

# **Anti-vaccine activism: agnotological dissent and epistemic harm**

Student Number: SN17143387

Supervisor: Dr Brendan Clarke

## **Abstract**

Vaccine hesitancy, the delay or refusal to vaccinate despite availability, is a current global concern, as it threatens to undermine the effectiveness of a pillar of public health. Lying at one extreme of hesitancy are anti-vaccine activists, or anti-vaxxers. Often, they are organised into groups who avidly campaign against vaccines, aiming to persuade others to withhold from vaccination, despite the overwhelming scientific and medical consensus that it is safe and effective. Campaigns of misinformation and doubt-creation against scientific unanimity have been used to protect commercial interests, for instance of the tobacco and fossil fuel industries. This practice has been termed agnotology, or the cultural production of ignorance. Through a case study of a prominent anti-vaccination organisation, this dissertation shows that these organisations employ the same agnotological tactics to cast doubt on the safety and efficacy of vaccines. The motivation of anti-vaccine organisations to agnotology is considered, before examination of its epistemic consequences, specifically its effects on scientific and public inquiry and understanding of vaccines. One case study indicates that manufactured debate by climate sceptics is epistemically detrimental to climate science by impeding inquiry and progress. Anti-vaccine agnotology does not seem to exert this effect on vaccine science, as new vaccines are developed and introduced. This dissertation argues that the dissent of anti-vaxxers is nonetheless epistemically corrupting and ultimately damaging. It creates a manipulative communication environment in which epistemic vices – character traits which impede effective and responsible inquiry – are encouraged and maintained in anti-vaxxers and the general public.

(249 words)

## **1 Introduction**

Vaccination is a central pillar of public health. Since the introduction of the first vaccine, against smallpox, in the 19<sup>th</sup> century, disease prevention and even eradication has been possible on a global scale. Yet vaccination has always been a contentious issue, particularly in the present day where vaccine hesitancy is recognised as a top ten global health threat by WHO (WHO, undated a).

The causes of vaccine hesitancy are multifactorial, and include issues of health inequality and access common to all health services. It encompasses individuals and groups which stridently and publicly denounce and reject vaccines. These are the anti-vaccine (AVX) activists, better known by their soubriquet ‘antivaxxer’ (AVXer), the subject of this dissertation.

In the last half century, debate and controversy has affected both scientific progress and public understanding of issues of global importance; anthropogenic climate change being a current example. Historians and philosophers of science have shown that these debates are constructed and fuelled by parties with interests to protect, using a combination of strategies designed to obscure and confuse. This has been termed ‘agnotology’ or the cultural production of ignorance (Proctor, 2008).

Such manufactured debate is thought directly epistemically detrimental; i.e., it impedes the production and acquisition of knowledge (Biddle and Leuschner, 2015). Furthermore, its often hostile nature and persistence may have wider epistemic effects by giving rise to and maintaining epistemic vices: behaviours, character traits and attitudes that actively oppose intellectual virtues and knowledge acquisition (Battaly, 2014; Cassam, 2016).

It is my contention that AVX activism is agnotological, producing cultural ignorance, and epistemically damaging, impeding knowledge production and acquisition. I therefore start by addressing the question “do AVX activists use agnotology to manufacture debate?” I commence with a review of relevant literature on AVX activism, and move on to consider the paradigmatic case study of agnotology, the tobacco industry. By conducting my own case study of a prominent American AVX organisation (AVXO), I will demonstrate the range of agnotological strategies used, before considering their motivations.

In the second part of my dissertation, I will address the question “what are the epistemic effects of AVX agnotology?” I will look at the suggested epistemic effects of manufactured debate. I conclude by considering the manifestation of epistemic corruption and resultant epistemic vices in AVXOs, and the consequences.

## **2 Literature Review on Vaccines, Anti-Vaccine Activism and Agnotology**

### **2.1 Vaccines: a safe and effective public health intervention**

For over two hundred years, vaccination has combatted the morbidity and mortality of infectious diseases. A century ago, infectious disease was a leading cause of premature death in the UK (Oxford Vaccine Group, 2019). Now, vaccines against previously fatal diseases prevent an estimated two to three million deaths/year.

There is an overwhelming consensus that vaccines are a safe and effective means of controlling infectious diseases. This is supported by a wealth of evidence, as demonstrated by publications from organisations including the NHS (2019), WHO (undated b), UNICEF (2019) and the CDC (2019) and research groups including the Vaccine Centre (undated) and the Vaccine Knowledge Project (undated). As with any health care intervention, or indeed activity, vaccination is not risk free, and it can certainly cause serious harm, or death. However, this is rare: the yellow fever vaccine has a greater association with severe adverse reactions than others, yet these occur in about 1/125,000 doses (CDC, 2011a).

### **2.2 Vaccine hesitancy and global vaccination rates**

Vaccination’s success in preventing infection relies on uptake, typically 95% of the population, which establishes so-called herd immunity; where this exists, sporadic outbreaks of the disease are contained and individuals contraindicated for vaccination are protected. Herd immunity is threatened by vaccine hesitancy (delay in acceptance or refusal of vaccines despite availability of vaccine services). This has three main components:

- i) Confidence: trust in the efficacy and safety of the vaccine, and in the overall system of delivery;
- ii) Complacency: perception of low risk of infection, removing requirement for vaccination;

- iii) Convenience: accessibility in terms of physical availability, affordability, and comprehensibility in language and health terms, and aspects such as time, place and cultural context of delivery (WHO, 2014).

For three decades, worldwide vaccine coverage has increased, and links between socioeconomic status and vaccination rates have weakened, indicating improved access (de Figueiredo, *et al.*, 2015). However, in many parts of the developed world, rates are falling (European Parliament, 2018), with some US infants receiving no vaccinations at all by age 24 months (Hill *et al.*, 2018). The risk of this is evident: populations with low vaccination rates have suffered outbreaks of vaccine-preventable diseases, such as measles and whooping cough (CDC, 2014; WHO, 2018).

### 2.3 Anti-vaccine activism

Vaccine hesitancy is not a new phenomenon. The UK Vaccination Act 1853 made the smallpox vaccine compulsory for all children born after 1 August 1853; it included measures to fine non-compliant parents. Enforcement of the law incited significant popular resistance. Thus, a socially and politically diverse AVX movement was born (Weber, 2010). Dissent was not restricted to the general public; eminent naturalist Alfred Russell Wallace and social reformer William Tebb were both committed AVXers (Weber, 2010; Durbach, 2006). In the last century, a backlash against whole-cell pertussis (whooping cough) vaccine spread through the UK and other countries, leading to a resurgence of cases (Baker, 2003) and ultimately to vaccine reformulation. More recently, UK doctor Andrew Wakefield questioned the use of the combined measles, mumps and rubella (MMR) vaccine (Wakefield *et al.*, 1998: since retracted). This led to a significant decline in UK MMR vaccine uptake from 2000 - 2004 (Thompson, 2009). The present day, diverse AVX movement is thus a continuation of previous scepticism, distrust and outright rejection of vaccines<sup>1</sup>. AVXers are often highly organised in pressure groups, publishing vaccine-critical content on social media and ardently promoting the AVX message. They refer to vaccines as toxic, and see them as destructive, even deadly. They believe that vaccines do more harm than good, and are responsible for an increasing global burden of chronic disease; AVXers are thus at one extreme of vaccine hesitancy.

AVXers maintain that vaccine science is not settled, and there are significant knowledge gaps regarding mechanism of action, and overall safety (e.g., VaccineChoice Canada, 2016; NVIC, 2017). Further, some dismiss vaccines as being responsible for the reduction in infectious diseases in the twentieth century (e.g., Learn the Risk, undated; Health Impact News, 2019). In their opposition to the consensus view on vaccine safety and efficacy, AVXers act to undermine public confidence in vaccines, and fuel debate on vaccine policy. I believe this is agnotology, as recognised and described in a number of fields.

### 2.4 Agnotology, or the cultural production of ignorance

The historian of science Robert Proctor began researching the tobacco industry following the publication of a tobacco company memo. “Doubt is our product,” it read, “since it is the best means of competing with the ‘body of fact’ that exists in the mind of the general public.” Proctor’s study showed that the industry’s reaction to emerging scientific evidence that tobacco caused lung cancer and other diseases was to employ a vigorous campaign of misinformation and obfuscation, with the direct intention of generating evidential doubt in

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<sup>1</sup> Expanded on and referenced in section 3.

the public. Proctor recognised this active construction of ignorance, doubt and uncertainty as separate from other forms of ignorance, *viz.* lack of knowledge (things yet to be learnt), loss of knowledge (things once learned but now forgotten) or avoidance of knowledge (things we could know, but choose not to). He named this practice and its study ‘agnotology’, from the Greek words *agnoia* and *agnosia*, meaning ‘want of knowledge’ and ‘state of ignorance or not knowing’ (Proctor, 2008).

Agnotology occurs in different areas of society. Oreskes and Conway (2010) showed how manufacturing doubt about science effectively countered claims of industrial environmental damage. Pinto’s case studies include the pharmaceutical and finance sectors (Pinto, 2017). She showed how five agnotological mechanisms<sup>2</sup> were consistently used to fuel evidential uncertainty.

Pinto’s paradigmatic example is the tobacco industry’s defence of their products. Their first action was to emphasise the uncertainty inherent to science, scientific claims being based on probabilities, not absolutes. This is an important aspect of scientific enquiry and integrity, and the impetus for scientific discovery. Tobacco companies exploited science’s natural scepticism to overplay the aspect of uncertainty in the causal link between tobacco and cancer. They highlighted the need for more and better research, implying that the science was less certain than it actually was.

This led to the second agnotological ploy: the direct support of favourable research. US tobacco companies set up their own research organisation, the Tobacco Industry Research Council (TIRC), which role was to award and manage industry-funded research. The research funded was selected to be high quality, in areas which would not provide evidence to strengthen the link between tobacco and disease. Thus, research was funded into other potentially relevant factors, such as heredity and environment. This was to divert attention from tobacco smoke as a leading cause of lung disease, and to emphasise that research into multiple factors was needed to understand causal mechanisms.

The TIRC needed scientific credibility, through engagement of and endorsement by distinguished scientists. It appointed renowned geneticist Clarence Cook Little, known for his sceptical views on smoking and lung cancer, as scientific director. A firm believer in a genetic cause for lung cancer, he became a key spokesman in the campaign of research misinformation. Another scientific heavyweight employed was Frederick Seitz, former science advisor to NATO and president of the National Academy of Scientists. Both men were engaged not for their expertise in cancer, medicine or epidemiology, but for their sceptical views which concurred with the scientific position that suited the tobacco industry in its attempts to deflect attention from tobacco as a cause of disease.

To protect their product, the tobacco companies needed their message of uncertainty to be heard widely. Thus, the fourth agnotological ploy was to use PR firms to produce publicity material, and organise events, in particular to promote industry-sponsored research, and highlight its endorsement by notable scientists. Additionally, the research programmes were disseminated to the scientific community through their own journals and symposia. The latter had the bonus of generating ‘proceedings’ publications. In this way, industry-supportive publications entered the scientific canon, bypassing the usual assurance of peer review.

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<sup>2</sup> The description of these in the following paragraphs is a summary of the account of Pinto (2017).

The final strategy was to go beyond claims of evidential uncertainty to directly impugn opposing research and researchers. In particular, government-funded research was criticised for being biased and politically motivated. Opposing research was described as ‘junk science’, suggesting that swathes of academic science were unreliable. This was a devious tactic, as similarly to the exploitation of inherent scepticism, it used the positive characteristic of academic challenge and constructive criticism to create doubt and confusion, rather than to enhance rigour.

### 3 Researching AVX organisations

#### 3.1 Method

I researched anti-vaccination organisations using online searching. This required prior knowledge, as anti-vaccination material is not prioritised in searches. For instance, Google searching ‘anti-vaccine organisation’ gives top-level results such as ‘Revealed: AmazonSmile helps fund anti-vaccine groups (Wong, 2019) and ‘Six common misconceptions about immunization’ (WHO, 2019). This is probably due to recent efforts to contain AVX content online (Becker, 2019; Najera, 2019). I was already aware of some groups, for which I could directly search (e.g., Age of Autism). To gain further leads, I consulted an AVX book (Seymour, 2017a), chapter 6 of which is entitled ‘Others who are trying to warn you’. Searching individual names from this chapter (e.g., Robert Kennedy Jr) led to their organisational websites (for Kennedy, The Children’s Health Defense), and to websites of the like-minded, e.g., the National Vaccine Information Center (NVIC, undated a). This searching also led to a number of fact-checking/debunking websites, such as Respectful Insolence (Respectful Insolence, undated), Skeptical Raptor (Skeptical Raptor, undated) and Science Based Medicine (Science Based Medicine, undated), which provided information on AVXOs. From these, I looked for candidates for agnotological analysis.

#### 3.2 Agreement with the Consensus View

During my literature review, I read significant amounts of literature from both sides of the vaccine argument. Initially, I aimed for neutrality. This proved impossible, due to the magnitude of fact-checking claims and counter-claims, each leading to a significant literature of its own. I therefore assessed sources of information and expertise on both sides with reference to two accounts of lay assessments of experts. Douglas invokes a ‘tripod of trust’ (Douglas, 2018). This comprises 1) evidence of success, and position in their community of peers (baseline assessment); 2) the functionality of their epistemic community (social conditions for expertise) and 3) regard for evidence, response to criticism, tolerance for false negatives or positives (values). Anderson offers a set of criteria for judging i) expertise, ii) honesty, iii) epistemic responsibility, and iv) whether there is a consensus of trustworthy experts (Anderson, 2011). I have concluded that the pro-vaccination position is unassailable. My reasons are summarised as follows:

- The pro-vaccine position of significant academic groups and associated researchers (e.g., Jenner Institute and Oxford Vaccine Group, London School of Hygiene and Tropical Medicine); there are no comparable AVX academic groups.
- The pro-vaccine position of organisations responsible for public health (NHS, CDC, WHO, UNICEF); there is no support for the AVX position.
- The response to excess adverse events. Use of the rotavirus vaccine, RotaShield, was suspended nine months after its introduction due to increased risk of serious complications. Two emergency investigations were conducted. The vaccine was

voluntarily withdrawn by the manufacturer shortly after (CDC, 2011b). These events demonstrate that the vaccine adverse reaction monitoring and response systems are fit for purpose.

- The amount of peer-reviewed, published evidence and systematic reviews of vaccine safety and efficacy in high-impact journals, including that in direct response to vaccine safety concerns (CDC, 2015); the AVX literature is in low-impact journals<sup>3</sup> with questionable peer review.
- The response to evidence-challenge<sup>4</sup>. Whilst most of the direct countering of AVX claims occurs in the ‘blogosphere’ (e.g., Hall, 2018; Skeptical Raptor, 2019), it is notable that AVX contentions are highly refutable. In return to refutation, AVXers generally resort to personal attacks, allude to organised conspiracy by government and industry, or fail to respond.

Therefore, at present, there is compelling evidence to believe that vaccines are safe and effective, and substantial grounds to disbelieve the claims made by AVXers. This simplified the agnotological analysis as I did not have to investigate the background or assess the veracity of every claim and refutation on both sides of the debate.

### 3.3 Types of AVX organisation

AVXOs/groups are many and varied. Below, I will detail a preliminary and rudimentary classification: this is not exhaustive, and the categories are overlapping, nonetheless, I believe it is a useful overview of the different functions and interests of AVXOs which could be developed into a taxonomy, particularly if combined with other studies<sup>5</sup>. Interestingly, the majority of these organisations insist that they are not AVX, but rather pro-safe vaccines, vaccine choice and information (e.g., Vaxopedia, 2018; Sheridan, 2018; PR Newswire, 2019).

**Disease-centric:** Organisations cluster around a disease/condition considered to be caused by vaccination, e.g., autism. Age of Autism is ‘the daily web newspaper of the autism epidemic’ (Age of Autism, undated). It believes autism is a man-made, preventable disorder and it publishes editorials and news stories which are critical of vaccines. Another autism-centric organisation is AutismOne (AutismOne, undated), which runs an annual conference for parents with autistic children, and offers ‘progressive information on the bigger picture affecting families with autism’.

**Chemical-centric:** Organisations focus on perceived toxins. The Children’s Health Defense organisation has the mission to end childhood health epidemics contributed to by aluminium and mercury in vaccines. The organisation’s mission is to work ‘aggressively to eliminate harmful exposures, (and) hold those responsible accountable’ (Children’s Health Defense, undated a). The Children’s Medical Safety Research Institute (CMSRI) focuses on the effects of aluminium (CMSRI, undated; and see below).

**Research funders:** The Katlyn Fox Foundation is a charitable foundation which raises funds for independent scientific research into safety and efficacy of vaccines, and to support other

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<sup>3</sup> Since the 1990s, research has been assessed by quantitative means. Journals are measured on the number of article citations, as a proxy for impact (Bornmann and Leydesdorff, 2014).

<sup>4</sup> Most healthcare related sites do not engage with direct claims of AVXers, but refer generally to safety profile, efficacy studies, etc. of vaccines.

<sup>5</sup> The studies of Bracken Scott (2016) on AVX boundary work and Jacobson *et al.* (2007) on a taxonomy of reasoning flaws are relevant here, but beyond the scope of this dissertation.

‘vaccine awareness groups’ (Katlyn Fox Foundation, undated). CMSRI similarly funds independent research. This organisation is the subject of my case study, and is covered in detail in section 4.

**Information providers:** The NVIC is a non-profit organisation that describes itself as a ‘clearing house for information on diseases and vaccine science, policy, law and the ethical principle of informed consent.’ It was founded in 1982 in the wake of perceived vaccine injury caused by the pertussis vaccine (NVIC, undated a).

**Alternative health/wellness:** Dr Mercola is a medical doctor and author of a number of books about diverse health threats. His company sells dietary supplements, health foods, and other consumer goods, and publishes regular anti-vaccine articles (e.g., Mercola, 2019). Erin Health Nut News is a similar business (Health Nut News, undated).

**Informed consent:** The Informed Consent Action Network (ICAN) was founded in 2016 by TV producer Del Bigtree<sup>6</sup>. Its mission is to investigate and report on medical safety issues, while promoting the right of informed consent to vaccination. With its substantial private funding, and undeniably charismatic leader, ICAN is one of the foremost global AVXOs (Sun and Brittain, 2019).

**Pervasive conspiracy theories:** It is notable that AVX opinions are often demonstrated by those with pervasive beliefs about conspiracy theories. Natural News is an example of such a website. It describes itself as a science-based ‘natural health advocacy organisation’, and its founder as ‘activist-turned-scientist’ (Natural News, undated; Johnson, 2014). It publishes a large amount of AVX information, and sells health and wellness merchandise.

The above is a thumbnail of AVXOs intended as an overview of the types of organisations this term encompasses, and their various foci.

### 3.4 Selection of organisation for case study

I selected CMSRI as a suitable organisation. This is for several reasons:

- its organised website and its veneer of respectability. Its website is highly professional and comparable in style to those of scientific organisations;
- its substantial funding and the profile of its founders, who are major Democratic party donors;
- its involvement in research funding, sustaining the research of at least two laboratories;
- its organisation and support of dissemination activities, including international conferences.

These will be expanded upon in the next section.

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<sup>6</sup> Bigtree worked on US medical talk shows, where he learned of Wakefield’s criticism of the MMR vaccine. He subsequently produced the 2016 documentary ‘Vaxxed: From Cover-Up to Catastrophe’, which investigated claims of MMR vaccine data cover-up at the CDC (ICAN, undated a).

## 4 Case Study of Agnotology and Anti-Vaccine Activism: Children's Medical Safety Research Institute

### 4.1 CMSRI organisational details

CMSRI<sup>7</sup> was founded by Claire and Albert Dvoskin to use money from their private Dvoskin Family Foundation (DFF) to fund research in the most tax-efficient manner (Ditz, 2017a)<sup>8</sup>. Claire Dvoskin (hereafter CD) is founder and principal officer, and its 2017 budget was \$486,000 (Alma, undated). According to its non-profit profile, CMSRI's mission is to 'address eroding public confidence in national vaccine policies due to concerns about safety' (Guidestar, undated), clearly indicating its target. The organisation's website<sup>9</sup> carries a more general statement about funding research to 'address eroding national health', and refers to scientific community concerns of increasing incidence in immune, inflammatory and cognitive disorders (About Us page).

CMSRI's website describes its governing board as 'scientists, physicians, experts in vaccine regulation, social science and health policy, and consumer child health advocates' (Mission, Role and Impact page). The reality is that it has five members, who do not easily fit this description (Governing Board page). Albert Dvoskin is a property developer, and substantial Democratic party donor (Merica, 2019). CD was previously a Board member of the NVIC. Other members are Barton Rubinstein (sculptor and artist, with a background in maths and neuroscience), Gina Green (environmentalist, with a background in forestry) and Tim Meyers (management consultant).

As a vehicle for research funding, CMSRI's website specifies a grant application process (Grant Making Guidelines page), and lists members of a Scientific Advisory Board (SAB) (Scientific Advisory Board page). No terms of reference or other operational documents are available on the website.

### 4.2 CMSRI agnotological assessment

In order to determine the extent, if any, of CMSRI's agnotology, I began with a detailed assessment of material on its website, looking for evidence of Pinto's five strategies. Website information led me to examine other online sources, e.g., to gain further information about SAB members, or to look for CMSRI's involvement or interaction on other websites, including specific searches of CD's activity. These activities provided evidence of CMSRI's consistent use of agnotological strategies, with additional features, described below.

#### 4.2.1 Evidence for Strategy 1: Emphasizing the Uncertainty

CMSRI paints a picture of eroding national (US) health, dubbed 'a burgeoning crisis'. It states a wish to discover 'changes in exposure' contributing to chronic disease, and rounds on vaccines; other environmental factors receive cursory mention. It calls for 'targeted research to determine whether vaccine schedules, combinations, preparations or ingredients play a role' (About Us page).

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<sup>7</sup> Since I commenced this dissertation, there have been news reports that Albert Dvoskin is estranged from his wife, has filed for divorce and has wound up CMSRI (Kucinich, 2019). At present, there is no change to the information on the website, or official announcement/indication of winding up, and therefore I shall refer to CMSRI as an ongoing organisation.

<sup>8</sup> For simplicity, use of CMSRI in the text includes DFF.

<sup>9</sup> The CMSRI website is at [www.cmsri.org](http://www.cmsri.org). Its webpages are referred to by their title only throughout this section.



It highlights questions about vaccine safety, and describes these concerns as ‘downplayed’ by government, regulators and industry<sup>10</sup>. Space is devoted to undermining current vaccine safety research methods, stating doubts about use of active placebos, duration of post-vaccination follow-up, and passive surveillance for adverse reactions. Gaps in understanding are suggested, including vaccine impact on the neurological and immune systems, and potential to cause biological or genetic changes. Vaccination schedule safety is questioned, and vaccine policy is declared to lack a science base (Background page).

Evidently, CMSRI constructs doubt and fuels uncertainty in vaccine safety. Its ‘crisis’ of chronic disease has a single causal suspect, vaccination, in particular aluminium vaccine adjuvant. The knowledge gaps that need filling are solely concerning vaccines, and there is no hint of, nor openness to an alternative view. CMSRI seeks to fill these gaps with its own research.

#### 4.2.2 Evidence for Strategy 2: Direct Support of Favourable Research

CMSRI is quite unusual amongst AVXOs in being established to fund research, specifically to critique existing vaccine safety data and address scientific gaps. It declares the expectation that its research will have a profound impact on vaccination health policies, and provide science-based information to the public (About Us page). In a video clip taken at CMSRI’s first vaccine safety conference, CD speaks of the need for private funding for this research, due to lack of government support (Vaccine Safety Conference, 2011).

CMSRI showcases its research, providing links to a number of studies (Research & Resources page). In fact, it does not include all the work it has funded (Table 1). The studies range in subject matter from description of novel autoimmune diseases, through animal studies of aluminium adjuvant toxicity, to studies of the health of vaccinated vs. unvaccinated children. They all seek to prove detrimental effects of vaccines, and their published findings universally support the AVX position: ‘observations raise plausible concerns about overall safety of current childhood vaccination programmes’ (Tomljenovic and Shaw, 2011a); ‘significant correlation exists between the amounts of aluminum (*sic*) administered...and the current prevalence of autism spectrum disease’ (Tomljenovic and Shaw, 2011b); and so on.

In general, CMSRI-funded research is published in low-impact journals (Table 2a and b) and is widely criticised by members of the scientific/medical community (e.g., WHO, 2012, Hawkes and Benhamu, 2017); indeed, a number have been retracted<sup>11</sup>. The research is however promoted and disseminated by AVXOs; e.g., the blogger Liz Ditz noted eleven approving reviews of the Mawson vaccinated/unvaccinated study (Mawson *et al.*, 2017a and b: papers 15 and 16 in Table 1) on AVX sites (Ditz, 2017b).

CMSRI-funded research has been criticised as ‘scientifically irresponsible’ for inferential leaps between observation and hypothesis (Weeks, 2015), for undisclosed conflicts of interest (Harpocrates Speaks, 2016), and for being methodologically flawed (Hawkes and Benhamu, 2017). These criticisms are similar to those directed at tobacco industry research. Barnes and Bero (1996) found that tobacco industry-commissioned research was more likely to support industry’s position than research commissioned by an independent panel; likewise articles

<sup>10</sup> See also section 4.2.5

<sup>11</sup> See Table 1. The publication history of some of the papers is complicated; they have been retracted and republished in other journals.

published for industry-sponsored symposia, where there was no peer-review, were deemed low quality, and unsuitable for use in scientific, legal or policy settings (Barnes and Bero, 1997). Furthermore, review articles on effects of smoking reached different conclusions, which accorded with the tobacco industry-affiliation, or not, of the author (Barnes and Bero, 1998).

A clear difference between CMSRI funding and all examples of agnotology described by Oreskes and Conway (2010) or Pinto (2017) is the lack of (visible) commercial interests. The declared motivation of CMSRI could be described as epistemologically virtuous, *viz.* they are addressing their perceived need for ‘high quality, methodologically sound safety research’ to fill evidence gaps (Background page). Nevertheless, they are highly selective in the science and scientists they fund. The research supports their AVX stance, investigating harmful effects of existing vaccines and components, rather than progressive exploration of potential improvements. Furthermore, the funding recipients act as CMSRI scientific advisers, in the third agnotological strategy.

### 4.2.3 Evidence for Strategy 3: Enlisting Experts

CMSRI has a number of reputed experts on its SAB. Some hold senior positions at reputable institutions. The majority have, ostensibly, the scientific credentials to fulfil the role of an SAB member. Typically, SABs are independent, and advise impartially and objectively. On close inspection, however, it is clear that CMSRI has selected an SAB which is anything but independent, and thus unlikely to be either impartial or objective. Several SAB members are recipients of CMSRI research funding, or are co-authors on papers which acknowledge the same. This and further information about SAB members is presented in Table 3.

Examination of the members of the SAB shows clearly that CMSRI surrounds itself with a phalanx of scientists with fringe views, which coincide with the agenda of discrediting vaccine safety and efficacy. It is therefore unsurprising that members of the SAB have received substantial financial support from CMSRI. The importance of private funding is acknowledged by recipient scientists: both Shaw and Exley are vocal on the challenge to researchers conducting research which questions vaccine safety (Vaccine Safety Conference, 2011). Indeed, it was reported that Exley was refused UK research council funding (Das and Leake, 2019).

The relationship between CMSRI and its enlisted experts contrasts with the TIRC, whose experts were selected to impart scientific credibility. If the scientific profile of CMSRI’s SAB is loosely appropriate, the bestowal of funding mainly to SAB members is highly questionable. It is my contention that the CMSRI has created its own version of ‘independent research’ in an attempt to add scientific evidence to its AVX message.

An addition to the agnotological repertoire of AVXOs is the enlisting of non-experts, often individuals who have experience of a child with autism, believed to have been caused by vaccination. This includes celebrities/people in the public eye, such as Jenny McCarthy<sup>12</sup> (former model and TV personality) and Sharryl Atkinson<sup>13</sup> (writer and journalist). CMSRI’s non-expert is Del Bigtree (*q.v.*), who plays an important part in its fourth agnotological tactic.

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<sup>12</sup> Einbinder (2019)

<sup>13</sup> Sharyl Attkisson (undated)

#### 4.2.4 Evidence for Strategy 4: Broadcast the Message

CMSRI is a visible and active member of the AVX ‘community’, using a variety of means to communicate the AVX message. For AVXers focussed on aluminium, it is a nucleus for coalescence, providing something of a respectable face. In particular, CD generally presents a measured, reasonable persona. She describes herself as a child health advocate; indeed, she won a ‘Lifetime Contribution to Autoimmunity’ award for work in ‘vaccine safety and advocacy’ (PRWeb, 2014). In video interviews she is calm, clear, even authoritative as she speaks about scientific uncertainty and CMSRI’s research (AutismOne Media, 2014). She is well-connected, counting former US President G.W. Bush’s sister Doro as a friend (Health Gig Podcast, 2018), and hosting a political fundraiser with Tipper Gore (ex-wife of Al Gore) as special guest (Halper, 2017). Further indication of her influence is her input to three AVX books, as reviewer (Amazon, 2016), editor (Shaw *et al.*, 2017), and contributor (Landry, 2019). In this way, she obtains a veneer of gravitas. Nonetheless, ardent AVX credentials are not far from the surface: in a 2008 fund-raising appeal for the NVIC, she called for donations to ‘end vaccine injury and protect health choices’ and to ‘stand up and be counted as our health ... is on the line’ (NVIC, 2008). Further, she was quoted as having written ‘vaccines are a holocaust of poison on our children’s brains and immune systems’ in a furious email response to a Fox News piece on vaccines (Ditz, 2017a<sup>14</sup>).

Similar underlying strength of feeling is seen in CMSRI’s harnessing of child health in its AVX communication. In 2011, CMSRI provided seed-funding for a documentary film entitled ‘The Greater Good’ (GreaterGoodMovie, undated). The film follows three families who believe they have been affected by vaccine adverse reactions. Despite giving the appearance of balance by including comments from vaccine expert Paul Offit, and Merck Vice President Mark Feinberg, the documentary is clear which side it is on. In heart-tugging scenes, a mother describes the death of her infant daughter following vaccination, and a teenager with severe incapacitation attributed to human papilloma virus (HPV) vaccine ends up in the emergency room on her prom night. The film’s popular Facebook page<sup>15</sup> states ‘The Greater Good strives to support empowerment through science-based education assuring the right to an informed choice regarding vaccination.’ The manipulation of emotions is an additional strategy, not identified in other case studies of agnotology.

As with the tobacco industry, the CMSRI seeks to boost its research credentials by conference organisation, e.g., the 2011 Vaccine Safety Conference and a series of International Symposia on Vaccines at SAB member Shoenfeld’s International Congresses on Autoimmunity (Events & Conferences page). The Vaccine Safety Conference<sup>16</sup> had the remit of discussing ‘current vaccine science and policy safety concerns.’ The speakers included seven current SAB members and the NVIC founder. Top of the billing was discredited doctor Andrew Wakefield, a heroic figure to the AVX community (Boseley, 2018). Unsurprisingly, the conference supported the view of knowledge gaps in vaccine safety. The series of International Symposia on Vaccines featured many of the same names, and the repeated message of vaccine-associated harm (see CMSRI YouTube<sup>17</sup>).

<sup>14</sup> Link to primary source is obsolete (<http://www.foxbusiness.com/on-air/stossel/blog/2010/10/30/holocaust-of-poison>)

<sup>15</sup> <https://www.facebook.com/greatergoodmovie/about/>

<sup>16</sup> All details at Vaccine Safety Conference, 2011 website <http://www.vaccinesafetyconference.com>.

<sup>17</sup> Links to Symposia pages on the CMSRI website are obsolete. CMSRI’s YouTube channel is at <https://www.youtube.com/channel/UCmmGltDaeYNsX00rzG9c-aQ/feed>.

CMSRI has a standard social media presence, with Facebook, Twitter and Instagram accounts and YouTube channel. CD appears in YouTube interviews from other AVXOs, such as AutismOne (AutismOne Media, 2014), and the Highwire with Del Bigtree. The latter is particularly effusive in his support for CMSRI and its research. In a representative edition of the Highwire (The Highwire, 2018), Bigtree reports live from the CMSRI-sponsored fifth International Symposium on Vaccines. In interview, CD speaks of scientists being under attack, and stresses the importance, quality and independence of the research into aluminium adjuvant being discussed at the symposium. The programme includes Bigtree's interviews with Exley and Shoenfeld, who Bigtree calls 'great scientists of our time' and 'superstars of science'. The programme ends with an appeal from Bigtree for donations to CMSRI; he implores people to be part of something, and to fund science to change the world.

CMSRI's social media communication includes articles written by freelance journalist Celeste McGovern, who specialises in 'in-depth analysis on...news that mainstream media shuns'. She is a particularly vehement critic of vaccines and the pharmaceutical industry, and her work contributes to CMSRI's final agnotological aim.

#### 4.2.5 Evidence for Strategy 5: Attack the Research and the Researchers

In common with other AVXOs, CMSRI seeks to undermine confidence in vaccines by questioning government and industry-sponsored research methods, and additionally vaccines as a product, in terms of their physical make up and function. CMSRI has three main criticisms:

*Lack of 'true' placebo:* AVXers claim that the absence of inert placebos or saline controls in many studies masks adverse effects. Contrary to AVXer claims, trials with saline placebos have taken place (e.g., Maruyama *et al.*, 2010). Furthermore, the use in trials of placebo where there is an existing effective/partially effective vaccine is ethically problematic, and generally unjustifiable (WHO, 2013).

*Inadequate follow up:* Timeframes for follow-up are described as relatively short, thus long-term sequelae are missed. Again, this is inaccurate; e.g., one study continued follow-up for five years (Villa *et al.*, 2006).

*Aluminium as a pervasive toxin:* CMSRI's promotional material 'Age of Aluminum' stresses that aluminium adjuvants have not been clinically approved, separate to vaccines (Vaxresearch, undated<sup>18</sup>). Their 'Makes You Wonder' social media campaign also focussed on aluminium safety, aiming to influence consumer preference for aluminium-free products, including vaccines (Boyle, 2015). This is despite longstanding use of aluminium in vaccines, and research determining its negligible risk (Mitkus *et al.*, 2011). Ironically, given CMSRI's clamour for independent research, research supporting adverse effects of aluminium is chiefly from Exley, Gherardi and Shaw (*q.v.*).

CMSRI's website does not overtly state that industry-sponsored research is conflicted, nor is it explicitly critical of vaccine-supportive research and researchers, in comparison to the rancorous language and *ad hominem* attacks seen elsewhere (e.g., Adams, 2017; Children's Health Defense, 2018). However, in interview on the Highwire, CD described patients as 'vulnerable to only having marketing campaigns as defining their health' (The Highwire,

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<sup>18</sup> Third party pdf. The document 'Age of Aluminum (*sic*)' is not available on CMSRI website.

2018). Shaw is on record describing Dr Paul Offit, vaccine expert and inventor of the current rotavirus vaccine, as a medical fascist (Dachel, 2018).

Vaccines as a product are indirectly targeted by CMSRI. Its Facebook and Twitter accounts have posted links to articles claiming multiple issues with vaccine formulations. McGovern's article 'Dirty Vaccines – Part One' reports on a paper published in a journal of low repute which purported to find diverse contaminants<sup>19</sup> (Gatti and Montanari, 2017). She goes on to describe the 'long and sordid history' of vaccine contamination (McGovern, 2017a). In 'Dirty Vaccines – Part Two' (McGovern 2017b), McGovern twists the facts from a reputable publication which found metallic contamination within safety limits in vaccine adjuvant (Schlegl *et al.*, 2015). The publication was concerned with impact on vaccine stability, not safety, however McGovern comments that 'very low concentrations of toxin and toxicants are dangerous to children's neurological development' and describes vaccine ingredient lists as 'a witches' brew.'

Clearly, CMSRI uses the final agnotological strategy to cast further doubt and uncertainty on vaccines as a safe product. These doubts are amplified by strident opposition from CMSRI-associates. Overall, the credibility of the scientific evidence underpinning vaccines as a safe and effective intervention is undermined.

#### 4.2.6 Summary of agnotological strategies used by CMSRI

I have demonstrated CMSRI's use of Pinto's five agnotological strategies to fuel debate and manufacture doubt over the scientific consensus that vaccines are safe and effective. There are some differences, principally the enlistment of non-experts. There is also direct assault on the product, not seen in the tobacco industry example. CMSRI harnesses available, diverse online media, and is frequently referenced by other AVXOs. It funds research within a restricted band of scientists, characterised by their marginal views on aluminium in disease aetiology. Far from 'pro-safety', CMSRI is resolutely AVX, as demonstrated by all of its activities. Many of these are also demonstrated by other AVXOs, often to a more extreme extent<sup>20</sup>, however CMSRI is set apart from most by its extensive support for research, and organisation of quasi-scientific dissemination events. These activities lend ostensible credibility and evidential weight to the rhetoric of all AVXOs.

#### 4.3 Motivations of CMSRI and other AVX organisations:

The motivations of AVXOs are of interest, not only to attempt to understand their misguided view of immunisation, but also to recognise why agnotology is an integral strategy for CMSRI and AVXers in general. Motivation is also relevant to the emerging field of vice epistemology, to be considered in section 5. Thus, it is germane to examine motivations for both the AVX stance and employment of agnotology.

To date, agnotological case studies have considered examples where there are clear commercial interests. Oreskes and Conway (2010) concluded that defence of the free market was the common thread in the cases they considered; US corporations railed against government regulation of industry, seen as an imposition on economic freedom. The free market was deemed central to progress, upon which liberty was thought to depend.

<sup>19</sup> The methodology of the study was heavily criticised by the European Medicines Agency (Andalo, 2017)

<sup>20</sup> Although not directly covered in this account, quick perusal of any of the following websites will confirm this: Age of Autism, Natural Health News (*q.v.*); Stop Mandatory Vaccination ([www.stopmandatoryvaccination.com](http://www.stopmandatoryvaccination.com)); Circle of Mamas ([www.circleofmamas.com](http://www.circleofmamas.com)).

Accordingly, case studies of agnotology demonstrate the involvement of right-wing, conservative think tanks, particularly in research activities<sup>21</sup>.

There are commercial interests at stake for some AVXOs (*q.v.*), but this does not seem to be a major motivation for most. AVX motivations are related to defence of civil liberties, particularly in opposing state vaccine mandates. These are the principle target of Del Bigtree's ICAN, who alludes to the founding fathers' fight against tyranny when encouraging Americans to stand up for the freedom to choose (ICAN, undated b).

It is also relevant that there are conspiracy theorists in whom AVX views combine with generalised beliefs of cover-up in official explanations for a multitude of events, observations and even natural phenomena. Conspiracy theorists are pertinent to this account as their beliefs are manifestations of failings in responsible, effective intellectual inquiry. As will be discussed in section 5, these failings can be described as intellectual or epistemic vices, and their presence and expression in a community impedes production of knowledge and true beliefs.

The above motivations are not apparent for CMSRI. There is no commercial interest, and as Democratic donors (*q.v.*) the Dvoskins do not fit the right-wing, conservative mould, nor is there evidence that they are conspiracy theorists. The main motivation of CMSRI, and many other AVXOs, is the desire to educate the public as to 'the facts' of vaccines. This is interesting, as it is *prima facie* altruistic. In terms of direct effects of vaccination, there is no impact on AVXers if others vaccinate their children. Nevertheless, many AVXers have personal experiences of family members they believe to have been damaged by vaccines, and express the need to inform other parents of the 'risks': CD tells the story of her twins' regression following immunisation (Vaccine Myth, 2014), Jenny McCarthy's son was diagnosed with autism (Kluger, 2009); the list goes on. Of course, construing this as virtuous is dependent on the respective beliefs of the message originator and recipient. AVXers believe they are saving humanity from destruction; the consensus view argues the contrary. Both sides believe that the other is deceptive and obfuscating. I contend that this acrimonious situation is a cradle for agnotology.

To fulfil their need to educate and inform requires AVXers to be taken seriously; their 'facts' must compete with the weight of medical and scientific evidence. In 1998, when Wakefield questioned the safety of the MMR vaccine<sup>22</sup>, the situation was redressed by research effort, which restored confidence in the vaccine (*q.v.*). About a decade later, the NVIC launched a call for donations to 'fund unbiased, scientific research into the health effects of vaccination' (Loe Fisher, 2009). Genuine scientific evidence would be countered by AVXer evidence. The first CMSRI-funded studies were published soon after (*q.v.*), and with the enlistment of a close circle of scientific advisers, the suite of agnotological processes was set in motion. AVXers could use their biased, subjective evidence to ratchet up the debate. In the next section I will examine the resultant epistemic effects.

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<sup>21</sup> For example, the Cato Institute ([www.cato.org](http://www.cato.org)), the Atlas Network ([www.atlasnetwork.org](http://www.atlasnetwork.org)).

<sup>22</sup> Wakefield was commercially motivated (Deer, 2011).

## 5 The epistemic effects of AVX agnotology

### 5.1 Background

As previously stated, debate, challenge and dissent are customary parts of scientific discovery and knowledge generation; they are usually epistemically beneficial. Agnotology is the extreme manipulation of this process, turning debate and disagreement from useful to detrimental. I have demonstrated that AVXers use agnotological strategies to spread doubt and cause confusion. I contend that this agnotology has widespread epistemic effects, and thus this section of my dissertation will focus on the question “what are the epistemic effects of AVX agnotology?”

Epistemology is concerned with matters such as the source, structure and limits of knowledge, and the justification for beliefs (Goldman and Blanchard, 2018). In this study I am concerned with the epistemology of real humans, rather than stylised examples used for analytical purposes. I use a broad definition of epistemology as the study of knowledge-creation and dissemination. As per this definition, epistemology is a practical and social endeavour, looking beyond the individual to the social environment, its interactions and systems. Studying the epistemic effects of AVX agnotology therefore includes evaluation of knower and believer, and the social conditions and attributes that shape them.

AVXers take great pains to communicate their message through all media, to all people (*q.v.*). They cite the need to inform about harms of vaccines and lies of the health system. A typical testimony reads “This is why I do what I do. I want to make sure other healthy, happy babies, like my son, are not harmed in the name of the greater good.” (Children’s Health Defense, undated b)<sup>23</sup>. AVXers also claim a high regard for knowledge and truth; they advocate individual research and even claim superiority of knowledge over professionals<sup>24</sup>. Thus Seymour (2017b) writes: “the average GP doctor... only receives a few hours of so called (*sic*) education on vaccines ... I on the other hand have ... completed more than 10,000 hours of research.” Likewise, Del Bigtree has no scientific credentials, yet pronounces on scientific data with supreme confidence and authority (e.g., The Highwire, 2019). In short, AVXers are ardent, convincing and supremely confident in their misguided communications, and I will argue this contributes to epistemic detriment.

### 5.2 AVX rhetoric as epistemically problematic dissent

#### 5.2.1 Consideration of Biddle and Leuschner’s conditions and AVX research

My starting point is Biddle and Leuschner’s (hereafter B&L) account of climate scepticism (Biddle and Leuschner, 2015), which describes four jointly sufficient conditions for epistemically problematic dissent. B&L’s basis is inductive risk: the risk of wrongly accepting or rejecting a hypothesis. As it is not possible to absolutely verify any hypothesis, its acceptance or rejection is decided on the strength of evidence. The degree of strength required increases as the consequence of mistakenly accepting/rejecting the hypothesis becomes more severe. Thus, the decision includes value judgments. Using case studies of industrial agnotology, B&L define four conditions for epistemically detrimental dissent:

- The non-epistemic consequences of wrongly rejecting a hypothesis are likely to be severe;

<sup>23</sup> This is a mild example. For a more extreme version, see Hayes (2018).

<sup>24</sup> AVXers are likely epistemic trespassers (Ballantyne, 2018), however consideration of this is beyond the scope of this account.

- The research that underpins the objection violates established conventional standards;
- The research favours protecting the producer from risk at the expense of public risk;
- Risks to producer and public largely affect different parties.

The ‘vaccinated/unvaccinated’ health outcomes study of Mawson *et al.*<sup>25</sup> was widely heralded as vindication of AVX views, with vaccinated children reported as having higher rates of a number of conditions than unvaccinated. Using this paper as my reference, I will consider B&L’s conditions for hypothesis H ‘vaccines are a safe public health intervention’.

**Severity of non-epistemic consequences of wrongly rejecting H:** The non-epistemic consequences of rejecting H would be on population health. If vaccines were no longer thought as safe, and their use curtailed, vaccine-preventable infectious disease rates would rise. Given that vaccines are estimated to save two to three million lives a year (*q.v.*), wrongly rejecting the hypothesis would have severe non-epistemic effects. AVX dissent over vaccine safety meets this condition.

**Research that underpins the objection violates established conventional standards:** The time-honoured standard for research publications is peer review. However, the standard of peer review is questionable in many journals; in particular, some journals are labelled ‘predatory’, as they exploit open-access publication by publishing papers of any quality to earn an article processing charge (Cobey *et al.* 2018). As outlined in sections 3.2 and 4.2, research cited by AVXers has been repeatedly criticised, retracted from publication, and generally published in low-impact journals, including some that are considered predatory (Beall’s list, 2019). Mawson’s paper exists in two versions, both of which are available on the CMSRI website. Version one was published in ‘Frontiers in Public Health’, from whence it was removed within a week. Version two appeared in Journal of Translational Science, then retracted, but republished (Retraction Watch, 2017). The publishers of both journals are considered predatory, and the fact of retraction from both indicates the poor quality of this paper, and violation of conventional standards. The condition is thus met.

**Research favours protecting the producer from risk at the expense of public risk:** In this context, protecting producer risk entails continued administration of vaccines in the face of research that demonstrates adverse effects of vaccines outweighing benefits. Although Mawson claims a greater incidence of a number of chronic diseases in vaccinated children, there is no quantitative analysis of the benefit of being unvaccinated. Thus, this research does not provide any evidence to support a claim that these benefits are greater than those of vaccination, for which there is a body of such evidence (WHO, 2010). Additionally, even if there were reliable quantitative evidence indicating that vaccine harms outweigh benefit, Mawson and other AVXers would not recommend continued administration of vaccines. This condition is not met by Mawson’s study, and is unlikely to be met by any study with AVX-support, given that AVXers are generally strongly critical of the pharmaceutical industry.

**Risks to the producer and public fall largely upon different parties:** Vaccines are commercial products, and it is therefore in the interests of their manufacturers that they are administered widely. However, this interest aligns exactly with that of public health, where the creation of herd immunity by wide uptake of vaccination prevents the spread of infectious disease. Thus, if H is rejected erroneously, there is risk to both producer and public. On these grounds, AVX dissent over vaccine safety does not meet this condition.

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<sup>25</sup> Table 1 #15 and 16.



Why does AVX dissent fail two of B&L's conditions? One difference is that, unlike climate debate, the dissenter is not the producer. Additionally, the producer's action reduces public risk, rather than increasing it. It is clear that B&L's conditions are not comprehensively applicable, but it is beyond the scope of this dissertation to consider alternatives.

B&L further propose that dissent meeting their conditions is epistemically problematic for two reasons. The first is the drain on resources caused by continual response to objections and questions. The second is the creation of a hostile environment, in which scientific inquiry is inhibited, and scientists intimidated; overall, scientific progress is impeded. If B&L's conditions for epistemically detrimental dissent are not met by AVX rhetoric, is it nonetheless epistemically problematic by their account? Undoubtedly, refuting AVX research has consumed resource; e.g., Wakefield's MMR/autism study prompted a number of studies, all of which showed no link between MMR vaccination and autism (CDC, 2015). It is conceivable that the same might be ongoing for HPV vaccines (e.g., Ikeda *et al.*, 2018). Certainly, research funding is used to combat vaccine hesitancy, e.g., Vaccine Confidence Project (Vaccine Confidence Project, undated) and the Vaccine Knowledge Project (*q.v.*)<sup>26</sup>, However, groups such as these are part of a functioning research infrastructure, and I cannot say that their funding or existence is solely due to AVX activism. Their existence, however, does argue against epistemic timidity, as does continued development of vaccines (see next paragraph). I therefore do not have unequivocal evidence of sustained epistemic wastage, or timidity.

There is likewise scant evidence that AVX rhetoric impedes progress in vaccines. This can be demonstrated by the licensing and rapid uptake of Gardasil (HPV vaccine), and by the growing number of vaccines included in the paediatric schedule; these are targets of, and possibly strengthen, AVX protest (e.g., Lobato, 2017; Loe Fisher, 2017; Caceres, 2018). Thus, agnotology of AVXOs does not accord with B&L's account based on climate scepticism. Again, I propose that this indicates limitations of B&L's account, rather than relieving the epistemic harm of AVX. I strongly contend that AVX rhetoric is epistemically harmful and I will argue that this is because it is epistemically corrupting.

### 5.2.2 AVX rhetoric and epistemic corruption

In a second study, B&L (with Kidd) propose that manufactured debate is epistemically corrupting, resulting in individuals developing epistemic vices (Biddle *et al.*, 2017). Epistemic vices (and virtues) are the character traits, thinking styles and attitudes which underpin how people think, reason, and explore information<sup>27</sup>. Epistemic vices oppose epistemic or intellectual virtues, or the agential characteristics that promote intellectual development, or skilled thought, leading to beneficial epistemic effect (Turri *et al.* 2017). Accordingly, epistemic vices obstruct effective and responsible intellectual inquiry and impede acquisition, retention and transmission of knowledge (Cassam, 2016; Kidd, 2016; Madison, 2017).

Agnotology creates a social environment in which vices develop. Biddle *et al.* (2017) suggest that it affects epistemic socialization, that is the establishment of processes which ground knowledge, and which form the basis of future inquiry and conduct (Bennett and Ferrell,

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<sup>26</sup> Both centres receive support from the Department of Health in England, via National Institute for Health Research.

<sup>27</sup> A list of suggested epistemic vices and virtues is given in Table 4.

1987). This combines with selective application of epistemic norms and standards: the corruption of the academic process which is facilitated by predatory journals, and the support of research which serves the interests of the funder. These social conditions allow sustained epistemic vice; in their utilisation of unprincipled norms and standards, they nullify or reduce the ability to withstand corruption.

I have shown that AVXers violate epistemic norms and standards: by assuming the mantle of credible experts, by selective funding of ‘crony’ researchers, and by their dissemination of this same biased, substandard research, all the while decrying the work of the real experts. Furthermore, they use appeals to the emotion of parents, associating fact with anecdote, and exploiting their vulnerability. They use all available channels to convey their message, reaching into the lives of ordinary people to fuel doubt. This is all the more powerful when celebrity voices are involved (Biddle *et al.* 2017). This is truly epistemic corruption: the active manipulation of the public understanding of vaccines, from composition, through mode of action, to effectiveness, and repeated undermining of true expert opinion, leads to eroded confidence, vaccine hesitancy and rejection.

### 5.2.3 AVX rhetoric and epistemic vice

Epistemic corruption creates conditions which are likely to nurture epistemic vices. These vices impede effective intellectual inquiry and arrival at true beliefs. Epistemologists have debated the importance of motives in determining whether a behaviour is truly vicious. Battaly (2014) has produced a detailed account of epistemic traits. She delineates two concepts, reliabilism and responsibilism, which differ in their view of whether intention or result is the defining factor of vice. For reliabilists, epistemic traits are innate or learned reliable, belief-forming faculties<sup>28</sup> which dependably produce expected ends. For epistemic vices, these are bad epistemic results. This account allows that a person with epistemic vice who by chance arrives at true beliefs is not epistemically vicious. For reliabilists, achieving negative ends is necessary and sufficient for vice; a vicious motive is not sufficient.

Alternatively, responsibilists consider intellectual vices to be acquired traits of character<sup>29</sup>, over which the individual has some control. They are not in-born characteristics and thus there is no intrinsic hard-wiring to seeking/obstructing truth. The responsibilist account therefore requires the motivation for effects, as well as their reliable production. Accordingly, responsibilist epistemic vices require blameworthy motives, and production of bad epistemic effects. The production of bad effects alone is insufficient, as these may occur by chance.

Where do AVXers stand with respect to the responsibilist/reliabilist account? As discussed, for some, e.g., CMSRI, their motives are seemingly virtuous (education of the ‘truth’ about vaccines), yet their ends are decidedly vicious (hesitancy and refusal of effective intervention). This aligns with the reliabilist view. The corrupting influence of agnotology could then be seen as supporting the development of epistemically vicious faculties. But other AVXers may have different, potentially blameworthy motives (e.g., the civil liberty argument, where the right of an individual to refuse vaccination is judged more important than benefit of the population) and thus accord with the responsibilist view.

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<sup>28</sup> In faculty psychology, the mind is understood to be composed of a number of faculties, such as perception, thinking and judgement, each of which is considered to be relatively independent of the others (Peel, 2017).

<sup>29</sup> Character traits are mental and moral qualities which are stable and enduring and are products of learning or cultivation, not fortune (Homiak, 2019).

I contend that AVX rhetoric and its agnotological effects are vicious, for both the ends attained and the motives. The need to educate and inform is borne out of a heinous process of misinformation on vaccine safety and efficacy; the two are so intertwined as to render it impossible to determine which gave rise to the other. Certainly, each now sustains the other. Added to this is the emotional manipulation of parents who are anxious for their children's welfare. I believe this to meet the conditions of a robust vice charge, and not a rhetorical complaint (Kidd, 2016). From Kidd's description, rhetorical complaints cannot be substantiated, and are akin to *ad hominem* attacks. In contrast, robust charges are well-reasoned and backed up by evidence. They are also specific in the vices being invoked, and provide explanation of the relationship between the vice and the acts provoking the charge, which I will now explicate.

I suggest that AVXers exhibit a range of inter-related epistemic vices. Those reading and believing the online content of AVXOs are gullible, careless and negligent in their approach to evidence. They are also prejudiced with respect to expertise, affording this information more credit than it deserves. This favouring of selected evidence is a form of cynicism, another epistemic vice (Cassam, 2016). For ardent AVXers, no amount of new evidence is enough to shake their beliefs<sup>30</sup>; thus, AVXers exhibit the vice of closed-mindedness by their refusal to engage seriously with alternative options (Battaly, 2018). Battaly contends that closed-mindedness affects the conduct of inquiry, sources consulted, methods used and questions; thus, it is broadly affective. Furthermore, closed-mindedness may lead to superficial engagement with evidential options before their dismissal and suggestion of alternatives, i.e., to agnotology.

Vice epistemology is an emerging field, and thus there is no agreed list of vices, and no established taxonomy or ontology of vices. However, closed-mindedness is a commonly agreed example (Cassam, 2016) and has been suggested as a capital epistemic vice, i.e., a vice that is corrupting, creating conditions in which further vices are developed and used (Kidd, 2017). One such offspring vice is dogmatism: the tendency to assert principles as unquestionable and the refusal to engage with alternatives (Kidd, 2017, Battaly, 2018).

AVXOs such as CMSRI are both closed-minded and dogmatic, and this is reflected throughout their operation. They engage superficially with the consensus view of vaccine safety before rejecting it and propounding their one-sided view of harm. They denounce impartial, high-quality research as biased, while offering their epistemically-risible alternatives as incontrovertible. They promote their isolated, partisan researchers as true experts and denigrate others with opposing views. Through their communications, they encourage the same in others. In short, they actively foster an epistemically polluted, corrupting environment, likely to lead to further epistemic vice.

#### 5.2.4 Summary of epistemic effects of AVX rhetoric

In this section, I have considered how AVX rhetoric can have detrimental epistemic effects. Starting with B&L's account, based on climate scepticism, I have shown that AVX agnotology does not meet all of B&L's proposed sufficient conditions for detrimental dissent. Likewise, it does not exactly align with B&L's account of impeding epistemic progress, wasting epistemic resources, or causing epistemic timidity. I believe this reflects on the inadequacy of B&L's account. To demonstrate this, I have shown that AVX rhetoric is

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<sup>30</sup> This has been shown empirically (Nyhan *et al.*, 2013; Nyhan and Reifler, 2015)

epistemically corrupting, actively fostering multiple epistemic vices including closed-mindedness and dogmatism, and encouraging the same in others.

## 6 Conclusion

Vaccine hesitancy is a problem of the developed world, and threatens the control of serious infectious diseases. AVXOs broadcast their version of vaccine science to the world, setting themselves up as expert, science-based sources of information. They play to the emotions of conscientious parents, fuelling doubt and suspicion about a demonstrably safe and effective public health intervention.

My case study of CMSRI shows that this is achieved through five agnotological ploys, analogous to those used by the tobacco industry since the 1950s, and still being used when scientific fact competes with other interests. For CMSRI, and other AVXOs, the motivation seems to be education and information. Apart from most other AVXOs, CMSRI has sponsored dubious, partial research which it invokes to strengthen its AVX message.

Ardent communication in an agnotological manner has the potential for widespread epistemic damage; i.e., it impedes the progress of developing knowledge and the process of gaining knowledge and true beliefs, for both the scientific community and the general public. Using a model for judging epistemically detrimental debate (B&L, 2017) I have shown that AVX agnotology has not had the same effect on the scientific community as the debate on climate change. B&L's model is not a good fit for AVX agnotology, probably because the dissenter is not protecting commercial interests. Future work could develop B&L's conditions to account for other types of dissenters.

Despite the partial lack of fit with B&L's model, I emphatically contend that AVX agnotology is epistemically corrupting and has an epistemically detrimental effect on the public. I argue that this is because AVXOs exhibit epistemic vices, including the capital vice of closed-mindedness, and its offspring vice, dogmatism. These create an environment that nurtures further epistemic vice in the general public, rather than in scientists. These public epistemic vices fuel vaccine hesitancy and garner support for AVXOs. It is truly a vicious epistemic circle.

In my study of the pertinent topic of AVX activism I have needed to be highly selective, due to the wealth of possible directions for research. I have chosen to analyse the agnotological and epistemically detrimental processes used by AVXers, as I believe this is central to their success in influencing public opinion on vaccines. I believe this to be the first study to consider AVXer epistemic vices. In doing so, I have elucidated how these vices arise from and sustain AVXer organisation, activities, communication methods and ultimately their ongoing eminence and persistence.

9984 words (Sections 1 – 6)

**Table 1. Research papers which acknowledge CMSRI or DFF funding**

Details of studies which have acknowledged CMSRI/DFF funding (acknowledgement is verbatim). These were either listed on the CMSRI website, as indicated, or were found by searching PubMed/Google Scholar. It is not an exhaustive list. There are also some studies which are claimed as CMSRI-funded on the website, but there is no acknowledgment of this in the publication; these are not included in this list.

#	Title, Journal and Notes <sup>31</sup>	Year	Authors <sup>32</sup>	Funding Acknowledgement	Link on CMSRI website
1	Do aluminum vaccine adjuvants contribute to the rising prevalence of autism? Journal of Inorganic Biochemistry  Considered by WHO to be seriously flawed	2011	Tomljenovic, L. and <b>Shaw, C.A.</b>	This work was supported by the Katlyn Fox and the <b>Dwoskin Family Foundations.</b>	Yes
2	Aluminium Vaccine Adjuvants: Are they Safe? Current Medicinal Chemistry  Considered by WHO to be seriously flawed	2011	Tomljenovic, L. and <b>Shaw, C.A.</b>	This work was supported by the Katlyn Fox Foundation, the <b>Dwoskin Family Foundation</b> and the Lotus Foundation.	Yes
3	Mechanisms of aluminum adjuvant toxicity and autoimmunity in pediatric populations Lupus	2012	Tomljenovic, L. and <b>Shaw, C.A.</b>	This work was supported by the Katlyn Fox, Lotus, and the <b>Dwoskin Family Foundations.</b>	Yes
4	Human papilloma virus vaccine and primary ovarian failure: another facet of the autoimmune/inflammatory syndrome induced by adjuvants. American Journal of Reproductive Immunology	2013	Colafrancesco, S., Perricone C., Tomljenovic, L. and <b>Shoenfeld. Y.</b>	The authors thank the <b>Dwoskin Family Foundation</b> for support.	Yes

<sup>31</sup> Unless mentioned in the main document, these papers are not in the bibliography.

<sup>32</sup> CMSRI SAB members in bold face.

5	Slow CCL2-dependent translocation of biopersistent particles from muscle to brain BMC Medicine	2013	Khan, Z., Combadière, C., Authier, F.J., Itier, V., Lux, F., <b>Exley, C.</b> , Mahrouf-Yorgov, M., Decrouy, X., Moretto, P., Tillement, O., <b>Gherardi, R.K.</b> and Cadusseau, J	This work has benefited from research funding from two patients associations: E3M (Entraide aux Malades de Myofasciite à Macrophages), AFM (Association Française contre les Myopathies) and <b>Dwoskin Foundation (Nano in brain)</b> ; from Région Ile-de-France through a programme PICRI (Partenariat Institutions-Citoyens pour la Recherche et l'Innovation), and through two post-doctoral positions from NeRF (Neuropole de Recherche Francilien); and from the European Community's Seventh Framework Programme in the project ENDOSTEM (Grant agreement number 241440).	No
6	Aluminum in the central nervous system (CNS): toxicity in humans and animals, vaccine adjuvants, and autoimmunity Immunologic Research	2013	<b>Shaw, C.A.</b> and Tomljenovic, L.	Acknowledgments: The authors thank the <b>Dwoskin Family Foundation</b> and the Katlyn Fox Foundation for support.	Yes
7	Aluminium's role in CNS-immune system interactions leading to neurological disorders Immunome Research	2013	<b>Shaw, C.A.</b> , Kette, S.D., Davidson, R.M. and <b>Seneff, S.</b>	This work was supported in part by <b>Dwoskin Family Foundation</b> and Katlyn Fox Foundation grants and the Luther Allyn Dean Shourds estate (CAS) and by Quanta Computers, Taiwan, under the auspices of the Qmulus project.	Yes
8	HPV vaccines and cancer prevention, science versus activism. Infectious Agents and Cancer	2013	Tomljenovic, L., Wilyman, J., <b>Vanamee, E.</b> , Bark, T., & <b>Shaw, C. A.</b>	This work was supported by the <b>Dwoskin</b> and Katlyn Fox <b>Family Foundations.</b>	No

9	Clinical features in patients with long-lasting macrophagic myofasciitis Frontiers in Neurology	2014	Rigolet, M., Aouizerate, J.Couette, M., Ragunathan- Thangarajah, N., Aoun-Sebaiti, M., <b>Gherardi, R.K.</b> , Cadusseau, J and Authier, F.J.	This work has benefited from research funding from (i) patients associations: E3M (Entraide aux Malades de Myofasciite à Macrophages), AFM (Association Française contre les Myopathies) (grant #7239); (ii) <b>Dwoskin Foundation (Nano in brain)</b> ; (ii) Région Ile-de-France through PICRI (Partenariat Institutions-Citoyens pour la Recherche et l'Innovation) program (Grant agreement number 241440).	No
10	Biopersistence and brain translocation of aluminum adjuvants of vaccines Frontiers in Neurology	2015	<b>Gherardi, R.K.</b> , Eidi, H., Crépeaux, G. Authier, F.J. and Cadusseau, J.	This work has benefited from research funding from patients associations: E3M (Entraide aux Malades de Myofasciite à Macrophages), Association Française contre les Myopathies (AFM) and <b>Dwoskin Foundation (Nano in brain)</b> ; from Région Ile-de-France through a program PICRI (Partenariat Institutions-Citoyens pour la Recherche et l'Innovation) and from ANSM, procédure hors appel d'offre	No
11	Postural Orthostatic Tachycardia Syndrome (POTS) – A novel member of the autoimmune family (editorial) Lupus	2016	Dahan, S., Tomljenovic, L and <b>Shoenfeld, Y.</b>	L Tomljenovic receives funding from Luther Allyn Shourds Dean Estate Foundation and the <b>Dwoskin Family Foundation</b> (private foundations).	Yes
12	Insight into the cellular fate and toxicity of aluminium adjuvants used in clinically approved human vaccinations. Scientific Reports	2016	Mold, M., Shardlow, E., and <b>Exley C.</b>	This research is supported financially by the UK Medical Research Council (MRC, MR/J006939/1). The <b>Dwoskin Foundation</b> is also thanked for funding.	No

13	Behavioral abnormalities in female mice following administration of aluminum adjuvants and the human papillomavirus (HPV) vaccine Gardasil Immunologic Research  Republication of article that was withdrawn from Vaccine (2016)	2017	Inbar, R., Weiss, R., Tomljenovic, L., Arango, M.-T., Deri, Y., <b>Shaw, C.A.</b> , Chapman, J., Blank, M. and <b>Shoenfeld, Y.</b>	This work was supported by the grants from the <b>Dwoskin Foundation Ltd.</b>	Yes
14	Subcutaneous injections of aluminum at vaccine adjuvant levels activate innate immune genes in mouse brain that are homologous with biomarkers of autism Journal of Inorganic Biochemistry  Retracted.	2017	Li, M.D., Tomljenovic, L., Li, Y. and <b>Shaw, C.A.</b>	The authors thank the <b>Dwoskin Family Foundation</b> (grant #20R73006), the Katlyn Fox Foundation (grant #20R47306) and the Luther Allyn Shourds Dean estate (grant #20R17162) for financial support.	No
15	Preterm birth, vaccination and neurodevelopmental disorders: a cross-sectional study of 6- to 12-year-old vaccinated and unvaccinated children Journal of Translational Science  This is republication of the paper above.	2017	Mawson, A.R., Bhuiyan, A.R., Jacob, B. and Ray, B.D.	This study was supported by grants from Generation Rescue, Inc., and the <b>Children's Medical Safety Research Institute</b> . Both are charitable organizations that support research on children's health and safety.	Yes
16	Pilot comparative study on the health of vaccinated and unvaccinated 6- to 12-year-old U.S. children Frontiers of Public Health  Retracted.	2017	Mawson, A.R., Ray, B.D., Bhuiyan, A.R. and Jacob, B.	This study was supported by grants from Generation Rescue, Inc., and the <b>Children's Medical Safety Research Institute</b> , charitable organizations that support research on children's health and safety.	Yes
17	Aluminium in Brain Tissue in Multiple Sclerosis. International Journal of Environmental Research & Public Health	2018	Mold, M., Chmielecka, A., Rodriguez, M., Thom, F., Linhart, C., King, A., and <b>Exley, C</b>	MM is a <b>CMSRI Research Fellow</b> . This research was partially funded by a grant to CE from the <b>Children's Medical Safety Research Institute (CMSRI)</b> , a charity based in Washington, DC, USA.	No



18	Aluminium in brain tissue in autism, Journal of Trace Elements in Medicine and Biology	2018	Mold, M., Umar, D., King, A. and Exley, C.	The research is supported by a grant from the <b>Children's Medical Safety Research Institute (CMSRI)</b> , a not-for- profit research foundation based in Washington DC, USA	No
19	Unravelling the enigma: elucidating the relationship between the physicochemical properties of aluminium-based adjuvants and their immunological mechanisms of action. Allergy Asthma & Clinical Immunology	2018	Shardlow, E., Mold. M. and Exley C.	MM and ES are <b>CMSRI-funded research fellows</b> in the Research Group on Aluminium and Silicon. CE, ES and MM acknowledge the support of the <b>Children's Medical Safety Research Institute (CMSRI)</b> .	No

**Table 2a. Impact of journals publishing CMSRI/DFE-funded research**

The journal impact factor for the year of article publication was obtained for 19 CMSRI/DFE publications using InCites Journal Citation Reporting Tool (<https://jcr.clarivate.com>).

<b>Journal Title</b>	<b>Year of publication</b>	<b>Publisher</b>	<b>Journal impact in year published</b>
Current Medicinal Chemistry	2011	Bentham Science	4.859
Journal of Inorganic Biochemistry	2011	Elsevier	3.354
Lupus	2012	Sage	2.783
American Journal of Reproductive Immunology	2013	Wiley	2.668
BMC Medicine	2013	Springer Nature	7.276
Immunologic Research	2013	Springer Link	3.525
Immunome Research	2013	Longdom	0*
Infectious Agents and Cancer	2013	Springer Nature	2.071
Frontiers in Neurology	2014	Frontiers	0*
Frontiers in Neurology	2015	Frontiers	3.184
Lupus	2016	Sage	2.454
Scientific Reports	2016	Nature Research	4.259
Frontiers of Public Health	2017	Frontiers	0*
Immunologic Research	2017	Springer Link	2.487
Journal of Inorganic Biochemistry	2017	Elsevier	3.063
Journal of Translational Science	2017	OA Text	0*
Allergy Asthma & Clinical Immunology	2018	Springer Nature	2.664
International Journal of Environmental Research & Public Health	2018	MDPI	2.468
Journal of Trace Elements in Medicine and Biology	2018	Elsevier	2.895

\* Journals that were not indexed have been scored as 0 impact and included in the average impact calculation.

**Table 2b. Average impact assessment of CMSRI publications**

The average journal impact figure of 19 CMSRI/DFF funded publications was calculated from the figures in Table 2a. This average figure was compared to the ranking by impact of all journals in 2018, according to the InCites Journal Citation Reporting Tool (<https://jcr.clarivate.com>).

<b>Journal</b>	<b>Impact in 2018</b>	<b>Rank by impact in 2018</b>
CAA cancer journal for clinicians	223.679	1
Nature Reviews Materials	74.449	2
Materials Today	24.372	50
Annual Review of Fluid Mechanics	17.214	100
Nature Communications	11.878	200
Pharmacology and Therapeutics	9.396	300
Environment Intl	7.943	400
Mayo Clinic Proc	7.091	500
Business and Society	5.013	1000
Future Medicinal chemistry	3.617	2000
Journal of vegetation science	2.944	3000
Human Resource Development Review	2.487	4008
Molecular Reproduction and Development	2.124	5000
	<i>average impact of 19 papers</i>	<i>average against 2018 impact</i>
CMSRI/DFF (papers in Table 1)	2.63	3660

**Table 3. CMSRI SAB Members**

<b>Name</b>	<b>Position</b>	<b>Institution</b>	<b>Notes on conflicts / cautions</b>	<b>References</b>
Dr Beatrice Golomb	Professor of Medicine	University of California at San Diego	Controversial views on contested diseases	LaFee (2018)
Dr Chris Exley	Professor of Bioinorganic Chemistry	Keele University	Funded by CMSRI; controversial views on aluminium in neurological disease	Table 1; Chivers (2017)
Dr Christopher Shaw	Professor of Ophthalmology	University of British Columbia	Funded by CMSRI; controversial views on aluminium in neurological disease; co-founder of company developing and marketing diagnostic and therapeutic products for neurodegenerative conditions.	Table 1; Neurodyn (undated)
Dr Eva Vanamee	Co-Founder	FusionBio Inc.	Author on publication funded by CMSRI; appeared in AVX documentary with Andrew Wakefield	Table 1; IMDb (2013)
Dr Jimmy Cheng-Ho Lin	Founder	Rare Genomics Institute		
Dr Nadine Kabbani	Associate Professor, School of Systems Biology	George Mason University		
Dr Richard Deth	Professor of Pharmacology (retired)	Northeastern University	Controversial views on autism and vaccination link	Thomas (2018)
Dr Rita Colwell	Distinguished Professor	University of Maryland; Johns Hopkins University	Controversial views on cholera	Levy (2005)

Dr Romain Gheradi	Professor of Neuromuscular Disease	Henri Mondor Hospital, University of Paris-Est	Author on publication funded by CMSRI; controversial views on autoimmune diseases; commercial interests	Table 1; Vaxopedia (2019)
Dr Stephanie Seneff	Senior Research Scientist in Computer Science and Artificial Intelligence	Massachusetts Institute of Technology	Controversial views on autism aetiology	Bloom (2017)
Dr Vicky Pebsworth	Board Member and Director of Research and Patient Safety	NVIC	Volunteer for NVIC; parent of 'vaccine damaged' child	NVIC (undated)
Dr Yehuda Shoenfeld	Professor (Laura Schwarz-Kipp Chair for Research of Autoimmune disease)	Tel Aviv University	Author on publication funded by CMSRI; controversial views on autoimmune diseases	Table 1; Science Based Medicine (2019)

**Table 4. List of proposed epistemic virtues and vices**

<b>Epistemic virtues</b>	<b>Epistemic vices</b>
attentiveness	insensitivity to detail, idleness, laziness
benevolence	malevolence
creativity	rigidity
curiosity	conformity
discernment	gullibility, wishful thinking
honesty	obtuseness
humility	arrogance
objectivity	prejudice, cynicism
open-mindedness	closed-mindedness, dogmatism
intellectual courage	servility, timidity, cowardice
conscientiousness	lack of thoroughness, negligence, carelessness
intellectual integrity	self-indulgence
epistemic responsibility	intellectual pride

Compiled from suggestions of Baehr (2010), Battaly (2014), Cassam (2016), Madison (2017), Tanesini (2018). Arranged in suggested opposition by EG.

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