



The Value of Knowledge Translation in an Infectious Disease Context: The COVID-19 Pandemic Perspective

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ABSTRACT: As of 2021, the impact of the COVID-19 pandemic is evident in every facet of life, despite the availability of knowledge to prevent or mitigate the spread of infectious diseases. Infectious disease pandemics will continue to be a global challenge, and yet the hesitancy of decision makers to utilize the plethora of evidence based strategies in a pandemic response threatens the future global health security. Therefore, this paper focuses on exploring how knowledge translation (KT) practices can be integrated into infectious disease prevention and control using the current COVID-19 pandemic to identify KT barriers. By continually synthesizing and incorporating research findings into routine decision making processes, public health institutions can adequately prepare health systems to manage a pandemic. The application of KT can be approached from four different stages: synthesis of information, dissemination of knowledge, exchange of knowledge, and ethical application of knowledge. Using the four stages of KT, the following propositions were made: investing in links between knowledge synthesis and utilization, engaging broader stakeholders in knowledge dissemination activities, creating effective two-way communication lines between knowledge producers and users, and strengthening knowledge utilizing activities. By demonstrating the utility of applying the four KT stages in an infectious disease pandemic context, it is hoped that more discussions and research is stimulated to engage the incorporation of KT into future outbreak responses.

KEYWORDS: COVID-19, Knowledge Translation, Policy, Infectious Diseases

INTRODUCTION

The 2019 SARS-CoV-2 (COVID-19) disease has now been recorded in 192 countries, infecting over 122 million people and causing the death of over 2.7 million people.¹ The impact of the COVID-19 pandemic is apparent in every facet of life, a reality that could have been avoided.² Given the experiences with Severe Acute Respiratory Syndrome (SARS) in 2003 and the predictions of future viral outbreaks, nations could have better prevented and mitigated the impact of the pandemic.² Unfortunately, infectious disease pandemics will continue to be a global challenge, but the bigger challenge to global health security threat lies in the hesitancy of decision makers to use the plethora of evidence to prevent future pandemics.

It is crucial to note that a health system's ability to prevent and mitigate the impact of a pandemic is hinged on the extent to which decision makers support health system strengthening initiatives.³ Evidence-driven initiatives to identify and resolve health system gaps in a timely manner ensures future optimum performance and rapid response. Despite this fact, Fan et al.² as well as the World Health Organization (WHO)³ highlight that available evidence was not optimally used to predict and mitigate the negative consequences of the current COVID-19 pandemic. This failure to implement or drive an appropriate infectious disease preparedness strategy to strengthen the health system and other necessary apparatuses indicates a knowledge translation gap.⁴ As such, efforts need to be mobilized to fast track knowledge translation (KT) processes responsible for opening channels to bridge the gap between decision makers and knowledge producers in order to strengthen health initiatives.^{4,5}

The objective of this paper is to highlight the value of KT in strengthening health systems' capacity to prevent and mitigate future infectious disease threats in countries and globally. KT as a concept will be defined, before exploring its various participants. Afterwards, the four stages of KT are highlighted and contextualized within the COVID-19 pandemic. Finally, recommendations based on the experiences of COVID-19 and KT are presented. The authors of this paper are confident that by continually synthesizing and incorporating research findings into routine decision making processes, public health institutions tasked with ensuring public health security will be adequately prepared to strengthen the health system's capacity to manage a pandemic.



The 2019-Coronavirus pandemic, did we see it coming?

Drawing on knowledge from past epidemics, several countries had national guidelines, and infectious disease response guidelines to deal with an infectious disease outbreaks, with knowledge producers even predicting the imminent coronavirus threat prior to the current COVID-19 pandemic.² Following the 2003 SARS epidemic, Cheng et al.⁶ provided a comprehensive narrative of the epidemiology, diagnosis, and global response to 2003 SARS. These efforts provided insights into how to better prepare decision makers to deal with future pandemics. Additionally, prior to COVID-19, the Global Health Security (GHS) Index published in October 2019, rated the United States, China, Italy, and South Korea as being ‘more prepared’ in terms of their infectious disease emergency preparedness.⁷ The GHS Index is a comprehensive assessment that evaluates the health care security of 195 countries against the International Health Regulations.⁷ Despite being highly ranked in infectious disease preparedness, the United States currently faces and continues to maintain the highest COVID-19 case and death counts globally, highlighting that high income countries are equally vulnerable to ‘pandemic shocks’.¹

In addition to previous experiences with past epidemics and preparations for future outbreaks, knowledge producers had highlighted the risk of an outbreak of coronaviruses in China.² As highlighted in the January 2019 edition of the academic journal *Viruses*, Fan et al.² documented a detailed prediction of a coronavirus outbreak almost one year prior to the first publicly reported cases of COVID-19. Despite knowledge producers articulating the risk of an infectious disease outbreak, a COVID-19 outbreak was reported in China’s Hubei province.^{8,9,10,11} In a relatively short time, the outbreak escalated to become one of the worst flu-like infectious disease pandemics since the 1918-1920 Spanish influenza pandemic.¹² With the experience of previous infectious disease epidemics, preparations for epidemics, and warnings of an imminent outbreak - , the question arises, how did such an outbreak rapidly spiral into into an uncontrolled pandemic? While answers may vary depending on perspective, or metrics being measured, one possibility lies in the challenges of effectively applying KT in infectious disease preparedness, response and prevention, - indicative of a disconnect between those who produce knowledge and those who use it.

Definition of Knowledge Translation (KT):

Several aspects of national COVID-19 responses could have been optimized through the application of KT. The KT process is defined “as methods for closing the gaps from knowledge to practice”.⁴ In practise, KT is the bridge that links researchers who are responsible for evidence synthesis, to policymakers responsible for putting the knowledge into action.⁴ KT can be broken down into four different distinct stages: synthesis of information, dissemination of knowledge, exchange of knowledge, and ethical application of knowledge.^{13,14,15} These stages are defined as follows:

1. Synthesis of information: Involves generating and integrating evidence from various research studies into a decision making process.¹⁵ Information synthesis is critical, because it amasses knowledge from various research into a central pool that stakeholders can draw from, increasing the accuracy of their decisions.
2. Dissemination of knowledge: This stage focuses on how knowledge is disseminated to different stakeholders in a manner that is compelling and useful.⁴ It ensures that the pool of available information is not just archived, but communicated to all relevant decision makers in a manner that they can easily understand and utilize.^{15, 16}
3. Exchange of knowledge: This stage works best when there is a regular feedback loop between the knowledge producers, decision makers, and information users who utilize the evidence for developing best practices and policies.^{14,16,17}
4. Ethical application of knowledge: This stage is the most important component of KT, as it ensures the constant evaluation and monitoring of evidence-based interventions and policies to ensure that no harm is done.^{14,15} In a public health context, the ethical application of knowledge ensures the rapid implementation of interventions with an emphasis on safe-guarding lives throughout the process.

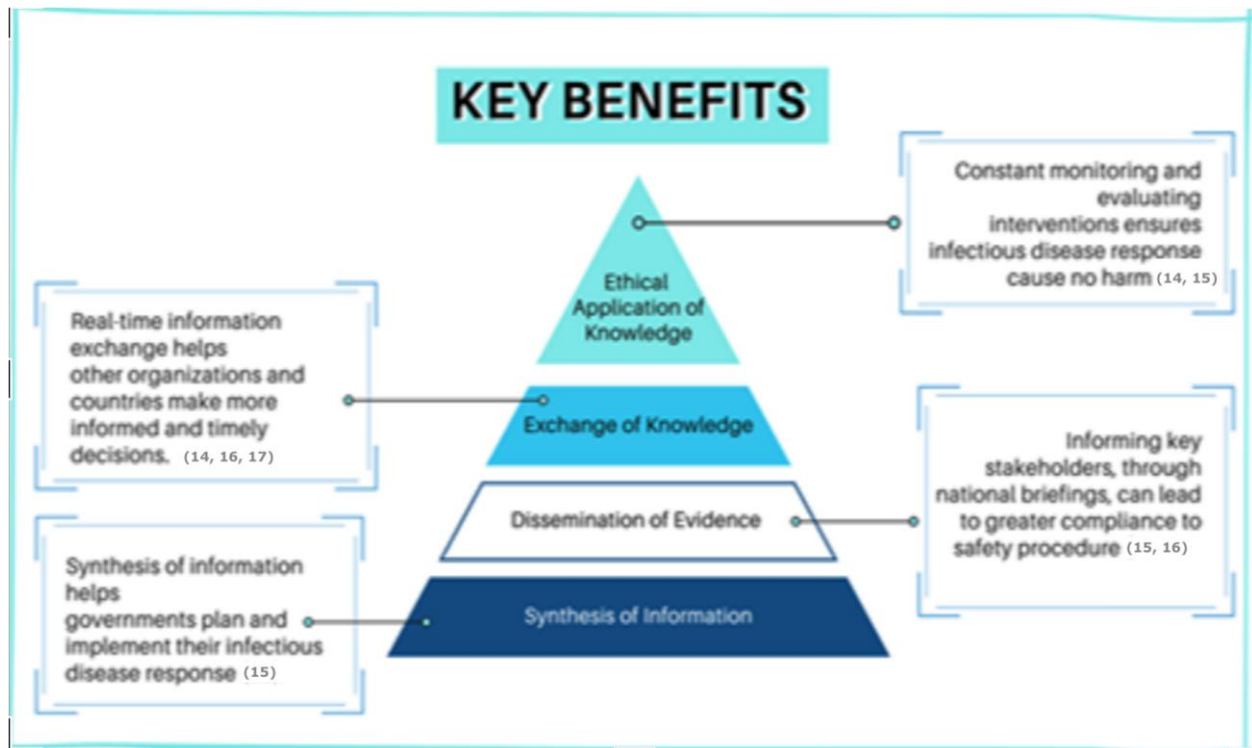


Figure 1: Illustration of KT stages

Although researchers continually make their findings available through various means, knowledge may not be put into practice in a timely manner due to political agendas, lack of funding, or poor implementation.^{8,18} This time gap needs to be addressed in an infectious disease pandemic context. Not only does a slow KT practice challenge the implementation of valuable research when it is required, it also predisposes these policies and practices to being outdated in the face of an increasingly evolving science.¹⁸ Some schools of thought believe that the hesitancy to promote and invest in KT in an infectious disease context comes from unfavourable past experiences, where findings from randomised controlled trials were generalized onto broader subjects.⁶ Doing so resulted in a waste of resources.⁸ As such, exploring viable options that can increase a decision maker's confidence in research findings is essential to preventing the generation of outdated policies.¹⁸ However, it is believed that these obstacles can be overcome through more frequent interactions between decision makers and knowledge producers.⁸

Who are the decision makers and knowledge producers?

Based on work by the WHO³ and Straus et al.⁴, a definition of decision makers was synthesised for the purpose of this analysis. This paper defines the decision maker as any person working in the context of an infectious disease response whose primary role is to set the direction for how a country will respond before, during, and after an infectious disease pandemic. They are the people in the various national infectious disease agencies and other government parastatals whose understanding and role in an infectious disease response can define how well the country is able to control the threat. Their reliance on knowledge from research and other sources of information is critical in their decision making process. Their negligence and poor quality decision making could lead to poor preparedness, poor health systems performance, economic, and ultimately human loss.³ This paper classifies decision makers into three categories: policy makers at different global and country levels, government officials involved in the pandemic response, and clinical facility administrative staff.

Knowledge producers, on the other hand, are those who have the skills, technical competence, and experience to synthesize context specific evidence through research to bridge a knowledge gap for managing infectious diseases at country or global level.⁴ Knowledge producers are defined in this paper as: researchers, clinical staff partaking in producing pertinent data on the pandemic, and relevant government and private bodies producing predictive and performance analytic reports on the infectious disease onset



and progression. With the key participants of KT defined, it is now possible to examine how KT can be applied in the COVID-19 context, starting with the disconnect between knowledge producers and decision makers.

Stages of knowledge translation in an infectious disease context:

The application of KT concepts are best demonstrated through its four different stages, and the following section will focus on describing the stages of KT by exploring how they are applied in a COVID-19 context.^{4,5,13,14} According to the Lowy Institute's COVID-19 performance index report, it is interesting to note that the countries with the best performance included elements of the KT process in the national COVID-19 response.¹⁹ Both Taiwan and New Zealand are in the top 3 best performing countries, KT elements of the early stages of their responses will be highlighted below.

Knowledge synthesis: Taiwan's centralized control centre, called the Central Epidemic Command Center (CECC), is a great example for knowledge synthesis efforts.²⁰ The CECC was charged with rapidly generating new knowledge on a COVID-19 outbreak, such that decision makers are well positioned to act swiftly when required.²⁰ The CECC also acts as a central hub, coordinating knowledge from research on infectious diseases to guide their policy making processes.²⁰ Taiwan's CECC generated knowledge on the epidemiology of COVID-19 through information on the symptoms, and viral shedding of the COVID-19 virus, which was critical for their response.^{20,21,22} Furthermore, upon the detection of the first cases in Taiwan, researchers were able to rapidly draw from all the synthesized data when developing effective testing procedures and isolation centres for positive cases.²² Taiwan's example describes the value of creating systems that can rapidly produce knowledge to guide a responsive, evidence-based decision making process. Rapidly generating information avoids the long delays involved in translating knowledge into action during public health emergencies.

Dissemination of evidence: Engaging multiple stakeholders through dissemination of evidence is a value approach in a pandemic response. For instance, the general populace are considered to be key stakeholders in the COVID-19 pandemic, as their behaviour determines how quickly transmission of the virus can be stopped within the community.⁵ Taiwan ensured that the predictions of the pandemic were communicated in a simple way to its citizens, in order to strategically build social cohesion.^{20,21,22,24} The Taiwanese government's transparency has been praised by researchers and world leaders throughout the pandemic.^{21,24} Countries such as New Zealand took a similar approach in their COVID-19 response by holding regular briefings to inform the country on updated infection numbers and safety protocols.^{21, 25} These updates led to greater compliance of safety procedures such as community based non-pharmaceutical interventions (NPI) including social distancing and regular hand washing.²⁵ Similarly, the WHO also applauded New Zealand for its leadership and careful communication of COVID-19 relevant information.²⁵ The government of New Zealand was revered for their empathetic and transparent language during the peak of the pandemic where several of its officials served as the main public communicators, ensuring that COVID-19 was de-stigmatized and the pandemic viewed as an opportunity to unite. The consistent and unilateral approach proved to be successful and is highlighted via increased public trust levels.²⁶ This approach has clearly contributed to New Zealand being one of the few countries whose first and second wave recorded lower morbidity and mortality rates when compared with similar high-income countries.¹

Exchange of Knowledge: Real-time exchange of knowledge also reduces the chances of generating false assumptions and allows for sharing of best practices to occur between different nations during their COVID-19 response.^{15,17,18} During the early onset of the COVID-19 outbreak in late January 2020, the Taiwanese government implemented an exchange of knowledge approach to rapidly respond to a potential COVID-19 case imported from China.^{21,23} The Taiwanese CDC and CCEC came together to lead the management of the response.^{21,23} The collaboration of the two organizations allowed the border officials to assess the citizen's risk level before returning to the general public - directing those of high risk to self isolate in a timely manner to prevent community spread.²³ All passengers arriving from Wuhan were prompted for screening; eventually, screening was extended to all passengers regardless of their travel origins.²³ By mid March, a legal framework was devised combining information from the National Immigration Agency (NIA) and Taiwan's National Health Insurance Administration's (NHIA) to include citizen's travel history.^{21,23} This framework allowed decision makers access to information that would increase their ability to detect and isolate COVID-19 cases. The government's response was so swift and effective that no stringent restriction or national lockdowns were imposed on the nation.²³

Ethical application of knowledge: Upon the recognition of a novel pneumonia-like disease occurring in Wuhan, China, the CECC in Taiwan acted quickly to understand viral transmission to explore various prevention options.^{21,22} At the outset of an outbreak, the Taiwanese government prioritized detection and screening, nationalizing the production and distribution of respirators and face masks, and enacting policies that would prevent shortages or hoarding of essential protective gear.^{21,24} Through these policies, the government was able to ensure universal access to surgical masks from February 2020 onwards.²³ New Zealand also demonstrates ethical application of knowledge through its very early aggressive national lockdown.^{23,25,26} New Zealand recorded its first case on March 23, 2020 prompting a lockdown on March 25th; easing of its lockdown regime only began May 9th, 2020. As of May 27th, 2020, the country had only recorded 1,504 cases, of which 1,474 have recovered, and 22 deaths.²⁶ Additionally, the nation created an open channel for knowledge exchange in its COVID-19 response.²³ The nation’s preliminary response was based on its existing influenza pandemic plan that was revised back in 2017.²³ The plan followed a mitigation strategy which looked to flatten the curve.^{23,27} However, the government shifted gears to a full lockdown of the highest levels shortly after detection of the first case in the nation.²³ The shift came after examining early data out of China that demonstrated the ineffectiveness of the mitigation approach.²³ As a result, the New Zealand Parliament passed legislation granting special powers to address the pandemic.²³ Along with the nation’s effective contact tracing, systematic quarantine measures, and effective border control, New Zealand is now been able to resume a higher level of normalcy than other OECD nations, hosting large gatherings and even music festivals.²⁸ The country noted the success of the lockdown in reducing spread in other countries and committed to an elimination strategy that promised to contain and eliminate future spread. Furthermore, New Zealand was able to exhibit an ethical application of knowledge, by providing its residents with extensive economic relief packages such as wage subsidies, rent and mortgage deferral plans, payments, etc.²⁹ Together, these policies serve as an example of ethical application of knowledge, because they seek to minimize the economic losses to individuals that can occur during a lockdown²⁹.

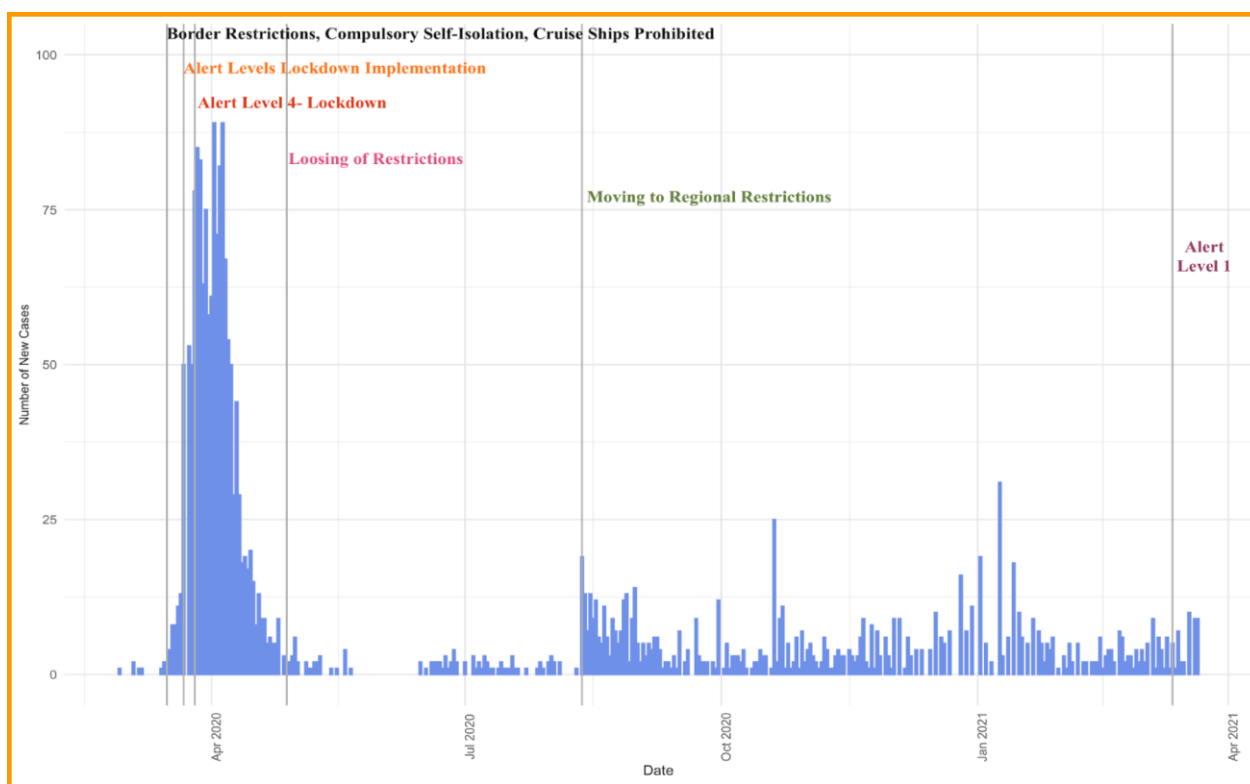


Figure 2: New Zealand Epicurve Demonstrating the Introduction of Policies and COVID-19 Case Count Progression Since the Onset of the Viral Outbreak



RECOMMENDATIONS

Going through the stages of KT by citing examples from Taiwan and New Zealand's COVID-19 response highlights KT elements that helped them stand out on the global stage. Therefore, key recommendations based on the four stages of KT are proposed to help decision makers prepare for future infectious disease outbreaks.

Recommendations for Knowledge Synthesis:

This stage is the base unit of the KT process, providing the necessary evidence to carry out the rest of the KT stages. To ensure that KT products are not misleading, and are consistent and comprehensive, it is important that:

- Efforts must be explored to centralize information into a national/provincial hub to allow for a robust, accurate, timely response upon the occurrence of another infectious disease outbreak.
- Organizations design a systematic and auditable approach on a national or regional level that would catalyze the process by which scientific studies are investigated for their validity and accuracy.

Recommendations for Dissemination of Evidence:

The public has been one of the major determinants of how this pandemic played out. Their compliance with the novel measures was key in controlling the community transmission of the virus.^{5,21} As such, it is important that successful methods be highlighted and utilized in future infectious disease outbreaks. Dissemination of information was best received when it was communicated:

- In real-time and transparently.
- Using empathetic language to communicate vital information to all stakeholders and the general public.

Recommendations for Exchange of Knowledge:

Knowledge being available is not sufficient; it needs to be put into the right hands. This is especially true when a robust, timely, evidence based strategy is required. Therefore, agencies should emphasize efforts for:

- Instituting two way lines of communication between knowledge producers and decision makers to increase efficiency by which gaps are identified and closed on either end.
- Establishing two way lines of communications between relevant government agencies involved in responding to infectious disease outbreaks.
- Streamlining the flow of information to ensure stakeholders can send feedback as quickly as they receive information.

Recommendations for Ethical Application of Knowledge:

The pinnacle of the KT process, this stage holds a lot of weight. Application of knowledge requires that every possible implementation outcome is considered. At the moment, the process is lengthy, resulting in the archiving of valuable knowledge. In countries that experienced SARS in 2003 and utilized the documented lessons, it proved valuable. As such, it is important to learn from past experiences by:

- Continuously investing in bridging the gap between knowledge synthesis and utilization for infectious disease pandemics
- Expanding funding for infectious disease surveillance and provide the means to act on new information

By strategically working to implement the four stages of KT, governments may fare better when faced with infectious disease outbreaks in the future. These recommendations are shaped by the experiences of Taiwan and New Zealand, who have implemented the various stages of KT throughout their pandemic responses. It is hoped that by working to centralize information in an auditable way, disseminating information quickly and transparently, creating effective two-way lines of communication, and bridging the gap between knowledge producers and users, future infectious disease outbreaks can be addressed quickly before they become epidemic.

CONCLUSION

Epidemics and pandemics are hardly a new phenomenon; many countries have had experiences with infectious disease outbreaks like the 2003 SARS epidemic.⁶ Despite lessons learned from these experiences, sophisticated health care systems that are supposed



to be prepared for infectious disease outbreaks, and evidence for a coronavirus outbreak, COVID-19 was able to spread from an outbreak to pandemic in a relatively short period of time.^{2, 6,9,10,12}

This paper posits that applying the four stages of KT can be beneficial to infectious disease outbreaks, as demonstrated by the actions of Taiwan and New Zealand throughout the COVID-19 pandemic. Their actions demonstrated effective knowledge synthesis, dissemination of knowledge, exchange of knowledge, and ethical application of knowledge. Therefore, it is recommended that decision makers work to strategically implement KT processes in their current and future infectious disease response to address infectious disease outbreaks quickly. It is hoped that by providing these recommendations, a case for further research is made, so that more knowledge producers and users work to engage with each other moving forward.

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