

**Health system responses to changes in the supply and demand for healthcare workers during and after a viral respiratory infection pandemic: protocol for a systematic review of the evidence to inform post-pandemic preparedness**

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# **Health system responses to changes in the supply and demand for healthcare workers during and after a viral respiratory infection pandemic: protocol for a systematic review of the evidence to inform post-pandemic preparedness**

## **ABSTRACT**

**Background:** Healthcare systems need comprehensive, policy-actionable evidence to mitigate not just the immediate risk of infectious exposures from the current Coronavirus disease (COVID-19) outbreak, but also longer-term impacts of pandemic responses. Infectious disease outbreaks are associated with surges in the supply of and demand for healthcare workers (HCWs). How these surges impact health systems' abilities to manage chronic noncommunicable diseases (NCDs) during the pandemic and post-pandemic periods are less well known.

**Objective:** This paper outlines a protocol for a systematic review of the evidence on temporal changes in HCW supply/demand surrounding infectious respiratory diseases identified by the World Health Organization as outbreaks with pandemic potential (e.g., COVID-19, SARS, MERS, H1N1) to help inform health workforce policies. The focus will be on the unanticipated consequences of surges in HCW supply/demand for sustaining primary care services, including for diabetes mellitus and other chronic ambulatory care sensitive conditions.

**Methods:** We will systematically search, extract, appraise, and synthesize the literature from multiple bibliographic databases for observational studies characterizing pre-pandemic/pandemic and post-pandemic measures of HCW supply/demand, including studies published between 2000 and 2020 in English or French, and without restriction for the health financing system. Evidence will be appraised using a risk assessment tool adapted from the GRADE (Grading of Recommendations Assessment, Development and Evaluation) methodology for complex social interventions. Results will be reported following the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-analyses) standard.

**Results:** Database searches will be conducted in July 2020 and full-texts screened and appraised by two reviewers. We will narratively synthesize the data. Because of the wide range of outcomes considered, we do not expect to perform a meta-analysis. We aim to submit the review for publication in early 2021.

**Protocol record:** This review protocol has been registered in the PROSPERO International prospective register of systematic reviews (CRD42020178650).

## **KEYWORDS**

Systematic review; research protocol; health personnel; health emergencies; pandemics.

## INTRODUCTION

Healthcare systems need comprehensive, policy-actionable evidence to mitigate not just the immediate risk of infectious exposures from the current Coronavirus disease (COVID-19) outbreak, but also longer-term impacts of pandemic responses. Outbreaks of respiratory viruses are associated with surges in the supply of and demand for healthcare workers (HCWs). How these surges impact health systems' abilities to manage chronic, noncommunicable diseases (NCDs) during the pandemic and post-pandemic periods are less well known. Changes in demand for HCWs have been attributed to rising health expenditures (Léonard et al. 2009). During outbreaks, HCWs may experience risk of infection, stress, anxiety, and compassion fatigue, leading to increased absenteeism and burnout (Brooks et al. 2018; Cocker and Joss 2016; Lai et al. 2020). A study of the nursing workforce during the SARS epidemic in Toronto found a just-in-time staffing policy for acute care increased overall healthcare costs, while lowering capacity in the community and long-term care sectors (Baumann et al. 2006). Effects of pandemic economic contractions will depend on policy responses; government policies to reduce budget deficits may be amplified for the largest spending sectors (including community health), resulting in HCWs having potentially decreased job security, purchasing power, and labour market opportunities (Jesus et al. 2019). In Quebec, substitution effects of relative price changes for HCWs have been linked to subsequent reduced service supply (Shearer et al. 2018). Meanwhile, risk factors for unhealthy weight gain and obesity-associated NCDs may be exacerbated in the population due to school and business closures and other social distancing orders (Rundle et al. 2020), potentially leading to increased future demand for primary care services.

This investigation will systematically assess the evidence on temporal changes in HCW supply/demand surrounding infectious respiratory diseases identified by the World Health Organization as outbreaks with pandemic potential – such as SARS-CoV-2 (the virus causing COVID-19, previously referred to as 2019-nCoV), SARS, MERS, and H1N1 (Box 1) – to help inform health workforce policies. The focus will be on the unanticipated consequences of surges in HCW supply/demand for sustaining primary care services, including for diabetes mellitus and other chronic obesity-associated ambulatory care sensitive conditions. We will systematically search, extract, appraise, and synthesize the literature from multiple bibliographic databases for

observational studies characterizing pre-pandemic/pandemic and post-pandemic measures of HCW supply/demand, including studies published in English or French, and without restriction for the health financing system. Evidence will be appraised using a risk assessment tool adapted from the GRADE (Grading of Recommendations Assessment, Development and Evaluation) methodology for complex social interventions (Movsisyan et al. 2016).

**Box 1: Respiratory infectious diseases with potential to become international threats**

- Avian and other zoonotic influenza [A(H5N1), A(H7N9), A(H7N6) A(H10N8), A(H3N2), A(H5N6), A(H9N2)]
- Seasonal influenza [influenza A and B viruses, e.g. A(H3N2), A(H1N1)]
- Pandemic influenza [A(H1N1)pdm09]
- Severe acute respiratory syndrome coronavirus [SARS-CoV, Middle-East respiratory syndrome (MERS-CoV), novel coronavirus disease (SARS-CoV-2)]

Source: World Health Organization 2018, 2020

## **METHODS**

We are conducting our study based on a PICOS (Population, Intervention, Comparison, Outcomes, Study type) framework, in line with the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) guidelines (Liberati et al. 2009). The study protocol was registered in the PROSPERO international database of prospectively registered systematic reviews in health and social care in May 2020 (Gupta et al. 2020).

### ***Research question***

We will synthesize the evidence on health system responses to sustainably manage surges in HCW supply/demand. Specifically, we aim to answer the questions:

- Which factors affect the supply of healthcare workers during an acute respiratory illness pandemic? To what extent do these same factors affect the supply of healthcare workers following a pandemic?
- Which factors affect the demand for healthcare workers during an acute respiratory illness pandemic? To what extent do these same factors affect the demand for healthcare workers following a pandemic?

## ***Eligibility***

We will include original peer-reviewed studies reporting primary quantitative research results addressing any of the following criteria: the impact of a viral respiratory illness outbreak on the supply of healthcare workers; the impact of a viral respiratory illness outbreak on the demand for healthcare workers; any health workforce policy or governance reactions to the outbreak; how any of these impacts or reactions were associated with any health workforce policies in response to the outbreak or post-pandemic recovery. Data will aim to include measures of the supply and demand for the following cadres: physicians, nursing and midwifery personnel, pharmacists, physiotherapists, occupational therapists, psychologists and other mental health workers, clinical dietitians, non-physician clinicians and other allied health professionals, paramedics and emergency medical technicians, respiratory therapists, medical laboratory service workers, personal support workers, nurse aides and orderlies, and community health workers.

Studies are to be included if they include a comparator/control for changes over time either in the supply of healthcare workers before/during/after an outbreak, or in the demand for providers of healthcare services before/during/after an outbreak. This will include original quantitative observational studies, including cohort and multiple cross-sectional studies characterizing pre-pandemic/pandemic and post-pandemic measures of the supply/demand for healthcare workers. Studies will be excluded if they lack at least 2 time point measures. Also excluded will be pandemic response process descriptions, commentaries, discussion papers, qualitative studies, conference abstracts, and reviews synthesizing previous findings.

## ***Search strategy***

We will conduct systematic searches for up-to-date knowledge from multiple electronic abstract and citation databases: ABI/INFORM (ProQuest), CINAHL (EBSCO), Embase (Elsevier), EconLit (EBSCO), Medline (Ovid), PsycINFO (EBSCO), Scopus (Elsevier), and SocINDEX (EBSCO). The search strategy will include nomenclature related to health workforce supply and demand (e.g., healthcare workers, health personnel, physicians, nurses, clinicians), as well as nomenclature related to viral respiratory infection pandemics of global significance in the 21<sup>st</sup> century (e.g., Covid-19, MERS, SARS, H1N1). Results of an initial exploratory search

performed in Embase are presented in Appendix A. Following an analysis of the text words contained in the retrieved titles, abstracts, and subject descriptors, a search drawing on the keywords and subject terms obtained in this first step will be performed in all of the databases included in this review, with the search terms and filters translated to respect database-specific requirements. Studies published in English and French will be considered for inclusion. The search will be limited to studies published from the year 2000 through June 2020.

### ***Data extraction***

Title and/or abstract screening will be piloted, for finalization of a standardized instrument with inclusion and exclusion criteria. Titles and abstracts will then be extracted using the predetermined search strategy and screened by two reviewers. Following reconciliation of duplicate records and application of the inclusion/exclusion criteria (with reasons for exclusion being documented), full texts will be assessed for study relevance and quality of the evidence. Two reviewers will assess the quality of the evidence and examine the information for narrative synthesis of the results, with any discrepancies in reporting resolved by discussion to reach consensus.

### ***Quality assessment***

Studies will be limited to those having undergone a peer review process. The quality of the retained studies will be appraised using an adapted risk assessment tool for complex social interventions, based on the GRADE (Grading of Recommendations Assessment, Development and Evaluation) approach (Guyatt et al. 2008, 2011a, 2011b) and the STROBE (STrengthening the Reporting of OBServational studies in Epidemiology) standard (von Elm et al. 2008). Two reviewers will independently assess the risk, with any discrepancies resolved by discussion to reach consensus.

### ***Analysis***

The database searches will be collated using the Rayyan reference management software (Ouzzani et al. 2016), from which de-duplication and title/abstract screening will be conducted. The study setting, year(s) and type of outbreak, measures and coverage of the supply of

healthcare workers, measures and coverage of the demand for healthcare workers, description of the policy or governance reaction to manage surge capacity, and the study methodology used to assess impacts of the reaction will be recorded. We will perform a formal synthesis of the findings from the included studies using tables and narrative statements synthesizing whether there was an effect of a policy/governance change on the measured supply/demand for healthcare workers over time and, if so, which reactions were most effective in continuing to meet the demand in the post-pandemic period. Results will be synthesized separately by health worker cadre based on a minimum of 3 studies.

The analysis will include consideration of potential consequences of healthcare workforce supply/demand dynamics for common chronic NCDs for which the risk of acute-care hospitalization can largely be prevented or delayed by effective management in primary care. These may include diabetes mellitus, hypertension, and ischemic heart disease, among other ambulatory care sensitive conditions.

We anticipate it will not be possible to conduct a meta-analysis given the heterogeneity of potential outcome measures for provider care practices and patient demand for healthcare services.

## **DISCUSSION**

The COVID-19 crisis will significantly impact health, social, and economic policies long after there is progress in “flattening the curve.” Pre-COVID-19 shortages and maldistribution of HCWs in New Brunswick, across Canada, and around the world underscore the need for comprehensive evidence to produce better pandemic and post-pandemic health workforce outcomes. This project will collate and synthesize the research evidence on policy options to enhance recruitment and retention of HCWs, to help ensure that population health needs are sustainably met following a surge in acute-care needs.

We aim to submit a manuscript with the review’s findings for publication in a peer-reviewed, open-access journal by March 2021. To facilitate effective translation of research results into action, key findings will be disseminated through multiple virtual networking platforms among health system stakeholders at the local, national, and international levels.

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## APPENDIX A: SEARCH STRATEGY IN EMBASE @ ELSEVIER

Limited to journal articles and reviews.

Limited to the last 20 years.

No.	Query	Results
#32	#30 AND ('Article'/it OR 'Review'/it) AND (2000:py OR 2001:py OR 2002:py OR 2003:py OR 2004:py OR 2005:py OR 2006:py OR 2007:py OR 2008:py OR 2009:py OR 2010:py OR 2011:py OR 2012:py OR 2013:py OR 2014:py OR 2015:py OR 2016:py OR 2017:py OR 2018:py OR 2019:py OR 2020:py)	359
#31	#30 AND ('Article'/it OR 'Review'/it)	364
#30	#10 AND #23 AND #29	546
#29	#24 OR #25 OR #26 OR #27 OR #28	27958
#28	'physician shortage'/exp	18
#27	'nursing shortage'/exp	332
#26	'personnel shortage'/exp	1881
#25	((('general practitioner*' OR physician* OR doctor* OR nurse OR nurses OR 'first responder*' OR clinician* OR personnel OR staff* OR worker* OR provider* OR technician* OR professional* OR coordinator* OR workforce* OR pharmac*) NEAR/3 (shortage* OR reassign* OR capacit* OR casual* OR adapt* OR flexib* OR redistribut*)):ti,ab	18138
#24	((health OR healthcare OR 'health care' OR hospital* OR clinic* OR surge) NEAR/2 (capacit* OR manpower OR 'human resources')):ab,ti	8952
#23	#11 OR #12 OR #13 OR #14 OR #15 OR #16 OR #17 OR #18 OR #19 OR #20 OR #21 OR #22	263188
#22	'epidemic'/exp	109168
#21	'pandemic'/exp	21075
#20	'nco v':ab,ti	0
#19	h1n1:ab,ti	22001
#18	influenza:ab,ti AND outbreak*:ab,ti	8727
#17	virus:ab,ti AND outbreak*:ab,ti	27572
#16	mers:ab,ti	4907
#15	sars:ab,ti	15856
#14	covid:ab,ti	22019
#13	'corona virus*':ab,ti	687
#12	epidemic*:ab,ti	119637
#11	pandemic*:ab,ti	38227
#10	#1 OR #2 OR #3 OR #4 OR #5 OR #6 OR #7 OR #8 OR #9	2463881
#9	'health care personnel'/exp	1570552
#8	((health OR healthcare OR 'health care' OR hospital* OR clinic* OR medical*) NEXT/1 (personnel OR staff* OR worker* OR provider* OR technician* OR professional* OR coordinator* OR workforce* OR pharmac*)):ab,ti	361718

#7	clinician*:ab,ti	317349
#6	'first responder*':ab,ti	2861
#5	nurses:ab,ti	214983
#4	nurse:ab,ti	150475
#3	doctor*:ab,ti	182296
#2	physician*:ab,ti	553818
#1	'general practitioner*':ab,ti	67249

## **ABOUT THE SERIES**

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