[c]	0.42	−0.95[c]	0.52	−1.57[a]	0.53	−0.31	0.33	0.30	0.63	−0.07	0.16
Knowledge	−0.70[b]	0.42	−0.73	0.53	−1.47[a]	0.53	−0.12	0.33	0.56	0.63	−0.09	0.16
Social certification	−0.57	0.53	−0.58	0.67	−0.88	0.67	−0.15	0.41	−0.05	0.80	0.01	0.21
Social values	−0.62	0.43	−0.70	0.54	−1.14[c]	0.54	0.00	0.33	0.50	0.65	−0.11	0.17
Professional activities	−0.77[b]	0.46	−0.83	0.58	−1.70[a]	0.58	−0.08	0.36	0.62	0.69	−0.13	0.18
Social organisations	−0.68	0.48	−0.87	0.61	−1.52[c]	0.61	0.00	0.38	0.68	0.73	−0.18	0.19
Financial systems	−0.66	0.41	−0.73	0.51	−1.59[a]	0.52	−0.01	0.32	0.74	0.62	−0.13	0.16
Political power structures	−0.68	0.41	−0.73	0.52	−1.54[a]	0.52	−0.08	0.32	0.62	0.62	−0.14	0.16
No. of COVID-19 news articles	0.00	0.00	0.00[b]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
COVID-19 situation												
Cases	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Deaths	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hospitalisations	0.00	0.00	0.00	0.00	0.00[b]	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Stringency	0.00	0.01	0.00	0.01	0.03[c]	0.01	0.00	0.01	−0.02	0.01	0.00	0.00
Constant	0.77[b]	0.40	0.94[b]	0.50	1.59[c]	0.51	0.05	0.31	−0.52	0.60	0.11	0.16

Scientific ethos omitted because of collinearity. The cumulative daily proportion of the NOS salience always sums to 1 and thus one category could not be put together in the model due to multicollinearity.
NOS, nature of science; VAR, vector autoregressive model.
[a] Significant at the 0.01 level.
[b] Significant at the 0.1 level.
[c] Significant at the 0.05 level.

often uses sensationalism to heighten public concerns.[58] For example, the scientific frame focused mainly on the biology of the virus and health impacts (e.g. symptoms and case/deaths) but lacked practical advice for individuals and communities.[59] This suggests that the media did not provide the public with the necessary information to make informed decisions.

In addition, social media platforms provide alternative means for public engagement in scientific communication during pandemic crises.[17,60] However, this could lead to the unintentional spread of misinformation.[61] Poor adherence, mistrust and public fear are factors that threaten the effectiveness of the public health measures to prevent the spread of diseases.[62] The present study, by identifying certain types of NOS salience in news media that were associated with changes in public mobility, can help the government and media publishers understand how scientific content in the media mediates community responses in future health crises. To help individuals make informed decisions and minimise the effects of the pandemic, it is important to disseminate scientific content in (social) media to prevent further spread of the virus in an effective and sustainable manner.[63]

Limitations

The present study was subject to several limitations. First, the study was limited by a lack of information on the distribution and size of the mobility data collected by Google. Furthermore, the data were only available for Android users whose location history had been turned on. Despite these constraints, multiple scholars have found that the data can be useful in predicting social phenomena.[34–36] In addition, although the Granger test results suggested that directionality was applicable for some variables, causality should be taken with a caution, as this study did not directly examine how exposure to news articles impacted individuals' behaviours. In addition, the manual coding of news articles might be influenced by the background and expertise of the coders. As NOS is a meta-characterisation of how scientific information was obtained in communicating public health crises, using a machine learning technique for processing news articles might not accurately capture holistic aspects of scientific works. This is counterbalanced by calculating intercoder reliability and providing an explanatory and transparent procedure of coding.

The study findings demonstrate the need to cover epidemics in responsible ways that emphasise how scientific information is generated and how risk information is shared. Even after the effects of COVID-19 have diminished, the public remain concerned and fear for their safety on public transport.[51] To restore public trust in public transport, the government and general practitioners need to promote and introduce specific measures,[64–68] possibly starting with the justification of sources and forms of scientific information in the news media.

Future research could further examine the geographical disparities and exposure to different media platforms within the same country or among different countries. The present study approach combines time series and content analysis, as well as using an interdisciplinary lens from science communication. This approach can be adopted to other interdisciplinary public health topics, such as air pollution in relation to climate change and physical activity in relation to emerging transport innovations, such as the e-scooter.

Finally, using a nuanced approach to the characterisation of science in health and risk communication, namely, through a robust framework on NOS, researchers may potentially uncover what aspects of science in health and risk communication in news media need to be clarified and emphasised for enhanced mobility response to crises such as the COVID-19 pandemic.[69,70]

Author statements

Ethical approval

Not applicable.

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Competing interests

The authors declare that they have no competing interests.

Author contributions

H.-Y.C. contributed to conceptualisation, data curation, methodology, software, visualisation and writing, reviewing and editing. K.K.C.C. contributed to conceptualisation, data curation, methodology, writing, reviewing and editing. S.E. contributed to conceptualisation, supervision, and review and editing.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.puhe.2023.03.001.

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