



Quarantine acceptance and adherence: qualitative evidence synthesis and conceptual framework

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Abstract

Aim Emergent infectious diseases often lack medical treatment or preventive vaccines, thus requiring non-pharmaceutical interventions such as quarantine to reduce disease transmission. Quarantine, defined as the separation and restriction of movement of healthy people who have potentially been exposed to the disease, remains contentious especially when the risks and benefits are not fully discussed and not effectively communicated to the people by the organizations who impose this public health measure.

Subject and methods A qualitative evidence synthesis was conducted to examine the phenomenon of adherence to quarantine focused on the following questions: What strategies affect adherence to quarantine? What are the barriers and facilitators to quarantine acceptance? What benefits and harms of quarantine have been described or measured?

Results The evidence synthesis produced 18 findings assessed with high confidence. The findings were used to construct a conceptual framework for inter- and within-organization coordination and public communication that includes the following topics for consideration: desired orientation for implementation; population demographics; perceptions of messages; prior acceptance of quarantine; likelihood of impacts of quarantine; perceptions of health infrastructure; and perceptions of policy importance.

Conclusion The findings and conceptual framework can guide development of effective non-pharmaceutical interventions and as such have direct relevance to public health policy and decision-making for intervening in emergent infectious diseases outbreak such as the ongoing COVID-19 pandemic.

Keywords Public health quarantine · Non-pharmaceutical interventions · Infectious disease pandemic · Conceptual framework · Qualitative evidence synthesis

Emergent infectious diseases often have no effective medical treatment or preventive vaccine and as such require non-pharmaceutical interventions (NPI) as a public health intervention to reduce disease transmission, especially in the early

stages of an outbreak (Aiello et al. 2010; Aledort et al. 2007; Nussbaumer-Streit et al. 2020). These interventions are commonly based on physical (also called social or spatial) distancing to minimize contact between individuals. As a response to the ongoing Coronavirus Disease-2019 (COVID-19) pandemic, several NPIs such as lockdown/stay-at-home orders, cancellation of mass gatherings, school and business closures, isolation, and quarantine have been implemented by local, regional, and national governments globally to curtail contact between individuals and reduce spread of the disease.

Quarantine is a NPI with a long history of use and is defined by the United States Centers for Disease Control and Prevention (CDC) as the separation and restriction of movement of people who have potentially been exposed to a contagious disease, to limit disease spread (CDC 2018). With the objective of monitoring symptoms and ensuring early disease detection, quarantine involves the restriction of movement or

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separation from others of healthy persons who may have been exposed to the disease-causing agent but are not exhibiting any symptoms themselves. As such, all healthy people on whom quarantine is imposed may not accept its restrictions and adhere to them consistently (Nese et al. 2020). Although sometimes used interchangeably, quarantine differs from isolation, which applies to people who have been diagnosed with the disease (Apenhorst et al. 2020; Chittick et al. 2016).

To examine the issue of quarantine, we conducted a qualitative evidence synthesis focused on the following three inter-related questions of interest: What strategies affect adherence to quarantine? What are the barriers and facilitators to quarantine acceptance? What benefits and harms of quarantine have been described or measured? Given the qualitative research approach, the questions were treated as informing the understanding of the phenomenon of adherence to quarantine and the evidence synthesis sought to explicate this phenomenon's various aspects. Using the findings, we developed a conceptual framework for further investigating acceptance of and adherence to quarantine.

Method

This qualitative evidence synthesis is part of a larger set of sponsored qualitative reviews related to public health

preparedness whose methodology was identical and is described in detail in National Academies of Sciences, Engineering, and Medicine (2020). An overview of the process is provided below.

Literature search and study selection

A literature search was conducted by a professional librarian in PubMed, Scopus, Medline, and Embase between December 2017 and January 2019 to identify peer-reviewed primary articles that used qualitative methods. The key search terms included, non-pharmaceutical intervention, quarantine, social distance, self-isolation, restricted movement, adherence, and compliance. The *inclusion* criteria were date (2001-present) and language (English), while the *exclusion* criteria were document types (commentaries, editorials, letters, and notes excluded). To be selected for the review, 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. The evidence of interest for answering the questions of interest was the findings from primary research studies that used qualitative research methods such as ethnographic observations, interviews, and focus group discussions.

Based on the above and broadly using the Preferred Reporting Items for Systematic Reviews and Analyses

Table 1 Study citation, relevance assessment, and CASP quality rating ($N = 16$)

Study [author, publication year]	Relevance [direct, indirect, partial, unclear]	CASP Assessment of Quality [no or very minor, minor, moderate, serious concerns regarding methodological limitations]
Baum et al. (2009)	Direct	No or very minor
Beaton et al. (2007)	Direct	Minor
Bell et al. (2004)	Direct	Moderate
Braunack-Mayer et al. (2010)	Direct	Minor
Cava et al. (2005a, 2005b)	Direct	No or very minor
Charania and Tsuji (2013)	Direct	No or very minor
Desclaux et al. (2017)	Direct	No or very minor
DiGiovanni et al. (2004)	Direct	No or very minor
Dwyer et al. (2017)	Partial	Minor
Hawryluck et al. (2004)	NA	NA
Leung et al. (2008)	Direct	Minor
Lin et al. (2010)	Direct	No or very minor
Maunder et al. (2003)	Indirect	Moderate
Pellecchia et al. (2015)	Direct	No or very minor
Robertson et al. (2004)	Direct	No or very minor
Sell et al. (2018)	Direct	No or very minor
Smith et al. (2012)	Direct	No or very minor

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

(PRISMA) process (Moher et al. 2009), 17 published articles were selected for the evidence synthesis. Of these, two articles (Cava et al. 2005a, 2005b) 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 relevant qualitative component (Hawryluck et al. 2004) was included for examination.

All selected studies (first author and year) are listed in Table 1. The table also lists the relevancy assessment and quality appraisal assessment for the studies.

Relevance assessment and quality appraisal 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.

The selected studies were individually appraised using the Critical Appraisal Skills Programme (CASP; 2018) checklist, which is applicable to assessing primary 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 “cannot tell.” We modified the checklist to include an overall assessment in addition to the assessment of individual elements. Based on the CASP evaluations, each study received a final overall assessment of methodological quality: no, very minor, or minor concerns (not impacting credibility/validity of findings); moderate concerns (likely to impact credibility/validity of findings); or serious concerns (impacting credibility/validity of findings).

Data extraction 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. We used the general process of reading and rereading the full article, including the abstract, rationale,

method, results and analysis, and discussion sections, to extract study characteristics and findings data of interest.

A total of 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.

The key study data 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 was to identify and note evidence that mapped onto the phenomenon of interest.

To analyze and synthesize the extracted data, we employed the pragmatic framework synthesis method (see Barnett-Page and Thomas 2009; Pope et al. 2000), which uses an iterative deductive and inductive process. 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 families of descriptive codes (descriptive themes); interpretive grouping of descriptive themes (analytic themes); and charting/mapping and interpretation. The descriptive themes were more closely tied to the data whereas the analytic themes reflected a greater interpretive input. Findings are broadly reported using the enhancing transparency in reporting the synthesis of qualitative research (ENTREQ) guideline for qualitative evidence syntheses (Tong et al. 2012).

Quality assurance

Quality assurance at all steps was achieved through discussion until consensus was reached. The discussion of both the process and findings involved the authors as well as the sponsor organization’s staff and its committee of experts. The authors did not start out with a position on whether quarantine was positive or negative and remained sensitive to the full range of experiences reported in the studies during both data extraction and synthesis.

Assessment of confidence in synthesized findings

A mix of descriptive and analytic 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 adequacy of data supporting the finding. Each synthesized finding was then given an overall assessment as follows: high confidence (highly likely that finding is a representation of the phenomena); moderate

Table 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

Table 2 (continued)

Study characteristic	Characteristic categories
	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

confidence (likely that finding is a representation of the phenomena); low confidence (possible that finding is a representation of the phenomena); and very low confidence (not clear if finding is a representation of the phenomena).

Findings

Study characteristics

The study characteristics are detailed in Table 2 and provide the context for the synthesized findings. Briefly, all 16 studies dealt with communicable infectious diseases, including Ebola ($n = 4$), influenza ($n = 4$), SARS ($n = 7$), and general ($n = 1$). 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 ($n = 4$) and post-real event ($n = 10$), with six studies collecting during the course of a real event. The most common data source was interview ($n = 12$) followed by focus group discussion/forum ($n = 8$). Four studies were from the United States, 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 an 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.

Synthesized findings

Eighteen synthesized findings were developed to describe aspects of the phenomenon of adherence to quarantine as embodied in the questions of interest. The GRADE-CERQual assessment of confidence in the evidence for each finding is noted. Also noted is whether it is descriptive theme finding

(written in past tense as it remains close to the evidence generated by already conducted studies in the past) or analytic theme finding (written in present or future tense as it is a relatively new insight not seen explicitly in past studies).

Quarantine effectiveness: conceptualization

Finding 1 (high confidence; analytical; analytic): Agencies may want to judge the effectiveness of a 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 et al. 2009; Beaton et al. 2007; Bell et al. 2004; Braunack-Mayer et al. 2010; DiGiovanni et al. 2004; Pellecchia et al. 2015; Sell et al. 2018; Smith et al. 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 et al. 2005a, 2005b; Desclaux et al. 2017; DiGiovanni et al. 2004; Dwyer et al. 2017; Lin et al. 2010; Maunder et al. 2003; Pellecchia et al. 2015; Robertson et al. 2004).

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

Quarantine effectiveness: graded options

Finding 2 (moderate confidence; analytical; analytic): Agencies can enhance effectiveness of quarantine by developing screening and monitoring criteria that allow for graded options for quarantine that are 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 health care 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 et al. 2004; Charania and Tsuji 2013; Desclaux et al. 2017; Smith et al. 2012).

Quarantine effectiveness: unavailability of medical response

Finding 3 (high confidence; analytical; descriptive): Agencies should recognize that for regions that lack robust medical response infrastructures, non-pharmaceutical interventions, such as quarantine, by agencies were especially effective. At the outbreak of an infectious disease, countries can lack countermeasures such as drugs and vaccines. Similarly, there can be regions in a country where the stockpile of drugs and vaccines is limited or where the delivery of such supplies can take time due to remoteness. In these circumstances, non-pharmaceutical interventions were the only measures available to combat epidemics, especially at the beginning of an outbreak (Bell et al. 2004; Braunack-Mayer et al. 2010; Charania and Tsuji 2013).

Quarantine adherence strategy: community orientation

Finding 4 (high confidence; analytical; analytic): 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. 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 et al. 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 et al. 2009; Braunack-Mayer et al. 2010; Cava et al. 2005a, 2005b; Charania and Tsuji 2013; Desclaux et al. 2017; Leung et al. 2008; Pellecchia et al. 2015; Smith et al. 2012).

Quarantine adherence strategy: public information

Finding 5 (high confidence; analytical; descriptive): Agencies increased adherence to quarantine during an infectious disease event through public information dissemination. This was equally important for both the public and the health care staff on whom quarantine was imposed. Effective information from agencies increased adherence to quarantine during an infectious disease event. The effective information emphasized suasion over threat and strived to be two-way rather than just one-way. Effective information dissemination took place over the full course of the event and involved multiple channels, including mass media and interpersonal, and multiple sources, including public health and health care staff. In particular, effective information was that was provided about the disease, the instructions for the quarantine and the need for it, did not arouse fear and anxiety, was not stigmatizing, did not use terms with confusing meanings, and had clear and consistent information about infection control and coping strategies. This was equally important for both the general public and the health care staff on whom quarantine was imposed (Cava et al. 2005a, 2005b; DiGiovanni et al. 2004; Dwyer et al. 2017; Lin et al. 2010; Pellecchia et al. 2015; Robertson et al. 2004; Sell et al. 2018; Smith et al. 2012).

Quarantine adherence strategy: care orientation

Finding 6 (low confidence; analytical; analytic): Agencies can have an orientation of care, as opposed to an orientation of enforcement, for the people on whom quarantine has been imposed to increase adherence to quarantine. 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 et al. 2017; Maunder et al. 2003).

Quarantine adherence facilitator: agency coordination

Finding 7a (moderate confidence; analytical; descriptive): Agencies facilitated quarantine adherence by understanding that multiple agencies and multiple jurisdictions are required to work in concert. Agencies remained aware that planning and implementation of quarantine requires inter-agency cooperation, including that of the legal and law enforcement systems. The inter-agency coordination included plans for scalability of operations in terms of the increased number of people that were required to be put under quarantine during the

course of an infectious disease event (Desclaux et al. 2017; DiGiovanni et al. 2004; Dwyer et al. 2017; Sell et al. 2018).

Quarantine adherence facilitator: preexisting public acceptance

Finding 7b (high confidence; analytic): Agencies can facilitate quarantine adherence 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 et al. 2009; Bell et al. 2004; Cava et al. 2005a, 2005b; Desclaux et al. 2017; DiGiovanni et al. 2004; Leung et al. 2008; Lin et al. 2010; Pellecchia et al. 2015; Robertson et al. 2004).

Quarantine may be seen as effective when the people on whom quarantine is imposed adhere voluntarily 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.

Quarantine acceptance: provision of financial compensation

Finding 7c (high confidence; analytical; descriptive): People on whom quarantine was imposed found the quarantine restrictions acceptable dependent on provision of financial compensation by the government or other agencies. A salient factor that made quarantine restrictions acceptable was provision of financial compensation for lost work by the government or other agencies. This compensation included 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 et al. 2009; Braunack-Mayer et al. 2010; Cava et al. 2005a, 2005b; Desclaux et al. 2017).

Quarantine acceptance: provision of food

Finding 7d (high confidence; descriptive): People on whom quarantine is imposed found the quarantine restrictions acceptable dependent on provision of food and other basic necessities. A salient factor that made quarantine restrictions acceptable was provision of food and other basic necessities. The government and other agencies either directly delivered these to the people in quarantine or agencies assisted community groups, neighbors, friends, and volunteers with the

purchase and delivery. It was kept in mind that the food support matched the dietary needs and wishes of the people under quarantine (Braunack-Mayer et al. 2010; Cava et al. 2005a, 2005b; Desclaux et al. 2017; DiGiovanni et al. 2004; Leung et al. 2008; Pellecchia et al. 2015).

Quarantine acceptance: provision of social support

Finding 7e (high confidence; descriptive): People on whom quarantine is imposed found the quarantine restrictions acceptable dependent on provision of professional social support by agencies. A salient factor that may made quarantine restrictions acceptable was provision of professional social support. This was in the form of a new dedicated or preexisting general confidential telephone hotline that provided professional counselling. This also included providing cell phones to people who did not possess one to make phone calls (Braunack-Mayer et al. 2010; Cava et al. 2005a, 2005b; Desclaux et al. 2017; Dwyer et al. 2017; Lin et al. 2010; Maunder et al. 2003).

Quarantine acceptance: policy adaptation

Finding 7f (moderate confidence; analytic): People on whom quarantine is imposed may find the restrictions acceptable dependent on agencies adapting policies to fit 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 the 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 et al. 2004; Cava et al. 2005a, 2005b; Charania and Tsuji 2013; Desclaux et al. 2017; DiGiovanni et al. 2004; Leung et al. 2008; Sell et al. 2018).

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

Quarantine harms: financial instability

Finding 8a (high confidence; descriptive): People on whom quarantine is imposed experienced the harm of financial instability. A salient harm of quarantine was financial. People put into quarantine were often done so with little advance notice that affected their employment status, which resulted in loss of regular wages and other income without compensation. The situation was exacerbated for people whose income came from part-time work, casual work, or self-employment

(Baum et al. 2009; Braunack-Mayer et al. 2010; Cava et al. 2005a, 2005b; Desclaux et al. 2017; DiGiovanni et al. 2004).

Quarantine harms: social isolation

Finding 8b (high confidence; descriptive): People on whom quarantine is imposed experienced the harm of social isolation. A salient harm of quarantine was 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 resulted in feeling of physical and psychological isolation. This isolation was exacerbated by active distancing by others such as family, friends, and neighbors (Cava et al. 2005a, 2005b; DiGiovanni et al. 2004; Lin et al. 2010; Robertson et al. 2004; see also Hawryluck et al. 2004).

Quarantine harms: social stigma

Finding 8c (high confidence; descriptive): People on whom quarantine is imposed experienced the harm of social stigma. A salient harm of quarantine was social stigma. People in quarantine were publically labelled as potential carriers of an infectious disease, which led 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 exacerbated discrimination and further marginalization. The stigma lasted well beyond after the end of the quarantine period (Cava et al. 2005a, 2005b; Desclaux et al. 2017; DiGiovanni et al. 2004; Dwyer et al. 2017; Lin et al. 2010; Pellecchia et al. 2015; Robertson et al. 2004).

Quarantine harms: negative psychological states

Finding 8d (high confidence; descriptive): People on whom quarantine is imposed experienced the harm of negative psychological states. A salient harm of quarantine was negative psychological states. These effects were primarily avoidable heightened anxiety, fear, worry, stress, and loneliness. The sources for these were financial, social isolation, stigmatization, and risk of infecting others (Cava et al. 2005a, 2005b; DiGiovanni et al. 2004; Lin et al. 2010; Maunder et al. 2003; Pellecchia et al. 2015; Robertson et al. 2004). These findings are in line with a recent rapid review of the literature on the psychological impact of quarantine (Brooks et al. 2020).

Quarantine harms: health care staff experience

Finding 8e (high confidence; descriptive): Health care staff on whom quarantine is imposed experienced additional harms. Health care staff on whom quarantine is imposed experienced several harms, such as financial, social, and psychological, similar to the general public; however, these harms got

amplified for health care staff. For example, health care staff experienced stronger negative psychological states such as anxiety and stress due to the possibility of them having infected patients prior to their quarantine, and also experienced guilt and shame as a result. Health care staff under quarantine also worried 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 led to even greater anxiety. This situation also led to resentment and conflict with non-essential co-workers put under quarantine at home (Desclaux et al. 2017; Maunder et al. 2003; Robertson et al. 2004).

Quarantine and vulnerable groups

Finding 9 (high confidence; analytic): 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 as a result of 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 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 et al. 2009; Charania and Tsuji 2013; Desclaux et al. 2017; Leung et al. 2008; Pellicchia et al. 2015).

Discussion

The purpose of the qualitative evidence synthesis was to describe and understand the phenomenon of adherence to quarantine. Although quarantine is considered an important public health intervention for lowering morbidity and mortality due to infectious disease outbreaks, its acceptance and adherence is often contested. 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 organizations, with some advocating an emphasis on voluntary adherence and others asking for mandatory enforcement. When community groups and the general public are added as stakeholders, as they should, the divergence of views on acceptability of quarantine as a public health intervention may become even wider. The findings from our evidence synthesis lend themselves to a comprehensive and testable conceptual framework for new research examining acceptance of and adherence to quarantine.

Conceptual framework for non-pharmaceutical interventions

The conceptual framework (see Fig. 1) uses the findings and casts them as topics to consider (e.g., importance of policy of financial compensation, likelihood of personal financial instability) by organizations that can act as predictors of effective quarantine implementation, especially in terms of acceptance and adherence. The findings suggest two main contexts of communication activities that stakeholders, such as government agencies and community groups, can do regarding the topics: inter- and within-organization communication regarding coordination and public communication of information.

The framework proposes that these activities can take place under a *desired orientation of quarantine implementation* (care or enforcement—Finding 4; community, individual, or “common good”—Finding 6) and for identified *population demographics* (health care staff—Finding 8e; vulnerable populations—Finding 9; life circumstances of populations—Finding 4). Other topics for considerations include *perceptions of messages* disseminated by agencies (Finding 5), degree of *prior acceptance* of quarantine (Finding 7b), and estimate of *likelihood of impacts of quarantine* (financial instability—Finding 8a; social isolation—Finding 8b; social stigma—Finding 8c; negative psychological states—Finding 8d). In addition, the *perceptions of health infrastructure* (medical response infrastructures—Finding 3; coordination among agencies—Finding 7a) and *perceptions of policy importance* (civil rights addressed—Finding 1; policy for harm mitigation—Finding 1; provision of financial compensation—Finding 7c; provision of food and basic necessities—Finding 7d; provision of professional counselling services—Finding 7e; adaptation of policy to fit population/situation—Finding 7f; graded options for implementation—Finding 2) should be considered. All these can be measurable factors that can be used by organizations to assess the process and outcomes of their coordination activities and can also be used for the design of the structure and content of messages for dissemination to the public.

The framework can be tested at various stages of a public health emergency event that may require quarantine as an intervention. These include before an event as part of the planning and preparation (e.g., anticipated likelihood of quarantine adherence), during an ongoing event (e.g., current quarantine adherence), and after event is over (e.g., lessons learnt for future quarantine adherence).

The framework can be applied to other non-pharmaceutical interventions as well, such as lockdown/stay-at-home and wearing of face masks, that evoke responses from the public similar to that to quarantine and thus require attention to be paid to the same set of topics for

consideration. For a non-pharmaceutical intervention implementation to be effective, stakeholders will need to fully discuss all factors and outcomes of such interventions and communicate these effectively to the public. The conceptual framework provides a pathway for achieving these goals.

Equity considerations

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 do 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 the proposed conceptual framework when invoking quarantine for vulnerable groups is even more essential.

Limitation

A limitation of the review was the relative size of the identified evidence corpus. Although all studies were relevant to the broader phenomenon of interest, they all together did not provide enough “thick description” to closely describe all the specific aspects of adherence to quarantine from the

perspectives of both the agencies who implement a quarantine and the people on whom quarantine is imposed. In addition, the evidence synthesis was undertaken specifically for the United States context, which may have introduced a bias toward understanding the phenomenon of quarantine adherence from the perspective of high-income, in contrast to low- and middle-income, countries.

Conclusion

Although there are recent rapid reviews on quarantine adherence (e.g., Webster et al. 2020), our findings represent the first detailed synthesis of evidence from qualitative research studies that provide a description and understanding of the phenomenon of public health quarantine adherence. The synthesis helps see quarantine adherence with more depth at an overall level as well as at the level of its specific aspects to develop a closer understanding of both its implementation and unintended consequences. Quarantine is contentious and people can suffer harms if the risks and benefits are not understood by the organizations who impose quarantine and are not effectively communicated to the public by the organizations. The findings have high confidence in their evidence base, and the conceptual framework derived from them can serve as a guide for developing effective non-pharmaceutical interventions and as such has direct relevance to public health policy- and decision-makers for intervening in the current COVID-19 pandemic.

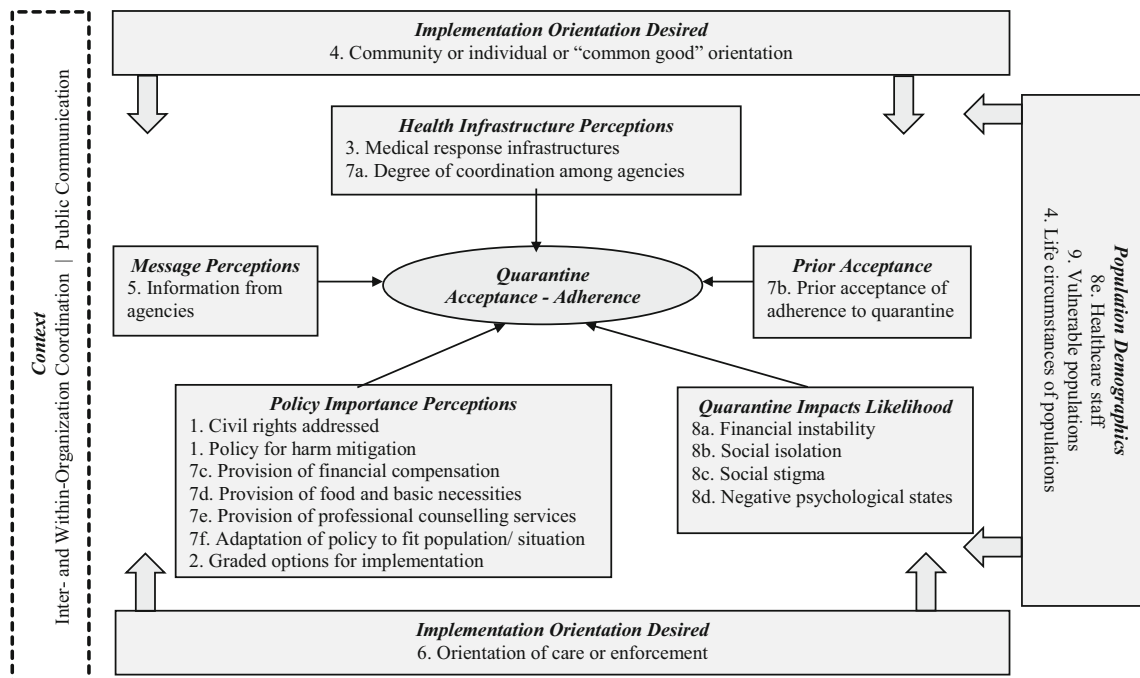


Fig. 1 Conceptual framework for quarantine acceptance and adherence: topics to consider for inter- and within-organization coordination and public communication. *Note.* The numbers in the boxes refer to the finding number used in the text

Code availability Not applicable.

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Data availability Not applicable.

Declaration

Conflict of interest All authors declare no conflict of interest.

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