Pathologies of the Post-Truth Era:

Vaccine hesitancy, fake science and the post-factual debate on the MMR vaccine

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Abstract

In 2019, the World Health Organization identified vaccine hesitancy as one of the top ten threats to global health. One of the most noteworthy of ‘eradicated’ diseases in the Western world - measles, has made a resurgence as a direct result of the immunisation threshold not being reached in an increasing number of countries. The decline in public confidence around the measles, mumps and rubella (MMR) vaccine is due to many reasons, but one significant contributing factor is the ‘anti-vaccination movement’ and its persistent spreading of false and misleading information on social media. The aim of this dissertation is two-fold: (1) develop an understanding of how a rapidly changing information environment has led to the emergence of a post-truth era in which the rational, evidence-based domain of healthcare is under assault from the anti-vaccination rhetoric of the MMR-autism controversy; (2) develop an understanding of how the post-factual characteristics of the vaccine debate are producing information pathologies of decision-making that are influencing the uptake of the MMR vaccine.

This dissertation met both these research aims through a literature review and a case study that utilises document analysis. This research produced a number of key findings: the anti-vaccination movement and the dissemination of false and misleading information about the MMR vaccine has been exacerbated by the changing information environment through the increasing dominance of social media and the phenomenon of the ‘echo chamber’; the characteristics of the post-factual vaccine debate are based on fake science and an increasing contempt for expert knowledge that is driven by Web 2.0 technologies and post-truth thinking. The conclusion drawn from this research points to the development of information fluency and the evolution of digital literacy to help society recover its fluency and effectiveness at dealing with information that has largely been lost in the post-truth era.
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Chapter 1: Introduction

1.1 Background
In most developed countries in the West there is a predominantly high rate of vaccination coverage, but outbreaks of diseases previously considered controlled or eradicated are now occurring because of groups of under-vaccinated individuals. Moreover, there is an increasing number of parents who, having made the decision to vaccinate their children, are now beginning to have doubts and concerns about vaccination. The decline in public confidence around vaccination is due to many reasons, but one significant contributing factor is the ‘anti-vaccination movement’ and its persistent spreading of false and misleading information on social media. This is encouraging misconceptions about the facts and risks associated with vaccines amongst certain sections of the general public, whilst also disregarding vaccine experts from the scientific community (Rossen et al., 2019).

Many people opposed to vaccination believe that Western medicine has been corrupted and allude to a conspiratorial cover-up by the medical profession, pharmaceutical companies and government agencies to suppress evidence of the dangers of vaccines. They assert that vaccines cause various diseases such as cancer, or developmental disorders such as autism; and human rights are denied because vaccines can be administered without the possibility of choice. Public opinion on vaccines is negatively influenced in this way as opponents of vaccination utilise social media to strengthen their presence in public forums. Their messages promote misinformation about vaccines being harmful, and present misinterpretations of scientific facts while advocating acupuncture, herbalism and homeopathy as natural alternatives to immunisation (Vrdelja et al., 2018).

For vaccination programmes to be efficient, Vrdelja et al. (2018) point out that it is essential that a high percentage of the population are vaccinated. This is necessary to protect not only individuals, but also for herd immunity - the protection of individuals who have not been vaccinated. The *Wellcome Global Monitor* has identified that for herd immunity to work against measles, which is a highly contagious disease, 90-95% of the population need to be vaccinated. If people simply rely on herd immunity for protection and reject vaccination, there will be a continuing surge of outbreaks of preventable diseases such as the recent outbreaks of measles in Brazil, India, the Ukraine and the US (Gallup, 2019). Three years after the measles virus was eradicated in the UK, the BBC (2019) reports that the UK has also lost its measles-free status.
The World Health Organization (WHO) has declared that the world is now under threat from vaccine-preventable diseases, and this is largely due to a decline in confidence around the effectiveness and safety of vaccines. In January 2019, the WHO identified vaccine hesitancy as one of the top ten threats to global health. The WHO define vaccine hesitancy as:

‘the delay in acceptance or refusal of vaccines despite the availability of vaccination services’ (Gallup, 2019, p.106).

The complex issue of vaccine hesitancy has its roots at both a personal and societal level and are not only concerns about vaccination, but also a consequence of the ‘post-truth’ era in which every fact has become open to debate (Arede et al., 2019).

The term ‘post-truth’ came to prominence in 2016 when it was selected as the Oxford English Dictionary’s international word of the year. Post-truth signifies a situation when evidence and objective facts become lost in sentiment, emotion and deeply entrenched personal beliefs. Post-factual politics are closely related to the post-truth era, emphasising a compelling story or strong narrative in favour of factual, science-based explanations. This has changed the way that experts in the scientific field inform political decision-making, and introduced a new way of devaluing the worth of scientific expertise. The concept that science can offer absolute certainties was gradually undermined by postmodernist thinking during the 1990s in which contextual truths replaced universal ones. The emergence of the post-truth era and a post-factual society has been blamed on postmodernism and critical theory as much as on the World Wide Web and social media (Berling and Bueger, 2017).

The World Wide Web is vitally important in today’s information society as the amount of digital content on this network continues to grow, but the Web’s popularity and constant expansion has also fostered perennial and persistent difficulties that can be referred to as ‘information pathologies’ (Gotlieb, 2014). Information pathologies are a broad collection of negative phenomena that distort the searching, analysis, use or sharing of information and have the potential to impact on the well-being of individuals, organisations and societies. Gyenes and Mina (2018) suggest that healthcare misinformation can be regarded as an information pathology that spreads through Google results and social media updates, and can have a real impact on a person’s physical health. Understood in this way, healthcare misinformation can influence our decision-making and behaviour so that we become more vulnerable to disease, the viral misinformation facilitating the spread of an actual health disorder or disease in the physical world.
As McAweeney (2019) notes, the WHO, along with many other public health organisations are warning that misinformation is not only compromising a person’s well-being, but also a hundred years of public trust in medical institutions. As the Internet allows freely available communication and information sharing to anyone with access to a computer and an Internet connection, Amith and Tao (2018) consider the Internet to be like a modern-day ‘Pandora’s Box’ that contains both benefits and costs, particularly in relation to the seeking of health-related information.

1.2 Research Focus

The arrival of the participatory Web, sometimes referred to as Web 2.0 has created a shift towards information generated by a broader range of content creators that are largely independent; but the shift towards greater user-generated content has also brought with it concerns surrounding the creation, dissemination and use of false and misleading health content that accompanies the growth of social networking sites such as Twitter, Facebook and Instagram (Yiannakoulias et al., 2018). The dynamics of the healthcare industry and the interactions between patient and physician has also changed considerably since online access to healthcare information. The power has shifted from doctors as the exclusive custodians of a patient’s care, to patients sharing the decision-making with physicians. Although this can seem like an advantageous situation for the layperson, the Internet is also home to false and misleading information that can lead to negative consequences such as vaccine hesitancy and vaccine refusal (Hussain et al., 2018).

Web 2.0 is characterised by user-generated content and interactivity that is now found everywhere on the Internet; but as Kata (2012) contends, just as significant is a new postmodern medical paradigm that has emerged from Web 2.0 in which power has shifted from doctors to patients, the idea of the expert has been redefined, and questioning the legitimacy of science has become the new status quo. This has created an information environment in which anti-vaccination activists can effectively spread their messages and influence whether people vaccinate themselves or their children. Waszak et al. (2018) conclude that the impact of misleading health content has resulted in behavioural changes towards public health that is now emerging as a serious health threat.

One of the most noteworthy of ‘eradicated’ diseases in the Western world - measles, has made a resurgence as a direct result of the immunisation threshold not being reached in an increasing number of countries. Opposition to the measles, mumps and rubella (MMR) vaccine has largely been driven by the rising celebrity-status of disgraced ex-physician Andrew Wakefield, and the continuing exposure of his discredited work that claims a link
between the MMR vaccine and the development of autism in enfants. Wakefield’s scientifically debunked paper was embraced by the anti-vaccination movement, along with Wakefield himself, and his ideas spread quickly on the Internet. The influence of Wakefield’s study has led to multiple outbreaks of measles (Hussain et al., 2018), and single-handedly reinforced public distrust of the scientific community (Kata, 2010).

Considerable difficulties can develop during the processing of uncorroborated sources of information that involve complex situations, and this can result in information pathologies of decision-making that become a distorting influence on the perceived situation, subsequent action, and reactions to errors and mistakes made (Bronner, 2003). Effective ways need to be found to steer the public away from myths and pseudoscience, and towards evidence-based content as an increasing number of people seek health-related information online (Collier, 2018).

Critical to this dissertation is understanding how the presence of fake science, alternative facts, and the emergence of a post-truth world has cast a shadow over the rational, evidence-based domain of healthcare. A review of literature will trace the rise of the anti-vaccination movement from its beginning in the 18th century to the present-day controversy surrounding the MMR vaccine. The literature review will also identify the key beliefs associated with vaccine hesitancy towards the MMR vaccine, outline the real-world consequences of the current measles pandemic, and look at how the creation, dissemination and use of false and misleading information has been exacerbated by information communication technologies (ICTs). Finally, the review of literature will examine how information pathologies can contaminate decision-making and result in unwise actions that can have potentially disastrous consequences.

A systematic analysis of journal articles will form the second part of the research and investigate how the post-truth era has introduced a new way of devaluing the worth of scientific expertise, framed within the context of the post-factual debate on the effectiveness and safety of the MMR vaccine that is at the centre of anti-vaccination rhetoric. The systematic literature analysis will be led by Kata’s (2012) theory of a new postmodern medical paradigm that has emerged from Web 2.0 and is responsible for behavioural changes towards public health. The dissertation will conclude by considering how the discipline and profession of Library and Information Science (LIS) can overcome the post-factual debate on the effectiveness and safety of the MMR vaccine.
1.3 Overall Research Aim and Individual Research Questions

The overall aim of this dissertation is two-fold:

1.) To develop an understanding of how a rapidly changing information environment has led to the emergence of a post-truth era in which the rational, evidence-based domain of healthcare is under assault from the anti-vaccination rhetoric of the MMR-autism controversy.

2.) To develop an understanding of how the post-factual characteristics of the vaccine debate are producing information pathologies of decision-making that are influencing the uptake of the MMR vaccine.

The objectives of the dissertation are to answer the following research questions (RQ):

RQ1 How has the anti-vaccination movement and the dissemination of false and misleading information about the MMR vaccine been exacerbated by the changing information environment, and how do information pathologies contaminate decision-making that can result in vaccine hesitancy?

RQ2 What are the characteristics of the post-factual vaccine debate that are driving behavioural changes towards public health, and why is the post-truth era and a post-factual society nurturing vaccine hesitancy towards the MMR vaccine?

RQ3 As a result of these research questions, how can LIS practitioners in their roles as providers of information overcome the post-factual debate on the effectiveness and safety of the MMR vaccine?

In order to answer RQ1, it would be difficult to gain a deeper understanding of the social phenomenon of vaccine hesitancy without historical context that traces the beginning of the anti-vaccination movement to the present-day controversy surrounding the MMR vaccine; and without understanding how the creation, dissemination and use of false and misleading information about vaccines has been exacerbated by information communication technologies (ICTs), it would be difficult to understand why vaccine hesitancy has become a threat to global health. It would also be difficult to understand the roots of vaccine hesitancy without first understanding how information pathologies are entwined with the quality and quantity of information provision, and how they can distort problem-solving and decision-making.
In order to answer RQ2, it would be difficult to gain a deeper understanding of vaccine hesitancy without understanding the implications of the post-truth era and identifying the characteristics of the post-factual vaccine debate. A systematic analysis of literature that investigates how the post-truth era has introduced a new way of devaluing the worth of scientific expertise within the context of the post-factual debate on the MMR vaccine will therefore be undertaken. The literature analysis will be framed by Kata’s (2012) theory of a new postmodern medical paradigm that has emerged from Web 2.0 and is responsible for behavioural changes towards public health. The dissertation will conclude by suggesting that the development of information fluency and the evolution of digital literacy is a way that LIS can overcome the post-factual debate on the effectiveness and safety of the MMR vaccine (RQ3).

1.4 Outline Research Methods
This dissertation will depend on a review of relevant literature (RQ1), and a case study that exclusively utilises document analysis (RQ2). The secondary data for the literature review will consist of journal articles and webpages. The secondary data for the case study will utilise journal articles selected from the electronic database: MEDLINE Complete.

Pickard (2013) suggests that the case study is the most suitable research strategy when the aim of the research involves a holistic, in-depth investigation of a phenomenon. Rowley (2002) tells us that holistic case studies investigate the case as one unit, focus on broad issues, and offer a birds-eye perspective of the case. O’Leary (2004) informs us that document analysis can be understood as both a data collection method and a framework for data analysis. The process of moving from raw data to meaningful understanding relies on the exploration of relevant themes, identified by engaging with the literature and shaped by the research question.

Bowen (2009) describes document analysis as a systematic and replicable research technique for reviewing or evaluating documents for qualitative research that incorporates elements of both content analysis and thematic analysis. The purpose of document analysis is to examine and interpret data in order to draw out meaning, attain understanding and develop knowledge acquired by empirical study. Chapter 3 contains the full details of the research strategy and a justification for all the chosen research methods.

1.5 Value of this Research
Understanding the implications of the post-truth era in which the rational, evidence-based domain of healthcare is now under assault from the anti-vaccination rhetoric of the MMR-
autism controversy is an area worthy of study. It is also a timely study now that vaccine hesitancy has been identified as one of the top ten threats to global health by the WHO. The phenomenon of vaccine hesitancy is at the forefront of current global health concerns because of the resurgence of measles in countries where the disease was previously eradicated. Examining the post-factual characteristics of the vaccine debate and how they are producing information pathologies of decision-making that are influencing the uptake of the MMR vaccine is also particularly relevant from an LIS perspective.

This research may contribute to helping LIS practitioners and professionals from other disciplines in overcoming the issue of alternative facts in their roles as providers of information, particularly within a healthcare environment. Bawden (2017) maintains that the response of LIS practitioners needs to be distinct from the social and political ideas that we may individually or collectively be aligned with, and this response in itself would not be a remedy for all the difficulties created by the post-truth era. However, to be able to provide an LIS perspective on the post-factual debate on the effectiveness and safety of the MMR vaccine may prove valuable for future research. This research could continue to examine information pathologies as a distorting influence on decision-making, and its impact on the well-being of individuals, organisations and societies.

1.6 Outline Chapter Structure
Chapter 1: Introduction
This chapter contains background information on the decline in public confidence around vaccination; the global resurgence of measles; and the rise of vaccine hesitancy as a consequence of the anti-vaccination movement and ‘post-truth’ era. The focus of this research discusses how the shift towards greater user-generated content of Web 2.0 has also brought with it concerns surrounding the creation, dissemination and use of false and misleading health content; the emergence of a new postmodern medical paradigm that nurtures vaccine scepticism; and the processing of uncorroborated sources of information that result in information pathologies of decision-making that can become a distorting influence. The overall research aim and individual research questions are also identified, and the research methods are outlined.

Chapter 2: Literature Review
This chapter traces the history of the anti-vaccination movement to the present-day controversy surrounding the MMR vaccine that is at the centre of anti-vaccination rhetoric. This chapter also identifies the key beliefs associated with vaccine hesitancy towards the MMR vaccine, outlines the real-world consequences of the current measles pandemic, and
looks at the role of new forms of information sharing that have become pervasive on the Internet. The chapter concludes by considering how information pathologies can contaminate decision-making and result in unwise actions that can have potentially disastrous consequences.

Chapter 3: Research Methods
This chapter discusses and justifies a case study approach as the chosen research strategy and provides details of the case study design. This chapter also discusses and justifies document analysis as both the data collection method and framework for data analysis to be adopted. The potential limitations and problems of the case study design are discussed, in terms of its credibility and reliability because it utilises qualitative data and interpretative methods; and in terms of its validity because it lacks triangulation of multiple sources of data. The potential limitations of document analysis as a data collection method are discussed, in terms of its biased selectivity; and the potential problems of document analysis as an interrogation tool are also discussed, in terms of examining aspects of communication that are more subtle and intricate.

Chapter 4: Case Study Findings
This chapter reveals the findings of the case study described in Chapter 3, and develops the research initially addressed by the literature review in Chapter 2. The case study focuses on vaccine hesitancy towards the MMR vaccine as a consequence of the post-truth era and investigates the characteristics of the post-factual vaccine debate on the MMR vaccine. Documents were retrieved from the electronic database: MEDLINE Complete, and a superficial examination of 700 articles was undertaken. 14 articles were selected that met the inclusion criteria and a thorough examination of these articles was undertaken using thematic analysis to reveal the main characteristics of the vaccine debate. An interrogation of the literature attempts to analyse and explain these characteristics in greater detail, and explain why the post-truth era and a post-factual society is nurturing vaccine hesitancy towards the MMR vaccine.

Chapter 5: Conclusion
This chapter revisits the overall research aim and presents a summary of the findings for RQ1 and RQ2, and a conclusion for RQ1 and RQ2. The dissertation concludes by addressing RQ3 and considers the idea of sufficient ‘stewardship’ over the information environment as one of the keys to overcoming the post-factual debate on the effectiveness and safety of the MMR vaccine. This incorporates the development of information fluency around the new digital environment and the new forms of digital documents that are emerging, and the evolution of
digital literacy to develop skills that are required to access, navigate and contribute to the new information environment. Finally, a *self-reflection* is included that provides the reader with a personal reflection on the changes that were made from the original dissertation proposal and the process undertaken to complete the research journey.

**Chapter 6: References**
This chapter contains a listing of all the sources referred to in this dissertation. They are presented in alphabetical order by surname and use the Harvard (author-date) system of referencing.
Chapter 2: Literature Review

2.1 Introduction

This literature review will trace the rise of the anti-vaccination movement from its beginning in the 18th century to the present-day MMR-autism controversy at the centre of anti-vaccination rhetoric; outline the real-world consequences of the current measles pandemic; identify the key beliefs associated with vaccine hesitancy towards the MMR vaccine; look at how the creation, dissemination and use of false and misleading information about vaccines has been exacerbated by information communication technologies (ICTs); and consider how information pathologies can contaminate decision-making and result in unwise actions that can produce potentially disastrous consequences such as vaccine hesitancy. The study within this review of literature focuses on RQ1 below. RQ2 will be achieved through a case study that utilises document analysis to systematically collect and analyse journal articles retrieved from the electronic database: MEDLINE Complete. RQ3 will be answered as a result of the findings from RQ1 and RQ2, and will conclude the dissertation.

RQ1 How has the anti-vaccination movement and the dissemination of false and misleading information about the MMR vaccine been exacerbated by the changing information environment, and how do information pathologies contaminate decision-making that can result in vaccine hesitancy?

RQ2 What are the characteristics of the post-factual vaccine debate that are driving behavioural changes towards public health, and why is the post-truth era and a post-factual society nurturing vaccine hesitancy towards the MMR vaccine?

RQ3 As a result of these research questions, how can LIS practitioners in their roles as providers of information overcome the post-factual debate on the effectiveness and safety of the MMR vaccine?

By investigating the above area of research (RQ1), it is hoped that a useful contribution will be made to understanding why anti-vaccination sentiment has persisted for over two hundred years, and how the information environment of the 21st century has strengthened anti-vaccination rhetoric and given rise to the phenomenon of vaccine hesitancy. It is also hoped that a useful contribution will be made to understanding how ‘information pathologies’ are entwined with the quality and quantity of information provision, how they can distort decision-making, and how they are instrumental in producing the phenomenon of vaccine hesitancy.
At the end of this chapter it is hoped that a critical understanding of the key issues are presented so that the reader will be more knowledgeable in this area. It is also hoped that a clear focus and justification will emerge for the case study that will investigate why vaccine hesitancy towards the MMR vaccine can also be considered a consequence of the post-truth era in which every fact has become open to debate (RQ2). A useful starting point is to examine the anti-vaccination movement from a historical perspective in order to place into context the phenomenon of vaccine hesitancy that the WHO has identified as one of the top ten threats to global health.

2.2 A Brief History of the Anti-vaccination Movement
The history of the anti-vaccination movement begins in France in 1763 when inoculation was introduced to Paris by the Italian physician Angelo Gatti. As there was no official quarantine strategy, people who had been inoculated risked the health of other Parisians which led to the French government banning inoculation altogether in Paris (Kirkpatrick, 2019). In England in the 18th Century, Hussain et al. (2018) note that opposition towards vaccines manifested in the theological arguments of Reverend Edmund Massey who declared that vaccines opposed God’s punishments upon mankind, and in the United States, Reverend John Williams decried that vaccines were the work of the devil.

In the late 1790s, outbreaks of smallpox were devastating Europe, killing approximately 400,000 people a year and causing disfigurements and blindness in many others. Edward Jenner’s cowpox experiments demonstrated that a child could be protected from smallpox if they were infected with lymph from a cowpox pustule (Figure 1). Jenner published his research in 1796, and by the turn of the century, over 100,000 people had been inoculated against smallpox in Europe.

Figure 1: Dr Jenner performing his first vaccination, 1796. Credit: Wellcome Collection. CC BY 4.0
Around the same time, the first anti-vaccination propaganda appeared in France in the form of a disturbing caricature (Figure 2) that illustrated the public’s distrust of vaccination (Watling, 2019). Jenner’s contribution to science was a turning point in the history of vaccination that led to the first large-scale inoculations, but from the very beginning his novel ideas faced public criticism based on religious, scientific, sanitary and political arguments. In addition to this, many people maintained that their personal liberty was being violated, a situation that was exacerbated by mandatory vaccine polices that were introduced by the British Government in the mid-19th century (The College of Physicians of Philadelphia, 2018).

Figure 2: A diseased woman turning into a mermaid, a physician riding a cow and an apothecary wielding a syringe form a grotesque procession that scares children; referring to the distrust of the French public in the face of vaccination. Coloured etching. Credit: Wellcome Collection. CC BY 4.0

The National Anti-Vaccination League formed in London in the late 19th century after laws were passed that made child vaccination mandatory and introduced penalties for non-compliance. The League saw itself as a protector of people’s liberties that were under attack from the compulsory vaccination laws that had been passed by the British Government (Hussain et al., 2018). The Vaccination Act of 1853 required infants up to 3 months of age to be vaccinated, and the Act of 1867 increased this age to 14 years which included punishments for vaccine refusal. In response to the mandatory laws by citizens who demanded the right to have control over their bodies and those of their children, anti-vaccination organisations began to form, and many anti-vaccination journals began to appear that contained depictions of anti-vaccination propaganda (Figure 3) (The College of Physicians of Philadelphia, 2018).
In England in 1885, Leicester was a popular meeting point for anti-vaccination leagues who organised a demonstration march supported by tens of thousands of protestors who carried anti-vaccination banners, children's coffins, and burnt an effigy of Edward Jenner (Kirkpatrick, 2019). General opposition to vaccines lead to a commission designed to study vaccination and, in 1896, the commission suggested that although vaccination protected against smallpox, penalties for failing to vaccinate should be removed. The Vaccination Act of 1898 discarded penalties and introduced a ‘conscientious objector’ clause that allowed parents who were opposed to vaccination to acquire an exemption certificate (The College of Physicians of Philadelphia, 2018).

Vaccination entered a ‘Golden Age’ during the 20th Century with a profusion of new vaccines developed to protect children against life-threatening diseases such as polio, measles and rubella (RSPH, 2019). By 1924, new vaccines were available for tuberculosis, tetanus, diphtheria and smallpox, and vaccines were being developed for polio, typhoid, influenza and whooping cough (Kirkpatrick, 2019). However, since Edward Jenner’s cowpox experiments
first made large-scale inoculation possible, times have changed but the emotions and deep-rooted beliefs that underlie opposition to vaccines has endured and remain relatively unchanged (The College of Physicians of Philadelphia, 2018). Criticism towards vaccines can also originate, as Kata (2010) points out, from within the scientific community as Andrew Wakefield’s MMR paper demonstrated, single-handedly reinforcing public distrust of the scientific community at the end of the 20th Century.

2.3 Wakefield and the MMR-autism Controversy
In 1998, a study by Andrew Wakefield that incorrectly claimed a link between the MMR vaccine and autism was published in *The Lancet*, a highly respected peer-reviewed medical journal. The repercussions of Wakefield’s study, although discredited and thoroughly debunked by later studies, was extremely damaging and the myth spread around the world, particularly to Western Europe and North America. In the UK, MMR vaccine uptake dropped from 92% in 1996 to 84% in 2002, and in 2003, MMR uptake was as low as 61% in certain parts of London (Hussain et al., 2018).

Bricker and Justice (2019) assert that Wakefield’s paper was scientific rubbish, characterised by an extremely small sample size, the deliberate alteration of the medical history of patients included in the study, and a conflict of interest with the research funding that he failed to disclose. Unfortunately, Wakefield’s study was successful in influencing many parent’s attitudes towards the MMR vaccine, as well as towards vaccines in general. The UK and US mainstream media repeatedly and sensationaly reported the claims of Wakefield’s study over the years, until *The Lancet* fully retracted his paper in 2010. The repeated and sensationalised media coverage of the study meant that the public received information uncritically, and many people, particularly parents of autistic children, accepted Wakefield’s claim of a link between the MMR vaccine and the development of autism (Poland and Spier, 2010). Despite the thorough debunking of Wakefield and his findings, this study became the defining moment in the modern-day anti-vaccination movement. Wakefield continues to be viewed as a persecuted hero by an influential group of anti-vaccinators who prolifically spread his scientifically inaccurate and disproven message (Bricker and Justice, 2019).

2.4 Vaccine Hesitancy and the Resurgence of Measles
Vaccine hesitancy is generally understood as the refusal or delay in the acceptance of vaccines, regardless of the accessibility of vaccination services (Rossen et al., 2019). Anxiety around vaccines is not a new phenomenon, but their uptake has mostly been far-reaching enough to put an end to both deadly and debilitating infectious diseases. However, an increasing volume of studies is highlighting that in both wealthier and poorer countries, people
are losing confidence in certain vaccines to the extent that they are deciding not to vaccinate their children (Gallup, 2019).

UNICEF estimate that worldwide, 169 million children did not receive their first injection of the measles vaccine between 2010 and 2017. In the UK, the figure is estimated to be around 500,000, putting it behind France with 600,000 and the US with 2.5 million, making the UK the third highest in high-income nations for children missing out on their first MMR shot. The full course of the MMR vaccination requires two shots, the first of which is administered between 12 and 15 months of age, and the second between 4 and 6 years of age. UNICEF estimate that a 110,000 people, many of them children, died from measles in 2017 which is a 22% increase from 2016. During the first three months of 2019, there were 110,000 measles cases reported worldwide, an almost 300% increase from the same time-frame of 2018. The WHO suggests that between two to three million deaths are prevented each year because of vaccination programmes, so it is therefore logical that vaccine hesitancy is a health risk to children and to the wider society (Astrup, 2019).

Common misconceptions associated with vaccine hesitancy include beliefs that vaccines contain harmful ingredients, they can overload a child’s immune system, and because of the decrease in many vaccine-preventable diseases, immunisation is not necessary. Other key determining factors of vaccine hesitancy are a lack of trust in the pharmaceutical industry and government agencies, and a lack of trust in healthcare professionals. A further catalyst that drives vaccine hesitancy as well as vaccine controversy is the divided opinion over the effectiveness and safety of vaccines from both the general public, and certain practitioners from within the scientific community. For any relevant, present-day discussion that considers the causes for vaccine hesitancy, this discussion will need to look at the role of new forms of information sharing that have become pervasive on the Internet (Yiannakoulia et al., 2018).

2.5 The Changing Information Environment
The Internet became a significant provider of news and information in the 1990s when Netscape introduced the first web browser in 1994. Google quickly rose to dominate Internet searches in the early 2000s, and the advent of social media continued to expand the influence of the Internet, populating it with opinion and commentary (Iyengar and Massey, 2018). In recent years, the rapid increase in the use of social media and social networking sites by individuals and organisations has meant that online interaction has become a part of daily life for billions of people who post their opinions, thoughts or feelings on nearly all aspects of life. The way people communicate is becoming transformed by social media, both in their daily
lives, but also during times of crisis or extreme circumstances when public health is under threat (Ahmed et al., 2017).

The changing information environment has been created by the emergence of new information communication technologies (ICTs), and this has deep implications for society and the provision of information. The Internet is the most important among the new ICTs and is generally considered a democratising medium and positive influence upon society. This is because its connections are decentralised and there is not one single machine or network that can be said to control its operation. However, the Internet also exhibits negative qualities, most notably its vast volume of material that is generally considered to be of substandard quality that contains partial, biased and inaccurate information (Robinson and Bawden, 2001).

The advent of online media has profoundly changed the way that we debate and form our opinions, but despite early optimism about this decentralised and democratic information environment, the online world seems to draw out the worst of human instincts. We congregate in tribes that protect us from disagreement and reaffirm our beliefs, inhabiting 'echo chambers' that foster confirmation biases and reinforce existing world views. Developing simultaneously in this online world is an increasing reduction in the credibility and quality of available information that is characterised by biased narratives, fake news, conspiracy theories and paranoia (Törnberg, 2018).

The arrival of the participatory Internet, sometimes referred to as Web 2.0, has created a shift towards information generated by a broader range of content creators who are largely non-institutional and independent. However, this shift towards greater user-generated content also raises concerns around the increased sharing of misleading health content that accompanies the growth of participatory social networking sites such as Facebook, Twitter and Instagram (Yiannakoulia et al., 2018). Iyengar and Massey (2018) suggest that misleading information on the Internet is comprised of three overlapping forms: fake news which is deliberately fabricated information constructed to imitate mainstream media content and spread lies; misinformation which is false and misleading information that is spread without the intention to deceive; and disinformation which is false information that is spread specifically with the intention to deceive.

Kata (2010) reminds us that the Internet has been labelled a modern-day ‘Pandora’s Box’ because of the availability of deceptive and inaccurate information online, and because of its nature to permit any opinion to spread far and wide, and almost instantaneously. The predominant lack of filtering or reviewing of online messages is something that anti-
vaccination advocates have taken advantage of. Anti-vaccination messages are more common online than any other type of media, and this increases the likelihood that decisions about vaccination are based on misleading information.

2.6 Information Pathologies
The term, ‘information pathologies’ was coined by Harold L. Wilensky in 1967 which he used interchangeably with the term, ‘intelligence failures’ to describe various inadequacies and deficiencies of knowledge production. Information pathologies can develop, Scholl (1999) suggests, from many circumstances and their causes can be found, for example, in the failure of an individual to exhibit problem awareness, or from being lost in a fantasy. Browne et al. (2017, p.2) define information pathologies as:

‘distortions in information search, analysis, use, or sharing, that result from the cognition or motivation of human actors in decision-making contexts’.

The knowledge needed to make good decisions, Scholl (1999) points out, is advanced by relevant information, but information pathologies can contaminate decision-making and result in unwise actions that can have potentially disastrous consequences. The integration of relevant pieces of information allows human knowledge to develop, but information pathologies delay, bias, or even prevent the acquisition of knowledge that is required for good decision-making and problem-solving.

Restian (1997, cited in Hanson, 1998) explains that the human brain and nervous system is an informational system that, through selection and interpretation, allocates relative value and emotional importance to information received. Although absolutely necessary, in certain conditions information can become a source of illness by virtue of its quality or quantity. As information can become a pathogenic factor, it is therefore included with other pathogenic factors that can assault a person’s health. As Weiland (2017) notes, information can be heavily loaded with pathologies that are related to its quality or quantity, and this can produce information pathologies such as the phenomenon of information overload.

Contrary to popular belief, Bawden and Robinson (2009) observe that information pathologies are not a recent phenomenon and a consequence of the World Wide Web, but rather perennial problems that can be identified at many different times throughout history. However, these ‘information problems’ that are entwined with the quality and quantity of information provision have been exacerbated by recent developments in technology, and new information pathologies will continue to emerge as the information environment changes.
2.7 Summary and Emerging Issues

The review of literature revealed that:

- Fear-based myths about vaccines began long ago and persist to this day.
- Wakefield’s MMR study and the subsequent mainstream media coverage managed to have a devasting impact on the uptake of the MMR vaccine in certain parts of the world, and on vaccine discourse in general.
- Lower rates of parental vaccine acceptance and heightened anti-vaccination sentiments present significant risks to public health.
- During the first three months of 2019, there were 110,000 measles cases reported worldwide, an almost 300% increase from the same time-frame of 2018.
- There are many worrying issues surrounding the quality of content on the web that has emerged because of the democratic nature of online content creation.
- The increasing dominance of social media in the present-day information environment has produced the phenomenon of the ‘echo chamber’ that is strengthening and amplifying deeply entrenched personal beliefs.
- Information pathologies can delay, bias, or even prevent the acquisition of relevant knowledge that is required for good decision-making and problem-solving.
- Information pathologies can develop from the failure of an individual to exhibit problem awareness, or from being lost in a fantasy.
- The Internet and Web 2.0 plays a significant role in the dissemination of anti-vaccination information and has been labelled a modern-day ‘Pandora’s Box’ because of its nature to permit any opinion to spread far and wide, and almost instantaneously.

It is hoped that a clear focus and justification has emerged for the research into why vaccine hesitancy towards the MMR vaccine can also be considered a consequence of the post-truth era in which every fact has become open to debate. Specifically, this research will investigate the post-factual characteristics that attack the value of scientific truth within the context of the post-factual debate on the effectiveness and safety of the MMR vaccine. The next stage of this research will present the research methods to be adopted, including details on the research strategy, research design, data collection method, and framework for data analysis.
Chapter 3: Research Methods

3.1 Introduction
This dissertation has a number of inter-related research questions set within the context of the phenomenon of vaccine hesitancy and the post-factual debate on the effectiveness and safety of the MMR vaccine:

RQ1 How has the anti-vaccination movement and the dissemination of false and misleading information about the MMR vaccine been exacerbated by the changing information environment, and how do information pathologies contaminate decision-making that can result in vaccine hesitancy?

RQ2 What are the characteristics of the post-factual vaccine debate that are driving behavioural changes towards public health, and why is the post-truth era and a post-factual society nurturing vaccine hesitancy towards the MMR vaccine?

RQ3 As a result of these research questions, how can LIS practitioners in their roles as providers of information overcome the post-factual debate on the effectiveness and safety of the MMR vaccine?

A valuable aspect to this research relates to RQ2 and provides an opportunity to study vaccine hesitancy as a consequence of the post-truth era in which every fact has become open to debate. RQ1 was initially addressed by the literature review in Chapter 2; RQ2 develops this research further through the systematic collection, review and interrogation of journal articles retrieved from the electronic database: MEDLINE Complete. The focus of this database search is to select documents that draw attention to the characteristics of the post-factual vaccine debate that attack the value of scientific truth, specifically within the context of the MMR vaccine and the resurgence of measles. The documents will be reviewed and analysed, the post-factual characteristics of the vaccine debate will be identified, and the findings will be presented and discussed in detail. The research is led by Kata’s (2012) theory of a new postmodern medical paradigm that has emerged from Web 2.0 and is responsible for behavioural changes towards public health. Postmodernism, Bricker and Justice (2019) contend, is an intentionally slippery term, but when applied to medicine, the postmodern medical paradigm has three defining characteristics: aversion to singular truths; hostility towards scientific objectivity; and lack of trust in expertise.
This chapter will provide details of the research strategy to be adopted for addressing the research issues identified above, together with the other research methods for collecting and analysing the data. The potential limitations and problems with the chosen research methods will also be discussed.

3.2 Research Strategy
The research strategy that will be used to carry out the research is a case study. This raises the question: ‘What is a case study approach and why is it suitable for this research?’ In attempting to answer this question, Pickard (2013) suggests that defining a case study is not as easy as other research strategies because the form and nature of the strategy is both the process engaged with to investigate a phenomenon, and the writings that are produced as a result of that investigation. However, a case study should function specifically within well-defined boundaries and be governed by the purpose of the investigation.

In order to decide whether a case study can be helpful for a particular type of investigation, Rowley (2002) identifies three factors that need to be considered to determine the most appropriate research methodology: the type of research question to be addressed; the degree of influence that the researcher has over behavioural events; and the extent of the focus on present-day events rather than historical events. ‘The case’ to be investigated, Denscombe (2017) contends, is not an artificially generated situation for the purposes of the research, but rather a naturally occurring phenomenon that already exists and will continue to do so after the research is completed. Indeed, an important strength of the case study approach, Rowley (2002) explains, is the ability to investigate a phenomenon within its context so that reproducing the phenomenon in an experimental environment becomes unnecessary in order to understand it better. To this end, a case study is a useful way of examining the world before us.

The point of the case study, Denscombe (2017) remarks, is to cast light upon the general by focusing on the specific. Case studies look at one, or sometimes several instances of a specific phenomenon in order to provide a thorough account of the processes, experiences, relationships or events that are happening in that specific instance or instances. However, there is a much greater opportunity to gain valuable insights into a phenomenon by taking the strategic decision to investigate one instance in-depth, rather than investigating several instances that might produce more superficial findings overall. Case studies can follow an inductive logic that describes a situation in detail, compares available possibilities, or explores specific aspects of a situation; or case studies can sometimes follow a deductive logic that is
used to test a theory in order to see if the theory predicts what is happening in a real-world setting.

Rowley (2002) concludes that the research question is the most significant factor for deciding the most suitable case study approach, and questions that concentrate on ‘who’, ‘what’ and ‘where’ can be applied to descriptive, exploratory or explanatory research. Descriptive and explanatory case studies require propositions that are translated from the research questions. They are speculative in nature, and based on an earlier review of literature and any other evidence that points to what the findings of the research are expected to be. The data collection and analysis can then be constructed to corroborate or contradict the research propositions.

As part of the investigation, Denscombe (2017) observes that the case study approach allows the researcher to utilise qualitative or quantitative data, and combine different research methods such as observation, questionnaires, interviews and documents. One of the strengths of the case study approach is that it permits the utilisation of many different methods that are determined by the circumstances and particular requirements of the situation. The ultimate purpose of a case study, Pickard (2013) reveals, is to give a holistic report of the case and provide an in-depth understanding of a particular phenomenon that is transmitted through descriptions grounded in context.

3.3 Research Design
In order to answer RQ2, the approach of this case study focuses on the phenomenon of vaccine hesitancy towards the MMR vaccine and takes the strategic decision to investigate one instance of this phenomenon in-depth: the characteristics of the post-factual vaccine debate that are driving behavioural changes towards public health. It is hoped that by providing a thorough account of the processes and relationships that are happening in this single instance, further valuable insights will be gained into understanding the phenomenon of vaccine hesitancy towards the MMR vaccine. This case study is a descriptive and explanatory piece of research on a contemporary phenomenon in which the behaviour under study cannot be influenced by the researcher. The case study follows a deductive logic and is led by Kata’s (2012) theory of a new postmodern medical paradigm that has emerged from Web 2.0 and is responsible for behavioural changes towards public health.

3.4 Data Collection Method
The data collection method that will be exclusively utilised to carry out the research is document analysis. This raises the question: ‘What is document analysis and why is it suitable
as the exclusive data collection method for the case study to be undertaken?’ In attempting to answer this question, O’Leary (2004) informs us that document analysis refers to documents as a source of data and is similar to data collected in surveys, interviews and observation. However, the main distinction between document analysis and other sources of data is that the documents have not been created by the researcher, and exist as pre-produced texts.

Whereas document analysis usually supplements other sources of data, Bowen (2009) asserts that document analysis can also be applied as a stand-alone data collection method for specialised forms of qualitative research that depend entirely on the analysis of documents. Moreover, for certain projects, Duffy (2005) notes that document analysis can be exclusively utilised as a data collection method when gaining access to the subjects of the research proves challenging, or is simply not possible.

In order to undertake document analysis, O’Leary (2004) points out that the researcher needs to plan for all eventualities; collect documents; review their trustworthiness; reflect on any problems associated with collecting the data; interrogate the evidence; refine the interrogation process; and undertake appropriate analysis of the data. The role of the researcher is therefore restricted to the collection, review, and interrogation of pertinent documents. For this reason, document analysis can be understood as both a data collection method and a framework for data analysis.

Mogalakwe (2006) identifies two types of documents utilised in document analysis. Primary sources refer to documents that describe first-hand accounts of events, whereas the background and importance of events, and the evaluation of the processes after events have manifested, is established by secondary sources. O’Leary (2004) reveals that documents suitable for analysis can also be authoritative, and authoritative sources include documents that attempt to be unbiased and objective through their authorship and authority. These types of documents include journals, independent enquiries and reports that are categorised as secondary sources of data.

The advantage of using documents in the qualitative research process, Karpinnen and Moe (2011) contend, is their relatively unobtrusive nature in which the data is found instead of created through the researcher’s involvement in the area of study. Documents are waiting to be selected and analysed, and the creation of the collected material has not been affected by the researcher, so in this sense, documents are created under natural conditions. However, documents are not protected from the intervention by the researcher, so in this sense they are not natural and therefore require methodological awareness.
3.5 Database Search

In order to undertake the data collection for the proposed case study, secondary sources of data in the form of journal articles will be retrieved from the electronic database: MEDLINE Complete. The following Boolean search string will be used to search for the documents:

    mmr vaccine OR post-factual OR post factual OR post-truth OR post truth

The publication date range will be restricted to 2014-2019, the language will be restricted to English, and the publication type will be restricted to academic journal articles. The trustworthiness of this literature will be reviewed, and any problems associated with the collected literature will be reflected upon.

3.6 Framework for Data Analysis

As mentioned earlier, document analysis is also the framework to be utilised for the interrogation of the collected literature, and in its function as an interrogation tool, document analysis also incorporates elements of content analysis and thematic analysis. Bowen (2009) describes document analysis as a systematic and analytical procedure for reviewing and evaluating documents for qualitative research. The purpose of document analysis is to examine and interpret data in order to draw out meaning, attain understanding and develop knowledge acquired by empirical study. The analytic process involves discovering; choosing; appraising; and synthesising data contained within documents. Document analysis can identify quotations, excerpts, or entire paragraphs of text that are then organised into categories, themes and case examples.

The analysis of documents, Prior (2008) suggests, is primarily concerned with what is contained within them and framed in this way, documents can be seen as conduits of communication that can contain meaningful messages. These messages are generally in the form of writing, but can also appear in other formats such as maps, photographs and moving images. Regardless of which form they inhabit, Denscombe (2017) proposes that a document possesses two qualities that are helpful in the context of research: it is evidence of something; and it represents if not a permanent record, a stable form that persists beyond the moment that it was produced.

Bowen (2009) explains that the appropriate analysis of data using document analysis involves three key stages: superficial examination; thorough examination; and interpretation in which this iterative process incorporates elements of both content analysis and thematic analysis.
Content analysis is the action of organising information into groups that are connected to the research question, and in the context of document analysis, involves a first-pass review of the documents in which relevant and meaningful text or other data are highlighted. Thematic analysis is a type of pattern recognition in which arising themes within the data become the categories for analysis, and this process involves a much more focused re-reading and reviewing of the data. The researcher constructs categories based on the characteristics of the data to reveal themes that are relevant to the phenomenon of interest.

Content analysis, Bawden and Robinson (2012) suggest, always involves a certain type of quantitative assessment of the content of documents in order to evaluate the extent that issues and concepts are stated or not stated. Content analysis can also contain a qualitative perspective in order to record how issues and concepts are described. Content analysis uses a method, Denscombe (2017) observes, that is both transparent and reproducible, at least in principle, by other researchers. Content analysis has the potential to reveal many hidden messages that are being communicated through the text, but is most effective when examining aspects of communication that are obvious and straightforward, rather than subtle and intricate.

### 3.7 Limitations and Potential Problems

Rowley (2002) asserts that the greatest challenge of case study research is to elevate the investigation from a descriptive report to a piece of work that can be considered as a valuable, if modest extension of existing knowledge on the topic of study. The disadvantage of the case study approach, Denscombe (2017) contends, is its vulnerability to criticism concerning the credibility of generalisable findings. Case study research is sometimes viewed as generating ‘soft data’ because it mostly utilises qualitative data and interpretative methods. In addition to this, Mogalakwe (2006) suggests that the reliability and validity of a case study is weakened if it lacks triangulation: the use of multiple sources of data to investigate the same phenomenon of interest. It is easier for researchers to transcend personal biases that can arise from research strategies that utilise a diverse range of evidence from different sources, and to succeed in dealing with the deficiencies that can flow from a single source of data.

Document analysis as a data collection method, Bowen (2009) maintains, has some potential flaws and limitations that are inherent in documents, such as retrieving them can be difficult, they can contain insufficient detail, and a collection of documents suggests biased selectivity. O’Leary (2004) identifies two potential sources of bias: the author’s bias of a pre-produced text, and the researcher’s bias of how they read and draw inferences from a pre-produced text. Defining the boundaries of the case study in a definitive way, Denscombe (2017) reveals,
can become problematic and present difficulties when deciding the inclusion and exclusion of data for the case study. When document analysis is functioning as an interrogation tool and incorporates elements of content analysis, Franzosi (2004) suggests that content analysis is most effective when examining aspects of communication that are obvious and straightforward, rather than subtle and intricate. When meanings conveyed by a text are more subtle and intricate, content analysis becomes a less valuable instrument for revealing the meaning of a text.

Holistic case studies, Rowley (2002) concludes, investigate the case as one unit, focus on broad issues, and offer a birds-eye perspective of the case; but holistic case studies can also become superficial. Case studies have long been considered as lacking objectivity and rigour, and this makes it important to carefully explain the research design and its execution. However, regardless of the ongoing scepticism surrounding case studies, they are still extremely popular because they can offer insights that might not be achievable with other research strategies.
Chapter 4: Case Study Findings

4.1 Introduction

This dissertation has a number of inter-related research questions set within the context of the phenomenon of vaccine hesitancy and the post-factual debate on the effectiveness and safety of the MMR vaccine:

RQ1 How has the anti-vaccination movement and the dissemination of false and misleading information about the MMR vaccine been exacerbated by the changing information environment, and how do information pathologies contaminate decision-making that can result in vaccine hesitancy?

RQ2 What are the characteristics of the post-factual vaccine debate that are driving behavioural changes towards public health, and why is the post-truth era and a post-factual society nurturing vaccine hesitancy towards the MMR vaccine?

RQ3 As a result of these research questions, how can LIS practitioners in their roles as providers of information overcome the post-factual debate on the effectiveness and safety of the MMR vaccine?

This chapter reveals the findings of the case study described in Chapter 3 and develops the research initially addressed by the literature review in Chapter 2 (RQ1). The case study focuses on the phenomenon of vaccine hesitancy towards the MMR vaccine as a consequence of the post-truth era in which every fact has become open to debate, and takes the strategic decision to investigate one instance of this phenomenon in-depth: the characteristics of the post-factual vaccine debate that are driving behavioural changes towards public health (RQ2). The findings of this case study present a thorough account of the processes and relationships that are happening in this single instance, and offers further valuable insights into the phenomenon of vaccine hesitancy towards the MMR vaccine.

The case study for RQ2 is a descriptive and explanatory piece of research, and follows a deductive logic led by Kata’s (2012) theory of a new postmodern medical paradigm that has emerged from Web 2.0 and is responsible for behavioural changes towards public health. The case study utilises document analysis as both the data collection method and framework for data analysis in order to systematically collect and analyse journal articles retrieved from the
electronic database: MEDLINE Complete. A useful starting point is to describe the inclusion criteria for the database search and the documents selected for analysis.

4.2 Database Search Results
The focus of this database search was to select secondary sources of data that draw attention to the characteristics of the post-truth era and the post-factual tendencies that attack the value of scientific truth, specifically within the context of the post-factual debate on the effectiveness and safety of the MMR vaccine. In order to undertake the data collection for the case study, documents were retrieved from the electronic database: MEDLINE Complete. The following Boolean search string was used to search for the documents:

mmr vaccine OR post-factual OR post factual OR post-truth OR post truth

The publication date range was restricted to 2014-2019, the language was restricted to English, and the publication type was restricted to academic journal articles. The search was run on the 8th December 2019 and returned 700 results. The inclusion criteria for the document analysis was very specific. Documents were included if they framed the resurgence of measles, the MMR-autism controversy, or vaccination more generally within the context of the post-truth era or post-factual society. A superficial examination of 700 articles was undertaken, and 14 articles were selected (Appendix A) that met the inclusion criteria.

4.3 Characteristics of the Post-Factual Vaccine Debate
A thorough examination of the 14 articles was undertaken using thematic analysis to reveal the characteristics of the post-factual vaccine debate on the MMR vaccine. The thematic analysis revealed the following characteristics:

- Based on fake science.
- Based on denial of vaccine effectiveness and safety.
- Based on the exclusion of factually-based evidence.
- Based on an increasing contempt for expert knowledge driven by Web 2.0 technologies and post-truth thinking.

The thematic analysis was followed by an interrogation of the literature that attempts to analyse the post-factual characteristics of the vaccine debate in greater detail and explain why the post-truth era and a post-factual society is nurturing vaccine hesitancy towards the MMR vaccine. These findings are presented in the following section.
4.4 Analysing the Characteristics of the Post-Factual Vaccine Debate

The term post-truth describes a situation in which debate is constructed by appeals to emotion and repeated claims of partial truths or outright falsehoods, and where factual counter-arguments are ignored. Post-truth declarations are increasingly targeting the sciences and have become a disreputable and unfortunate trend in human development that undermines science as a haven of truth and as a refuge for the general public (Grech, 2017). Post-truth can also be regarded as a virulent new type of a much older disease that has been weaponised by the Internet and social media (Hawkes, 2017).

The Internet has become an alternative source of health information for many people and a substantial proportion of the population now have access to the Internet to not only search for health-related information, but also to create and share their own user-generated content (Arede et al., 2019). The increasing contempt for expert knowledge has been encouraged by Web 2.0 in which the collapse of any division between professionals and laypeople continues to divide the views of the scientists from those of the public, and in which the perceived wisdom of the masses seemingly rules the Internet. The increasing dominance of social media in the present-day information environment has produced the phenomenon of the ‘echo chamber’ that is strengthening and amplifying personal beliefs while contributing to a rapid and deeper polarisation of opinions. This is nurturing an environment in which misleading, factually incorrect, or entirely fabricated information can attain a level of prominence that would have never been possible with previous communication technologies. One of the key symptoms of the post-truth era is the viral diffusion of fake news and its influence on Western societies, spread predominantly through social media (Numerato et al., 2019).

Since they both became globally interactive as a result of Web 2.0, science can be affected by fakery as much as everyday information. A vicious cycle of fake science and fake news is operating on an increasing scale now that every individual can potentially become a publisher and create and disseminate true or false information, almost instantaneously and on a global platform. This vicious cycle of fake science/fake news is subverting the trustworthiness of science and interfering with the ability of certain individuals to make evidence-informed healthcare decisions, and this can result in illnesses, permanent disabilities or death. This has never been more evident than with Wakefield’s fabricated scientific study that claims a link between the MMR vaccine and autism. Despite the proven effectiveness of the MMR vaccine, this lie continues and has not only resulted in record levels of measles outbreaks, but also acted as a catalyst for the wider phenomenon of vaccine hesitancy (Hopf et al., 2019).
One of the most significant outcomes of evidence-based medicine has been the development of systematic reviews and clinical guidelines that lead to advances in healthcare practice, but in the post-truth era, lies become facts and confusion reigns over reality, and this is occurring in the domain of healthcare. One of the most damaging effects of post-truth has been the positive impact on the anti-vaccination movement and the negative impact on public health. (Barry et al., 2018). The anti-vaccination movement has become a disturbing development in society that claims that vaccination is dangerous and ineffective, opposing strong scientific evidence that proves these claims to be false. The anti-vaccination movement draws its strength from the post-truth world that supports alternative facts and fake news, and rejects the systematic and rational approach of trusted scientific methods that have been developed over the last three hundred years (Munk and O’Keeffe, 2017).

The emergence of populist movements throughout the world is synonymous with the post-truth era and is challenging scientific credibility, and undermining basic scientific tenets such as the effectiveness and safety of vaccines. Populist movements provide answers to complex problems by offering oversimplified solutions, favouring sensationalism and opinions over facts. Populist movements propagate anti-science campaigns, and anti-science campaigns are often aligned with conspiracy theories about the pharmaceutical industry (Capua, 2018). The power of populist movements is drawn from mass opinion, and populist movements separate society into two opposing sides: the virtuous, common people versus the vile, corrupt elite. These movements result in a perceived ‘middle’ that are politically powerful and utilise social media for their political purposes. People who are not identified as belonging to the ‘middle’ are generally on the fringes of society and are ignored, criticised or politically disenfranchised. They are more likely to accept fake news, alternative facts and distorted claims that reinforce populist power (Sparks, 2017).

Fake science can emerge from either fraudulent science, or from the politicisation of science for personal gains. The relegation of actual truth to a level of secondary importance is an idea that is inconceivable in the sciences, but post-truth deliberately reverses, disguises, obscures or distorts the meaning of words. The modern version of this false discourse is referred to as ‘alternative facts’, and are promoted by the spreading of fake news that consists of false and misleading content (Grech, 2017). The concept of alternative facts is abhorrent to scientists who accept that facts, although not absolute values, can still be measured, reproduced and validated. Facts can of course be subject to alternative interpretations without disputing their truthfulness, but the greater the divergence, the more likely that the theory belongs in the domain of politics rather than the domain of science. There will always be the possibility for statements that claim to be true to contaminate the public record, such as the debate
surrounding the MMR-autism controversy (Griffiths, 2017); but in spite of the overwhelming medical evidence that the MMR vaccine does not cause autism, it is unclear if this scientific fact is having a beneficial effect on the minds of concerned parents who are exhibiting vaccine-hesitant behaviour. There is a growing tension between respecting and understanding vaccine-hesitant views, and an understanding of the science that proves those views to be incorrect. The resurgence of measles is an unfortunate consequence of widespread public distrust, and the ideological dismantling of social institutions (Campbell-Scherer, 2019).

The emergence of populist movements in many countries has resulted in political consequences that are aligned with particular elites who dismiss evidence, or are unable to take accountability when the evidence contradicts their own version of events. They are not concerned about marginalisation and real disadvantage, leading to trust in politics becoming eroded and demonstrating that while populism is ultimately still a part of democracy, movements such as these present a significant challenge to democratic politics that are genuine. This populist shift that has occurred in many countries can be understood as the emergence of a post-truth era. This new political landscape in which post-truth arguments contest the truth, or downgrade it to something that is unimportant, challenges the evidence-based position of healthcare and raises serious concerns about the integrity of research and the role of science (Sparks, 2017).

We live in an era in which personal belief has replaced evidence-based facts, and in which pseudoscience is diametrically opposed to the scientific method. Pseudoscience emerges when other sources of knowledge that includes personal belief take on the role of science itself. Pseudoscience is characterised as exaggerated and unproven claims that are reliant on confirmation bias instead of a thorough attempt to prove a theory wrong, and lack systematic practices or an openness to evaluation by other experts. As a way of disseminating misleading information, social media and other Web 2.0 technologies have allowed these approaches to obtain exaggerated attention, promoting personal belief to the rank of science and strengthening the presence of pseudoscience. Questioning the effectiveness and safety of vaccination has become a symptom of the post-truth era in which scientific facts appear to be weaker than personal belief, and the route to safe, evidence-based practice has become obscured (González-Méjome, 2017).

Science denial has a long history, but within the changing information environment and post-truth world, evidence-based conclusions now appear to be increasingly threatened from emotion-driven beliefs and isolated personal experience. Science denial that manifests in anti-vaccination movements and the post-factual vaccine debate in which scientific facts are
disputed, are based on pseudoscience that to a large extent stems from Andrew Wakefield’s scientifically discredited and debunked MMR paper that was eventually retracted in 2010 (Nature, 2018). The link between the MMR vaccine and autism was not only proven to be inaccurate, but actually fraudulent. The MMR-autism controversy is an example of fake science that has attained a level of immortality, endlessly reappearing in social media posts as a conspiracy theory (Grech, 2017).

The present-day campaign against vaccination can be regarded as the most visible example of scientific denialism, and often co-exists with conspiracy theories that can be considered a form of counter-knowledge or alternative knowledge. Conspiracy theories surrounding vaccination generally focus on a war against humanity in which the common people are secretly misled by a controlling elite, and in which the scientific community are in league with pharmaceutical companies and governments. Although conspiracy theories can be traced back further than the digital age and the post-truth era, the changing information environment and the anti-expert climate of epistemological populism is producing conditions that allow conspiracy theories to flourish and take root in anti-vaccination rhetoric (Numerato et al., 2019).

Wakefield’s MMR study became a textbook example of exaggerated claims and unsubstantiated findings, crystallising all the elements of the emerging post-factual ideology in which alternative truths and alternative science can gain ground over the authority of scientific evidence. Multiple failures in the system of academic self-control and journal publishing, and the continual media exposure of Wakefield’s paper aggressively introduced doubt into the minds of parents who were concerned that the MMR vaccine might cause autism. This doubt became imprinted in the minds of people, reinforced by the indiscriminate exposure of misleading information in the unregulated space of social media. The phenomenon of vaccine hesitancy began to grow with people questioning the effectiveness and safety of the MMR vaccine, and Wakefield was elevated to the status of an iconic hero by anti-vaccination activists. The paradox of vaccine hesitancy would appear to be the need to rediscover the catastrophic effect of preventable infectious diseases, in order to rediscover that vaccines are valuable (Sansonetti, 2018).
Chapter 5: Conclusion

5.1 Introduction
The overall aim of this dissertation was two-fold:

1.) To develop an understanding of how a rapidly changing information environment has led to the emergence of a post-truth era in which the rational, evidence-based domain of healthcare is under assault from the anti-vaccination rhetoric of the MMR-autism controversy.

2.) To develop an understanding of how the post-factual characteristics of the vaccine debate are producing information pathologies of decision-making that are influencing the uptake of the MMR vaccine.

The objectives of the dissertation were to answer the following research questions (RQ):

RQ1  How has the anti-vaccination movement and the dissemination of false and misleading information about the MMR vaccine been exacerbated by the changing information environment, and how do information pathologies contaminate decision-making that can result in vaccine hesitancy?

RQ2  What are the characteristics of the post-factual vaccine debate that are driving behavioural changes towards public health, and why is the post-truth era and a post-factual society nurturing vaccine hesitancy towards the MMR vaccine?

RQ3  As a result of these research questions, how can LIS practitioners in their roles as providers of information overcome the post-factual debate on the effectiveness and safety of the MMR vaccine?

RQ1 was addressed by the literature review in Chapter 2, and RQ2 was addressed by the case study in Chapter 4. RQ3 is addressed in this concluding chapter after a summary of the findings for RQ1 and RQ2, and a conclusion for RQ1 and RQ2. A self-reflection on the dissertation process is also included in the final section.
5.2 Summary of Findings for RQ1
The literature identified that the anti-vaccination movement and the dissemination of false and misleading information about the MMR vaccine has been exacerbated by the changing information environment through:

- the democratic nature of online content creation.
- Web 2.0 permitting any opinion to spread far and wide, and almost instantaneously.
- the increasing dominance of social media that has produced the phenomenon of the ‘echo chamber’ that is strengthening and amplifying deeply entrenched personal beliefs.

The literature also identified that information pathologies can contaminate decision-making that can result in vaccine hesitancy by:

- delaying, biasing, or even preventing the acquisition of relevant knowledge that is required for good decision-making and problem-solving.

5.3 Summary of Findings for RQ2
The thematic analysis revealed the following characteristics of the post-factual vaccine debate on the effectiveness and safety of the MMR vaccine:

- Based on fake science.
- Based on denial of vaccine effectiveness and safety.
- Based on the exclusion of factually-based evidence.
- Based on an increasing contempt for expert knowledge driven by Web 2.0 technologies and post-truth thinking.

An interrogation of the literature attempted to analyse these characteristics in greater detail. The findings revealed that the post-factual vaccine debate is based on:

- the deliberate reversing, disguising, obscuring or distorting of the meaning of words.
- unproven claims and unsubstantiated findings that are reliant on confirmation bias, disseminated through Web 2.0 that has allowed these approaches to obtain exaggerated attention.
- debate that is constructed by appeals to emotion and repeated claims of partial truths or outright falsehoods, and where factual counter-arguments are ignored.
5.4 Conclusion for RQ1 and RQ2

The attraction of anti-vaccination discourse, Bricker and Justice (2019) contend, is connected to two features of the postmodern medical paradigm: Firstly, scientific consensus is countered by people opposed to vaccination who rely on highly emotional personal stories and are convinced of the vaccine-autism link. Secondly, conspiracy theory rhetoric is utilised to counter pro-vaccination arguments by implying that the vaccine-autism link could be proven if it was not for the collusion of the pharmaceutical industry and government agencies that are concealing the truth. Within the context of the vaccine debate, a postmodern propensity has supported and developed a group of vaccine sceptics who reject scientific evidence that they regard as only one version of reality. Furthermore, for information concerning vaccine decisions, sceptics use postmodern philosophical principles to favour social networks and online communities over traditional physicians.

Picciotto (2019) maintains that leaders in the postmodernist movement such as Jacques Derrida and Jean Baudrillard considered scientific evidence as the equivalent to myths and arbitrary social constructs. They doubted the genuineness of all knowledge that they claimed relies on ideological preconceptions, and characterised the quest for objective truth as the fool’s journey. Their theories examined the uncertainty of language and acknowledged alternative approaches to knowing, but when postmodern cultural principles are detached from common sense, this can have real-life consequences. Popular culture has been infiltrated by abuses of logic, and cynicism surrounding scientific evidence has spread.

For the non-discerning user, the boundary between mainstream media and alternative media has become blurred by social technologies, and this has meant that the participatory nature of the Web 2.0 environment is as much a platform for knowledge production as it is for conspiracy theories. Marginalised groups are generally found to produce conspiratorial thinking, and a belief in conspiracy theories is often due to a feeling of powerlessness within society that may originate from a lack of trust or low self-esteem. Before conspiracy theories become popular interpretations of knowledge, they begin as simple gossip. The idea that vaccines can cause autism falls into the category of one such conspiracy theory, and this idea is spread and replicated in ‘information grounds’ that have increasingly become represented by social media platforms (Narayan and Preljevic, 2017).

Găveanu (2017) observes that it is never easy to define a period of history while still living in it, but the most significant aspect of the post-truth era is the disregard for objective facts that have been exacerbated by technological developments. The technological and informational landscape has been completely transformed in recent decades, and the use of the Internet
and social media as major sources of information and domains of socialisation has resulted in consequences that few could anticipate. The notion of a digital environment that would become a space for free communication and exchange, and would be rooted in tolerance and mutual respect, has mostly resulted in the exact opposite occurring. Alternative facts circulate within social media bubbles, propagating falsehoods and causing concerns for practitioners of all disciplines. The consequences of the post-truth era has already affected many communities throughout the world, so the belief that this negative development in history can be easily overcome is rather optimistic.

5.5 Addressing RQ3 and Overcoming the Post-Factual Vaccine Debate

Floridi (2016) asserts that the defining challenge of the 21st Century is the Internet of echo chambers that satisfy our need for reassuring falsehoods and pleasing lies, an information environment that has grown carelessly and chaotically without sufficient 'stewardship' to guard against its pollution and deterioration. This idea of sufficient stewardship over the information environment is one of the keys to overcoming the post-factual debate on the effectiveness and safety of the MMR vaccine.

As Bawden (2017) points out, one important, specific and in fact traditional role for LIS practitioners is keeping the part of the information environment that is under our influence in a welcoming, clean and tidy state. This can be achieved, for example, by reporting abuse on social media, or by helping to remove fake news. Another response by the LIS community, Robinson (2017) identifies, has been the ardent public recommendation for information literacy that focuses on the selection of valid sources and the evaluation of information.

Biasio (2017) explains that health literacy can be understood as the level of ability that people have when obtaining, processing and understanding basic health services and health information required to make suitable health decisions. Health literacy influences a person’s capacity for accessing and using healthcare, interacting with providers, and caring for themselves and their children. Adults possessing limited or inadequate health literacy skills are less likely to adopt protective behaviours and use preventative services such as vaccination services.

‘eHealth’ literacy, Ghezzi et al. (2019) maintain, can be an important contributing factor for how people select sources of health information. People with typically lower eHealth literacy are more likely to trust blogs, celebrity webpages and social media, whereas people with high eHealth literacy correctly evaluate the relevance and creditability of online health information. People with lower eHealth literacy are more vulnerable to the real-life effects of misleading
information, such as vaccine hesitancy towards the MMR vaccine, and are more likely to depend on sources that spread inaccurate and inflammatory information.

While information literacy does indeed have value, Robinson (2017) suggests that it also appears to have limitations as an approach for making progress in a wider post-factual context. The reason for this, Bawden (2017) explains, is because misinformation and disinformation increases as rapidly as valid information, and many people who personify the post-truth movement are highly information literate, but only use sources that promote their view of the world. Therefore, the remit of the library and information disciplines and professions should be the promotion of understanding as well as the provision of information.

Ironically, ‘understanding’, Robinson (2017) points out, is a badly understood idea and from a documentation perspective, there is much theoretical work to be undertaken on how best to promote it, although it will likely involve two components: Firstly, the development of information fluency around the new digital environment and the new forms of digital documents that are emerging. Secondly, the evolution of digital literacy to develop skills that are required to access, navigate and contribute to the new information environment. This approach by LIS is an attempt to help society recover its fluency and effectiveness at dealing with information that has largely been lost in the post-truth era. There also needs to be an ethical obligation that accompanies these theoretical and practical concerns that prevents and neutralises the post-factual propensity and its advocates who are resistant to taking part in reasoned fact-based debate. This ethical obligation can be understood as sufficient stewardship over the information environment in order to counteract the pathologies of the post-truth era.

5.6 Self-Reflection
It became apparent very early on that the aims and objectives of my dissertation proposal (Appendix B) were simply too broad and vague, and would need to be reconfigured into a workable dissertation that had clearly defined boundaries. I did not want to lose the essence of these aims and objectives that drew upon the concepts of reality versus unreality, the manipulation of health behaviour, and the pathologies of information that can arise from healthcare misinformation; but as I had not yet formulated research questions at this early stage of the dissertation process, the research lacked the precise focus necessary for a Masters-level dissertation. The other obvious issue with my proposal was an undefined research methodology that is also a requirement for a small-scale project of this kind.
Although the dissertation proposal was accepted and was certainly acceptable, and is indeed a starting point from which things would invariably change and develop, in retrospect I can see that it was a mistake to have not presented research questions or a research strategy that clearly focused my research at this initial stage. This meant that subsequent research began in an incoherent way as I struggled to find the most appropriate research angle and strategy to examine the controversial, yet timely topic of vaccine hesitancy towards the MMR vaccine. This is a big, complicated topic so it was never going to be the easiest task to refine the focus of this research. However, if I had done more preparation leading up to the proposal submission, I think that I would have saved myself a lot of time spent unnecessarily focusing on areas of research that became irrelevant when the research questions were eventually formulated. I might have also avoided unnecessarily diverging too far from the accepted proposal at one point in the research journey when I began looking into the thorny subject of ‘toxic' tweets posted about the MMR vaccine on Twitter. This analysis was eventually dropped from the write-up.

The research questions that were formulated from the revised objectives meant that the role of AI as a curator in a transitioning and unregulated informational environment became a casualty of the reconfigured dissertation. This is clearly an area worthy of study in and of itself, as is Floridi’s vision of the infosphere and his concept of ‘onlife’ that also remained undeveloped within the context of a rapidly changing information environment for RQ1. Although the dissemination of misleading health content was examined in the literature review, a more detailed examination of the processes of the communication chain became another aspect of the original proposal that was omitted from the final piece of work. However, reconfiguring the research methodology to examine vaccine hesitancy in a post-truth and post-factual context provided me with a strong framework for my revised overall aim, and ultimately allowed me to develop my research questions into a suitable and relatively contained direction. The addition of Kata’s (2012) theory of a postmodern medical paradigm also provided me with an appropriate academic research angle to take this revised research methodology forward, and acted as a suitable bridge between RQ1 and RQ2.

The original proposal’s methodology consisted of an extended literature review that, in retrospect, was rather limited in its scope, so this was expanded to include the research strategy of a case study and the systematic and replicable research methods of document analysis. I decided upon the case study approach because I felt that it was the most appropriate strategy for research that focuses on one instance of a phenomenon in detail. However, the case study approach typically relies on multiple data collection methods and this initially deterred me from adopting this strategy until I understood that a case study can depend
entirely on pre-produced texts under certain conditions. I was not entirely happy with the small sample of literature that was ultimately selected from the database search, but this is also a consequence of very specific inclusion criteria. The case study also became a very descriptive piece of work and perhaps lacked the depth that other data collection methods would have brought to this part of the dissertation. Nevertheless, the research findings for RQ2 still provides some valuable insights into the post-factual vaccine debate on the effectiveness and safety of the MMR vaccine, and also demonstrates systematic research methods that are transparent and replicable.

The overall structure and presentation of this dissertation is largely influenced by the work of Biggam (2017), whose step-by-step handbook proved indispensable for approaching a piece of work of this size and made the writing process more manageable and achievable. However, I still found the process of researching and writing this dissertation to be very challenging, but the experience was also invaluable as it gave me insights into a controversial topic that is particularly relevant today. Vaccine hesitancy has serious implications for global health and needs to be addressed in an interdisciplinary way, and LIS has an important role to play in this conversation. It is hoped that this dissertation serves as a useful reference point for future research on this topic, and contributes in some way to the wider discussion on vaccine hesitancy that is at the forefront of current global health concerns.
Chapter 6: References


# Appendices

## Appendix A: Case Study Articles

<table>
<thead>
<tr>
<th>Search Result</th>
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<th>Author(s)</th>
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<td>1</td>
<td>Evidence from large Danish cohort does not support an association between the MMR vaccine and autism: facts in a post-truth world</td>
<td>Campbell-Scherer, D.</td>
<td>2019</td>
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<td>The vaccination debate in the &quot;post-truth&quot; era: social media as sites of multi-layered reflexivity</td>
<td>Numerato, D., Vochocová, L., Štětka, V. and Macková, A.</td>
<td>2019</td>
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<td>66</td>
<td>The challenge of the post-truth era</td>
<td>Nature</td>
<td>2018</td>
<td><a href="https://doi.org/10.1038/s41556-018-0231-z">https://doi.org/10.1038/s41556-018-0231-z</a></td>
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<td>167</td>
<td>A brief history of post-truth in medicine</td>
<td>Hawkes, N.</td>
<td>2017</td>
<td><a href="https://doi.org/10.1136/bmj.j4193">https://doi.org/10.1136/bmj.j4193</a></td>
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<td>169</td>
<td>Defending the Truth in a Post-Truth Era</td>
<td>Munk, P.L. and O’Keeffe, M.E.</td>
<td>2017</td>
<td><a href="https://doi.org/10.1016/j.canj.2017.06.001">https://doi.org/10.1016/j.canj.2017.06.001</a></td>
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<td>Promoting health in a post-truth world</td>
<td>Sparks, M.</td>
<td>2017</td>
<td><a href="https://doi.org/10.1093/heapro/dax042">https://doi.org/10.1093/heapro/dax042</a></td>
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<td>274</td>
<td>Fake science and the knowledge crisis: ignorance can be fatal</td>
<td>Hopf, H., Krief, A., Mehta, G. &amp; Matlin, S.A.</td>
<td>2019</td>
<td><a href="http://dx.doi.org/10.1098/rsos.190161">http://dx.doi.org/10.1098/rsos.190161</a></td>
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Appendix B: Dissertation Proposal

Working title
Vaccine misinformation: an investigation into the phenomenon of unreality, pathologies of information, and other paradoxes

Introduction
This small-scale desk research project will investigate the role of vaccine misinformation in the information communication chain and look at how it relates to the phenomenon of unreality in both an analogue and digital space. The project will explore the phenomena of the echo chamber and filter bubble, and the pathologies of information and other paradoxes that arise from the communication of vaccine misinformation. The project is framed by a current ‘information pandemic’ that is being spread by the Internet and the world wide web; and recommendations will be formulated for the roles that humans and artificial intelligence can play as curators in a transitioning and unregulated informational environment. As the project is centred upon an existing body of research, it will take the form of an extended literature review.

Aims and objectives
The overall aims of the research are to:

- Understand the phenomenon of reality versus unreality and its relationship to pervasive and ubiquitous technologies and new media.
- Investigate the manipulation of health behaviour and its effects on individuals and health organizations.
- Determine strategies to combat the effects of pathologies of information created by health misinformation.

The objectives of this research are to:

1. Identify the processes of the information communication chain as they relate to vaccine misinformation.
2. Explore the phenomenon of unreality that manifests as the echo chamber and filter bubble in social media.
3. Evaluate critically pathologies of information and other paradoxes that arise from vaccine misinformation.
4. Formulate recommendations for the roles that humans and artificial intelligence can play as curators in a transitioning and unregulated informational environment.
Scope and definition
With regards to the scope of the project, the history of anti-vaccination movements begins in Ancient China in the 10th Century and will be traced to the present day ‘information pandemic’ of vaccine misinformation that is being spread by the world wide web and social media. The project will look at anti-vaccination movements from an historical perspective before focusing on their current manifestation within the informational environment of the 21st Century. The project will attempt to understand why vaccine misinformation is created and disseminated, and investigate its manipulation of human behaviour and the pathologies of information that arise from it. The project will conclude by examining the roles that humans and artificial intelligence can play in preventing the spread of an information pandemic. Floridi’s (2014) vision of the infosphere and his concept of onlife will be used as a basis for addressing these research questions; and the writings of Robinson (2009; 2010) and Bawden and Robinson (2009; 2012) will be used as a framework to shape the project.

With regards to defining concepts of the research, misinformation can be defined as information that is false, regardless of whether there is an intention to mislead. Pathologies of information can be defined as any type of disorder or illness caused by the communication of information. The infosphere can be defined as a space of information that is supported by a genuine material reality behind it, which is itself information. Onlife can be defined as a way of understanding the world informationally in which the distinction between living online or offline has disappeared, and we inhabit an environment that is simultaneously both offline and analogue, online and digital.

Research context/literature review
The roots of misinformation are probably as old as healthcare itself, but its potential to do harm has been raised to a new level by the global reach of the Internet. The communication of misinformation in healthcare has resulted in behavioural changes towards public health and is now emerging as a serious health threat (Waszak et al., 2018). In November 2018, Dictionary.com chose ‘misinformation’ as its word of the year. They define misinformation as the spreading of information that is false, regardless of whether there is an intention to mislead. The word was chosen because of the increasing role that technology platforms play in the spreading of falsehoods and conspiracy theories. Healthcare more than any other industry is affected by misinformation, and healthcare misinformation can have serious and sometimes fatal repercussions (Keckley, 2018). In January 2019, the World Health Organization (WHO) listed vaccine hesitancy, or anti-vaccination beliefs in their top ten global health threats. The WHO, along with many other public health organizations are warning that viral misinformation is not only compromising a person’s well-being, but also a hundred years of public trust in
medical institutions. Without historical context, vaccine misinformation can be incorrectly perceived as a phenomenon of the participatory nature of social media; but anti-vaccination beliefs have existed for nearly as long as widespread vaccination (McAweeney, 2019).

Although Edward Jenner did not discover vaccination, he pursued its scientific investigation and his dedicated research transformed the practice of medicine (Riedel, 2005). Medicine is one of the oldest practical disciplines and one of the first to be recorded in documents. The historical development of healthcare and the creation of recorded information to support it at various periods in time needs to be considered in order to understand where it is today (Robinson, 2010). The information communication chain of recorded information has been understood differently over time, but its underlying principles of Creation; Dissemination; Organisation; Indexing; Retrieval; and Use seem to be unaffected by developments in technology and media. These principles are still relevant as a framework for explaining the activities within the fields of the document and computational traditions (Robinson, 2009). However, whereas the principles of the communication chain remain unchanged, all components of the chain are affected by technology and influence the development of each other (Bawden and Robinson, 2012).

Information communication technologies (ICTs) create and shape our mental and physical realities, transform how we understand our selves and interpret the world, and influence how we relate to each other. In maturing information societies, we inhabit an environment that is both analogue and digital, offline and online. We can call this environment the infosphere in which the distinction between living online or offline has disappeared and we live an onlife existence (Floridi, 2014; 2016). One consequence of the infosphere is the phenomenon of reality versus unreality. Pervasive and ubiquitous computer technologies are redefining what we perceive as real. Social media enforces particular perspectives and promotes the unreal phenomenon of the filter bubble (Robinson, 2018). Two decades ago, Rafael Capurro explored the idea of reality versus unreality in an informational world (Robinson and Dunne, 2018), and suggested that the digital realm rather than the physical realm is the new foundation and model for answering the question: what is real? (Capurro, 1999).

The rise of the Internet, and in particular social media has allowed the dissemination of unreliable healthcare information to be taken to new heights. Algorithms determine what people see in their web searches and this is not necessarily based on accuracy or substance. Journalism is also underperforming in its key function to screen information for truth and provide the public with believable material. For the consumption of news today, the role of the user has shifted to that of an editor as greater choice provides greater freedom than ever
before, but with no obligation to screen for truth. On social media people share whatever they want and this has produced a world of echo chambers that are populated by nonexpert opinions which are portrayed as credible sources (Keslar, 2018). Existing strategies to correct vaccine misinformation have been unsuccessful and often boomerang so that ill-founded beliefs are reinforced. At the core of this issue are people’s inability to revise their perspectives in view of corrective information (Pluviano et al., 2017). In the same way that the influence of broadcasters has shifted from organizations to individuals, the targeting of evidence-based healthcare information needs to shift from how the medical profession can get this information to people, to who can share this information for them on social media platforms (Vogel, 2017).

In the 21st century, social media has become an important channel for health information and a platform for sharing opinions, personal accounts and concerns regarding treatments for illnesses. In the field of health communication, it is a primary concern to correct misinformation transparently and gain the public’s trust (Gesser-Edelsburg et al., 2018). Today, healthcare misinformation is undermining legitimate interventions with unproven ideas and this is producing adverse effects on health on a global scale. Medical misinformation is not a new phenomenon but now its presence is ubiquitous. The digital domain is an environment without editorial supervision or curation in which exotic fallacies seemingly spread faster than boring truths (Armstrong and Naylor, 2019). Healthcare misinformation can be regarded as an information pathology that spreads through Google results and social media updates and can have a real impact on a person’s physical health that sometimes leads to a tragic outcome. Misinformation in healthcare can influence our decision-making and behaviour so that we become more vulnerable to disease, the viral misinformation facilitating the spread of an actual health disorder or disease in the physical world (Gyenes and Mina, 2018). We need to contemplate the frontier that separates reality and unreality as we are exposed to greater unscripted realities through our increasingly online experience (Robinson and Dunne 2018).

**Methodology**

The project will be entirely desk-based research consisting of an extended literature review and discussion following on from the findings. The project will study vaccine misinformation from an historical perspective and investigate it from several different angles of a Library and Information Science (LIS) perspective. As this is a big area to cover for a small-scale research project, the focus may need to be narrowed further as the project develops. I’m also aware that while an extended literature review is relatively straight-forward and light on resources, its value as a high-quality piece of work is dependent on the literature selected and the detection of any personal bias that might filter through into the writing. This subjectivity can certainly be seen as a potential limitation of the project, but I still believe that an extended
literature review and discussion is the most suitable method to meet the project’s aims and objectives. The types of literature I will be sourcing for the project will include relevant books, journals, conference proceedings, reports, blogs, websites and videos. The following library databases will also be used to support this research: CINAHL Complete; Cochrane Library; Medline Complete.

Dissemination
I intend to use Twitter to promote interest in my work as the project progresses.

Work plan
The following work plan outlines the various stages and activities to be undertaken over the duration of 30 weeks beginning in June 2019 and ending in January 2020:

<table>
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<tr>
<th>Action</th>
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<tr>
<td>Undertake research and note-taking</td>
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<tr>
<td>Consolidate note-taking and plan dissertation</td>
<td>August – September 2019</td>
</tr>
<tr>
<td>Write dissertation</td>
<td>September – December 2019</td>
</tr>
<tr>
<td>Proofread dissertation</td>
<td>December 2019 – January 2020</td>
</tr>
<tr>
<td>Submit dissertation</td>
<td>January 2020</td>
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Over the months of June, July and August I intend to undertake the majority of my research and make detailed notes as I progress. The note-taking will then be consolidated during the month of August and a structure will begin to be devised in order to weave the research together. The main body of writing will take place during the Months of September and October with the intention to have a first draft of the dissertation completed by the beginning of November. I will aim to have a final draft completed by the first week of December allowing for a month of proof reading and corrections before its submission in early January 2020.

Resources
As this is a desk-based research project, all required resources are either in print format or digital format and will be available from the Library Services at City, University of London, The British Library, or through open access via an Internet connection.
Ethics
It is not anticipated that any issues around ethics will arise as the proposed project will be a piece of desk-based research that does not involve any participants. The Research Ethics checklist has been completed and included in Appendix 1.

Confidentiality
It is not anticipated that any issues around confidentiality will arise as the proposed project is not dealing with any confidential material.

Appendix 1

If your answer to any of the following questions (1-3) is YES, you must apply to an appropriate external ethics committee for approval:

1. Does your project require approval from the National Research Ethics Service (NRES)? (E.g. because you are recruiting current NHS patients or staff? If you are unsure, please check at http://www.hra.nhs.uk/research-community/before-you-apply/determine-which-review-body-approvals-are-required/) No

2. Will you recruit any participants who fall under the auspices of the Mental Capacity Act? (Such research needs to be approved by an external ethics committee such as NRES or the Social Care Research Ethics Committee http://www.scie.org.uk/research/ethics-committee/) No

3. Will you recruit any participants who are currently under the auspices of the Criminal Justice System, for example, but not limited to, people on remand, prisoners and those on probation? (Such research needs to be authorised by the ethics approval system of the National Offender Management Service.) No

If your answer to any of the following questions (4 – 11) is YES, you must apply to the Senate Research Ethics Committee for approval (unless you are applying to an external ethics committee):

4. Does your project involve participants who are unable to give informed consent, for example, but not limited to, people who may have a degree of learning disability or mental health problem, that means they are unable to make an informed decision on their own behalf? No
5. Is there a risk that your project might lead to disclosures from participants concerning their involvement in illegal activities? | No 
---|---
6. Is there a risk that obscene and or illegal material may need to be accessed for your project (including online content and other material)? | No 
---|---
7. Does your project involve participants disclosing information about sensitive subjects? | No 
---|---
8. Does your project involve you travelling to another country outside of the UK, where the Foreign & Commonwealth Office has issued a travel warning? (http://www.fco.gov.uk/en/) | No 
---|---
9. Does your project involve invasive or intrusive procedures? For example, these may include, but are not limited to, electrical stimulation, heat, cold or bruising. | No 
---|---
10. Does your project involve animals? | No 
---|---
11. Does your project involve the administration of drugs, placebos or other substances to study participants? | No 
---|---

If your answer to any of the following questions (12 – 18) is YES, you should consult your supervisor, as you may need to apply to an ethics committee for approval.

12. Does your project involve participants who are under the age of 18? | No 
---|---
13. Does your project involve adults who are vulnerable because of their social, psychological or medical circumstances (vulnerable adults)? This includes adults with cognitive and / or learning disabilities, adults with physical disabilities and older people. | No 
---|---
14. Does your project involve participants who are recruited because they are staff or students of City University London? For example, students studying on a particular course or module. (If yes, approval is also required from the Project Tutor.) | No 
---|---
15. Does your project involve intentional deception of participants? | No 
---|---
16. Does your project involve identifiable participants taking part without their informed consent? | No 
---|---
17. Does your project pose a risk to participants or other individuals greater than that in normal working life? | No 
---|---
18. Does your project pose a risk to you, the researcher, greater than that in normal working life? | No 
---|---

If your answer to the following question (19) is YES and your answer to all questions 1 – 18 is NO, you must complete part B of this form.

---|---
19. Does your project involve human participants? For example, as interviewees, respondents to a questionnaire or participants in evaluation or testing. No

References


