Use of Quarantine as a Non-Pharmaceutical Intervention for Public Health Emergencies: Findings from Case Reports

Sneha Patel, MSW, MPH

Commissioned by the National Academies of Sciences, Engineering, and Medicine,
Committee on Evidence-Based Practices for Public Health Emergency Preparedness and Response

Date: December 5, 2019

Contents

1 Executive Summary

The National Academies of Sciences, Engineering, and Medicine, Committee on Evidence-Based Practices for Public Health Emergency Preparedness and Response commissioned this report to synthesize findings from case reports related to the effectiveness of quarantine during a public health emergency. More specifically, the report seeks to summarize strategies affecting adherence with quarantine, barriers and facilitators to effective quarantine, and benefits and harms associated with quarantine. The report is intended to support findings from research studies, provide a different perspective from research studies, or provide the only available perspective concerning a specific phenomenon of interest.

The Committee identified case reports directly or indirectly related to quarantine by conducting a broad literature search and call for reports. These reports were then further prioritized through the development and application of a "Sorting Tool." Reports were categorized as either "high priority" or "low priority" using the criterion of relevance, adapted from the AACODS checklist (Authority, Accuracy, Coverage, Objectivity, Date, Significance). Tabletop exercises were deprioritized unless they elicited new themes. Data were then coded in NVivo.

A total of 27 case reports were categorized as high priority, and 1 was categorized as low priority. Ultimately, all 28 case reports were included in the thematic analysis. Most did not directly address the research questions of interest. Review findings suggest that quarantine may be effective in reducing disease transmission in some circumstances; however, it is unclear whether it is the cost effective given the potential resource implications and direct and indirect costs associated with it. Some case reports also discussed the lack of clarity over how helpful quarantine actually was in reducing disease transmission, while others suggested that quarantine led to increased transmission and mortality. Additional harms associated with quarantine include infringement of civil liberties and privacy, stigma and psychological harm, and potential for lost wages and school absenteeism. Further research is recommended to better understand both the effectiveness and acceptability of voluntary quarantine compared to legally-enforced quarantine. Although facilitators such as transparency, trust, clear and accurate risk communication, provision of necessary supports for quarantined people, and culturally-appropriate approaches may enable more effective quarantine measures, additional research is recommended to better understand the potential for short- and long-term harms.

2 Introduction

Quarantine, "the separation and/or restriction of movement of persons who are not ill but are believed to have been exposed to infection to prevent transmission of diseases," is a non-pharmaceutical intervention that was developed centuries ago (334). However, it has rarely been used in recent times on a large scale, and its effectiveness remains unclear. This report was commissioned by the National Academies of Sciences, Engineering, and Medicine, Committee on Evidence-Based Practices for Public Health Emergency Preparedness and Response to synthesize the gray literature around when and in what circumstances quarantine is effective. More specifically, this paper examines the strategies that affect adherence with quarantine, the barriers and facilitators to effective quarantine, and the benefits and harms of quarantine.

Additionally, evidence-to-decision considerations for implementation of quarantine (acceptability/preferences, resources and economic considerations, equity issues, and feasibility) are discussed. Findings from this review will be used to add weight to findings from research studies examined in the commissioned paper entitled *Quarantine as a Non-Pharmaceutical Intervention: Qualitative Research Evidence Synthesis,* provide a different perspective from research studies, or to provide the only perspective concerning specific phenomena of interest.

3 Methods

Literature search

The Committee identified gray literature published by relevant domestic and international organizations and agencies. This included Association of Public Health Laboratories (APHL), Assistant Secretary for Preparedness and Response (ASPR), the Association of State and Territorial Health Officials (ASTHO), Centers for Disease Control and Prevention (CDC), Center for Health Security, Council of State and Territorial Epidemiologists (CSTE), European Centre Disease Prevention and Control (ECDC), Disaster Information Management Research Center at the National Library of Medicine at the National Institutes of Health (NLM/NIH), Department of Homeland Security (DHS), Federal Emergency Management Agency (FEMA), US Government Accountability Office (GAO), National Association of County and City Health Officials (NACCHO), National Center for Disaster Medicine and Public Health (NCDMPH), Preparedness and Emergency Response Centers (PERRC), Public Health Canada, Public Health England, RAND Corporation, and the World Health Organization (WHO). Additionally, the committee obtained 370 after-action reports published from 2009 to 2019 from the Homeland Security Digital Library (HSDL).

In addition to online searching, the Committee proactively solicited reports, both published and unpublished, through a request for documents. The reports were solicited through internal list servs at the National Academies, as well as through external mechanisms. An online request was published on the committee's study webpage, and the Board on Health Sciences Policy distributed the call for reports through the Forum on Medical and Public Health Preparedness for Disasters and Emergencies and the Disaster Science Action Collaborative. Staff contacted CDC, the study sponsor, for document suggestions, and also had them disseminate the announcement to their networks, and particularly the former PERRCs and PERLCs networks. Additionally, staff sent targeted emails PHEPR practitioner associations (e.g., NACCHO and ASTHO) and disaster science organizations (e.g., DR2, NCDMPH, and ASPPH). Submissions were accepted through March 8, 2019. This proved to be an effective way to collect theses, and white papers.

Reports identified will be called "case reports" for the purposes of this report. The scope of this report is case reports that did not report a research study. The commissioned paper entitled *Quarantine as a Non-Pharmaceutical Intervention: Qualitative Research Evidence Synthesis* provides a synthesis of qualitative studies that reported qualitative methods.

Prioritization of case reports

The literature search resulted in a total of 28 case reports directly or indirectly related to quarantine. To further prioritize which reports to review, a Sorting Tool was developed with input from the Committee. Reports were categorized into "High" priority or "Low" priority based on relevance to the research question of interest. The definition of "relevance" was adapted from the AACODS checklist (Authority, Accuracy, Coverage, Objectivity, Date, Significance). Rigor was not used as a sorting criterion because the primary purpose of this case report review was to synthesize experiential data to add weight to findings from research studies, provide a different perspective from research studies, or to provide the only available perspective concerning specific phenomena of interest. Please see Appendix A for the tool and reviewer guidance.

Case reports covering tabletop exercises were categorized as low priority given that findings from tabletops are not based on real experience or simulations. However, if a tabletop case report was relevant to the research question, it was included in the analysis if the specific area of relevance did not otherwise emerge from analysis of the high priority report.

Time-permitting, reports categorized as low priority would be randomly sampled. If the initial random sample yielded new themes, additional reports would be randomly sampled until saturation was reached. However, because application of the sorting tool resulted in all but one (96%) of the reports being considered high priority, random sampling of low priority reports was not conducted. The one low priority case report was categorized as such because it was based on a tabletop exercise. It was ultimately included in the analysis due to emergent themes.

Coding and synthesis of data from selected case reports

Data were analyzed using NVivo 12 Pro. Once coding was completed, key word searches of the high priority reports were conducted in Mendeley to ensure reports with details relevant to the key findings were not overlooked in the analysis phase. A codebook was developed based on the key areas of interest and used to code data in NVivo.

4 Findings

4.1 Case Report Characteristics

The sorting tool was applied to 28 total case reports. Of these 96% were categorized as high priority (27 case reports). Only one case report was categorized as low priority and was ultimately included in the analysis as it added to the emergent themes. **Figure 1** provides a breakdown of prioritization results.

Figure 1: Prioritization of Case Reports

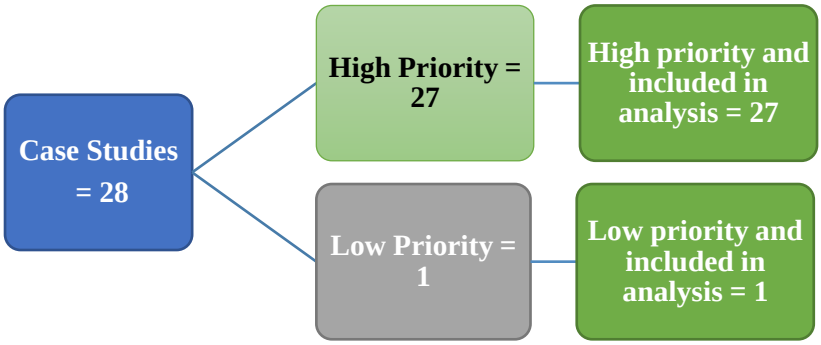

Table 1 provides a summary of case report characteristics. The vast majority of the case reports (93%, n=26) of the case studies were based on real events. Full scale exercises (n=1) and tabletop exercises (n=1) accounted for 3.5% of the reports each. Two percent were described as both functional and full scale exercises. Public health threats ranged from Ebola, H1N1, H3N1, Lassa Fever, measles, MERS-CoV, novel respiratory virus (exercise), and SARS. The year of incidents ranged from 2002 to 2014. Incidents were reported from 7 states in the United States, and several other countries including Australia, China, Germany, Japan, Liberia, Nigeria, Singapore, South Korea, Taiwan, and Thailand.

Table 1: Case Report Characteristics

Characteristics of Case Reports (N = 28)	
Type of Event	Real Event 93% (n=26) Exercise 7% (n=2) • Tabletop 3.5% (n=1) • Full Scale 3.5% (n=1)
Public Health Threats	Ebola, H1N1, H3N1, Lassa Fever, Measles, MERS-CoV, Novel respiratory virus (exercise), SARS
Incident Years	2002 - 2014
Location	USA: CA, IA, IN, MN, NY, OH, TX Australia; China; Germany; Japan; Liberia; Nigeria; Singapore; South Korea; Taiwan; Thailand

4.2 Synthesis of Findings: Themes and Dimensions

Findings are presented in the context of the Key Evidence Review Questions and organized into themes. **Table 2** provides a summary of findings.

When and in what circumstances is quarantine effective?

Specific themes did not emerge related to this overarching question due to scant data. Therefore, findings are presented in the context of the specific key evidence review questions related to quarantine.

Key Question 1 – What strategies affect adherence with quarantine?

Voluntary vs legally enforced quarantine

Several case reports discussed the use of voluntary quarantine as well as compulsory quarantine, however, they did not examine if one strategy leads to greater adherence than the other (335, 336, 468, 479, 594, 337, 352, 445, 468, 577, 594). Voluntary self-quarantine of healthcare workers in Dallas, Texas during the 2014 cluster of Ebola had high compliance, with over 30 healthcare workers adhering with quarantine without requiring public health orders. Only a small subset of additional contacts required public health control orders (336). Similarly, during the SARS outbreak in Toronto, only 0.1% of contacts requiring quarantine were issued enforceable quarantine orders (QOs) due to initial noncompliance (604). Other case reports from SARS and H1N1 in Singapore and MERS-CoV in Thailand described mandatory QOs, but did not provide the compliance rate (594, 479, 468).

Additional research is recommended to examine if voluntary or legally enforceable quarantine is more effective. Self-quarantine may motivate people to adhere to restrictions as they may feel a sense of choice. However, the fear of prosecution and hefty fines may encourage greater adherence. Use of police, sheriffs, and security agencies were also cited as ways to enforce policies with some guarding doors and buildings and others conducting random checks (334, 337, 572, 594, 596). During the 2003 SARS outbreak in Beijing, China, community members could also call a SARS hotline to report any breaches in quarantine and police could enforce quarantine if necessary; however, such action was ultimately not required (596).

An added strategy during the 2003 SARS outbreak in Singapore and Taiwan was the use of video cameras (572). In Taiwan, video monitoring was used for almost all persons living in Tapei and Kaohsiung under home quarantine, although it was initially intended for quarantine violators who were residents of the high-population density areas (572). In Singapore, cameras were used because there were instances in which people under home quarantine would divert their home telephone numbers to give an impression of compliance during random phone checks (594). Therefore electronic picture cameras were installed in each home, and were normally switched off to maintain privacy unless called for a random check.

While some legally enforceable strategies may be relevant in the US context, it is possible that more invasive or aggressive measures such as police guards and video cameras may face resistance. Therefore, cultural context should be carefully considered when developing strategies. For instance during a tabletop exercise in San Diego focused on quarantine, civilian law enforcement officials frequently expressed concerns about carrying out enforcement measures that were requested by civilian public health authorities (366). They instead urged county officials to emphasize public education to minimize the need for enforcement.

Provision of financial, social, and psychological support

Several case reports also described provision of food, accommodation, social and psychological support, medical leave, and/or wage compensation during quarantine (336, 352, 475, 572, 577, 434, 445, 596). For instance, during the 2014 Ebola cluster in Dallas, the hospital where healthcare workers were quarantined provided food, accommodation and wage compensation for workers placed in administrative leave (336). During voluntary quarantine of Ebola contacts in Liberia in 2014, prayer services and psychosocial support were also provided (352). During 2009 H1N1 in China, people quarantined in hotels were provided room service

and the government budget supported living expenses (475). In instances where contacts are banned from reporting to work, these types of supports could potentially serve as strategies to encourage compliance with quarantine, although no case reports directly examined this (445).

Community engagement and risk communication

Lessons learned from case reports in Liberia and Ohio indicate that engaging local leaders and involving community members during the planning and implementation phases helped support safe and effective quarantine (347, 370). Additionally, efforts made to minimize stigmatization of Ebola survivors through education, social mobilization, and reintegration programs might have also led to greater compliance with voluntary quarantine if community members did not fear being stigmatized (352).Conversely, a case report of MERS from South Korea found that many quarantined individuals were unwilling to provide personal information due to anticipated sigma or negative local perception of MERS (434).

Some case reports also mentioned that raising public awareness through risk communication strategies was helpful in promoting adherence (445, 472, 598). These are further discussed in the next section as a facilitator to effective quarantine.

Key Question 2 – What are the barriers and facilitators to effective quarantine?

As mentioned earlier, case reports did not focus specifically on the effectiveness of quarantine as quarantine was typically implemented with other control measures. Therefore, barriers and facilitators to effective quarantine are inferred in the context of multiple control measures implemented together.

Trust

Trust was mentioned as an important factor in facilitating effective quarantine in case reports from Liberia, Singapore, and Germany (347, 445, 468). During the 2014 Ebola outbreak in Liberia, community trust and confidence in response efforts was found to be challenging at times, as some community members may not have been willing to accept proposed quarantine without first witnessing the devastating effect of the disease on their village (347). Trusted local leaders helped facilitate trust and acted as liaisons between community leaders and district health authorities, suggesting that integration of trusted local leaders into response planning and giving them an opportunity to provide feedback before decisions are made related to public health interventions may promote effective quarantine.

A case report of 2009 H1N1 in Singapore also mentioned the importance of building trust in advance of a public health crisis (468). Public perception of the quality and credibility of decisions related to control measures and policies reportedly enabled buy-in from healthcare stakeholders during the H1N1 response, particularly for policies that were burdensome to implement. Regular engagement amongst stakeholders during "peacetime" was recommended as a way to foster stronger coordination of public health control measures during a crisis.

In their case report of 2016 Lassa fever in Germany, Ehlkes et al. (2017) also describe how contact tracing interviews can be used as an opportunity to build trust between investigators and interviewees to enhance compliance (445). Findings showed that in-depth interviews with targeted probing for high-risk situations and behaviors were essential during follow up as they can lead to identification of further contacts. They found the CDC/ WHO EVD management

guideline to be "very helpful" and suggested that an information template for contact persons describing the disease as well as the rationale for control measures could help reduce fear and maximize compliance.

Although these findings are inferred from case reports abroad, lessons may be applicable in the US as the level of trust amongst the public and key stakeholders is likely to influence effectiveness of quarantine, particularly amongst communities that may have a historical distrust of the US government.

Transparent and strategic risk communication, and clear definitions

Lessons learned also stressed the importance of open, frequent, and transparent communication with the public to ease fear and anxiety (468, 598). Useful channels for public communication included daily press briefings, TV and radio announcements, internet bulletins, health talks, and a hotline for public enquiry. During SARS, Beijing's Ministry of Health and municipal government also ran education campaigns via billboards, bus advertisements, and traditional banners (596). In the US context, Indiana issued local media releases, and utilized the Indiana Health Alert Network to inform community members and providers about potential exposure to measles in 2011 (337). Strategic timing of communication can also be an important facilitator of effective quarantine. During the H1N1 pandemic in Singapore, the strategic gradual shift from containment to mitigation as part of the risk communication strategy enabled the public to adapt to new measures more steadily (468). Home visits to provide health education for those quarantined at home may also promote compliance (594). The need for clear understanding of the term "quarantine" among the public and health workers was also noted as there is often misunderstanding around the definition despite often having backing by legal authority (334). Differences in interpretation may lead to inconsistent application of quarantine laws across jurisdictional boundaries.

Provision of necessary supports for quarantined individuals

In addition to clear and effective messaging, ensuring necessary supports are in place for people that are asked to refrain from entering public venues can impact their willingness to comply with voluntary and compulsory quarantine orders (339). As previously mentioned, provision of food, accommodation, financial assistance, and paid leave may enable more effective quarantine practices (347, 336). Based on Dallas's experience with Ebola in 2014, Smith et al. (2015) suggest that engaging a wide range of community partners such as businesses, schools, charitable foundations, community and faith-based organizations, and mental health resources would enhance public health emergency preparedness for Ebola by readying resources for potential needs (339). Provision of laptops, textbooks, and school supplies and development of lesson plans that could be completed at home was also considered important (339). Although effectiveness was not specifically assessed, case reports from Liberia, Taiwan, Beijing, and South Korea also mention the role of social and psychological supports such as community committees mobilizing for gestures including giving flowers and comforting letters, provision of social services by local health or civil affairs departments, day care, and mental health services (572, 596, 434, 347).

Culturally- and contextually-informed approaches

Given the cultural diversity of the US, utilizing culturally-informed strategies may enable more effective quarantine. For instance during measles outbreaks in a Somali community in Ohio

in Minnesota and an Amish community in Ohio, efforts were made to engage community, religious, and spiritual leaders as advisors due to their strong influence over social networks (19, 370). Lessons learned from Ebola in Dallas found that "recognizing unique cultural, linguistic, and socioeconomic differences helped ensure contacts' compliance with monitoring, particularly among the community contacts (339)." Contact tracers found that because the first Ebola patient was Liberian, many of his contacts were part of the local Liberian community. Therefore, they engaged aid organizations to provide familiar food and clothing in a culturally sensitive manner.

Potential challenges to quarantine arise when engaging transient populations such as people that are homeless as they may be difficult to locate and monitor (339, 19). Homeless shelter residents who have continuity of care challenges due to lack of health record documentation may pose additional challenges as was the case with a measles outbreak in Minnesota that confirmed measles in a 9-month-old US-born infant who resided at a homeless shelter and had recently returned from abroad (19).

Additionally, as previously mentioned, fear of stigmatization may be a barrier, whereas efforts to minimize stigma can help facilitate effective quarantine (434, 352).

Integrated response systems and surge capacity

Effective control measures do not work in isolation and require effective coordination form key stakeholders (598). The majority of case reports described quarantine as one of multiple measures implemented during a response. Therefore, it is inferred that a facilitator of effective quarantine includes appropriate measures and strategies beyond quarantine. Furthermore, integrated responses at the systems level were found to be essential for a coherent response as it fosters a better coordinated system (468). Reliance on preexisting organizational frameworks can also enable efficient redirection of resources (352). Collaborative agreements and coordinated incident command were also highlighted as essential for areas with multiple jurisdictions (e.g. civilian, military, federal, or tribal) (366). Case reports also mentioned the general need for public health surge capacity in light of threats of emerging diseases and large-scale outbreaks (604, 437, 598). A strong sense of political will and sense of urgency was viewed as a facilitator of quick set up of command structures aimed at steering action and mobilizing relevant sectors and resources (598). Furthermore, the need for flexibility was also highlighted as existing plans and pre-determined control measures may need to be modified as the public health emergency evolves (336, 468).

Key Question 3 – What benefits and harms (desirable and/or undesirable impacts) of quarantine have been described or measured?

Most case reports did not directly address the benefits of quarantine. Those that did mentioned potential benefits based on experiences with SARS in Taiwan, China, and Singapore (571, 594, 572). More case reports discussed the unintended consequences or harms related to quarantine.

Benefit: Reduced risk for transmission

Although acknowledging challenges with careful application of quarantine measures, CDC *Morbidity and Mortality Reports* indicate that quarantine effectively eliminated the risk for transmission of SARS from quarantined people to community members (571). In Taiwan,

although just a small percentage of people quarantined had suspect or probable SARS subsequently diagnosed, and an even smaller percentage were laboratory-confirmed cases, the CDC asserts that use of quarantine may have prevented additional cases as even just one infected person could expose others and generate successive waves of infection (572). A SARS case report from Singapore describes how the decision to undertake the measures was not based on scientific evidence of the merits of quarantine, but on the need to protect the public from a serious new disease with a high case fatality of 14% (594). The absence of effective vaccination and antiviral treatment strengthened the argument for quarantine management to stop the spread of the disease given the potential catastrophic consequences.

Benefit: Public confidence

Ooi et al. (2005) describe how quarantine gave the public in Singapore confidence to continue with their daily activities given their knowledge of public health safeguards against SARS (594). They conjectured that the public would otherwise take actions to avoid public places, and consequently cause a situation in which the unaffected majority would stay at home instead of the affected minority. However, additional research is recommended to examine the impact of quarantine on public confidence and behavior as the pre-existing level of confidence in local government or the fear of punitive measures for lack of compliance may also play an important role.

Harm: Potential for increased transmission and mortality, and impact on emergency and routine services

A case report focused on the 2002-2003 SARS outbreak in Taiwan illustrated many unintended consequences of quarantine including increased risk for transmission and mortality (334). Due to inappropriate application of quarantine, all healthcare workers, patients and visitors at Hoping Hospital were forcibly quarantined inside the hospital where they were at serious risk of cross-infection due to a shortage of protective gear and lack of internal segregation based on level of exposure. Surge capacity of healthcare workers was limited due to space, despite the hospital's ability to obtain supplies from external sources. Healthcare workers with varied levels of exposure worked together with infected/symptomatic and asymptomatic patients, and healthy individuals were continually exposed to possible sources during quarantine, making it challenging to identify their last exposure. Quarantined people were also cared for by healthcare workers that may have been infected, increasing the likelihood of exposure. Furthermore, disease transmission may increase in the quarantine population if symptomatic people are not isolated immediately, or are contagious prior to the onset of symptoms. Additionally, symptomatic patients may have diseases that present similarly to the disease of interest (e.g. malaria rather than Ebola), and therefore be put at risk of contracting the illness.

Many exposed individuals in Taiwan were missed, and those with no significant risk of spreading the disease were quarantined. With more than ten thousand patients and visitors exposed, the logistics to effectively implement quarantine on such a large population were found to be impossible, and the way hospital quarantine was implemented in Hoping Hospital resulted in increased mortality (334).

Another important unintended consequence of hospital quarantine was that four hospitals were forced to discontinue both emergency and routine services for a period of time. A case report from Toronto also found that while infection control measures worked well once SARS

was recognized, hospitals with severe restrictions due to SARS resulted in delays in cancer treatments and surgeries (604).

Harm: Restrictions on civil liberties

Another potential negative impact of quarantine is the restriction on civil liberties and personal freedoms, which can in turn lead to unintended consequences. For instance, misapplication of guidelines and involuntary quarantine of health workers returning to the US from Ebola-stricken countries led to fewer volunteers deploying overseas to support the Ebola response due to concerns about restrictions upon their return (334). Barbisch et al. (2015) also point out that the unclear benefits of quarantine may be insufficient to justify the restriction on personal freedoms, especially when implemented inappropriately (334). Lessons learned from the 2003 Beijing response to SARS indicated that some people were initially quarantined because they were thought to have been exposed to people evaluated for SARS, but those evaluated for SARS were later excluded (571). These issues were corrected as SARS was characterized; however, they still resulted in the unnecessary loss of personal freedom of those who did not require quarantine in the first place. Additionally, the use of cameras in Taiwan for ensuring compliance with quarantine likely led to a loss of privacy in people's own homes (572).

Harm: Psychological impact and stigmatization

Case reports also discussed psychological harm resulting related to quarantine (334, 339). Contacts under quarantine in Dallas due to Ebola often reported feelings of social isolation, and feeling "unsafe leaving their homes because of stigmatization by others in their community after their photos, names, and addressed had been published in the media (339)". Similarly, during the 2003 SARS outbreak in Singapore, some quarantined individuals reported problems related to stigmatization by their neighbors (594). Among the 1221 people placed in quarantine and who experienced psychological and emotional difficulties in Gyeonggi, South Korea during the 2015 MERS outbreak, 350 required continuing mental health services (434).

Healthcare worker contacts during 2014 Ebola in Dallas also experienced heightened anxiety after witnessing the first Ebola patient's health deteriorate and hearing that two health workers were ill (339). Over three quarters of community and healthcare worker contacts reported stress, social isolation, or stigma, and the majority of healthcare worker contacts reported experiencing some level of anxiety about the possibility of becoming ill or infecting their family members. During the 2015 MERS outbreak in South Korea, despair, anxiety, and anger were evident on social networking services, and families and friends of loved ones killed by Ebola experienced psychological problems including depression, sleep disturbances, abnormal behavior and post-traumatic symptoms (434).

The case report that focused on hospital quarantine during the 2002-2003 SARS outbreak in Taiwan reported graver impacts among healthcare workers (334). Some felt they were being treated like prisoners and were forced to witness some of their colleagues get sick and die. Some doctors and nurses attempted to flee, while others refused to treat patients. One depressed man suspected of having SARS hanged himself despite psychiatric counseling, and another suicide attempt was reported the following day as an individual attempted to jump from one of the hospital windows. These experiences emphasize the potential for terrible unintended consequences resulting from mandatory hospital quarantine.

Harm: Lost wages and school absence

Another potential impact of quarantine is children being disallowed from school and adults being banned from work, resulting in lost school time and wages (339, 347, 366). Parents faced challenges finding childcare when asked to keep children at home due to fear that they may pose a risk to other school children (339). As a result, parents may also be forced to take time away from work in order to provide childcare. While some case reports described provision of financial support and school supports to account for these negative impacts, some found that these issues remained unresolved (366).

Table 2: Summary of Findings

Key Question	*Synthesized Theme*	*Theme Dimensions*	*Citations*
When and in what circumstances is quarantine effective?	**Insufficient data*		
What strategies affect adherence with quarantine?	Voluntary vs. legally enforced quarantine	• Voluntary self-quarantine • Use of law enforcement • Random checks • Video monitoring	334, 335, 336, 337, 352, 366, 445, 468, 479, 572, 577, 594, 596, 604
	Provision of financial, social, and psychological support	• Wage compensation • Food • Accommodation • Professional psychological support and prayer services	336, 352, 434, 445, 475, 572, 577, 596
	Community engagement and raising public awareness	• Engaging local leaders • Involving communities in planning and implementation phases • Education, risk communication, and reintegration programs	347, 352, 370, 434, 445, 472, 598
What are the barriers and facilitators to effective quarantine?	Trust	• Community trust and confidence in response efforts • Local leader support • Development of trust in advance of a public health crisis	347, 445, 468
	Transparent and strategic risk communication, and clear definitions	• Timely public communication through various outlets (press briefings, TV, billboards, radio, websites, hotlines, Health Alert Network, etc. • Clear definition of quarantine to enable appropriate application of measures	334, 337, 468, 594, 596, 598
	Provision of necessary supports for quarantined individuals	• Food, accommodation, financial assistance, paid leave, school supports, and social and psychological support	336, 339, 347, 434, 572, 596
	Culturally- and contextually-informed approaches	• Involvement of religious and spiritual leaders • Recognition of unique cultural, linguistic, and socioeconomic differences • Transient populations with continuity of care challenges	19, 339, 352, 370, 434
	Integrated response systems and surge capacity	• Interagency coordination • Collaborative agreements • Surge capacity for large-scale outbreaks • Political will and sense of urgency • Flexibility	336, 352, 366, 437, 468, 598, 604
What benefits and harms of quarantine have been described or measured?	Benefit: Reduced risk for transmission	• Helpful for outbreaks with a high case fatality rate and an absence of effective vaccination and treatment	571, 572, 594
	Benefit: Public confidence	• Knowledge of public health safeguards	594
	Harm: Potential for increased transmission and mortality, and impact on emergency and routine services	• Risk of cross-infection and exposure in hospitals • Discontinuation of routine and emergency services • Delayed surgeries and cancer treatments	334, 604
	Harm: Restrictions on civil liberties	• Fewer volunteers to support responses abroad • Inappropriate quarantine leads to unnecessary restrictions on civil liberties	334, 571, 572
	Harm: Psychological impact and stigmatization	• Social isolation, stigmatization, emotional difficulties, anxiety, post-traumatic stress, suicide and attempted suicide	334, 339, 434, 594
	Harm: Lost wages and school absence	• School and/or work bans lead to childcare challenges, lost wages, and missed school	339, 347, 366

4.3 Evidence-to-Decision Discussion

Constructs from the evidence-to-decision framework were also applied when reviewing the case reports. This section describes considerations related to the acceptability of quarantine and associated preferences; resources and economic considerations; equity issues; and the feasibility of quarantine. Findings are limited by the lack of detail provided in many of the case reports and are noted accordingly.

Acceptability and Preferences

Case reports did not examine acceptability or preferences related to quarantine in any detail. Based on reports of psychological distress; anxiety; and fear of income loss, stigma, and social isolation, it is likely that quarantine may not be acceptable to all communities. While high rates of compliance were reported in some case reports, this does not necessarily mean that way quarantine measures were implemented were acceptable to the public or healthcare workers. It is possible that provision of food, wage compensation, and other financial or in-kind supports may enhance acceptability of quarantine. Implementing voluntary instead of mandatory quarantine may also increase acceptability. Furthermore, authorities and public health agencies may have different preferences with regard to implementation of quarantine as evidenced by findings from a tabletop exercise in San Diego. As previously mentioned civilian law enforcement officials expressed concerns with enforcement measures and urged emphasis on public education (366). Therefore, additional research is recommended to better understand the factors that motivate adherence to quarantine and to find ways to enhance acceptability.

Resources and Economic Considerations

Some case reports discussed the need to carefully consider the resources needed for quarantine against the expected benefits (336, 473, 572, 370, 337, 347, 475). For instance, the 2011 measles outbreak in Indiana resulted in the state health department incurring costs in the tens of thousands of dollars for public health measures. Although it is unclear how much was allocated to quarantine, findings suggest a greater need to weigh the burden of time and resources against outcomes (337). Other cases discussed hospital provision of food and accommodation for healthcare workers that were quarantined in the hospital, as well as wage compensation for those placed on administrative leave (336). In some instances, the government undertook payment of self-employed persons during the quarantine period to make up for some lost income, and gave an allowance to small businesses employing 50 or fewer people that were ordered to close temporarily (594). The City of Dallas also made provisions for food and water for a pet that had potentially been exposed to Ebola, and the City also requested state assistance to support quarantine (340). Agencies also need to be able to quickly mobilize resource and surge capacity to cope with workloads (598, 468, 437). This requires significant investment in public health personnel and infrastructure, including training and exercises for healthcare workers and leadership (387).

As previously mentioned, implementation of quarantine may be costly not only for public health agencies, hospitals, and local authorities, but also for the public. The public may incur direct and indirect costs including childcare expenses, lost wages due to lack of employer or government compensation, psychological harm, social stigma, and curtailment of civil liberties.

Equity Issues

Barbisch et al. (2015) are the only authors who explicitly mentioned difficulty with determining effectiveness and equitable application of quarantine policies, particularly given the issues of personal liberties (334). The authors assert that the restrictive nature of quarantine means that it should be evaluated for efficacy. For instance, "Is the action supported by evidence of improved outcomes?; can it be effectively implemented given the need for balanced [Stuff, Staff, and Structure] surge?; will it lead to unintended negative outcomes?; are other less restrictive public health measures such as monitoring and social distancing equally effective?; and finally, given the impact on civil liberties, is it reasonable and is it enforceable? (334)."

It is also important to consider the impact on various subpopulations based on demographics, socioeconomic considerations, and access to resources. Extra efforts need to be made at homeless shelters to ensure residents are appropriately supported as they may face unique challenges and access to fewer resources compared with people that self-quarantine in their own homes (19, 572). Insufficient support may lead to ineffective quarantine and increase risk of transmission in this population. Additionally, people that belong to communities hesitant to engage with the public health system, may require strategic, culturally-tailored outreach in order to ease fear and anxiety (370, 339).

Unintended consequences of quarantine orders may include stigmatization of specific groups if restrictive measures are taken without particular attention to cultural and social considerations (335, 339). While this was not explicitly mentioned in the case report of H1N1 in Singapore, it may be of possible concern that all travelers arriving to Singapore from Mexico were issued quarantine orders for 7 days (468). Although these measures were lifted once the case fatality rate in Mexico was estimated to be lower than expected at 0.4%, the quarantine policy may impact how travelers from impacted regions are treated by the public. Efforts can be made, however, to promote equity. The Ebola case report from Dallas described concerted efforts to minimize stigma by working with community organizations and leaders from the local Liberian community (339). School children were also provided laptops, textbooks, and lesson plans to enable them to comply with quarantine measures. Similarly, financial assistance to support compliance with quarantine may help ease an otherwise inequitable burden amongst lower income communities (339, 336, 366).

Feasibility

Few case reports discussed feasibility of quarantine, however, those that did, described issues related to resources and scale (342, 352, 596). Effective quarantine may not be feasible at a large scale if jurisdictions lack adequate capabilities and resources (342, 352). Preexisting organizational frameworks are necessary to support effective quarantine (352). Pang et al. (2003) describe several factors that should be considered when deciding who should be quarantined, such as resource availability, ability to mobilize public health personnel, and social acceptability (596). These factors are important for public health departments to weigh when setting quarantine guidelines. For instance, Pang et al. (2003) suggest "in smaller outbreaks or when resources are limited, public health authorities might consider active but non-quarantined surveillance in lower-risk settings, such as workplaces and schools, and among those whose contact with patients with SARS was only during the asymptomatic incubation phase (596)." Therefore, weighing these factors together is important in developing a feasible plan for quarantine or alternative measures that may be more effective in a given circumstance.

5 Limitations

Findings in this report are limited by the lack of availability of case reports focused on the specific research questions of interest. Few case reports discussed effectiveness of quarantine directly, and diverse perspectives from the various stakeholders involved in quarantine efforts was limited. It is also difficult to assess the effectiveness of quarantine specifically given that it is typically implemented with a host of other measures. An additional limitation is that many of the case reports did not provide sufficient detail regarding methods or any methods at all. Therefore, there is a potential for possible bias based on unknown methods. Lastly, many case reports are from countries outside of the US, which have differing healthcare and legal systems and cultural norms, therefore, not all findings may be applicable in the US context.

6 Conclusion

Based on findings from this case report review, it appears that quarantine may be effective in reducing disease transmission in some circumstances; however, it is unclear whether it is the most cost effective approach given the resource implications and direct and indirect costs associated with it. Some case reports discussed the lack of clarity over how helpful quarantine actually was in reducing disease transmission, while others suggested that quarantine led to increased transmission and mortality. Although facilitators such as transparency, trust, clear and accurate risk communication, provision of necessary supports for quarantined people, and culturally-appropriate approaches may enable more effective quarantine measures, additional research is recommended to better understand the potential for short- and long-term harms.

7 References

Report ID/ Reference

19 Gahr, P., DeVries, A. S., Wallace, G., Miller, C., Kenyon, C., Sweet, K., … Lynfield, R. (2014). An outbreak of measles in an undervaccinated community. *Pediatrics*, *134*(1), e220–e228.

334 Barbisch, D., Koenig, K. L., & Shih, F.Y. (2015). Is there a case for quarantine? Perspectives from SARS to Ebola. *Disaster Medicine and Public Health Preparedness*, *9*(5), 547–553.

335 McKeever, V., Adams, H., Thornton, T., Quinlisk, P., Cetron, M., Goodman, R., … Papania, M. (2004). Postexposure prophylaxis, isolation, and quarantine to control an import-associated measles outbreak - Iowa, 2004. *Morbidity and Mortality Weekly Report*, *53*(41), 969–971.

336 Chung, W. M., Smith, J. C., Weil, L. M., Hughes, S. M., Joyner, S. N., Hall, E. M., … Schrag, S. J. (2015). Active tracing and monitoring of contacts associated with the first cluster of Ebola in the United States. *Annals of Internal Medicine*, *163*(3), 164–173.

337 Collier, M. G., Cierzniewski, A., Duszynski, T., Munson, C., Wenger, M., Beard, B., … Pontones, P. (2013). Measles outbreak associated with international travel, Indiana, 2011. *Journal of the Pediatric Infectious Diseases Society*, *2*(2), 110–118.

339 Smith, C. L., Hughes, S. M., Karwowski, M. P., Chevalier, M. S., Hall, E., Joyner, S. N., … Santibañez, S. (2015). Addressing needs of contacts of Ebola patients during an investigation of an ebola cluster in the united states—Dallas, Texas, 2014. *Morbidity and Mortality Weekly Report*, *64*(5), 121–123.

340 Spengler, J. R., Stonecipher, S., McManus, C., Hughes-Garza, H., Dow, M., Zoran, D. L., … Behravesh, C. B. (2015). Management of a pet dog after exposure to a human patient with Ebola virus disease. *Journal of the American Veterinary Medical Association*, *247*(5), 531–538.

342 Grigg, C., Waziri, N. E., Olayinka, A. T., & Vertefeuille, J. F. (2015). Use of group quarantine in Ebola control — Nigeria, 2014. *Morbidity and Mortality Weekly Report*, *64*(5), 124.

347 Nyenswah, T., Blackley, D. J., Freeman, T., Lindblade, K. A., Arzoaquoi, S. K., Mott, J. A., … Laney, A. S. (2015). Community quarantine to interrupt Ebola virus transmission —. *Morbidity and Mortality Weekly Report*, *64*(7), 179–182.

352 Reaves, E. J., Mabande, L. G., Thoroughman, D. A., Allison Arwady, M., & Montgomery, J. M. (2014). Control of Ebola virus disease — Firestone District, Liberia, 2014. *Morbidity and Mortality Weekly Report*, *63*(42), 959–965.

366 DiGiovanni, C., Bowen, N., Ginsberg, M., & Giles, G. (2005). Quarantine stressing voluntary compliance. *Emerging Infectious Diseases*, *11*(11), 1778–1779.

370 Gastañaduy, P. A., Budd, J., Fisher, N., Redd, S. B., Fletcher, J., Miller, J., … DiOrio, M. (2016). A measles outbreak in an underimmunized Amish community in Ohio. *New England Journal of Medicine*, *375*(14), 1343–1354.

387 Nathawad, R., Roblin, P. M., Pruitt, D., & Arquilla, B. (2013). Addressing the gaps in preparation for Quarantine. *Prehospital and Disaster Medicine*, *28*(2), 132–138.

434 Yoon, M.-K., Kim, S.-Y., Ko, H.-S., & Lee, M.-S. (2016). System effectiveness of detection, brief intervention and refer to treatment for the people with post-traumatic emotional distress by MERS: A case report of community-based proactive intervention in South Korea. *International Journal of Mental Health Systems*, *10*(51), 1–5.

437 Binns, P. L., Sheppeard, V., & Staff, M. P. (2010). Isolation and quarantine during pandemic (H1N1) 2009 influenza in NSW: the operational experience of public health units. *New South Wales Public Health Bulletin*, *21*(1–2), 10–15.

445 Ehlkes, L., George, M., Samosny, G., Burckhardt, F., Vogt, M., Bent, S., … Zanger, P. (2017). Management of a Lassa fever outbreak, Rhineland-Palatinate, Germany, 2016. *Eurosurveillance*, *22*(39), 1–8.

468 Tay, J., Ng, Y. F., Cutter, J., & James, L. (2010). Influenza a (H1N1-2009) Pandemic in Singapore - Public health control measures implemented and lessons learnt. *Annals of the Academy of Medicine Singapore*, *39*(4), 313–324.

472 Ward, K. A., Armstrong, P., McAnulty, J. M., Iwasenko, J. M., & Dwyer, D. E. (2010). Outbreaks of pandemic (H1N1) 2009 and seasonal Influenza A (H3N2) on cruise ship. *Emerging Infectious Diseases*, *16*(11), 1731–1737.

473 Yasouka, A. (2009). Infection Control of the H1N1 Influenza in hospitals and local region Akira. *Asian Pacific Society of Respirology*, *14*(Suppl 3).

475 Zhang, Y., Yang, P., Liyanage, S., Seale, H., Deng, Y., Pang, X., … Wang, Q. (2012). The characteristics of imported cases and the effectiveness of outbreak control strategies of pandemic influenza A (H1N1) in China. *Asia-Pacific Journal of Public Health*, *24*(6), 932–939.

479 Plipat, T., Buathong, R., Wacharapluesadee, S., Siriarayapon, P., Pittayawonganon, C., Sangsajja, C., … Hemachudha, T. (2017). Imported case of Middle East respiratory syndrome coronavirus (MERS-CoV) infection from Oman to Thailand, June 2015. *Eurosurveillance*, *22*(33), 1–8.

571 Centers for Disease Control and Prevention. (2003a). Efficiency of quarantine during an epidemic of Severe Acute Respiratory Syndrome — Beijing, China, 2003. *Morbidity and Mortality Weekly Report*, *52*(43), 1037–1040.

572 Centers for Disease Control and Prevention. (2003b). Use of quarantine to prevent transmission of Severe Acute Respiratory Syndrome — Taiwan, 2003. *Morbidity and Mortality Weekly Report*, *52*(29), 680–683.

577 Chen, K. T., Twu, S. J., Chang, H. L., Wu, Y. C., Chen, C. T., Lin, T. H., … Su, I. J. (2005). SARS in Taiwan: An overview and lessons learned. *International Journal of Infectious Diseases*, *9*(2), 77–85.

594 Ooi, P. L., Lim, S., & Kai Chew, S. (2005). Use of quarantine in the control of SARS in Singapore. *American Journal of Infection Control*, *33*(5), 252–257.

596 Pang, X., Zonghan, Z., Fujie, X., Guo, J., Gong, X., Liu, D., … Feikin, D. R. (2003). Evaluation of control measures implemented in the severe acute respiratory syndrome outbreak in Beijing, 2003. *JAMA*, *290*(24), 3215–3221.

598 Tsang, T., & Lam, T. (2003). SARS: Public health measures in Hong Kong. *Respirology*, *8*, S46–S48.

604 Svoboda, T., Henry, B., Shulman, L., Kennedy, E., Rea, E., Ng, W., … Glazier, R. H. (2004). Public health measures to control the spread of the Severe Acute Respiratory Syndrome during the Outbreak in Toronto. *New England Journal of Medicine*, *350*(23), 2352–2361.

Appendix A: Case Report Sorting Tool

Sorting Criteria: Significance	Prioritization	Comments	Reviewer guidance	*Notes*
1. Does the report include information relevant to quarantine during a public health emergency?	**High/ Low** ***Yes = High*** ***No = Low***	[Reviewer to provide brief explanation for prioritization]	*Yes = High Priority*: The report provides sufficient relevant information to inform a thematic analysis. It adds context, is meaningful, useful, and may be used to inform decision making *No = Low Priority*: The report either briefly mentions, or does not mention the key areas of interest. Insufficient information to inform a thematic analysis.	*Adapted from AACODS checklist - "This is a value judgment of the item, in the context of the relevant research area"* *Reports categorized as "High" priority will be analyzed by key area of interest.* *Reports categorized as "Low" priority will be randomly sampled. The number sampled will be dependent on # of low priority reports and time available. If initial random sample yields new themes, additional reports will be randomly sampled until saturation is reached.* *Reports covering tabletop exercises will be categorized as low priority given that findings from tabletops are not based on real experience or simulations. However, if a tabletop report is relevant to the research question, it will be included in the analysis if the specific area of relevance did not otherwise emerge from analysis of the high priority report.* *Some reports may have little to no information related to quarantine to warrant inclusion into the analysis. These reports will not be included in the analysis.* *Note: Rigor is not used as a sorting criterion because the primary purpose of this case report review is to synthesize experiential data to add weight to findings from research studies, provide a different perspective from research studies, or to provide the only available perspective concerning specific phenomena of interest. Additionally, reports eligible for the Case Report thematic analysis are those that have been excluded from the analysis of research studies. Therefore, they already do not meet a certain threshold for rigor.*

Appendix B: Sorted Case Reports

ID	Case Report Reference	EOC Prioritization
19	Gahr, P., DeVries, A. S., Wallace, G., Miller, C., Kenyon, C., Sweet, K., … Lynfield, R. (2014). An outbreak of measles in an undervaccinated community. *Pediatrics*, *134*(1), e220–e228.	High
334	Barbisch, D., Koenig, K. L., & Shih, F.Y. (2015). Is there a case for quarantine? Perspectives from SARS to Ebola. *Disaster Medicine and Public Health Preparedness*, *9*(5), 547–553.	High
335	McKeever, V., Adams, H., Thornton, T., Quinlisk, P., Cetron, M., Goodman, R., … Papania, M. (2004). Postexposure prophylaxis, isolation, and quarantine to control an import-associated measles outbreak - Iowa, 2004. *Morbidity and Mortality Weekly Report*, *53*(41), 969–971.	High
336	Chung, W. M., Smith, J. C., Weil, L. M., Hughes, S. M., Joyner, S. N., Hall, E. M., … Schrag, S. J. (2015). Active tracing and monitoring of contacts associated with the first cluster of Ebola in the United States. *Annals of Internal Medicine*, *163*(3), 164–173.	High
337	Collier, M. G., Cierzniewski, A., Duszynski, T., Munson, C., Wenger, M., Beard, B., … Pontones, P. (2013). Measles outbreak associated with international travel, Indiana, 2011. *Journal of the Pediatric Infectious Diseases Society*, *2*(2), 110–118.	High
339	Smith, C. L., Hughes, S. M., Karwowski, M. P., Chevalier, M. S., Hall, E., Joyner, S. N., … Santibañez, S. (2015). Addressing needs of contacts of Ebola patients during an investigation of an Ebola cluster in the United States—Dallas, Texas, 2014. *Morbidity and Mortality Weekly Report*, *64*(5), 121–123.	High
340	Spengler, J. R., Stonecipher, S., McManus, C., Hughes-Garza, H., Dow, M., Zoran, D. L., … Behravesh, C. B. (2015). Management of a pet dog after exposure to a human patient with Ebola virus disease. *Journal of the American Veterinary Medical Association*, *247*(5), 531–538.	High
342	Grigg, C., Waziri, N. E., Olayinka, A. T., & Vertefeuille, J. F. (2015). Use of group quarantine in Ebola control — Nigeria, 2014. *Morbidity and Mortality Weekly Report*, *64*(5), 124.	High
347	Nyenswah, T., Blackley, D. J., Freeman, T., Lindblade, K. A., Arzoaquoi, S. K., Mott, J. A., … Laney, A. S. (2015). Community quarantine to interrupt Ebola virus transmission —. *Morbidity and Mortality Weekly Report*, *64*(7), 179–182.	High
352	Reaves, E. J., Mabande, L. G., Thoroughman, D. A., Allison Arwady, M., & Montgomery, J. M. (2014). Control of Ebola virus disease — Firestone District, Liberia, 2014. *Morbidity and Mortality Weekly Report*, *63*(42), 959–965.	High
366	DiGiovanni, C., Bowen, N., Ginsberg, M., & Giles, G. (2005). Quarantine stressing voluntary compliance. *Emerging Infectious Diseases*, *11*(11), 1778–1779.	Low *(included in analysis)*
370	Gastañaduy, P. A., Budd, J., Fisher, N., Redd, S. B., Fletcher, J., Miller, J., … DiOrio, M. (2016). A measles outbreak in an underimmunized Amish community in Ohio. *New England Journal of Medicine*, *375*(14), 1343–1354.	High
387	Nathawad, R., Roblin, P. M., Pruitt, D., & Arquilla, B. (2013). Addressing the gaps in preparation for Quarantine. *Prehospital and Disaster Medicine*, *28*(2), 132–138.	High
434	Yoon, M.-K., Kim, S.-Y., Ko, H.-S., & Lee, M.-S. (2016). System effectiveness of detection, brief intervention and refer to treatment for the people with post-traumatic emotional distress by MERS: A case report of community-based proactive intervention in South Korea. *International Journal of Mental Health Systems*, *10*(51), 1–5.	High
437	Binns, P. L., Sheppeard, V., & Staff, M. P. (2010). Isolation and quarantine during pandemic (H1N1) 2009 influenza in NSW: the operational experience of public health units. *New South Wales Public Health Bulletin*, *21*(1–2), 10–15.	High
445	Ehlkes, L., George, M., Samosny, G., Burckhardt, F., Vogt, M., Bent, S., … Zanger, P. (2017). Management of a Lassa fever outbreak, Rhineland-Palatinate, Germany, 2016. *Eurosurveillance*, *22*(39), 1–8.	High
468	Tay, J., Ng, Y. F., Cutter, J., & James, L. (2010). Influenza a (H1N1-2009) Pandemic in Singapore - Public health control measures implemented and lessons learnt. *Annals of the Academy of Medicine Singapore*, *39*(4), 313–324.	High

472	Ward, K. A., Armstrong, P., McAnulty, J. M., Iwasenko, J. M., & Dwyer, D. E. (2010). Outbreaks of pandemic (H1N1) 2009 and seasonal Influenza A (H3N2) on cruise ship. *Emerging Infectious Diseases*, *16*(11), 1731–1737.	High
473	Yasouka, A. (2009). Infection Control of the H1N1 Influenza in hospitals and local region Akira. *Asian Pacific Society of Respirology*, *14*(Suppl 3).	High
475	Zhang, Y., Yang, P., Liyanage, S., Seale, H., Deng, Y., Pang, X., … Wang, Q. (2012). The characteristics of imported cases and the effectiveness of outbreak control strategies of pandemic influenza A (H1N1) in China. *Asia-Pacific Journal of Public Health*, *24*(6), 932–939.	High
479	Plipat, T., Buathong, R., Wacharapluesadee, S., Siriarayapon, P., Pittayawonganon, C., Sangsajja, C., … Hemachudha, T. (2017). Imported case of Middle East respiratory syndrome coronavirus (MERS-CoV) infection from Oman to Thailand, June 2015. *Eurosurveillance*, *22*(33), 1–8.	High
571	Centers for Disease Control and Prevention. (2003a). Efficiency of quarantine during an epidemic of Severe Acute Respiratory Syndrome — Beijing, China, 2003. *Morbidity and Mortality Weekly Report*, *52*(43), 1037–1040.	High
572	Centers for Disease Control and Prevention. (2003b). Use of quarantine to prevent transmission of Severe Acute Respiratory Syndrome — Taiwan, 2003. *Morbidity and Mortality Weekly Report*, *52*(29), 680–683.	High
577	Chen, K. T., Twu, S. J., Chang, H. L., Wu, Y. C., Chen, C. T., Lin, T. H., … Su, I. J. (2005). SARS in Taiwan: An overview and lessons learned. *International Journal of Infectious Diseases*, *9*(2), 77–85.	High
594	Ooi, P. L., Lim, S., & Kai Chew, S. (2005). Use of quarantine in the control of SARS in Singapore. *American Journal of Infection Control*, *33*(5), 252–257.	High
596	Pang, X., Zonghan, Z., Fujie, X., Guo, J., Gong, X., Liu, D., … Feikin, D. R. (2003). Evaluation of control measures implemented in the severe acute respiratory syndrome outbreak in Beijing, 2003. *JAMA*, *290*(24), 3215–3221.	High
598	Tsang, T., & Lam, T. (2003). SARS: Public health measures in Hong Kong. *Respirology*, *8*, S46–S48.	High
604	Svoboda, T., Henry, B., Shulman, L., Kennedy, E., Rea, E., Ng, W., … Glazier, R. H. (2004). Public health measures to control the spread of the Severe Acute Respiratory Syndrome during the Outbreak in Toronto. *New England Journal of Medicine*, *350*(23), 2352–2361.	High