

Assessing Misinformation Models, Theories, and Frameworks (MTFs): Bridging Theory and Practice in Public Health

By Zeynep Cildir, MSc Candidate

B.Sc. in Translational and Molecular Medicine, University of Ottawa, 2023

Thesis Submitted to the University of Ottawa in partial fulfillment of the requirements of the
Masters of Science in Epidemiology

School of Epidemiology and Public Health (SEPH)

Faculty of Medicine

University of Ottawa

© Zeynep Cildir, Ottawa, Canada, 2025

PREFACE

Approvals

Chapter 2 presents findings from primary data collected through semi-structured interviews with public health professionals. This study, titled *"Understanding the Real-World Misinformation Countering Initiative Development Process: Theory-Guided Semi-Structured Interviews,"* received ethics approval from the Ottawa Hospital Research Institute Research Ethics Board (Protocol #20240602-01H). The ethics certificate can be found in **Appendix A** of Chapter 3. Dr. Jamie Brehaut has been added as the Principal Investigator, Dr. Justin Presseau as the co-investigator, and Zeynep Cildir as the primary research staff member.

Author Contributions

The master's candidate Zeynep Cildir (ZC) is the primary author of this thesis manuscript. Dr. Jamie Brehaut (JCB), the principal investigator, co-authored the manuscript and collaborated with ZC on the development of the study methodology. ZC was responsible for all aspects of the research process, including methodological planning, primary and secondary data collection, data analysis, and manuscript drafting, with ongoing guidance from JCB throughout the thesis.

The work presented in Chapter 1, which involved data collection and extraction, was conducted collaboratively with Dr. Natasha Hudek (NH), Dr. Tamara Morgan (TM), and Christine Tulk (CT). Chapter 2, which focused on primary data collection and qualitative coding, was completed with guidance from NH.

Members of the Thesis Advisory Committee—Dr. Justin Presseau, Dr. Tamara Morgan, and Dr. Heather Colquhoun—provided invaluable feedback during the development of this thesis manuscript.

ABSTRACT

Since the COVID-19 pandemic, there has been a surge of health misinformation, prompting two key outcomes: a significant increase in misinformation research, with many models, theories and frameworks (MTFs) seeking to describe, explain, and propose strategies against misinformation, and development of real-world interventions by public health organizations. However, the extent to which these MTFs inform real-world efforts remains unclear. This thesis aims to 1) assess the quality and nature of existing misinformation MTFs, and 2) explore the integration of such MTFs within the intervention development processes. Objective 1 is addressed through a scoping review, appraising misinformation MTFs through the purpose, characteristics, usability, implementability and testability. Objective 2 involves semi-structured interviews capturing the development process of misinformation countering initiatives. These findings can guide developers in selecting relevant misinformation MTFs and highlight how theoretical insights could translate into real-world misinformation countermeasures.

(140/150)

ACKNOWLEDGEMENTS

Over the past two years, I have leaned on the support, kindness, and guidance of many people, both academically and personally, who helped me complete this thesis. I am deeply grateful to all of them.

First and foremost, I would like to thank Dr. Jamie Brehaut for his unwavering commitment to my professional development and for providing me the opportunity to work not only within this team but also with the team at the Centre for Implementation Research. Your approach to learning, navigating through problems, and critical thinking has taught me immensely, not just professionally but also personally. I am incredibly fortunate to have a supervisor who set an example of professionalism, innovative thinking and flexibility for me to carry these qualities into my future career.

I also want to thank the team, starting with Kelly Carroll, the anchor of our team, whose organization, bright laughter and jokes made sure everything ran smoothly and brightened our days. Thank you to Dr. Tamara Morgan and Dr. Natasha Hudek for their encouragement, expertise and belief in me. Their mentorship shaped the direction of this thesis. Dr. Natasha's baking also made our weekly lab meetings joyful, making everyone eagerly look forward to our team meetings. To Christine Tulk and Lisa Chen, thank you for fostering such a supportive, collaborative environment. Overall, I am grateful to have learned about qualitative research in a space where I felt comfortable voicing my ideas, working through challenges, and growing as a scholar. Their approach to research not only developed but also fueled my passion for this field.

I would also like to extend my sincere thanks to our partner, the Sickle Cell Awareness Group of Ontario (SCAGO). In particular, Mrs. Lanre Tunji-Ajayi, thank you for your generous support and invaluable expertise. Thank you to my Thesis Advisory Committee members, Dr. Justin Presseau and Dr. Heather Colquhoun, for your thoughtful feedback and encouragement. Their feedback not only made this thesis possible but also helped me to build a holistic understanding of research design and interpretation by challenging me to think critically and address assumptions.

Lastly, to my family, thank you for standing by me through every high and low. Your unwavering love and support mean the world to me. Special thank you to Dr. Ayse Hafsa Es-

Anderson and Manwen Liu for believing in me, celebrating my successes as your own, and standing beside me in the most challenging moments.

Thanks to everyone mentioned here, I've grown in many ways — as a researcher, a learner, and a person. This thesis is a reflection of your support, and I carry that forward with deep gratitude.

Table of Contents

PREFACE	ii
<i>Approvals</i>	<i>ii</i>
<i>Author Contributions</i>	<i>ii</i>
ABSTRACT	iii
ACKNOWLEDGEMENTS	iv
LIST OF TABLES	viii
LIST OF FIGURES	viii
LIST OF ABBREVIATIONS	ix
CHAPTER 1: Introduction	1
<i>Background</i>	<i>1</i>
1.1 Health Misinformation: What is it and Why does it matter?	1
1.2 Defining Misinformation	1
1.3 Consequences of Health Misinformation	2
1.4 COVID-19 Infodemic: Scope and Spread	3
1.5 Vaccine Misinformation and Hesitancy: Then and Now	4
1.6 Drivers of Misinformation Spread and Acceptance	5
1.7 Consequences of Health Misinformation during COVID-19	6
1.8 Current Methodologies to Counteract Misinformation	7
1.9 Addressing Misinformation-Associated Health Behaviours (MAHB)	8
1.10 Misinformation Models, Theories, and Frameworks (MTFs)	9
1.11 Guiding Paradigm	9
1.12 Objectives	10
1.13 Category and Format of Thesis	10
CHAPTER 2 (Draft Manuscript 1): An Appraisal of Misinformation Models, Theories and Frameworks on Purpose, Characteristics, Usability, Implementability, and Testability: A Scoping Review	22
<i>Preface</i>	<i>22</i>
<i>Abstract</i>	<i>24</i>
2.1 Introduction	25
2.2 Methods	26
2.2.1 Protocol and Registration	26
2.2.2 Search Strategy and Information Sources	27
2.2.3. Study Records	27
2.2.4. Data Synthesis and Analysis	30
2.3 Results	31
2.3.1. Study Selection	31
2.3.2. Study Characteristics	32
2.3.3. Usability of Misinformation MTFs	33
2.3.4. Implementability of Misinformation MTFs	34
2.3.5. Testability of Misinformation MTFs	35

<i>2.4 Discussion</i>	36
<i>2.5 Limitations of Study</i>	40
<i>2.6 Conclusion</i>	41
<i>Declarations</i>	49
<i>Appendix A – Completed PRISMA-ScR Checklist</i>	50
<i>Appendix B – List of Target Articles</i>	52
<i>Appendix C - Search Strategy</i>	54
<i>Appendix D – Data Extraction Items</i>	56
<i>Appendix E – Complete List of Included Studies</i>	68
<i>Appendix F – Expanded Version of Excluded Full-Text Articles by Reason</i>	78
CHAPTER 3 (Draft Manuscript 2): Understanding the real-world misinformation countering initiative development process: Theory-guided semi-structured interviews	84
<i>Preface</i>	84
<i>Abstract</i>	86
<i>3.1 Introduction</i>	88
<i>3.2 Methodology</i>	89
<i>3.2.1 Ethics</i>	89
<i>3.2.2. Study Design</i>	89
<i>3.3 Results</i>	93
<i>3.3.1 Participants</i>	93
<i>3.3.1 Themes</i>	94
<i>3.4 Discussion</i>	102
<i>3.5 Limitations of the study</i>	104
<i>3.6 Conclusion</i>	105
<i>Appendix A: Ethics Approval Letter</i>	114
<i>Appendix B: SCAGO Website Initiative</i>	115
<i>Appendix C: Recruitment Email sent to SCAGO experts</i>	116
<i>Appendix D: 1-Page Project Description attached within the recruitment email</i>	117
<i>Appendix E: Information Sheet</i>	118
<i>Appendix F: Qualitative Interview Guide</i>	122
<i>Appendix G: Extracted Themes with Sample Quotes</i>	125
CHAPTER 4: Discussion of Results	149
<i>4.1 Summary of findings</i>	149
<i>4.2 Considerations from misinformation MTFs for organizations</i>	156
<i>4.3 Implications for future use</i>	159
<i>4.4 Conclusion</i>	160

LIST OF TABLES

Chapter 2

Table 1. Study details of misinformation MTFs in the scoping review.

Table 2. Characterization of misinformation MTFs according to Nilsen and Delen et al.

Table 3. Misinformation MTF Usability

Table 4. Misinformation MTF Implementability

Table 5. Misinformation MTF Testability

Chapter 3

Table 1. Demographic characteristics of interviewees (n=7).

Table 2. Themes reported to describe the components of the SCAGO Misinformation Initiative

Table 3. Themes reported to describe the development process of the SCAGO Misinformation Initiative

Table 4. Mapping SCAGO Misinformation Initiative using the AACTT Framework

Table 5. Measuring the Success of the Misinformation Initiative using the RE-AIM framework

Table 6. Barriers and Enablers to successful misinformation initiative

Table 7. Countering Misinformation and the extent of MTF integration

Table 8. Additional Considerations regarding the initiative

LIST OF FIGURES

Chapter 2

Figure 1. PRISMA Flow Diagram of Misinformation MTF Selection.

Discussion

Figure 1. Nan et al.'s Accessibility-Acceptance Framework of Countering Health Misinformation

LIST OF ABBREVIATIONS

MTFs	Models, Theories and Frameworks
MAHB	Misinformation Associated Health Behaviors
SCAGO	Sickle Cell Awareness Group of Ontario
T-CaST	Theory Comparison and Selection Tool
AACTT	Action, Actor, Context, Target, Time
RE-AIM	Reach, Effectiveness, Adoption, Implementation, Maintenance

CHAPTER 1: Introduction

Background

1.1 Health Misinformation: What is it and Why does it matter?

Health misinformation poses a persistent challenge to public health.¹ The issue intensified during the COVID-19 pandemic, where widespread uncertainty and anxiety fueled a significant increase in the spread of misinformation.¹⁻³ In response, the World Health Organization declared an “infodemic” — an overabundance of false or misleading information during a disease outbreak in digital and physical environments.⁴ In this context, misinformation can become harmful, undermining public health interventions, eroding trust in science, and endangering lives.⁴⁻⁹ As the term “misinformation” became increasingly popular across media and research during the pandemic,^{10,11} it has also been used inconsistently, highlighting the need for clear and focused definitions.

1.2 Defining Misinformation

In public discourse and some literature, *misinformation* is frequently used interchangeably with related terms such as *fake news*, *disinformation*, *rumours*, *propaganda*, and *conspiracy theories*.¹² One of the most debated among these is “fake news,” a phrase criticized for its vagueness and politicization. Some scholars recommend replacing it with more specific terms like *misinformation* and *disinformation*.¹³ It is, therefore, essential to distinguish between these two terms.

Misinformation refers to false or misleading content shared without the intent to deceive, while *disinformation* involves the deliberate spreading of such content for financial, political, or ideological gain.^{1,14} Some definitions characterize misinformation more broadly, as any information that turns out to be false.^{15,16} While this framing may appear straightforward, it can unfairly label scientific communication as misinformation, particularly in fast-evolving situations like the COVID-19 pandemic, where evidence and guidance can change substantially over time.¹⁷ In contrast, the U.S. Surgeon General defines misinformation as “false, inaccurate, or misleading [information] according to the best available evidence at the time.”¹ This definition acknowledges the evolving nature of scientific understanding and avoids penalizing the natural progression of knowledge. Accordingly, this thesis adopts the U.S. Surgeon General’s definition of misinformation, as it is better suited to the nature of public health communication.

While disinformation is distinguished by its intentionality, the intent is often difficult to ascertain in practice. A well-known historical example of disinformation is the anti-Semitic propaganda spread by the Nazi regime during World War II, which was intentionally crafted to manipulate public opinion into accepting the persecution of Jews, ultimately leading to atrocities that were supported by German citizens.^{17–19} However, many instances of disinformation can be more ambiguous, and determining intent can be quite challenging. In many cases, the same piece of false information may function as both misinformation and disinformation, making the two difficult to separate in practice. Yet, what ultimately matters is not always the intent behind the message or whether the misinformation actors genuinely believe the message they share, but the consequences of its spread. For example, the Pizzagate conspiracy theory during the 2016 U.S. election falsely accused political figures of running a child trafficking ring out of the restaurant's basement, resulting in property vandalism and death threats.²⁰ One individual, believing in this claim, entered the establishment armed with a gun and demanded to see the nonexistent basement.²¹ Similarly, false claims about the origins of the 2023 Canadian wildfires, suggesting they were caused by state-driven arson, eco-terrorism and drones, disrupted emergency responses, endangered the safety of the citizens and eroded public trust.²² These examples demonstrate that poor outcomes can occur regardless of whether false claims are spread with the intent to deceive or out of genuine belief.

1.3 Consequences of Health Misinformation

Over the years, health-related misinformation has had serious consequences for public safety. A few decades ago, opponents of seat belt laws argued that being thrown free from the vehicle during a crash could be advantageous, challenging seat belt legislation.²³ Similarly, during health crises such as Ebola and AIDS outbreaks in Africa, misinformation hindered effective responses, ranging from denial that HIV causes AIDS to beliefs that outbreaks don't exist.^{1,24,25} Many believed that the outbreaks were the result of government conspiracies and could be cured with traditional remedies.^{1,24,25} These misconceptions led to limited access to proper treatment and contributed to over 330,000 preventable deaths.²⁴ Most recently, the misinformation surge during the COVID-19 pandemic led to physical health risks for individuals but also widespread social and institutional consequences.^{1–3}

1.4 COVID-19 Infodemic: Scope and Spread

1.4.1 Measurable Impacts

Although estimating the economic toll of misinformation is challenging, a few studies have tried to quantify its impact. One analysis estimated that misinformation during the COVID-19 pandemic led to nearly 13,000 hospitalizations and 2,800 deaths, resulting in approximately \$300 million in hospitalization costs in Canada.²⁶ A 2021 report further estimated that misinformation contributed to an estimated daily loss of \$50 to \$300 million, with even greater financial impacts during the Delta variant surge.²⁷ These figures highlight just how damaging misinformation can be during a public health crisis, not only in terms of health outcomes but also economic burden. One of the key drivers behind this widespread impact is the rapid and large-scale dissemination of misinformation through social media and other digital platforms.

1.4.2. Recent trends in the spread of misinformation

Social media has become a primary source of information for many,²⁸ with approximately 4.62 billion active users worldwide.²⁹ This is particularly pronounced among younger demographics, with 89% of college students reporting using social media as their primary news source.³⁰ Unlike traditional news, these online platforms allow rapid, real-time sharing of unverified content to massive audiences, particularly during times of crisis such as the COVID-19 pandemic.^{1,31,32}

This digital landscape has enabled misinformation to spread at unprecedented speed and scale.³³ Studies have shown that false claims are more likely to be engaged with and shared than factual content, making it harder for accurate information to keep up.³⁴ For example, a study analyzing tweets containing the hashtag "#vaccine" found that anti-vaccine tweets were shared 4.13 times more often than neutral tweets.³⁵ This resulted in a surge of misinformation online; between March and April 2020 alone, Facebook labelled 90 million posts with misinformation warnings.³⁶ During the pandemic, Facebook and Instagram took action by removing 20 million posts that contained health misinformation.³⁷ Similarly, YouTube emerged as a significant source of false information, with approximately 23% to 26% of its videos containing false or misleading content related to COVID-19.³⁸

Several features of social media contribute to this problem. Platforms incentivize users to share content by offering social rewards such as likes and comments, which reinforces the desire for social acceptance and affirmation.^{39,40} Unfortunately, this also encourages users to share content without verifying its accuracy.^{39,40} Algorithms further accelerate this spread by

promoting content based on popularity or similarity to previously seen content rather than accuracy.^{37,41} These dynamics help explain why 94% of social media users report seeing others share misinformation, while 67% admit to sharing it themselves.⁴²

Despite platform-level interventions, these efforts have not kept pace with the scale and speed of misinformation. For instance, Facebook recently ended its fact-checking programs, signalling the difficulty of intervening or managing misleading content.⁴³ This indicates that the misinformation issue persists unresolved and may potentially escalate.

1.5 Vaccine Misinformation and Hesitancy: Then and Now

Vaccine misinformation is not unique to the COVID-19 era. In fact, it has long been one of the most persistent and harmful forms of health-related misinformation, fueling public distrust, resistance, and even outbreaks of preventable diseases.³¹ This resistance dates back to 1796 when Edward Jenner's groundbreaking development of the first smallpox vaccine was met with immediate opposition. False claims circulated suggesting that a vaccine derived from cowpox could cause facial deformities, lead individuals to take on bovine characteristics, or even result in people growing horns.⁴⁴

More than two centuries later, one of the most damaging examples of vaccine misinformation emerged from Andrew Wakefield's now-discredited article falsely linking the measles, mumps, and rubella (MMR) vaccine to autism.⁴⁵ Although based on a single, deeply flawed study, later retracted⁴⁶, this claim had a lasting impact on public perception. In November 2023, 25 years later, the percentage of people who believe vaccines cause autism has increased from 10% to 16% since 2021.⁴⁷ Many parents grew fearful of vaccinating their children, contributing to a decline in MMR vaccination rates over the following two decades.⁴⁸ This decline has been associated with measles outbreaks in countries such as the UK, USA, and Canada, where vaccine refusal has become more widespread.^{1,49}

The COVID-19 pandemic intensified longstanding challenges related to vaccine misinformation, particularly by undermining public trust in the safety and efficacy of COVID-19 vaccines.⁵⁰ This erosion of trust was often fueled by misinformation suggesting that the vaccines were improperly tested, contained harmful or experimental ingredients, or were not considered "true" vaccines, along with doubts about their ability to fully prevent infection.^{51–54} Exposure to these types of COVID-19 vaccine misinformation has been shown to reduce individuals' willingness to get vaccinated significantly.⁵⁵ Similar trends have been observed in Canada, where

misinformation contributed to vaccine hesitancy among an estimated 2.35 million people.^{26,56} This is particularly concerning given that mortality rates are significantly higher among unvaccinated individuals.⁵⁷

1.6 Drivers of Misinformation Spread and Acceptance

Misinformation often persists not only because of its content but also due to a range of cognitive biases that shape how people process information. One such bias is the tendency to rely on intuition or “gut feelings” when assessing the accuracy of a claim.^{58,59} Studies show that people who rely on intuitive thinking are more prone to believing misinformation, while those who rely on analytical thinking are less susceptible.^{60,61} This tendency is reinforced by the illusory truth effect, which is when repeated exposure to a false claim increases its perceived accuracy.^{58,62,63} The effects can persist for months,^{58,64} even when corrective information is available,^{58,65} especially when misinformation is deeply entrenched or emotionally resonant.

Social and emotional factors further contribute to the persistence and acceptance of misinformation. People tend to place greater trust in information that comes from in-group members or sources they perceive as credible.^{58,66,67} This perceived credibility often extends to public figures and political elites, whose statements can strongly influence public beliefs.^{68–70} For example, individuals who relied on conservative media and Trump briefings during the COVID-19 pandemic were less likely to perceive the virus as a serious threat or believe in the effectiveness of preventative measures, ultimately reducing their adherence to public health guidelines.⁷¹ Similarly, a 2020 survey in France revealed that those at the political extremes, both left and right, were more likely to believe COVID-19 was created in a laboratory.⁷² In addition to social alignment, emotional responses also play a role. Misinformation that evokes strong emotional responses, such as fear, uncertainty, and confusion, is more likely to be believed and shared without checking its authenticity.^{37,73,74} For instance, research on news article virality found that emotional content, especially anger, anxiety, and awe, significantly increases the likelihood of an article being shared.⁷⁵ Together, these social and emotional factors could amplify the reach and impact of misinformation, especially in public health contexts such as COVID-19.

1.7 Consequences of Health Misinformation during COVID-19

1.7.1 Belief in COVID-19 Misinformation

Misinformation during the COVID-19 pandemic significantly shaped public perceptions, undermining trust in health authorities, institutions, and scientific evidence.⁴⁻⁹ Many individuals believed in alternative explanations for the virus's origin, including conspiracy theories suggesting it was engineered by the Chinese government or used as a bioweapon by the United States.⁷⁶ Claims such as “5G causes the coronavirus” or that COVID-19 was part of a government cover-up became widespread.^{37,77-79} These beliefs in COVID-19 misinformation led to a growing distrust of health authorities and institutions, resulting in the rejection of official information and public health guidance, pushing individuals to seek alternative narratives.^{5,80}

1.7.2 Behaviours resulting from belief in COVID-19 misinformation

The dangers of misinformation are most evident when false beliefs translate into actions that compromise both individual and public health. One of the most immediate physical harms observed as a consequence of COVID-19 misinformation was the rise in self-medication with unverified treatments. For example, hydroxychloroquine (HCQ) gained attention after President Trump retweeted HCQ-related claims, despite the FDA's warning against its use.⁸¹ This resulted in a surge in the uptake of the drug, which rapidly increased between March and April 2020,⁸² and, in one case, led to the death of a man in Arizona who ingested a chloroquine-containing product.⁸³ Similarly, false claims about ivermectin as a COVID-19 treatment led to a spike in poison control calls and prompted joint warnings from Canadian health authorities.²⁶ Dangerous myths also circulated about supposed cures, including the consumption of saltwater, bleach, and oregano oil.⁷⁶ One particularly deadly claim that drinking alcohol could kill the virus led to over 800 deaths and 5876 hospitalizations due to methanol poisoning.⁸⁴

Belief in misinformation further disrupts social functioning by driving harmful collective behaviour. During the COVID-19 pandemic, false rumours of a national lockdown sparked panic buying across the U.S., contributing to food shortages and worsening food insecurity for vulnerable populations.⁸⁵ Misinformation also led to incidents of violence, including doxing, armed protests at private residences, and acts of vandalism targeting healthcare professionals, public health workers, and other frontline personnel.⁸⁶ The false claims that “5G causes COVID-19” led to 77 cell phone towers being set on fire.³⁷ Another example was the “Freedom Convoy”

protests in Canada against public health mandates, which resulted in major disruptions, including blocked international border crossings and a 20-day occupation of Ottawa.²⁶ These events demonstrate how misinformation can escalate from individual belief to large-scale societal unrest.

1.8 Current Methodologies to Counteract Misinformation

In response to the widespread harm caused by COVID-19 misinformation, researchers, practitioners, and public health agencies across diverse fields, including psychology, computer science, communication, and political science, have increasingly collaborated to understand and develop strategies to counter its spread.^{10,87–90} This led to a significant increase in research on misinformation interventions to mitigate the spread and impact of health misinformation.⁹¹

One such widely used intervention is the detection of fake news and the use of warning labels.^{92,93} These interventions usually involve algorithmic or manual detection of false content, followed by the use of visual warnings to indicate that the content contains false information.^{93,94} Studies suggest that although their overall effectiveness is limited, they can reduce users' likelihood of sharing misinformation.⁹³ Considering this, many media organizations such as Facebook, Twitter, and YouTube have allocated resources to detect and put labels on COVID-19 misinformation.¹ For example, Facebook implemented machine learning algorithms to detect COVID-19 misinformation, subsequently lowering the visibility of detected content in users' news feeds.⁹² Other platforms also have taken action; for instance, Twitter provides credible articles when users search for COVID-19-related topics, while Instagram redirects users to reliable sources for accurate information.⁹²

Another strategy used is fact-checking and debunking strategies. These aim to correct misinformation by providing accurate information after false claims have been circulated.^{58,95,96} Research shows that these interventions can be effective at reducing belief in misinformation.⁹⁷ During COVID-19, many initiatives were created, such as the #CoronaVirusFacts Alliance, involving fact-checkers from over seventy countries working to identify and correct false information.⁹⁸

Another mitigation strategy is prebunking, which aims to pre-emptively protect individuals from false claims.^{58,95} Prebunking, derived from inoculation theory, involves exposing individuals to weakened forms of misinformation or common manipulation tactics in advance,

often paired with a forewarning and refutational content to build resistance against misinformation.^{58,95,99}

Lastly, media literacy campaigns have been identified as one of the effective ways to counter misinformation.¹⁰⁰ This method focuses on improving individuals' ability to gauge online content and discern fake news by themselves.¹⁰⁰

1.9 Addressing Misinformation-Associated Health Behaviours (MAHB)

Despite the range of interventions focused on identifying, flagging, and removing misinformation, such efforts largely treat misinformation as an informational problem. While these approaches are important, many factors guide misinformation-related behaviours, including vaccine uptake, that are shaped by broader factors beyond information accuracy alone, such as social dynamics, group identity, accessibility, and personal attitudes.^{101,102} As such, a more comprehensive approach is required since information is rarely the sole determinant of misinformation-related behaviour.¹⁰³

We propose that misinformation becomes a significant threat to public health when it translates into action, affecting Misinformation-Associated Health Behaviours (MAHB). For example, false claims about vaccine safety are not dangerous solely because people believe them. They are dangerous because they can lead individuals to delay or refuse vaccination, putting both themselves and others at risk.⁵³ Some factors that guide MAHBs include individual variability in susceptibility to misinformation,^{60,104} whether the information aligns with pre-existing beliefs,¹⁰⁵ the emotional tone and structure of the content,^{104,105} trust in the information source^{106–108} and the degree of deliberation on the content.¹⁰⁹ We propose that incorporating these factors in the misinformation space could yield more effective interventions.^{101,102,110}

This type of shift (i.e. belief-focused to behaviour-focused) is analogous to the evolution in implementation science over the past two decades. Early knowledge translation models framed change as a largely informational process: new research was disseminated, adopted, and implemented through exposure to evidence.¹¹¹ However, implementation science has since recognized the limits of this view, moving toward behaviour change frameworks that account for the complexity of real-world decision-making and the contexts in which those decisions unfold.^{103,112,113}

1.10 Misinformation Models, Theories, and Frameworks (MTFs)

With the surge in misinformation, there has been a significant rise in the development of Models, Theories, and Frameworks (MTFs) intended to describe, explain, and propose strategies towards misinformation. However, it remains unclear how far the field has progressed—whether this proliferation of frameworks is as extensive or useful as it appears, and whether they are being practically applied. In particular, it is unknown whether these MTFs incorporate a behavioural lens or consider MAHBs in a meaningful way. While academic literature continues to generate new conceptual tools, it is not yet known whether these MTFs have been practically applied by those developing anti-misinformation initiatives or whether they reflect the insights and constraints of real-world intervention design.

This research seeks to explore our current position in the development and application of misinformation MTFs and to assess their practical relevance. Ultimately, this work can inform future research in the creation of an appraisal tool to identify, evaluate, and apply suitable frameworks in real-world settings.

1.11 Guiding Paradigm

This thesis is grounded in a critical realist paradigm, which combines a realist ontology with a constructivist epistemology.^{115,116} Critical realism holds that while a reality exists independently of our perceptions, our understanding of that reality is mediated by interpretation, context and positionality.^{115,116} Realist ontology assumes “truth” exists while recognizing it may never be fully understood.^{115,116} Constructivist epistemology acknowledges that knowledge is co-constructed through interactions between the researcher and participants. Interviews and thematic analysis are used to capture participants’ lived experiences and interpret deeper enablers and barriers about the initiative’s developments and outcomes. Therefore, acknowledging my positionality as a researcher is central to this approach. I am a Turkish-Canadian female with a background in Bachelor’s of Translational and Molecular Medicine, and my current position is as a Master’s student in Epidemiology at the Ottawa Hospital Research Institute. I have also approached this study motivated by a desire to address the harms of health misinformation. Considering my background, I have been intentional with the data collected, trying to make sure I am not picking those that align with my past experiences, but rather conveying the experiences reflected by the data.

Critical realism is well-suited to this thesis because it allows for an exploration of both the observable practices and the underlying mechanisms that shape how misinformation interventions are designed and implemented. Given the complex, context-dependent nature of public health initiatives, especially those addressing misinformation, critical realism supports a nuanced analysis that goes beyond describing what happened to interrogating why it happened, how structural and contextual factors shaped it, and for whom it worked. This paradigm aligns with the thesis's aim to understand not just individual experiences but also the deeper causal forces influencing the use of behavioural frameworks in real-world settings.

1.12 Objectives

The overall objective of this project is to assess the quality and nature of existing misinformation MTFs and to explore how these MTFs informed the development of misinformation interventions, using the Sick Cell Awareness Group of Ontario (SCAGO) as a real-world example. By comparing these aspects, we aim to evaluate the integration of misinformation MTFs into practical applications and provide insights for future developments.

To achieve this, we have set two specific objectives: 1) conduct a scoping review using Wang et al.'s approach to categorize and assess misinformation MTFs, and 2) conduct theory-guided interviews with SCAGO to understand the development of real-world misinformation interventions and identify whether any misinformation MTFs are used.

This study seeks to bridge the gap between theoretical models and practical interventions by systematically categorizing and appraising misinformation MTFs and evaluating their application in real-world settings.

1.13 Category and Format of Thesis

This thesis involves a secondary analysis of existing literature through a scoping review and primary qualitative data collection through interviews. It is written in accordance with the guidelines set by the School of Epidemiology and Public Health. The thesis consists of four chapters. Chapter 1 provides a comprehensive literature review, detailing key concepts related to misinformation and MTFs, along with establishing the rationale and objectives of the study. Chapter 2 is a standalone manuscript that presents a scoping review of misinformation MTFs targeting MAHBs, alongside a structured appraisal of their purpose, usability, implementability

and testability. Chapter 3 is a standalone manuscript based on interviews with SCAGO, examining the development and implementation of misinformation countermeasures within a real-world public health context. Chapter 4 presents the discussion, synthesizing key findings, highlighting their implications for research and practice, and identifying avenues for future inquiry.

References

1. Murthy V. Confronting Health Misinformation. Published online 2021. <https://www.hhs.gov/sites/default/files/surgeon-general-misinformation-advisory.pdf>
2. Ahmed S, Rasul ME. Social Media News Use and COVID-19 Misinformation Engagement: Survey Study. *J Med Internet Res*. 2022;24(9):e38944. doi:10.2196/38944
3. Diekman C, Ryan CD, Oliver TL. Misinformation and Disinformation in Food Science and Nutrition: Impact on Practice. *J Nutr*. 2023;153(1):3-9. doi:10.1016/j.tjnut.2022.10.001
4. Pool J, Fatehi F, Akhlaghpour S. Infodemic, Misinformation and Disinformation in Pandemics: Scientific Landscape and the Road Ahead for Public Health Informatics Research. In: Mantas J, Stoicu-Tivadar L, Chronaki C, et al., eds. *Studies in Health Technology and Informatics*. IOS Press; 2021. doi:10.3233/SHTI210278
5. Siani A, Green I. Scientific Misinformation and Mistrust of COVID-19 Preventive Measures among the UK Population: A Pilot Study. *Vaccines*. 2023;11(2):301. doi:10.3390/vaccines11020301
6. Bin Naeem S, Kamel Boulos MN. COVID-19 Misinformation Online and Health Literacy: A Brief Overview. *Int J Environ Res Public Health*. 2021;18(15):8091. doi:10.3390/ijerph18158091
7. Islam MS, Kamal AHM, Kabir A, et al. COVID-19 vaccine rumors and conspiracy theories: The need for cognitive inoculation against misinformation to improve vaccine adherence. Lavorgna L, ed. *PLOS ONE*. 2021;16(5):e0251605. doi:10.1371/journal.pone.0251605
8. Nelson T, Kagan N, Critchlow C, Hillard A, Hsu A. The Danger of Misinformation in the COVID-19 Crisis. *Mo Med*. 2020;117(6):510-512.
9. Adams Z, Osman M, Bechlivanidis C, Meder B. (Why) Is Misinformation a Problem? *Perspect Psychol Sci*. Published online February 16, 2023:174569162211413. doi:10.1177/17456916221141344
10. Nan X, Wang Y, Thier K. Why do people believe health misinformation and who is at risk? A systematic review of individual differences in susceptibility to health misinformation. *Soc Sci Med*. 2022;314:115398. doi:10.1016/j.socscimed.2022.115398
11. American Psychological Association. How and why does misinformation spread? Journalism and Facts. November 29, 2023. Accessed April 10, 2025. <https://www.apa.org/topics/journalism-facts/how-why-misinformation-spreads>
12. Persily N, Tucker JA, eds. *Social Media and Democracy: The State of the Field, Prospects for Reform*. 1st ed. Cambridge University Press; 2020. doi:10.1017/9781108890960

13. Wang Y, McKee M, Torbica A, Stuckler D. Systematic Literature Review on the Spread of Health-related Misinformation on Social Media. *Soc Sci Med* 1982. 2019;240(ut9, 8303205):112552. doi:10.1016/j.socscimed.2019.112552
14. Shu K, Wang S, Lee D, Liu H. Mining Disinformation and Fake News: Concepts, Methods, and Recent Advancements. In: Shu K, Wang S, Lee D, Liu H, eds. *Disinformation, Misinformation, and Fake News in Social Media*. Lecture Notes in Social Networks. Springer International Publishing; 2020:1-19. doi:10.1007/978-3-030-42699-6_1
15. Gabarron E, Oyeyemi SO, Wynn R. COVID-19-related misinformation on social media: a systematic review. *Bull World Health Organ*. 2021;99(6):455-463A. doi:10.2471/BLT.20.276782
16. Chen S, Xiao L, Kumar A. Spread of misinformation on social media: What contributes to it and how to combat it. *Comput Hum Behav*. 2023;141:107643. doi:10.1016/j.chb.2022.107643
17. McSween-Cadieux E, Lane J, Hong QN, et al. Production and use of rapid responses during the COVID-19 pandemic in Quebec (Canada): perspectives from evidence synthesis producers and decision makers. *Health Res Policy Syst*. 2024;22(1):22. doi:10.1186/s12961-024-01105-x
18. Bytwerk RL. Believing in “Inner Truth”: *The Protocols of the Elders of Zion* in Nazi Propaganda, 1933–1945. *Holocaust Genocide Stud*. 2015;29(2):212-229. doi:10.1093/hgs/dcv024
19. Posetti J, Matthews A. A short guide to the history of ‘fake news’ and disinformation. Published online July 2018. https://www.icfj.org/sites/default/files/2018-07/A%20Short%20Guide%20to%20History%20of%20Fake%20News%20and%20Disinformation_ICFJ%20Final.pdf
20. Au CH, Ho KKW, Chiu DKW. The Role of Online Misinformation and Fake News in Ideological Polarization: Barriers, Catalysts, and Implications. *Inf Syst Front*. 2022;24(4):1331-1354. doi:10.1007/s10796-021-10133-9
21. The Associated Press. Edgar Welch, gunman from “Pizzagate” political conspiracy case, shot dead by N.C. police. <https://www.cbc.ca/news/world/pizzagate-gunman-killed-1.7427770>. January 10, 2025.
22. Russill C, Bridgman A, Hayes H, et al. *FLAME WARS: Misinformation and Wildfire in Canada’s Climate Conversation.*; 2024.
23. Giubilini A, Savulescu J. Vaccination, Risks, and Freedom: The Seat Belt Analogy. *Public Health Ethics*. Published online October 22, 2019;phz014. doi:10.1093/phe/phz014
24. Chigwedere P, Seage GR, Gruskin S, Lee TH, Essex M. Estimating the Lost Benefits of Antiretroviral Drug Use in South Africa. *JAIDS J Acquir Immune Defic Syndr*. 2008;49(4):410-415. doi:10.1097/QAI.0b013e31818a6cd5

25. Vinck P, Pham PN, Bindu KK, Bedford J, Nilles EJ. Institutional trust and misinformation in the response to the 2018–19 Ebola outbreak in North Kivu, DR Congo: a population-based survey. *Lancet Infect Dis*. 2019;19(5):529-536. doi:10.1016/S1473-3099(19)30063-5
26. The Council of Canadian Academies. *Fault Lines: Expert Panel on the Socioeconomic Impacts of Science and Health Misinformation*.; 2023. Accessed February 8, 2025. <https://cca-reports.ca/wp-content/uploads/2023/02/Report-Fault-Lines-digital.pdf>
27. Bruns R, Hosangadi D, Trotochaud M, Sell T. *COVID-19 Vaccine Misinformation and Disinformation Costs an Estimated \$50 to \$300 Million Each Day*. Center for Health Security; 2021.
28. Shearer E, Gottfried J. *News Use Across Social Media Platforms 2017*. Pew Research Center; 2017. Accessed February 7, 2025. http://assets.pewresearch.org/wp-content/uploads/sites/13/2017/09/13163032/PJ_17.08.23_socialMediaUpdate_FINAL.pdf
29. Obada DR, Dabija DC. “In Flow”! Why Do Users Share Fake News about Environmentally Friendly Brands on Social Media?. *Int J Environ Res Public Health*. 2022;19(8). doi:10.3390/ijerph19084861
30. Head AJ, Wihbey J, Metaxas PT, MacMillan M, Cohen D. *How Students Engage with News: Five Takeaways for Educators, Journalists, and Librarians. The News Study Report*. Project Information Literacy; 2018.
31. Dubé E, Laberge C, Guay M, Bramadat P, Roy R, Bettinger J. Vaccine hesitancy: an overview. *Hum Vaccines Immunother*. 2013;9(8):1763-1773. doi:10.4161/hv.24657
32. Rubinelli S, Purnat TD, Wilhelm E, et al. WHO competency framework for health authorities and institutions to manage infodemics: its development and features. *Hum Resour Health*. 2022;20(1):35. doi:10.1186/s12960-022-00733-0
33. Siapera E. *The Handbook of Global Online Journalism*. 1st ed. John Wiley & Sons, Incorporated; 2012.
34. Vosoughi S, Roy D, Aral S. The spread of true and false news online. *Science*. 2018;359(6380):1146-1151. doi:10.1126/science.aap9559
35. Blankenship EB, Goff ME, Yin J, et al. Sentiment, Contents, and Retweets: A Study of Two Vaccine-Related Twitter Datasets. *Perm J*. 2018;22(3):17-138. doi:10.7812/TPP/17-138
36. Barua Z, Barua S, Aktar S, Kabir N, Li M. Effects of misinformation on COVID-19 individual responses and recommendations for resilience of disastrous consequences of misinformation. *Prog Disaster Sci*. 2020;8(101778592):100119. doi:10.1016/j.pdisas.2020.100119
37. Yu W, Payton B, Sun M, Jia W, Huang G. Toward an integrated framework for misinformation and correction sharing: A systematic review across domains. *New Media Soc*. 2023;25(8):2241-2267. doi:10.1177/14614448221116569

38. Li HOY, Bailey A, Huynh D, Chan J. YouTube as a source of information on COVID-19: a pandemic of misinformation? *BMJ Glob Health*. 2020;5(5):e002604. doi:10.1136/bmjgh-2020-002604
39. Lindström B, Bellander M, Schultner DT, Chang A, Tobler PN, Amodio DM. A computational reward learning account of social media engagement. *Nat Commun*. 2021;12(1):1311. doi:10.1038/s41467-020-19607-x
40. Shahzad K, Khan SA, Iqbal A, Shabbir O, Latif M. Determinants of fake news diffusion on social media: a systematic literature review. *Glob Knowl Mem Commun*. Published online 2023. doi:10.1108/GKMC-06-2023-0189
41. Tang L, Fujimoto K, Muhammad (Tuan) Amith, et al. “Down the Rabbit Hole” of Vaccine Misinformation on YouTube: Network Exposure Study. *J Med Internet Res*. 2021;23(1). doi:10.2196/23262
42. Chen X, Sin SJ. ‘Misinformation? What of it?’ Motivations and individual differences in misinformation sharing on social media. *Proc Am Soc Inf Sci Technol*. 2013;50(1):1-4. doi:10.1002/meet.14505001102
43. Isaac M, Schleifer T. Meta Says It Will End Its Fact-Checking Program on Social Media Posts. *The New York Times*. <https://www.nytimes.com/live/2025/01/07/business/meta-fact-checking>. January 7, 2025. Accessed April 10, 2025.
44. Snowden FM. *Epidemics and Society: From the Black Death to the Present*. Yale University Press; 2019.
45. Amazeen MA, Krishna A. Processing Vaccine Misinformation: Recall and Effects of Source Type on Claim Accuracy via Perceived Motivations and Credibility. *Int J Commun*. 2023;17:560-582.
46. Wakefield A, Murch S, Anthony A, et al. RETRACTED: Ileal-lymphoid-nodular hyperplasia, non-specific colitis, and pervasive developmental disorder in children. *The Lancet*. 1998;351(9103):637-641. doi:10.1016/S0140-6736(97)11096-0
47. Annenberg Public Policy Center. *Vaccine Confidence Falls as Belief in Health Misinformation Grows*. University of Pennsylvania; 2023. Accessed April 12, 2025. <https://www.annenbergpublicpolicycenter.org/vaccine-confidence-falls-as-belief-in-health-misinformation-grows/>
48. Hussain A, Ali S, Ahmed M, Hussain S. The Anti-vaccination Movement: A Regression in Modern Medicine. *Cureus*. Published online July 3, 2018. doi:10.7759/cureus.2919
49. Rao TSS, Andrade C. The MMR vaccine and autism: Sensation, refutation, retraction, and fraud. *Indian J Psychiatry*. 2011;53(2):95-96. doi:10.4103/0019-5545.82529

50. Ferreira Caceres MM, Sosa JP, Lawrence JA, et al. The impact of misinformation on the COVID-19 pandemic. *AIMS Public Health*. 2022;9(2):262-277. doi:10.3934/publichealth.2022018
51. Skafle I, Nordahl-Hansen A, Quintana DS, Wynn R, Gabarron E. Misinformation About COVID-19 Vaccines on Social Media: Rapid Review. *J Med Internet Res*. 2022;24(8):e37367. doi:10.2196/37367
52. Zimmerman T, Shiroma K, Fleischmann KR, et al. Misinformation and COVID-19 vaccine hesitancy. *Vaccine*. 2023;41(1):136-144. doi:10.1016/j.vaccine.2022.11.014
53. Ruggeri K, Vanderslott S, Yamada Y, et al. Behavioural interventions to reduce vaccine hesitancy driven by misinformation on social media. *BMJ*. Published online January 16, 2024:e076542. doi:10.1136/bmj-2023-076542
54. Lee SK, Sun J, Jang S, Connelly S. Misinformation of COVID-19 vaccines and vaccine hesitancy. *Sci Rep*. 2022;12(1):13681. doi:10.1038/s41598-022-17430-6
55. Loomba S, De Figueiredo A, Piatek SJ, De Graaf K, Larson HJ. Measuring the impact of COVID-19 vaccine misinformation on vaccination intent in the UK and USA. *Nat Hum Behav*. 2021;5(3):337-348. doi:10.1038/s41562-021-01056-1
56. Naeem M, Ozuem W. Understanding misinformation and rumors that generated panic buying as a social practice during COVID-19 pandemic: evidence from Twitter, YouTube and focus group interviews. *Inf Technol People*. 2022;35(7):2140-2166. doi:10.1108/ITP-01-2021-0061
57. Barua Z. COVID-19 Misinformation on Social Media and Public's Health Behavior: Understanding the Moderating Role of Situational Motivation and Credibility Evaluations. *Hu Arenas*. Published online 2022. doi:10.1007/s42087-022-00291-w
58. Ecker UKH, Lewandowsky S, Cook J, et al. The psychological drivers of misinformation belief and its resistance to correction. *Nat Rev Psychol*. 2022;1(1):13-29. doi:10.1038/s44159-021-00006-y
59. Prike T, Arnold MM, Williamson P. The relationship between anomalistic belief, misperception of chance and the base rate fallacy. *Think Reason*. 2020;26(3):447-477. doi:10.1080/13546783.2019.1653371
60. Pennycook G, Rand DG. Who falls for fake news? The roles of bullshit receptivity, overclaiming, familiarity, and analytic thinking. *J Pers*. 2020;88(2):185-200. doi:10.1111/jopy.12476
61. Pehlivanoglu D, Lin T, Deceus F, Heemskerk A, Ebner NC, Cahill BS. The role of analytical reasoning and source credibility on the evaluation of real and fake full-length news articles. *Cogn Res Princ Implic*. 2021;6(Allcott, H., and Gentzkow, M. (2017). Social media and fake news in the 2016 election. *Journal of Economic Perspectives*, 31(2), 211-236

<https://dx.doi.org/10.1257/jep.31.2.211> Allen, J., Howland, B., Mobius, M., Rothschild, D., Watts, D. J. (2020). Evalu. doi:10.1186/s41235-021-00292-3

62. Dechêne A, Stahl C, Hansen J, Wänke M. The Truth About the Truth: A Meta-Analytic Review of the Truth Effect. *Personal Soc Psychol Rev.* 2010;14(2):238-257. doi:10.1177/1088868309352251
63. Unkelbach C, Koch A, Silva RR, Garcia-Marques T. Truth by Repetition: Explanations and Implications. *Curr Dir Psychol Sci.* 2019;28(3):247-253. doi:10.1177/0963721419827854
64. Brown AS, Nix LA. Turning lies into truths: Referential validation of falsehoods. *J Exp Psychol Learn Mem Cogn.* 1996;22(5):1088-1100. doi:10.1037/0278-7393.22.5.1088
65. Unkelbach C, Greifeneder R. Experiential fluency and declarative advice jointly inform judgments of truth. *J Exp Soc Psychol.* 2018;79:78-86. doi:10.1016/j.jesp.2018.06.010
66. Nadarevic L, Reber R, Helmecke AJ, Köse D. Perceived truth of statements and simulated social media postings: an experimental investigation of source credibility, repeated exposure, and presentation format. *Cogn Res Princ Implic.* 2020;5(1):56. doi:10.1186/s41235-020-00251-4
67. Mackie DM, Worth LT, Asuncion AG. Processing of persuasive in-group messages. *J Pers Soc Psychol.* 1990;58(5):812-822. doi:10.1037/0022-3514.58.5.812
68. Brulle RJ, Carmichael J, Jenkins JC. Shifting public opinion on climate change: an empirical assessment of factors influencing concern over climate change in the U.S., 2002–2010. *Clim Change.* 2012;114(2):169-188. doi:10.1007/s10584-012-0403-y
69. Lachapelle E, Montpetit É, Gauvin J. Public Perceptions of Expert Credibility on Policy Issues: The Role of Expert Framing and Political Worldviews. *Policy Stud J.* 2014;42(4):674-697. doi:10.1111/psj.12073
70. Calvillo DP, Rutchick AM, Garcia RJB. Individual Differences in Belief in Fake News about Election Fraud after the 2020 U.S. Election. *Behav Sci.* 2021;11(12):175. doi:10.3390/bs11120175
71. Chung M, Jones-Jang SM. Red Media, Blue Media, Trump Briefings, and COVID-19: Examining How Information Sources Predict Risk Preventive Behaviors via Threat and Efficacy. *Health Commun.* 2022;37(14):1707-1714. doi:10.1080/10410236.2021.1914386
72. Beauvais C. Fake news: Why do we believe it? *Joint Bone Spine.* 2022;89(4):105371. doi:10.1016/j.jbspin.2022.105371
73. Sell TK, Hosangadi D, Trotochaud M. Misinformation and the US Ebola communication crisis: analyzing the veracity and content of social media messages related to a fear-inducing infectious disease outbreak. *BMC Public Health.* 2020;20(1):550. doi:10.1186/s12889-020-08697-3

74. Herrero-Diz P, Conde-Jiménez J, Reyes De Cózar S. Teens' Motivations to Spread Fake News on WhatsApp. *Soc Media Soc.* 2020;6(3):2056305120942879. doi:10.1177/2056305120942879
75. Berger J, Milkman KL. What Makes Online Content Viral? *J Mark Res.* 2012;49(2):192-205. doi:10.1509/jmr.10.0353
76. Apuke OD, Omar B. Fake news and COVID-19: modelling the predictors of fake news sharing among social media users. *Telemat Inform.* 2021;56(9918300979606676):101475. doi:10.1016/j.tele.2020.101475
77. Bean SJ. Emerging and continuing trends in vaccine opposition website content☆. *Vaccine.* 2011;29(10):1874-1880. doi:10.1016/j.vaccine.2011.01.003
78. Manene S, Hove C, Cilliers L. Mitigating misinformation about the COVID-19 infodemic on social media: A conceptual framework. *Jamba Potchefstroom South Afr.* 2023;15(1):1416. doi:10.4102/jamba.v15i1.1416
79. Li Z, Qiu H, Zhou Q. Social-mediated diffusion of conspiracy theories about COVID-19: A study integrating SMCC and TPB models. *Int J Hum-Comput Interact.* 2022;38(7):680-689. doi:10.1080/10447318.2021.1960726
80. Pierre JM. Mistrust and misinformation: A two-component, socio-epistemic model of belief in conspiracy theories. *J Soc Polit Psychol.* 2020;8(2):617-641. doi:10.5964/jspp.v8i2.1362
81. Federal Drug Agency. *FDA Cautions against Use of Hydroxychloroquine or Chloroquine for COVID-19 Outside of the Hospital Setting or a Clinical Trial Due to Risk of Heart Rhythm Problems.*; 2020. Accessed February 8, 2025. <https://www.fda.gov/drugs/drug-safety-and-availability/fda-cautions-against-use-hydroxychloroquine-or-chloroquine-covid-19-outside-hospital-setting-or>
82. Madanay F, McDevitt RC, Ubel PA. Hydroxychloroquine for COVID-19: Variation in Regional Political Preferences Predicted New Prescriptions after President Trump's Endorsement. *J Health Polit Policy Law.* 2022;47(4):429-451. doi:10.1215/03616878-9716698
83. DeJong C, Wachter RM. The Risks of Prescribing Hydroxychloroquine for Treatment of COVID-19—First, Do No Harm. *JAMA Intern Med.* 2020;180(8):1118. doi:10.1001/jamainternmed.2020.1853
84. Rocha YM, De Moura GA, Desidério GA, De Oliveira CH, Lourenço FD, De Figueiredo Nicolette LD. The impact of fake news on social media and its influence on health during the COVID-19 pandemic: a systematic review. *J Public Health.* 2023;31(7):1007-1016. doi:10.1007/s10389-021-01658-z
85. Spencer S. False Claims of Nationwide Lockdown for COVID-19. Debunking Viral Claims. March 16, 2020. Accessed February 8, 2025. <https://www.factcheck.org/2020/03/false-claims-of-nationwide-lockdown-for-covid-19/>

86. Mello MM, Greene JA, Sharfstein JM. Attacks on Public Health Officials During COVID-19. *JAMA*. 2020;324(8):741. doi:10.1001/jama.2020.14423
87. Konstantinou L, Panos D, Karapanos E. Exploring the Design of Technology-Mediated Nudges for Online Misinformation. *Int J Hum-Comput Interact*. Published online 2024. doi:10.1080/10447318.2023.2301265
88. Ruokolainen H, Widén G. Conceptualising misinformation in the context of asylum seekers. *Inf Process Manage*. 2020;57(3). doi:10.1016/j.ipm.2019.102127
89. Di Domenico G, Sit J, Ishizaka A, Nunan D. Fake news, social media and marketing: A systematic review. *J Bus Res*. 2021;124(Allcott, H., Gentzkow, M. (2017). Social media and fake news in the 2016 election. *Journal of Economic Perspectives*, 31(2), 211-236. .Allcott, H., Gentzkow, M., Yu, C. (2019). Trends in the diffusion of misinformation on social media. *Research and Pol*):329-341.
90. Pierre JM. Conspiracy Theory Belief: A Sane Response to an Insane World? *Rev Philos Psychol*. Published online 2023. doi:10.1007/s13164-023-00716-7
91. Nan X, Thier K, Wang Y. Health misinformation: what it is, why people believe it, how to counter it. *Ann Int Commun Ass*. 2023;47(4):381-410. doi:10.1080/23808985.2023.2225489
92. De Beer D, Matthee M. Approaches to Identify Fake News: A Systematic Literature Review. In: Antipova T, ed. *Integrated Science in Digital Age 2020*. Vol 136. Lecture Notes in Networks and Systems. Springer International Publishing; 2021:13-22. doi:10.1007/978-3-030-49264-9_2
93. Martel C, Rand DG. Misinformation warning labels are widely effective: A review of warning effects and their moderating features. *Curr Opin Psychol*. 2023;54:101710. doi:10.1016/j.copsyc.2023.101710
94. Hu B, Mao Z, Zhang Y. An overview of fake news detection: From a new perspective. *Fundam Res*. 2025;5(1):332-346. doi:10.1016/j.fmre.2024.01.017
95. Amazeen MA, Krishna A. Refuting misinformation: Examining theoretical underpinnings of refutational interventions. *Curr Opin Psychol*. 2024;56. doi:10.1016/j.copsyc.2023.101774
96. Amazeen M, Krishna A. Processing Vaccine Misinformation: Recall and Effects of Source Type on Claim Accuracy via Perceived Motivations and Credibility. *Int J Commun*. 2023;17:560+.
97. Ecker UKH, O'Reilly Z, Reid JS, Chang EP. The effectiveness of short-format refutational fact-checks. *Br J Psychol*. 2020;111(1):36-54. doi:10.1111/bjop.12383
98. López-García X, Costa-Sánchez C, Vizoso Á. Journalistic Fact-Checking of Information in Pandemic: Stakeholders, Hoaxes, and Strategies to Fight Disinformation during the COVID-19 Crisis in Spain. *Int J Environ Res Public Health*. 2021;18(3):1227. doi:10.3390/ijerph18031227

99. Sundelson AE, Jamison AM, Huhn N, Pasquino SL, Sell TK. Fighting the infodemic: the 4 i Framework for Advancing Communication and Trust. *BMC Public Health*. 2023;23(1):1662. doi:10.1186/s12889-023-16612-9
100. Anthonysamy L, Sivakumar P. A new digital literacy framework to mitigate misinformation in social media infodemic. *Glob Knowl Mem Commun*. Published online 2022. doi:10.1108/GKMC-06-2022-0142
101. Henrich N, Holmes B. The public's acceptance of novel vaccines during a pandemic: A focus group study and its application to influenza H1N1. *Emerg Health Threats J*. 2008;2. doi:10.3134/ehj.09.008
102. Michie S. Encouraging vaccine uptake: lessons from behavioural science. *Nat Rev Immunol*. 2022;22(9):527-528. doi:10.1038/s41577-022-00769-2
103. Michie S, Johnston M. Theories and techniques of behaviour change: Developing a cumulative science of behaviour change. *Health Psychol Rev*. 2012;6(1):1-6. doi:10.1080/17437199.2012.654964
104. Baptista JP, Gradim A. Understanding Fake News Consumption: A Review. *Soc Sci*. 2020;9(10):185. doi:10.3390/socsci9100185
105. Bryanov K, Vziatysheva V. Determinants of individuals' belief in fake news: A scoping review determinants of belief in fake news. Triberti S, ed. *PLOS ONE*. 2021;16(6):e0253717. doi:10.1371/journal.pone.0253717
106. Lewandowsky S, Ecker UKH, Seifert CM, Schwarz N, Cook J. Misinformation and Its Correction: Continued Influence and Successful Debiasing. *Psychol Sci Public Interest*. 2012;13(3):106-131. doi:10.1177/1529100612451018
107. Chowdhury N, Khalid A, Turin TC. Understanding misinformation infodemic during public health emergencies due to large-scale disease outbreaks: a rapid review. *J Public Health*. 2023;31(4):553-573. doi:10.1007/s10389-021-01565-3
108. Merchant RM, South EC, Lurie N. Public Health Messaging in an Era of Social Media. *JAMA*. 2021;325(3):223. doi:10.1001/jama.2020.24514
109. Bago B, Rand DG, Pennycook G. Fake news, fast and slow: Deliberation reduces belief in false (but not true) news headlines. *J Exp Psychol Gen*. 2020;149(8):1608-1613. doi:10.1037/xge0000729
110. Horney JA, Moore Z, Davis M, MacDonald PDM. Intent to Receive Pandemic Influenza A (H1N1) Vaccine, Compliance with Social Distancing and Sources of Information in NC, 2009. Timmer A, ed. *PLoS ONE*. 2010;5(6):e11226. doi:10.1371/journal.pone.0011226
111. Wilson P, Kislov R. *Implementation Science*. 1st ed. Cambridge University Press; 2022. doi:10.1017/9781009237055

112. Bauer MS, Damschroder L, Hagedorn H, Smith J, Kilbourne AM. An introduction to implementation science for the non-specialist. *BMC Psychol.* 2015;3(1):32. doi:10.1186/s40359-015-0089-9
113. Eccles M, Grimshaw J, Walker A, Johnston M, Pitts N. Changing the behavior of healthcare professionals: the use of theory in promoting the uptake of research findings. *J Clin Epidemiol.* 2005;58(2):107-112. doi:10.1016/j.jclinepi.2004.09.002

CHAPTER 2 (Draft Manuscript 1): An Appraisal of Misinformation Models, Theories and Frameworks on Purpose, Characteristics, Usability, Implementability, and Testability: A Scoping Review

Preface

Chapter 2 presents a scoping review aimed at assessing existing misinformation MTFs that describe, evaluate, and counter misinformation and Misinformation-Associated Health Behaviours (MAHBs). The ultimate goal is to utilize the findings from this chapter with insights from semi-structured interviews to assess the extent of their usage in practice.

Author Contributions: Zeynep Cildir (ZC), the master's candidate, served as the primary author of the thesis manuscript. Dr. Jamie Brehaut (JCB), the principal investigator, conceptualized the research, provided guidance, and co-authored the manuscript. ZC was responsible for all aspects of the research process, including methodological planning, data collection, and data analysis. JCB assisted with abstract screening, while Dr. Tamara Morgan (TM) aided in full-text screening. TM, Christine Tulk (CT), and Dr. Natasha Hudek (NH) collaborated with ZC on data extraction.

Notes: For further details, such as the PRISMA-ScR Checklist, search strategy, and data extraction items, please refer to the appendices at the end of this chapter. Ethics approval was not required for this study, as it relied on secondary data available online. This article is set to be published in a peer-reviewed journal.

Publication Citation: Cildir Z, Morgan T, Hudek N, Tulk C, Carroll K, Pesseau J, Colquhoun H, Brehaut J “An Appraisal of Misinformation Models, Theories and Frameworks on Purpose, Characteristics, Usability, Implementability, and Testability: A Scoping Review.” (In preparation)

An Appraisal of Misinformation Models, Theories and Frameworks on Purpose, Characteristics, Usability, Implementability, and Testability: A Scoping Review

Zeynep Cildir, MSc (candidate)^{1,2}, Tamara Morgan, PhD², Natasha Hudek, PhD², Christine Tulk, MA², Kelly Carroll, MA², Justin Presseau, PhD^{1,2}, Heather Colquhoun, PhD³, Jamie Brehaut, PhD^{1,2*}

¹School of Epidemiology and Public Health, University of Ottawa, 451 Smyth Road, Ottawa, Ontario, K1H 8M5, Canada

²Ottawa Hospital Research Institute, Centre for Implementation Research, The Ottawa Hospital, General Campus, 501 Smyth Road, Centre for Practice Changing Research, Box 201B, Ottawa, Ontario, K1H 8L6, Canada

³Department of Occupational Science and Occupational Therapy, University of Toronto, Rehabilitation Sciences Building, 500 University Avenue, Floor 9, Toronto, Ontario, Canada M5G 1V7

Author Email List:

Zeynep Cildir: zcildir@ohri.ca

Tamara Morgan: tamorgan@ohri.ca

Natasha Hudek: nhudek@ohri.ca

Christine Tulk: ctulk@ohri.ca

Kelly Carroll: kecarroll@ohri.ca

Justin Presseau : jpresseau@ohri.ca

Heather Colquhoun: heather.colquhoun@utoronto.ca

Jamie Brehaut: jbrehaut@ohri.ca

***Corresponding Author:** Jamie Brehaut (jbrehaut@ohri.ca), The Ottawa Hospital, General Campus, 501 Smyth Road, Centre for Practice Changing Research, Box 201B, Ottawa, Ontario, K1H 8L6, Canada

Abstract

Introduction: Since the COVID-19 pandemic, there has been a surge in health misinformation, leading to an increase in proposed models, theories, and frameworks (MTFs) designed to explain, describe, or help counter misinformation. However, the abundance of MTFs makes it challenging to discern which ones to consider under specific circumstances and comprehend their utility, purpose, and characteristics.

Methods and Analysis: We conducted a scoping review using a structured framework based on Wang et al.'s categorization of MTF characteristics, usability, implementability, and testability. A comprehensive database search was developed in collaboration with a professional librarian and included databases such as Medline, APA PsycINFO, PubMed, Scopus, and ProQuest. The literature was limited to peer-reviewed English articles. Screening and data extraction were completed using a double-screening and double-charting process. Data extraction was facilitated using Microsoft Excel, and analysis was conducted through consensus.

Results: A total of 118 studies and 121 MTFs were included. Most MTFs were labelled as models or frameworks, with only one self-classified as a theory. Only one evaluation framework was identified. While most MTFs were well-described, only a few provided detailed guidance on application, addressed implementation contexts, or included testable hypotheses. Over half did not specify a target audience, and empirical testing was limited.

Significance: By synthesizing the literature on existing misinformation MTFs, this study summarizes their range and utility, contributing to the establishment of a theoretical foundation for developing more effective strategies to counter healthcare misinformation.

Registration: N/A

Keywords: framework, health services research, implementation science, misinformation, quality

2.1 Introduction

Health misinformation has existed for centuries but intensified during the COVID-19 pandemic, as widespread uncertainty and anxiety fueled its rapid dissemination.^{1–3} Due to this unprecedented spread, and the potential harm it could cause during a public health emergency, the threat of misinformation was recognized by the World Health Organization when it declared an “infodemic”, defined as an overabundance of false or misleading information during a disease outbreak.⁴ This surge of misinformation, which can include myths, conspiracy theories, and low-quality and often harmful health-related information, complicates informed decision-making, interferes with public health initiatives, fosters mistrust in healthcare professionals and institutions, and produces counter-productive health behaviours, i.e. misinformation-associated health behaviours (MAHBs).^{4–9}

In response to the rise in misinformation, researchers and public health agencies have aimed to understand and describe it through the development of models, theories, and frameworks (MTF).^{10,11} Models are simplified representations of particular aspects or phenomena, developed to improve understanding and analysis.¹¹ Theories offer more comprehensive descriptions, providing analytical principles or statements that organize observations and interpretations of the world. They show the relationships between constructs and are typically testable through empirical investigation.¹¹ Frameworks seek to outline a full range of relevant factors, structuring approaches to complex problems or organizing information, but do not show the relationships between concepts.¹¹ MTFs can be valuable for identifying and describing the key features of misinformation, as well as informing the design and optimization of interventions in complex healthcare settings.¹² However, as MTFs vary in purpose, complexity, and intended targets, it can be challenging to determine which MTF might be appropriate for which circumstances, and how intervention developers can best use this knowledge to target MAHB.¹² Especially after COVID-19, due to the rapid development of misinformation MTFs,^{13–17} it can be challenging for intervention developers to find appropriate MTFs to guide their implementation process.¹²

There are practical tools that exist within implementation science literature to facilitate the use of MTFs.^{10,18} For example, Nilsen et al. proposed a taxonomy of five categories used in implementation science to characterize the MTFs, helping to organize and bring clarity to the

vast number of existing MTFs.¹¹ Birken et al. later introduced the Implementation Theory Comparison and Selection Tool (T-CaST) to support the systematic selection of suitable MTFs for guiding the implementation efforts. T-CaST evaluates MTFs based on applicability, usability, testability and accessibility criteria.¹⁸ Building on this work, Wang et al. developed an expanded appraisal tool by adapting elements from both Nilsen's taxonomy and Birken's T-CaST framework. The tool appraises the existing implementation science MTFs based on their usability, applicability and testability, similar to Birken's tool, while also evaluating their purpose and characteristics, drawing partially from Nilsen's work.^{10,11,18}

While all of this work was carried out in the context of implementation science MTFs, the assessment of purpose, characteristics, usability, applicability and testability may also be useful to catalogue the range of misinformation MTFs. This study applies Wang et al.'s implementation science appraisal criteria to the misinformation context, to systematically categorize and evaluate existing misinformation MTFs. The objectives include (1) to improve understanding of the relative contributions of different misinformation MTFs, (2) to provide an understanding of their strengths and limitations, and (3) to provide a theoretical foundation for future misinformation MTF developments. Overall, this scoping review contributes to the growing body of misinformation literature by offering a structured and theory-informed approach to selecting and applying misinformation MTFs, ultimately supporting the development of more effective interventions to address misinformation and its associated health behaviours.

2.2 Methods

2.2.1 Protocol and Registration

We conducted a scoping review to describe and appraise misinformation MTFs using a modified and expanded version of Wang's appraisal tool. The protocol was registered with the Open Science Framework (OSF) on October 28, 2024 (<https://osf.io/85cep>), and was developed in accordance with the guidelines outlined by Wickstrom et al. and the Preferred Reporting Items for Systematic Review and Meta-Analysis Protocols (PRISMA-P).^{19,20} This review was conducted following the JBI Methodological Guidelines²¹ and Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR)

guidelines for reporting.²² The completed PRISMA-Scr checklist, including all key reporting items, is provided in **Appendix A**.

2.2.2 Search Strategy and Information Sources

This review aimed to identify articles proposing MTFs relevant to misinformation or strategies for countering it. Specifically, we focused on studies that extended beyond defining misinformation or detecting false content, and instead offered conceptual insights into how misinformation influences behaviour or how certain strategies affect MAHB. Studies were not excluded based on contextual factors such as geographic region, sex, or other demographic characteristics.

In collaboration with a library specialist, the study team developed the preliminary search strategy following the Peer Review of Electronic Search Strategy (PRESS) guidance.²³ 15 target articles were provided to the librarian to help inform the search strategy and to ensure comprehensiveness (**Appendix B**). While these target articles were initially identified to inform the search strategy, 7 papers were not captured in the final results due to the refinements in the eligibility criteria during the screening process.

The final search strategy involved the following databases: Medline, APA PsycINFO, PubMed, Scopus, and ProQuest (**Appendix C**). It included both thesis and peer-reviewed government documents, with the search encompassing all publications available from each journal's earliest issue (ranging from 1806 to 1946) up to February 26, 2024. In addition, the bibliographies of key articles were hand searched to identify any additional articles that met the inclusion criteria.

2.2.3. Study Records

2.2.3.1 Data Management

Results from the search strategy were imported into the reference manager Zotero for duplicate removal, and the de-duplicated records were then imported into Covidence for screening.

2.2.3.2 Abstract Screening

Two reviewers (JCB and ZC) independently screened titles and abstracts using Covidence. An initial piloting exercise was conducted with 100 records, followed by a second round of piloting with 500 articles. Once consistency was established, reviewers continued screening independently, meeting periodically to resolve conflicts through consensus. A third reviewer was consulted when consensus could not be reached. Records without abstracts did not proceed to full-text screening.

Abstracts were included if they:

1. were written in English;
2. described at least one MTF related to some aspect of misinformation;
3. provided the primary and/or most complete description of the MTF.

Abstracts were excluded if they met one of the following criteria:

1. not peer-reviewed;
2. focused solely on detecting misinformation (e.g. developing AI models to identify and/or discern fake news from real news);
3. primarily reviewed demographics of the misinformation literature (e.g. country of publication, definitions of misinformation);
4. conference abstracts;
5. study protocols.

2.2.3.3. Full-Text Screening

Full texts were independently screened by two reviewers (TM and ZC), with reasons for exclusion recorded. Disagreements were discussed and resolved after every 30 articles; unresolved cases were referred to a third reviewer (JCB).

The full-text articles were excluded if they met one of the following criteria:

1. The MTF's primary focus was not misinformation;
2. A major focus of the manuscript was not to describe the MTF in detail;

3. The study was primarily an empirical study rather than a detailed discussion of MTF;
4. The MTF was primarily specific to the “misinformation effect”;
5. The MTF was limited to regulatory, governance, analytical or ethical frameworks;
6. The “framework” presented was described as a future research plan alone or an author’s opinion piece;
7. The description of the MTF did not have a picture or a clearly labelled set of components.

2.2.3.4. Data Extraction

A data extraction form was created using Microsoft Excel (**Appendix D**). The form was piloted, and some extraction items were revised as the original items in the protocol did not fully capture the constructs relevant to our study objectives. ZC served as the primary extractor, with secondary coders (TM, NH, CT) assigned to a specific set of articles. Reviewers analyzed five full-text pilot articles, discussed the results, and adjusted the data extraction guide. Once coding began, reviewers met for consensus every three to five articles; only unresolved discrepancies were referred to another reviewer (TM or NH or CT).

Extraction domains were as follows:

1. Study details (study ID, year published, author name);
2. Purpose and Characteristics: Stated aim of the MTF; classification type adapted from Nilsen including determinant frameworks (seeks to list a full range of factors), evaluation framework (outlines how to assess success or outcomes), classic theories (theories from other fields applied to misinformation), misinformation theories (developed or adapted within the misinformation field) and process models (describe mechanisms by which misinformation could be more or less successful)^{10,11}; level of analysis (descriptive, diagnostic, predictive, prescriptive)^{10,24}; and focus (primarily describes misinformation, counter-strategies, or both). We chose not to adapt the Nilsen’s “theory level” (grand theory, mid-range theory and program theory) or the “theoretical underpinning” categorizations, as piloting showed limited variation across misinformation MTFs.

3. Usability: Assessed based on five criteria^{10,18} —level of detail, presence of a figure/table, guidance for application, inclusion of misinformation-reduction strategies, and clear articulation of relationships between constructs.
4. Implementability: This domain, adapted from the T-CaST framework, included several criteria relevant to real-world application. *Context* referred to description of the settings in which the MTF could be applied or the contextual factors it addressed. *Outcomes and metrics* captured whether the MTF included measures to assess the success of a misinformation intervention. *Supplemental tools* referred to any additional resources, instruments, or toolkits accompanying the MTF to support its implementation. *Fidelity* evaluated whether the MTF addressed the consistency of delivery as intended, while *adaptation* assessed its flexibility for tailoring across populations or settings. *Sustainability* considered whether the MTF discussed long-term viability, including continuity, capacity-building, or enduring impact. *Level of change* referred to the scale at which the MTF aimed to intervene (e.g., individual, community, organizational, or policy). *Generalizability* examined the potential for application across different disciplines, contexts, or populations. Finally, *intervention delivery* assessed whether the MTF specified how implementation should occur, such as through education, policy change, or guidelines.^{10,18}

The “strategy” construct from the original tool was removed due to overlap with the previously assessed “reducing the effects of misinformation” item. Additionally, the original “proposed measured metrics” item was incorporated under “outcomes and metrics.”

5. Testability: Evaluated based on whether the MTF proposed a testable hypothesis, cited supporting evidence, and had been empirically tested in the literature.^{10,18}

2.2.4. Data Synthesis and Analysis

The study selection process is presented through the PRISMA flow chart (**Figure 1**). Findings are summarized in a table of study characteristics (**Table 1**), as well as the frequency counts of each extraction category (characteristics, usability, implementability and applicability) are reported in this article (**Table 2, Table 3, Table 4, Table 5**). The findings are described in a

narrative form, summarizing the extracted data, key concepts, and recommendations to address the knowledge gap.

2.3 Results

2.3.1. Study Selection

Figure 1 outlines the screening process at both abstract and full-text stages. Of the 4,714 studies identified through the search strategy, along with nine additional articles found through snowballing, 118 articles provided a total of 121 misinformation MTFs. The complete list of included studies can be found in **Appendix E**. A comprehensive list of articles excluded during full-text screening, along with reasons for exclusion, is provided in **Appendix F**.

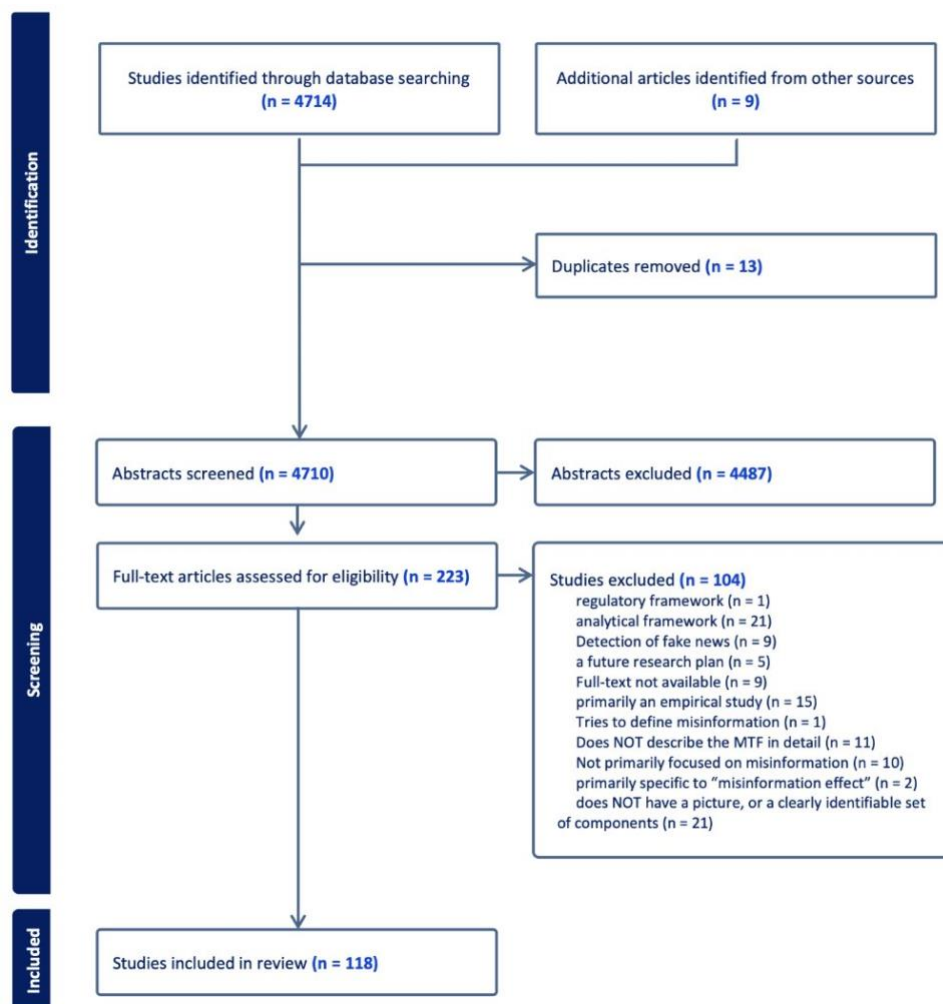


Figure 1. PRISMA Flow Diagram of Misinformation MTF Selection.

2.3.2. Study Characteristics

Table 1 presents the characteristics of the included misinformation MTFs (n=121). A significant portion of these were published between 2020 and 2024 (90.9%), with only 9.1% published from 2013 to 2019. Regarding the formats reported by the authors, frameworks were the most commonly identified type of MTF (64.5%), followed by models (47.9%). Only one study labelled itself as a theory (0.8%), and 3.3% were classified as unclear. This categorization was not mutually exclusive. The stated purposes of the misinformation MTFs varied widely, categorized into eight distinct purposes. The most common purpose (37.2%) was to describe factors related to negative misinformation behaviours (e.g. spreading, creating misinformation). This was followed by MTFs proposing strategies for correcting or countering misinformation (33.9%) and describing factors influencing belief in misinformation (24.0%). Other stated purposes included addressing the social consequences of misinformation (13.2%), susceptibility to misinformation (6.6%), positive misinformation behaviours (e.g. not engaging or reporting misinformation) (6.6%), or constructs only indirectly related to misinformation (5.8%). One study (0.8%) included factors related to behaviour with unclear directionality.

The study areas and contexts were also diverse. Social media emerged as the most common focus (24.8%), followed by COVID-19 (11.6%), politics (6.6%), and library and information science (5.8%). Other topics included online news and communication (5.0%), public health (4.1%), public service media (3.3%), public health emergencies (2.5%), and brands and consumers (2.5%). 28.9% of the studies examined other contexts.

In terms of the design of these misinformation MTFs, quantitative empirical studies comprised the largest share (33.1%), followed by descriptive accounts of the MTF (27.3%) and qualitative empirical studies (11.6%). Reviews comprised 24.0% of the sample, including 6.9% scoping reviews, 6.9% narrative reviews and 34.5% systematic reviews within this subset. Mixed methods studies accounted for 7.4% and a small subset (2.5%) was classified as “other.”

Table 2 summarizes how misinformation MTFs were characterized according to the framework of Nilsen and Delen et al.^{11,24} The most common categorization was “Misinformation Theories,” which appeared in 54.5% of studies, followed by “Determinant Frameworks” (36.4%) and

“Process Models” (19.0%). Fewer MTFs were classified as “Classic Theories” (15.7%) or “Evaluation Frameworks” (0.8%). These categories were not mutually exclusive, as the definitions amongst MTFs can overlap.¹¹ Therefore, many MTFs were assigned to multiple Nilsen categories where relevant. In terms of overall focus, the majority of MTFs (62.0%) concentrated on describing misinformation itself, while a smaller portion (15.7%) focused on countering strategies. A combined focus on both was observed in 22.3% of cases. Regarding the primary role of the MTF, most were categorized as descriptive (46.3%), outlining features or characteristics of misinformation or its correction. Predictive models were also common (30.6%), followed by diagnostic (17.4%) and prescriptive (5.8%) roles. Secondary roles were assigned only when applicable. Overall, diagnostic (40.0%) and descriptive (36.0%) roles were most common as secondary roles, while prescriptive (20.0%) and predictive (4.0%) roles were less frequently observed. Percentages for the secondary role of the MTF were calculated out of the total number of coded secondary roles (n=25).

2.3.3. Usability of Misinformation MTFs

Table 3 summarizes the usability characteristics of the misinformation MTFs included in this review. Most MTFs (83.5%) were described in detail, while 15.7% were only partially described, and a small minority (0.8%) referenced the MTF without further elaboration. Just over half of the MTFs (51.2%) explicitly discussed all relationships between constructs, while 22.3% discussed relationships only partially, and 26.4% did not describe any relationships. Visual representation of the MTF was common: 81.0% included a full diagram or table, whereas 9.1% included only a partial visual (e.g., missing constructs or omitted relational details), and 9.9% did not include a diagram or table at all. About one-third of the MTFs (38.0%) explicitly addressed how their MTF could be used to reduce the effects of misinformation. Over half (54.5%) of the misinformation MTFs offered no guidance on how to apply or design an intervention proposed in the MTF. One-third (33.9%) provided only limited or general guidance (e.g., brief mentions), while 11.6% provided detailed guidance for applying the MTF for the purposes described in the paper.

2.3.4. Implementability of Misinformation MTFs

Table 4 summarizes the implementability characteristics of the misinformation MTFs included in this review. The majority of MTFs did not address contextual factors (44.6%), while 36.4% mentioned context without elaboration, and only 19.0% discussed context in detail. Outcome or success metrics were discussed in 43.0% of studies, while adaptation or tailoring of the intervention to different recipients was addressed in just 1.7% of cases. Notably, no MTFs explicitly addressed fidelity. Sustainability considerations were absent in nearly all studies (97.5%), with only a small number offering minimal (1.7%) or detailed (0.8%) discussion. In terms of practical support, most MTFs did not provide tools for use (89.3%), with only 6.6% citing tools and 4.1% offering tools directly.

Regarding the level the MTF aimed to change, an individual-level application was most common (50.4%), followed by addressing multiple levels (45.5%). Interpersonal, Community, organizational, and policy levels were mostly seen within multiple levels and rarely represented solely by themselves. While 46.3% of MTFs offered a limited discussion of the implementation setting, fewer (24.8%) provided a detailed description, and 28.9% did not mention it at all.

When assessing the target audience, most of the misinformation MTFs (64.5%) did not specify any target audience. Of those mentioned, the most frequently cited were researchers (10.7%) and policymakers (10.7%), followed by healthcare and public health authorities (8.3%), and government professionals (5.0%). Other audiences included librarians and information science professionals (4.1%), communication professionals (4.1%), and members of the public (3.3%). Additional groups, such as social media platform stakeholders and marketing professionals, were each mentioned by 2.5% of MTFs.

Only a small subset of MTFs discussed generalizability to other disciplines in detail (9.1%), while 39.7% mentioned it briefly, and 51.2% made no mention at all. Similarly, the intended use of the MTF was clearly explained in just 9.1% of studies, with 26.4% offering some mention and 64.5% not discussing it altogether.

Among the studies that did state an intended use ($n = 84$), media literacy education was the most commonly proposed delivery mechanism, reported in 32.1% of cases. This included

interventions aimed at improving public skills in identifying and responding to misinformation, such as school-based curricula or public awareness training programs. Policy and legislation changes were the second most cited mechanism (21.4%), referring to efforts such as regulatory reforms, government mandates, or platform accountability policies aimed at curbing misinformation. Public campaigns were also common (17.9%) and included mass communication efforts to raise awareness or shift behaviours related to misinformation. A smaller proportion (7.1%) mentioned disseminating the findings of the MTF through media platforms. Guidelines (6.0%) were proposed in the form of structured recommendations for practitioners, organizations, or governments to address misinformation. Other mechanisms included community engagement and outreach (3.6%); label and warning signs (2.4%), such as visual indicators added to misinformation content; and AI tools (2.4%) for responding and controlling the spread of misinformation. A small portion (7.1%) of studies proposed other delivery mechanisms.

2.3.5. Testability of Misinformation MTFs

Table 5 summarizes the testability characteristics of the misinformation MTFs. Overall, only 32.2% of MTFs proposed at least one explicit hypothesis. However, this was anticipated, as theories are more commonly tested, whereas purely descriptive studies typically do not prioritize testability as a central objective. As anticipated, only 2.4% of purely descriptive MTFs featured a testable hypothesis, while 41% of Misinformation and/or Classic Theories presented one. Despite limited hypothesis generation, most MTFs (62.8%) provided detailed evidence to support their proposed mechanisms. A smaller proportion offered only partial evidence (19.8%) or no evidence at all (17.4%).

In terms of empirical support, half of the MTFs (50.4%) made no mention of testing or validation. In contrast, 38.0% explicitly conducted tests on the MTF, whereas 11.6% mentioned empirical support without performing formal testing themselves. Among the 60 MTFs that either mentioned or tested empirical support, 76.7% were tested within the paper itself, 21.7% had not been tested, and 1.7% were empirically supported through prior literature.

2.4 Discussion

This scoping review examined 118 studies that proposed or used 121 misinformation models, theories, or frameworks (MTFs). These MTFs were applied across a diverse range of disciplines, both within and beyond health, and varied in their purpose, level of specificity, and underlying development processes. Our goal was to characterize these misinformation-related MTFs in terms of features considered core to scientific MTFs, such as usability, implementability, and testability.

We note that although 43.1% of studies could be considered to be Misinformation Theories and 12.4% as Classic Theories, only one MTF was labelled a theory by its authors. This could suggest that many authors may be building theoretical explanations without explicitly calling them theories. In some cases, a model or framework might include relationships between variables or causal pathways — features usually found in theories — but the terminology used might differ across fields. It's also possible that some authors prefer to use terms like “framework” or “model” to make their work sound more practical or easier to apply. It is also important to note that because the definitions of models, theories, and frameworks can overlap, we have classified some MTFs into multiple categories when necessary. Therefore, there may be frameworks or models classified as misinformation theories if they partially fit the description but do not primarily demonstrate relationships between variables.

Our analysis showed very limited use of Evaluation Frameworks within the misinformation field. Only one MTF was categorized as such, defined here as a framework that outlines how the effectiveness or success of misinformation interventions can be measured. This could reflect a gap in the literature — many MTFs aim to suggest ways to reduce misinformation, while very few are designed to help evaluate the success of interventions. A well-developed evaluation framework might help guide what outcomes to look for when testing a misinformation intervention. For example, relevant outcomes could include changes in belief accuracy, reduced sharing of false information, improved trust in credible sources, or even changes in health behaviours such as vaccine uptake. Existing implementation science frameworks like RE-AIM may be helpful here, but it is unclear how often they are used in misinformation research.

Usability is a common barrier when applying MTFs. It can be difficult to interpret or implement them when they are overly abstract, poorly described, or lack practical guidance. One key element that enhances usability is the inclusion of clear visual representations, such as diagrams or tables, which help convey the framework's core concepts in an accessible and structured manner. In our analysis, most MTFs were well described and included a visual component, suggesting a positive starting point for usability. In addition to visual aids, the majority also provided detailed descriptions of the framework, which further supports understanding of its usability. However, there were also areas for improvement. While about half of the MTFs explained the relationships between key concepts, many did so only partially or not at all. This may reflect the nature of certain MTF types, such as models or frameworks, where detailing conceptual relationships is not always the primary aim, unlike in theory-driven approaches. Additionally, only a small number offered detailed guidance on how to use the MTF, with over half providing no guidance. Our analysis highlights several opportunities to improve MTF usability—particularly through clearer articulation of how MTFs are intended to be used and by whom. Providing practical guidance and specifying target users could enhance the uptake, relevance, and real-world impact of these MTFs.

A strong example of a misinformation MTF with high usability is Van Bavel et al.'s Model of (Mis)Information Belief.²⁵ The model clearly explains how exposure to misinformation influences belief and sharing, supported by full figures that illustrate the components, pathways, and moderating factors. Each relationship is described in detail, along with the influence of psychological risk factors such as partisan bias, polarization, political ideology, cognitive style, memory, morality, and emotion. The paper also offers clear guidance on how the model can be applied, including suggested solutions like fact-checking, fake news inoculation or “prebunking,” eliminating creators of misinformation, and restructuring incentives that promote fake news. By integrating a clear visual, detailed explanations of each construct and their relationships, and explicit recommendations for application, this model demonstrates how usability features can improve the practical relevance of misinformation MTFs.

Implementability refers to how easily an MTF can be applied in real-world settings, including whether it can be adapted, sustained, and effectively used across different contexts. It is a critical aspect of ensuring that MTFs move beyond conceptual development to practical application. In

our analysis, implementability was often limited. Most studies did not describe the settings in which the framework might be applied, how it could be tailored to different populations, or whether it would be sustainable over time. None of the MTFs addressed fidelity, whether the intervention, once implemented, would continue to align with the framework's original design and intent. While one might expect studies explicitly aimed at real-world application to perform better, there was no notable difference in ratings on implementability items between these and purely descriptive studies, highlighting the importance of considering implementability as a criterion for all MTFs, regardless of their intended purpose. These features are important in implementation science, but they may be underreported in the misinformation field or not yet fully developed in existing MTFs.

Most of the misinformation MTFs targeted multiple levels of change (e.g., individual and community levels), which is essential given that misinformation operates across personal, social, and systemic domains. Addressing these different levels increases the likelihood that interventions will be comprehensive and contextually effective. However, half of these MTFs primarily focused on the individual level of change. This may reflect the influence of psychological or communication-based disciplines in misinformation research, where individual cognition and behaviour are central. While individual-level interventions are undoubtedly important, expanding the focus to include organizational and societal-level influences could help account for the broader systems and structures that shape misinformation exposure and response. Additionally, most MTFs did not clearly specify the target audience. When audiences were mentioned, they typically consisted of researchers or policymakers. There was less focus on other groups, such as health professionals, media workers, or members of the public. This limitation could hinder the usefulness of the MTFs for designing practical interventions and highlights the need for future efforts to explicitly consider the intended users of the MTF.

A relatively strong example of implementability is Agarwal et al.'s *Disinformation Behaviour Framework and Model*.²⁶ This framework (and/or model) aims to explain how misinformation is created, shared, and mitigated while also listing effective interventions to counter its spread. While it does not address all implementability items, it serves as a valuable reference for demonstrating implementability in practice. The authors provide a detailed discussion of the specific context in which the MTF should be applied, particularly in the field of library and

information science, while incorporating contextual factors within the model (or framework) that may influence its effectiveness. They explicitly identify their target audience as practitioners and researchers in the field of library and information science and target the individual level of change. They also suggest relevant delivery mechanisms for interventions, such as policy and legislative changes, as well as guidelines. Although its discussion of generalizability to other settings is limited, this example illustrates how contextual specificity, clear mention of the target audience, and delivery mechanisms can enhance the implementability of a misinformation MTF.

Testability refers to the extent to which a misinformation MTF can generate hypotheses that are empirically examined. It is a key feature of scientific utility, as testable MTFs allow researchers to assess whether the proposed mechanisms or pathways hold true in real-world settings. Without testability, it becomes difficult to develop evidence-based strategies to counter misinformation. In our analysis, only one-third of MTFs proposed a clear hypothesis. Although this is common for descriptive MTFs, where empirical testing isn't usually the main focus, it restricts the incorporation of evidence-based strategies for understanding and combating misinformation. As anticipated, MTFs classified as theories according to Nilsen's categorization showed somewhat improved testability, probably because theories are generally designed to suggest and evaluate specific relationships among constructs. About 38% of MTFs were tested in some way, and most of those were tested within the same paper. Very few were tested across multiple studies, suggesting that there is not yet a strong tradition of validating misinformation MTFs over time.

A good example of testability is Adam-Troian et al.'s *Socio-Functional Model of Conspiracy Beliefs*, which aims to explain how precarity drives mistrust and fuels belief in conspiracy theories.²⁷ The model clearly outlines proposed hypotheses linking these constructs (e.g. "we hypothesized that precarity should be positively linked to conspiracy beliefs (H1)"),²⁷ provides evidence to support relationships between constructs from prior research and empirically tests the model using quantitative analyses. By proposing testable predictions and providing empirical evaluation, this model strengthens the validity, applicability, and utility of misinformation MTFs.

Taken together, these findings show that misinformation MTFs often describe concepts and goals well but less often provide tools, outcomes, or evaluation strategies that would support implementation or testing. The field may benefit from future work that focuses not just on what

misinformation is or how it spreads but also on how interventions can be designed, applied, and evaluated consistently.

2.5 Limitations of Study

This scoping review had several limitations that should be considered when interpreting its findings. First, although we aimed to include MTFs from both health and non-health fields, our search may not have captured the full range of relevant studies outside the health domain. For example, we identified at least one key target article that was not retrieved through our initial database search. Since our SCOPUS search strategy was limited to title and abstract fields, it is possible that studies that described relevant misinformation MTFs only within the full text were missed. This may also be attributable to the exclusion of articles that did not have an abstract. Additionally, the keywords used in our search strategy were anchored around terms like "model," "theory," and "framework," which may have excluded papers that used alternative terminology or implicitly proposed conceptual structures without formally labelling them. Misinformation is also a broad and interdisciplinary topic. While we selected relevant databases for the purposes of this scoping review, relevant MTFs may have been published in other databases not included in our search. Although we attempted to mitigate this limitation through reference list screening (i.e., snowballing) and targeted inclusion of known MTFs, it remains possible that our review did not comprehensively capture all relevant literature, particularly in fields outside of health and communication sciences.

Second, while our classification and coding strategy was carefully piloted and applied consistently, it required subjective interpretation in some cases. MTFs often did not present their constructs or intended purposes in a standardized way, which made certain coding decisions less straightforward. One challenge involved coding the extent to which MTFs described relationships between constructs, which we categorized as “detailed,” “partial,” or “none.” In several cases, the descriptions did not clearly fit any one category—for example, a framework might include some explanation of relationships, but not to the level typically considered “detailed,” while still exceeding what we had previously coded as “partial.” In these instances, coders had to rely on their best judgment, guided by piloted examples and comparison to

previously coded studies. Although we addressed this through the use of a coding guide, variability in how MTFs are reported introduces interpretive ambiguity.

Finally, our evaluation of MTF features (usability, implementability, and testability) was based on the publication that provided the most comprehensive description of each MTF. It is possible that some MTFs might have been coded differently if certain elements (e.g., tools, application guidance, or empirical testing) were assumed to be self-evident (and not made explicit for coding) or detailed in other publications not included in our review. Therefore, we cannot determine whether gaps in coding reflect limitations in how the MTFs were reported or fundamental gaps in the MTFs themselves. Future work could address these limitations by expanding the search strategy to include full-text screening and incorporating a broader range of databases.

2.6 Conclusion

This scoping review examined how misinformation models, theories, and frameworks could be described in terms of key characteristics, including usability, implementability, and testability. Our findings suggest that while many MTFs are well-articulated and visually represented, few offer clear guidance for application, consider implementation contexts, or have undergone empirical validation. Misinformation MTFs are often descriptive and focused at the individual level, with limited attention to social or systems factors. Additionally, most do not address how the framework could support sustained use over time or link clearly to intended intervention outcomes. We also identified inconsistencies in how MTFs are labelled and described, as well as a notable absence of evaluation frameworks tailored to misinformation interventions.

This review provides an important first step in mapping the current landscape of misinformation MTFs. As misinformation continues to influence health, politics, and public trust, there is a growing need for conceptual tools that not only describe the problem but also guide practical, scalable, and evidence-based solutions. Future work should aim to refine how MTFs are labelled and evaluated, expand them to incorporate higher levels of change (i.e. community, organizational, policy) and engage developers to design MTFs that are both theoretically sound and operationally useful.

Table 1. Study details of misinformation MTFs in the scoping review.

Characteristics	Number (%) of MTFs (n=121)
Type of MTF	
Framework	78 (64.5) ¹
Model	58 (47.9)
Theory	1 (0.8)
Unclear	4 (3.3)
Year of Publication	
2013-2019	11 (9.1)
2020-2024	110 (90.9)
Stated purpose of the MTF	
Describes factors related to negative misinformation behaviour	45 (37.2)
Describes strategies for correction of and/or countering misinformation	41 (33.9)
Describes factors related to belief in misinformation	29 (24.0)
Describes social consequences of misinformation	16 (13.2)
Describes factors related to positive misinformation behaviour	8 (6.6)
Describes factors related to susceptibility of misinformation	8 (6.6)
Describes construct(s) that are indirectly related to misinformation	7 (5.8)
Describes factors related to behavior (unclear sign of direction)	1 (0.8)
Topic Area/Setting	
Social media	30 (24.8)
COVID-19	14 (11.6)
Politics	8 (6.6)
Library and Information Science	7 (5.8)
Online News and Communication	6 (5.0)
Public Health	5 (4.1)
Public Service Media	4 (3.3)
Public Health Emergencies	3 (2.5)
Brands and Consumers	3 (2.5)
Other	22 (18.2)
No Topic Area Discussed	35 (28.9)
Type of Article	
Quantitative Empirical Study	40 (33.1)
Descriptive Account of the MTF	33 (27.3)
Qualitative Empirical Study	14 (11.6)
Review	29 (24.0)
Scoping Review	2 (6.9) ²
Systematic Review	10 (34.5) ²

Narrative Review	2 (6.9) ²
Other	15 (51.7) ²
Mixed Methods Study	9 (7.4)
Other	3 (2.5)

¹The classification is non-mutually exclusive; for example, a single paper may refer to the MTF as both a model and a theory simultaneously.

²Percentage calculated based on the subset of reviews (n=29)

Table 2. Characterization of misinformation MTFs according to Nilsen and Delen et al.

Characteristics	Number (%) of MTFs (n=121)
Nilsen Category¹	
Misinformation Theories	66 (54.5) ²
Determinant Framework	44 (36.4) ²
Process Models	23 (19.0) ²
Classic Theories	19 (15.7) ²
Evaluation Framework	1 (0.8) ²
MTF Focus	
Misinformation	75 (62.0)
Misinformation Countering Strategies	19 (15.7)
Both	27 (22.3)
MTF's Primary Role (Delen et al)³	
Descriptive	56 (46.3)
Predictive	37 (30.6)
Diagnostic	21 (17.4)
Prescriptive	7 (5.8)
MTF's Secondary Role (Delen et al)	
Diagnostic	10 (40.0) ⁴
Descriptive	9 (36.0) ⁴
Prescriptive	5 (20.0) ⁴
Predictive	1 (4.0) ⁴

¹ Nilsen categories were adapted from Nilsen (2015) and Wang et al. (2021) and reflect whether the MTF aimed to identify influencing factors (Determinant), assess effectiveness (Evaluation), apply external theories (Classic), propose original or adapted misinformation theories (Misinformation), or describe specific mechanisms (Process Models). The classification was not mutually exclusive; MTFs that aligned with multiple categories were assigned accordingly to capture their full scope.

² The classifications are not mutually exclusive, which accounts for the cumulative percentage exceeding 100%. A total of n=153 Nilsen category coding observations were recorded.

³ Primary roles were adapted from Delen et al. (2022) and reflect the analytical function of each MTF. Descriptive roles characterize or summarize features of misinformation or interventions. Diagnostic roles explain relationships between components of the MTF. Predictive roles propose directional or causal hypotheses. Prescriptive roles provide guidance for implementing counter-misinformation strategies.

⁴ Secondary roles were only assigned when applicable; not all MTFs were classified under a secondary role if they did not clearly fulfill more than one functional role. Percentages are calculated out of the total number of coded secondary roles (n=25).

Table 3. Misinformation MTF Usability

Characteristics	Number (%) of MTFs (n=121)
Level of detail	
MTF has a detailed description	101 (83.5)
MTF is partially described	19 (15.7)
Reference to MTF only	1 (0.8)
Describes relationships between constructs	
All relationships are discussed in detail	62 (51.2)
Relationships are discussed partially ¹	27 (22.3)
No relationship is discussed	32 (26.4)
Includes a diagram or table of the MTF	
MTF has a full diagram or table	98 (81.0)
MTF has a partial diagram or table ²	11 (9.1)
MTF has no diagram or table	12 (9.9)
MTF addresses how to reduce the effects of misinformation	
Yes	46 (38.0)
Guidance for MTF application	
No guidance	66 (54.5)
Limited guidance ³	41 (33.9)
Detailed guidance	14 (11.6)

¹Misinformation MTF either discusses some components in detail or covers all components without going into detail.

² A partial diagram or table refers to instances where the MTF includes a visual element but omits key constructs or, in the case of theories, lacks a depiction of relationships between constructs.

³ Limited guidance indicates that the MTF provides only brief or superficial instructions for application—such as mentioning use or offering general suggestions—without detailed explanations or steps.

Table 4. Misinformation MTF Implementability

Characteristics	Number (%) of MTFs (n=121)
Context	
Not addressed	54 (44.6)
Mentioned only	44 (36.4)
Discussed in detail	23 (19.0)
Outcome and/or Metrics relevant to the success of the misinformation strategy or intervention	
Discussed	52 (43.0)
Adaptation/Tailoring of interventions to different recipients	
Discussed	2 (1.7)
Fidelity	
Not discussed	121 (100.0)
Sustainability	
Not discussed	118 (97.5)
Mentioned only	2 (1.7)
Discussed in detail	1 (0.8)
Provides tools for MTF use	
None provided	108 (89.3)
Tools cited only	8 (6.6)
Tools provided	5 (4.1)
Level of change	
Multiple levels	55 (45.5)
Individual	61 (50.4)
Interpersonal	0 (0.0)
Community	1 (0.8)
Organizational	3 (2.5)
Policy	1 (0.8)
Intended Implementation setting	
No mention	35 (28.9)
Limited discussion	56 (46.3)
Detailed discussion	30 (24.8)
Target audience	
Not specified	78 (64.5) ¹
Researchers	13 (10.7) ¹
Policymakers	13 (10.7) ¹
Healthcare and Public Health Authorities	10 (8.3) ¹
Government Professionals	6 (5.0) ¹
Librarians and Information Science Professionals	5 (4.1) ¹
Communication Professionals	5 (4.1) ¹
Members of the public	4 (3.3) ¹
Social Media Platform stakeholders	3 (2.5) ¹
Marketing professionals	3 (2.5) ¹

Health Institutions	2 (1.7) ¹
Public figures	2 (1.7) ¹
Public service media organizations	2 (1.7) ¹
Other	8 (6.6) ¹
Generalizability to other areas/disciplines	
Not mentioned	62 (51.2)
Mentioned only	48 (39.7)
Discussed in detail	11 (9.1)
MTF's intended use explained	
Not mentioned	78 (64.5)
Mentioned only	32 (26.4)
Discussed in detail	11 (9.1)
Stated delivery mechanism	%(n)²
Media Literacy Education ³	27 (32.1)
Policy and Legislation Changes ⁴	18 (21.4)
Campaigns ⁵	15 (17.9)
Media Platforms ⁶	6 (7.1)
Guidelines ⁷	5 (6.0)
Community Engagement and Outreach ⁸	3 (3.6)
Label and Warning Signs ⁹	2 (2.4)
AI Tools ¹⁰	2 (2.4)
Other	6 (7.1)

¹ The classifications are not mutually exclusive, which accounts for the cumulative percentage exceeding 100%. A total of n=76 papers explicitly mentioned the target audience, with some papers referencing multiple stakeholder groups

² Percentages were calculated based on the total number of studies that reported an intended use (n = 84).

³ Media literacy education refers to efforts aimed at improving individuals' ability to critically evaluate, identify and respond to misinformation such as school-based programs, online media literacy curricula, or training workshops.

⁴ Policy and Legislation Changes refer to implementing or recommending regulatory or legal actions to counter misinformation through laws or policies on content moderation.

⁵ Campaigns refer to initiatives designed to raise awareness or shift beliefs about misinformation through in-person or online campaigns.

⁶ Media platforms refer to MTF findings or interventions being disseminated via social or traditional media channels.

⁷ Guidelines involve structured recommendations for professionals or organizations on how to counter misinformation, which can include protocols for verifying information or responding to misinformation.

⁸ Community Engagement and Outreach refers to strategies involving direct interaction with community members to share accurate information and address misinformation concerns.

⁹ Label and Warning Signs refer to visual or textual cues added to content to signal that it may be misleading or false, such as using disclaimers or warning banners to flag misinformation.

¹⁰ AI Tools refer to artificial intelligence-based interventions designed to respond or control the spread of misinformation.

Table 5. Misinformation MTF Testability

Characteristics	Number (%) of MTFs (n=121)
MTF proposes at least 1 Explicit hypothesis	
Yes	39 (32.2)
Within descriptive MTFs	1 (2.4) ¹
Within misinformation and classic theories	34 (41.0) ²
Provides evidence supporting MTF mechanisms	
Detailed Evidence	76 (62.8)
Partial Evidence	24 (19.8)
No	21 (17.4)
Details empirical support for the MTF	
No mention	61 (50.4)
Explicitly tests the MTF	46 (38.0)
Empirical support is described	14 (11.6)
Description of the empirical support	
MTF is not tested	13 (21.7) ³
MTF is tested within the paper	46 (76.7) ³
MTF is tested within previous literature	1 (1.7) ³

¹Percentage calculated based on the subset of MTFs (n=41) whose primary role is classified solely as descriptive

²Percentage calculated based on the subset of MTFs (n=83) whose Nilsen category is Misinformation and/or Classic Theories

³Percentage calculated based on the subset of MTFs (n=60) that either mentioned or tested for empirical support

Declarations

Ethics Approval and Consent to Participation

Not Applicable

Consent for Publication

Not Applicable

Availability of Data and material

The datasets utilized in this study can be accessed from public databases.

Competing Interests

The authors state they have no conflicts of interest.

Funding

ZC received the Canadian Institutes of Health Research (CIHR) Master's Scholarship. Funding bodies did not participate in designing the study, collecting, analyzing, or interpreting data, nor in writing the manuscript.

Authors' Contributions

ZC drafted the manuscript, collected the data, and completed the reporting. TM conducted full-text screening and data extraction alongside ZC. NH and CT participated in data extraction with ZC. JCB conceptualized this study, performed abstract screening, provided guidance, and revised the manuscript. ZC is the guarantor of this study.

Acknowledgements

We extend our gratitude to Risa Shorr for assisting with the development and review of the search strategy.

Appendix A – Completed PRISMA-ScR Checklist

SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTED ON PAGE #
TITLE			
Title	1	Identify the report as a scoping review.	23
ABSTRACT			
Structured summary	2	Provide a structured summary that includes (as applicable): background, objectives, eligibility criteria, sources of evidence, charting methods, results, and conclusions that relate to the review questions and objectives.	24
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known. Explain why the review questions/objectives lend themselves to a scoping review approach.	25
Objectives	4	Provide an explicit statement of the questions and objectives being addressed with reference to their key elements (e.g., population or participants, concepts, and context) or other relevant key elements used to conceptualize the review questions and/or objectives.	26
METHODS			
Protocol and registration	5	Indicate whether a review protocol exists; state if and where it can be accessed (e.g., a Web address); and if available, provide registration information, including the registration number.	26
Eligibility criteria	6	Specify characteristics of the sources of evidence used as eligibility criteria (e.g., years considered, language, and publication status), and provide a rationale.	27
Information sources*	7	Describe all information sources in the search (e.g., databases with dates of coverage and contact with authors to identify additional sources), as well as the date the most recent search was executed.	27
Search	8	Present the full electronic search strategy for at least 1 database, including any limits used, such that it could be repeated.	54-55
Selection of sources of evidence†	9	State the process for selecting sources of evidence (i.e., screening and eligibility) included in the scoping review.	27-29
Data charting process‡	10	Describe the methods of charting data from the included sources of evidence (e.g., calibrated forms or forms that have been tested by the team before their use, and whether data charting was done independently or in duplicate) and any processes for obtaining and confirming data from investigators.	29-30
Data items	11	List and define all variables for which data were sought and any assumptions and simplifications made.	29-30
Critical appraisal of individual sources of evidence§	12	If done, provide a rationale for conducting a critical appraisal of included sources of evidence; describe the methods used and how this information was used in any data synthesis (if appropriate).	N/A
Synthesis of results	13	Describe the methods of handling and summarizing the data that were charted.	30
RESULTS			
Selection of sources of evidence	14	Give numbers of sources of evidence screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally using a flow diagram.	31
Characteristics of sources of evidence	15	For each source of evidence, present characteristics for which data were charted and provide the citations.	32-35
Critical appraisal within sources of evidence	16	If done, present data on critical appraisal of included sources of evidence (see item 12).	N/A

SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTED ON PAGE #
Results of individual sources of evidence	17	For each included source of evidence, present the relevant data that were charted that relate to the review questions and objectives.	32-35
Synthesis of results	18	Summarize and/or present the charting results as they relate to the review questions and objectives.	32-35
DISCUSSION			
Summary of evidence	19	Summarize the main results (including an overview of concepts, themes, and types of evidence available), link to the review questions and objectives, and consider the relevance to key groups.	36-40
Limitations	20	Discuss the limitations of the scoping review process.	40-41
Conclusions	21	Provide a general interpretation of the results with respect to the review questions and objectives, as well as potential implications and/or next steps.	41
FUNDING			
Funding	22	Describe sources of funding for the included sources of evidence, as well as sources of funding for the scoping review. Describe the role of the funders of the scoping review.	49

Appendix B – List of Target Articles

Article #	Citation
1	Akther T, Nur T. A model of factors influencing COVID-19 vaccine acceptance: A synthesis of the theory of reasoned action, conspiracy theory belief, awareness, perceived usefulness, and perceived ease of use. PloS one. 2022;17(1):e0261869.
2	Bautista JR, Zhang Y, Gwizdka J. Healthcare professionals' acts of correcting health misinformation on social media. Int J Med Inform. 2021;148:104375.
3	Compretta CE, Fouad M, Sarpong D, Williams L, Krousel-Wood M, Washington R, et al. A New Model for Engagement and Action Mitigating COVID-19 Harm in Vulnerable Communities: The Work of Collaborative Community Engagement Alliance (CEAL) Initiatives in Three Southern States. American journal of public health. 2024;114(S1):S33-S6.
4	Enyinnaya JC, Anderson AA, Kelp NC, Long M, Duncan CG. The Social Ecology of Health Beliefs and Misinformation Framework: Examining the impact of misinformation on vaccine uptake through individual and sociological factors. Vaccine. 2024;42(3):455-63.
5	Fogg BJ. Prominence-Interpretation Theory: Explaining How People Assess Credibility Online 2003. 722-3 p.
6	Fridman I, Johnson S, Elston Lafata J. Health Information and Misinformation: A Framework to Guide Research and Practice. JMIR medical education. 2023;9:e38687.
7	Houlden S, Veletsianos G, Hodson J, Reid D, Thompson CP. COVID-19 health misinformation: Using design-based research to develop a theoretical framework for intervention. Health Education. 2022;122(5):506-18.
8	Manene S, Hove C, Cilliers L. Mitigating misinformation about the COVID-19 infodemic on social media: A conceptual framework. Jamba (Potchefstroom, South Africa). 2023;15(1):1416.
9	Mende M, Ubal VO, Cozac M, Vallen B, Berry C. Fighting Infodemics: Labels as Antidotes to Mis- and Disinformation?! Journal of Public Policy & Marketing. 2024;43(1):31-52.
10	Ransing R, Adiukwu F, Pereira-Sanchez V, Ramalho R, Orsolini L, Teixeira ALS, et al. Mental Health Interventions during the COVID-19 Pandemic: A Conceptual Framework by Early Career Psychiatrists. Asian journal of psychiatry. 2020;51:102085.
11	Reyna VF. A scientific theory of gist communication and misinformation resistance, with implications for health, education, and policy. PNAS Proceedings of the National Academy of Sciences of the United States of America. 2021;118(5).
12	Rubin VL. Disinformation and misinformation triangle: A conceptual model for “fake news” epidemic, causal factors and interventions. Journal of Documentation. 2019;75(5):1013–1034.

13	Sundelson AE, Jamison AM, Huhn N, Pasquino S-L, Sell TK. Fighting the infodemic: the 4 i Framework for Advancing Communication and Trust. BMC public health. 2023;23(1):1662.
14	Van Bavel JJ, Harris EA, Parnamets P, Rathje S, Doell KC, Tucker JA. Political psychology in the digital (mis)information age: A model of news belief and sharing. Social Issues and Policy Review. 2021;15(1):84-113.
15	Warner EL, Basen-Engquist KM, Badger TA, Crane TE, Raber-Ramsey M. The Online Cancer Nutrition Misinformation: A framework of behavior change based on exposure to cancer nutrition misinformation. Cancer. 2022;128(13):2540-8.

Appendix C - Search Strategy

Medline: 1020

PsycInfo: 650

Scopus: 2838

Proquest (Business One and Nursing & Allied Health) 1485

Total: 5993

Total after duplicates: 4849

Duplicate: 1144

Ovid MEDLINE(R) ALL <1946 to March 06, 2024>

```
1      exp Propaganda/      894
2      (misinformation or disinformation).tw,kf.    7041
3      (propaganda or gaslighting or fake news or infodemic*).tw,kf.    2984
4      1 or 2 or 3      9666
5      Models, Theoretical/ 163050
6      framework*.tw,kf.    433106
7      ((theoret* or concept*) adj2 model*).tw,kf.  53607
8      model*.ti. or model*.ab. /freq=2      1763353
9      5 or 6 or 7 or 82215052
10     4 and 91040
11     limit 10 to english language    1020
```

APA PsycInfo <1806 to February Week 5 2024>

```
1      misinformation/ or conspiracy beliefs/ or conspiracy theories/      1786
2      (misinformation or disinformation or propaganda or gaslighting or fake news or
infodemic*).tw.      6176
3      1 or 2      6732
4      framework*.tw.      250220
5      exp models/      134184
6      ((theoret* or concept*) adj2 model*).tw.      41912
7      model*.ti. or model*.ab. /freq=2      409098
8      or/4-7      673781
9      3 and 8715
10     limit 9 to english language      650
```

Scopus

(TITLE-ABS (propaganda) OR TITLE-ABS (disinformation) OR TITLE-ABS (misinformation) OR TITLE-ABS (gaslighting) OR TITLE-ABS ("fake news") OR TITLE-ABS (infodemic*)) AND (((TITLE (((theoret* OR concept*) W/4 model*)) OR ABS ((

(theoret* OR concept*) W/4 model*))) OR ((TITLE (framework*) OR ABS (framework*)))) AND (LIMIT-TO (LANGUAGE , "English"))

2839 References

Proquest :

Proquest One Business, Proquest Nursing & Allied Health

Set#	Searched for	Databases	Results
S1	((abstract(model*) OR abstract(framework*) OR title(model*) OR abstract(framework*)) AND (noft(misinformation) OR noft(disinformation) OR noft("fake news") OR noft(propaganda) OR noft(infodemic*) OR noft(Gaslighting))) NOT (at.exact("News") AND a.exact("ENG"))	Nursing & Allied Health Premium, ProQuest One Business These databases are searched for part of your query.	1485

Appendix D – Data Extraction Items

Study Details

1. Reviewer Initials:

2. Author Name:

3. Publication Year:

4. Article Title:

5. What is the identified **MTF name** that the authors use? (if there is no name mentioned, write a generic placeholder name (e.g. If it is about predictors of misinformation, write “Predictors of misinformation model”)

6. If the MTF presented is a "new" MTF authors came up with, but it is significantly based on a previous MTF, please take a note of the name here

7. What is the **design** of the resource reporting on the MTF? (Select ALL that apply)

A Review (A knowledge synthesis)	[A paper that creates a summary of the resources available in the literature to answer an important research question or current area of research. (Gulpinar & Gucal Guclu, 2014)]
A Quantitative Empirical Study	[Systematic investigation that relies on numerical data and statistical methods to test hypotheses and measure relationships between variables. (Emerald Publishing, n.d.)]

A Qualitative Empirical Study	[involves collecting and analyzing non-numerical data, such as interviews, observations, and texts, to understand concepts, opinions, or experiences.]
Mixed Methods Study	[integrates both qualitative and quantitative research approaches to provide a comprehensive analysis of the research problem, combining numerical data with in-depth contextual understanding.]
Descriptive account of the MTF	[A paper that provides a detailed account or introduction of a specific model, theory, or framework (MTF)]
OTHER (specify)	(e.g., case study, opinion piece etc.):

8. **IF YES to Review**, what kind of review does the study self-identify as? [Select ALL that apply (e.g., systematic review, meta-analysis)]

Scoping Review	[research synthesis that aims to map the existing literature on a particular topic, identifying key concepts, gaps, and evidence.]
Systematic Review	[structured and comprehensive synthesis of research studies on a specific topic, following a predefined protocol to minimize bias. (Higgins et al 2011)]
Includes META-ANALYSIS	[statistical technique that combines the results of multiple quantitative studies to determine the overall effect size or trend. (Grant 2009). Note: SRs often, not always have a meta-analysis. Meta-analyses sometimes, not often, done without a systematic review – e.g. on a narrative review of studies]
Narrative Review	[qualitative synthesis of research on a specific topic, providing a summary and interpretation of findings without a systematic approach. (Demiris et al 2019)]
Rapid Review	[streamlined synthesis of research evidence, conducted in a shorter timeframe to inform decision-making in a timely manner (Khangura et al 2012)]
OTHER (specify)	(e.g., Literature review, etc.):

Purpose

9. What is the described **purpose** of the MTF as mentioned in the paper? (Quotation that best describes the purpose)

--

10. **Summary** of the purpose by the main extractor (ZC)

--

Characterization

11. Does the MTF **self-identify** as a **model, theory or framework**? (Select **ALL** that apply)

Model	simplified representations of particular aspects of phenomena. It tries to enhance understanding and analysis. May or may not be testable/falsifiable
Theory	analytical principles or statements. It tries to organize observations and interpretations of the world. They are testable/falsifiable
Framework	structures or systems that describe full range of factors. It tries to guide complex problems or organizes information. They are rarely testable/falsifiable.
Does not self-identify or unclear	There is no mention of any MTFs, or it is unclear

12. What is **the categorization of the MTF** in terms of Nilsen categories? (Select ALL that apply)

Determinant Framework	seeks to list a full range of factors that determine the effectiveness and countering. Fairly high level and does not show relationships between constructs (framework)
Evaluation Frameworks	describing how misinformation effectiveness/success can be measured, pretty broad, shows range of constructs relevant to measurement and/or described relevant outcomes

Classic Theories	any theories that were developed in a non-misinformation area and applied relatively unchanged to misinformation. Explains relationships between constructs and often shows causality (theory)
Misinformation Theories	encompassing any theory developed WITHIN misinformation field either that have been developed from scratch or by adapting existing theories and concepts to provide understanding and/or explanation aspects of misinformation
Process Models	describes one or more individual processes by which misinformation could be more or less successful. More specific (model)
Other (specify)	

13. Is the MTF **primarily** based on describing misinformation, misinformation countering strategies or BOTH?

Misinformation	Explains how misinformation works and/or predictors of misinformation (e.g. how fake news spread, how it influences individuals or social media)
Misinformation countering strategies	Explains strategies to counter or reduce the effects of misinformation (e.g. debunking, educational programs or policy changes)
Both	Paper presents a MTF that both explains and counters misinformation

14. What is the **PRIMARY** role of the MTF presented in the paper?

Descriptive	Describes the properties, characteristics, and/or qualities of misinformation countering strategies.
Diagnostic	Specify relational and/or relationships between framework concepts.
Predictive	Provide hypotheses or propose directional relationships between concepts of misinformation. (implies causation)
Prescriptive	Provide directions (explains what to do) on the implementation of misinformation countering strategies process via a series of steps or procedures

15. **If any**, what is the **SECONDARY** role of the MTF presented in the paper? (Role of the MTF presented not other MTFs in relation to it)

Descriptive	Describes the properties, characteristics, and/or qualities of misinformation countering strategies.
Diagnostic	Specify relational and/or relationships between framework concepts.
Predictive	Provide hypotheses or propose directional relationships between concepts of misinformation. (implies causation)
Prescriptive	Provide directions (explains what to do) on the implementation of misinformation countering strategies process via a series of steps or procedures

Usability

16. What is the **level of detail** of misinformation MTF description?

Reference only	The misinformation MTF is mentioned but without any elaboration or detail (i.e. only gives a reference and maybe 1-2 sentences about it very briefly without discussing it)
Partial description	The misinformation MTF is described with some detail (i.e. talks about some components presented OR ALL components but NOT thoroughly - description is incomplete or lacks depth)
Detailed description	The misinformation MTF is thoroughly described with comprehensive details (talks about all the components presented and provides explanations).

17. Does the **MTF PRESENTED describe clear relationships between constructs?** [i.e. the MTF showcases the relationships between constructs and how they influence one another]

No mention	The MTF does not describe any relationships between constructs or how they influence one another.
Limited discussion	The MTF includes a brief or superficial mention of relationships between constructs (includes some components, excludes others) and how they influence one another.
Detailed discussion	The MTF provides an in-depth and comprehensive explanation of ALL relationships between constructs/components and how they influence one another.

18. Does the MTF have a clear and useful **figure or table** depicting the included constructs? (and for theories relationships between constructs)

No figure or table	The MTF does not include any figure or table depicting the constructs or, for theories, the relationships between constructs.
Partial figure or table	The MTF includes a figure or table but has missing constructs/components or, for theories, the relationships between constructs.
Full figure or table	The MTF includes a clear and useful figure or table with all components presented that comprehensively depicts the constructs or, for theories, the relationships between constructs.

19. If applicable, does the MTF itself clearly provide methods or approaches for **reducing the effects of misinformation**?

No	The MTF does not provide any methods or approaches for reducing the effects of misinformation
Yes	There are methods or approaches to reduce the effects of misinformation inherent in the MTF presented

20. Does the MTF provide clear **guidance for application and/or designing an intervention**? (i.e. the MTF provides guidance on how to apply the misinformation MTF presented)

No	The MTF does not include any guidance on how to apply the misinformation MTF in practice.
Limited guidance	The MTF provides a brief or superficial guidance on applying the misinformation MTF (i.e. just mentions)
Detailed guidance	The MTF offers comprehensive and in-depth guidance on how to apply the misinformation MTF (i.e. list or goes in detail about the approaches or designing the intervention)

Implementability

21. Does the MTF clearly incorporate: **context** (important environmental/contextual factors affecting effectiveness)

No	The MTF does not incorporate or mention any environmental or contextual factors affecting effectiveness.
Limited discussion	The MTF includes a context used to build the MTF (e.g. social media context) however does not incorporate environmental or contextual factors as a component within the MTF or does not explain in detail
Detailed discussion	The MTF provides environmental or contextual factors as a component integrated within MTF (i.e. MTF is designed to be applicable to various contexts) or talks about the consideration of the context in-depth

22. Does the MTF clearly describe the **outcomes (i.e. components authors want to measure)** and/or **metrics (i.e. operationalizations of those outcomes)** that it sees as relevant to success of the misinformation strategy or intervention?

No mention	The MTF does not incorporate or mention outcome and metrics to measure the success of the misinformation strategy or intervention.
Mentions outcome and/or metrics	The MTF mentions or incorporates outcome and metrics to measure the success of the misinformation strategy or intervention

23. Does the MTF clearly incorporate: **adaptation/tailoring** of interventions to different recipients/subgroups

No	The MTF does not incorporate or mention any adaptation/tailoring breakdown of the complete misinformation strategy.
Yes	The MTF incorporates clear adaptation of the breakdown of the complete misinformation strategy to different subgroups (e.g. x constructs of this MTF can be used by the population)

24. Does the MTF clearly incorporate: **fidelity** (clearly consider the extent to which the misinformation intervention is delivered as intended)

No mention	The MTF does not incorporate or mention the extent to which the misinformation intervention is delivered as intended.
-------------------	--

Limited discussion (mentions)	The MTF includes a mention of the extent to which the misinformation intervention is delivered as intended.
Detailed discussion (mentions + provides explanations)	The MTF provides an in-depth and comprehensive discussion of the extent to which the misinformation intervention is delivered as intended by providing explanations

25. Does the MTF clearly incorporate: **sustainability** (includes continuation of activities, capacity, health benefits or financial viability in the literature)

No mention	The MTF does not incorporate or mention any aspects of sustainability, such as continuation of activities, capacity, health benefits, or financial viability.
Limited discussion (mentions)	The MTF mentions aspects of sustainability, such as continuation of activities, capacity, health benefits, or financial viability.
Detailed discussion (mentions + provides explanations)	The MTF provides an in-depth and comprehensive discussion of sustainability aspects, such as continuation of activities, capacity, health benefits, or financial viability by providing explanations

26. Does the paper describe **ANY supplemental or linked tools in support of the MTF?** [i.e. misinformation MTF presents supplemental or linked tools that are directly relevant in the use of MTF]

No mention	The paper does not describe any linked tools for the misinformation MTF.
Tools cited only	The paper includes a mention ONLY of supplemental or linked tools for the misinformation MTF.
Tools explicitly provided	The paper provides a supplemental or linked tool that is explicitly provided with explanation and/or examples for the misinformation MTF.

27. How does the MTF describe the targeted **level of change?** Select ALL that apply

individual	[changes in personal behaviors, attitudes, knowledge, skills, or health outcomes] (e.g. enhanced ability to evaluate the credibility of sources,
-------------------	--

	increased skepticism of unverified claims, skills for fact-checking information, reduced anxiety about false health claims)
interpersonal	[changes in relationships and interactions between people, such as within families, peer groups, or social networks] (e.g. family discussions about the impact of misinformation on health decisions, peer groups encouraging fact-checking before sharing information online)
community	[changes within larger groups or communities, addressing communal behaviors, social norms, and collective efficacy] (e.g. community workshops on recognizing misinformation or community campaigns that promote accurate health information through local media channels)
organizational	[changes within institutions or organizations, such as workplaces, schools, or healthcare facilities] (e.g. implementing training programs on recognizing and addressing misinformation for staff, revising communication strategies to include accurate information, or creating resources for patients that clarify misinformation about health interventions)
policy	[changes in public policies, laws, regulations, and their implementation at local, state, or national levels] (e.g. establishment of guidelines for social media platforms to identify and limit the spread of misinformation or government initiatives that promote media literacy programs in schools)
Not specified	

28. Is the **context/setting/area** to which the MTF is intended to be applied discussed? (e.g. health, public opinion, military etc.)

No	The MTF does not discuss the context, setting, or area to which it is intended to be applied.
Limited discussion (mentions)	The MTF includes a brief or superficial discussion of the context, setting, or area to which it is intended to be applied.
Detailed discussion (mentions + provides explanations)	The MTF provides a comprehensive and in-depth discussion of the context, setting, or area to which it is intended to be applied.

29. If **YES** to previous, **what is the context/setting/area** to which MTF is being applied to?

--

30. Is the **target audience** EXPLICITLY and CLEARLY mentioned within the MTF (intended users of the MTF)? (e.g. clinical practitioners, elders, adults, policy makers, students etc.)

No	The MTF does not specify the target audience or intended users.
Yes	The MTF includes discussion of the target audience or intended users.

31. If yes, who are the **target audience MENTIONED**?

--

32. Does the description of the MTF clearly mention or discuss the extent to which it is intended to be **generalizable** to areas/disciplines other than the one for which it was originally developed?

No	The MTF description does not address or discuss the extent of its generalizability to other areas or disciplines.
Limited discussion (mentions)	The MTF description includes a mention of the extent to which it is intended to be generalizable to other areas or disciplines.
Detailed discussion (mentions + provides explanations)	The MTF description provides a comprehensive and in-depth discussion of the extent to which it is intended to be generalizable to other areas or disciplines.

33. Does the MTF description recommend **relevant intervention delivery mechanisms** (e.g. guidelines, educational programs, policy changes)?

No	The MTF description does not recommend any relevant intervention delivery mechanisms.
Limited mention (mentions)	The MTF description includes a mention of recommendation to intervention delivery mechanisms.

Detailed discussion (mentions + provides explanations)	The MTF description provides a comprehensive and in-depth recommendation of relevant intervention delivery mechanisms, such as guidelines, educational programs, or policy changes.
---	--

34. If YES to previous question, **what are the delivery mechanisms** mentioned?

--

Testability

35. Does the MTF description explicitly describe one or more specific **hypotheses** (i.e. does MTF clearly and explicitly describe a testable hypothesis?)

No	The MTF description does not explicitly describe any specific hypotheses
Yes	The MTF description includes a clear explanation of one or more specific hypotheses.

36. Does the MTF description provide **evidence to support the specific relationships** proposed in the MTF? (incorporation of evidence cited **elsewhere**) [e.g. evidence should be face valid and specific to individual relationships in the model, and NOT evidence supporting the model as a whole]

No	The MTF description does not provide evidence to support the specific relationships proposed in the model.
Partial evidence	The MTF description includes a brief or superficial amount of evidence to support some of the specific relationships proposed in the model.
Detailed discussion	The MTF description provides comprehensive and specific evidence supporting each of the relationships proposed in the model, focusing on individual relationships rather than the model as a whole.

37. Does the MTF **mention OR conduct empirical tests of the MTF?**

No	The MTF description does not include ANY mention about empirical tests or studies involving the MTF.
Yes: mentions it	The MTF description includes mention of whether the MTF has been used in empirical studies.

Yes: conducts it	The MTF description includes conducting empirical tests for the MTF
-----------------------------	--

38. If YES to previous question, **how is the empirical testing of the MTF described?**

Not tested	The mention of the use of empirical tests indicates MTF not being tested in empirical studies
Tested within the paper	The mention of the use of empirical tests indicates MTF is tested empirically within the paper
Tested: within previous literature	The mention of the use of empirical tests indicates MTF is tested empirically within previous/external literature

Appendix E – Complete List of Included Studies

1. Ecker UKH, Lewandowsky S, Cook J, et al. The psychological drivers of misinformation belief and its resistance to correction. *Nat Rev Psychol*. 2022;1(1):13-29. doi:10.1038/s44159-021-00006-y
2. Adam-Troian J, Chayinska M, Paladino MP, Uluğ ÖM, Vaes J, Wagner-Egger P. Of precarity and conspiracy: Introducing a SOCIO-FUNCTIONAL model of conspiracy beliefs. *Br J Soc Psychol*. 2023;62(S1):136-159. doi:10.1111/bjso.12597
3. Agarwal NK, Alsaeedi F. Creation, dissemination and mitigation: toward a disinformation behavior framework and model. *Aslib J Inf Manag*. 2021;73(5):639-658. doi:10.1108/AJIM-01-2021-0034
4. Agarwal NK, Alsaeedi F. Understanding and fighting disinformation and fake news: Towards an information behavior framework. *Proc Assoc Inf Sci Technol*. 2020;57(1):e327. doi:10.1002/pras.327
5. Karlova NA, Fisher KE. A social diffusion model of misinformation and disinformation for understanding human information behaviour. *Inf Res*. 2013;18(1):573.
6. Ahmed S, Rasul ME. Social Media News Use and COVID-19 Misinformation Engagement: Survey Study. *J Med Internet Res*. 2022;24(9):e38944. doi:10.2196/38944
7. Ahmed W, Önköl D, Das R, et al. Developing Techniques to Support Technological Solutions to Disinformation by Analyzing Four Conspiracy Networks During COVID-19. *IEEE Trans Eng Manag*. 2024;71:13327-13344. doi:10.1109/TEM.2023.3273191
8. Alanzi TM. Public Perceptions Towards Online Health Information: A Mixed-Method Study in Eastern Province of Saudi Arabia. *J Healthc Leadersh*. 2023;15(101614314):259-272. doi:10.2147/JHL.S431362
9. Ali M. Fake-News Network Model: A Conceptual Framework for Strategic Communication to Deal with Fake News. *Int J Strateg Commun*. 2022;16(1):1-17. doi:10.1080/1553118X.2021.1988616
10. Almaliki M. Misinformation-Aware Social Media: A Software Engineering Perspective. *IEEE Access*. 2019;7:182451-182458. doi:10.1109/ACCESS.2019.2960270
11. Amazeen MA, Krishna A. Refuting misinformation: Examining theoretical underpinnings of refutational interventions. *Curr Opin Psychol*. 2024;56:101774. doi:10.1016/j.copsyc.2023.101774
12. Amazeen M, Krishna A. Processing Vaccine Misinformation: Recall and Effects of Source Type on Claim Accuracy via Perceived Motivations and Credibility. *Int J Commun*. 2023;17:560+.

13. Anthonysamy L, Sivakumar P. A new digital literacy framework to mitigate misinformation in social media infodemic. *Glob Knowl Mem Commun*. 2024;73(6/7):809-827. doi:10.1108/GKMC-06-2022-0142
14. Apuke OD, Omar B. Fake news and COVID-19: modelling the predictors of fake news sharing among social media users. *Telemat Inform*. 2021;56:101475. doi:10.1016/j.tele.2020.101475
15. Apuke OD, Omar B. Modelling the antecedent factors that affect online fake news sharing on COVID-19: the moderating role of fake news knowledge. *Health Educ Res*. 2020;35(5):490-503. doi:10.1093/her/cyaa030
16. Arayankalam J, Krishnan S. The Spread and Impact of Fake News on Social Media: A Systematic Literature Review and Future Research Agenda. *E - Serv J*. 2022;14(1):32-95,120. doi:10.2979/eservicej.14.1.02
17. Au CH, Ho KKW, Chiu DKW. The Role of Online Misinformation and Fake News in Ideological Polarization: Barriers, Catalysts, and Implications. *Inf Syst Front*. 2022;24(4):1331-1354. doi:10.1007/s10796-021-10133-9
18. Austin EW, Borah P, Austin BW, et al. Media literacy's role in the mitigation of disinformation effects on substance misuse. *J Subst Use*. 2024;29(4):517-523. doi:10.1080/14659891.2023.2183150
19. Bailey TC, Hsieh-Yee I. Combating the Sharing of False Information: History, Framework, and Literacy Strategies. *Internet Ref Serv Q*. 2019;24(1-2):9-30. doi:10.1080/10875301.2020.1863286
20. Barua Z. COVID-19 Misinformation on Social Media and Public's Health Behavior: Understanding the Moderating Role of Situational Motivation and Credibility Evaluations. *Hum Arenas*. 2024;7(4):883-906. doi:10.1007/s42087-022-00291-w
21. Barua Z, Barua S, Aktar S, Kabir N, Li M. Effects of misinformation on COVID-19 individual responses and recommendations for resilience of disastrous consequences of misinformation. *Prog Disaster Sci*. 2020;8:100119. doi:10.1016/j.pdisas.2020.100119
22. Bastani P, Hakimzadeh SM, Bahrami MA. Designing a conceptual framework for misinformation on social media: a qualitative study on COVID-19. *BMC Res Notes*. 2021;14(1):408. doi:10.1186/s13104-021-05822-2
23. Bautista JR, Zhang Y, Gwizdka J. Healthcare professionals' acts of correcting health misinformation on social media. *Int J Med Inf*. 2021;148(ct4, 9711057):104375. doi:10.1016/j.ijmedinf.2021.104375
24. Blom R. Believing false political headlines and discrediting truthful political headlines: The interaction between news source trust and news content expectancy. *Journalism*. 2021;22(3):821-837. doi:10.1177/1464884918765316

25. Blom R. *Fact or Fiction: Believability of Statements Made by News Networks*. Dissertation. Michigan State University; 2013.
26. Brashier NM, Marsh EJ. Judging Truth. *Annu Rev Psychol*. 2020;71(1):499-515. doi:10.1146/annurev-psych-010419-050807
27. Chadwick A, Vaccari C, Hall NA. What Explains the Spread of Misinformation in Online Personal Messaging Networks? Exploring the Role of Conflict Avoidance. *Digit Journal*. 2024;12(5):574-593. doi:10.1080/21670811.2023.2206038
28. Chadwick A, Vaccari C, Kaiser J. The Amplification of Exaggerated and False News on Social Media: The Roles of Platform Use, Motivations, Affect, and Ideology. *Am Behav Sci*. 2025;69(2):113-130. doi:10.1177/00027642221118264
29. Chang C. Fake News: Audience Perceptions and Concerted Coping Strategies. *Digit Journal*. 2021;9(5):636-659. doi:10.1080/21670811.2021.1923403
30. Chatterjee S, Chaudhuri R, Vrontis D. Role of fake news and misinformation in supply chain disruption: impact of technology competency as moderator. *Ann Oper Res*. 2023;327(2):659-682. doi:10.1007/s10479-022-05001-x
31. Chen L, Fu L. Let's fight the infodemic: the third-person effect process of misinformation during public health emergencies. *Internet Res*. 2022;32(4):1357-1377. doi:10.1108/INTR-03-2021-0194
32. Chen ZF, Cheng Y. The diffusion process of product-harm misinformation on social media: evidence from consumers and insights from communication professionals. *Internet Res*. 2023;33(5):1828-1848. doi:10.1108/INTR-07-2022-0571
33. Chon MG, Kim KH. Misinformation and Government Crisis Management in South Korea: Understanding Active Publics' Belief in Misinformation about the Yemeni Refugee Issue and Its Effect on Active Communication Behaviors. *J Int Crisis Risk Commun Res*. 2021;4(3):545-578. doi:10.30658/jicrcr.4.3.4
34. Chowdhury A, Kabir KH, Abdulai AR, Alam MF. Systematic Review of Misinformation in Social and Online Media for the Development of an Analytical Framework for Agri-Food Sector. *Sustainability*. 2023;15(6):4753. doi:10.3390/su15064753
35. Horner CG, Galletta D, Crawford J, Shirsat A. Emotions: The Unexplored Fuel of Fake News on Social Media. *J Manag Inf Syst*. 2021;38(4):1039-1066. doi:10.1080/07421222.2021.1990610
36. Cohen E. Building an Informing Science Model in Light of Fake News. *Informing Sci Int J Emerg Transdiscipl*. 2019;22:095-114. doi:10.28945/4486
37. Dai Y, Yu W, Shen F. The Effects of Message Order and Debiasing Information in Misinformation Correction. *Int J Commun*. 2021;15:1039-1059.

38. Daunt KL, Greer DA, Jin HS, Orpen I. Who believes political fake news? The role of conspiracy mentality, patriotism, perceived threat to freedom, media literacy and concern for disinformation. *Internet Res.* 2023;33(5):1849-1870. doi:10.1108/INTR-07-2022-0565
39. de Regt A, Montecchi M, Lord Ferguson S. A false image of health: how fake news and pseudo-facts spread in the health and beauty industry. *J Prod Brand Manage.* 2020;29(2):168-179. doi:10.1108/JPBM-12-2018-2180
40. Di Domenico G, Sit J, Ishizaka A, Nunan D. Fake news, social media and marketing: A systematic review. *J Bus Res.* 2021;124(Allcott, H., Gentzkow, M. (2017). Social media and fake news in the 2016 election. *Journal of Economic Perspectives*, 31(2), 211-236. .Allcott, H., Gentzkow, M., Yu, C. (2019). Trends in the diffusion of misinformation on social media. *Research and Pol*):329-341.
41. Dowse A, Bachmann SD. Information warfare: methods to counter disinformation. *Def Secur Anal.* 2022;38(4):453-469. doi:10.1080/14751798.2022.2117285
42. Effron DA, Helgason BA. The moral psychology of misinformation: Why we excuse dishonesty in a post-truth world. *Curr Opin Psychol.* 2022;47:101375. doi:10.1016/j.copsyc.2022.101375
43. Enyinnaya JC, Anderson AA, Kelp NC, Long M, Duncan CG. The Social Ecology of Health Beliefs and Misinformation Framework: Examining the impact of misinformation on vaccine uptake through individual and sociological factors. *Vaccine.* 2024;42(3):455-463. doi:10.1016/j.vaccine.2024.01.001
44. Eysenbach G. How to Fight an Infodemic: The Four Pillars of Infodemic Management. *J Med Internet Res.* 2020;22(6):e21820. doi:10.2196/21820
45. Faix A, Fyn A. Framing fake news: Misinformation and the ACRL framework. *Portal.* 2020;20(3):495-508. doi:10.1353/pla.2020.0027
46. Geers M, Swire-Thompson B, Lorenz-Spreen P, Herzog SM, Kozyreva A, Hertwig R. The Online Misinformation Engagement Framework. *Curr Opin Psychol.* 2024;55:101739. doi:10.1016/j.copsyc.2023.101739
47. Gwebu KL, Wang J, Zifla E. Can warnings curb the spread of fake news? The interplay between warning, trust and confirmation bias. *Behav Inf Technol.* 2022;41(16):3552-3573. doi:10.1080/0144929X.2021.2002932
48. Halpern D, Valenzuela S, Katz J, Miranda JP. From Belief in Conspiracy Theories to Trust in Others: Which Factors Influence Exposure, Believing and Sharing Fake News. In: Vol 11578 LNCS. Springer Verlag; 2019:217-232. doi:10.1007/978-3-030-21902-4_16
49. Ho KKW, Ye S. Factors Affecting the Formation of False Health Information and the Role of Social Media Literacy in Reducing Its Effects. *Information.* 2024;15(2):116. doi:10.3390/info15020116

50. Douglas KM, Sutton RM, Cichocka A. The Psychology of Conspiracy Theories. *Curr Dir Psychol Sci.* 2017;26(6):538-542. doi:10.1177/0963721417718261
51. Van Prooijen JW. An Existential Threat Model of Conspiracy Theories. *Eur Psychol.* 2020;25(1):16-25. doi:10.1027/1016-9040/a000381
52. Horowitz M, Cushion S, Dragomir M, Gutiérrez Manjón S, Pantti M. A Framework for Assessing the Role of Public Service Media Organizations in Countering Disinformation. *Digit J.* 2022;10(5):843-865. doi:10.1080/21670811.2021.1987948
53. Humprecht E, Esser F, Van Aelst P. Resilience to Online Disinformation: A Framework for Cross-National Comparative Research. *Int J Press Polit.* 2020;25(3):493-516. doi:10.1177/1940161219900126
54. Hwang Y, Jeong SH. Misinformation Exposure and Acceptance: The Role of Information Seeking and Processing. *Health Commun.* 2023;38(3):585-593. doi:10.1080/10410236.2021.1964187
55. Hwang Y, So J, Jeong SH. Does COVID-19 Message Fatigue Lead to Misinformation Acceptance? An Extension of the Risk Information Seeking and Processing Model. *Health Commun.* 2023;38(12):2742-2749. doi:10.1080/10410236.2022.2111636
56. Khan A, Khan MK, Hussain A. Mis/Disinformation About COVID-19 and the Position of Information Professionals in Infodemic Management. *J Hosp Libr.* 2022;22(4):299-310. doi:10.1080/15323269.2022.2124800
57. Khan SA, Shahzad K, Shabbir O, Iqbal A. Developing a Framework for Fake News Diffusion Control (FNDC) on Digital Media (DM): A Systematic Review 2010–2022. *Sustainability.* 2022;14(22). doi:10.3390/su142215287
58. Konstantinou L, Panos D, Karapanos E. Exploring the Design of Technology-Mediated Nudges for Online Misinformation. *Int J Hum-Comput Interact.* Published online 2024. doi:10.1080/10447318.2023.2301265
59. Kopp C, Korb KB, Mills BI. Information-theoretic models of deception: Modelling cooperation and diffusion in populations exposed to “fake news”. *PloS One.* 2018;13(11):e0207383. doi:10.1371/journal.pone.0207383
60. Krause NM, Freiling I, Scheufele DA. The “Infodemic” Infodemic: Toward a More Nuanced Understanding of Truth-Claims and the Need for (Not) Combatting Misinformation. *Ann Am Acad Pol Soc Sci.* 2022;700(1):112-123. doi:10.1177/00027162221086263
61. Lee T. How people perceive influence of fake news and why it matters. *Commun Q.* 2021;69(4):431-453. doi:10.1080/01463373.2021.1954677
62. Lelo T. Introducing a praxeological framework for studying disinformation. *Commun Theory.* 2024;34(1):18-28. doi:10.1093/ct/qtad017

63. Lesser M, Stern HJ, Terp SJ. Countering Russian Misinformation, Disinformation, Malinformation and Influence Campaigns in Italy Surrounding the Russian Invasion of Ukraine. In: Vol 3289. CEUR-WS; 2022. <https://www.scopus.com/inward/record.uri?eid=2-s2.0-85143786320&partnerID=40&md5=c2dbe865de2f9f9397216c98ec94c995>
64. Li Z, Qiu H, Zhou Q. Social-mediated diffusion of conspiracy theories about COVID-19: A study integrating SMCC and TPB models. *Int J Hum-Comput Interact.* 2022;38(7):680-689. doi:10.1080/10447318.2021.1960726
65. Lu J, Xiao Y. Heuristic Information Processing as a Mediating Factor in the Process of Exposure to COVID-19 Vaccine Information and Misinformation Sharing on Social Media. *Health Commun.* 2023;(dr9, 8908762):1-14. doi:10.1080/10410236.2023.2288373
66. Maddox JD, Gentzel C, Levis A. Toward a Whole-of-Society Framework for Countering Disinformation. In: *Great Power Cyber Competition: Compet. and Win. in the Inf. Environment.* Taylor and Francis; 2024:183-198. doi:10.4324/9781003425304-14
67. Magarini FM, Pinelli M, Sinisi A, Ferrari S, De Fazio GL, Galeazzi GM. Irrational Beliefs about COVID-19: A Scoping Review. *Int J Environ Res Public Health.* 2021;18(19). doi:10.3390/ijerph18199839
68. Mahdi A, Farah MF, Ramadan Z. What to believe, whom to blame, and when to share: exploring the fake news experience in the marketing context. *J Consum Mark.* 2022;39(3):306-316. doi:10.1108/JCM-05-2020-3863
69. Manene S, Hove C, Cilliers L. Mitigating misinformation about the COVID-19 infodemic on social media: A conceptual framework. *Jamba Potchefstroom South Afr.* 2023;15(1):1416. doi:10.4102/jamba.v15i1.1416
70. Mehta AM, Liu BF, Tyquin E, Tam L. A process view of crisis misinformation: How public relations professionals detect, manage, and evaluate crisis misinformation. *Public Relat Rev.* 2021;47(2). doi:10.1016/j.pubrev.2021.102040
71. Mende M, Ubal VO, Cozac Marina, Vallen Beth, Berry C. Fighting Infodemics: Labels as Antidotes to Mis- and Disinformation?!. JPP&M. *J Public Policy Mark.* 2024;43(1):31-52. doi:10.1177/07439156231184816
72. Muhammed T S, Mathew SK. The disaster of misinformation: a review of research in social media. *Int J Data Sci Anal.* 2022;13(4):271-285. doi:10.1007/s41060-022-00311-6
73. Naeem M, Ozuem W. Understanding misinformation and rumors that generated panic buying as a social practice during COVID-19 pandemic: evidence from Twitter, YouTube and focus group interviews. *Inf Technol People.* 2022;35(7):2140-2166. doi:10.1108/ITP-01-2021-0061
74. Nan X, Thier K, Wang Y. Health misinformation: what it is, why people believe it, how to counter it. *Ann Int Commun Ass.* 2023;47(4):381-410. doi:10.1080/23808985.2023.2225489

75. Obada DR, Dabija DC. “In Flow”! Why Do Users Share Fake News about Environmentally Friendly Brands on Social Media?. *Int J Environ Res Public Health*. 2022;19(8). doi:10.3390/ijerph19084861
76. Olan F, Jayawickrama U, Arakpogun EO, Suklan J, Liu S. Fake news on Social Media: the Impact on Society. *Inf Syst Front J Res Innov*. 2022;(101685853):1-16. doi:10.1007/s10796-022-10242-z
77. Osman A, Ogbunugafor CB. An Epidemic Analogy Highlights the Importance of Targeted Community Engagement in Spaces Susceptible to Misinformation. *Front Commun*. 2022;7:824682. doi:10.3389/fcomm.2022.824682
78. Perach R, Joyner L, Husbands D, Buchanan T. Why Do People Share Political Information and Misinformation Online? Developing a Bottom-Up Descriptive Framework. *Soc Media Soc*. 2023;9(3). doi:10.1177/20563051231192032
79. Pierre JM. Conspiracy Theory Belief: A Sane Response to an Insane World? *Rev Philos Psychol*. Published online 2023. doi:10.1007/s13164-023-00716-7
80. Pramukh Nanjundaswamy Vasist, Krishnan S. Engaging with deepfakes: a meta-synthesis from the perspective of social shaping of technology theory. *Internet Res*. 2023;33(5):1670-1726. doi:10.1108/INTR-06-2022-0465
81. Pundir V, Devi EB, Nath V. Arresting fake news sharing on social media: a theory of planned behavior approach. *Manage Res Rev*. 2021;44(8):1108-1138. doi:10.1108/MRR-05-2020-0286
82. Riaz M, Jie W, Sherani M, Ali S, Boamah FA, Zhu Y. An empirical evaluation of the predictors and consequences of social media health-misinformation seeking behavior during the COVID-19 pandemic. *Internet Res*. 2023;33(5):1871-1906. doi:10.1108/INTR-04-2022-0247
83. Rubinelli S, Purnat TD, Wilhelm E, et al. WHO competency framework for health authorities and institutions to manage infodemics: its development and features. *Hum Resour Health*. 2022;20(1):35. doi:10.1186/s12960-022-00733-0
84. WHO. WHO Competency Framework: Building a response workforce to manage infodemics. Published online 2021.
85. Rubin VL. Disinformation and misinformation triangle: A conceptual model for “fake news” epidemic, causal factors and interventions. *J Doc*. 2019;75(5):1013-1034. doi:10.1108/JD-12-2018-0209
86. Ruokolainen H, Widén G. Conceptualising misinformation in the context of asylum seekers. *Inf Process Manage*. 2020;57(3). doi:10.1016/j.ipm.2019.102127

87. Sampat B, Raj S. Fake or real news? Understanding the gratifications and personality traits of individuals sharing fake news on social media platforms. *Aslib J Inf Manage*. 2022;74(5):840-876. doi:10.1108/AJIM-08-2021-0232
88. Scannell D, Desens L, Guadagno M, et al. COVID-19 Vaccine Discourse on Twitter: A Content Analysis of Persuasion Techniques, Sentiment and Mis/Disinformation. *J Health Commun*. 2021;26(7):443-459. doi:10.1080/10810730.2021.1955050
89. Schmid P. Using Behavioral Science for Infodemic Preparedness: The Case of Vaccination Misinformation. *Policy Insights Behav Brain Sci*. 2024;11(1):93-101. doi:10.1177/23727322231219684
90. Sethi V, Jeyaraj A, Duffy K, Sethi N. Using Cascade Theories to Explain the Spread of Fake News in the Asian Context. *J Asia-Pac Bus*. 2023;24(1):55-72. doi:10.1080/10599231.2023.2197418
91. Shahzad K, Khan SA, Iqbal A, Shabbir O, Latif M. Determinants of fake news diffusion on social media: a systematic literature review. *Glob Knowl Mem Commun*. Published online 2023. doi:10.1108/GKMC-06-2023-0189
92. Sharevski F, Devine A, Pieroni E, Jachim P. Folk Models of Misinformation on Social Media. In: *The Internet Society*; 2023. doi:10.14722/ndss.2023.24293
93. Shin H. A model for examining the effects of fake news and social endorsement cues on information seeking about public health risk. *Diss Abstr Int Sect B Sci Eng*. 2023;84(3-B):No-Specified.
94. Spampatti T, Hahnel UJJ, Trutnevyte E, Brosch T. Psychological inoculation strategies to fight climate disinformation across 12 countries. *Nat Hum Behav*. 2024;8(2):380-398. doi:10.1038/s41562-023-01736-0
95. Sundelson AE, Jamison AM, Huhn N, Pasquino SL, Sell TK. Fighting the infodemic: the 4 i Framework for Advancing Communication and Trust. *BMC Public Health*. 2023;23(1):1662. doi:10.1186/s12889-023-16612-9
96. Sun Y, Chia SC, Lu F, Oktavianus J. The Battle is On: Factors that Motivate People to Combat Anti-Vaccine Misinformation. *Health Commun*. 2022;37(3):327-336. doi:10.1080/10410236.2020.1838108
97. Tandoc EC, Lee J, Chew M, Tan FX, Goh ZH. Falling for fake news: the role of political bias and cognitive ability. *Asian J Commun*. 2021;31(4):237-253. doi:10.1080/01292986.2021.1941149
98. Tran T, Rad P, Valecha R, Rao HR. Misinformation in Crises: A Conceptual Framework for Examining Human-Machine Interactions. In: *Institute of Electrical and Electronics Engineers Inc.*; 2020:46-50. doi:10.1109/AI4G50087.2020.9311010

99. Van Bavel JJ, Harris EA, Pärnamets P, Rathje S, Doell KC, Tucker JA. Political Psychology in the Digital (mis)Information age: A Model of News Belief and Sharing. *Soc Issues Policy Rev.* 2021;15(1):84-113. doi:10.1111/sipr.12077
100. Van Bavel JJ, Rathje S, Vlasceanu M, Pretus C. Updating the identity-based model of belief: From false belief to the spread of misinformation. *Curr Opin Psychol.* 2024;56(101649136):101787. doi:10.1016/j.copsyc.2023.101787
101. Vasist PN, Chatterjee D. Combating Fake News and Digital Deception at the Workplace: An Integrative Review and Open Systems Theory-led Framework for Future Research. *IIM Kozhikode Soc Manag Rev.* Published online 2023. doi:10.1177/22779752231163360
102. Vasist PN, Krishnan S. Demystifying fake news in the hospitality industry: A systematic literature review, framework, and an agenda for future research. *Int J Hosp Manage.* 2022;106. doi:10.1016/j.ijhm.2022.103277
103. Warner EL, Basen-Engquist KM, Badger TA, Crane TE, Raber-Ramsey M. The Online Cancer Nutrition Misinformation: A framework of behavior change based on exposure to cancer nutrition misinformation. *Cancer.* 2022;128(13):2540-2548. doi:10.1002/cncr.34218
104. Weiss AP, Alwan A, Garcia EP, Kirakosian AT. Toward a comprehensive model of fake news: A new approach to examine the creation and sharing of false information. *Soc.* 2021;11(3). doi:10.3390/soc11030082
105. Wilson TD, Maceviciute E. Information misbehaviour: modelling the motivations for the creation, acceptance and dissemination of misinformation. *J Doc.* 2022;78(7):485-505. doi:10.1108/JD-05-2022-0116
106. Wu M. What Drives People to Share Misinformation on Social Media during the COVID-19 Pandemic: A Stimulus-Organism-Response Perspective. *Int J Environ Res Public Health.* 2022;19(18). doi:10.3390/ijerph191811752
107. Wu S. What Motivates Audiences to Report Fake News?: Uncovering a Framework of Factors That Drive the Community Reporting of Fake News on Social Media. *Digit J.* Published online 2023. doi:10.1080/21670811.2023.2243489
108. Wu Y, Ngai EWT, Wu P, Wu C. Fake news on the internet: a literature review, synthesis and directions for future research. *Internet Res.* 2022;32(5):1662-1699. doi:10.1108/INTR-05-2021-0294
109. Xu S, Coman IA, Yamamoto M, Najera CJ. Exposure Effects or Confirmation Bias? Examining Reciprocal Dynamics of Misinformation, Misperceptions, and Attitudes Toward COVID-19 Vaccines. *Health Commun.* 2023;38(10):2210-2220. doi:10.1080/10410236.2022.2059802
110. Xu X, Lin CA, Chen H. Exploring COVID-19 Vaccine Misinformation Exposure, Beliefs, Fear, and Information Avoidance via the Stimulus–Organism–Response Framework. *Sci Commun.* 2023;45(6):824-850. doi:10.1177/10755470231207611

111. City University of Hong Kong, Li YJ, Marga JJ, et al. Health Misinformation on Social Media: A Systematic Literature Review and Future Research Directions. *AIS Trans Hum-Comput Interact.* 2022;14(2):116-149. doi:10.17705/1thci.00164
112. Yu W, Payton B, Sun M, Jia W, Huang G. Toward an integrated framework for misinformation and correction sharing: A systematic review across domains. *New Media Soc.* 2023;25(8):2241-2267. doi:10.1177/14614448221116569
113. Zhu X, Yang S. Toward a Sociotechnical framework for Misinformation Policy Analysis. In: *The Usage and Impact of ICTs Dur. the COVID-19 Pandemic*. Taylor and Francis; 2023:11-45. <https://www.scopus.com/inward/record.uri?eid=2-s2.0-85148181213&doi=10.4324%2f9781003231769-3&partnerID=40&md5=322311d318df1c9963a5620adb19eacd>
114. Zifei Fay Chen, Cheng Y. Consumer response to fake news about brands on social media: the effects of self-efficacy, media trust, and persuasion knowledge on brand trust. *J Prod Brand Manag.* 2020;29(2):188-198. doi:10.1108/JPBM-12-2018-2145
115. Zimmerman T, Njeri M, Khader M, Allen J. Default to truth in information behavior: a proposed framework for understanding vulnerability to deceptive information. *informLearnSci.* 2022;123(1-2):111-126. doi:10.1108/ILS-08-2021-0067
116. Zmigrod L, Burnell R, Hameleers M. The misinformation receptivity framework: Political misinformation and disinformation as cognitive Bayesian inference problems. *Eur Psychol.* 2023;28(3):173-188. doi:10.1027/1016-9040/a000498
117. Maertens R, Gotz FM, Golino HF, et al. The Misinformation Susceptibility Test (MIST): A psychometrically validated measure of news veracity discernment. *Behav Res Methods.* 2023;(101244316). doi:10.3758/s13428-023-02124-2
118. Kozyreva A, Lorenz-Spreen P, Herzog SM, et al. Toolbox of Interventions Against Online Misinformation. Published online December 16, 2022. doi:10.31234/osf.io/x8ejt

Appendix F – Expanded Version of Excluded Full-Text Articles by Reason

Author and Date	Exclusion Reason
Ahmad 2022	Detection of fake news
Nusbaum 2021	
Atele-Williams 2023	
Babaei 2022	
AbascalMiguel 2024	
Canan 2020	
Galal 2021	
Admoko 2021	
Ho 2023	Does NOT describe the MTF in detail
Gamage 2022	
Grant 2023	
Tripodi 2022	
Houlden 2021	
McGowan-Kirsch 2023	
Goldstein 2021	
Mahajan 2021	
Konstantinou 2019	
deVereHunt 2022	
Riordan 2023	Full-text not available
Ançanello 2023	
Siddiqui 2022	
Netshakhuma 2024	
Golob 2021	
Malik 2023	
German 2020	
Mishra 2024	
Adikpo 2019	
Karch 2024	Analytical framework
Trammell 2021	
Bak-Coleman 2022	
Harashima 2023	
Rabb 2022	
Lisi 2023	
Martins 2020	
deOliveira 2021	
Acemoglu 2021	
Fong 2021	
Sikder 2020	
Giusti 2020	
Vemprala 2021	

Aymanns 2022	
Tambuscio 2015	
Mostagir 2022	
Aida 2022	
Borukhson 2022	
Bursztyn 2020	
Varsos 2021	
Horz 2021	
Acemoglu 2010	
Akther 2022	Not primarily focused on misinformation
Reyna 2021	
Araújo 2022	
Abidin 2021	
Allen 2023	
Carignan 2023	
Caliskan 2022	
Spitzberg 2023	
Abdel-Fadil 2019	
Pennycook 2023	
DePaor 2020	does NOT have a picture, or a clearly identifiable set of components
Häusler 2023	
Scales 2023	
Czerniak 2023	
DiazRuizCarlos 2023	
Savolainen 2022	
Young 2022	
Bastos 2023	
Bjola 2020	
Anderau 2023	
Jerit 2023	
Yee 2024	
Cisar 2023	
Farhoudinia 2023	
Paris 2022	
Cover 2023	
Houlden 2022	
Avieson 2022	
SyrovátkaJonáš 2023	
vanderLinden 2021	
FosterBhusari 2022	
Buczel 2022	primarily specific to “misinformation effect”
Ecker 2015	
Bogart 2023	a future research plan
Chadwick 2022	
Ali 2021	

Eun-Ju 2021	
Daume 2024	
Roozenbeek 2022	primarily an empirical study
Wang 2022	
Pérez-Díaz 2022	
Chan 2023	
Nefes 2023	
Boulianne 2022	
Neyazi 2022	
Baek 2019	
Andrade 2023	
Chadwick 2018	
Myneni 2023	
Al-Rawi 2019	
Boman 2021	
Lee 2023	
Abeles 1999	
Azim 2020	regulatory framework
Kapantai 2021	Tries to define misinformation
Egelhofer 2019	

References

1. Murthy V. Confronting Health Misinformation. Published online 2021. <https://www.hhs.gov/sites/default/files/surgeon-general-misinformation-advisory.pdf>
2. Ahmed S, Rasul ME. Social Media News Use and COVID-19 Misinformation Engagement: Survey Study. *J Med Internet Res*. 2022;24(9):e38944. doi:10.2196/38944
3. Diekman C, Ryan CD, Oliver TL. Misinformation and Disinformation in Food Science and Nutrition: Impact on Practice. *J Nutr*. 2023;153(1):3-9. doi:10.1016/j.tjnut.2022.10.001
4. Pool J, Fatehi F, Akhlaghpour S. Infodemic, Misinformation and Disinformation in Pandemics: Scientific Landscape and the Road Ahead for Public Health Informatics Research. In: Mantas J, Stoicu-Tivadar L, Chronaki C, et al., eds. *Studies in Health Technology and Informatics*. IOS Press; 2021. doi:10.3233/SHTI210278
5. Siani A, Green I. Scientific Misinformation and Mistrust of COVID-19 Preventive Measures among the UK Population: A Pilot Study. *Vaccines*. 2023;11(2):301. doi:10.3390/vaccines11020301
6. Bin Naeem S, Kamel Boulos MN. COVID-19 Misinformation Online and Health Literacy: A Brief Overview. *Int J Environ Res Public Health*. 2021;18(15):8091. doi:10.3390/ijerph18158091
7. Islam MS, Kamal AHM, Kabir A, et al. COVID-19 vaccine rumors and conspiracy theories: The need for cognitive inoculation against misinformation to improve vaccine adherence. Lavorgna L, ed. *PLOS ONE*. 2021;16(5):e0251605. doi:10.1371/journal.pone.0251605
8. Nelson T, Kagan N, Critchlow C, Hillard A, Hsu A. The Danger of Misinformation in the COVID-19 Crisis. *Mo Med*. 2020;117(6):510-512.
9. Adams Z, Osman M, Bechlivanidis C, Meder B. (Why) Is Misinformation a Problem? *Perspect Psychol Sci*. Published online February 16, 2023:174569162211413. doi:10.1177/17456916221141344
10. Wang Y, Wong ELY, Nilsen P, Chung VC ho, Tian Y, Yeoh EK. A scoping review of implementation science theories, models, and frameworks — an appraisal of purpose, characteristics, usability, applicability, and testability. *Implement Sci*. 2023;18(1):43. doi:10.1186/s13012-023-01296-x
11. Nilsen P. Making sense of implementation theories, models and frameworks. *Implement Sci*. 2015;10(1):53. doi:10.1186/s13012-015-0242-0
12. Wilson P, Kislov R. *Implementation Science*. 1st ed. Cambridge University Press; 2022. doi:10.1017/9781009237055
13. Rubinelli S, Purnat TD, Wilhelm E, et al. WHO competency framework for health authorities and institutions to manage infodemics: its development and features. *Hum Resour Health*. 2022;20(1):35. doi:10.1186/s12960-022-00733-0

14. Barua Z, Barua S, Aktar S, Kabir N, Li M. Effects of misinformation on COVID-19 individual responses and recommendations for resilience of disastrous consequences of misinformation. *Prog Disaster Sci.* 2020;8:100119. doi:10.1016/j.pdisas.2020.100119
15. Yu W, Payton B, Sun M, Jia W, Huang G. Toward an integrated framework for misinformation and correction sharing: A systematic review across domains. *New Media Soc.* 2023;25(8):2241-2267. doi:10.1177/14614448221116569
16. Li HOY, Bailey A, Huynh D, Chan J. YouTube as a source of information on COVID-19: a pandemic of misinformation? *BMJ Glob Health.* 2020;5(5):e002604. doi:10.1136/bmjgh-2020-002604
17. Vosoughi S, Roy D, Aral S. The spread of true and false news online. *Science.* 2018;359(6380):1146-1151. doi:10.1126/science.aap9559
18. Birken SA, Rohweder CL, Powell BJ, et al. T-CaST: an implementation theory comparison and selection tool. *Implement Sci.* 2018;13(1):143. doi:10.1186/s13012-018-0836-4
19. Wickstrom J, Butera G, Lely J, et al. How to write a scoping review protocol: Guidance and template. Published online 2023. doi:10.17605/OSF.IO/YM65X
20. PRISMA-P Group, Moher D, Shamseer L, et al. Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015 statement. *Syst Rev.* 2015;4(1):1. doi:10.1186/2046-4053-4-1
21. Peters MDJ, Marnie C, Tricco AC, et al. Updated methodological guidance for the conduct of scoping reviews. *JBIM Evidence Synthesis.* 2020;18(10):2119-2126. Doi:10.11124/JBIES-20-00167
22. Tricco AC, Lillie E, Zarin W, et al. PRISMA Extension for Scoping Reviews (PRISMA-ScR): Checklist and Explanation. *Ann Intern Med.* 2018;169(7):467-473. doi:10.7326/M18-0850
23. McGowan J, Sampson M, Salzwedel DM, Cogo E, Foerster V, Lefebvre C. PRESS Peer Review of Electronic Search Strategies: 2015 Guideline Statement. *J Clin Epidemiol.* 2016;75:40-46. doi:10.1016/j.jclinepi.2016.01.021
24. Delen D, Ram S. Research challenges and opportunities in business analytics. *J Bus Anal.* 2018;1(1):2-12. doi:10.1080/2573234X.2018.1507324
25. Van Bavel JJ, Harris EA, Pärnamets P, Rathje S, Doell KC, Tucker JA. Political Psychology in the Digital (mis)Information age: A Model of News Belief and Sharing. *Soc Issues Policy Rev.* 2021;15(1):84-113. doi:10.1111/sipr.12077
26. Agarwal NK, Alsaedi F. Creation, dissemination and mitigation: toward a disinformation behavior framework and model. *Aslib J Inf Manag.* 2021;73(5):639-658. doi:10.1108/AJIM-01-2021-0034

27. Adam-Troian J, Chayinska M, Paladino MP, Uluğ ÖM, Vaes J, Wagner-Egger P. Of precarity and conspiracy: Introducing a SOCIO-FUNCTIONAL model of conspiracy beliefs. *Br J Soc Psychol*. 2023;62(S1):136-159. doi:10.1111/bjso.12597

CHAPTER 3 (Draft Manuscript 2): Understanding the real-world misinformation countering initiative development process: Theory-guided semi-structured interviews

Preface

Chapter 3 presents theory-guided semi-structured interviews that explore the decision-making processes and misinformation strategies behind Sickie Cell Awareness Group of Ontario (SCAGO)’s efforts, particularly within the context of the COVID-19 pandemic. Building on these findings, we will integrate the results with our previously conducted scoping review to examine the extent to which existing misinformation Models, Theories, and Frameworks (MTFs) explicitly or implicitly informed the misinformation tool development process. The scoping review yields results that can inform the development of real-world interventions.

Author Contributions: Zeynep Cildir (ZC), the master's candidate, served as the primary author of the thesis manuscript. Dr. Jamie Brehaut (JCB), the principal investigator, conceptualized the research, provided guidance, and co-authored the manuscript. ZC was responsible for all aspects of the research process, including methodological planning, data collection, and data analysis. Dr. Natasha Hudek (NH) provided guidance and collaborated with ZC on conducting interviews and coding. The guarantor of this review is ZC.

Ethics Approval: The ethics approval for this study was obtained by the Ottawa Health Science Network Research Ethics (OHSN-REB# 20240602-01H).

Publication Citation: Cildir Z, Hudek N, Carroll K, Morgan T, Presseau J, Colquhoun H, Brehaut J C “Understanding the real-world misinformation countering initiative development process: Theory-guided semi-structured interviews.” (In preparation)

Understanding the real-world misinformation countering initiative development process: Theory-guided semi-structured interviews

Zeynep Cildir, MSc (candidate)^{1,2}, Natasha Hudek, PhD², Kelly Carroll, MA², Tamara Morgan, PhD², Justin Presseau, PhD^{1,2}, Heather Colquhoun, PhD³, Jamie C. Brehaut, PhD^{1,2*},

¹School of Epidemiology and Public Health, University of Ottawa, 451 Smyth Road, Ottawa, Ontario, K1H 8M5, Canada

²Ottawa Hospital Research Institute, Centre for Implementation Research, The Ottawa Hospital, General Campus, 501 Smyth Road, Centre for Practice Changing Research, Box 201B, Ottawa, Ontario, K1H 8L6, Canada

³Department of Occupational Science and Occupational Therapy, University of Toronto, Rehabilitation Sciences Building, 500 University Avenue, Floor 9, Toronto, Ontario, Canada M5G 1V7

Author Email List:

Zeynep Cildir: zcildir@ohri.ca

Natasha Hudek: nhudek@ohri.ca

Kelly Carroll: kecarroll@ohri.ca

Tamara Morgan: tamorgan@ohri.ca

Justin Presseau : jpresseau@ohri.ca

Heather Colquhoun: heather.colquhoun@utoronto.ca

Jamie Brehaut: jbrehaut@ohri.ca

***Corresponding Author:** Jamie C. Brehaut (jbrehaut@ohri.ca), The Ottawa Hospital, General Campus, 501 Smyth Road, Centre for Practice Changing Research, Box 201B, Ottawa, Ontario, K1H 8L6, Canada

Abstract

Introduction: The COVID-19 pandemic accelerated the spread of health misinformation, complicating public health responses and disproportionately impacting communities with historical mistrust in healthcare systems. While a growing body of literature offers models, theories, and frameworks (MTFs) for addressing misinformation, it remains unclear how effectively this academic knowledge informs real-world interventions. The Sickle Cell Awareness Group of Ontario (SCAGO), which serves a population uniquely vulnerable to misinformation, implemented several COVID-19 initiatives to counter misinformation. This study explores how such initiatives were developed, their alignment with academic guidance, and the real-world challenges encountered in the process.

Methods and Analysis: Semi-structured interviews were conducted with seven SCAGO interest holders involved in the development of their COVID-19 misinformation initiatives. The interviews were guided by theoretical frameworks, including Ecker's Psychological Drivers Model, the AACTT framework and RE-AIM. Dual independent coding was carried out, and consensus discussions were held after each interview. Data were analyzed thematically using an iterative, primarily deductive approach.

Results: Participants described a multifaceted initiative involving both informational material (e.g., online content, printed booklets) and community engagement strategies (e.g., WhatsApp sessions, phone calls, in-person clinics). Participants consistently identified misinformation as a core focus of their intervention, but they rarely referenced formal MTFs in their planning. Instead, strategies were developed through community feedback, professional expertise, and guidance from public health authorities. Trust-building and leveraging credible messengers were key priorities. Evaluations focused largely on reach and vaccination rates, with limited attention to long-term sustainability or implementation fidelity. Barriers included individual resistance to change, logistical constraints, and emotional fatigue among ambassadors. Whether ethical considerations were part of initiative development was inconsistent. Notably, participants expressed the need for clearer, more user-friendly resources to support community-led efforts.

Significance: While SCAGO's initiative actively engaged with misinformation, its development was shaped more by community context and practical experience than by formal academic frameworks. These results reveal a gap between theory and practice, emphasizing the necessity for MTFs that are both user-friendly and adaptable for practical applications. Future efforts should focus on co-developing tools and strategies with community organizations to better bridge the gap between research and implementation.

Registration: N/A

Keywords: health misinformation, community-based interventions, sickle cell disease, misinformation, theories and frameworks (MTFs), qualitative research

3.1 Introduction

The emergence of COVID-19 triggered a global public health emergency, with the virus spreading rapidly and placing immense pressure on healthcare systems worldwide.¹ In response, public health agencies acted to slow the spread through preventative measures and public guidance.² Yet these efforts were complicated by a surge of many kinds of misinformation, in part facilitated by a vacuum of high-quality data.^{3,4} For example, myths claiming that masks are ineffective or that children are immune to COVID-19 led to higher infection rates worldwide,⁵ while other forms of misinformation contributed to pushback against vaccine mandates critical to ensuring uptake sufficient to enable herd immunity.⁶ Ultimately, COVID-related misinformation not only interfered with the uptake of public health measures but also fueled active resistance against them, undermining efforts, eroding trust in health institutions, and harming both individuals and society as a whole.^{3,7–10}

In response to this surge in misinformation, there has been a comparable increase in both the science of misinformation and the development of models, theories, and frameworks (MTFs) seeking to understand, organize and describe factors contributing to misinformation.^{3,11,12} One recent study found that 87% (53/61) of all empirical studies on susceptibility to misinformation were published after 2020,¹¹ including both theoretical explorations and guidance on the design of practical interventions against misinformation.^{13,14}

During the same period, public health agencies and organizations have been at the forefront of developing strategies to counteract misinformation.^{7,8,15,16} Many interventions were designed and implemented (e.g. fact-checking tools, awareness campaigns, warning labels, and resource creation).^{17–19} Given the urgency of the situation, much of this work was likely conducted without optimal integration of the scientific literature or established misinformation MTFs. Nevertheless, existing frameworks that address key factors relevant to designing more effective interventions—such as individual variability in susceptibility to misinformation,^{20,21} the alignment of information with pre-existing beliefs,²² the emotional tone and structure of the content,^{21,22} trust in the information source,^{23–25} and the degree of deliberation²⁶—may complement the efforts of these organizations. While public health interventions may not always

be informed by established scientific MTFs, it is equally important to recognize that many MTFs may not sufficiently address the practical and contextual challenges faced in real-world implementation. For example, real-world interventions are often designed to serve multiple purposes and may not be solely focused on counteracting misinformation. Some MTFs may provide general guidance under idealized conditions but fail to address competing institutional priorities or other real-world considerations.

In this study, we sought to explore how misinformation interventions are developed, including goals, context, process, and identified outcomes, as well as the extent to which existing misinformation MTFs inform their strategies. We partnered with the Sickie Cell Awareness Group of Ontario (SCAGO), an organization that actively developed misinformation countering campaigns during the COVID-19 pandemic. Our study aims to highlight potential gaps in current practices and offer insights into which types of MTFs and additional guidance may be most useful for informing future intervention development.

3.2 Methodology

3.2.1 Ethics

The ethics approval for this study was obtained by the Ottawa Health Science Network Research Ethics (OHSN-REB# 20240602-01H). The ethics approval letter is attached in **Appendix A**. The consolidated criteria for reporting qualitative research (COREQ) guidelines have informed the reporting of this article.²⁷

3.2.2. Study Design

Semi-structured interviews were conducted with interest holders of SCAGO who have been or were involved in creating and developing strategies to counter misinformation during COVID-19. SCAGO is a community-based organization that facilitates clinical research, educates patients and caregivers, raises public awareness, and develops guidelines for best practices.²⁸ SCAGO has developed numerous initiatives aimed at addressing misinformation, specifically targeting vulnerable populations. Examples of these efforts —many of which are publicly accessible— include COVID-19 counselling services, webinars, Q&A sessions, and informational booklets.²⁸ A view of the initiatives available on the website is attached in **Appendix B**.

SCAGO was selected for this study for several reasons. First, they played a direct role in designing and implementing interventions related to misinformation during the pandemic. Second, their work specifically targets individuals living with sickle cell disease—a hereditary blood disorder that disproportionately affects individuals of African descent.²⁹ Given the history of unethical research and ongoing structural inequities in healthcare, Black communities often experience deep-rooted mistrust toward healthcare institutions, which increases their vulnerability to health-related misinformation.³⁰ Finally, our previous partnership with SCAGO facilitated access and collaboration with the executives involved in the development of these initiatives.

3.2.2.1 Participant Selection

Participants consisted of adult, English-speaking individuals involved in developing and delivering the SCAGO initiatives. Sample size considerations were based on data saturation guidelines and the availability of interviewees from this relatively small organization.³¹ Our goal was to conduct a minimum of 10 interviews and assess data saturation. Participants were purposively sampled through a SCAGO executive who reached out to interest holders on our behalf by providing a study description outlining the purpose of the study and what they could expect from the interviews. If participants were interested in participating, they reached out to the research team through email. Email contacts enabled setting up interview times and questions to be answered. We also sent a reminder email with the consent form and interview questions three days before the interview date.

3.2.2.2 Interview Conduct

Semi-structured interviews lasted approximately one hour and were conducted online over Microsoft Teams. Authors ZC and NH conducted the interviews. ZC is a female master's candidate in Epidemiology with no prior experience in qualitative interviews. To meet the institutional standards and ensure the comprehensiveness of the findings in this study, NH, a female interviewer with a PhD in psychology and extensive experience in conducting qualitative interviews across various topics, participated alongside ZC. Before commencing the study interviews, ZC conducted pilot interviews for preparation. At the time of the study, ZC and NH were employed at the Ottawa Hospital Research Institute (OHRI). Participants were only informed of what was included in the email letters attached in **Appendices C, D, and E**. No prior

relationships were established with participants before the study, except one individual, the head of the organization, who was known to the research team through previous collaborative work with SCAGO. Field notes were taken, and verbal consent was obtained to audio/video record the interviews.

3.2.2.3 Interview Guide

The study team (ZC, JCB, NH) designed the theory-based interview guide and piloted it among friends and colleagues in the researchers' personal networks, after which questions were refined for clarity. The interview guide was informed by Ecker's Psychological Drivers Model, the Action, Actor, Context, Target, Time (AACTT) framework, and the RE-AIM (Reach, Effectiveness, Adoption, Implementation, and Maintenance) framework.³²⁻³⁴ The Ecker's Psychological Drivers Model provides a theoretical model that outlines the core cognitive, social, and emotional processes that shape how individuals interpret, accept, and retain misinformation.³⁴ The AACTT framework helps clarify the behavioural components of interventions by specifying who is expected to do what, where, toward whom, and when.³³ RE-AIM is commonly used to evaluate public health interventions by assessing their reach, effectiveness, adoption, implementation, and sustainability in real-world settings.³⁵

Each interview commenced with a discussion about the expert's role within SCAGO, which subsequently delved into the misinformation initiative and the development of strategies to counter misinformation. The characterization of SCAGO's misinformation initiative development was extracted through addressing 11 components: understanding the elements of the initiative; the development process; targeted audience; individuals involved in the development process; inclusion of diverse perspectives; specific goals and outcomes; desired behaviours; the appropriate timing and context for delivering the initiative; measuring the success of the initiative; consideration of factors that facilitated or hindered the initiative; and any ethical issues discussed. Misinformation countering strategies were examined through eight components: whether misinformation was included in their development discussions; methods for countering misinformation; considerations of reactions, sources, emotions, and worldviews related to misinformation; unintended consequences; and the extent of misinformation MTF integration within the initiative. The interview guide is included in **Appendix F** for reference. These interviews were transcribed verbatim for analysis.

3.2.2.4 Reflexivity

The reporting of reflexivity was guided by Olmos-Vega et al.³⁶ ZC, a graduate researcher and the primary author of this thesis, approached this study motivated by a personal desire to address the harms of health misinformation. ZC encountered family members impacted by misinformation during the COVID-19 pandemic, underscoring the urgency of developing evidence-based strategies and, most importantly, implementing them. Thus, it was important to consider reflexivity throughout these interviews and critically examine the researcher ZC's background and motives for conducting this research, which was the first step to understanding how that may impact the interpretation of the results. Additionally, no relationship was established with the participants before the study's commencement. This allowed ZC to enter each interview as an impartial listener.

We aimed to understand participants' experiences and contextual knowledge in shaping and delivering a misinformation initiative. Although our interview guide was based on established theoretical frameworks, we were aware of the potential risk that these structures might limit participants' perspectives or restrict their answers. To address this, we included an open-ended question at the end of each interview, inviting participants to share any additional thoughts or experiences that our guided questions may not have captured. This enabled the development of viewpoints outside theoretical boundaries and ensured that valuable insights were included. NH has extensive experience in qualitative research, which assisted in building up the coding framework in collaboration with ZC.

During analysis, we avoided forcing participant responses into predefined categories when they did not naturally align. The approach focused on placing data in the most relevant contexts, even if it required positioning a quote beyond its original thematic section. This adaptable coding method facilitated a more genuine portrayal of participants' viewpoints. In addition, NH's involvement in the interviews and coding process encouraged diverse interpretations and minimized individual bias.

Recognizing the initiative was delivered by SCAGO – an organization serving primarily Black individuals with a long-standing history of medical mistrust – the study team remained sensitive

to how systemic and sociocultural factors may have shaped both participants' narratives and her own interpretations.

3.2.2.5 Data Analysis

All interviews were anonymized prior to analysis. The extraction sheet was developed by incorporating the domains from the AACTT, RE-AIM Framework, and Ecker's Model and by conducting an inductive review of the interview guide questions to come up with broad themes. The items were finalized through team discussions. These initial themes formed the basis of the extraction sheet, followed by a deductive process to identify specific themes mentioned during the interviews, which were then organized into appropriate categories. Themes were refined as necessary. Two data coders (ZC and NH) independently coded the data in Excel,³⁷ selecting and coding relevant quotes into appropriate themes. If a quote did not fall into any of the categories, new theme ideas were generated inductively by consensus. The coders met regularly, modifying and refining the themes. Any disagreements were resolved through consensus or a third party (JCB). Interview participants did not provide feedback on the findings.

3.3 Results

3.3.1 Participants

Interviews were conducted between October 2024 and February 2025, lasting 26 to 51 minutes (median $n = 39$ minutes). The SCAGO executive identified 12 individuals involved in the initiative's development. Seven people participated, while the other five did not respond. Recruitment of interview participants was initially planned to continue until thematic saturation was achieved; however, due to the limited number of SCAGO interest holders involved in countering misinformation initiatives, recruitment ceased after seven interviews. Hence, saturation was not obtained within the seven interviews.

The interviewees included four females and three males, ages ranging from 23 to 58 years. Over half of the participants identified as Black and African Canadian ($n=5$). Their roles ranged from COVID-19 Ambassador ($n=4$), Physician ($n=2$), CEO ($n=1$), Education Coordinator ($n=1$), member of funding agency ($n=1$) or IT Manager ($n=1$). Several individuals held multiple roles within SCAGO over the course of the initiative.

Although one participant held the role of Education Coordinator (n=1), a role not directly involved in developing the misinformation initiative, they were also actively involved in the initiative as a COVID-19 Ambassador. Their various roles in this initiative offered relevant insights into the implementation process. Considering the small number of interviewees, their perspective was maintained to preserve the range of available data.

3.3.1 Themes

3.3.1.1 Components of the Initiative

Two themes were identified that describe the core components of the SCAGO misinformation initiative: creating informational materials (n=5) and engaging with the community (n=5). Participants outlined each theme as comprising multiple elements. For creating informational materials, most participants (n=6) indicated that developing online content was a central strategy to combat misinformation in addition to producing printed informational booklets for distribution (n=2).

A variety of multifaceted community engagement strategies were discussed, mostly ranging from WhatsApp sessions (n=5) and outreach calls (n=4) to in-person clinic visits (n=4), all aimed at delivering accurate information and answering community questions. Less commonly, participants also mentioned webinars (n=3) and conferences (n=1). In addition to these communication strategies, some participants described more practical forms of support (n=1), such as booking vaccination appointments, providing transportation to vaccination sites (n=3), and offering food vouchers as incentives (n=3).

3.3.1.2 Development Process of the Initiative

Table 1 outlines the themes that emerged from interviews describing how the SCAGO misinformation initiative was developed. First, ideas were generated through multiple pathways. Participants described ideas arising from community-identified concerns (n=3), individual suggestions (n=1), group brainstorming (n=1), or proposals from organizational leadership, such as the CEO (n=1).

Once ideas were formed, participants described efforts to incorporate evidence-based content into the informational documents. Consulting public health websites was the most common

method of incorporating evidence (n=4), though some also conducted their own research (n=1). These activities were often part of an effort to stay up to date with evolving COVID-19 guidance (n=1) in a rapidly changing information landscape.

Another aspect of the initiative's development was working within teams. Participants described the importance of assembling multidisciplinary groups, such as the COVID-19 advisory group (n=1) and ambassador teams (n=2), and consulting with experts (n=5). Leveraging SCAGO's networks (n=1), team meetings (n=1) and town hall participation (n=1) also shaped the initiative.

Finally, participants described several steps involved in creating the materials. This included developing scripts for discussions (n=2), drafting graphic content (n=1), obtaining feedback and approval (n=4) and posting or distributing the final materials (n=2). These steps represent a collaborative approach that integrates community feedback and utilizes evidence to create content to counter misinformation.

3.3.1.3 Discussions on who should be involved and diversity within the initiative development

Table 1 presents themes related to discussions on who should be involved in the development of the SCAGO misinformation initiative, along with reflections on incorporating diverse perspectives. Most participants emphasized the involvement of physicians (n=6), with some specifying specialties such as hematology (n=2), mental health (n=1), infectious disease (n=1), and family medicine (n=1). Patients were frequently cited (n=3) as important contributors to the discussion, alongside the sickle cell community (n=2) and insights derived from COVID-related lived experiences (n=1). Additionally, community organizations (n=2), students (n=1), social workers (n=1), and trusted individuals within SCAGO (n=1) were discussed as being involved during development. Two participants noted that they were not directly involved in the planning process and were uncertain about how interest holder inclusion decisions were made. Overall, although some participants emphasized specific strategies for inclusive development, others either were not part of these discussions or were unclear about the integration of diverse perspectives.

3.3.1.4 Targeted Goals and Outcomes for the Initiative

Table 1 displays 10 themes summarizing the key goals and intended outcomes described by participants regarding the SCAGO misinformation initiative. The primary objectives reported were increasing COVID-19 vaccination rates (n=5) and providing accurate information (n=4), both of which were essential to the initiative's design and execution. Several participants also emphasized counteracting misinformation (n=4) and building trust (n=4) as core objectives. Engaging the sickle cell community in discussion (n=3) was noted as a specific outreach priority, with some participants highlighting the importance of educating this community about COVID-19 vaccines and related research (n=2) and supporting informed decision-making (n=1). Other targeted goals included making information easier to understand (n=2), alleviating fears (n=2), and providing emotional or practical support (n=1). Less commonly, participants also described goals such as changing public perceptions of clinical trials (n=1) and aiming to reach as many people as possible (n=1).

3.3.1.5 Actor, Action, Context, Target, Time (AACTT) of the Misinformation Countering Initiative

Table 2 categorizes SCAGO's misinformation initiative using the AACTT framework. This framework is useful for examining the specificity with which the initiative identified and targeted the behaviours of its intended audience, helping to clarify who was expected to do what, where, when, and how. The table does not present the component Actor, as it was expected to be SCAGO as the primary implementer.

In terms of targeted actions, the most frequently reported goal was increasing COVID-19 vaccination uptake (n=6). Additional behavioural aims included improving research and numeracy literacy (n=2), enhancing compliance with healthcare guidelines (n=1) and increasing self-advocacy (n=1). Some responses emphasized non-behavioural outcomes, such as reducing fear (n=1) and fostering informed decision-making (n=1).

The context for the initiative's delivery varied. In-person formats were prevalent, featuring activities in community settings (n=4), hospitals or clinics (n=3), and conferences (n=1). Online engagement was significant as well, particularly via social media (n=4) and the organization's website (n=3). Additionally, four participants noted outreach conducted over the phone.

In terms of the target audience, all participants identified sickle cell patients (n=7) and their caregivers (n=7) as primary targets of the initiative. Several also mentioned the broader Black population (n=4) and, in fewer cases, healthcare professionals (n=1) and a global audience (n=1) as significant targets for the intervention.

Lastly, themes on timing varied. While some participants indicated that the initiative began immediately (n=2) or ended when funding ran out (n=2), others were unsure (n=2) or noted that the initiative concluded once COVID-19 restrictions were lifted (n=1). This reflects some flexibility in the delivery period based on evolving needs and resources.

3.3.1.6 Measuring the Success of the Misinformation Initiative using the RE-AIM framework

Table 3 summarizes how participants described measuring the success of the misinformation initiative organized into categories of the RE-AIM framework during analysis. Under the Reach domain, three participants reported tracking direct interactions with the public, while others mentioned monitoring website visitations (n=1), counting the number of booklets distributed to organizations (n=1), and recording the number of booklets created (n=2).

In the Effectiveness domain, most participants evaluated success by tracking COVID-19 vaccination rates (n=4) and collecting data on vaccine hesitancy or shifts in public opinion (n=1). However, two participants reported that success was not explicitly discussed.

For Adoption, some participants (n=3) stated they tracked the distribution of in-person materials. However, a participant noted that they did not assess whether recipients engaged with or used the materials. This variation may reflect differing roles and levels of involvement in implementation, or a lack of shared processes for tracking how materials were received and acted upon.

None of the participants explicitly addressed implementation—whether individuals were receiving or interacting with the initiative in the way it was intended. In our interviews, this concept was framed by asking whether participants had tried to track how the initiative was received on the ground (e.g., whether people engaged with the materials as designed or followed

the recommended actions). Two participants responded to this question by indicating they did not discuss the measurement of success.

Lastly, under Maintenance, two participants acknowledged that the initiative's sustainability was not discussed. This may reflect either a lack of long-term planning or the initiative's time-limited nature during the pandemic response.

3.3.1.7 Barriers, Enablers, and Ethical Considerations

Table 4 presents the factors identified by participants as either supporting or hindering the success of the SCAGO misinformation initiative, as well as reflections on ethical considerations. A key enabling factor was that the initiative originated from a trusted community source (n=4), which participants felt enhanced its credibility and acceptance. Several participants also highlighted the importance of having a supportive environment (n=2), having access to public health resources (n=2) and funding (n=2). They also emphasized the initiative's interactive nature (n=3) and the expression of empathy in its delivery (n=3) as aspects that contributed to its success. Additional enablers included the use of user-friendly materials (n=1), the involvement of a multidisciplinary team (n=3), guidance from the team (n=1), and being up-to-date with research and COVID-19 updates (n=1). SCAGO's ability to leverage existing networks (n=1) was also described as a strength, helping to extend the reach and relevance of the initiative. In some cases, community focus during the design phase (n=1) and participation in broader coalitions (n=1) were seen as important contributors to successful implementation.

In contrast, a number of barriers were identified. The most commonly mentioned challenge was individual resistance to changing one's mind (n=5), highlighting the challenge of addressing deeply held beliefs. However, some participants recognized that complete attitudinal change was not always possible or necessary, emphasizing that even shifting a few perspectives was considered a meaningful success.

“For those who are very hard set. Is there still a way to help them understand? Some people never change their minds about the vaccine because they just believe what they believe, no matter what you do. But if we are able to change, you know. If we have 10 people there [...] and

half of them now say, I'll take [the vaccine]. I consider it a success. We have saved five people out of 10. So, for us it wasn't to change everybody but was to give the fact" (P05)

Other obstacles included logistical issues (n=3), ongoing COVID-19 restrictions (n=1), and difficulties in message acceptance, with some audiences challenging the accuracy of the information presented (n=1). Additional barriers included the complexity of scientific material (n=1), challenges in contacting people (n=1), burnout of the deliverer of the initiative, such as COVID-19 Ambassadors (n=2), and the rapidly evolving information landscape during the pandemic (n=2). Additionally, while the initiative's community-driven approach was seen as a strength, it was also described as resource-intensive (n=1), requiring significant time and effort to coordinate and sustain.

Ethical considerations were not consistently raised across interviews. Some participants expressed uncertainty about the role of ethics in the initiative's development (n=4), while others referenced general ethical reflections (n=1) or more specific concerns. These included maintaining confidentiality within the SCAGO database (n=1), securing research ethics approval (n=1), and deliberations around the appropriateness of providing financial support to encourage vaccination (n=1). This variation could suggest that ethics may not have been a consistent focus across all SCAGO experts.

3.3.1.8 Countering Misinformation and Integration of Models, Theories, and Frameworks (MTFs)

All participants reported that misinformation was a central part of the conversation during the initiative's development. A variety of strategies were used to counter misinformation presented in **Table 5**. Participants commonly presented correct information directly (n=6) by relying on guidance from public health representatives or organizations to craft appropriate responses (n=3). Some participants also described using emotional appeal (n=2), providing educational material to help people discern fake news (n=1), fostering community trust (n=1), and connecting physicians with the community (n=2) as ways to respond to misinformation.

Discussions about how people react to misinformation were less consistent. Some participants did not raise this issue (n=3), while others gave mixed responses that it was either unclear (n=2),

not a priority of the initiative (n=1), or discussed only as part of ambassador training (n=1) and when discussing safety concerns for ambassadors against hostility (n=1).

A similar pattern emerged when discussing the sources of misinformation. Social media was the most frequently mentioned source (n=5) identified by the misinformation-countering experts, followed by more general or community-identified sources (n=2). Two participants noted there was no discussion about sources of misinformation. However, some participants provided mixed responses, emphasizing that the focus of the intervention was to be a credible source rather than to discredit others (n=1), while another participant contradictorily stated they would track sources to discredit them (n=1).

Participants were also asked about any discussions surrounding emotions associated with misinformation. Emotions like anger, mistrust (n=3), nervousness, and fear (n=3) were raised by several interviewees, and some described including mental health experts in their efforts to discuss emotions (n=2). This involved including this discussion in ambassador training to prepare those reaching out to the community (n=1). Some participants mentioned these discussions occurred when discussing vaccine hesitancy with patients (n=2).

Regarding worldviews, participants highlighted the influence of medical mistrust across all interviews (n=7), as well as issues like the rapid rollout of COVID-19 vaccines (n=3), intrinsic concerns about vaccinations (n=1), religious beliefs (n=2), and broader demographic influences (n=1). This suggests mistrust plays a big role in shaping worldviews surrounding medical decisions, especially vaccine hesitancy.

Responses varied when asked whether any pre-specified MTFs had been used within the initiative. Some participants were unsure or unclear (n=3), while others explained that they had developed approaches unique to the Sickle Cell community (n=3). One participant noted that such approaches were not explicitly discussed (n=1).

Finally, unintended consequences were not a major focus of discussion. Most participants did not identify any (n=4). However, one participant expressed concern that the initiative unintentionally spread misinformation through WhatsApp (n=1) or potentially contribute to information overload for community members (n=1), due to the interactive nature of group discussions and

the potential amplification of anti-vaccine views. Another participant raised the issue of online abuse of attendees (n=1) caused by ill-intentioned individuals crashing online events. There were also concerns over providing medical advice to patients over a WhatsApp group chat (n=1).

3.3.1.9 Additional Considerations Informing the Misinformation Initiative

Table 6 presents supplementary themes that emerged from participant reflections beyond the structured interview guide. One prominent consideration was the vulnerability of the target audience (n=3). Participants emphasized that individuals living with sickle cell disease may be more susceptible to misinformation due to their chronic condition and past negative experiences with the healthcare system. This vulnerability was framed within the broader context of systemic inequities and heightened fear during the pandemic. Some participants (n=2) discussed how distrust, stemming from historical and ongoing discrimination, influenced the necessity for SCAGO's initiatives to address not only informational gaps but also community concerns and lived experiences.

Other reflections included more process-oriented observations. One participant noted that they were not involved in the early stages of planning (n=1), expressing uncertainty about how the initiative was originally conceived. Another participant emphasized the significance of being perceived as a credible source (n=1), stating that trust in the messenger held greater influence than broad public health messaging. One participant described taking their own initiative to research misinformation and vaccine hesitancy independently.

Lastly, the participants offered suggestions. One participant highlighted the importance of being mindful of volunteers' time (n=1), especially considering the demands of the pandemic and the volunteer nature of the work. Others stressed the necessity for clear and consistent communication between practitioners and the public (n=1) while noting that physicians and frontline professionals also need support (n=1), particularly in high-pressure public health situations like COVID-19. Finally, there was a call for any guidance released to be as pragmatic and accessible as possible (n=1), indicating that recommendations should be clear, actionable, and feasible, particularly during times of crisis.

3.4 Discussion

This study examined how SCAGO's interest holders thought about and developed an initiative to counteract misinformation during the COVID-19 pandemic. By conducting in-depth semi-structured interviews and mapping the findings onto relevant theoretical frameworks, we explored the extent to which a real-world, practice-based development process aligned with, or could be informed by, established MTFs.

While this project has been described as a misinformation initiative, it is unclear whether all interviewees would characterize it in those terms. Although misinformation was a central concern, the intervention also addressed broader goals such as trust-building, education, and community engagement, suggesting that “misinformation” may only partially capture the scope of its intent and design.

All SCAGO interest holders acknowledged that misinformation was a core consideration in developing their initiative, demonstrating that the initiative was shaped by a proactive approach to misinformation rather than a passive focus on information delivery. Despite this focus, participants rarely described using formal behaviour change frameworks. This may indicate that misinformation was not commonly understood in behavioural terms during the planning phase, and that the initiative was developed reactively, rather than through a systematic, theory-driven method. Instead, responses mostly reflected a reliance on informal strategies and collaborations with public health partnerships, specifically approaches that had proven effective previously and were based on a deep understanding of and a relationship with the sickle cell community. Additionally, some modifications were implemented to address the specific needs of this population. This reflects a broader pattern in public health, where theoretical models can be valuable for conceptualizing behaviour change but are not always practically employed.

The identification of 10 distinct themes related to targeted goals and outcomes suggests that team members may not have shared a fully unified understanding of the initiative's core objectives. Rather than indicating disorganization, this diversity may reflect the varied roles, priorities, and perspectives of those involved in the initiative's development. For example, some participants emphasized behavioural change (e.g., vaccine uptake), while others focused on broader

outcomes such as reducing fear or increasing trust. This variation is not uncommon in community-based initiatives, where multiple goals may coexist and evolve in response to community needs. However, if clear and shared objectives are not established from the beginning, it may result in discrepancies during the design or implementation phases. Establishing common goals early in the process may improve coordination, consistency, and overall effectiveness in future interventions.

Notably, this study found a strong emphasis on trust-building initiatives and communication with the community it serves. Strategies such as employing community ambassadors, utilizing social media, and providing practical support (e.g., food and transportation vouchers) align with SCAGO's mission to be a trusted entity that emphasizes the importance of relational trust in combating misinformation. Participants described how mistrust, particularly in healthcare institutions, shaped both the design and delivery of the initiative. This is consistent with longstanding research on the historical and systemic mistrust among Black communities and its implications for vaccine uptake and public health messaging.³⁰

Although participants were not directly asked to define the “Actor” component of the AACTT framework, some responses revealed a broader interpretation of agency. For example, one participant noted:

“Yes, we did want to empower people to be able to do their own research, to understand how some sort of baseline literacy for and numeracy for, you know, a bit more scientific and complex data.” (P06)

This suggests that the intended actors may have included not only SCAGO but also members of the target audience, such as patients and caregivers, who were encouraged to take a more active role in engaging with information and making health decisions for themselves.

While the initiative was grounded in responsive, community-tailored strategies, participants provided limited detail on how outcomes were defined or measured, highlighting an area that may benefit from greater clarity and structure in future evaluations. While some participants tracked vaccination rates and public engagement, others were unsure how success was defined or

evaluated. The implementation and maintenance components of the RE-AIM framework were particularly under-discussed. In fact, the COVID-19 hub was partially taken down later. This illustrates a wider trend in public health, where urgency often leads to rapid deployment of interventions without a solid evaluation framework to assess their effectiveness.

Additionally, the role of emotions and worldviews was variably addressed. While some participants recognized how fear, anger, and mistrust shaped vaccine hesitancy, many provided non-specific or surface-level responses. The lack of deep engagement with psychological drivers of misinformation may represent a missed opportunity, especially given the known role of emotion and identity in misinformation susceptibility.³⁸

Most participants did not appear to consider the possibility of unintended consequences during the initiative's development. However, a few did raise concerns, such as the potential for misinformation to spread through WhatsApp since it facilitated a group chat or for audiences to feel overwhelmed by excessive information provided to them. While these cases were not common, they illustrate the unpredictable nature of misinformation environments, where even well-intentioned interventions can produce unintended effects. Notably, our exploration of development processes was guided by established frameworks, which may have shaped the focus of our questions. To reduce this potential bias, we incorporated open-ended prompts and ensured that responses were also coded inductively to capture themes beyond those prescribed by the frameworks.

3.5 Limitations of the study

This study has several limitations. First, the small number of participants (n=7) and lack of data saturation limit the generalizability of findings. Furthermore, all participants were affiliated with a single initiative and may have had overlapping roles, which could introduce bias or limit diverse perspectives. Moreover, interviews were carried out retrospectively, and certain participants struggled to fully remember discussions or events from earlier in the pandemic. In the future, conducting these interviews throughout the development process could prove beneficial.

3.6 Conclusion

This study provides valuable insight into how community-based misinformation interventions are conceptualized and executed in real-world contexts. The findings reveal a gap between MTFs and their practical integration and execution, indicating a demand for guidance that is more accessible, adaptable, and sensitive to context for community organizations. Future research should explore ways to integrate the insights of misinformation interest holders into the creation of these MTFs and consider how community organizations can be better supported in adopting and adapting them. Evaluating the long-term impacts and sustainability of real-world countering initiatives will also be critical for informing future preparedness and response strategies.

Table 1. Themes reported to describe the development process of the SCAGO Misinformation Initiative (n=7)

Themes (frequency)	Subthemes	Example quote ¹
How ideas for initiative components were generated		
Community Identified Concerns (n=3)		“Now, when we want to develop resources, the COVID-19 ambassador team works with the Advisory Council [...], communicating with community, with patient, what are we hearing? So that will help us to develop the resources that we develop” (P05)
Individual Idea Generation ²		
Group idea generation		
CEO proposes an idea		
How evidence played a role in the development		
Consulting public health websites (n=4)		“I would usually get the information from those town halls or from like public health websites” (P01)
Conduct own research		
Staying up to date with COVID information		
How working within teams played a role in the development		
Consulting experts (n=5)		“[SCAGO] asked me to get involved to provide sort of medical consulting on the materials that were developed” (P02)
Creating the COVID-19 Ambassador team (n=2)		
Setting up COVID-19 Advisory Group		
Attending townhalls (n=2)		
Leveraging informal networks		
Meetings to discuss ideas/concerns with the team		
How the materials were created		
Feedback and approval (n=4)		“Then you would share it with the CEO or the social media coordinator and they would take a look, suggest some edits” (P01)
Creating a script for discussions (n=2)		
Creating a draft - graphic design		
Posting/Distributing the material (n=2)		

Discussion on who should be involved in initiative development		
Physicians (n=6)	hematology mental health infectious disease family physicians	“So, these were doctors that had volunteered their time so people could reach out, ask more questions” (P03)
Patients (n=3)		
Other community organizations (n=2)		
Students		
Social worker		
Trusted individuals of SCAGO		
Sickle cell community (n=2)		
COVID lived experiences		
Targeted goals and outcomes of the initiative		
Disseminating correct information (n=5)	Educating people on COVID-19 vaccine and research Empowering decision making	“I think the overall purpose was to give the SCAGO members information about how to protect their health in pandemic” (P07)
Increasing COVID-19 vaccination (n=4)		
Counteracting misinformation (n=4)		
Building trust (n=4)		
Engaging sickle cell community in discussion (n=3)		
Making information easy to understand (n=2)		
Alleviate fears (n=2)		
Providing support		
Changing people's perspective on clinical trials		
Aim to reach as many people as possible		

¹To enhance the clarity of the tables, example quotes have been included for the most frequently referenced themes. However, this does not suggest that these themes are of greater or lesser importance than others.

²Themes without reported frequencies were mentioned by only a single participant

Table 2. Mapping SCAGO Misinformation Initiative using the AACTT Framework (n=7)

Themes (frequency)	Subthemes	Example quote ¹
Action (Specific behaviours targeted in the initiative)		
Increased COVID-19 vaccination (n=6) Increased research and numeracy literacy (n=2) Increased compliancy to healthcare guidelines ² Non-behavior discussions	fear reduction informed decision making	“Yeah, I think definitely vaccine adherence. I would love that to go up, so making sure you know people were opting to take their vaccination, were going to take their booster” (P03)
Increase self-advocacy		
Context (Settings in which the initiative is delivered)		
In-person (n=4) Online (n=4) Over the phone (n=4)	Community hospitals/clinics conferences social media Website	“So, in person we have booklets at various events” (P06)
Target (Audience of the initiative)		
Sickle cell patients (n=7) Caregivers of sickle cell patients (n=7) Black population (n=4) Healthcare professionals Global audience		“I'd say for people that you know, had sickle cell” (P03)
Time (When the initiative was delivered or planned to be delivered)		
Unsure (n=2) Immediately (n=2) Stopped when funding ran out (n=2) Stopped when COVID restrictions lifted		“I'm not necessarily sure I do” (P03)

¹To enhance the clarity of the tables, example quotes have been included for the most frequently referenced themes. However, this does not suggest that these themes are of greater or lesser importance than others.

²Themes without reported frequencies were mentioned by only a single participant

Table 3. Measuring the Success of the Misinformation Initiative using the RE-AIM framework (n=7)

Themes (frequency)	Example quote ¹
Reach (Awareness and engagement of the initiative)	
Tracked interactions (n=3)	<i>“We would track how many people we would reach just to like speak to them in general” (P04)</i>
Tracked number of booklets created (n=2)	
Tracked website visitations ²	
Tracked booklets given to organizations	
Effectiveness (Observed outcomes and perceived impact of the initiative)	
Tracked vaccination rates (n=4)	<i>“We kept track of, you know, whether they took the vaccine, whether they took their doses in what type, what type of vaccine they got as well” (P03)</i>
Did not discuss success (n=2)	
Tracked vaccine hesitancy opinions	
Adoption (How and by whom the initiative materials were used)	
Tracked in-person material given out (n=3)	<i>“Also, when we would speak to people in person, we would track how many people we spoke to, what type of pamphlets and things like that we gave out” (P04)</i>
<i>did not track recipient use of the material</i>	
Implementation (Delivery of the initiative as planned or intended)	
Did not discuss success (n=2)	<i>“I don't really recall like any discussions about how we were going to measure success at all of these initiatives” (P01)</i>
Maintenance (Sustainability of the initiative)	
Did not discuss sustainability (n=2)	<i>“The COVID-19 hub is still there [...] I don't think further than that was discussed” (P03)</i>

¹To enhance the clarity of the tables, example quotes have been included for the most frequently referenced themes. However, this does not suggest that these themes are of greater or lesser importance than others.

²Themes without reported frequencies were mentioned by only a single participant

Table 4. Enablers and Barriers to a successful misinformation initiative (n=7)

Themes (frequency)	Example quote ¹
Factors that favored the initiative	
Initiative from a trusted source within the community (n=4)	<i>“One thing that worked in our favor was that when contacting sickle cell families and patients, they already kind of knew the organization and there is certain level of trust” (P04)</i>
Supportive environment (n=2)	
Resources from public health (n=2)	
Interactive nature of the initiative (n=3)	
Funding (n=2)	
Being empathetic (n=3)	
Having a multidisciplinary team (n=3)	
Guidance	
Being up to date with research and COVID-19 guidance	
Community focus in designing the initiative	
Being part of a coalition	
User-friendly documents	
Leveraging networks of SCAGO	
Factors that hindered the initiative	
Individual resistance to change mind (n=5)	<i>“For those who are very hard set. Is there still a way to help them understand? some people never change their mind about the vaccine because they just believe what they believe, no matter what you do” (P05)</i>
Complicated scientific material online	
Logistical issues (n=3)	
COVID restrictions	
Information accuracy challenged by the audience	
Unsure	
Challenges in contacting people	
Bottom-up Approach Resource Intensive	
Deliverer Burnout (n=2)	
Changing information environment during pandemic (n=2)	
Discussion of ethical issues	
Not discussed/unsure (n=4)	<i>“Not that I know.” (P03)</i>
Indirect discussion	
Discussed SCAGO database confidentiality	
Discussed research ethics approval	
Ethics around financial support for vaccine recipients	

¹To enhance the clarity of the tables, example quotes have been included for the most frequently referenced themes. However, this does not suggest that these themes are of greater or lesser importance than others.

Table 5. Countering Misinformation and the extent of MTF integration (n=7)

Theme (frequency)	Subthemes	Example quote ¹
Was misinformation part of your discussion when developing the initiative?		
Yes (n=7)		<i>"Yeah, yes, definitely." (P01)</i>
Methods of Countering Misinformation		
By presenting correct information (n=6)		<i>"Just trying to put out, you know more detailed and correct information about why these things had been developed so quickly" (P02)</i>
	<i>Guidance from public health representatives/organizations to develop responses</i>	
Using emotional appeal (n=2)		
Through connecting physicians with the community (n=2)		
Building trust with the community		
Through providing educational materials to help people discern fake news		
Discussions around reactions to misinformation		
Not discussed (n=3)		<i>"We didn't explicitly talk about it" (P03)</i>
Unclear response (n=2)		
Not a focus of initiative		
Part of ambassador training		
Ambassador safety concerns against hostility		
Discussions around sources of misinformation		
social media (n=5)		<i>"I think we all know where these things circulate. You know, like it's on social media, TikTok, you know that kind of thing" (P02)</i>
Non-specific discussion (n=2)		
<i>Sources brought by community</i>		
Not discussed (n=2)		
Focus was on being a credible source more than discrediting sources		
Tracking source to discredit		
Discussions surrounding emotions related to misinformation		

Nervousness and fear (n=3)	<i>"Probably fear" (P07)</i>
Anger/mistrust towards organizations (n=3)	
Non-specific discussion (n=2)	
	<i>emotions brought up when asking patients about vaccine hesitancy</i>
Included mental health experts to discuss emotions (n=2)	
Not discussed	
Discussed during ambassador training	
Discussions surrounding worldviews related to misinformation	
Medical mistrust (n=7)	<i>"Some individuals in the sickle cell community may not trust medical professionals or even individuals who may be from lower income communities. Or, racialized communities based on like past history may have distrust towards medical professionals" (P04)</i>
COVID-19 vaccines developing and rolling out fast creating hesitancy (n=3)	
Intrinsic concerns about vaccinations	
Religious beliefs (n=2)	
Demographic factors influencing worldviews	
Any integration of pre-specified approaches including MTFs	
Unsure/Unclear response (n=3)	<i>"Not that I know" (P03)</i>
Develop own methods unique to Sickle Cell community (n=3)	
No discussion	
Any unintended consequences observed with the initiative	
Not discussed (n=4)	<i>"No, not at all." (P03)</i>
Observed facilitation of spreading misinformation	
Information overload	
Protecting participants from online abuse	
Medical legal responsibility in providing specific medical advice	

¹To enhance the clarity of the tables, example quotes have been included for the most frequently referenced themes. However, this does not suggest that these themes are of greater or lesser importance than others.

Table 6. Additional Considerations regarding the initiative (n=7)

Themes (frequency)	Sample Quote
Consideration of vulnerability of the audience (n=3)	<i>"I think I explained before about perhaps some reasons why the sickle cell disease community would be a little bit more vulnerable to some misinformation just because of previous negative experiences in the healthcare system [...] and also people with sickle cell disease are already living with chronic disease" (P01)</i>
Experiences of audience with discrimination and stigma (n=2)	<i>"Lots of them experience like discrimination and stigma and things like that because of their race and kind of that intersection with their chronic disease as well" (P01)</i>
Not involved in initial planning	<i>"I actually wasn't involved at the beginning of, of when they were kind of creating this" (P01)</i>
Focus was on being a credible source	<i>"I think the main thing was just appreciating [...] mass saturation of like go get your vaccine, now do it, everyone do it, is not going to be as effective as hearing it directly from somebody that you trust and who is, you know, available to answer your questions" (P02)</i>
Participant did their own research to educate themselves	<i>"I did do a lot of reading around about vaccine hesitancy, its history, its sources." (P02)</i>
Staying conscious of volunteer's limited time	<i>"It was like all hands-on deck. This was all my, this was all volunteer time on my part, and I was working around the clock seven days a week for, you know, four years in the pandemic" (P07)</i>
Need for shared understanding and communication between practitioners and public	<i>"So, I think it's the listening that's missing [...] we need to at least be able to explain why or why not and [...] what are we doing now that's showing that we're listening?" (P07)</i>
Recognizing physicians also need support	<i>"Recognize that practitioners as human beings, they have feelings too" (P07)</i>
Guidance to public should be as pragmatic/simplistic as possible	<i>"So whatever recommendations that come up [...] got to be pragmatic, you know, like two or three things that are reasonable to do in an emergency" (P07)</i>

Appendix A: Ethics Approval Letter



September 26, 2024

Dr. Jamie Brehaut

Ottawa Hospital - General Campus
Clinical Epidemiology Program
Centre for Practice- Changing Research (CPCR)
501 Smyth Rd, Room L1284, Box 201 B
Ottawa, ON K1H 8L6

Re: OHRI Institutional Approval for Ottawa Health Science Network Research Ethics Board (OHSN-REB) Submission

Protocol ID#: 20240602-01H;

Understanding the real-world misinformation countering initiative development process: Theory-guided semi-structured interviews

Dear Dr. Jamie Brehaut,

This letter serves as **Ottawa Hospital Research Institute (OHRI)** Institutional Approval for the above-referenced study. Please maintain this documentation in your investigator study file.

Based on the information you provided about this study through the Clinical Research Registration Form, you have satisfied the requirements for institutional (OHRI) approval. This includes initial research ethics approval by OHSN-REB, appropriate departmental/service area notifications and execution (fully signed versions) of all agreement(s) required to begin the study locally. Please note there may be additional agreement(s) pending execution that are required to send funds, samples, or data to external sites, but are not required for you to begin your study locally.

Changes and/or additions to your study that may require additional agreement(s) or revisions to existing agreement(s) must be communicated to the OHRI Contracts Office. This should be undertaken simultaneously with any related OHSN-REB amendment submission.

Changes and/or additions to your study that affect various hospital/institution departments (e.g., pharmacy, Department of Medical Imaging, EORLA, EEG, etc.) must be communicated to the relevant departments.

As mentioned in the 'Response' tab of the Ethics application, you have 3 months from the date of initial OHSN-REB approval to submit French documents including the translation certificate to OHSN-REB through the Translated Documents section of the ethics application (if applicable).

Should you have any questions, please contact REBadministration@ohri.ca or 613-798-5555 extension 16719.

Appendix B: SCAGO Website Initiative

[About Us](#) ▾[Advocacy](#)[Resources & Education](#) ▾[Programs](#) ▾[News & Events](#) ▾[Contact Us](#)[Get Involved](#)

The COVID-19 Hub

A central hub for fact-checked information and updates about COVID-19 & how it affects those with sickle cell disease.



About the Hub

SCAGO is doing its part in the fight against COVID-19! Our COVID-19 hub was created to help keep our community safe, healthy, and informed with the latest information and resources. Here we separate fact from fiction — you'll find

Vaccination Booklets

Must read booklets with insights from individuals affected by sickle cell disease and improving vaccine understanding amongst the sickle cell community.

Click on a booklet to open it

VACCINATION PERSPECTIVES OF PEOPLE AFFECTED BY SICKLE CELL DISEASE

VACCINE EQUITY IN SICKLE CELL DISEASE



SCAGO
Sickle Cell Awareness Group of Ontario

IMPROVING VACCINE UNDERSTANDING

VACCINE EQUITY IN SICKLE CELL DISEASE



SCAGO
Sickle Cell Awareness Group of Ontario

Public Health
Agence de la santé
publique du Canada

Appendix C: Recruitment Email sent to SCAGO experts

Recruitment Email for Non-Patient Professionals

Subject Line: Invitation to participate in research: Interviews on SCAGO's health misinformation countering initiatives

Hello,

You are receiving this email because you were involved in creating and developing initiatives designed to counteract misinformation by the Sick Cell Awareness Group of Ontario (SCAGO). This research is a collaborative effort between SCAGO and The Ottawa Hospital Research Institute (OHRI).

You are being asked to participate in a research study that we are conducting.

Participation is voluntary.

The COVID-19 pandemic has significantly increased the prevalence of health misinformation, which poses challenges to public health initiatives and informed decision-making. Organizations like SCAGO have developed various educational materials and interventions to combat this misinformation. Our study aims to understand the processes and decisions behind the development of these educational materials and how scientific knowledge can better support SCAGO in designing more effective strategies by conducting virtual interviews. These will help us identify the barriers and drivers considered in the development process, the extent to which existing scientific knowledge was utilized, and how future interventions can be improved.

Given your experience with SCAGO's initiatives, we would like to invite you to participate in a 1-hour interview, which will be conducted via Microsoft Teams. More information regarding the study's purpose, discussion points and significance of this study can be found within the 1-page document and the Information Sheet/Informed Consent Form is attached to the email.

We will be sending a reminder email 3 weeks after the first recruitment email if there are not enough participants recruited. For recruited participants, we will send an appointment reminder email a few days prior to the interview.

Thank you for considering our request. If you are interested in participating, or if you have any questions or concerns, please contact Zeynep Cildir by email at zcildir@ohri.ca. You can also contact Dr. Jamie Brehaut by email at jbrehaut@ohri.ca

Thank you,

Zeynep Cildir

Ottawa Hospital Research Institute

zcildir@ohri.ca

613-737-8899 extension 73820

Appendix D: 1-Page Project Description attached within the recruitment email

Since the onset of COVID-19 pandemic, there has been a significant rise in health misinformation — defined as false, inaccurate, or misleading information diverging from the best available evidence at the time. Public health agencies and organizations such as the Sickle Cell Awareness Group of Ontario (SCAGO) often seek to counteract misinformation as part of their efforts to develop educational materials and other interventions designed to promote healthy behaviours. Very often, the urgency of these challenges means that such organisations must design these interventions based on the expertise they have on hand, rather than on a complete understanding of the relevant academic literatures. We are interested in exploring whether these literatures might be better employed to help organisations design better educational strategies and interventions.

One such literature outlines a wide range of factors relevant to understanding and countering health misinformation, including education about misinformation, the individual, social and group factors that lead to people believing misinformation, and the factors that lead to misinformation-associated health behaviours (e.g. vaccine denial, distrust of the healthcare system). While considerable knowledge exists about how to counter misinformation, it is unclear to what extent this knowledge is potentially of use to real-world intervention developers, or whether it is already understood and used.

To explore these issues further, we would like to **conduct a series of interviews of people who supported the development of SCAGO education materials and interventions around COVID**. Through these interviews, we'll learn about the processes and decisions involved in SCAGO's efforts to design these educational interventions, as well as how and to what extent the process was intended to counteract health misinformation and misinformation-associated health behaviors. Understanding these processes will help us understand how existing knowledge from the academic literature might be employed to support future such efforts. Interviews will involve exploring the interviewees' roles in development of the SCAGO materials, the process of development as understood by interviewees, and the knowledge and expertise that informed development. Our overall goal for this work is to help SCAGO design new tools and processes that could inform future development of these kinds of initiatives, allowing this project to evaluate the efficacy of existing strategies, guide future interventions, and inform the development of effective tools to combat misinformation effectively.

Appendix E: Information Sheet

Study Title: Understanding the real-world misinformation countering initiative development process: Theory-guided semi-structured interviews

Principal Investigator: Dr. Jamie Brehaut (613) 737-8899 ext. 73820

OHSN-REB Number: 20240602-01H (5946)

INTRODUCTION

You are being invited to participate in an interview for a research study. You are invited to participate in this study because of your experience and involvement with Sickie Cell Awareness Group of Ontario (SCAGO)'s misinformation initiatives. This information sheet provides you with information to help you make an informed choice. Please read this document carefully and ask any questions you may have. All your questions should be answered to your satisfaction before you decide whether to participate in this research study.

Please take your time in making your decision. Taking part in this study is voluntary. Deciding not to take part or deciding to leave the study later will not result in any penalty.

IS THERE A CONFLICT OF INTEREST?

There are no conflicts of interest to declare related to this study.

WHY IS THIS STUDY BEING DONE?

Health misinformation has become a major challenge in public health. Organizations such as SCAGO work to combat misinformation by developing educational materials and interventions that promote healthy behaviors. Often, these organizations must rely on their existing expertise rather than a comprehensive understanding of relevant scientific literature due to the urgency of the situation. Our research aims to explore how academic knowledge can better support these organizations in designing more effective educational strategies and interventions.

WHAT WILL HAPPEN DURING THIS STUDY?

You will be asked to take part in one interview over Microsoft Teams, with one or two members of the research team. This interview will be informal and will take approximately 60 minutes. Part of this interview will involve answering and discussing questions around the interviewees' roles in development of the SCAGO materials, the process of development as understood by interviewees, and the knowledge and expertise that informed development. The questions will allow us to understand the processes and decisions involved in SCAGO's efforts to design these educational interventions, as well as how and to what extent the process was intended to counteract health misinformation and misinformation-associated health behaviors. You may skip any questions that make you uncomfortable or that you do not wish to answer. The session will be audio and video recorded, but you can opt out of the recording and still participate. In this instance written notes will be taken as an alternative.

VOLUNTARY PARTICIPATION AND WITHDRAWAL

You can choose to end your participation in this research (called withdrawal) at any time without having to provide a reason. If you choose to withdraw from the study, you are encouraged to contact the research team.

You may withdraw your permission to use information that was collected about you for this study at any time by letting the research team know. However, this would also mean that you withdraw from the study.

HOW LONG WILL PARTICIPANTS BE IN THE STUDY?

Your participation in the study will last approximately 1 hour for the interview.

CAN PARTICIPANTS CHOOSE TO LEAVE THE STUDY?

Yes, you can choose to leave at any time.

WHAT ARE THE RISKS OR HARMS OF PARTICIPATING IN THIS STUDY?

You might find that some of the questions are sensitive in nature, and or personal. You can choose not to answer questions that make you feel uncomfortable.

WHAT ARE THE BENEFITS OF PARTICIPATING IN THIS STUDY?

You may not receive any direct benefit from your participation in this study. We hope that findings from this study will help SCAGO design new tools and processes that could inform future development of these kinds of initiatives, allowing this project to evaluate the efficacy of existing strategies, guide future interventions, and inform the development of effective tools to combat misinformation effectively.

HOW WILL PARTICIPANT INFORMATION BE KEPT CONFIDENTIAL?

If you decide to participate in this study, the research team will only collect the information they need for this study. Records identifying you at this centre will be kept confidential and, to the extent permitted by the applicable laws, will not be disclosed or made publicly available, except as described in this consent document.

Authorized representatives of the following organizations may look at your original (identifiable) records at the site where these records are held, to check that the information collected for the study is correct and follows proper laws and guidelines.

- The Ottawa Health Science Network Research Ethics Board who oversees the ethical conduct of this study
- Ottawa Hospital Research Institute, the Sponsor of the study and who oversees the conduct of research at this location

Information that is collected about you for the study (called study data) may also be sent to the organizations listed above. Your name, address, or other information that may directly identify you will not be used. The records received by these organizations may contain your participant code.

Any identifying information shared during the discussion will not be included in the written records. Any individual quotations used in publications will be non-identifiable, labeled only by study identification numbers.

The audio/video recordings will be stored in a secure location and viewed/heard only by members of the research team. The recordings will be kept until they have been professionally transcribed (turned into written records), and then they will be destroyed.

This research study collects information on age, sex, gender, ethnicity, and other characteristics of individuals because these characteristics may influence how people respond. Providing information on your age, sex, gender or ethnic origin is voluntary.

If the results of this study are published, your identity will remain confidential. The information collected during this study will be used in analyses and published/ presented to the scientific community at meetings and in journals.

Your de-identified data from this study may be used for other research purposes. If your study data is shared with other researchers, information that links your study data directly to you will not be shared.

Even though the likelihood that someone may identify you from the study data is very small, it can never be completely eliminated.

WHAT IS THE COST TO PARTICIPANTS?

There is no cost associated with participation.

ARE STUDY PARTICIPANTS PAID TO BE IN THIS STUDY?

You will not be paid for taking part in this study.

WHAT ARE THE RIGHTS OF PARTICIPANTS IN A RESEARCH STUDY?

You will be told, in a timely manner, about new information that may be relevant to your willingness to stay in this study.

You have the right to be informed of the results of this study once the entire study is complete. If you want to be informed of this study's results, please contact the research team.

Your rights to privacy are legally protected by federal and provincial laws that require safeguards to ensure that your privacy is respected.

By signing this form, you do not give up any of your legal rights against the researcher, or involved institutions for compensation, nor does this form relieve the researcher or their agents of their legal and professional responsibilities.

WHOM DO PARTICIPANTS CONTACT FOR QUESTIONS?

If you have questions about taking part in this study, please contact Zeynep Cildir via email at zcildir@ohri.ca, or Dr. Jamie Brehaut at 613-737-8888 ext. 73820 or via email at jbrehaut@ohri.ca,

If you have questions about your rights as a participant or about ethical issues related to this study, you can talk to someone who is not involved in the study at all. Please contact The Ottawa Health Science Network Research Ethics Board, Chairperson at 613-798-5555 extension 16719.

Appendix F: Qualitative Interview Guide

Misinformation initiatives SCAGO: Interview Guide

Pre-ambble: Thank you for taking the time to meet with us. We're interested in your role and experience in the development of the SCAGO COVID initiative.

The purpose of our discussion today is to gain an understanding of SCAGO's COVID initiative, your thoughts about the process that was used, and whether health misinformation was a consideration for the initiative. Your insights will be invaluable in helping us understand how the initiative developed, and the outcomes you were seeking to achieve.

Your responses will be kept confidential and used solely for this research. We've provided a consent form by email. Any questions before we start? Is it ok if I record and transcribe our conversation so that I can review it later?

Part 1: Icebreaker

Q1: Can you tell me what your **role** is with respect to SCAGO?

Prompt: What does that mean in terms of time spent, day-to-day activities?

Part 2:

We are interested in learning more about how the **Sickle Cell Disease and COVID-19 Vaccine initiative** was developed and implemented. (*show example on computer*) Do you remember this? If you like, you can look at it in more detail to refresh your memory.

Q2: How would you **describe the initiative** as you understand it?

Prompt: Are there different components to the initiative? Was it just about putting information on the website, or were there other components?

Q3: How did you go about **developing** this initiative as you recall it?

Prompt: Were you part of the development from the start? If not, when did you join? Can you tell me the various steps you were involved in?

Q4: Who do you think was the **audience** for this initiative? Do you recall any discussions about who specifically the group wanted to target?

Q5: Can you recall discussions about **who should be involved** in this initiative's development? Was there discussion about why certain people should be involved?

Q6: Can you recall any discussions about involving **diverse perspectives** (e.g. gender, ethnicity) during development?

Q7. During discussions about this initiative, how would you describe what you hoped its **goals** or **outcomes** would be?

Prompt: What effects did you hope the initiative would have? How was that discussed?

Q8. Did you ever discuss any **specific behaviours** that you hoped your audience would perform because of the initiative?

Prompt: any behaviours you want to see increased? e.g. taking the COVID vaccine? Any behaviours you want to see decreased? E.g. close contact during COVID

Prompt: Any other behaviours?

Prompt: Any behaviours by other groups (e.g. health care providers?)

Q8a: Did you ever discuss the **time/when** this initiative would be applied?

Q8b: Did you ever discuss the **context/where** to implement this initiative?

Prompt: If you see “behaviour” as hopefully changing this initiative, help me understand more about it. You’d want ‘action’ to (increase/decrease) by (actors) [for (targets)], mostly (where/context), mostly (when/time)? Is that about right?

Q9. Did you discuss how you would **measure the success** of your initiative? If yes, tell me more about that.

After they answer this, check the prompts for outcomes based on RE-AIM categories below not mentioned (don’t use the jargon, just the ideas)

Reach: Did you think about how many people were aware of the initiative?

Effectiveness: Did you think about whether the initiative worked? What changes/benefits did you observe?

Adoption: Did you think about how people use the material?

Implementation: Did you try and track if people were receiving the initiative the way you intended?

Maintenance: Did you think about whether the initiative continuing to be effective? What efforts are being made to sustain the initiative long-term?

Q10. Looking back on your experience with this intervention, what are some things **that worked in your favour towards a successful initiative**?

Prompt: Others have reported (e.g. having a good team)? worked in your favour...

Q11. Looking back on your experience with this intervention, what are some things that **got in the way of having a successful initiative**?

Prompt: Others have reported (e.g. limited resources)? worked against this initiative...

Q12. Looking back on your experience with this intervention, were there any **ethical issues** mentioned or discussed within the team?

Prompt: Issues emerging in the development process or from organizational review (e.g. SCAGO endorsing medical treatments or procedures)? Issues around the acceptability of the intervention?

Part 3:

We are also interested in how **health misinformation** informs the development of interventions like this one.

Q13: During development of this initiative, did you discuss how **misinformation** might come into play?

Prompt: Were you worried conflicting health messages would interfere with the initiative?

If they answer NO, skip to Question 20

Q14: Did you discuss how to counteract this misinformation? Tell me about that.
A few quick questions about the misinformation piece. In terms of dealing with misinformation specifically...

Q15: Did you ever discuss **how people can react differently** to misinformation? (e.g. intuitive thinking, people lacking analytical thinking or deliberation)

Q16: Did you ever discuss the potential **sources** of misinformation?

Q17: Did you ever discuss **emotions** surrounding misinformation? (e.g. emotion-laden misinformation, audience emotional reactions to misinformation)

Q18: Did you ever discuss how someone's **existing beliefs** affect susceptibility to misinformation?

Q19: Did you ever discuss how **worldviews could affect** susceptibility to misinformation?

Q20. In designing this initiative, were there any **pre-specified approaches**, or frameworks, or guidance, or templates, that you used to help you design the initiative?

Prompt: For example, in developing an intervention to address misinformation about vaccines, a team might use the Health Belief Model to shape the campaign. This model would help design messages that address perceived barriers, benefits, self-efficacy, and threats associated with vaccine misinformation.

Q22: Did you ever consider or discuss whether there might be **unintended consequences** of the initiative? So, results that you **didn't** want to happen?

Q23: **Anything else** about the development process you would like us to know?

Appendix G: Extracted Themes with Sample Quotes

Themes	Sub-theme	Sample Quote	Frequency (Out of 7)
Components of the initiative			
creating informational materials		“Initiatives like the, you know, development of vaccine educational resources, you know, filming little promotional videos in support of vaccination. (P02)	5
	Online Content (e.g. personal testimonials, interviews with patients, website)	“Also just updating our social media or website with information on COVID-19 [...] There was, like some posters, videos that we made related to COVID-19 and sickle cell that we created that was shared on our social media and the website” (P04)	6
	Printed booklets	“but I think for the booklet, which was something that was actually going to be printed and disseminated that was more so, had more perspectives of more people looking at it, reviewing it, and providing their input on that” (P04)	2
Community Engagement			
	WhatsApp sessions	“I think we had some town hall meetings by WhatsApp if I recall where people could call in and ask questions.”(P02)	5
	phone calls	“I also did some outreach into the community through like phone calls.” (P01)	4
	in-person clinics	“It would involve me going in person to like clinics, for example, where individuals might be getting COVID-19 vaccines. So, I would get some information out about sickle cell or if they had questions related to sickle cell and COVID-19, then I'd also address that as well.” (P04)	4
	food and transportation vouchers for vaccinations	“I know we support with Uber to vaccination sites and transportation support.” (P05)	3
	Webinars	“So, we had to do, you know, to develop resources, we have to organize [...] webinars and all of that to better inform people and	3

		help them understand why the vaccines were important and what were facts.” (P05)	
	conferences	“You know, occasionally will speak at conferences that SCAGO organizes.” (P02)	1
	practical support	“And so my role then was to essentially provide vaccine details, both in terms of location and help people schedule appointments [...] and then what their options were in terms of vaccines, the different types of vaccines, you know, all the information around that where they can go to get the vaccines, who they should be talking to in regards to their GP, their specialist, what the vaccines do, how it could affect them if they have sickle cell disease, will it contradict with any other medications they're taking.” (P06)	1
Development process of the initiative			
Idea generation for initiative components			
	Community Identified Concerns	“Now, when we want to develop resources, the COVID-19 ambassador team [...] communicates with community, with patient, what are we hearing? So that will help us to develop the resources that we develop” (P05)	3
	Individual Idea Generation	“Yeah. So I think what I did was, I kind of came up with like an idea or I was kind of given an idea by someone else on the team and then I would do some research about the idea, mostly kind of looking at like public health, like website and things like that.” (P01)	1
	Group idea generation	“Then started planning out what initiatives we wanted to create to address the vaccine hesitancy and then also inform and empower the sickle cell community.” (P06)	1
	CEO proposes an idea	“Like many things with SCAGO, this is sort of the brainchild of [...], who is the President of the organization.” (P02)	1
Role of evidence in development			

	consulting public health websites	“So, I would usually get the information from those town halls or from like public health websites.” (P01)	4
	conduct own research	“I know they also had [...] like a research study going on about COVID-19 in the sickle cell disease in black communities. I think that was like a larger initiative that was kind of brought up by the CEO and the board of directors and the research team at SCAGO.” (P01)	1
	staying up-to-date with COVID information	“Before doing the outreach calls, obviously make sure that we're up to date on everything as much as possible, both in terms of the vaccinations available. What spaces had vaccinations? What events we were doing next that they could attend and then what the latest protocols were in terms of lockdown and other measures. And so, we'd be prepared as much as possible” (P06)	1
Working with teams			
	consulting experts	“Right. So, for instance, I just remembered out of the blue earlier this week, Doctor [...], you know, and I send that e-mail because I know she was involved from Toronto Public Health Agency. We wanted her input because she works for the public health and she did provide good input” (P05)	5
	Creating the COVID-19 ambassador team	“we created the COVID-19 team and then started planning out what initiatives we wanted to create” (P06)	2
	attending townhalls	“I would also sometimes get ideas because I used to attend [...] these like COVID-19 town halls because I think they have like, I think they encourage a lot of like nonprofit groups to have COVID-19 ambassadors and like things like that. So, they would have town halls for the ambassadors and talk about like new developments in COVID. So, I would sometimes like get information from those town halls and then kind of create like a	2

		graphic or something like that to be shared.” (P01)	
	setting up COVID-19 Advisory Group	“So, first of all, we set up a COVID-19 advisory group or something like that, a Council” (P05)	1
	Meetings to discuss ideas/concerns with the team	“And then for the WhatsApp chat I think there were a couple discussions to plan for it, to get me familiar with the format”(P07)	1
	Leveraging informal networks	“People probably really relied on their informal social networks to find out information, including who they should be speaking to, or who had who had credible knowledge.” (P07)	1
Creating the materials		“And then to develop the resources then, our team now, you know, start to put the materials together” (P05)	1
	Feedback and approval	“Like you draft it and then you would share it with the CEO or the social media coordinator and they would take a look, suggest some edits and then that was basically it.” (P01)	4
	Creating a script for discussions	“Yeah, we did have a guideline that was developed from us and I think we developed it through looking at community, like a lot of times we look at what Ontario health released or you know what the data is there. [...] but also when we were talking to people we had like a script that we comment points to talk to people about if they had questions.” (P03)	2
	Posting/Distributing the material	“And then you could post it like onto the social media.” (P01)	2
	Creating a draft - graphic design	“And then I would kind of just draft the graphic.”(P01)	1
Targeted audience of the initiative			
Sickle cell patients		“I’d say for people that you know, had sickle cell, people that had loved ones with sickle cell, people within the Black community” (P03)	7
Caregivers of sickle cell patients		“Definitely patients and caregivers of those patients, in particular the parents of children with sickle cell disease were the people that we	7

		thought we needed to reach.” (P02)	
Black population		“And our secondary audience was, you know, black people in general because we understand that a lot of the systems was in the black community again due to historical experiences having been used in prior experiences as Guinea pigs.” (P05)	4
Healthcare professionals		“You know healthcare professionals, so anyone within the sphere.” (P06)	1
Global Audience		“There were actually a lot of questions, people living with the disease in other countries. So, you know, I recall some of the follow up questions were within the UK or in Africa, I think also from other provinces.” (P07)	1
Discussion on who should be involved within the initiative development			
Physicians		“So, these were doctors that had volunteered their time so people could reach out, ask more questions” (P03)	6
	hematology (pediatric and adult)	“So, we had hematologists, family physicians as part of this COVID-19 broader team [...] And then you also had pediatric hematologist, adult hematologist who was specific to anyone.” (P06)	2
	mental health	“when we identified we need to have at least one doctors and hematologist, one who is in mental health. Because there are mental health implications to understand the issues” (P05)	1
	infectious disease	“and also someone in infectious diseases. And that's how we made-up the Council.” (P05)	1
	family physicians	“So we had hematologists, family physicians as part of this COVID-19 broader team” (P06)	1
Patients		“And we've included also patient voice on the panel, so, you know, we have diversity in that in that regard.” (P05)	3
No discussion/not part of discussion		“No, I wasn't actually part of those discussions.” (P02)	2
Other community organizations		“So, for this initiative specifically, it was something	2

		that was in conjunction with the black vaccine engagement team with the City of Toronto” (P04)	
students		“A lot of us were from what I recall students and we had like a science backgrounds. (P03)	1
Social worker		“We have patient partners, we have, you know, social worker” (P05)	1
trusted individuals of SCAGO		“Individuals who've worked with the community before. Always been part of SCAGO for a long time. So, we have that connection and rapport, so individuals like myself, who's been with organization for numerous years” (P06)	1
Discussion on involving diverse perspectives within the initiative development			
No discussion/not part of discussion		“So I wasn't actually again part of the discussion generally about who should be contributing” (P02)	3
Sickle cell community		“A lot of them have like experienced both sickle cell disease or it somehow touched them in their lives. So, I think a lot of them bring that perspective already.” (P01)	2
non-specific discussion			
	large team indicating diverse perspectives	“I don't really think it was mentioned specifically about involving genders or ethnicities, but I think just by having a wide group of individuals, I think a lot of different ethnicities and different genders were able to look at it.” (P04)	2
COVID lived experiences		“Like the interviews that I did with people about their COVID-19 experiences. Like that was the discussion about kind of bringing in their experiences into the discussion of like COVID-19 and stuff like that.” (P01)	1
Physicians		“I know that I was not the only medical person who reviewed it” (P07)	2
Other community organizations		“So, there was our individual team at SCAGO. You're part of a larger vaccine, I think it was the Toronto vaccine hesitancy organization [...] But yeah, that	1

		larger coalition definitely helped us align on the goals and strategies that were working in different communities or with different individuals. So diverse opinions and backgrounds was definitely there through that” (P06)	
Targeted goals and outcomes of the initiative			
Increasing COVID-19 vaccination		<i>“I think what was talked about was an uptake in COVID-19 vaccination in that specific audience that we were catering to. I think that was really the main goal” (P04)</i>	4
	reducing vaccine hesitancy	“Yeah then I guess the primary one is to reduce the hesitancy because the sickle cell disease community is immunocompromised and we're at greater risk.” (P06)	1
disseminating correct information		“Give them the information that they need to ensure their well-being and also to support” (P05)	5
Counteracting misinformation		“So, goals and outcomes were to reduce the, you know, the myths that people have around COVID-19 in the vaccine” (P05)	4
Building trust		“So that was my goal to create like a safe space or to create like a trusted community where people can believe the information also to feel comfortable to ask questions as well.” (P03)	4
Engaging sickle cell community in discussion		“Yeah, I think, I think the goal of the initiative was just to engage with the sickle cell disease community and provide more trustworthy information to them” (P01)	3
	educating people on COVID-19 vaccine and research	“So, making sure that they weren't furthering that risk due to not understanding what the risk was. And then their options for mitigating the risk.” (P06)	2
	empowering decision making	“Also empowering people to make the decision that they felt comfortable with.” (P06)	1
Making information easy to understand		“So really giving them the general information and breaking down the way that was	2

		approachable and accessible and informative.” (P06)	
alleviate fears		“With all the things we did, it kind of also help to alleviate some of those fears” (P05)	2
Providing support		“Also to support, we are still supporting them getting vaccinated because I know we support with Uber to vaccination sites and transportation support” (P05)	1
changing people's perspective on clinical trials		“We have to do a lot of group sessions, webinars, seminars, one-on-one small groups to really start to change people's thinking. Help them understand that there are so much, you know, guidelines, that guiding clinical trials that you cannot be used as a Guinea pig” (P05)	1
Aim to reach as many people as possible		“And these are the things that we did to ensure that, you know, we have, as many people involved, and we get feedback, and we target and reach as many people as we possibly could.” (P05)	1
Specific behaviours targeted in the initiative			
Increased COVID-19 vaccination		“No, I mean it was literally just, you know, willingness to receive the vaccine.” (P02)	6
increased research and numeracy literacy		“Another behavior that I really wanted people to have is like being able to be inquisitive and do the research yourself and find ways to get evidence-based research that can answer your questions” (P03)	2
Increased compliancy to healthcare guidelines		“Obviously following guidelines as well, so social isolation, making sure that you know you're doing right by yourself” (P03)	1
non-behavior discussions			
	fear reduction	“The fear reduction through being able to understand the information they're given and also look for information that was from a valid and verified resource.” (P06)	1

	informed decision making	“And then of course, being able to make a decision, an informed decision.” (P06)	1
Increase self-advocacy		“So, one of the things you hope after an intervention like this, that people will not just do the action, but they'll also interact with health professionals to hold them accountable, right? So, it's not being done to you, it's that you're taking control of what you're asking for, testing, demanding. That you're entitled to.” (P07)	
Targeted time of commencing and/or ending the initiative			
unsure		“I'm not necessarily sure I do. I came in the middle of it, yeah.” (P03)	2
Immediately		“When I was brought into this initiative, the idea was that we needed to do this immediately.” (P02)	2
Stopped when funding ran out		“also when the funding ran out for COVID-19 ambassadors, so there was no one else to, you know, we were like gradually moved on to like different roles.” (P03)	2
Stopped when COVID restrictions lifted		“I think like when, when restrictions were kind of opening up again” (P03)	1
Targeted context of delivering the initiative			
in-person		“So, in person we have booklets at various events” (P06)	1
	community	“You know, anybody was welcome, but promotionals were targeting black churches and black organizations to ensure that, you know, they were well informed.” (P05)	4
	hospitals/clinics	“So, I know that they attend different like clinics like community.” (P04)	3
	conferences	“Yeah. And then also I think they have [...] like a conference that they hold, where they give out information about different things related to sickle cell.” (P04)	1
online			
	social media	“I think we had some town hall meetings by WhatsApp if I recall where people could call in and ask questions.” (P02)	4

	website	“on the website. We have the COVID-19 vaccine hub” (P06)	3
over the phone		“So my role, specifically within community engagement was to call people that were, like subscribe to SCAGO or were involved in SCAGO's community and discuss vaccination with them and also, you know, dispel common myths, talk to them about ways to go about getting it.” (P03)	4
Measuring the initiative's success			
tracked vaccination rates		“We kept track of, you know, whether they took the vaccine, whether they took their doses in what type, what type of vaccine they got as well. So, I think through that you could kind of measure the success” (P03)	4
Did not discuss success		“I don't really recall like any discussions about how we were going to measure success at all of these initiatives” (P01)	2
Did not discuss sustainability		“The COVID-19 hub is still there. I think like people can access it when they need, but I don't think further than that was discussed” (P03)	2
tracked interactions (reach)		“So, pertaining to the database, we would track how many people we would reach just to like speak to them in general” (P04)	3
tracked in-person material given out		“Also, when we would speak to people in person, we would track how many people we spoke to, what type of pamphlets and things like that we gave out, like how many things we gave out to individuals. How many times we went out in person to speak to people” (P04)	3
	did not track recipient use of the material	“Yeah, I don't think we really tracked how they used material. I don't think that was tracked.” (P04)	1
Number of booklets created		“We did. So, with every project we have, we usually have success measuring: (1) How many booklets? So, we aim to	2

		make at least two. We end up making three.” (P05)	
tracked booklets given to organizations		“we aim to distribute at least to 10 organization. I think we need 25 organizations.” (P05)	1
tracked vaccine hesitancy opinions		“In terms of the hesitancy for sure during the outreach calls, we would mark obviously those who are hesitant and the reasons for being hesitant. And yeah, even the forms themselves had that hesitancy question” (P06)	1
tracked website visitations		“And then the information giveaway, we obviously tracked, but prior to that, how many people visit the website, you know, what materials that they clicked on, what pages that they were on the most” (P06)	1
Unsure		“I don't remember precisely.” (P07)	1
Factors that favored the initiative			
initiative from a trusted source within the community		“I think, one thing that worked in our favor was that when contacting sickle cell families and patients, they already kind of knew the organization and there is certain level of trust. So, it didn't seem hostile to contact them” (P04)	4
supportive environment		“Also having those physicians readily willing to support the program was also very helpful” (P05)	2
resources from public health		“Thing that helped as well was kind of like the resources that were provided by public health and things like that” (P01)	2
interactive nature of the initiative		“People were able to have that one-on-one connection and feel really, you know, valued and like heard” (P06)	3
Funding		“Well, I know for sure we got funding from the Public Health Agency of Canada. That helped us and work in our favour, because, without funding, we couldn't do it” (P05)	2
Being empathetic		“I think when you're talking to like the community members,	3

		being empathetic and being understanding of, you know, their experience” (P03)	
having a multidisciplinary team		“And then of course, as I mentioned, the team that we had and the individuals that already worked with SCAGO for numerous years. So having access to specialists and doctors who not only could reduce years but give actual credible information specific to the sickle cell disease community was immense.” (P06)	3
Guidance		“It was really good to have like guidance from other people and some help from other ambassadors” (P01)	1
Being up to date with research and COVID-19 guidance		“I would say making sure that we're up to date with the material as well and the research that's coming, so being really up to date with any of the new restrictions, any of the new information coming out of the vaccine on our parts” (P03)	1
Community focus in designing the initiative		“And what has worked for us and that's what we use in designing and also in learning about where our patients were. So that's one of the things we have focus sessions where they are. What do they know?” (P05)	1
being part of a coalition		“I guess, yeah, being part of that wider coalition and having, you know, some strategies and ideas to workshop and learn from” (P06)	1
User friendly documents		“I think they kept it quite focused like, it's very clear, purpose wise. You know the document was short. It was designed to be user friendly.” (P07)	1
Leveraging networks of SCAGO		“The fact, you know, that we are in emergency times, I think all the people to contribute, and I think also they took advantage of	1

		the networks of knowledge that they knew about.” (P07)	
Factors that hindered the initiative			
Logistical issues		“I think maybe just like logistical things related to like the organization and like admin like issues here and there, like miscommunications and things like that. They're, I think, common with like just being in an organization in general” (P01)	3
Individual resistance to change mind		“I feel as though there was a lot of people — would see like complexity data like on social media regarding the vaccines, and a lot of times, those hard to dismantle—dismantle that kind of information— because of how entrenched it was in the community members” (P03)	5
COVID restrictions		“I guess the timing of everything, the pandemic was just difficult. I think like when we did try to engage with the community out, like at health fairs and vaccine clinics and things like that, it was harder to get people to like engage, just because it was like a time when people were told to be like socially isolated” (P01)	1
Information accuracy challenged by the audience		“There was kind of like, within that period, where people who were vaccine hesitant [...] There was discussion about like certain topics related to vaccination, I suppose, and some people who felt, I guess that like we weren't necessarily providing like 100% truthful information or anything like that based on the things that they feel is correct.” (P01)	1
Unsure		“Yeah, I mean, again, I'd, yeah, I don't know how successful we were or were not” (P02)	1
Complicated scientific material online		“I feel as though there was a lot of people — would see like complexity data like on social media regarding the vaccines, and a lot of times, those hard to dismantle—dismantle that kind of information— because of how entrenched it was in the community members” (P03)	1

Challenges in contacting people		"I think when contacting people, it can be difficult sometimes to reach people. That, I think, was a difficulty." (P04)	1
Deliverer burnout		"There's a fatigue for sure from a COVID-19 ambassadors [...] So I just guess the fatigue aspect and just the emotional turmoil of having to deal with this sensitive subject and you know very polarizing subject as well" (P06)	2
changing information environment during pandemic		"I'm trying to coordinate and make sure things are working efficiently and the ever-changing scope of the pandemic was challenging as well because the information's always coming out" (P06)	2
Bottom-up approach resource intensive		"I understand how recognizing detecting the different needs in a population is important and to try to respond to them. But we shouldn't always, I think, we shouldn't reflexively without thinking, assume that we have to create something different all the time. So, resources and time are limited. You know, in the future, we think about, is there an existing tool that could be adapted?. Or it could be used and then you just describe the limitations of it." (P07)	1
Discussion of any ethical issues throughout the initiative			
Not discussed/unsure		"Not that I know." (P03)	4
Indirect discussion		"I think there was a lot of suspicion about the companies that were manufacturing these vaccines. You know, the possible collusion with government and that sort of unethical behavior like, you know, doing something, for money rather than for patient benefit. But no, I don't recall anything, any ethical concerns about what we were doing per se" (P02)	1
Discussed SCAGO database confidentiality		"Well for one, we had to keep all the records secure and confidential and even contacting individuals, I couldn't just use my personal phone" (P04)	1

Discussed research ethics approval		"I think we got a very packed REB approval. So, in terms of ethics and consent and all of that, we did all the due diligence that was necessary" (P05)	1
ethics around financial support for vaccine recipients		"Yeah, we did for sure. Especially when it came to the incentives [...] So if you're having difficulties getting there, we can support this. If you're doing on your lunch break, you don't think you'll have time or it's gonna be out of pocket and you know you can, provide you this gift card as, as a way for that" (P06)	1
Whether Misinformation was a central part of the initiative			
Yes		"Yeah, yes, definitely" (P01)	7
Countering Misinformation			
by presenting correct information		"Just trying to put out, you know more detailed and correct information about why these things had been developed so quickly" (P02)	6
	Guidance from public health representatives/organizations to develop responses	"I mean, I probably would have, like, put links to some of our information. I always— I always try and link to external sources, so probably going into Public Health Agency of Canada, National Advisory Committee on Immunization on the Health website. And then the particular link that I set in the chat— it was from a, like, a medical specialty body, so I can't remember if it was from immunology— something that was relevant to recommended vaccines for sickle cell disease." (P07)	3
Using emotional appeal		"I think you know the only time I really sort of made an appeal to kind of emotional reasoning was really mostly when I was having my one-on-one meetings with my patients. And I would tell them, look, you know, like I got my kids vaccinated right up front. I actually personally vaccinated my own son and I	2

		would never ever, ever do anything that would harm my own children” (P02)	
through connecting physicians with the community		<i>“And then also on the website and other materials as FAQs and then, this is what also our doctors would address within the webinars or the information sessions.” (P06)</i>	2
Building trust with the community		<i>“Also just fostering that bond, I think what you build rapport with, a lot of the like community members, they can believe you and your word” (P03)</i>	1
through educational material to help people discern fake news		<i>“It's important to have critical basal skill in that. It's important to try and like have an approach to, you know, fact checking or examining information that you get online and determine for yourself if it's credible” (P07)</i>	1
Reactions to misinformation			
Not discussed		“We didn't explicitly talk about it” (P03)	3
unclear response/unsure		“Don’t think so?” (P07)	2
Not a focus of initiative		“I'm not sure if that was a point that people can react differently. I think our goal was provide facts, reduce myths and understand people's perception where they're coming from, get their questions answered. But not so much about reaction” (P05)	1
Part of ambassador training		“Absolutely. So that was part of the counselling that the counsellors, training, the counsellors received, have consistently discussed this. When people are being aggressive on cooperative or dismissive, like not to obviously, you know, retaliating kind, to really, you know, understand and empathize with the situation that everyone's going through, and especially those who are potentially a bit more scared and vulnerable. And to just ask how we can help. What would help in	1

		this situation to alleviate the fears that they were having, or the perception that they were having of the situation?” (P06)	
ambassador safety concerns against hostility		“And then, you know, later on in the pandemic in those town halls, because of mistrust, issues of safety came up and how to kind of deescalate, and.[...] Yeah. Or because they were also approaching people like in grocery stores or like, wherever people gathered to give them information and they had to kind of have an approach to hostility.” (P07)	1
Sources of misinformation			
social media		“I think we all know where these things circulate. You know, like it's on social media, TikTok, you know that kind of thing” (P02)	5
Non-specific discussion			
	Sources brought by community	“We did have opportunities to talk about [sources of misinformation] which are even in peer support sessions and in focus group sessions that we held, those kind of information were also you know you know, discussed right.” (P05)	2
Not discussed		“Potential sources misinformation? I don't think so” (P01)	2
Focus was on being a credible source more than discrediting sources		“We weren't so much sort of trying to like kind of shut down the sources of the misinformation as simply just, you know, provide a better alternative to it” (P02)	1
Tracking source to discredit		“And then whatever those social media outlets were pointing to, so there was some specific websites that were purely fear mongering or against vaccines that had all their collated research on why it wasn't good. So, we would kind of go through these rabbit holes of finding that social media individual or, you know group, seeing what	1

		resources that they were sharing with that community or those, their followers and then going to that and seeing what that information was” (P06)	
Emotions surrounding misinformation			
anger/mistrust towards organizations		“I think one thing that's really big, especially in the black community, is there's a lot of medical mistrust within the system, and that has stemmed from, you know, previous cases” (P03)	3
nervousness and fear		“Probably fear” (P07)	3
Non-specific discussion			
	emotions brought up when asking patients about vaccine hesitancy	“Like not within the team. It probably came up like when I was doing interviews with patients, but not within the team, no” (P01)	2
Included mental health experts to discuss emotions		“And yeah, one of the members of the COVID-19 team was a psychiatrist that provided some counseling advice and did some sessions around that. And so, he was producing information around managing emotions in regards or your mental health, and your overall state of being when it comes to this pandemic” (P06)	2
Not discussed		“Not really” (P04)	1
discussed during ambassador training		“So, I just guess the fatigue aspect and just the emotional turmoil of having to deal with this sensitive subject and you know very polarizing subject as well. Yeah, wasn't something to navigate because we did have training as ambassadors on how to kind of mitigate some of these objections” (P06)	1
Worldviews surrounding misinformation			
Medical mistrust		“I think that was mentioned. Some individuals in the sickle cell community may not trust medical professionals or even individuals who may be from lower income communities. Or, racialized communities based on	7

		like past history may have distrust towards medical professionals” (P04)	
COVID-19 vaccines developing and rolling out fast creating hesitancy		“Yeah, I guess you know specific like vaccine hesitancy specifically if it was like I don't trust the vaccine because it was developed too quickly. I don't trust the vaccine because it's never been tested before” (P06)	3
intrinsic concerns about vaccinations		“I think there is sort of an intrinsic suspicion of something that could be given in such tiny quantities that could have permanent and profound physiologic effects. I think that in of itself, I think is intrinsically, kind of creepy to people.” (P02)	1
religious and spiritual beliefs		“So, we saw that, religion played a huge factor into how people perceived their inherent risk. And then how they would react if they were to get a vaccine and if it was something that was gonna be compromising to their faith in themselves” (P06)	2
demographic factors influencing worldviews		“And then, of course, just educational background as well. [...] As I said, you saw a huge gap in individuals numeracy levels. And so, understanding all this data and statistics was not a good way to approach things” (P06)	1
Pre-Specified Approaches			
Unsure/Unclear response		“ <i>Not that I know</i> ” (P03)	3
Develop own methods unique to Sickle Cell community		“ <i>No, I think it was given to me. [...] SCAGO developed it</i> ” (P07)	3
No discussion		“ <i>We didn't. There was no sort of theory, you know, or scaffolding that we used.</i> ” (P02)	1
Unintended Consequences			
Not discussed		“No, not at all.” (P03)	4
Observed facilitation of spreading misinformation		“When I was talking about like the WhatsApp group and things like that, I think like people were	1

		almost starting like trying to spread some misinformation through the WhatsApp group. [...] But there was discussion about like, what is allowed or not in this chat and almost more policing the chat a little bit. There was a little bit of discussion related to that. And I guess maybe that was like an unintended consequence of like bringing up like more stuff related to COVID-19 and vaccination in this group chat.” (P01)	
information overload		“Yeah, we always, it was a concern. Were we adding to the noise? There's one more voice in people's heads providing conflicting or contradictory information. And it's just was information overload, because at the time, everything's remote.” (P06)	1
protecting participants from online abuse		“I mean, the other thing is like, not that I express this, but there was this phenomenon of like very racist targeting of forums set up for people of color to exchange. And so I recall for sessions like this in other ones, you know on the Black Scientist Task Force having to be careful about how registration occurs so that you don't get essentially crashed by people who just, you know, want to make participants feel bad” (P07)	1
medical legal responsibility in providing specific medical advice		“Like as a physician, if you're careful that if you haven't actually assessed a patient, you shouldn't be giving specific medical advice. So, I was careful about the general recommendations” (P07)	1
Additional Considerations			
Consideration of vulnerability of the audience		“I think I explained before about perhaps some reasons why the sickle cell disease community would be a little bit more	3

		vulnerable to some misinformation just because of previous negative experiences in the healthcare system [...] and also people with sickle cell disease are already living with chronic disease” (P01)	
Experiences of audience with discrimination and stigma		“Lots of them experience like discrimination and stigma and things like that because of their race and kind of that intersection with their chronic disease as well” (P01)	2
Not involved in initial planning		“I actually wasn't involved at the beginning of, of when they were kind of creating this” (P01)	1
Focus was on being a credible source		“I think the main thing was just appreciating [...] mass saturation of like go get your vaccine, now do it, everyone do it, is not going to be as effective as hearing it directly from somebody that you trust and who is, you know, available to answer your questions” (P02)	1
Participant did their own research to educate themselves		“I did do a lot of reading around about vaccine hesitancy, its history, its sources.” (P02)	1
staying conscious of volunteer's limited time		“It was like all hands-on deck. This was all my, this was all volunteer time on my part, and I was working around the clock seven days a week for, you know, four years in the pandemic” (P07)	1
Need for shared understanding and communication between practitioners and public		“So, I think it's the listening that's missing [...]we need to at least be able to explain why or why not and [...] what are we doing now that's showing that we're listening?” (P07)	1
recognizing physicians also need support		“Recognize that practitioners as human beings, they have feelings too” (P07)	1
guidance to public should be as pragmatic/simplistic as possible		“So whatever recommendations that come up [...] got to be pragmatic, you know, like two or three things that are reasonable to do in an emergency” (P07)	1

References

1. Filip R, Gheorghita Puscaselu R, Anchidin-Norocel L, Dimian M, Savage WK. Global Challenges to Public Health Care Systems during the COVID-19 Pandemic: A Review of Pandemic Measures and Problems. *J Pers Med*. 2022;12(8):1295. doi:10.3390/jpm12081295
2. Public Health Agency of Canada. *Public Health Agency of Canada's COVID-19 Response: Lessons Learned.*; 2023. Accessed April 7, 2025. <https://www.canada.ca/en/public-health/corporate/transparency/corporate-management-reporting/evaluation/covid-19-response-lessons-learned-summary.html#a3.1>
3. Ferreira Caceres MM, Sosa JP, Lawrence JA, et al. The impact of misinformation on the COVID-19 pandemic. *AIMS Public Health*. 2022;9(2):262-277. doi:10.3934/publichealth.2022018
4. Spicer AJ, Jalkanen S. Why Haven't We Found an Effective Treatment for COVID-19? *Front Immunol*. 2021;12:644850. doi:10.3389/fimmu.2021.644850
5. Monostra M. Health care professionals battle misinformation 'infodemic' on internet, social media. <https://www.healio.com/news/endocrinology/20201030/health-care-professionals-battle-misinformation-infodemic-on-internet-social-media>. October 30, 2020.
6. Singh K, Lima G, Cha M, et al. Misinformation, believability, and vaccine acceptance over 40 countries: Takeaways from the initial phase of the COVID-19 infodemic. *PloS One*. 2022;17(2):e0263381. doi:10.1371/journal.pone.0263381
7. Manene S, Hove C, Cilliers L. Mitigating misinformation about the COVID-19 infodemic on social media: A conceptual framework. *Jamba J Disaster Risk Stud*. 2023;15(1). doi:10.4102/jamba.v15i1.1416
8. Mehta AM, Liu BF, Tyquin E, Tam L. A process view of crisis misinformation: How public relations professionals detect, manage, and evaluate crisis misinformation. *Public Relat Rev*. 2021;47(2):102040. doi:10.1016/j.pubrev.2021.102040
9. Sampat B, Raj S. Fake or real news? Understanding the gratifications and personality traits of individuals sharing fake news on social media platforms. *Aslib J Inf Manag*. 2022;74(5):840-876. doi:10.1108/AJIM-08-2021-0232
10. Apuke OD, Omar B. Fake news and COVID-19: modelling the predictors of fake news sharing among social media users. *Telemat Inform*. 2021;56(9918300979606676):101475. doi:10.1016/j.tele.2020.101475
11. Nan X, Wang Y, Thier K. Why do people believe health misinformation and who is at risk? A systematic review of individual differences in susceptibility to health misinformation. *Soc Sci Med*. 2022;314:115398. doi:10.1016/j.socscimed.2022.115398
12. Wilson P, Kislov R. *Implementation Science*. 1st ed. Cambridge University Press; 2022. doi:10.1017/9781009237055

13. Roozenbeek J, Van Der Linden S. How to Combat Health Misinformation: A Psychological Approach. *Am J Health Promot.* 2022;36(3):569-575. doi:10.1177/08901171211070958
14. Walter N, Brooks JJ, Saucier CJ, Suresh S. Evaluating the Impact of Attempts to Correct Health Misinformation on Social Media: A Meta-Analysis. *Health Commun.* 2021;36(13):1776-1784. doi:10.1080/10410236.2020.1794553
15. Nekmat E, Kong D. Effects of online rumors on attribution of crisis responsibility and attitude toward organization during crisis uncertainty. *J Public Relat Res.* 2019;31(5-6):133-151. doi:10.1080/1062726X.2019.1644644
16. Pang A. Social Media Hype in Times of Crises: Nature, Characteristics and Impact on Organizations. *Asia Pac Media Educ.* 2013;23(2):309-336. doi:10.1177/1326365X13517189
17. Bin Naeem S, Kamel Boulos MN. COVID-19 Misinformation Online and Health Literacy: A Brief Overview. *Int J Environ Res Public Health.* 2021;18(15):8091. doi:10.3390/ijerph18158091
18. Sundelson AE, Jamison AM, Huhn N, Pasquino SL, Sell TK. Fighting the infodemic: the 4 i Framework for Advancing Communication and Trust. *BMC Public Health.* 2023;23(1):1662. doi:10.1186/s12889-023-16612-9
19. Agarwal NK, Alsaeedi F. Understanding and fighting disinformation and fake news: Towards an information behavior framework. *Proc Assoc Inf Sci Technol.* 2020;57(1). doi:10.1002/prat.327
20. Pennycook G, Rand DG. Who falls for fake news? The roles of bullshit receptivity, overclaiming, familiarity, and analytic thinking. *J Pers.* 2020;88(2):185-200. doi:10.1111/jopy.12476
21. Baptista JP, Gradim A. Understanding Fake News Consumption: A Review. *Soc Sci.* 2020;9(10):185. doi:10.3390/socsci9100185
22. Bryanov K, Vziatysheva V. Determinants of individuals' belief in fake news: A scoping review determinants of belief in fake news. Triberti S, ed. *PLOS ONE.* 2021;16(6):e0253717. doi:10.1371/journal.pone.0253717
23. Lewandowsky S, Ecker UKH, Seifert CM, Schwarz N, Cook J. Misinformation and Its Correction: Continued Influence and Successful Debiasing. *Psychol Sci Public Interest.* 2012;13(3):106-131. doi:10.1177/1529100612451018
24. Chowdhury N, Khalid A, Turin TC. Understanding misinformation infodemic during public health emergencies due to large-scale disease outbreaks: a rapid review. *J Public Health.* 2023;31(4):553-573. doi:10.1007/s10389-021-01565-3
25. Merchant RM, South EC, Lurie N. Public Health Messaging in an Era of Social Media. *JAMA.* 2021;325(3):223. doi:10.1001/jama.2020.24514

26. Bago B, Rand DG, Pennycook G. Fake news, fast and slow: Deliberation reduces belief in false (but not true) news headlines. *J Exp Psychol Gen.* 2020;149(8):1608-1613. doi:10.1037/xge0000729
27. Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. *Int J Qual Health Care.* 2007;19(6):349-357. doi:10.1093/intqhc/mzm042
28. SCAGO. COVID-19 Hub. <https://sicklecellanemia.ca/covid19/>
29. Elendu C, Amaechi DC, Alakwe-Ojimba CE, et al. Understanding Sickle cell disease: Causes, symptoms, and treatment options. *Medicine (Baltimore).* 2023;102(38):e35237. doi:10.1097/MD.00000000000035237
30. Jaiswal J, LoSchiavo C, Perlman DC. Disinformation, Misinformation and Inequality-Driven Mistrust in the Time of COVID-19: Lessons Unlearned from AIDS Denialism. *AIDS Behav.* 2020;24(10):2776-2780. doi:10.1007/s10461-020-02925-y
31. Francis JJ, Johnston M, Robertson C, et al. What is an adequate sample size? Operationalising data saturation for theory-based interview studies. *Psychol Health.* 2010;25(10):1229-1245. doi:10.1080/08870440903194015
32. Holtrop JS, Estabrooks PA, Gaglio B, et al. Understanding and applying the RE-AIM framework: Clarifications and resources. *J Clin Transl Sci.* 2021;5(1):e126. doi:10.1017/cts.2021.789
33. Pesseau J, McCleary N, Lorencatto F, Patey AM, Grimshaw JM, Francis JJ. Action, actor, context, target, time (AACTT): a framework for specifying behaviour. *Implement Sci.* 2019;14(1):102. doi:10.1186/s13012-019-0951-x
34. Ecker UKH, Lewandowsky S, Cook J, et al. The psychological drivers of misinformation belief and its resistance to correction. *Nat Rev Psychol.* 2022;1(1):13-29. doi:10.1038/s44159-021-00006-y
35. Glasgow RE, Harden SM, Gaglio B, et al. RE-AIM Planning and Evaluation Framework: Adapting to New Science and Practice With a 20-Year Review. *Front Public Health.* 2019;7:64. doi:10.3389/fpubh.2019.00064
36. Olmos-Vega FM, Stalmeijer RE, Varpio L, Kahlke R. A practical guide to reflexivity in qualitative research: AMEE Guide No. 149. *Med Teach.* 2023;45(3):241-251. doi:10.1080/0142159X.2022.2057287
37. Microsoft Corporation. (2018). Microsoft Excel. Retrieved from <https://office.microsoft.com/excel>
38. Sharma PR, Wade KA, Jobson L. A systematic review of the relationship between emotion and susceptibility to misinformation. *Memory.* 2023;31(1):1-21. doi:10.1080/09658211.2022.2120623

CHAPTER 4: Discussion of Results

4.1 Summary of findings

This thesis aimed to explore the extent to which behavioural and implementation science perspectives inform misinformation models, theories, and frameworks (MTFs) and how these frameworks align with real-world misinformation initiatives. Two studies were conducted. Study 1 involved a scoping review of misinformation MTFs, categorizing their characteristics, testability, usability, and implementability using an appraisal tool adapted from the implementation science literature. Study 2 involved qualitative interviews with the Sickie Cell Awareness Group of Ontario (SCAGO), a community organization, to explore the development process of their COVID-19 misinformation countering initiative and identify whether any existing MTF concepts were used, either implicitly or explicitly, within that process.

4.1.1. Scoping Review

The scoping review revealed that misinformation MTFs can be evaluated based on their characteristics, testability, usability, and implementability. In the context of misinformation, understanding the stated purpose, type, and role of MTFs, (i.e., MTF focuses on countering and/or understanding misinformation) is critical for the efficient application of MTFs and provides real-world intervention developers with factors to consider for selecting the appropriate misinformation MTFs. Considerable variation was observed across three other domains of misinformation MTFs, indicating that MTF development is heavily influenced by specific goals or contexts, along with a lack of standardized guidance in developing misinformation MTFs.

Usability refers to the clarity, accessibility, and actionability of an MTF, specifically how easily it can be understood and applied by its intended audience. Explicit descriptions of these misinformation MTFs' components, elements, or constructs are necessary for their efficient use. This is essential because poorly described MTFs or those lacking practical guidance can be challenging to interpret or implement. In our review, usability encompasses describing the level of detail of the MTF, describing clearly the relationships between constructs, offering guidance for application, providing methods for reducing misinformation, and presenting a clear visual representation of the proposed MTF. While usability showed low variation in the level of detail

and use of visual representation (i.e. most MTFs scored high), there was variation in relationships between constructs, offering guidance for application and providing methods for reducing misinformation.

This variation may be partly attributable to the stated goals of the MTFs. Those aiming to solely explain or conceptualize misinformation without a focus on implementability, or countering misinformation, tend not to provide practical guidance or methods for reducing misinformation, which may be appropriate given their intended use. In contrast, frameworks that aim to counter misinformation often (but not always) included more actionable elements and explicitly included recommendations for reducing its spread. Similarly, there was variation in clearly describing relationships between proposed constructs. This variation may be explained by theories generally proposing relationships, whereas frameworks and models often do not. While the nature of the proposed MTFs may help explain these variations, this does not intend to overlook the usability aspects. For example, Van Bavel's Model of (Mis)Information Belief aims to describe how psychological risk factors can influence exposure, belief and sharing of misinformation.¹ Although it is categorized as a model, we refer to it as Misinformation Theory in our review, according to Nilsen's classification.² Misinformation theories are those developed within the field of misinformation, either from scratch or by adapting existing concepts to provide an understanding and explanation of various aspects of misinformation.²

The Model of (Mis)Information Belief provides a detailed description of the model, detailed proposed relationships, and provided a full figure which aligns with its diagnostic nature and theoretical underpinning.¹ However, it didn't aim to counter misinformation or create an intervention; nonetheless, it includes practical guidance on its application, making it highly usable despite its descriptive and diagnostic orientation. This suggests that even conceptual models can enhance usability by including contextual applications or suggestions for practice. Therefore, while not all MTFs require detailed guidance, relationships, or methods for reducing misinformation, it is recommended to incorporate these elements wherever applicable. Particularly, MTFs designed for applied use should clearly articulate how they can be operationalized. Future developers should include concrete applications, examples of use, and adaptable components to enhance usability for intended users.

Implementability refers to how well a misinformation MTF can be adapted, operationalized, and sustained in real-world settings, making it essential for bridging the gap between evidence-based MTFs and effective public health action. For Wang et al,³ the term “applicability” is not explicitly defined, and it may be interpreted loosely as whether an MTF is “relevant” or “suitable” to a context. However, this does not necessarily capture whether the MTF provides practical guidance for real-world use. In this review, we used the term implementability instead to reflect the extent to which an MTF can be operationalized in practice, aligning the construct more closely with established concepts in implementation science.

Implementability constructs included consideration of context within the MTF and its intended application, adaptation, fidelity, sustainability, the inclusion of outcomes or related tools in support of the MTF, the specific level of change targeted, a clear identification of intended users and delivery methods, and the generalizability for the MTF to be applicable in other fields or areas. Many MTFs in our sample did not address these considerations explicitly. For instance, fidelity and sustainability were absent from virtually all misinformation MTFs, and most did not provide tools for the use of MTFs, clearly specify their target audience, or state the context of MTF’s use. This could have been reasonable if it were provided only for MTFs that either counter misinformation or are intended for application in real-world settings; however, even those MTFs lacked explicit clarification on these items. As misinformation does not disappear from the internet, ensuring that countering strategies are sustainable is a crucial consideration for future developments.

Similarly, although several papers discussed the intended implementation settings and addressed outcomes and/or metrics related to the success of misinformation strategies or interventions, these were often not detailed in the misinformation MTFs. This could have been because papers that include such information tend to prioritize implementability, whereas others that provided limited explanation or omitted these constructs altogether were likely intended as purely descriptive or conceptual MTFs. However, when we compared descriptive MTFs with those intended to be implementable, we observed no differences in implementability scores; in fact, some descriptive MTFs scored highly in implementability, emphasizing the use of these elements regardless of the type of MTF.

A particular example of descriptive MTFs scoring high on implementability is found in the Spread and Impact of Fake News framework.⁴ It demonstrates practical relevance by clearly articulating its application setting (social media), its delivery mechanism (a guideline), and its consideration of multiple contextual factors that influence misinformation. Additionally, the MTF explicitly identifies its target audience, such as practitioners, policymakers, or researchers, which enhances implementability by clarifying who the framework is designed to serve. This clarity supports translation into practice by allowing intended users to more easily assess fit and apply the model in their respective settings.

The authors also discuss generalizability in detail, presenting the framework as a conceptual tool that can adapt to changing misinformation ecosystems. Although the link between generalizability and implementation may seem unclear, generalizable MTFs that can be adapted to new contexts support implementation as they reflect the ever-changing conditions of real-world environments. Compared to the Spread and Impact of Fake News framework,⁴ approximately half of the MTFs in our review did not address generalizability. There could be several reasons for that. It may be due to MTFs prioritizing contextual specificity over external transferability. This was evident in some MTFs, which clearly stated the specific context for which the MTF was designed while not explicitly addressing generalizability. Authors may have intended the MTF to be applied within a defined setting rather than the lack of generalizability being an oversight. Alternatively, generalizability may not have been addressed because the MTF had not yet undergone empirical validation.

Future research should promote the inclusion of implementability considerations (e.g. fidelity, sustainability, contextual application, identification of target users), regardless of the designed purpose of the MTF. While not all MTFs are intended for direct application, incorporating implementability considerations can enhance clarity and promote future adaptations by practitioners or researchers seeking to apply them. Additionally, including these elements does not necessarily compromise conceptual depth; it acts as a bridge for translating theoretical constructs into action. However, it is equally important to acknowledge that not all implementability components will be relevant for every MTF, particularly those developed with a purely conceptual intent. Clearly stating the purpose of the MTF can help clarify which

elements are applicable and which are being excluded, provide reasons for exclusion, and guide appropriate expectations for use.

Testability refers to the extent to which an MTF can be empirically assessed through observation or experimentation. In this review, testability constructs included providing explicit hypotheses, evidence to support specific relationships proposed in the MTF, and demonstrations of empirical testing. Most of the misinformation MTFs provided evidence supporting the proposed mechanism, but mostly did not propose a hypothesis or detailed empirical support for the MTF. The results showed variability between different types of MTFs as well.

While this scoping review identified certain features that may indicate the testability of MTFs (e.g., explicit hypothesis, empirical testing), these items should not be treated as a “quality” metric. The purpose of this study was to determine the testability of MTFs, acknowledging that not all MTFs are expected to achieve high testability scores. Consequently, the results of this review demonstrated variation in testability among different MTFs based on their purposes. For example, classic theories² are expected to be testable, propose clearly defined constructs, and describe causal relationships that can be empirically examined through experimentation. In our results, we observed higher scores on testability among MTFs labelled as classic and/or misinformation theories. Comparatively, process models and determinant frameworks are generally not expected to be testable, as they are primarily descriptive and do not necessarily demonstrate relationships between constructs.² Overall, descriptive models or frameworks serve a different purpose and should not be penalized for lacking empirical testing. Instead, testability constructs proposed here should differ based on their stated goals.

Although there are testability tools such as T-CaST in implementation science, we have not found a validated testability tool in the context of misinformation. Future research can focus on developing and validating a scale that accurately captures testability as a measure of quality, particularly for subsets of MTFs that state or conduct empirical assessments. For these MTFs, testability should be considered a marker of quality, since MTFs intended to guide intervention development or explain causal relationships must be capable of withstanding empirical examination. The current testability items used in this review could serve as a starting point for constructing a psychometrically sound assessment instrument. There should also be efforts to

clarify which categories of MTFs should be testable (e.g. classic theories, misinformation theories) and which do not need to be testable (e.g. determinant frameworks, process models). Until such validation occurs, these criteria should be viewed as provisional indicators rather than definitive measures. Since most MTFs are not tested within the current literature, future literature could move forward with more clearly testable misinformation MTFs. Further work could also explore whether MTFs that score higher on testability dimensions consistently perform better in real-world applications, thereby refining our understanding of what makes a framework empirically actionable.

4.1.2. Semi-structured Interviews

The Sickle Cell Awareness Group of Ontario (SCAGO) is a community-based organization dedicated to enhancing the quality of life for sickle cell patients and their families.⁵ They were chosen as a case study for this thesis because of their unique role as a community-based organization actively tackling both broad-based and population-specific health misinformation during the COVID-19 pandemic. The organization implemented several targeted initiatives, including COVID-19 counselling services, public webinars, Q&A sessions, and informational booklets.⁵ As the disease mainly affects Black individuals and given the history of unethical research and structural inequities in healthcare, this community often exhibits mistrust toward healthcare institutions, increasing their vulnerability to misinformation.⁶ As a result, SCAGO's efforts offer valuable insight into how anti-misinformation initiatives are developed and applied.

Through interviews with SCAGO, we found that their misinformation initiative was deeply rooted in community needs and feedback, employing a bottom-up approach focused on trust-building and delivering accurate information to empower informed decision-making. SCAGO operationalized this by leveraging trusted messengers (e.g., community leaders, physicians), familiar platforms (e.g., WhatsApp), and by addressing emotional and logistical barriers. Their most common goals included increasing COVID-19 vaccination, engaging and building trust within the community, disseminating accurate information, and countering misinformation. Rather than relying on passive messaging, they prioritized interactive engagement, iterative feedback, and culturally grounded delivery, highlighting the importance of real-world adaptability.

Their approach raises two key points: the need to expand the scope of MTFs and the importance of integrating them effectively, particularly given that many MTFs function in a top-down manner. First, SCAGO's approach, which was not focused solely on countering misinformation, suggests that future MTFs should consider other important goals. This could include focusing on strategies aimed at building trust and enhancing emotional, cultural, and structural responsiveness. Second, although many MTFs are created in top-down academic settings, SCAGO's initiative highlights the success of a community-driven, bottom-up approach. However, this does not imply that MTFs are completely unsuitable for community contexts. MTFs designed with usability and implementability in mind can be adapted to fit real-world community settings, ultimately improving their structure, clarity, and evaluation efforts.

The findings emphasize the need for more actionable, context-sensitive misinformation MTFs that effectively bridge the gap between theory and public health practice. Providing clear and practical guidance ensures that proposed MTFs are usable by practitioners, policymakers, and community organizations to effectively tackle misinformation. Considering multiple contexts or explicitly stating the context in which the MTF is to be used enhances the translation of proposed evidence-based mechanisms or suggestions into the real world. Furthermore, involving misinformation intervention developers and the intended audience early in the design of MTFs can ensure that MTFs are grounded in lived experiences, increasing their practical utility and relevance. While we did not extract data specifically on community engagement, we did notice that community engagement in the creation, implementation, and revision was entirely absent in formal MTFs. Future MTF development would benefit from incorporating these ideas. The involvement of knowledge users in the design of misinformation MTFs allows for the integration of lived experiences, contextual expertise, and practical relevance. This strategy aligns with integrated knowledge translation (iKT) and patient and public involvement (PPI) literature.^{7,8} iKT promotes collaboration between researchers and decision-makers, while PPI emphasizes the importance of meaningfully involving patients and members of the public throughout design, conduct, and dissemination of research.^{7,8} Specifically, PPI and iKT approaches advocate for early-stage involvement, co-design processes, and ongoing feedback mechanisms to ensure that MTFs are usable and meaningful in real-world settings.^{7,8} When developing the MTFs, researchers could utilize tools such as the GRIPP2 checklist to report PPI transparently, while

strategies like capacity building and role clarity could help structure community partnerships.⁹ Doing so could lead to MTFs that are more inclusive, actionable, and impactful in target communities.

4.2 Considerations from misinformation MTFs for organizations

In the following section, we consider how specific misinformation MTFs from the literature may align with or inform SCAGO's existing practices. These MTFs were selected based on their relevance to SCAGO's goals and community-centred approach. It is important to note that these are possible considerations and not formal recommendations.

4.2.1. Theoretical Overlaps Between Misinformation MTFs and SCAGO's Approach

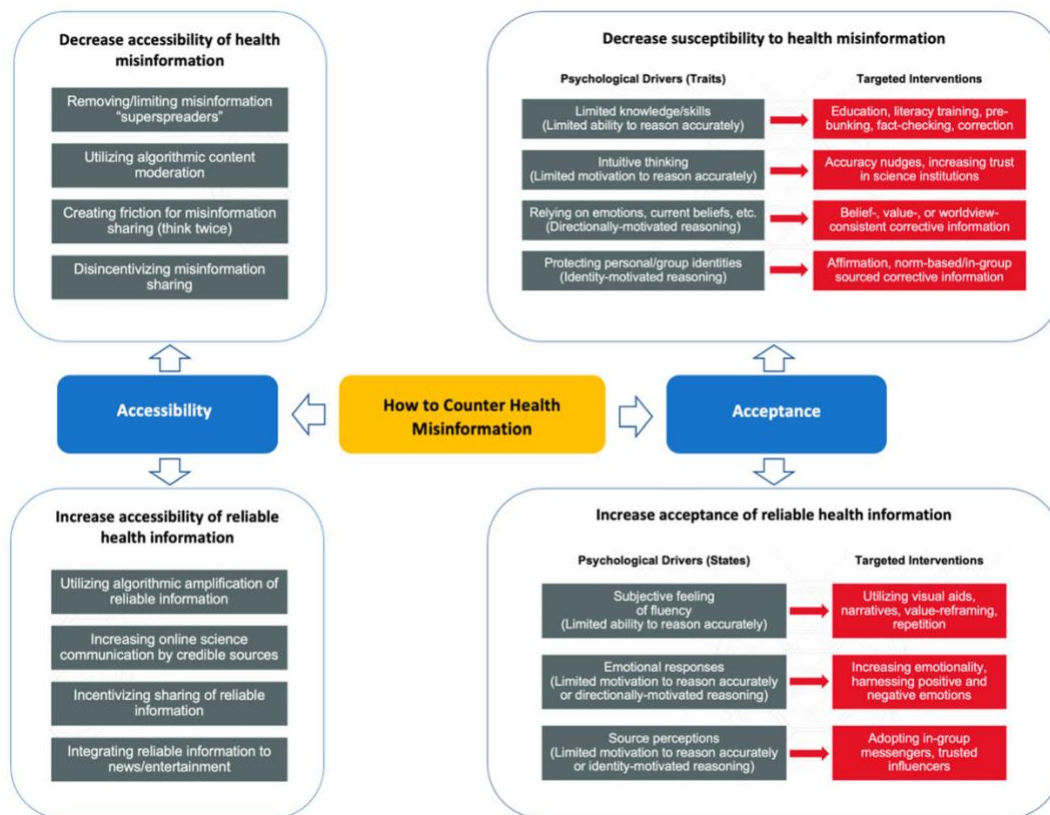


Figure 1. Nan et al.'s Accessibility-Acceptance Framework of Countering Health Misinformation

A central feature of SCAGO's approach was using **trusted messengers**, such as physicians and community leaders, to deliver accurate information. Multiple MTFs support this construct: Nan

et al.'s Accessibility-Acceptance Framework (AAF) of Countering Health Misinformation¹⁰ (**Figure 1**) and Mende et al.'s Framework for Understanding Consumer Responses to Infodemic-Related Disclosures and Warnings.¹¹ Nan et al.'s framework emphasizes enhancing accessibility and acceptance of reliable health information. It highlights the importance of how the target audience perceives the sources of this information, which is crucial for increasing their acceptance of the conveyed message.¹⁰ Similarly, Mende et al.'s framework also identifies trusted sources as critical for improving message acceptance.¹¹

Another key theme SCAGO emphasized from the interviews was the goal of **simplifying complex health information** to empower community members as informed decision-makers and to increase the uptake of accurate information. This strategy aligns with Riaz et al.'s Social Media Health-Misinformation Seeking Model,¹² which suggests that simplifying content can reduce misinformation exposure and confusion, particularly for populations with diverse levels of health literacy.

SCAGO also employed **emotionally resonant content**, such as personal testimonials and stories that addressed vaccine-related concerns. Rather than relying solely on factual claims like “vaccines are safe”, SCAGO framed vaccination as a means to protect loved ones and support community well-being. Their approach aligns with Nan et al.'s AAF, which argues that emotionally strategic communication, such as framing messages that reflect recipients' values, worldviews, and psychological states, can enhance the likelihood that reliable information will be accepted rather than dismissed.¹⁰ Mende et al.'s Framework also supports this, as it states that positively framed warning messages tend to be perceived as more credible and persuasive than fear-based or negatively framed messages.¹¹ However, more research is needed in this area to strengthen these findings.

One of SCAGO's primary goals was to build **trust** and foster **communication** between the public and credible sources of health information. For example, they built WhatsApp chat groups, where community members could directly engage with medical professionals and trained COVID-19 Ambassadors to ask questions and address concerns. This approach reflects Nan et al.'s AAF, which advocates for scientists and health experts to engage the public in two-way

dialogues through platforms like WhatsApp, thereby enhancing the visibility and acceptance of accurate health information.¹⁰ Similarly, Riaz et al.'s Model¹² highlights the importance of strengthening the credibility of institutional sources to ensure the effective dissemination of reliable COVID-19 information.

4.2.2. Opportunities for Integrating Misinformation MTFs into SCAGO's Approach

Beyond engaging in practices consistent with some aspects of MTFs, SCAGO could incorporate additional strategies to strengthen its approach. Several misinformation frameworks, including Riaz et al.'s Digital Misinformation Response Framework¹² Ecker's Drivers and Barriers to False Belief¹³ and Nan et al.'s AAF,¹⁰ emphasize the potential utility of **prebunking** as an approach to countering misinformation. Prebunking involves exposing individuals to weakened forms of misinformation in advance, often by highlighting common manipulation techniques or psychological cues.^{10,12,13} Simple pre-bunking interventions can involve presenting accurate information, using misinformation warnings before the misinformation or pre-emptive corrections.¹³ This strategy has been shown to enhance resistance to misinformation by fostering cognitive resilience before individuals encounter false information. Prebunking techniques are particularly effective in digital environments, where emotionally charged and misleading content spreads rapidly.¹³

Prebunking could be an appropriate and practical addition to SCAGO or similar organizations that aim to build anti-misinformation educational materials and community engagement initiatives. For instance, SCAGO could distribute myth-busting booklets that not only address common COVID-19 myths but also explain the psychological tactics behind them.¹ They could also send short prebunking messages through community WhatsApp groups—for example:

“Some messages going around use emotional stories to scare people about vaccines. Remember: fear doesn't equal fact. Here's what the real data says...”

Two additional MTFs that may align with SCAGO's work are Ecker's Drivers and Barriers to False Belief¹³ and Mehta's Model for Crisis Misinformation Detection, Decision-making, Response, and Evaluation.¹⁴ SCAGO has considered emotional and cultural factors, but Ecker's

model can help expand their approach by addressing the cognitive drivers of false belief. Debunking strategies can also be useful, such as a myth-busting booklet tailored specifically to the sickle cell community, or including personal stories from individuals who overcame vaccine concerns.

Finally, Mehta et al.'s model can guide SCAGO in crisis communication.¹⁴ This model emphasizes the importance of early detection, decision-making, offers response and correction strategies, and systematic evaluation when addressing misinformation during crises such as COVID-19. While they did not have much information at the start of the COVID-19 pandemic, they could have implemented “crisis misinformation acknowledgement” using pre-approved, culturally sensitive templates to quickly address misinformation, even when full details were unavailable.¹⁴ This would help build trust and transparency. Additionally, although not part of SCAGO's original scope, their strong community ties could be leveraged to detect misinformation earlier, through WhatsApp, local networks, or community leaders, rather than relying solely on public social media posts. Long-term sustainability should also be a consideration. Misinformation is not just a crisis issue, and ongoing efforts are needed to keep communities informed and protected.

4.3 Implications for future use

This thesis takes a meaningful step forward in bridging the gap between theoretical misinformation MTFs and their practical use in real-world initiatives. Through a scoping review and theory-informed interviews with SCAGO, we identified not only the variation and limitations in existing misinformation MTFs but also demonstrated how aspects of these MTFs can be applied, even implicitly, in community misinformation interventions.

Our findings suggest that future misinformation MTF development should more clearly articulate which components (e.g., usability, implementability) are most applicable based on the framework's intended purpose. While implementability is an essential dimension to allow implementation of these MTFs, it may not be relevant for all MTFs, especially those developed solely for conceptual or diagnostic purposes. Rather than prioritizing any single construct universally, future developers should consider clarifying an MTF's intended use and audience to guide which elements to include or omit.

The Wang et al. appraisal tool,³ adapted from implementation science, proved effective for highlighting strengths and gaps, suggesting it may be a valuable resource for both researchers and public health practitioners seeking to navigate the misinformation MTF environment. While this tool was effective in its current application, future research could refine this tool or our adaptation of their criteria and formally validate it for selecting or adapting MTFs for practical use. Developing a psychometrically defensible version of the appraisal tool may support more consistent evaluation of future MTFs.

Additionally, the SCAGO case study revealed that community organizations may already use elements of misinformation MTFs, such as emotional resonance, trusted messengers, and message simplification, without formal guidance. This indicates an important opportunity, to co-create or tailor MTFs with community partners so they are theoretically sound and actionable in real-world settings. Incorporating PPI and iKT strategies into the development process may be particularly valuable.^{7,8} Engaging practitioners, community leaders, and target populations through co-design, early-stage collaboration, and feedback mechanisms can help produce MTFs that are more useful, actionable, and sustainable. The next phase of research may involve piloting these misinformation MTFs in real-time misinformation interventions to evaluate their effectiveness, feasibility, and sustainability in diverse contexts.

4.4 Conclusion

Misinformation poses a significant threat to public health, particularly when it influences behaviour. This thesis assessed the landscape of existing misinformation MTFs through a scoping review and explored their real-world application in a misinformation initiative led by SCAGO. The findings revealed that existing MTFs serve various purposes, ranging from conceptual descriptions of misinformation to interventions, and consequently vary in their usability, implementability, and testability. While many anti-misinformation efforts in practice, such as SCAGO's, are not formally guided by MTFs, they still engage in activities consistent with some theoretical constructs.

In order to bridge the gap between theory and practice, we need to make misinformation MTFs more actionable and reflective of real-world needs. Incorporating principles from PPI, such as

engaging stakeholders in the early development of misinformation MTFs, along with efforts to enhance usability, implementability, and testability in line with implementation science best practices, could assist future MTFs in becoming more useful to practitioners. Ultimately, this thesis provides a foundation for future research and the development of actionable, behaviour-focused MTFs that can guide the development of more effective misinformation combatting strategies.

References

1. Van Bavel JJ, Harris EA, Pärnamets P, Rathje S, Doell KC, Tucker JA. Political Psychology in the Digital (mis)Information age: A Model of News Belief and Sharing. *Soc Issues Policy Rev.* 2021;15(1):84-113. doi:10.1111/sipr.12077
2. Nilsen P. Making sense of implementation theories, models and frameworks. *Implement Sci.* 2015;10(1):53. doi:10.1186/s13012-015-0242-0
3. Wang Y, Wong ELY, Nilsen P, Chung VC ho, Tian Y, Yeoh EK. A scoping review of implementation science theories, models, and frameworks — an appraisal of purpose, characteristics, usability, applicability, and testability. *Implement Sci.* 2023;18(1):43. doi:10.1186/s13012-023-01296-x
4. Arayankalam J, Krishnan S. The Spread and Impact of Fake News on Social Media: A Systematic Literature Review and Future Research Agenda. *E-Serv J.* 2022;14(1):32-95. doi:10.2979/esj.2022.a877445
5. SCAGO. COVID-19 Hub. <https://sicklecellanemia.ca/covid19/>
6. Jaiswal J, LoSchiavo C, Perlman DC. Disinformation, Misinformation and Inequality-Driven Mistrust in the Time of COVID-19: Lessons Unlearned from AIDS Denialism. *AIDS Behav.* 2020;24(10):2776-2780. doi:10.1007/s10461-020-02925-y
7. Gagliardi AR, Berta W, Kothari A, Boyko J, Urquhart R. Integrated knowledge translation (IKT) in health care: a scoping review. *Implement Sci.* 2015;11(1):38. doi:10.1186/s13012-016-0399-1
8. Arumugam A, Phillips LR, Moore A, et al. Patient and public involvement in research: a review of practical resources for young investigators. *BMC Rheumatol.* 2023;7(1):2. doi:10.1186/s41927-023-00327-w
9. Staniszewska S, Brett J, Simera I, et al. GRIPP2 reporting checklists: tools to improve reporting of patient and public involvement in research. *BMJ.* Published online August 2, 2017;j3453. doi:10.1136/bmj.j3453
10. Nan X, Thier K, Wang Y. Health misinformation: what it is, why people believe it, how to counter it. *Ann Int Commun Ass.* 2023;47(4):381-410. doi:10.1080/23808985.2023.2225489
11. Mende M, Ubal VO, Cozac M, Vallen B, Berry C. Fighting Infodemics: Labels as Antidotes to Mis- and Disinformation?! *J Public Policy Mark.* 2024;43(1):31-52. doi:10.1177/07439156231184816
12. Riaz M, Jie W, Sherani M, Ali S, Boamah FA, Zhu Y. An empirical evaluation of the predictors and consequences of social media health-misinformation seeking behavior during the COVID-19 pandemic. *Internet Res.* 2023;33(5):1871-1906. doi:10.1108/INTR-04-2022-0247

13. Ecker UKH, Lewandowsky S, Cook J, et al. The psychological drivers of misinformation belief and its resistance to correction. *Nat Rev Psychol*. 2022;1(1):13-29. doi:10.1038/s44159-021-00006-y
14. Mehta AM, Liu BF, Tyquin E, Tam L. A process view of crisis misinformation: How public relations professionals detect, manage, and evaluate crisis misinformation. *Public Relat Rev*. 2021;47(2). doi:10.1016/j.pubrev.2021.102040