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# Matters of Biocybersecurity With Consideration to Propaganda Outlets and Biological Agents

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**Abstract:** The modern era holds vast modalities in human data utilization. Within Biocybersecurity (BCS), categories of biological information, especially medical information transmitted online, can be viewed as pathways to destabilize organizations. Therefore, analysis of how the public, along with medical providers, process such data, and the methods by which false information, particularly propaganda, can be used to upset the flow of verified information to populations of medical professionals, is important for maintenance of public health. Herein, we discuss some interplay of BCS within the scope of propaganda and considerations for navigating the field.

**Keywords:** biocybersecurity, cyberbiosecurity, cybersecurity, public health, biosecurity

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## 1. Introduction

The flow of information to a medical professional is variable in terms of content and volume. Generally, licensed healthcare providers and allied health professionals are supplied a myriad of information during their education and training. While the number of years and tests required for employment varies amongst the possible careers for this population, generally there are one or multiple certifications or licensure exams at the terminus of their formal education. Additionally, there tend to be required clinical internships, often before those formerly mentioned exams, that allow these professionals to officially join the workforce. This is especially the case for professions that require the internship as part of the requirements to legally join the field. Even after fully earning the title of their profession, the learning continues in the form of a specific number of continuing education credits, announcements from supervisory medical professionals or healthcare management, specialized public health announcements conversations with their peers, and entries in academic medical journals. In contrast, the general population, specifically patients without a formal medical background, instead utilize a much wider front of knowledge. This front encompasses newspapers, television programs, videos, and posts on social media from healthcare professionals and those without any medical training, and official announcements from government and non-government agencies. Thus, information sources are available to everyone, regardless of medical background. However, people with limited or no medical background are exposed to this often with scientifically unsupported information void of the knowledge helpful to separate facts from misinformation or disinformation. This problem uniquely rests at the intersection of biosecurity, cyber-physical security, and cybersecurity, wherein the interlock of biology in the form of data or as a pathological agent especially in times of pandemics, can be used to exploit systems. Governments and economic entities would find value in preventing exploits that could disrupt their stability. In this article, we seek to suggest how avenues of knowledge, both for the medical professional and the layperson, may be hindered or compromised regarding an indeterminate biological agent.

## 2. Veracity of information

We will begin by discussing how laypeople obtain information. As outlined above, their methods are far less formalized than that of medical professionals. For example, in the U.S., the ability for news services to operate under FCC regulations prevents intentionally broadcasting false information under the guise of news (Broadcasting False Information 2021). However, this is predicated on the broadcaster completely understanding the nature of biological agents and such information is variably available. Online services (either sites that are commonly referred to as "Social Media", but any network that allows for information sharing - which could even be a video game service provided it enables the communication of citizens) are given some protection from what their users choose to share under Section 230 of the Communications Decency Act

(Section 230 of the Communications Decency Act). These services may have internal policies that support the dissemination of truthful information. However, they are not required to do so given lack of consequences for transmission.

### **3. Exploitation of a general public**

Many methods exist for exploiting communities through generating or disseminating data. Some routes obfuscate facts, misdirect, cause dissemination of false information, and unnecessary emphasis in reporting to disturb public focus. These can all be directed and gamed by state-level and local actors for various motives, including but not limited to applying economic pressure to another state to weaken, probe, or use it as a testbed for in the form of a deferred study, or a combination. In the case of a deferred study: this may not be uncommon. For example, 90% of experimental drugs were reported to have been tested outside of the United States and Canada in 2017, and further, these drugs commonly yielded more favorable results in developing countries, which may hint at questionable motives in data collection and potential to mislead those not privy to eccentricities in studies undertaken (Panagiotou, et al, 2013; Robbins, 2017). This route can open the door to indirect probing of nation health, while also being used as a vehicle for misleading interested parties in said data. Albeit this potential being fringe, the consideration can help map future scenarios regarding the discussion of international testing dynamics in epidemiological interventions.

For simplification, an episode of the COVID-19 pandemic will be used as an example in considering inherent dangers. One potential example of this can be found from hypothetical imaginings based on praise and critique in the coverage of Sweden, who resisted lockdown measures in favor of their economy, but eventually changed its policy (Ellyatt, 2020). Data in Sweden has since been compared with data of other countries that both chose different lockdown strategies (Taylor, 2020). There is no evidence for one to say that Sweden's decision was affected by disinformation, but it is possible that select episodes of Sweden's policy could be misrepresented for propaganda to encourage harmful or counter-productive healthcare policy in other nations, but this remains to be seen. For consideration, the closest example might be through the encouragement of hydroxychloroquine use in Brazil as influenced by the US in 2020, but it must be stated that there's inconclusive evidence to imply that the use and encouragement were malicious, especially at a state-level, and this is just as a thought exercise (Berlivet and Löwy, 2020). Early on and following experiments for verification, some researchers expressed concern due to inconclusive evidence of hydroxychloroquine's efficacy and or the negative effect that stockpiling had on patients of other maladies who had a more immediate need of the drug in other countries, profits notwithstanding (Cavalcanti et al, 2020; Falcão et al, 2020; Martins-Filho et al, 2020; Palmeira et al, 2020). This illustrates a potential for propaganda in the form of disinformation or misinformation to deliver an effect in a country at cost but in favor to others. If eventually and truly acted upon, this means of BCS propaganda is important to monitor.

### **4. The routes in further detail**

Obfuscation involves propaganda that makes meaningful information difficult by flooding the public with useless or inaccessible information. This can come in the form of media that recklessly reports threat severity and the non-solutions, ultimately resulting in much of the public rejecting mainstream news advice delivery. Non-compliance remains a risk ((Feunekes and Hermans, 2020; Nivette et al, 2020). In terms of COVID-19, this has taken the form of news that worn the public on information concerning origins, validity, and impact of COVID-19, as well as any proposed intervention, such as stay-at-home orders or lockdown encouragement, social distancing, mask-wearing, and vaccine reception -- obfuscation typically complicates relief efforts (Forman et al, 2020; Scheid et al, 2020). Furthermore, such obfuscation can empower acceptance of ineffective and insufficiently evidenced interventions internationally, such as unnecessarily wide mesh masks that cannot stop droplet transmission, herbal concoctions, poorly-tested pharmaceuticals and other misinformed efforts of treatment, such as encouraged contraction. Such propaganda in essence carries hints of community and state capture as evidenced in the widespread and rapidly increasing cases of death and injury in countries where prominent leaders have resisted scientific consensus or peddled unproven treatments (Freckelton, 2020; Nordling, 2020; Reihani, 2020).

Another BCS-propaganda route is misdirection, which is related to obfuscation but differs on the directionality of consumer attention and effort and can lead to scapegoating. In the case of COVID-19, many individuals directed considerable animosity towards people of Asian descent in the early months of 2020 (Misra et al, 2020; Gover et al, 2020; Ziems et al, 2020). Other examples of misdirection can be found in the misplaced emphasis

on the logistics of solutions by competing political parties as evidenced through partisan bickering over aid and relief packages in legislation (Bard, 2017; Fiedler, 2020; Nicola et al, 2020). One more example can be found in conspiracy theories channeling dissatisfaction and action towards governments with accusations of liberties being stripped away and even protested efforts to mitigate the spread of the virus. (*Coronavirus lockdown protest: What's behind the US demonstrations?*, 2020). Malicious state-level actors looking to reduce pressure on their nations through inciting internal chaos can find such BCS-propaganda to their benefit. Some may use the information to prey on relief groups focus on less-privileged areas. Consequently, many health-focused groups are looking for more accessible means in the face of short supplies for the underserved who are likely to face delays with access to the vaccine in ways similar to the early days of the AIDS epidemic, which also amplified on-going disparities (Thrasher, 2020; *Pushing for a People's Vaccine for COVID-19*, 2020).

Concerning perhaps the most obvious propaganda, disinformation, involves the transfer or circulation of verifiably incorrect information. Disproving false information, amid widely imperfect public perception, can prove difficult. While spreading false information can confer many benefits for a malicious actor, it can be challenging to implement it without debating the proliferation of science communicators and general fact-checkers. However, especially highly-partisan, and conspiracy-aligned individuals can act as prominent vectors for spreading false information (Wallace-Wells, 2020). Additionally, research has demonstrated that false information spread by bots has low penetrance, but emotionally-charged, human-spread information can exceed transfer rates of truthful news (Langin, 2018). Thus, by using low-information, low-disciplined people as vectors for false information, a seed can be sown that persistently undercuts control efforts to defeat pandemics and related issues. However, it is worth restating that plenty of high-information, highly educated people can be successfully targeted as well. As others have alluded, the public, by and large, is highly susceptible, bringing complication to plans that tackle just education as a sole defense within info-war environments (Aro, 2016; Woolley and Howard, 2018).

A final example is that of omission, which can be accomplished via intentionally underreporting instead obscuring health-related data through direct attacks of networks that hold records. Clues can be found in disputes over Florida's data covering their number of Covid-19 cases, which some allege that information related to COVID-19 deaths or cases has been inaccurately reflected or hard to properly access at times (Chacin & Klas, 2020; *Why are coronavirus deaths doubling in Florida's nursing homes?*, 2020). While there may not be malfeasance, this controversy points to a potential for a malicious actor in a hypothetical situation to tailor propaganda that encourages state-level omissions. Questions already exist in other countries with regard to true COVID-19 tolls (Richards, 2020). This can create a false sense of business-as-usual and lead to the early lifting of travel bans and the potential of these locations becoming hotspots for areas near other parts of the country via travel.

## **5. Disinformation for medical professionals**

Medical professionals have an oath and strong legal and career consequences that help to prevent the intentional spread of false information. These consequences include revocation of one's license or certification to work in their profession, difficulty obtaining another license or certification in the medical field, or lawsuits with steep financial consequences. Even the publication of medical information requires some standards which could be called exacting, such as the accepted standard double-blind, peer-review process for academic journal integrity. However, this standard has been compromised to a degree by predatory publishing practices wherein quality and the information supporting a given work are not up to sufficient thresholds. Theoretically, the violation of academic medical publishing can also be considered a BCS-threat as it involves an exploit of cyber-systems that pertain to matters of biosecurity. Two of the authors, Palmer and Potter discussed this previously at their presentation, "Commentary on Cataloguing Biological Assets and Academic DDoSing: Thoughts on Biocybersecurity in the Global South" at a prior conference, with research on-going (Palmer and Potter, 2021). Hypothetical scenarios considered, one route of violation is through the DDOS of reviewers, in which malicious actors can inflict damage internationally through means of slowing meaningful review and publication of data on biological assets, which could lead to fractured biomedical logs for medical communities, by targeting different geographic areas of different fields. For example, one could target one paper for surgeons and another for internal medicine practitioners, with unnecessarily, differing information. In essence, this could further contribute to the already notable differences in opinion of care among mainstream health practitioners. Another is through the skewed representation of national assets, through false data, disrupting the progress of developing nations who look to expand their economies through biological resource discovery. Another is

through the slowed global advancement of biologically-based research through a combination of the above; this of course has indirect effects on lives saved, as disruptions to a country's economic stability can impact the quality-of-life. Given that biodiversity is largely underestimated and lack of identification for existing pathogens, this could hamper pandemic-related research (Larson, Ghosal, & De Sousa, 2020; Pennisi, 2020). Already various scientists and other specialists are acting proactively to root out and pre-empt pandemic capable pathogens and such may see their efforts diluted if abuses of medical literature records are unchecked (Cox, 2021; Scientists focus on bats for clues to prevent next pandemic, 2020). Such requires biological database manipulation which connects to the interlock of biology, making this inescapably BCS.

BCS propaganda could also vary professional opinions and medical decision-making. This overall can affect patient healthcare plans, especially where healthcare teams require a combination of professionals. This route may still threaten given: a higher degree of training undergone by healthcare providers in charge of creating and finalizing patient care plans, increased curation of high-caliber research in reputable journals, and decreased use of less-reputable journals by practitioners. Yet, the barrier to sabotage prevention may be lowered through flooding of ranks in healthcare with skeleton crews due to staffing issues and consequent inadequacies in facility-specific training; decreased cognitive functioning in exhausted units; infiltration of ranks with ideologically-driven, less-principled staff; increased barriers to accessing high-quality journals via pay-walls; attacks on high-quality journals via DDOS; and over-reliance on non-peer-reviewed sources. The previously described routes could gradually, deliver significant shocks to a nation's healthcare capacity and gradually sink struggling facilities. This possibility is compounded through medical professional susceptibility to propaganda as evidenced by some within the anti-vaccination movement (Khazan, 2017).

## **6. Unsubstantiated specific drugs and medical equipment preferences**

A significant mode of the BCS-propaganda may be primed towards individuals most likely to be able to command large-scale contracts such as senior company officials or members of the government. Secondly, such may be targeted towards their influencers, such as lobbyists or sales-representatives. Tertiarily, propaganda may be aimed at lower workers and academicians. Following, such propaganda targeting can be aimed at civilians to influence upwards. With this hierarchy, the influence for the purchase and reception of monetary incentives for drugs is possible. This also applies to equipment as BCS-propaganda can affect the directing of equipment of ventilators or masks. In terms of COVID-19, it has been found that some masks can be less effective than no masks (*The mask matters: How masks affect airflow, protection effectiveness*, 2020). The consequences of propaganda that skews purchases and the use of ineffective equipment can be nearly as damaging as BCS propaganda on drugs and related material, and further, can distract from current, more effective equipment-based interventions. One more area worthy of investigation is the global divide between the Global North and South. COVID-19 has shown that a divide in access has existed as vaccines are readied, whereas the wealthier nations have expressed resistance in relaxing COVID-19 vaccine IP (Farge, 2020). While they are willing to share. This is where malicious actors could hypothetically push for wealthier nations to find means of extended leverage for increased access to resources or strengthen groups in weaker nations who may push back against vaccines. Although extreme, this illustrates not only the reach, but the dimensionality that notions of kickbacks for stakeholders can take on.

## **7. Potential for Industrial sabotage**

BCS propaganda affecting research could result in supply chain damage and to the adequate production of the products themselves. This can kickstart a chain reaction wherein a nation's long-term response to pandemic management is hindered. Between companies and communities, this can produce large-scale market imbalances. However, a further dark side to this is that of potential, substantial damage to literature and clinical trials. As a result, misinformation or disinformation entered could result in improper entries to journals, thus delaying or clouding solutions to other pathogens that rely on said data. For example, mRNA-based vaccines, although crafted shortly for COVID-19, relied on data from prior vaccines decades prior (Garde & Saltzman, 2020). In the future, it is possible that malicious actors may look to the sabotage of research to delay or stop progress decades down the line. There are also cross-field effects in the case of agriculture and pharmaceutical generation being entwined. For example, one can point to cases such as of tobacco plants being used to generate pharmaceutical or vaccine components. BCS-propaganda attacks on the use of such agricultural technology can affect both agricultural research and that of pharmaceutical research at the same time, not counting emergent research that results from innovations in either field (Palca, 2020). An example of a short-term benefit is exercised leverage, but long-term ramifications can be worldwide and cross-discipline.

## **8. Relevance to bioagents**

A conventional assumption about how a bioweapon should work is that it would be an exceptionally virulent agent that would decay outside the human body rather quickly when exposed to normal, atmospheric conditions. This makes sense in the context of using bioweapons as a tool for conventional warfare. An actor would not want to soften a target only to make it outright impossible for their own forces to take due to the risk of catching a disease of one's own manufacture. This would only be useful in a "Scorched Earth" strategy which most conventional conflicts tend to avoid due to the widespread environmental and economic damage as shown with experiments with anthrax, which limited use of the land due to threat perseverance (Hulme, 2011; Li, 2005; Wilson, 2005). However, if one were to make a biological weapon and optimize it for psychological damage as a backdrop to an information-warfare campaign, it makes more sense to create an agent that would last a relatively long time, even if its effects would not be particularly deadly, or its onset particularly acute. Prior to COVID-19, the suspected agent for such an attack could have been something like a weaponized strain of Tularemia (Michaelis, 1991; Sjöstedt, 2001). The longevity of such an attack would be useful for two reasons. The first would be through draining resources caused by complicated triage of the infected. The second would be through draining personnel resources from a hospital system, especially those understaffed.

This psychological edge would be lost if perpetrator-identification were easy. Logically, giving face to an external cause of a devastating disease would likely fast-track adversary mobilization. Therefore, utilizing a "quieter" disease and creating a fog of war, especially in places like cyberspace where the flow of information is either unchecked or the flow mechanism faces no consequences for displaying unverified information. This in turn incentivizes subtle weakening techniques. Following, distribution of propaganda becomes a necessity for the optimal use of certain strains of bioweapons, and this then reinforces the importance of health education as a modern defense foundation component.

## **9. How BCS can be affected through propaganda**

To discuss theoretical fog of war creation, prior insight on misinformation and disinformation through cyber networks, specifically through social media, are helpful to examine. For example, Facebook has long been a hotbed and topic for propaganda, but criticism reached new heights in 2016, wherein flooding by malicious actors resulted in meaningful propaganda injections which have been alleged as critical election factors in 2016 and beyond (Benkler, 2018; Bourassa et al, 2017; Faris et al, 2017; Fisher, 2020; Golovchenko, 2020; Howard and Kollanyi, 2016; Howard et al, 2018; Stewart et al, 2018; Walter and Jamieson, 2020; Woolley and Guilbeault, 2017). Relevant to Biology is that of Covid-19 vaccinations, of which inadequate to borderline acceptable public support has concerned healthcare workers and officials, triggering questions of what social media giants can do fix this (Iboi et al, 2020; Neergaard et al, 2020; Wilson and Wiysonge, 2020). The social-cyber engineering barrier combined with physical ramifications places this squarely within BCS, and social media companies wield heavy influence here as they support a marketplace and often gear, which both eliminates the typical "distance" a user has from another, via from a cyber interface and a physical interface (phones, VR, and other equipment). Considerable research especially notes that the internet and VR platforms can play a role in affecting behavior, and this is important considering the value of cyber-competency in leaders, even to military personnel (Day, 2020; Fuenekes et al, 2020; Sundararaj and Rejeesh, 2021; Kavanagh, 2020; Adžgauskaitė and Presavento, 2020; Kim et al, 2020; Machulska et al, 2020). How social media will ultimately guide BCS-evolution since it can be a conduit for health information, is important for reflection.

## **10. Other intersections and cost comparisons**

BCS-based propaganda can stretch to military personnel maintenance, but also shares an intersection with biologics research, in terms of military advantage with respect to concerns of Covid-19 research espionage (Lallie et al, 2020; Lee and Haupt, 2020). This intersection is additionally valuable given the presence of biodata and value of exploiting it as an alternative means of conflict for nations looking to make themselves more competitive at reduced expense. For example, \$10,000 affords few effective munitions, but can buy considerable ad-space and time through social media with the possibility of allowing the Global south to spread inaccurate news. As another example, at the time of this writing, one site listed costs per click on a platform at under \$0.40 (Birk, 2020; Lua, (n.d.). Compare with the cost of an M1A2 tank, MQ-1 Predator UAV, and M4 Carbine Rifle) at over 6 million, 4 million, and 700 USD, respectively (*ABRAMS TANK (M1A2)*; Curtis, 2012; *UNITED STATES AIR FORCE FY 2011 Budget Estimates 2010*). Cost comparisons are convincing for slight military budget restructuring, in innocuous ways; comparisons of traditional weapons to cyber weapons, for example, are already noted in the literature (Bates, 2020). Long-term consequences may of budget modeling and diversification can be manifold

across multiple sectors. For example, adapted to agriculture, this can take form in the disruption of meaningful legislation for GMO crops for a rival nation or on legislation that affects farmer-to-distributor transactions (Shukla et al, 2018; Botha et al, 2020; Oloo et al, 2020; Mashal et al, 2021). A further application of this may see propaganda aimed at influencing divestment from weapons programs to save other sectors between rivals.

BCS-propaganda could also be used to change course and depress containment efforts. Super-spreader events possess this capacity, and it is possible for malicious actors to tweak propaganda to trigger more (Lemieux et al., 2020; Fontes, Reyes, Ahmed, & Kinzel, 2020; Wells, 2020). This falls into the hands of repressive efforts by some authoritarian governments, which have promoted for curtailing abuse of speech popularization risks for long-term threats regarding free-speech protections among weakened yet freer governments. This noted, research on curtailing speech abuses without repressive cuts on speech may be favorable for the preservation of Western values. This is just one of many routes of societal change that could use additional investigation as pandemics impact politics and government function.

## 11. Conclusion

An individual's choices will be largely determined by the information they are exposed to. In the case of BCS threats, this information must be timely, verifiable, or demonstrably correct to make high-quality decisions. The primary concern as discussed above is that of BCS threats and the different stakeholder groups acquired data through different modalities. Each of those modalities can be violated in different ways with misinformation and disinformation. In particular, average citizens who utilize social media for their information may have platforms that lack information verification standards. Medical and industrial professionals tend to have higher standards, yet those protocols can also be violated through most labor-intensive means. Additionally, the funding of a BCS threat based on primarily disinformation is cost-effective when compared to conventional military munitions, programs, and operations.

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**Xavier-Lewis Palmer, Ernestine Powell and Lucas Potter**

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