

**Anatomizing “Fake News:” Epistemologically Reframing Misinformation to Reorient
Healthcare Interventions**

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On my honor as a University Student, I have neither given nor received unauthorized aid on this
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Introduction

Misinformation is not like a plumbing problem you fix. It is a social condition, like crime, that you must constantly monitor and adjust to. (Tom Rosenstiel, 2017)

Misinformation is rapidly becoming a clear and present danger to individuals and communities around the world. The global shift towards digital information systems is increasingly empowering malicious actors to use online misinformation to disseminate conspiracy theories, sow doubts about news media trustworthiness, and erode confidence in expert opinion. Experts caution that misinformation has already had significant effect on major events such as the UK Brexit referendum (Narayan et al., 2017, p. 1), the 2016 U.S. presidential election (Allcott and Gentzkow, 2017, p. 3), and the COVID19 pandemic (Taylor and Asmundson, 2020, p. 1). Recognizing these repercussions, the World Economic Forum ranks the spread of digital misinformation as one of the foremost threats to global development (Kuklinski et al., 2000, p. 2). The ramifications of misinformation are particularly palpable in healthcare where misinformation has driven precipitous drops in vaccination rates (Larson et al., 2011, 526) and growing mistrust towards medical professionals (Saad, 2018, “Confidence in Medicine Hits Another All-Time Low”), resulting in the loss of “innumerable lives and immeasurable capital” (Poland and Spier, 2010, p. 2362).

Despite its prominence, the moniker of “misinformation” is a misnomer which belies the full scope of the problem: this phrasing implies that these false beliefs can be simply dispelled with accurate information. In practice, modern misinformation is seldom corrected by factual interventions; rather, “misinformation persists and continues to exert psychological influence after it has been factually rebutted.” This fundamental gap in our conceptualization of misinformation results in commensurately impaired intervention attempts (Chan et al., 2017, p.

1531). In my technical research, I explore technological advances in the fight against misinformation and demonstrate that neither new software solutions nor more potent algorithms are sufficient to mitigate misinformation, as these technical systems fail to consider the vital social dimensions of the problem. Despite the severe and escalating nature of the misinformation epidemic, interventions by the medical community have failed to significantly reduce the spread of health misinformation (Trethewey, 2019, p. 6). In this research, to reveal why our current strategies to control health misinformation are unsuccessful, I seek to understand the *epistemology* – the process by which knowledge is acquired – of misinformation. By using the justified-true-belief definition of knowledge, I argue that the evidence-first approach adhered to by the medical community is fundamentally at odds with the correspondence-based approach applied by misinformed parties. I demonstrate that this disparity is responsible for our misinterpretation of misinformation and constitutes the social context missing in our present inefficacious strategies. Leveraging these insights, I accordingly develop recommendations to reorient our interventions.

Defining the Problem: Challenges in the Fight against Healthcare Misinformation

With the advent of online information systems such as social media and online-only media outlets, the way that people educate themselves and learn about the world around them is rapidly changing. Throughout the 20th century, journalists and news media have historically served as the foremost arbiters of information by reporting on events around the world, developing robust evidentiary standards, and keeping larger organizations accountable through dissemination of quality information. Interviewing panels of journalists, Schapals (2018) underscores that the “defining function of journalism is its definition as a “watchdog” over society and its ability to ‘speak truth to power’” (p. 980) However, the rise of digital

information outlets is threatening this social role of conventional journalism and the integrity of the information we receive. The excising of fact-checking intermediaries like journalists from the content publishing process, termed *disintermediation*, “critically damages readers’ efforts to find reliable and trustworthy information online” (p. 982). For instance, users can use social media to immediately post opinions and content while events occur, making it difficult to distinguish information from opinion, thereby reducing the overall integrity of the news (Lazer et al., 2018, p. 1095). Indeed, Experts at Pew Research Center suggest that up to two of every five news articles shared on Facebook contain misinformative elements (Anderson and Rainie, 2017, p. 8).

Television dominates as a news source for older Americans

% of each age group who *often* get news on each platform

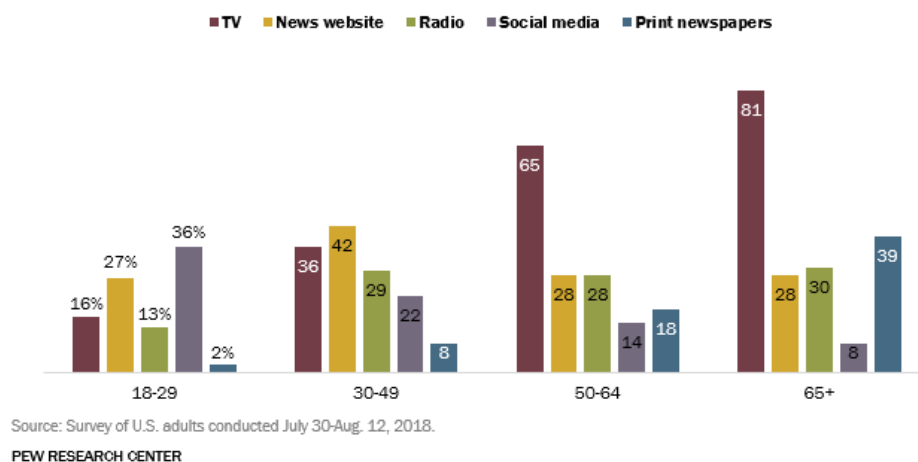


Figure 1. Pew Research Center survey results reflecting how the news sources are changing across different age ranges. Younger generations are increasingly looking to disintermediated digital platforms for their news (Shearer, 2018, p. 2).

Despite these marked concerns regarding the quality of information available through disintermediated platforms, these online information systems have become influential than ever. As illustrated in Figure 1, Pew Research Center indicates that in 2018, 36% of US young adults ages 18-29 reported receiving their news primarily from social media outlets like Twitter and Facebook, a drastic increase compared to older age groups and previous years (Shearer, 2018, p. 2). More than ever, users look to the increasingly disintermediated internet as the primary source

for their factual knowledge: a study by Bråten et al. (2005) revealed that 73% of students believe “the internet is the best source of truthful information” (p. 146). Through the advent of digital media, the way that our society acquires and processes knowledge has fundamentally changed.

Misinformation is Pervasive in Healthcare

In 2016, an article which touted, “Dandelion weed can boost your immune system and cure cancer,” was reposted across social media platforms a record-breaking 1.4 million times, making it one of most shared pieces of content ever. While dandelions may be hiding such benefits, no such study had ever been conducted to explore or document these effects.

Misinformation is particularly pervasive and dangerous in the healthcare space; campaigns consistently target disquieting topics such as vaccine safety and cancer therapies to prey on our innate desire for “information can help resolve uncertainty during a time of heightened anxiety” (Kossowska and Bukowski, 2015, p. 145).

One of the most prolific pieces of healthcare misinformation originates from the 1998 Wakefield paper which incorrectly proposed a causative connection between the measles-mumps-rubella (MMR) vaccine and the development of autism (Wakefield et al., 1998, pp. 640-641). Figure 2 depicts the catastrophic consequences as fearful parents began refusing vaccinations, causing measles cases to skyrocket and endangering at-risk populations. Despite the tens of millions of dollars of peer-reviewed research disproving the association, 21% of US parents still express substantial doubts about vaccine safety, and MMR coverage has yet to recover to pre-Wakefield levels (McIntyre and Leask, 2008, p. 729). In 2017, these misinformation-based choices drove a global 31% increase in vaccine preventable disease, resulting the loss of more than twenty thousand lives and trillions of dollars in expenditures (Marston et al., 2019, p. 2185).

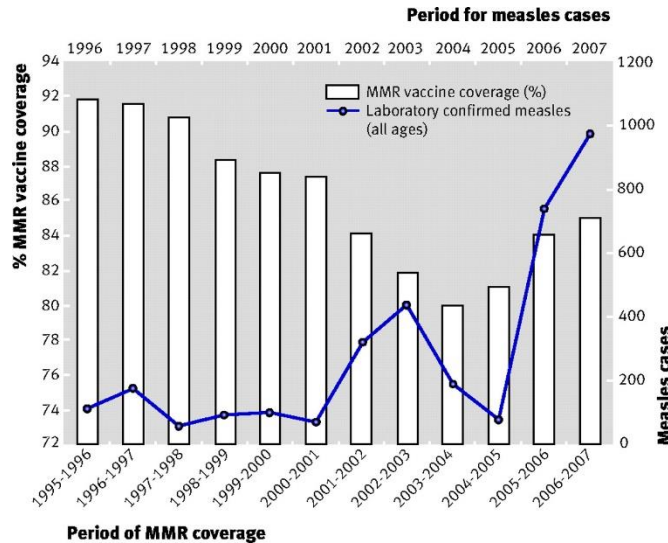


Figure 2. MMR coverage for 24-month infants across the UK and laboratory-confirmed cases of measles for all children under 18 from 1995 to 2007, adapted from McIntyre and Leask (2008, p. 729). The Wakefield paper was published in 1998 and is demarcated by the author with red underlining.

Unfortunately, Wakefield has “shaped a generation of parents’ attitudes toward modern medicine and vaccines in general” (Poland and Spier, 2010, p. 2363) and these effects can be readily seen in the present world-wide COVID19 pandemic. Facebook groups contesting the legitimacy of the virus and protesting the wearing of masks pose significant challenges to efforts to mitigate the epidemic. Estimates suggest that about 10-15% of adults in the US and Canada refused to wear masks, leading to thousands of additional infections and animosity towards healthcare professionals (Taylor and Asmundson, 2020). Despite significant evidence supporting the safety and efficacy of coronavirus vaccines, a 2020 YouGov poll indicates that 27% of Americans plan to refuse COVID-19 vaccinations and another 26% express trepidation, with many explicitly citing vaccine safety concerns (Smith, 2021, “COVID-19 vaccination willingness”). Clearly, health misinformation is a menace scarcely perturbed by facts.

Current Interventions Fail to Control Healthcare Misinformation

As touched on in the introduction, the medical community has made significant efforts towards fighting the spread of healthcare misinformation. In 2019, the American Medical Association released a public memo urging the community to prioritize “[stemming] the

proliferation of health-related misinformation that has helped vaccine-preventable diseases to reemerge” (Madara, 2019). Surveying these efforts, Trethewey (2019) notes that the community has adopted three main strategies: disseminating peer-reviewed research, publishing targeted fact-checking reports, and organizing campaigns to raise misinformation awareness. These approaches all strongly rely on providing quality evidence and reflect the medical community’s overarching adherence to evidentialism. Conee and Feldman (2009) explain that evidentialism is an epistemology which claims “the validity of justification of a belief is determined by the quality of the believer's evidence for the belief” (p. 15). For instance, the scientific method upon which the medical research process is founded is an evidentialist approach to knowledge (p. 23). A further discussion of justifications and beliefs is offered in the ensuing methods section. However, research by Bautista and Gwizdka (2021) suggest that these evidence authentication-based approaches are only successful at “correcting misinformed beliefs on small scales” (p. 5), such as focus groups. Present interventions have failed to curb the growth of the misinformation epidemic.

In recent years, groups espousing anti-vaccination, anti-mask, and predatory alternative treatments have been enjoying unprecedented growth and influence (Johnson et al., 2020). In 2020, more than 31 million Americans self-identified as anti-vaccine on social media, an increase of 7.8 million people compared to 2019 (Burki, 2020, p. 504). State-level studies show that each year, the average number of unvaccinated children attending schools is growing; as Figure 3 indicates, between 2003 and 2016, there has been a 19-fold increase in Texan students unvaccinated due to vaccine safety concerns (Hotez, 2016, p. 3). Concurrently, public trust in our medical institutions is steadily declining; a 2016 Gallup report revealed that only 36% of individuals have confidence in the US medical system, while 1 of every 5 individuals express

doubts regarding the credibility of scientific findings (Saad, 2018, “Confidence in Medicine Hits Another All-Time Low”).

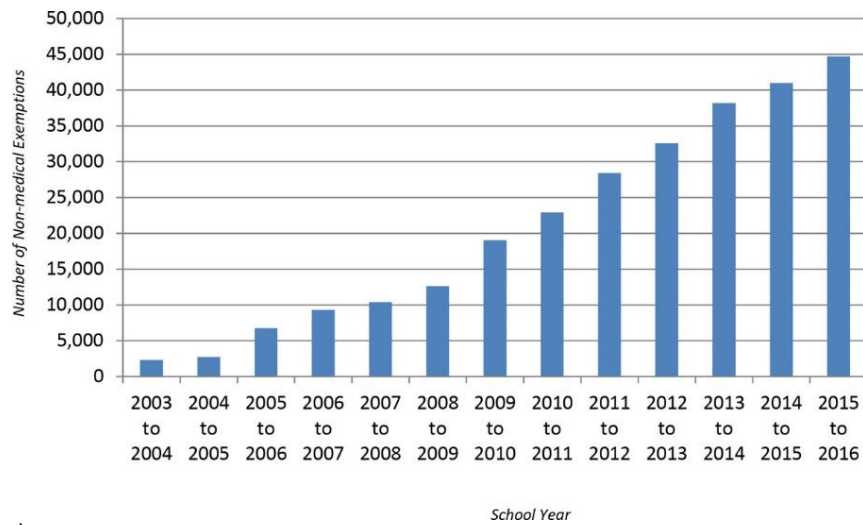


Figure 3. K-12th grade students throughout the state of Texas with nonmedical vaccine exemptions (Hotez, 2016, p. 2).

Presently, there is a paucity of research reconciling these opposing trends of increasing anti-misinformation expenditure and climbing adoption of misinformation. In a meta-analysis of misinformation debunking strategies, Chan et al. (2017) surprisingly finds that “detailed debunking message[s] correlated positively with the misinformation-persistence effect.” When confronted with factual refutation, many misinformed believers doubled down and expressed mistrust. Conventional evidentiary logic is unable to explain this unexpected behavior; however, when considered through the lens of alternative epistemologies, the inefficacy of evidence-based interventions in the healthcare space becomes consistent – it is counterproductive to use facts to reason with someone uninterested in objective evidence. Thus, I seek to bridge this gap in our understanding of misinformation by reframing the problem of ineffective interventions as an epistemological mismatch between healthcare professionals and misinformed individuals.

Epistemology is a Powerful Tool for Understanding Misinformation

To understand why current strategies employed by the healthcare community are not able to suppress the propagation of misinformation, we must first develop an appreciation of how

different groups of people acquire information. In the introduction, we establish that the medical community uses an evidentialist epistemology, and information is acquired through rigorous fact-finding. However, we have yet to identify the alternate epistemology which underlies the spread of misinformation. Towards this end, I use the justified-true-belief framework to establish a common epistemic vocabulary before describing the connections between correspondence theory and misinformation. I additionally develop a method for applying these epistemic insights to rationalize the spread of misinformation, using the infamous Wakefield vaccine paper as an example.

The Justified-True-Belief Framework formalizes Knowledge

In 369 BC, philosopher Plato authored a dialogue entitled *Theaetetus* in which the eponymous Theaetetus and Socrates explore the nature of knowledge through an illustrative application of the Socratic method. In one passage, the two discuss the definition of knowledge:

...He said that knowledge was true opinion accompanied by reason but that unreasoning true opinion was outside of the sphere of knowledge; and matters of which there is not a rational explanation are unknowable... (*Theaetetus*, 201c-d)

Plato's characterization of knowledge as "true opinion accompanied by reason" lays the foundations for the *justified-true-belief* (JTB) framework. The JTB framework is an Enlightenment-era theory which posits that "knowing something is as simple as having a justified belief that it is true, and it indeed being true" (Ichikawa and Steup, 2018, "Knowledge as Justified True Belief").

The JTB framework imposes three preconditions for knowledge: belief, as knowledge requires a degree of conviction; justification, as belief needs to be well founded; and truth, in that belief must correspond to observable reality. Brock (2018) explains that these basic precepts

were employed for thousands of years and educators still employ “[JTB] as a necessary component of teaching students how to acquire knowledge” (p. 250) Indeed, much of our pedagogy – the techniques of teaching – is based on the JTB framework, thus conferring a common foundation for different epistemologies. However, in 1963, Edmund Gettier revealed that “one can justify their belief in propositions and deem the propositions as true, when, in fact, the propositions are false” (Gettier, 1963, p. 121). Consider the following scenario:

Imagine that we are seeking water on a hot day. We suddenly see water, or so we think. In fact, we are not seeing water but a mirage, but when we reach the spot, we are lucky and find water right there under a rock. Can we say that we had genuine knowledge of water? The answer seems to be negative, for we were just lucky. (Dreyfus, 1997, p. 292)

Applying the naïve version of the JTB framework, our vision justified our belief in the presence of water, and this belief was confirmed upon arrival. However, we clearly lacked well-founded justification and had no idea that there was water under the rock, and thus lacked knowledge.

These scenarios are termed “Gettier problems” and necessitate the addition of a fourth precondition to strengthen the JTB framework: justifications of belief must be valid. This strengthened JTB framework can be represented by the Euler diagram presented in Figure 4. Knowledge is accordingly the subset of propositions that are well-justified true beliefs. As aforementioned, misinformation is borne of invalid justification – as such, this diagram reveals that fake news is in fact a poorly-justified true belief.

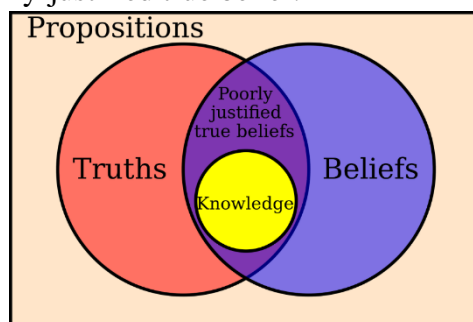


Figure 4. A simple Euler diagram depicting the JTB model. (Wikipedia, 2021, “Justified True Belief”).

The Evidentialist epistemology of healthcare leans heavily on objective evidence to derive valid justifications. With this common definition of knowledge acquisition and validation, let us now consider the type of justifications used by misinformed communities.

The Correspondence Theory of Truth

Developed by Bertrand Russell in 1912, correspondence theory claims that the truth is relative to one's perception and experience of reality. Expounding on this definition, Russell uses the analogy of describing a coin: "A circular coin, for example, though we should always judge it to be circular, will look oval unless we are straight in front of it" (p. 19). Though the physical shape of the coin remains constant, the perception or *sense-data* differs between distinct observers. Russell expands:

We can know only what is required in order to secure the correspondence. That is to say, we can know nothing of what it is like in itself, but we can know the sort of arrangement of physical objects which results from their spatial relations (p. 20).

While we may glean relational information from our sense-data, we cannot truly grasp the exact physicality of these objects as we only have access to our own perceptions. Thus, we form a correspondence between our personal perceptions colored by our beliefs regarding the external world and the true physical reality which cannot "be exactly like sense data, [but rather] more or less like" (p. 23). As such, we understand that truth is an individual correspondence of one's internal beliefs with the common external reality and differs from the true physical world on account of being filtered through our perceptions.

Using this framework, we can begin to understand the conflict between evidentialist and correspondence epistemologies. Correspondence theory is a natural choice for rationalizing the common person's belief, as it is derived directly from 'our present experience of the world' (p. 1)

and unlike evidentialism, does not require rigorous domain-knowledge nor difficult methodology to understand the world. Russell explicitly acknowledges this incompatibility:

[In] private spaces, the same object seems to have different shapes; thus the real space, in which it has its real shape, must be different from the private spaces. The space of science, is therefore not identical with them (p. 19)

As individuals limited to our own perceptually filtered information, even with evidence, it can be difficult to amend our internal beliefs to conform to an external world we cannot ourselves experience. This fact helps to explain the origin of the puzzling belief-persistence of misinformed individuals which remained could not be explained by Chan et al. From Russell's correspondence theory, we learn that when considering justifying belief in a piece of misinformation, one will evaluate correspondence between private or internal beliefs and the presented external facts of the fake news.

Applying Epistemology to Study Misinformation

With this foundation regarding the basis of knowledge acquisition and the different epistemologies which underlie scientific content and misinformation, we develop a methodology for dissecting beliefs regarding recent events. This method is illustrated pictorially in Figure 5 and is composed of three elementary steps. First, we establish the necessary conditions for knowledge per the JTB model to probe the validity of the topic at hand. Next, we leverage various epistemologies to validate possible justifications which can satisfy our fourth "strengthening" precondition. Finally, we contemplate the features of the different justifications, paying attention to factors such as generalizability. Through this approach, we can demonstrate how different individuals can interact with the same sound premise for knowledge but may extract contradictory learnings due to differences in underlying justifying epistemology. To

demonstrate the efficacy of our approach we apply it to the efforts to correct the Wakefield vaccine controversy.

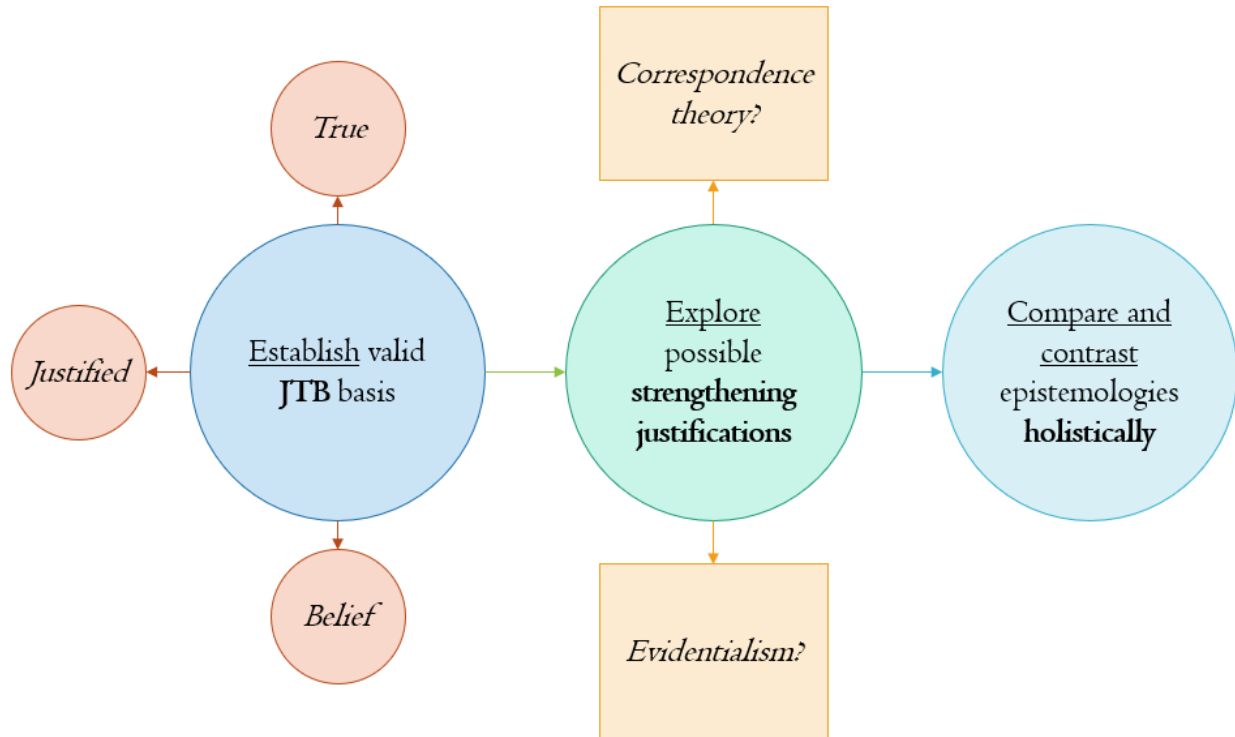


Figure 5. A three-step diagram illustrating the technique I propose for generically dissecting responses to misinformation. (created by author). First, internal consistency of the initial claim is established per the JTB definition of knowledge. Next, the validity of the justification is probed for validity from a variety of epistemological perspectives. Finally, consider how these epistemic differences propagate to the insights one may draw and the decisions this may inform.

Insights and Lessons from Epistemology

Applying our Model to the Wakefield Vaccine Controversy

Having outlined the approach for understanding failures in healthcare intervention, let us examine a specific intervention discussed by Chan et al.: the task of correcting one’s belief that vaccines cause autism. We consider the scenario in which an individual who believed in the Wakefield paper’s results being exposed to one of Trethewey’s (2019) medical fact checking reports.

To possess knowledge of the connection between vaccines and autism (henceforth, the *Wakefield connection*), one must have justified true belief. Given the aforementioned tangible

impacts of the Wakefield connection, it is safe to say that many believed and trusted the connection, as disbelief would not spur changes in behavior. We now know of the inaccuracy of the Wakefield connection; however, to understand the justification and perceived truth, we consider the evidence available following the 1998 Wakefield publication. A flurry of other reports followed Wakefield's 1998 paper, providing further credence to its claims. Celebrities and scientists alike promoted the findings as fact, amplifying the reach of the information through news media (Poland and Spier, 2010, p. 2361). Indeed, a fact-checker without *prima facie* would have robust evidence from which to infer and justify the truth of the Wakefield connection, thereby presenting a justified true belief.

Yet, as we now know, the Wakefield connection is untrue and as truth was inferred from invalid justification (Gettier 1963). Thus, we consider the efficacy of appealing to the fourth "valid justification" requirement of the strengthened JTB framework with an expert fact-checking report from the perspectives of different epistemologies. We begin with Jane Doe, who adheres to an evidentialist epistemology. She has a "justifiably true belief" in the Wakefield connection based on significant evidential support from reliable sources. As Jane justifies her belief through the veracity of the evidence provided, when the fact-checking report contradicts this evidence, she updates her beliefs to reflect the strongest evidence at hand, thereby dispelling the misinformation. John Doe, on the other hand, adheres to a correspondence-based epistemology. He shares Jane's "justifiably true belief" in the Wakefield connection and has accordingly built his internal belief system to match this knowledge. The fact-checking report external to John's belief contradicts the sense-data he perceives based on his internal beliefs. Therefore, John ignores the report as it fails to correspond with his beliefs and prior evidence which supports the validity of the Wakefield connection. In the next section, we look to complete

the last step of our method by analyzing the implications of these alternative epistemologies for misinformation acquisition and correction.

Ineffective Interventions, Epistemic Differences, and Derivative Learnings

In our scenario, both John and Jane justify an account of truth using the information at hand. Then, using their respective epistemic resources, they reach a resolution regarding the new information that they are presented with; however, as the epistemology underlying their respective resources differ, John and Jane reach different conclusions. Thus, our method rigorously demonstrates that epistemological differences account for inefficacy of traditional evidentiary interventions. Extending our methodology to the various interventions and pieces of misinformation Trethewey discusses (2019) confirms the generalizability of this result.

Our methodology surprisingly suggests that even conscientious fact-checkers can fall prey to misinformation. Correspondence theory suggests that though an internal belief may be justified and be true, a given belief is not necessarily generalizable to every scenario which pertains to this original basis. In John's scenario, his belief in the Wakefield connection corresponds to the external 1998 evidence, however, this internal belief is not necessarily generalizable to future information he receives through the fact-checking report. I contend that this inappropriate generalizing arises from insufficient understanding of knowledge limitations – if John understood that his internal beliefs were limited and contextual, he may have behaved differently. Without this important awareness, individuals can feel alienated and ashamed of their beliefs (Cavalera, 2020, "Guilt Implications"), as they perceive themselves arriving at conclusions via a logical process of knowledge acquisition, but others who can recognize their faulty generalizations disagree with their logic and thus findings. This blind spot may help to explain the characteristic "belief-persistence" characteristic of misinformation as it is difficult to

directly confront a flaw inherent to the knowledge acquisition process with case-related fact. These findings indicate that while educating individuals about fact-checking is necessary, it is insufficient to mitigate the adoption of misinformation. Accordingly, I provide two methods to improve our interventions against misinformation – one conceptual and another pedagogical.

First and foremost, to design better strategies against misinformation, we need to listen to the people we claim to be trying to help. The approaches which Trethewey (2019) presents all place a strong emphasis on providing replete evidence to convince readers, with little regard for how this information may be perceived and processed. However, medical journalism is often dense and inaccessible to the common reader so by the time research has transformed into a flashy headline, much of the essential content is lost. Our interventions fail because they look to achieve belief through evidentiary suffocation rather than epistemological understanding. To develop more effective interventions, we should begin by understanding the unique epistemologies of our population. Correspondence theory is not the only alternative epistemology, and by learning how one acquires information, we can best determine how to impart it. This concept is in line with the findings of Bautista and Gwizdka (2021), who determined that one-on-one sessions with an expert were one of the few effective means of correcting misinformation. In such forums, rather than being bombarded with cacophony of evidence, an individual's personal epistemology can be grasped, and invalid justifications can be directly confronted.

Secondly, education should enable individuals to know the applicability and limits of the knowledge they possess to facilitate accurate generalizations. Earlier, we establish that John incorrectly generalizes his internal beliefs and thus fails accept a healthcare intervention. A given set of true justified beliefs for one topic may not be relevant for understanding a superficially

related topic; for instance, understanding the MMR vaccine does not entail understanding of COVID-19 vaccines. Recognizing the contextuality of belief highlight the limits of knowledge and inform the decision to hold on to or update a belief. Church and Barrett (2017) describe this concept as intellectual humility, defined as “the virtue of accurately tracking ... the positive epistemic status of one’s own beliefs” (p. 75). Pedagogical changes are especially important to the development of intellectual humility. Academic environments penalize students for gaps in knowledge, thus incentivizing aggressive generalization. To foster a healthy intellectual humility and more robust epistemic justification, education systems must encourage students to become comfortable with the limits of their knowledge.

Conclusion

In this paper, I claim that differences in epistemology can explain why healthcare misinformation continues to rapidly propagate despite increasingly frequent countercampaigns. Towards this end, I discuss evidentialism and correspondence theories as foundational epistemologies which underlie scientific fact-checking efforts and the natural perceptual acquisition of misinformation respectively, using the justified-true-belief framework to provide a common definition of knowledge. I synthesize this information to present a three-step framework for analyzing responses to misinformation and fact-checking efforts, demonstrating its effectiveness by studying the infamous 1998 Wakefield vaccination paper. In addition to establishing that present interventions fail due to mismatching underlying epistemologies, we draw wider insights into the nature of misinformation. We find that individuals can possess justified true beliefs, but due to improper generalization of their beliefs, external misinformation can appear to align with these internal beliefs, undermining the conscientious fact-checkers’ efforts to acquire knowledge. The implications of this research are clear: the most effective

strategy for quelling the spread of misinformation is not better technology nor more evidence, it is better understanding of the individuals we seek to help. With this in mind, I present two recommendations for reorienting healthcare interventions: increase the individualization of interventions by focusing specifically on peoples' unique epistemologies and incorporate an acceptance of our limitations into healthcare pedagogy to help learners understand the limits of their epistemological stances. Thus, I cement the practical merit and untapped potential of epistemological analyses in the space of healthcare misinformation.

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