Issue Note

Misinformation and disinformation in relation to COVID-19

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Executive summary

Question: What is currently known about misinformation and disinformation in relation to COVID-19?

Definitions:

Misinformation: "Information that is false, inaccurate, or misleading. Unlike disinformation, misinformation does not necessarily need to be created deliberately to mislead. Misinformation is sometimes used to refer exclusively to inaccuracies that are accidental; however, since it is difficult to ascertain the intentions of the unknown individuals who create falsehoods that spread on the internet, we use misinformation as a broader umbrella term here." (1)

Disinformation: "Information that is false or inaccurate, and that was created with a deliberate intention to mislead people." (1)

Infodemic: "An "infodemic" is an overabundance of information – some accurate and some not – that occurs during an epidemic. It spreads between humans in a similar manner to an epidemic, via digital and physical information systems. It makes it hard for people to find trustworthy sources and reliable guidance when they need it." (2)

Summary of Included Resources

This rapid review includes three reviews of the evidence, 29 individual studies, and six other relevant documents (e.g., a report or handbook). Articles published until 5 March 2021 are included. In addition, we identified 10 relevant websites and a total of 10 funded research projects with lead researchers based in ON (5), QC (2), and one each in British Columbia, Nova Scotia, and Alberta. We may have missed some resources due to the rapid timeframe for this review.

What do we know?

People are regularly exposed to misinformation, and this can have serious impacts on public health (e.g., due to non-compliance with public health guidance, vaccine hesitancy, mental health impacts, and use of non-recommended treatments). Factors that are associated with susceptibility to misinformation include younger age, lower income, and lower levels of trust and numeracy. Strategies to address misinformation include 'nudging' (structuring choices in a way that influences behaviour), improving health literacy, and monitoring and debunking misinformation.

What are notable gaps?

- There is a lack of high-level evidence (i.e., evidence from systematic reviews, meta-analysis, or rapid reviews) focused on infodemics or misinformation globally as well as for Canadian contexts.
- We did not identify any qualitative studies that collected data on the users' perspective and considered how this data can be used to improve the public health response.
- "Our review highlights the paucity of studies on the application of machine learning on social media data related to COVID-19 and a lack of studies documenting realtime surveillance developed with social media data on COVID-19" (3).
- "Studies evaluating effective counter-infodemic interventions are also needed (3).

What is on the horizon? What are the studies that are underway to address the gaps?

There are currently 10 ongoing Canadian studies looking at misinformation. For example, Dr. Syed at York University is analyzing the **viral character and effects** of social media misinformation. Other ongoing studies look at how to **best address misinformation** such as: Dr. Caulfield's research at the University of Alberta looking at mapping and countering misinformation; research led by Dr. Fafard at the University of Ottawa includes comparative research related to communication and how misinformation is addressed in five different countries, including Canada. Dr. Fahim, Unity Health Toronto, will look into combating misinformation, fear, and stigma in collaboration with researchers from Singapore; Dr. Gillis, University of Toronto, will look at responding to stigma, fear, discrimination, and misinformation; Dr

Parsons, Dalhousie University, will look at how to best educate, engage and empower the public; and Dr. Veletsianos, Royal Roads University will look at inoculating against an infodemic. Two other studies (Dr. Dubé, University of Laval and Dr Genereux, University of Sherbrooke) are examining the **behavioural factors affecting the communities' response**. Finally, research led by Dr. Kennedy, York University, is related to understanding social perceptions of risk, information sources, trust, and public engagement related to the COVID-19 outbreak.

Concluding statement

This pandemic is characterized by the need to fight the disease, but also to fight against the unprecedented spread and impact of misinformation. More Canadian research is on the way to better understand how to best monitor and respond to the misinformation as part of the infodemic.

CanCOVID Rapid Review

What is currently known about misinformation and disinformation in relation to COVID-19?

Summary of included resources

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Misinformation and disinformation

This rapid review focuses on research related to COVID-19 and misinformation, disinformation, fake, rumors, conspiracy theories and/or false news. These concepts remain ambiguous and have different meanings in the public health, science, and communication domains (4). In this document we make the distinction between false, inaccurate or misleading information that is spread deliberately to mislead people (disinformation) and that which is accidentally spread (misinformation). Misinformation can be seen as the broader umbrella term (5); for readability of this document we will use this broader term to refer both to misinformation and disinformation.

Introduction

There are different models to characterize mis/disinformation, see for example Jia, 2020 (4) and Schillinger, 2020 (6). Other documents that provide key information with regards to misinformation include the World Health Organization (WHO)'s framework for managing the COVID-19 Infodemic (7), key considerations for online misinformation in the context of COVID-19 (8), and WHO's public health research agenda for managing infodemics (2).

This summary is organized following the four pillars of infodemics as developed by Eysenbach (5); 1) Monitoring Infodemiology, Infoveilance and Social Listening, 2) Building e-Health Literacy, 3) Knowledge Refinement, Filtering and Fact-Checking, The fourth pillar (Facilitate Accurate Knowledge Translation) is not included in this review as no studies were identified relating to this pillar.

Different classifications of the kinds of misinformation exist, and we highlight an example here where a study developed six main themes of reports on rumors, stigma and conspiracy theories based on 2311 posts from Twitter: 1) illness, transmission and mortality, 2) control measures, 3) treatment and cure, 4) cause of the disease including the origin, 5) violence, and 6) miscellaneous (9).

We identified one study with data from Canada: a COVID-19 news, social media and misinformation survey. This survey found that "68% of Canadians reported encountering COVID-19 misinformation on at least one of the social media sites/apps they use". Those who reported encountering misinformation "indicated they would consult other sources to verify information". Unfortunately, "56% of respondents in this cohort said they had never reported an account/post that shared misinformation to the social media site" (10). Canadians have a high degree of trust in "the accuracy of COVID-19 news from official sources". Similar findings can be found in the COVID-19 Global Knowledge Attitudes and Practice (KAP)

survey of Canada: Canadians have a higher trust in scientists, local health workers, world health organization and politicians – than in comparison to the global average. However, Canadians have a lower trust in televisions, newspapers, radio, journalists, online sources, ordinary people and social media than the average globally (KAP COVID Country Profiles with Demographic Disaggregation - Johns Hopkins Center for Communication Programs (jhu.edu)).

1. Monitoring Infodemiology, Infoveillance and Social Listening

Definitions:

Infodemiology: "Infodemiology can be defined as the science of distribution and determinants of information in an electronic medium, specifically the Internet, or in a population, with the ultimate aim to inform public health and public policy" …if the primary aim is surveillance, then this is called **infoveillance"** (11)

Social listening: "an emerging type of listening and as a means of attaining interpersonal information and social intelligence that can empower relationships and influence the way we listen to and communicate with one another through increasingly popular mediated channels" (12).

This pillar relates to the continuous monitoring and analysis of data and information exchange patterns on the internet (5). This topic is divided in three sections for this review: 1) prevalence of misinformation, 2) individual characteristics of people susceptible for misinformation, 3) spread of misinformation and 4) impact of misinformation.

1a) Prevalence mis- and/or disinformation

Five studies found a high prevalence of misinformation across different information resources such as websites, YouTube videos, social media platforms. This is in line with findings from surveys where about 70% of the participants report exposure to misinformation in Canada (10) and South Korea (13).

Three studies reviewed the content of the most viewed COVID-19 related videos on YouTube. Two studies found that 70% of these videos were useful (14, 15), one study found that 9% of the videos were misleading (14) or that 27.5% of the videos contained non-factual information (16). Independent users were more likely to post misleading videos whereas news agencies were most likely to post useful videos (14).There is a need for increased efforts from reputable sources to disseminate accurate information (14).

Another study looked at a 100 million Twitter messages aiming to define specific indicators for infodemic risk in countries. In this study Canada was described as a low-infodemic risk country. In addition, infodemic risk decreased for the majority of the countries as the epidemic spread, pointing at an increased focus on reliable news sources (17).

Finally, one study measured the quality of COVID-19 related health information of 48 URLs and found that there was an overall lack of good quality websites in March 2020, with results from sites like .edu, .gov and .org scoring higher for quality information (18).

1b) Individual characteristics

Research in this domain investigated what kind of specific individual characteristics are associated with people who are more prone to misinformation. In South Korea *exposure to misinformation* was associated with younger age, higher education level and lower income (13). Another study, in Australia, found an association between *misinformation beliefs* and younger age, male gender, lower education level and speaking another language then English, lower levels of digital health literacy, lower perceived threat of COVID-19, lower confidence in the government and lower trust in scientific institutions (19). Finally, one study looked that the association of certain characteristics and *susceptibility to misinformation* in the

United Kingdom (UK) and the United States of America (USA), Ireland. Mexico and Spain (20). These findings are summarized in the table below:

Table 1: Factors associated with susceptibility to misinformation

Associated to susceptibility to misinformation	Country and study reference
Younger age	UK, USA, Ireland and Spain (Roozenbeek, 2020)
Self-identifying as a minority	USA, Ireland, Spain and Mexico (Roozenbeek, 2020)
Lower trust in scientific institutions or researchers	UK, USA, Ireland, Spain and Mexico (Roozenbeek, 2020), USA (Agley, 2020(21))
Being exposed to information about the virus through social media	UK, USA and Ireland (Roozenbeek, 2020)
Lower performance on numeracy tasks	UK, USA, Ireland, Spain and Mexico (Roozenbeek, 2020)
Political conservatism	Ireland, Spain and Mexico (Roozenbeek, 2020)

Other factors that were investigated included for example “the susceptibility to false memories following exposure to fabricated news stories about the pandemic”. A “false memory is a phenomenon whereby individuals experience strong familiarity and recollection for events that never happened” (22). This study found that, in a sample of 3746 participants, “22.56% reported a false memory for at least one fabricated story”. “False memories were especially likely among individuals who are less analytic and less knowledgeable about the pandemic; in contrast, individuals who believed themselves to be very knowledgeable, or who reported high virus-related anxiety and frequent engagement with related media, reported more true memories but did not report correspondingly fewer false memories” (23).

A study in UK and USA conducted a randomized control trial and found that “some sociodemographic groups are differentially impacted by exposure to misinformation”. For example, low income groups are “less likely to lower their vaccination intent to protect themselves or others upon exposure to misinformation than the highest income group” (24). Further, a study in Australia found that strong agreement with misinformation related to prevention was associated with male gender and younger age, whereas misinformation related to causation was associated with lower education level and greater social disadvantage and misinformation related to cure was associated with younger age (19).

1c) Spread of misinformation

One study employed the metaphor of an epidemic to develop a “framework to guide the investigation and assessment of social media and public health” (6). In this study social media plays a role as contagion, as vector, as treatment, as inoculant, for surveillance, for disease control and mitigation (6). The following study (25) also used epidemic models to measure how false information spreads across five different social media platforms (Twitter, Instagram, YouTube, Reddit and Gab). This study found that information from sources either marked as reliable or questionable have similar spreading patterns. This study also measured the permeability of a platform to posts from questionable/reliable news outlets (defined as the coefficient of relative amplification) and found that Twitter was the most neutral, while YouTube amplified questionable sources less. Amongst less popular social media, Reddit reduces the impact of questionable sources, while Gab strongly amplifies them. The study concludes “that the main drivers of information spreading are related to specific peculiarities of each platform” (25).

Another study investigated the different characteristics of the spread of three different types of misinformation (misinformation related to 5G, ginger and sun) across eight English-speaking countries. This study found different doubling times, different start times of the misinformation appearance and incongruent peaks. This study concluded that a better understanding of the spread of misinformation and

similarities and differences across different contexts can help design appropriate interventions that limit the impact of misinformation (26).

1d) Impact of misinformation

In previous sections we reported that people are regularly exposed to misinformation. Misinformation can have potentially serious implications on the individual and community if prioritized over evidence-based information (9). This highlights the importance of limiting the spread of misinformation about the virus (20). In addition, understanding the impact of misinformation can inform the focus of public health strategies (27). "From "infodemics" perspective, additional research is needed to investigate how effective misinformation/rumours/fake news, such as anti-mask wearing, undermine preventions to compromise public health, although social media companies like Twitter and Facebook recently started to remove misinformation-based accounts or label unaccountable posts" (3).

Recommendations from different studies included:

- "health agencies must track misinformation associated with the COVID-19 in real time, and engage local communities and government stakeholders to debunk misinformation" (9).
- "It will be critical to confront both conspiracy theories and vaccination misinformation to prevent further spread of the virus in the US. Reducing those barriers will require continued messaging by public health authorities on mainstream media and in particular on politically conservative outlets that have supported COVID-related conspiracy theories" (28).
- Another effective strategy may be to "tell the stories of people who experienced significant consequences" from the use of treatments not validated by health authorities "or employing the protagonists of these stories as testimonials. Certainly, healthcare professionals, who are the main holders of patient trust, must be involved in these campaigns to communicate correct drug use" (29).

Exposure to misinformation damages society in a number of ways such as decreased compliance with public health guidance, vaccine hesitancy, mental health impacts, use of non-recommended treatments and overreaction (such as hoarding goods). Some of these impacts are described in more detail below:

Mental health: Two studies found that misinformation exposure was associated with psychological distress including anxiety, depressive and posttraumatic stress disorder symptoms in South Korea (13) and with increased anxiety scores in Singapore (30). With regards to access to general information, it was found that the official governmental WhatsApp channel was linked to reduced anxiety in Singapore (30).

Protective behaviours: Several studies found that there is no direct association between misinformation *exposure* and protective behaviours (13). Misinformation *belief* however, was associated with fewer preventive behaviours in South Korea (13) and in the USA (28). *Susceptibility* to misinformation was also associated with lower compliance with public health guidance in Spain, Mexico and the USA but not in Ireland and the UK (20). Another study, however, finds that "belief in COVID-19 related misinformation is less relevant to protective behaviors, but beliefs about the consequences of these behaviors are important predictors". This study recommends that health campaigns "emphasize the benefits of the protective behaviours rather then debunking unrelated false claims" (27).

Vaccination: Belief in COVID-related conspiracy theories predicted resistance to future vaccination in the USA (28). Another study found "recent misinformation induced a decline in intent of vaccination by 6.2 percentage points in the UK and 6.4 percentage points in the USA amongst those who stated that they would definitely accept a vaccine" and "scientific-sounding misinformation was more strongly associated with declines in vaccine intent (24). A study in the USA, UK, Ireland, Spain and Mexico found that an increase in the susceptibility to misinformation was associated with a decrease in the likelihood to get vaccinated and to recommend vaccination to vulnerable friends and family. "Conversely being older, male

and especially having higher trust in scientists are all associated with an increased likelihood to get vaccinated against COVID-19, as well as to recommend others to get vaccinated" (20).

Medication: A substantial proportion of misinformation concerned drugs that could have potential efficacy in the prevention or treatment of COVID-19. This kind of misinformation led to depleted stocks, the distribution of falsified products and drug intake without medical supervision (29). One example is the death of at least 700 people in Iran due to acute methanol intoxication as a consequence of fake misleading messages on social media and the internet of the protective effects of drinking alcoholic beverages as a prophylaxis of COVID-19 (31)

2. Build eHealth Literacy

This pillar "is to enhance the capacity of all stakeholders to build eHealth literacy, to select and assess health and science information found on the different layers of the information cake" (5). Research in this domain looked at 1) "different electronic strategies and interventions to increase the users' health literacy", (another term frequently used in relation to this is the inoculation against misinformation) and 2) why people share misinformation.

Two librarians wrote a paper on *The COVID-19 Misinformation Challenge*. This weeklong program aimed to help participants discern coronavirus fact from fiction" in different information sources. This Challenge was found to be popular, fun and educational (32).

A synthesis of the literature investigating why people believe and share "fake news" and other misinformation online found that "poor truth discernment is linked to a lack of careful reasoning and relevant knowledge as well as to the use of familiarity and other heuristics". Furthermore, there is "a substantial disconnect between what people believe and what they will share on social media" – largely driven by inattention. Effective interventions can influence social media users to consider the accuracy of the information retrieved, and can leverage crowdsourced veracity ratings (i.e. from fabricated to true) to improve social media ranking algorithms (1). "Research looking at the individual differences in susceptibility to false memories suggests that interventions aimed at increasing critical thinking or improving subject-knowledge, may help to reduce susceptibility to COVID-19 related fake news." In addition, governments may wish to consider proposals to include media literacy and critical thinking training in school curricula, to better prepare the next generation to discriminate true news from false news (23)

A study found "that the exposure to a corrective graphic on social media reduced misperceptions about the science of one false COVID-19 prevention strategy but did not affect misperceptions about prevention of COVID-19". "Similar impact was found when the graphic was shared by the World Health Organization or by an anonymous Facebook user and when the graphics were shared pre-emptively or in response to misinformation". This study concludes that "health organizations can and should create and promote shareable graphics to improve public knowledge" (33).

A study in Nigeria proposes a conceptual framework combining three theories: uses and gratification theory ("dominant theoretical approach to studying how and why individuals utilize media"), social networking sites dependency theory and social impact theory. This study drew data from 650 social media users. The results indicate that tie strength ("the level of intensity of the social relationship") is the strongest predictor of fake news sharing. It also found that perceived herd, social networking sites dependency, information-seeking and parasocial interaction were significant predictors of fake news sharing. The effect of status-seeking on fake news sharing was not significant. This study also found that gender and age had no significant effect on fake news sharing. In addition, the data suggests that "those with a high level of fake news knowledge tend to be more sceptical and critical when sharing information" (34).

An online survey, conducted in the USA with more than 1,700 adults, found that people were willing to share fake news “that they would have apparently been able to identify as being untrue if they were asked directly about accuracy”. This study also found that when participants were primed to think about accuracy, their level of discernment between sharing true and sharing false headlines was nearly tripled. Factors such as social validation and reinforcement may be more important than accuracy (35).

Finally, in a scoping review about social media in the time of COVID advices “to make the public inoculated against misinformation, public health organizations should create and spread accurate information on social media because social media have increasingly played an important role in policy announcement and health education” (3).

3. Knowledge Refinement, Filtering and Fact-Checking

This pillar captures activities “to encourage, facilitate, and strengthen knowledge refinement and filtering processes on each level, to accelerate internal quality improvement processes (5).” In this review we did not include individual research studies that report on measuring or debunking a single specific piece of misinformation. Efforts of some of the biggest internet and social media companies include actions such as the introduction of technical gatekeepers to control information, a chatbot to connect users with fact-checking organizations, machine learning algorithms to detect the advertisement of false claims, a ban on the sale of commercial safety products to ease the panic buying and a Fact Check Explorer to indicate the veracity of search results (36). Past research shows that corrections of misinformation cannot completely undo the impact of misinformation exposure. There is a risk that “corrections may actually cause individuals to more strongly believe the initial piece of misinformation in certain situations (37). Corrections “may lead individuals to discount the scientific process all together or disparage the information source” (37). Strategies to address misinformation include building health literacy and nudging (as described in section 2), other strategies include clinicians addressing misinformation with patients, encouraging skepticism towards disinformation agents, for example, by highlighting their ulterior motives and highlighting techniques used to spread misinformation, marking reliable information sources (37). It should, however, be kept in mind that “the provision of quality information online is unlikely to be a sufficient strategy to counter the influence of misinformation if digital health literacy is not accounted for. Messaging and debunking must be delivered on multiple trusted channels, consistent in content and style, and conveyed in local languages to ensure engagement with all communities” (19).

Two studies were identified in this domain 1) the development of a tool that is able to indicate the veracity of search results (36) and 2) the use of corrective messages about the impact of misinformation (38).Below is a short description of both studies.

With the rising amount of misinformation every day, machine learning (ML) may be “one of the potential candidates as a counterstrategy to handle and classify the authenticity of a large volume of information automatically and in real-time. One study evaluated the potential of a ML-based approach integrated in a search engine extension for notifying any public health misinformation. The findings indicate that the tool is able to detect the potentially new rumors early with high accuracy. This tool has the potential to reduce the spread of misinformation and monitor potential regions of heavy misinformation related to online searches (36).

An online experiment “used corrective messages about the impact of misinformation “as stimuli to investigate cognitive and effective factors that motivated people to engage in the social correction of COVID-19 misinformation when they were informed about the falsehood of the misinformation”.” The findings suggest “that if corrective messages emphasize that others are susceptible to the influence of misinformation and that being influenced by misinformation has serious consequences for other people, informed audiences are likely to be emotionally aroused and thus incentivized to respond to the misinformation” (38).

4. Concluding statement

The impact and effectiveness of different approaches are currently being tested. Promising strategies to address misinformation include:

- Understanding how misinformation spreads and why
- Reducing the spread and belief in misinformation by building e-health literacy with strategies such as encouraging critical thinking through nudging and improving content knowledge
- Continuously fact-check information, but it should be kept in mind that this strategy cannot completely undo the impact of misinformation.

Literature

What is currently known about misinformation, disinformation and infodemics in relation to COVID-19?

1a. What are the primary arguments or debates that emerge in published research?
1c. Which research groups are working on this in Canada?
1d. What kind of tools are available to monitor misinformation?

This rapid evidence scan aims to provide an overview of the landscape of existing literature, resources, research groups and tools that relate to misinformation and the infodemic. The information derived for this rapid evidence scan has been found through Ovid Medline and Google Scholar, the University of Toronto Library COVID-19 resources**,** as well as any other resources identified through consultation with contents experts and WHO's infodemic practice group. The comprehensiveness of this scan may be limited given the rapid timeline for our search and documents retrieved, and it is possible that we may have missed potentially relevant evidence. Links to the source documents are included. The short summaries for each resource listed below provide an overview of the main results and do not include any further analysis or integration of results.

Table 1: References and brief summaries

Type of Evidence	Author	Resource	Last updated	Summary
General infodemics				
Literature review (pre covid)	**Jia (4)**	IJOSSER-3-12-85-90.pdf	Dec 2020	• Misinformation, disinformation and fake news are defined differently in the public health, science and communication field. • Different categories have been used to define the type of false information, misinformation and disinformation, one example is seven categories of misinformation and disinformation: satire and parody, false connection, misleading content, false context, imposter content, manipulated content, and fabricated content • Different models exist to explain the source, spread mechanisms, reasons for, and impact of mis- and disinformation.

				• "there is little agreement or inter-discipline on the terms and models used in mis-/dis-information" – there is a need to agree on the terminology, definitions and frameworks of misinformation.
Individual study	**Eysenbach (5)**	JMIR - How to Fight an Infodemic: The Four Pillars of Infodemic Management | Eysenbach | Journal of Medical Internet Research	Jun 2020	• Four pillars of infodemic management: (1) information monitoring (infoveillance); (2) building eHealth Literacy and science literacy capacity; (3) encouraging knowledge refinement and quality improvement processes such as fact checking and peer-review; and (4) accurate and timely knowledge translation, •
Original paper	**Tangcharoensathien et al. (7)**	Framework for Managing the COVID-19 Infodemic: Methods and Results of an Online, Crowdsourced WHO Technical Consultation (nih.gov)	Jun 2020	• "A World Health Organization (WHO) technical consultation on responding to the infodemic related to the coronavirus disease (COVID-19) pandemic was held, entirely online, to crowdsource suggested actions for a framework for infodemic management." • The consultation revealed six policy implications to consider.
Brief	**SSHAP (8)**	Key considerations: online information, mis- and disinformation in the context of COVID-19 (March 2020) - World | ReliefWeb	Mar 2020	Brief developed by Social Science Humanitarian Action Platform (SSHAP). Brief summarizes current knowledge on: • The role of social media in public health emergencies • Types of content circulating on social media in relation to COVID-19 • Social media channels used to communicate information about COVID-19 • Key players and influencers • Understanding the behaviour and motives of social media users during an outbreak • Effects of mis- and disinformation

				• Strategies for ensuring accurate information • Disrupting and influencing misinformation flows
Report	**WHO (2)**	WHO publishes public health research agenda for managing infodemics	2 Feb 2021	Development of five priorities for research through 32 hrs of expert discussion: 1. "Measuring and monitoring the impact of infodemics during health emergencies. 2. Detecting and understanding the spread and impact of infodemics. 3. Responding and deploying interventions that protect against the infodemic and mitigate its harmful effects. 4. Evaluating infodemic interventions and strengthening resilience of individuals and communities to infodemics. 5. Promoting the development, adaptation and application of tools for managing infodemics."
Individual study	**Islam et al. (9)**	COVID-19–Related Infodemic and Its Impact on Public Health: A Global Social Media Analysis (nih.gov)	10 Aug 2020	• 2311 reports of rumors, stigma and conspiracy theories between Dec 31, 2019-April 5, 2020 have been identified in 25 languages. Main themes: illness, transmission and mortality, control measures and treatment and cure. • Monitoring social media data identified as the best method for tracking rumors in real time as well as possible way to dispel misinformation and reduce stigma. • Misinformation may have serious implications on the individual and community. • Health agencies must track misinformation and engage local communities and government stakeholders to debunk misinformation.
Report	**Gruzd et al. (10)**	Inoculating Against an Infodemic: A Canada-Wide	May 2020	1,500 online Canadian adults were asked to fill in survey to examine the "digital hygiene" practices of

		COVID-19 News, Social Media, and Misinformation Survey by Anatoliy Gruzd, Philip Mai :: SSRN		Canadians. Looking at sources of COVID-19 news, frequency of encountering misinformation and what they do about it. • "Most Canadians say they trust the accuracy of C19 news from official information sources. • COVID-19 news from television is preferred over social media. • Canadian's most popular sites for news are Facebook, Reddit and TikTok • Misinformation was reported present on all popular media sites, 68% of Canadian reported encountering COVID-19 misinformation. • 76% of Canadians indicated they would consult other sources to verify encountered misinformation".
1) Monitoring Infodemiology, Infoveillance and Social Listening				
1a) Prevalence mis- and/or disinformation				
Review article	**Tsao et al. (3)**	What social media told us in the time of COVID-19: a scoping review - The Lancet Digital Health	Jan 2021	• Study identified "five overarching public health themes concerning the role of online social platforms and COVID-19. One of these themes in identifying infodemics and evaluating the quality of health information in prevention education videos.
Individual study	**Lee et al. (13)**			• Study "aimed to assess the prevalence of COVID-19 misinformation exposure and beliefs, associated factors including psychological distress with misinformation exposure, and the associations between COVID-19 knowledge and number of preventive behaviors." • Cross-sectional online survey with 1049 South Korean adults in April 2020.

				• "Overall, 67.78% (n=711) of respondents reported exposure to at least one COVID-19 misinformation item. Misinformation exposure was associated with younger age, higher education levels, and lower income. Sources of information associated with misinformation exposure were social networking services (aOR 1.67, 95% CI 1.20-2.32) and instant messaging (aOR 1.79, 1.27-2.51). Misinformation exposure was also associated with psychological distress including anxiety (aOR 1.80, 1.24-2.61), depressive (aOR 1.47, 1.09-2.00), and posttraumatic stress disorder symptoms (aOR 1.97, 1.42-2.73), as well as misinformation belief (aOR 7.33, 5.17-10.38). Misinformation belief was associated with poorer COVID-19 knowledge (high: aOR 0.62, 0.45-0.84) and fewer preventive behaviors (≥7 behaviors: aOR 0.54, 0.39-0.74)."
Individual study	**D'Souza et al. (14)**	YouTube as a source of medical information on the novel coronavirus 2019 disease (COVID-19) pandemic	May 2020	• Study coded 113 most-widely viewed YouTube videos about COVID-19. • 69.9% were classified as useful, 8.8% as misleading. • "Independent users were more likely to post misleading videos than useful videos". • "News agencies were more likely to post useful videos than misleading videos". • The World Health Organization contributed one useful video, no videos from the Center of Disease Control • Reputable sources should increase efforts to disseminate accurate information to help mitigate disease spread and decrease unnecessary panic.
Individual study	**Khatri et al. (15)**	YouTube as source of information on 2019 novel coronavirus outbreak: a cross sectional study of	Jun 2020	• You Tube was searched for COVID related terms on Feb 2, 2020, 72 videos in English were reviewed. • 2 reviewers classified the videos as useful, misleading or news based on pre specified criterion,

		English and Mandarin content - ScienceDirect		modified DISCERN index were used for content analysis. • Videos attracted over 21 million views, 67% of English videos had useful information mean DISCERN score was 3.12/5 for English videos. • Viewership was higher than previous outbreaks, the medical content of videos is suboptimal.
Individual study	**Li et al. (16)**	YouTube as a source of information on COVID-19: a pandemic of misinformation? | BMJ Global Health	Apr 2020	• You Tube was searched for COVID related terms on 21 March 2020, 69 videos were assessed. • 2 reviewers coded the source, content and characteristics, primary outcome usability and reliability. • Tools used: CCS, mDISCERN, mJAMA • Videos attracted over 257 million views. • 19 (27.5%) contained non-factual information, with over more than 62 million views. • Governmental and professional videos contained only factual information but they only accounted for 11% of videos and 10% of views. • "Over one- quarter of the most viewed YouTube videos on COVID-19 contained misleading. Information, reaching millions of viewers worldwide. As the current COVID-19 pandemic worsens, public health agencies must better use YouTube to deliver timely and accurate information and to minimise the spread of misinformation."
Individual study	**Gallotti et al. (17)**	Assessing the risks of 'infodemics' in response to COVID-19 epidemics | Nature Human Behaviour	Dec 2020	• Study analysed more than 100 million Twitter messages during the early stages of epidemic and classified the reliability of the news being circulated. • "Measurable waves of potentially unreliable information preceded the rise of COVID-19 infections,

				exposing countries to falsehoods that pose a serious risk to public health". • Reliable information become quickly more dominant as infections started to rise
Individual study	**Joshi et al. (18)**	Quality of Novel Coronavirus Related Health Information over the Internet: An Evaluation Study (hindawi.com)	May 2020	• Study "examined the quality of COVID-19 related health information over the internet using the DISCERN tool". • A list of 100 URLs was created through COVID related search terms, 48 URLs were included in the study after the use of exclusion criteria. • All sites were evaluated by four independent raters using the 16-item DISCERN tool. • "This study highlights the gaps in the quality of information that is available on the websites related to COVID-19 and study emphasizes the need for verified websites that provide evidence-based health information related to the novel coronavirus pandemic."
1b) Individual characteristics				
Individual study	**Agley et al. (21)**	Misinformation about COVID-19: evidence for differential latent profiles and a strong association with trust in science | BMC Public Health | Full Text (biomedcentral.com)	Jan 2021	• Cross-sectional online survey (n=660) where people read five COVID-19 narratives and asked about the believability of the stories and the participants" political orientation, religious commitment, trust in science and sociodemographic data. • Latent profile analysis was used to identify subgroups with similar believability profiles. Multivariate logistic regression was used to identify factors associated with membership in a specific profile. • Sociodemographics, political orientation and religious commitment were non-significantly associated with COVID-19 belief profile membership.

				• Trust in science was a strong, significant predictor of profile membership. • Prophylaxis of COVID-19 misinformation might be achieved "by taking concrete steps to improve trust in science and scientist"
Individual study	**Greene et al. (23)**	Individual differences in susceptibility to false memories for COVID-19 fake news | Cognitive Research: Principles and Implications | Full Text (springeropen.com)	Dec 2020	• Exposure to 'fake news' can lead to false memories and possible negative influence on behaviour. • "Study measured susceptibility to false memories following exposure to fabricated news stories about the pandemic in a sample of 3746 participants. We investigated the effect of individual differences in (1) knowledge about COVID-19, (2) engagement with media or discussion about the coronavirus, (3) anxiety about COVID-19 and (4) analytical reasoning. Notably, objectively and subjectively assessed knowledge about COVID-19 were not significantly correlated. Objectively assessed knowledge was associated with fewer false memories but more true memories, suggesting a true discrimination between true and fake news. In contrast, participants who merely believed themselves to be very knowledgeable were more likely to report a memory for true stories, but showed no reduction in false memories. Similarly, individuals who reported high levels of media engagement or anxiety about COVID-19 reported an increase in true (but not false) memories. Finally, higher levels of analytical reasoning were associated with fewer memories for both true and fabricated stories, suggesting a stricter threshold for reporting a memory for any story. These data indicate that false memories can form in response to fake COVID-19 news and that susceptibility to this misinformation is affected by the individual's knowledge about and interaction with COVID-19 information, as well as their tendency to think critically.

Individual study	**Loomba et al. (24)**	Measuring the impact of COVID-19 vaccine misinformation on vaccination intent in the UK and USA | Nature Human Behaviour	Mar 2021	• "To inform successful vaccination campaigns, we conducted a randomized controlled trial in the UK and the USA to quantify how exposure to online misinformation around COVID-19 vaccines affects intent to vaccinate to protect oneself or others. Here we show that in both countries—as of September 2020—fewer people would 'definitely' take a vaccine than is likely required for herd immunity, and that, relative to factual information, recent misinformation induced a decline in intent of 6.2 percentage points (95th percentile interval 3.9 to 8.5) in the UK and 6.4 percentage points (95th percentile interval 4.0 to 8.8) in the USA among those who stated that they would definitely accept a vaccine. We also find that some sociodemographic groups are differentially impacted by exposure to misinformation. Finally, we show that scientific-sounding misinformation is more strongly associated with declines in vaccination intent".
Individual study	**Pickles et al. (19)**	JMIR - COVID-19 Misinformation Trends in Australia: Prospective Longitudinal National Survey | Pickles | Journal of Medical Internet Research	Jan 2021	• Study aimed "to investigate the prevalence and factors associated with COVID-19 misinformation in Australia and the changes over time". • Stronger agreement with misinformation was associated with younger age, male gender, lower education level, and language other than English spoken at home. • "After controlling for these variables, misinformation beliefs were significantly associated (P<.001) with lower levels of digital health literacy, perceived threat of COVID-19, confidence in government, and trust in scientific institutions." • "Analyses of specific government-identified misinformation revealed 3 clusters: prevention (associated with male gender and younger age), causation (associated with lower education level and greater social disadvantage), and cure (associated with younger age)."

1c) Spread of misinformation				
Individual study	**Cinelli et al. (25)**	The COVID-19 social media infodemic | Scientific Reports (nature.com)	Oct 2020	• Users behave similarly across different platforms (Gab, Reddit, YouTube, Instagram, Twitter) • Topics are similar across each social media platform (e.g. death toll infection rates, government and decision making, suspended flights and racism). • Model of epidemics is used to measure the emergence of an infodemic. • Comparison or questionable and reliable resources on each platform – both have similar characteristics. • Understanding social dynamics between content consumption and social media platform may help to design more effective and tailored communication strategies.
Individual study	**Nsoesie et al. (26)**	Journal of Medical Internet Research - COVID-19 Misinformation Spread in Eight Countries: Exponential Growth Modeling Study (jmir.org)	Dec 2020	• Study aims "to characterize and compare the start, peak, and doubling time of COVID-19 misinformation across 8 countries using an exponential growth model usually employed to study infectious disease epidemics". • "Patterns in the start, peak, and doubling time for "coronavirus AND 5G" were different from the other misinformation topics and were mostly consistent across countries assessed, which might be attributable to a lack of public understanding of 5G technology. Understanding the spread of misinformation, similarities and differences across different contexts can help in the development of appropriate interventions for limiting its impact similar to how we address infectious disease epidemics. Furthermore, the rapid proliferation of misinformation that discourages adherence to public health interventions could be predictive of future increases in disease cases."

1d) impact				
Individual study	**Roozenbeek et al. (20)**	Susceptibility to misinformation about COVID-19 around the world | Royal Society Open Science (royalsocietypublishing.org)	14 Oct 2020	• public belief in misinformation about COVID-19 is not particularly common, a substantial proportion views this type of misinformation as highly reliable in each country surveyed. In addition, a small group of participants find common factual information about the virus highly unreliable. • Increased susceptibility to misinformation negatively affects people's self-reported compliance with public health guidance about COVID-19, as well as people's willingness to get vaccinated against the virus and to recommend the vaccine to vulnerable friends and family. • Higher trust in scientists and having higher numeracy skills were associated with lower susceptibility to coronavirus-related misinformation.
Individual study	**Hornik et al. (27)**	Full article: Association of COVID-19 Misinformation with Face Mask Wearing and Social Distancing in a Nationally Representative US Sample (tandfonline.com)	Jan 2021	• "Should campaigns to promote protective behaviors focus on debunking misinformation or targeting behavior-specific beliefs? To address this question, we examine whether belief in COVID-19 misinformation is directly associated with two behaviors (face mask wearing and social distancing), and whether behavior-specific beliefs can account for this association and better predict behavior, consistent with behavior-change theory. We conducted a nationally representative two-wave survey of U.S. adults from 5/26/20-6/12/20 (n = 1074) and 7/15/20-7/21//20 (n = 889; follow-up response 83%). … Cross-lagged panel linear regression models assessed relationships among the variables. While belief in misinformation was negatively associated with both face mask wearing (B = −.27, SE =.06) and social-distancing behaviors (B = −.46, SE =.08) measured at the same time, misinformation did not predict concurrent or lagged behavior when the behavior-specific beliefs were incorporated in the

				models. Beliefs about behavioral outcomes accounted for face mask wearing and social distancing, both cross-sectionally (B =.43, SE =.05; B =.63, SE =.09) and lagged over time (B =.20, SE = 04; B =.30, SE =.08). In conclusion, belief in COVID-19 related misinformation is less relevant to protective behaviors, but beliefs about the consequences of these behaviors are important predictors. With regard to misinformation, we recommend health campaigns aimed at promoting protective behaviors emphasize the benefits of these behaviors, rather than debunking unrelated false claims".
Individual study	**Lee et al. (13)**	Journal of Medical Internet Research - Associations Between COVID-19 Misinformation Exposure and Belief With COVID-19 Knowledge and Preventive Behaviors: Cross-Sectional Online Study (jmir.org)	Nov 2020	• See also the summary in 1b) individual characteristics. Misinformation exposure was also associated with psychological distress including anxiety (aOR 1.80, 1.24-2.61), depressive (aOR 1.47, 1.09-2.00), and posttraumatic stress disorder symptoms (aOR 1.97, 1.42-2.73), as well as misinformation belief (aOR 7.33, 5.17-10.38). Misinformation belief was associated with poorer COVID-19 knowledge (high: aOR 0.62, 0.45-0.84) and fewer preventive behaviors (≥7 behaviors: aOR 0.54, 0.39-0.74)."
Individual study	**Romer et al. (28)**	Conspiracy theories as barriers to controlling the spread of COVID-19 in the U.S. - ScienceDirect	Oct 2020	• "We hypothesized that accepting conspiracy theories that were circulating in mainstream and social media early in the COVID-19 pandemic in the US would be negatively related to the uptake of preventive behaviors and also of vaccination when a vaccine becomes available". • "Method: A national probability survey of US adults (N = 1050) was conducted in the latter half of March 2020 and a follow-up with 840 of the same individuals in July 2020. The surveys assessed adoption of preventive measures recommended by public health authorities, vaccination intentions, conspiracy beliefs, perceptions of threat, belief about the safety of

				vaccines, political ideology, and media exposure patterns". • "Results: Belief in three COVID-19-related conspiracy theories was highly stable across the two periods and inversely related to the (a) perceived threat of the pandemic, (b) taking of preventive actions, including wearing a face mask, (c) perceived safety of vaccination, and (d) intention to be vaccinated against COVID-19. Conspiracy beliefs in March predicted subsequent mask-wearing and vaccination intentions in July even after controlling for action taken and intentions in March. Although adopting preventive behaviors was predicted by political ideology and conservative media reliance, vaccination intentions were less related to political ideology. Mainstream television news use predicted adopting both preventive actions and vaccination". • "Conclusions: Because belief in COVID-related conspiracy theories predicts resistance to both preventive behaviors and future vaccination for the virus, it will be critical to confront both conspiracy theories and vaccination misinformation to prevent further spread of the virus in the US. Reducing those barriers will require continued messaging by public health authorities on mainstream media and in particular on politically conservative outlets that have supported COVID-related conspiracy theories".
Individual study	**Tuccori et al. (29)**	The Impact of the COVID-19 "Infodemic" on Drug-Utilization Behaviors: Implications for Pharmacovigilance | SpringerLink	Jun 2020	• "This infodemic also included sensational and distorted information about drugs that likely first influenced opinion leaders and people particularly active on social media and then other people, thus affecting choices by individual patients everywhere. In particular, information has spread about some drugs approved for other indications (chloroquine, hydroxychloroquine, nonsteroidal anti-inflammatory drugs, angiotensin-converting enzyme inhibitors, angiotensin II receptor antagonists, favipiravir, and

				umifenovir) that could have led to inappropriate and therefore hazardous use." • "In this article, we analyze the rationale behind the claims for use of these drugs in COVID-19, the communication about their effects on the disease, the consequences of this communication on people's behavior, and the responses of some influential regulatory authorities in an attempt to minimize the actual or potential risks arising from this behavior". • "In this scenario, pharmacovigilance must face different challenges, such as promoting clinical and observational studies, implementing spontaneous adverse drug reaction reporting systems and signal detection, and implementing and supporting risk communication strategies".
2) Building eHealth Literacy				
Synthesis of literature – pre-publication, not peer reviewed	**Pennycook et al. (1)**	PsyArXiv Preprints | The Cognitive Science of Fake News	Nov 2020	In –depth synthesis of literature "investigating why people believe and share "fake news" and other misinformation online." • Misinformation is often believed or shared because people fail to stop and reflect about the accuracy of information on social media. • Proactive "inoculation" or "prebunking" against misinformation are promising interventions. • "Resistance to inaccurate information can be increased through metacognitive prompts (probing questions that have people reflect.)". • "Simple nudges or primes to think about accuracy increase the quality of content that people share on social media".
Individual study	**Bonnet et al. (32)**	The COVID-19 Misinformation Challenge: An Asynchronous Approach	Jan 2021	In response to the COVID-19 Infodemic "two librarians designed The COVID-19 Misinformation Challenge, a weeklong program aimed at discerning coronavirus fact

		to Information Literacy: Internet Reference Services Quarterly: Vol 24, No 1-2 (tandfonline.com)		from fiction on social media, in the news, and in academic publishing. Based on the number of program participants and their overwhelmingly positive feedback, the Challenge proved to be popular, fun, and educational".
Individual study	Vraga et al. (33)	Addressing COVID-19 Misinformation on Social Media Preemptively and Responsively (nih.gov)	Feb 2021	"Efforts to address misinformation on social media have special urgency with the emergence of coronavirus disease (COVID-19). In one effort, the World Health Organization (WHO) designed and publicized shareable infographics to debunk coronavirus myths. We used an experiment to test the efficacy of these infographics, depending on placement and source. We found that exposure to a corrective graphic on social media reduced misperceptions about the science of 1 false COVID-19 prevention strategy but did not affect misperceptions about prevention of COVID-19. Lowered misperceptions about the science persisted >1 week later. These effects were consistent when the graphic was shared by the World Health Organization or by an anonymous Facebook user and when the graphics were shared preemptively or in response to misinformation. Health organizations can and should create and promote shareable graphics to improve public knowledge".
Individual study	**Apuke et al. (34)**	Modelling the antecedent factors that affect online fake news sharing on COVID-19: the moderating role of fake news knowledge | Health Education Research | Oxford Academic (oup.com)	Jul 2020	"We proposed a conceptual model combining three theories: uses and gratification theory, social networking sites (SNS) dependency theory and social impact theory to understand the factors that predict fake news sharing related to COVID-19. We also tested the moderating role of fake news knowledge in reducing the tendency to share fake news. Data were drawn from social media users (n=650) in Nigeria, and partial least squares was used to analyse the data. Our results suggest that tie strength was the strongest predictor of fake news sharing related to COVID-19 pandemic. We also found perceived herd, SNS dependency, information-seeking and parasocial interaction to be significant predictors of fake news

				sharing. The effect of status seeking on fake news sharing, however, was not significant. Our results also established that fake news knowledge significantly moderated the effect of perceived herd, SNS dependency, information-seeking, parasocial interaction on fake news sharing related to COVID-19. However, tie strength and status-seeking effects were not moderated."
3) Knowledge Refinement, Filtering and Fact Checking				
Perspective	**Chou et al. (37)**	The COVID-19 Misinfodemic: Moving Beyond Fact-Checking - Wen-Ying Sylvia Chou, Anna Gaysynsky, Robin C. Vanderpool, 2021 (sagepub.com)	Dec 2020	"Online misinformation regarding COVID-19 has undermined public health efforts to control the novel coronavirus. To date, public health organizations" efforts to counter COVID-19 misinformation have focused on identifying and correcting false information on social media platforms. Citing extant literature in health communication and psychology, we argue that these fact-checking efforts are a necessary, but insufficient, response to health misinformation. First, research suggests that fact checking has several important limitations and is rarely successful in fully undoing the effects of misinformation exposure. Second, there are many factors driving misinformation sharing and acceptance in the context of the COVID-19 pandemic—such as emotions, distrust, cognitive biases, racism, and xenophobia—and these factors both make individuals more vulnerable to certain types of misinformation and also make them impervious to future correction attempts. We conclude by outlining several additional measures, beyond fact-checking, that may help further mitigate the effects of misinformation in the current pandemic".
Individual study	Shams (36)	Healthcare | Free Full-Text | Web Search Engine Misinformation Notifier Extension (SEMiNExt): A Machine Learning Based	Jan 2021	"Misinformation such as on coronavirus disease 2019 (COVID-19) drugs, vaccination or presentation of its treatment from untrusted sources have shown dramatic consequences on public health. Authorities have deployed several surveillance tools to detect and slow down the rapid misinformation spread online. Large

		Approach during COVID-19 Pandemic (mdpi.com)		quantities of unverified information are available online and at present there is no real-time tool available to alert a user about false information during online health inquiries over a web search engine. To bridge this gap, we propose a web search engine misinformation notifier extension (SEMiNExt). Natural language processing (NLP) and machine learning algorithm have been successfully integrated into the extension. This enables SEMiNExt to read the user query from the search bar, classify the veracity of the query and notify the authenticity of the query to the user, all in real-time to prevent the spread of misinformation. Our results show that SEMiNExt under artificial neural network (ANN) works best with an accuracy of 93%, F1-score of 92%, precision of 92% and a recall of 93% when 80% of the data is trained. Moreover, ANN is able to predict with a very high accuracy even for a small training data size. This is very important for an early detection of new misinformation from a small data sample available online that can significantly reduce the spread of misinformation and maximize public health safety. The SEMiNExt approach has introduced the possibility to improve online health management system by showing misinformation notifications in real-time, enabling safer web-based searching on health-related issues".
Individual study	Sun et al. (38)	The Role of Influence of Presumed Influence and Anticipated Guilt in Evoking Social Correction of COVID-19 Misinformation: Health Communication: Vol 0, No 0 (tandfonline.com)	Feb 2021	"Misinformation on social media pertaining to COVID-19 poses a great threat to public health. The active correction of misinformation by social media users and an understanding of the drivers of such behavior can help solve this ongoing issue. Drawing on the influence of presumed influence model and cognitive appraisal theory, an online experiment (N = 400) was conducted to examine how exposure to corrective messages with regard to COVID-19 misinformation induced individuals" threat appraisals of the influence of the misinformation on others and how these threat appraisals and the corresponding emotional responses motivated individuals to take corrective actions. The results suggested that people's perceptions of the

				severity of the influence of misinformation on others engendered anticipated guilt, which, in turn, strengthened their intentions to correct misinformation related to COVID-19. The study offers guidance on how to effectively craft a corrective message to encourage audiences to counter misinformation together".

2: Internet resources related to infodemics:

Websites for infodemics	**Description**
WHO Infodemic Management	WHO's website with key-resources and two-weekly News Flashes with information related to the infodemic.
HKS Misinformation Review (harvard.edu)	Harvard Kennedy Misinformation review is a journal with peer-reviewed scholarly publications that contributes to providing "reliable, unbiased research on the prevalence, diffusion, and impact of misinformation worldwide".
Tackling the Infodemic - European Science-Media Hub	Website that contributes to addressing the spread of deceptive narratives and to better understand the inner dynamics of the infodemic. The following can be found: • "a list of relevant initiatives tackling the enormous spread of false information on various aspects of the health crisis. • monthly reports, collecting the main false claims related to Covid-19 trending on selected social media. • a series of interviews with experts on dis- and misinformation. • thematic news articles focusing on selected aspects of the crisis."
Search Results - Carnegie Endowment for International Peace Endowment for International Peace	Project that developed a three-part series that looks into the future of the European Union's disinformation policy. Over one hundred experts, practitioners, and scholars participated in five days of workshops, made written submissions, and/or completed surveys that fed into these papers. Titles of the three papers: • Taking back the initiative • Crafting an EU Disinformation Framework • Developing Policy Interventions for the 2020s
Canadian websites for infodemics	**Description**

Homepage - (covid19misinfo.org)	"A rapid response project of the Ryerson Social Media Lab at Ted Rogers School of Management. The aim of this project is two-fold: (1) put a spotlight on COVID-19 related misinformation and (2) to provide Canadians with timely and actionable information that we all can use to protect ourselves and our community".
Who Is #ScienceUpFirst? — #ScienceUpFirst	"The #ScienceUpFirst initiative aims to rapidly and robustly address the infodemic arising from the COVID-19 pandemic in Canada. Our goal is to build a scalable and sustainable network for amplifying the communication of best available, science-based communication on social media."
Misinformation papers (google.com)	Cancovid resource with a summary of relevant papers on misinformation from the David Rand and Gordon Pennycook research team.
Websites with collected data	**Description**
World Health Organization - EARS - Early AI-supported Response with Social Listening (citibeats.com)	"This social listening platform aims to show real time information about how people are talking about COVID-19 online, so we can better manage as the infodemic and pandemic evolve." • Can find information about what Canadians are talking about on social media.
KAP COVID - Johns Hopkins Center for Communication Programs (jhu.edu)	"Johns Hopkins Center for Communication Programs KAP COVID dashboard presents data from a global survey of knowledge, attitudes and practices around COVID-19. The data were collected from more than 1.5 million people in 67 countries who chose to participate in a survey promoted on Facebook." • Data from Canada can be extracted, including data on the extend of trust in different information resources.
Canadian websites with collected data	
Misinformation during the COVID-19 pandemic (statcan.gc.ca)	"data from the Canadian Perspectives Survey Series (CPSS) 4: Information Sources Consulted During the Pandemic, which was conducted from July 20 to 26, 2020 among Canadians aged 15 and over living in the 10 provinces. The focus is on information found online by Canadians who used online resources to learn about COVID-19, as well as COVID-19 information sharing. In addition, the article examines the verification methods used by Canadians to check the accuracy of information found online as well as suspected information seen online about COVID-19."
(COVID-19 Disinfo and the Future of Internet Governance - YouTube	Panel discussion on COVID-19 Disinfo and the future of internet governance, hosted by Kyle Matthews, funded by the government of Canada, Canadian department of Heritage and the digital citizen initiative).

	• What is happening with COVID disinformation? • What can be done to deal with it in relation to internet governance and platform governance? Canadian participants: Fenwick McKelvey (Associate Professor, Communication Studies, Concordia University), Elizabeth Dubois, Associate Profession, Communication, University of Ottawa.

Table 3: Current research related to infodemics in Canada

PI/Author	University/Institute/Journal	Title
Ali, Syed H; Kurasawa, Fuyuki	York University (Toronto, Ontario)	COVID-19's Informational Virus: Analyzing the Viral Character and Effects of Social Media Misinformation
Caulfield, Timothy A	University of Alberta	Coronavirus Outbreak: Mapping and Countering Misinformation
Dubé, Eve; Steenbeek, Audrey	Université Laval	Sociocultural and behavioural factors affecting communities' response to countermeasures for COVID-19 epidemic: identifying interventions to build trust
Fafard, Patrick	University of Ottawa	Senior public health leadership during the 2019 novel coronavirus outbreak: Comparative approaches to mitigating the spread of infectious disease and its social consequences in Canada and abroad
Fahim, Christine; Straus, Sharon E	Unity Health Toronto	Combating misinformation, fear and stigma in response to the Covid-19 outbreak: An international collaboration between Canada and Singapore
Genereux, Mélissa	Université de Sherbrooke	The role of communication strategies and media discourse in shaping psychological and behavioral response to the COVID-19 outbreak: a comparative analysis between Canada and two Asian countries/regions
Gillis, Joseph R et al.	University of Toronto	Responding to the Stigma, Fear, Discrimination, and Misinformation Related to the COVID-19 Disease Outbreak: A Novel Analyses and Intervention for a Novel Coronavirus.
Kennedy, Eric B	York University (Toronto, Ontario)	Understanding Social Perceptions of Risk, Information Sources, Trust, and Public Engagement Related to the COVID-19 Outbreak

Parsons Leigh et al.	Dalhousie University (Nova Scotia)	Socio-Cultural Implications of COVID-19: Educating, Engaging & Empowering the Public
Veletsianos, George; Hodson, Jaigris	Royal Roads University (Victoria, BC)	Inoculating Against an Infodemic: Microlearning Interventions to Address COVID Misinformation

Table 4 Potential experts in misinformation, Canadian based researchers are highlighted

Corresponding Author (Affiliation)	Resource Link	Contact Information
Fang Jia (University of Pennsylvania)	IJOSSER-3-12-85-90.pdf	Not Found
Gunther Eysenbach (University of Victoria & JMIR Publications)	JMIR - How to Fight an Infodemic: The Four Pillars of Infodemic Management | Eysenbach | Journal of Medical Internet Research	Email: geysenba@gmail.com
Tina Purnat (Department of Digital Health and Innovation, Health Organization)	Framework for Managing the COVID-19 Infodemic: Methods and Results of an Online, Crowdsourced WHO Technical Consultation (nih.gov)	Email: tni.ohw@ttanrup
Olivia Tulloch (Social Science in Humanitarian Action Platform by Anthrologica)	Key considerations: online information, mis- and disinformation in the context of COVID-19 (March 2020) - World | ReliefWeb	Email: oliviatulloch@anthrologica.com
N/A (WHO)	WHO publishes public health research agenda for managing infodemics	N/A

Dr. Zahid A Butt (University of Waterloo)	What social media told us in the time of COVID-19: a scoping review - The Lancet Digital Health	Email: zahid.butt@uwaterloo.ca
Ryan D'Souza (Mayo Clinic College of Medicine)	YouTube as a source of medical information on the novel coronavirus 2019 disease (COVID-19) pandemic	Email: Dsouza.ryan@mayo.edu
Pier luigi Sacco & Manlio De Domenico (Italy IULM University of Milan)	Assessing the risks of 'infodemics' in response to COVID-19 epidemics | Nature Human Behaviour	Email: pierluigi.sacco@iulm.it manlio.dedomenico@gmail.com
Md Saiful Islam (International Centre for Diarrhoeal Disease Research, Bangladesh)	COVID-19–Related Infodemic and Its Impact on Public Health: A Global Social Media Analysis (nih.gov)	Email: saiful@icddrb.org
Ashish Joshi (City University of New York Graduate School of Public Health and Health Policy)	Quality of Novel Coronavirus Related Health Information over the Internet: An Evaluation Study (hindawi.com)	Email: ashish.joshi@sph.cuny.edu
Priyanka Khatri (Fast and Chronic Programmes, Alexandra Hospital, Singapore)	YouTube as source of information on 2019 novel coronavirus outbreak: a cross sectional study of English and Mandarin content - ScienceDirect	Email: Priyanka_khatri@nuhs.edu.sg
Heidi Oi-Yee Li (Faculty of Medicine, University of Ottawa)	YouTube as a source of information on COVID-19: a pandemic of misinformation? | BMJ Global Health	Email: heidi.li@live.ca
Xingyi Song (University of Sheffield)	Classification aware neural topic model for COVID-19 disinformation categorisation (plos.org)	Email: x.song@sheffield.ac.uk
Jon Agley (Indiana University Bloomington)	Misinformation about COVID-19: evidence for differential latent profiles and a strong association with trust in science | BMC Public Health | Full Text (biomedcentral.com)	Email: jagley@iu.edu
Ciara Greene (University of College Dublin)	Individual differences in susceptibility to false memories for COVID-19 fake news | Cognitive Research: Principles and Implications | Full Text (springeropen.com)	Phone: 01 716 8334 Email: ciara.greene@ucd.ie

Kristen Pickles (University of Sydney)	JMIR - COVID-19 Misinformation Trends in Australia: Prospective Longitudinal National Survey | Pickles | Journal of Medical Internet Research	Phone: 61 93512064 Email: kristen.pickles@sydney.edu.au
Yuxi Wang (Bocconi University)	Systematic Literature Review on the Spread of Health-related Misinformation on Social Media - ScienceDirect	Email: yuxi.wang@phd.unibocconi.it
Bahiyah Omar School of Communication, Universiti Sains Malaysia	Modelling the antecedent factors that affect online fake news sharing on COVID-19: the moderating role of fake news knowledge | Health Education Research | Oxford Academic (oup.com)	Email: bahiyah@usm.my
Walter Quattrociocchi (Università Ca' Foscari di Venezia, Venice, Italy)	The COVID-19 social media infodemic | Scientific Reports (nature.com)	Phone: 041 234 8457 Email: w.quattrociocchi@unive.it
Sarah Evanega (Cornell University)	Evanega-et-al-Coronavirus-misinformationFINAL.pdf (cornell.edu)	Email: snd2@cornell.edu
Jennifer Jin (Accenture Applied Intelligence)	127_133_811.pdf (ntpu.edu.tw)	Email: jennifer.jin@accenture.com
Kinga Makovi (New York University)	Web of lies: a tool for determining the limits of verification in preventing the spread of false information on networks | Scientific Reports (nature.com)	Email: km2537@nyu.edu
Elaine Okanyene Nsoesie (Boston University)	Journal of Medical Internet Research - COVID-19 Misinformation Spread in Eight Countries: Exponential Growth Modeling Study (jmir.org)	Phone: 1 617-638-5234 Email: onelaine@bu.edu
Gordon Pennycook (University of Regina)	Fighting COVID-19 Misinformation on Social Media: Experimental Evidence for a Scalable Accuracy-Nudge Intervention - Gordon Pennycook, Jonathon McPhetres, Yunhao Zhang, Jackson G. Lu, David G. Rand, 2020 (sagepub.com)	E-mail: gordon.pennycook@uregina.ca

Alex Williams Kirkpatrick, (Washington State University)	The spread of fake science: Lexical concreteness, proximity, misinformation sharing, and the moderating role of subjective knowledge - Alex Williams Kirkpatrick, 2021 (sagepub.com)	Email: alex.kirkpatrick@wsu.edu
Miro Jakovljevic (University Hospital Centre Zagreb)	COVID-19 INFODEMIC AND PUBLIC TRUST FROM THE PERSPECTIVE OF PUBLIC AND GLOBAL MENTAL HEALTH (srce.hr)	Email: jakovljevic.miro@yahoo.com
Chunmiao Zheng (Southern University of Science and Technology, China)	How do social media and individual behaviors affect epidemic transmission and control? - ScienceDirect	Email: zhengcm@sustech.edu.cn
Rachel Leigh Greenspan (University of Mississippi)	Pandemics and infodemics: Research on the effects of misinformation on memory - Greenspan - 2021 - Human Behavior and Emerging Technologies - Wiley Online Library	Email: rlgreen1@olemiss.edu
Robert Hornik (University of Pennsylvania)	Full article: Association of COVID-19 Misinformation with Face Mask Wearing and Social Distancing in a Nationally Representative US Sample (tandfonline.com)	Email: rhornik@asc.upenn.edu
Sunhwa Shin (Sahmyook University)	Journal of Medical Internet Research - Associations Between COVID-19 Misinformation Exposure and Belief With COVID-19 Knowledge and Preventive Behaviors: Cross-Sectional Online Study (jmir.org)	Phone: 82 2-3399-1595 Email: shinsh@syu.ac.kr
Piper Liping Liu (National University of Singapore)	Digital Disinformation About COVID-19 and the Third-Person Effect: Examining the Channel Differences and Negative Emotional Outcomes | Cyberpsychology, Behavior, and Social Networking (liebertpub.com)	Email: llpsxx@hotmail.com
Heidi Larson (University of Antwerp)	Measuring the impact of COVID-19 vaccine misinformation on vaccination intent in the UK and USA | Nature Human Behaviour	Email: heidi.larson@uantwerpen.be
Daniel Romer (University of Pennsylvania)	Conspiracy theories as barriers to controlling the spread of COVID-19 in the U.S. - ScienceDirect	Email: dan.romer@appc.upenn.edu

Marco Tuccori (University Hospital of Pisa)	The Impact of the COVID-19 “Infodemic” on Drug-Utilization Behaviors: Implications for Pharmacovigilance | SpringerLink	Not Found
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Stephan Lewandowsky (University of Bristol and University of Western Australia)	Debunking Handbook 2020 | Center For Climate Change Communication	Email: stephan.lewandowsky@bristol.ac.uk
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Abdullah Shams (University of Toronto)	Healthcare | Free Full-Text | Web Search Engine Misinformation Notifier Extension (SEMiNExt): A Machine Learning Based Approach during COVID-19 Pandemic (mdpi.com)	Email: abdullahbinshams@gmail.com
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Emily Vraga (University of Minnesota)	Addressing COVID-19 Misinformation on Social Media Preemptively and Responsively (nih.gov)	Email: ekvraga@umn.edu
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