Quarantine as a Non-Pharmaceutical Intervention:
Qualitative Research Evidence Synthesis

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1.0 INTRODUCTION

The National Academies of Sciences, Engineering, and Medicine (National Academies) Committee on Evidence-Based Practices for Public Health Emergency Preparedness and Response (PHEPR) commissioned a systematic review and synthesis of existing evidence to support the creation of guidelines for prioritizing public health preparedness and responses capabilities as developed by the Centers for Disease Control and Prevention (CDC).

The synthesis of evidence presented in this report addresses quarantine, which is one of several non-pharmaceutical interventions. Quarantine is defined as the "separation or restricted movement of healthy, but exposed individuals to determine if they are ill" (CDC, 2018, p. 114). Quarantine involves restrictions on individuals who have been in contact with a person thought to be infectious; individuals who are quarantined are asymptomatic and may or may not be infected. This is in contrast to isolation, which is the sequestration of infected, symptomatic individuals who often are in hospitals. Quarantine is considered a relatively targeted strategy of social distancing to reduce disease transmission.

The purpose of the evidence synthesis was to address the following questions related to quarantine:
. In what circumstances is quarantine effective?
. What strategies affect adherence with quarantine?
. What benefits and harms (desirable and/or undesirable impacts) of quarantine have been described or measured?
. What are the barriers and facilitators to effective quarantine?

The evidence of interest for answering the questions was the findings from primary research studies that used qualitative research methods such as ethnographic observations, interviews, and focus group discussions. Given the qualitative research approach and the methodological range of primary studies available in the corpus for this evidence synthesis, the questions were treated as informing different aspects of the phenomenon of interest of quarantine. That is, the evidence synthesis took quarantine as its phenomenon of interest and sought to explicate this phenomenon's various aspects.

2.0 METHOD

2.1 Literature Search

A broad literature search was undertaken from which relevant qualitative research studies were selected. The literature search was conducted in the Medline (Ovid), Embase (Ovid), and Scopus databases and used the following inclusion and exclusion criteria:
- Date: 2001 - present;
- Language: English; and
- Document Type: Exclude commentaries, editorials, letters, and notes.

More details about the search process, including the search strings, are available separately in the National Academies report.

To be selected for the present evidence synthesis, a qualitative study had to use a qualitative method of data collection, such as interviews, as well as a qualitative method of data analysis, such as thematic analysis.

Based on the above, there were 17 published articles selected for the evidence synthesis. Of these, two articles utilized an identical dataset and, hence, for the purposes of the evidence synthesis were treated as a single study. Thus, there were total 16 qualitative studies that formed the corpus for the evidence synthesis. In addition, one quantitative study that included a qualitative component was included for examination. All studies (first author and year) are listed in Table 3.1.

2.2 Relevance Assessment of Individual Studies

Individual articles were judged for different levels of relevancy to the phenomena of interest (see Lewin et al., 2018 and Noyes et al, 2018, for details of the relevancy criteria). Studies were judged to have direct relevance (i.e., directly mapped onto phenomenon of interest); indirect relevance (i.e., some aspects of phenomenon of interest covered whereas other aspects are analogs/substitutes for phenomenon of interest); partial relevance (i.e., only some aspects of the phenomenon of interest covered); or unclear relevance (i.e., unclear whether underlying data were relevant) with the phenomenon of interest.

2.3 Quality Appraisal of Individual Studies

The selected studies were individually appraised using the Critical Appraisal Skills Programme (CASP; 2018) checklist, which is applicable to assessing qualitative research. Areas of appraisal by CASP include appropriateness of qualitative methodology, data collection, relationship between research and participants, ethics, rigor of data analysis, clarity of findings, and value of research. Each area is assessed using "yes," "no," or "can't tell."

We modified the checklist to include an overall rating in addition to the ratings of individual elements. Based on the CASP checklist evaluations, each study received a final overall quality rating of one of the following four categories: no or very minor concerns (no significant flaws); minor concerns (minor flaws not impacting credibility/validity of findings); moderate concerns (some flaws likely to impact credibility/validity of findings); or serious concerns (significant flaws impacting credibility/validity of findings). This overall rating was not a summation of the individual element ratings but a separate judgment.

2.4 Data Analysis and Synthesis

We used Atlas.ti (Version 8.1, Atlas.ti Scientific Software Development GmbH, Berlin, Germany), a qualitative data analysis software, for data extraction and synthesis. The primary study articles were uploaded into Atlas.ti and the extraction, coding, and synthesis processes were directly applied to these documents.

Study characteristics and key findings along with supporting information were extracted from each study. We used the general process of reading and re-reading the full article, including the abstract, rationale, method, results and analysis, and discussion sections to identify the characteristics and findings of interest.

2.4.1 Study Characteristics

Total 15 study characteristics were extracted. These included: Country and location of event; population density of event location; event; event type; event phase focus; event scale focus; event year; quarantine only focus; quarantine location; quarantined population; data collection period; data source; data providers; and vulnerable populations addressed.

2.4.2 Study Findings

The key findings and supporting information from each study were extracted in the form of key phrases, sentences, and direct quotations. For studies that used multiple methods, only the qualitative portion was extracted. The purpose of extraction of findings was to identify and note evidence that mapped onto the phenomenon of interest.

Specifically, we employed the pragmatic framework synthesis method (see Barnett-Page, & Thomas, 2009; Pope, Ziebland, & Mays, 2000), which uses an iterative deductive and inductive process, to analyze and synthesize the findings. A five-step process was used: Familiarization to create a priori descriptive codes and codebook development; first-level in vivo coding using descriptive codes; second-level coding into descriptive themes (families of descriptive codes); analytic theming (interpretive grouping of descriptive themes); and charting/ mapping and interpretation. Tracy (2018), provides additional instructions on the key principles of coding qualitative data for the purposes of analysis, which was adapted for the current context.

The first step of familiarization involved an initial close reading of the project documents and the selected articles to create descriptive codes. The familiarization with the project documents unpacked the key questions, sub-key questions, context questions, evidence-to-decision issues, aims and objectives of the project, and the logic models, to identify key phrases/ words that meaningfully addressed the phenomenon of interest. The familiarization with the articles similarly identified key phrases/ words that described various aspects of the phenomenon of interest. Both sets of key phrases/ words were converted to descriptive codes, which captured the essence of the extractions and replaced the in vivo original words with ones that translated across studies, creating a common yet representative nomenclature. We developed a codebook, which compiled the codes with corresponding definitions, thereby forming a set of a priori descriptive codes.

The second step of first-level in vivo coding involved multiple close readings of the articles in their entirety, with attention to findings wherever they appeared (particularly in the abstracts, results, discussions, and conclusions). We highlighted the in vivo findings (consisting of verbatim key phrases, sentences, and paragraphs) related to the key question, sub-key questions, context questions, or evidence-to-decision issues and assigned a descriptive code. When there were no a priori codes that matched the essence of in vivo extractions, this was considered an emergent code. The emergent code was translated to a new descriptive code, and the code with a corresponding definition was incorporated in the codebook. During this process, the researchers were attentive to all meaningful extractions, whether they appeared to confirm or counter previously coded extractions. For mixed-method studies that had both qualitative and quantitative portions, only the qualitative findings were coded.

The third step of second-level coding involved a synthesis process of creating descriptive themes, where a theme was a family of descriptive codes in which codes that formed a cohesive set were grouped together. The themes represented a nuanced description, rather than just a generalized description, of the phenomenon of interest.

The fourth step involved a synthesis process of creating analytic themes. This analytical theming relied on a robust interpretation of the descriptive themes and how they intersected relationally with one another, whether, for example, separately, cumulatively, or dialectically. The descriptive themes were grouped together in a nuanced manner to create the analytic themes.

The fifth step of mapping/ charting involved explaining how the analytic themes specifically addressed the phenomenon of interest. Additionally, evidence-to-decision issues were addressed in this step by looking at how the analytic themes were grounded in descriptive themes, codes, and in vivo extractions.

2.5 Assessment of Confidence in Synthesized Findings

The fourth-step analytic themes, and in some cases the third-step descriptive themes, constituted the final set of synthesized findings. These findings were assessed for confidence using GRADE-Confidence in the Evidence from Reviews of Qualitative research (GRADE-CERQual; Lewin et al., 2015; Lewin et al., 2018).

The synthesized findings were assessed using four domains: Methodological limitations, relevance, coherence, and the adequacy of data supporting the synthesized finding. Each synthesized finding was then given an overall assessment as follows:
- High confidence - it is highly likely that the finding is a representation of the phenomena;
- Moderate confidence - it is likely that the finding is a representation of the phenomena;
- Low confidence - it is possible that the finding is a representation of the phenomena; and
- Very low confidence - it is not clear if the finding is a representation of the phenomena.

2.6 Quality Assurance of Review

Quality assurance of the review was achieved through discussion until consensus was reached. The discussion involved team members as well as the National Academies staff and methodology consultant.

2.6.1 Quality Assurance of Extraction of Data

An initial codebook for extracting study characteristics and findings was developed. After receiving feedback on a draft from team members, National Academies staff, and methodology consultant, the document was suitably revised. Training sessions for the use of the codebook were conducted with the research team.

Next, a pilot test of the codebook portion for extracting study characteristics and findings was conducted. Two team members, the lead author of the report and a graduate student research assistant, separately coded approximately 25% of the articles. An analysis of the coding showed high agreement (approx. 80%) between the two readers.

The pilot test generated suggestions for refinement from the team members. The final codebook was created after incorporating this feedback.

2.6.2 Quality Assurance of Quality Appraisal of Individual Studies

All team members discussed the different elements of the CASP ratings tool and their application to the identification and assessments of the elements within the articles. After this, two team members, the lead author of the report and a graduate student research assistant, separately used the CASP tool to appraise all the articles. The two team members discussed any disagreements. The lead author made the final determination based on the discussion.

2.6.3 Quality Assurance of Synthesis of Findings

The synthesis of findings was done by the lead author of the report. The synthesis process and the synthesized findings were discussed in weekly meetings with the second author, who closely read the synthesized findings and offered critique. A draft of the findings was also discussed with and critiqued by the National Academies staff and methodology consultant. The final synthesized findings were developed based on the discussion and critique.

The assessment of confidence in the synthesized findings was done by the lead author of the report. The second author reviewed the assessments, queried the lead author for additional information, and offered suggestions. The final assessment was decided after this discussion.

3.0 FINDINGS

3.1 Relevance Assessment and Quality Rating of Individual Studies

The relevance assessment, as summarized in Table 3.1, showed the following for the 16 qualitative research studies: 14 were of direct, one was of indirect, one was of partial, and none were of unclear relevance. Thus, 88% of the studies were directly relevant to the phenomenon of interest.

 The quality rating using the CASP tool, as summarized in Table 3.1, showed the following for the 16 studies: 10 had no or very minor, 4 had minor, 2 had moderate, and none had serious concerns. Thus, 88% of the studies were of high and moderate and 12% were of low quality.

Table 3.1. Study Citation, Relevance Assessment, and CASP Quality Rating (N = 16)

Study [First Author Only, Publication Year]	Relevance [Direct, Indirect, Partial, Unclear]	CASP Rating of Quality [No or Very Minor, Minor, Moderate, Serious Concerns]
Baum (2009)	Direct	No or Very Minor
Beaton (2007)	Direct	Minor
Bell (2004)	Direct	Moderate
Braunack-Mayer (2010)	Direct	Minor
Cava (2005)	Direct	No or Very Minor
Charania (2013)	Direct	No or Very Minor
Desclaux (2017)	Direct	No or Very Minor
DiGiovanni (2004)	Direct	No or Very Minor
Dwyer (2017)	Partial	Minor
Hawryluck (2004)	NA	NA
Leung (2008)	Direct	Minor
Lin (2010)	Direct	No or Very Minor
Maunder (2003)	Indirect	Moderate
Pellecchia (2015)	Direct	No or Very Minor
Robertson (2004)	Direct	No or Very Minor
Sell (2018)	Direct	No or Very Minor
Smith (2012)	Direct	No or Very Minor

Notes. Cava (2005a) and Cava (2005b) (see references) were based on an identical dataset and were therefore treated as a single study noted as Cava (2005) for the purposes of the review. Hawryluck (2004) was not assessed as it was primarily a quantitative study that included a qualitative data component. Study relevance was assessed as partial if NPI was not examined substantively. Study relevance was assessed as indirect if the examination of NPI did not have a public health component.

3.2 Study Characteristics

Of the 16 qualitative studies, four were from the United States. In addition, one was from Australia, and six were from mainland Canada. Thus, 12 studies may be considered to originate from high income countries. Of the rest, one study had a international focus, one study was from remote First Nations in Canada, two were from Africa (one each from Liberia and Senegal), and one was from Taiwan.

All 16 qualitative studies dealt with communicable infectious diseases, including Ebola (4), influenza (4), SARS (7), and general (1). Twelve studies examined real event occurrences, one study was a training exercise, and three studies were community consultations. The data collection period was pre-event (4) and post real event (10), with six studies collecting during the course of a real event. The time-frame of the events covered was 2003-2016.

The most common data source was interview (12) followed by focus group discussion/ forum (8). Table 3.2 provides additional information about all the study characteristics.

Table 3.2. Study Characteristic and Characteristic Categories

Study Characteristic	Characteristic Categories

Country and Location of Event	International: 1
	Australia, Adelaide: 1
	Canada: 8
	   --National/Multi-State: 1
	   --Toronto: 5
	   --Northern Ontario/First Nations: 1
	Liberia: 1
	Senegal: 1
	Taiwan: 1
	United States: 4
	   --National/Multi-State: 2
	   --Michigan: 1
	   --Washington State: 1

Population Density of Event Location	Urban: 3 Suburban: 0 Rural: 1 Mixed: 11 Not Determinable: 1

Event	Infectious Disease: 16
	   --General: 1
	   --Ebola: 4
	   --Influenza: 4
	   --SARS: 7

Event Type	Real Event: 12
	Training Exercise: 1
	   --Functional, Full-Scale: 0
	   --Tabletop, Webinar, Scenario: 1
	Community Consultation: 3

Event Phase Focus	Preparation for Response: 4 Actual Response: 12
Event Scale Focus	Local/County: 7 State/Multi-county: 4 National/Multi-state: 4 International/Multi-Country: 1
Event Year	2003: 7 2006: 1 2008-2009: 1 2008: 2 2009: 1

	2014: 2
	2014-2016: 2
Quarantine Only Focus	Yes: 4
	No: 12 (Also examined: Isolation; Screening; Monitoring)
Quarantine Location	Real Event: 13
	--Home/Residence: 9
	--Hospital: 1
	--Not Determinable: 2
	Training Exercise: 1
	--Home/Residence: 1
	Community Consultation: 3
	--Home: 2
	--Not Determinable: 1
Quarantined Population	General Public: 14
	Health Care Staff: 7
Data Collection Period	Training Exercise/Pre-Event: 4
	During Real Event: 6
	Post Real Event: 9
Data Source	Interview: 12
	Focus Group Discussion/ Forums: 8
	Participant Observation: 3
	Document Analysis: 1
	Survey Questionnaire: 2
Data Providers	Agencies Staff: 10
	--Real Event Response: 9
	--Training Exercise: 1
	General Public: 9
	--Experience with Quarantine: 6
	--No Experience: 3
Vulnerable Populations Addressed	Yes: 5
	No: 11

Note. The frequencies for the study characteristic categories may not add up to 16 (the total number of qualitative studies) as some studies examined multiple categories for a characteristic.

3.3 Synthesized Findings

The phenomenon of interest for the present evidence synthesis was quarantine, a non-pharmaceutical intervention. The findings from individual studies were synthesized to describe this phenomenon, both as a whole and its different aspects as embodied in the questions of interest noted in the introduction to this report.

Eighteen synthesized findings emerged from the 16 studies forming the corpus for the evidence base. The findings are discussed below and are summarized in Table 3.3.19. The table also presents the assessment of confidence in the evidence for the findings as judged using the GRADE-CERQual tool (see Section 2.5 for description).

3.3.1 Quarantine Effectiveness: Definition

Finding 1: Agencies may want to judge the effectiveness of quarantine not only using the metric of medical outcomes but also in terms of the degree of protection of the civil rights of the public on whom quarantine is imposed. Along the same lines, agencies may also want to judge the effectiveness of quarantine in terms of the

extent to which the public on whom quarantine is imposed is protected from harms that result from the quarantine restrictions.

Agencies typically judge the effectiveness of quarantine only from a single utilitarian criterion of reduction of morbidity and mortality in the general population. However, because almost always quarantine is imposed on a group of people without their consent, it may also be important to include two additional criteria, protection of civil rights and protection from harms, to judge the effectiveness of quarantine.

Quarantine requires a legal framework for restricting the free movement of the public on whom quarantine is imposed and the legal enforcement of this restriction. Quarantine restrictions can range from fully voluntary with no outside monitoring (only self or community member monitoring and reporting) or legal enforcement, which protects civil rights given the situation, to voluntary with outside intrusive monitoring and threat of legal enforcement, and to mandatory with outside intrusive monitoring and coercive legal enforcement (Baum, 2009; Beaton, 2007; Bell, 2004; Braunack-Mayer, 2010; DiGiovanni, 2004; Pellecchia, 2015; Sell, 2018; Smith, 2012). Additionally, quarantine, because it requires restriction of free movement, often results in multiple harms to the public on whom the quarantine is imposed. These harms often include financial, social, and psychological (Cava, 2005; Desclaux, 2017; DiGiovanni, 2004; Dwyer, 2017; Lin, 2010; Maunder, 2003; Pellecchia, 2015; Robertson, 2004).

Agencies, especially public health and healthcare, are engaged in ensuring well-being of people. As such, agencies may wish to expand the definition of an effective quarantine by judging success to mean meeting of all three protection criteria.

3.3.2 Quarantine Effectiveness: Graded Options

Finding 2: Agencies can enhance the effectiveness of quarantine by developing screening and monitoring criteria that allow for graded quarantine options matched to the characteristics of the infectious disease and its spread.

A decision to implement quarantine can be dependent on the virulence of the virus. Considering different levels of quarantine can depend on the severity and magnitude of the infectious disease situation. Similarly, there can be different criteria for placing persons in quarantine based on risk from exposure, with contacts at highest risk (aside from healthcare workers with certain unprotected patient care exposures) such as people exposed to ill family members in close quarters on a regular basis as opposed to casual contacts with only a brief interaction (Bell, 2004; Charania, 2013; Desclaux, 2017; Smith, 2012).

3.3.3 Quarantine Effectiveness: Lack of Medical Response

Finding 3: Agencies need to recognize that for regions lacking robust medical response infrastructures, non-pharmaceutical interventions such as quarantine may be especially effective.

At the outbreak of an infectious disease, countries may lack countermeasures such as drugs and vaccines. Similarly, there may be regions in a country where the stockpile of drugs and vaccines may be limited or where the delivery of such supplies may take time due to remoteness. In these circumstances, nonpharmaceutical interventions may be the only measures available to combat epidemics, especially at the beginning of an outbreak (Bell, 2004; Braunack-Mayer, 2010; Charania, 2013).

3.3.4 Quarantine Adherence Strategy: Community Orientation

Finding 4: Agencies need to understand that the members of a community on whom quarantine is imposed often regard its impact at the community rather than individual or abstract "common good," level to be more

important . Therefore, agencies need to consider the life circumstances of and work in cooperatively with the community to increase adherence to quarantine.

Quarantine is conceptualized as the restriction of rights of individuals done for the benefit of the abstract "common good," which may be thought of as the larger society. Between these two levels of the individual and the larger society exists the third level of community, which may be seen as a group of individuals with strong social bonds (Smith, 2012).

When quarantine is imposed on some individuals of a community, because of the tight social bonds, the life of the whole community is affected as well. Thus, to ensure that individuals on whom quarantine is imposed adhere to the restrictions, agencies should understand the life circumstances, such as economic status, political history, trust of agencies and government, and cultural and religious customs, of the community and work in cooperation with its existing power and leadership social structures (Baum, 2009; Braunack-Mayer, 2010; Cava, 2005; Charania, 2013; Desclaux, 2017; Leung, 2008; Pellecchia, 2015; Smith, 2012).

3.3.5 Quarantine Adherence Strategy: Communication

Finding 5: Agencies can use communication strategically to increase adherence to quarantine during an infectious disease event. This communication is equally important for both the public and the health care staff on whom quarantine has been imposed.

Communication from agencies can increase adherence to quarantine during an infectious disease event. The communication should emphasize suasion over threat and strive to be two-way rather than just one-way. Agencies should also remain aware that communication should take place over the full course of the event and should involve multiple channels, including mass media and interpersonal, and multiple sources, including public health and health care staff. The communication should in particular provide information about the disease, the instructions for the quarantine and the need for it, not arouse fear and anxiety, not be stigmatizing, not use terms with confusing meanings, and have clear and consistent information about infection control and coping strategies. This communication is equally important for both the general public and the health care staff on whom quarantine has been imposed (Cava, 2005; DiGiovanni, 2004; Dwyer, 2017; Lin, 2010; Pellecchia, 2015; Robertson, 2004; Sell, 2018; Smith, 2012).

3.3.6 Quarantine Adherence Strategy: Care Orientation

Finding 6: Agencies can have an orientation of care, as opposed to an orientation of enforcement, toward the people on whom quarantine is imposed to increase adherence .

Agencies can adopt an approach in their interactions with people under quarantine that resembles care, showing concern for their needs and extending empathetic support. This would be in contrast to an orientation that emphasizes control and enforcement. (Desclaux, 2017; Maunder, 2003).

3.3.7 Quarantine Adherence Facilitator: Inter-Agency Coordination

Finding 7a: Agencies can facilitate adherence to quarantine by understanding to implement quarantine that multiple agencies and multiple jurisdictions are required to work in concert.

Agencies should remain aware that planning and implementation of quarantine requires inter-agency cooperation, including that of the legal and law enforcement systems. The inter-agency coordination should include plans for scalability of operations in terms of the increased number of people that maybe required to be put under quarantine during the course of an infectious disease event (Desclaux, 2017; DiGiovanni, 2004; Dwyer, 2017; Sell, 2018).

3.3.8 Quarantine Adherence Facilitator: Preexisting Public Acceptance

Finding 7b: Agencies can facilitate adherence to quarantine by acknowledging that the public in general accepts, and does not resist, the concept of quarantine as a response to an infectious disease event.

The public understands and accepts the general concept of quarantine as one of the mechanisms for slowing the transmission of an infectious disease through a population. Even vulnerable groups, such as the homeless, are not opposed to the idea in general. People have several reasons for supporting this view, including a sense of duty, ethical concern, and civic-mindedness (Baum, 2009; Bell, 2004; Cava, 2005; Desclaux, 2017; DiGiovanni, 2004; Leung, 2008; Lin, 2010; Pellecchia, 2015; Robertson, 2004).

Quarantine may be seen as effective when the people on whom quarantine is imposed voluntarily adhere to the quarantine restrictions as opposed to complying with them under the threat of legal enforcement. Factors that may make quarantine restrictions acceptable include financial compensation, food, social support, and policy adaptations. These factors are discussed next.

3.3.9 Quarantine Adherence Acceptance: Provision of Financial Compensation

Finding 7c: People on whom quarantine is imposed may find the restrictions acceptable depending on provision of financial compensation by government or other agencies.

A salient factor that may make quarantine restrictions acceptable is provision of financial compensation for lost work by the government or other agencies. This compensation may include partial or full income replacement for the duration of the quarantine, assurance of job security and economic recovery after quarantine ends, and payment for rent, water, electricity, and other utilities (Baum, 2009; Braunack-Mayer, 2010; Cava, 2005; Desclaux, 2017).

3.3.10 Quarantine Adherence Acceptance: Provision of Food

Finding 7d: People on whom quarantine is imposed may find the restrictions acceptable depending on the provision of food and other basic necessities by government and other agencies.

A salient factor that may make quarantine restrictions acceptable is provision of food and other basic necessities. The government and other agencies can directly deliver these to the people in quarantine or agencies can assist neighbors, friends, and volunteers with the purchase and delivery. It should be kept in mind that the food support should match the dietary needs and wishes of the people under quarantine (Braunack-Mayer, 2010; Cava, 2005; Desclaux, 2017; DiGiovanni, 2004; Leung, 2008; Pellecchia, 2015).

3.3.11 Quarantine Adherence Acceptance: Provision of Social Support

Finding 7e: People on whom quarantine is imposed may find the quarantine restrictions acceptable depending on the provision of professional social support by government and other agencies.

A salient factor that may make quarantine restrictions acceptable is provision of professional social support. This can be in the form of a new dedicated or preexisting general confidential telephone hotline that provides professional counselling. This can also include providing cell phones to people who may not possess one to make phone calls (Braunack-Mayer, 2010; Cava, 2005; Desclaux, 2017; Dwyer, 2017; Lin, 2010; Maunder, 2003).

3.3.12 Quarantine Adherence Acceptance: Policy Adaptation

Finding 7f: People on whom quarantine is imposed may find the restrictions acceptable if agencies adapt quarantine policies to suit populations and situations.

A salient factor that may make quarantine restrictions acceptable is allowing reasonable modifications of rules and procedures to fit the needs of the situation and people placed under quarantine. These can include changes to policies for tobacco and alcohol use in group facilities, leaving quarantine sites for getting supplies or going to work, and using public transport to get to work. In this regard, quarantine can be seen as a nuanced measure that is situation dependent (Bell, 2004; Cava, 2005; Charania, 2013; Desclaux, 2017; DiGiovanni, 2004; Leung, 2008; Sell, 2018).

Members of the general public or health workers on whom quarantine is imposed may experience several harms due to quarantine. These harms may include financial instability, social isolation, social stigma, and negative psychological states. These harms are discussed next.

3.3.13 Quarantine Harms: Financial Instability

Finding 8a: People on whom quarantine is imposed may experience the harm of financial instability.

A salient harm of quarantine may be financial. People put into quarantine are often done so with little advance notice that can affect their employment status, which can result in loss of regular wages and other income without compensation. The situation can be exacerbated for people whose income comes from part-time work, casual work, or self-employment (Baum, 2009; Braunack-Mayer, 2010; Cava, 2005; Desclaux, 2017; DiGiovanni, 2004).

3.3.14 Quarantine Harms: Social Isolation

Finding 8b: People on whom quarantine is imposed may experience the harm of social isolation.

A salient harm of quarantine may be social isolation. Quarantine requires restriction of physical contact with close others like spouses, children, and siblings, wearing of a mask, and remaining at home which can result in feeling of physical and psychological isolation. This isolation may be exacerbated by active distancing by others such as family, friends, and neighbors (Cava, 2005; DiGiovanni, 2004; Lin, 2010; Robertson, 2004; see also Hawryluck, 2004).

3.3.15 Quarantine Harms: Social Stigma

Finding 8c: People on whom quarantine is imposed may experience the harm of social stigma.

A salient harm of quarantine may be social stigma. People in quarantine are publically labelled as potential carriers of an infectious disease which may lead others to develop feeling of avoidance, suspicion, mistrust, and fear, and thus stigma, toward the quarantined people. If the quarantined people are from marginalized groups, this stigmatization can exacerbate discrimination and further marginalization. The stigma may last well beyond after the end of the quarantine period (Cava, 2005; Desclaux, 2017; DiGiovanni, 2004; Dwyer, 2017; Lin, 2010; Pellecchia, 2015; Robertson, 2004).

3.3.16 Quarantine Harms: Negative Psychological States

Finding 8d: People on whom quarantine is imposed may experience the harm of negative psychological states.

A salient harm of quarantine may be negative psychological states. These effects are primarily avoidable heightened anxiety, fear, worry, stress, and loneliness. The sources for these can be financial, social isolation,

stigmatization, and risk of infecting others (Cava, 2005; DiGiovanni, 2004; Lin, 2010; Maunder, 2003; Pellecchia, 2015; Robertson, 2004).

3.3.17 Quarantine Harms: Health Care Staff Experience

Finding 8e: Health care staff on whom quarantine is imposed may experience additional harms beyond those experienced by the general public.

Health care staff on whom quarantine is imposed may experience several harms, such as financial, social, and psychological, similar to the general public; however, these harms may get amplified for health care staff. For example, health care staff may experience stronger negative psychological states such as anxiety and stress due to the possibility of them having infected patients prior to their quarantine. Health care staff may also experience guilt and shame as a result. Health care staff under quarantine also worry about leaving their colleagues understaffed and overworked. In cases of "work quarantine" where essential health care staff have to continue to come to work, having contact with patients known to be infected can lead to even greater anxiety. This situation may also lead to resentment and conflict with non-essential co-workers put under home instead of work quarantine (Desclaux, 2017; Maunder, 2003; Robertson, 2004).

3.3.18 Quarantine and Vulnerable Groups

Finding 9: Agencies when imposing quarantine on vulnerable population groups relative to the general population, should accept a greater need for modifications to standard policies and assume stronger harms will result from the quarantine.

Vulnerable groups, such as the urban poor, rural poor, and homeless, have unique needs that require overlooking the stringent application of standard policies of maintaining quarantine. These policies may need to be also modified to meet the life needs of such groups. In addition, the harms of quarantine, such as financial, social, and psychological, may be especially pronounced for these groups (Baum, 2009; Charania, 2013; Desclaux, 2017; Leung, 200; Pellecchia, 2015).

3.3.19 Summary of Synthesized Finding and Confidence in the Finding

The 18 synthesized findings as discussed above are summarized in the table below. The table also presents the GRADE-CERQual assessment of confidence in the evidence supporting each finding.

Table 3.3.19 Summary of Synthesized Finding and Confidence in the Finding

Objective: Describe the phenomenon of public health quarantine, both overall and its various specific aspects			
Perspective: Agencies imposing the quarantine and the people on whom the quarantine is imposed.			
Summary of Finding	**Studies Contributing to the Finding**	**Overall CERQual Assessment of Confidence in the Evidence for the Finding**	**Explanation of Assessment**
Quarantine Effectiveness			
1. Agencies may want to judge the effectiveness of quarantine not only	Baum (2009); Beaton (2007); Bell (2004);	High	The 14 studies have no, very minor, or minor

using the metric of medical outcomes but also in terms of the degree of protection of the civil rights of the public on whom quarantine is imposed. Along the same lines, agencies may also want to judge the effectiveness of quarantine in terms of the extent to which the public on whom quarantine is being imposed is protected from harms that result from the quarantine restrictions.	Braunack-Mayer (2010); Cava (2005); Desclaux (2017); DiGiovanni (2004); Dwyer (2017); Lin (2010); Maunder (2003); Pellecchia (2015); Robertson (2004); Sell (2018); Smith (2012);		concerns for methods, relevance, and adequacy, but have moderate concerns for coherence as the finding was constructed from two groups of studies (civil rights, harms) that were subsequently developed into a single finding.
2. Agencies can enhance the effectiveness of quarantine by developing screening and monitoring criteria that allow for graded quarantine options matched to the characteristics of the infectious disease and its spread.	Bell (2004); Charania (2013); Desclaux (2017); Smith (2012)	Moderate	The 4 studies have no, very minor, or minor concerns for methods and relevance, but have moderate concerns for coherence and adequacy.
3. Agencies need to recognize that for regions lacking robust medical response infrastructures, non-pharmaceutical interventions such as quarantine may be especially effective.	Bell (2004); Braunack-Mayer (2010); Charania (2013)	High	The 3 studies have no, very minor, or minor concerns for methods, coherence, adequacy, and relevance.
Quarantine Adherence Strategy			
4. Agencies need to understand that the members of a community on whom quarantine is imposed often regard its impact at the community rather than individual or abstract "common good," level to be more important . Therefore, agencies need to consider the life circumstances of and work in cooperatively with the community to increase adherence to quarantine.	Baum (2009); Braunack-Mayer (2010); Cava (2005); Charania (2013); Desclaux (2017); Leung (2008); Pellecchia (2015); Smith (2012)	High	The 8 studies have no, very minor, or minor concerns for methods, coherence, adequacy, and relevance.
5. Agencies can use communication strategically to increase adherence to quarantine during an infectious disease event. This communication is equally important for both the public and the health care staff on whom quarantine has been imposed.	Cava (2005); DiGiovanni (2004); Dwyer (2017); Lin (2010); Pellecchia (2015); Robertson (2004); Sell (2018); Smith (2012)	High	The 8 studies have no, very minor, or minor concerns for methods, coherence, adequacy, and relevance.

6. Agencies can have an orientation of care, as opposed to an orientation of enforcement, toward the people on whom quarantine is imposed to increase adherence .	Desclaux (2017); Maunder (2003)	Low	The 2 studies have no or very minor concerns for relevance, but moderate concerns for methods, coherence, and adequacy.

Quarantine Adherence Facilitation and Acceptance

7a. Agencies can facilitate adherence to quarantine by understanding to implement quarantine that multiple agencies and multiple jurisdictions are required to work in concert.	Desclaux (2017); DiGiovanni (2004); Dwyer (2017); Sell (2018)	Moderate	The 4 studies have no, very minor, or minor concerns for methods and relevance, but moderate concerns for coherence and adequacy.
7b. Agencies can facilitate adherence to quarantine by acknowledging that the public in general accepts, and does not resist, the concept of quarantine as a response to an infectious disease event.	Baum (2009); Bell (2004); Cava (2005); Desclaux (2017); DiGiovanni (2004); Leung (2008); Lin (2010); Pellecchia (2015); Robertson (2004)	High	The 9 studies have no, very minor, or minor concerns for methods, coherence, adequacy, and relevance.
7c. People on whom quarantine is imposed may find the restrictions acceptable depending on provision of financial compensation by government or other agencies.	Baum (2009); Braunack-Mayer (2010); Cava (2005); Desclaux (2017)	High	The 4 studies have no, very minor, or minor concerns for methods, coherence, adequacy, and relevance.
7d. People on whom quarantine is imposed may find the restrictions acceptable depending on the provision of food and other basic necessities by government and other agencies.	Braunack-Mayer (2010); Cava (2005); Desclaux (2017); DiGiovanni (2004); Leung (2008); Pellecchia (2015)	High	The 6 studies have no, very minor, or minor concerns for methods, coherence, adequacy, and relevance.
7e. People on whom quarantine is imposed may find the quarantine restrictions acceptable depending on the provision of professional social support by government and other agencies.	Braunack-Mayer (2010); Cava (2005); Desclaux (2017); Dwyer (2017); Lin (2010); Maunder (2003)	High	The 6 studies have no, very minor, or minor concerns for methods, coherence, adequacy, and relevance.
7f. People on whom quarantine is imposed may find the restrictions acceptable if agencies adapt quarantine policies to suit populations and situations.	Bell (2004); Cava (2005); Charania (2013); Desclaux (2017); DiGiovanni (2004); Leung (2008); Sell (2018)	Moderate	The 7 studies have no, very minor, or minor concerns for methods and relevance, but moderate concerns for coherence and adequacy.

Quarantine Harms			
8a. People on whom quarantine is imposed may experience the harm of financial instability.	Baum (2009); Braunack-Mayer (2010); Cava (2005); Desclaux (2017); DiGiovanni (2004)	High	The 5 studies have no, very minor, or minor concerns for methods, coherence, adequacy, and relevance.
8b. People on whom quarantine is imposed may experience the harm of social isolation.	Cava (2005); DiGiovanni (2004); Lin (2010); Robertson (2004)	High	The 4 studies have no, very minor, or minor concerns for methods, coherence, adequacy, and relevance.
8c. People on whom quarantine is imposed may experience the harm of social stigma.	Cava (2005); Desclaux (2017); DiGiovanni (2004); Dwyer (2017); Lin (2010); Pellecchia (2015); Robertson (2004)	High	The 7 studies have no, very minor, or minor concerns for methods, coherence, adequacy, and relevance.
8d. People on whom quarantine is imposed may experience the harm of negative psychological states.	Cava (2005); DiGiovanni (2004); Lin (2010); Maunder (2003); Pellecchia (2015); Robertson (2004)	High	The 6 studies have no, very minor, or minor concerns for methods, coherence, adequacy, and relevance.
8e. Health care staff on whom quarantine is imposed may experience additional harms beyond those experienced by the general public.	Desclaux (2017); Maunder (2003); Robertson (2004)	High	The 3 studies have no, very minor, or minor concerns for methods, coherence, adequacy, and relevance.
Quarantine and Vulnerable Groups			
9. Agencies when imposing quarantine on vulnerable population groups relative to the general population, should accept a greater need for modifications to standard policies and assume stronger harms will result from the quarantine.	Baum (2009); Charania (2013); Desclaux (2017); Leung (2008); Pellecchia (2015)	High	The 5 studies have no, very minor, or minor concerns for methods, coherence, adequacy, and relevance.

4.0 DISCUSSION

The purpose of the evidence synthesis was to describe and understand the phenomenon of public health quarantine, both overall as well as focused on specific aspects including effectiveness, adherence, facilitators, and harms. The analysis and synthesis of evidence from 16 qualitative research studies yielded 18 findings. Three of the findings were for effectiveness, three for strategies for adherence, five for facilitators for adherence, six for harms, and one for vulnerable groups. Of the 18 findings, 13 were assessed as having high, four having moderate, and one having low confidence. Thus overall, the majority of findings were seen as being based on evidence of strong quality.

4.1 Evidence to Decision Framework

4.1.1 Balance of Benefits and Harms

The studies in the corpus did not directly discuss the benefits of quarantine. The studies cited other studies that show positive effects of quarantine on reducing infectious disease transmission. However, indirectly, using perceptions of experts and lay citizens, the studies do acknowledge that quarantine is an important response to infectious disease outbreaks that can contribute to lowering morbidity and mortality in the larger population.

The studies in the corpus, however, are much more interested in the *process* of quarantine rather than examining only the disease-related final outcomes. Their focus is on understanding how the people on whom quarantine is imposed experience the quarantine. The studies find that quarantine has the potential to result in removal of civil rights protections and occurrence of negative outcomes such as financial instability, social stigma, and compromised psychological well-being.

With these two significant undesirable effects of quarantine, which can be both short and long term, the balance of benefits and harms is open to debate.

4.1.2 Acceptability and Preferences

Effective implementation of quarantine requires coordinated effort from a variety of stakeholders, ranging from local/ county to national and even international levels and from public health to legal, law enforcement, and other agencies. The acceptability of and preference for quarantine may differ widely across the different agencies, with some advocating an emphasis on voluntary adherence and others asking for mandatory enforcement, which may include a militaristic response. If community groups are added as stakeholders, which in many instances they should, the divergence of views on acceptability of quarantine as a public health intervention may become even wider. To address this and find a common ground, open-ended deliberations should take place among stakeholders. These discussions can try to come up with a graded set of quarantine options that match the level of severity of threat.

4.1.3 Equity

Vulnerable or at-risk population groups, such as the poor and marginalized communities, are in need of additional protections when placed under quarantine. The harms from quarantine, especially financial and social, may be more severe for them compared to what other population segments may experience. Such groups may already be in financial hardship and socially stigmatized, burdens that will be exacerbated when placed under quarantine. It may also be the case that some agencies may not view the protection of civil rights of marginalized groups, such as the homeless, with regard equal to that of other groups. As such, application of quarantine to vulnerable groups should be done with necessary caution and a strong orientation of care.

4.1.4 Resource and Economic Considerations

Resources that can facilitate more effective quarantine by agencies are of many different types. As discussed in Findings 7c, 7d, and 7e above, these can include provision of financial compensation, food, and professional social support to the people on whom quarantine is imposed.. A resource for effective implementation of quarantine at the time of an emergency can also the be inter-agency deliberations and training sessions that have taken place on an ongoing basis prior to an event.

The economic considerations regarding these resources were not addressed in the studies in the evidence base. However, one can surmise that provision of financial compensation for people in quarantine will require a large commitment of financial resources. Some studies (Cava, 2005; DiGiovanni, 2004) in the evidence corpus indicated that the government or employers can potentially   undertake this responsibility.. Similarly, assistance with food will require additional economic resources as well. Some studies (Cava, 2005; Desclaux, 2017; Dwyer, 2017; Pellecchia, 2015) in the evidence corpus suggested that these can potentially be funded by the government or its affiliated agencies. This may be especially required for unique populations under quarantine such as university students (Beaton, 2007)) and homeless people (Leung, 2008). In addition, economic resources will also be required for provision of professional support system and creation of organizational mechanisms for inter-agency deliberations and training. Whether these are to be funded by the government or the agencies themselves can be discussed among the agencies.

4.1.5 Feasibility and PHEPR System Considerations

The studies in the evidence corpus did not directly examine the organizational and systemic ability of agencies to implement quarantine. However, the studies in their descriptions of quarantine implementation make apparent that the staffing and operational capacities to implement quarantine, such as initiating a legal order and ensuring its enforcement, contact tracing, and quarantine monitoring, all currently exist and do not have to be freshly created. Some studies did indicate   implementation bottlenecks to medical care contexts (Dwyer, 2017; Sell, 2018), such as environmental decontamination, waste management, safe transportation, and availability of sufficient stocks of supplies such as masks and thermometers, which may be relevant to quarantine context as well, but these did not seem to hinder the response operations in any significant way. Some studies (Sell, 2018) pointed out that if quarantine is needed to be scaled up to a very large population from a small number of people, this situation will require dealing with shortage of staffing and supplies, which can be part of advance planning.

However, for quarantine implementation to be effective in a more comprehensive sense, as defined in the first finding and above in the discussion of harms and benefits, will require agencies to more clearly articulate their broad strategic vision and a corresponding plan for conducting quarantine operations that meet all three criteria of effectiveness. Based on the studies in the evidence corpus, it is likely that the agencies are not ready to re-conceptualize quarantine effectiveness and broaden their plans for implementation to realize these multiple goals.

Additionally, although in the last two decades an all-hazards approach has built capacity in emergency response agencies, including public health, at all local/county, state, and national levels, the implementation of quarantine is unique to infectious disease outbreaks and perhaps to other emergencies where the health hazard may be communicable through contact. As such, capacity building, such as through training, may require a dedicated one-hazard focus, which may not be feasible to implement on a regular basis.

4.2 Limitations

A limitation of the evidence synthesis was the limited number of studies in the evidence base. Although all studies were relevant to the broader phenomenon of interest, they all together did not provide enough of a "thick" corpus to closely describe all the specific aspects of quarantine from the perspectives of both the agencies who implement a quarantine and the people on whom quarantine is imposed.

4.3 Conclusion

The 18 findings from the synthesis of evidence from 16 qualitative research studies represent a description and understanding of the phenomenon of public health quarantine. Together, the findings help see the phenomenon with more depth at an overall level as well as at the level of its specific aspects. The findings have strong confidence and so can serve as a guide for developing recommendations for quarantine in the field and lend themselves to future research.

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6.0 APPENDIX

Table 6.1. Illustrative Excerpt of Findings Synthesis Process Showing Development of Descriptive and Analytical Themes

Descriptive Codes: a priori and Emergent	Verbatim Text from Article Linked to Descriptive Code	Descriptive Themes: Families of Descriptive Codes	Analytic Theme: Interpretive Grouping of Descriptive Themes
(A) Resistance to forced quarantine *[a priori]*	. Enforced quarantine did not comply with local communities' dynamics. (Pellecchia, 2015)	. (A) + (B) + (C) + (G): Between the two levels of the individual and the larger society exists the third level of community, which may be seen as a group of individuals with strong social bonds.	Finding 4. Agencies should note that often the impact of quarantine at the community, as opposed to individual or abstract "common good," level may be seen as more important by the members of a community on which quarantine is imposed. As such, agencies should strive to understand the life circumstances of the community and work in cooperation with it to increase adherence to quarantine.
(B) Quarantine for remote communities *[a priori]*	. Although church services and funerals were still held for cultural reasons, these findings support the results of previous studies in that participants were open to modifying cultural practices to decrease virus transmission, especially if advocated by community Elders. (Charania, 2013) . Only the home contacts of an index case should be requested to quarantine, as it would be challenging to maintain daily community functions if all of the casual contacts were also required to quarantine since extensive social networking occurs in their communities. (Charania, 2013)	. (B) + (E) + (G): When quarantine is imposed on some individuals of a community, because of the tight social bonds, the life of the whole community is affected as well.	
(C) Level of community *[Emergent]*	. These findings contrast, for instance, with the responsibilities outlined in the American Model State Emergency Health Powers Act, which makes explicit distinctions between the common good and individual rights, but does not consider the good of the community as described in our findings. (Smith, 2012) . Participants indicated that there are fundamental values that may not be within the scope of an individual's rights or the greater good (as it is conventionally viewed) that are important to,	. (D) + (E) + (F): To increase quarantine adherence agencies should understand the life circumstances, such as economic status, political history, trust of agencies and government, and cultural and religious customs, of the community. . (A) + (C) + (E) + (G): Agencies should work in	

	and define, a community – such as the right to assemble, obligations to one's family, and the view that religious rites trump the risk of mortality. (Smith, 2012) . First is the tension between protecting personal autonomy and promoting community well being. (Baum, 2009)	cooperation with a community's existing power and leadership social structures.
(D) Community history *[Emergent]*	. Distrust in Government, (especially among some communities). (Baum, 2009) . In the hardest hit neighboring countries, the epidemic revealed the fragility of health care systems that lack human resources, destroyed by conflicts over the past decades and weakened by neoliberal policies that favor the private sector. (Desclaux, 2017) . Experience of quarantine was shaped by individual differences such as life situation and experience of SARS before quarantine, within a context of overwhelming negative messages in the media about SARS. (Cava, 2005) . The outbreak was described as exploiting social bonds and creating mutual distrust. Containment measures duplicated such feelings and revived the time of civil war, with its climate of insecurity and suspicion towards neighbours, close acquaintances and foreigners. (Pellecchia, 2015)	
(E) Community culture *[Emergent]*	. Participants indicated that there are fundamental values that may not be within the scope of an individual's rights or the greater good (as it is conventionally viewed) that are important to, and define, a community – such as the right to assemble, obligations to one's family, and the view that religious rites	

	trump the risk of mortality. (Smith, 2012) . Social affiliations - adherence to medical authority; their respect for professional hierarchies; and their loyalty to the volunteers, doctors, and others involved with whom they established positive relationships (assistance, respect, etc.). (Desclaux, 2017) . Participants expressed that there should be allowances to determine what is deemed to be an acceptable risk at the community level; for example, holding a funeral, which may be detrimental for the greater good but actually beneficial for the community. (Smith, 2012) . Only the home contacts of an index case should be requested to quarantine, as it would be challenging to maintain daily community functions if all of the casual contacts were also required to quarantine since extensive social networking occurs in their communities. (Charania, 2013) . Enforced quarantine did not comply with local communities' dynamics. (Pellecchia, 2015) . Objectives of these measures were to quickly interrupt the transmission caused by funerals and by contacts of symptomatic persons. Lifestyles, traditions, and an ill-defined concept of culture were held to be the main responsible of the circulation of the virus by the implementing actors. (Pellecchia, 2015)		
(F) Community perceptions *[Emergent]*	. Lastly, contextual factors encouraged the contact persons' adherence to monitoring, such as a pre-existing positive appraisal of the health care system and its actors and trust in the national response to Ebola. (Desclaux, 2017)		

	. Experience of quarantine was shaped by individual differences such as life situation and experience of SARS before quarantine, within a context of overwhelming negative messages in the media about SARS. (Cava, 2005) . Link between participants' perceptions of risk, based on their personal experiences and available information, and their reported compliance. (Cava, 2005)		
(G) Community leadership *[Emergent]*	. The State-enforced quarantine was imposed vertically, and overshadowed local isolation measures that were already organized by local leaders (such as chairpersons, village chiefs, and opinion leaders) and were more socially accepted. These local measures started as spontaneous and self-organized form of protection, but institutional levels paid very little attention to them, choosing the imposition of power. (Pellecchia, 2015) . Can be developed at community level, and can be practiced with the consensus of involved citizens, supported by close leaders and a network of acquaintances. (Pellecchia, 2015) . Although church services and funerals were still held for cultural reasons, these findings support the results of previous studies in that participants were open to modifying cultural practices to decrease virus transmission, especially if advocated by community Elders. (Charania, 2013)		