



**Health  
Information  
and Quality  
Authority**

An tÚdarás Um Phaisnéis  
agus Cáilíocht Sláinte

# **Protocol: Identification of demand models for estimating the quantities of personal protective equipment (PPE) required for optimal patient care in the context of COVID-19.**

Published: 7 September 2021

## Purpose and aim

The purpose of this protocol is to outline the process by which the Health Information and Quality Authority's (HIQA's) Health Technology Assessment (HTA) Directorate will identify relevant demand models used for estimating personal protective equipment (PPE) requirements in hospital and community settings in the context of COVID-19. The output from this exercise will be provided to the Antimicrobial Resistance and Infection Control (AMRIC) team within the Health Service Executive.

### 1. Process outline

A standardised approach to the process has been developed and is documented to allow for transparency and to aid in project management. Five distinct steps have been identified in the process for completion. These are listed below and described in more detail in Sections 2.1-2.5.

- 1.** A systematic search of relevant databases.
- 2.** Grey literature search for the identification of models of interest.
- 3.** Screening the identified studies and models.
- 4.** Extract relevant information on the methodological approaches for estimating expected PPE usage.
- 5.** Summarise findings and circulate to the AMRIC team.

### 2. Review Process

This review will address the following question:

*'What models are available that estimate expected PPE requirements for health and social care workers in the context of COVID-19?'*

#### 2.1 Systematic search of relevant databases

The following databases will be searched using the search strategies defined in Appendix 1.

- Embase
- Medline (PubMed).

Preprint servers will also be specifically searched: MedRxiv and EuropePMC.

## 2.2 Grey Literature search

The grey literature search will entail a search of relevant websites, a grey literature database search and a review of the first five pages of a google scholar and google search for PPE models and or technical reports detailing PPE models. The google search will be conducted using the key words, “personal protective equipment (PPE)”, “model”, “calculator” and “tool”. The grey literature database search will be conducted in ‘OpenGrey’.

The websites listed below will be reviewed to identify any such models:

- World Health Organization (WHO)  
<https://www.who.int>
- European Centre for Disease Prevention and Control (ECDC)  
<https://www.ecdc.europa.eu>
- Centers for Disease Control and Prevention (CDC)  
<https://www.cdc.gov>
- Public Health Emergency  
<https://www.phe.gov/about/aspr/Pages/default.aspx>
- European Commission  
<https://ec.europa.eu>
- Public Health England  
<https://www.gov.uk/government/organisations/public-health-england>
- Health Protection Scotland  
<https://www.hps.scot.nhs.uk/>
- Public Health Agency of Northern Ireland  
<https://www.publichealth.hscni.net/>
- Public Health Wales

<https://phw.nhs.wales/>

- Australian Government Department of Health

<https://www.health.gov.au/>

- Government of Canada

<https://www.canada.ca/en.html>

- Ministry of Health New Zealand

<https://www.health.govt.nz/>

- Federal Office of Public Health, Switzerland

<https://www.bag.admin.ch/bag/en/home.html>

- Norwegian Institute of Public Health (NIPH)

<https://www.fhi.no/en/>

## 2.3 Screening of identified studies or models

All potentially eligible papers or models identified in the search strategy will be exported to Covidence systematic review software (available at [www.covidence.org](http://www.covidence.org)) and single screened against the POS (population, outcome, study design) framework, with any uncertainty checked by a second reviewer. An initial limit of 10 years will be applied to the search, this limit may be extended as appropriate. Non-English studies will be translated via Google translate and this will be noted as a caveat. The POS is provided in Table 1.

**Table 1. Population, Outcome and Study Design (POS) for PPE demand models.**

<b>Population</b>	Health and social care workers.  Where available, a breakdown of the care settings modelled will be provided: <ul style="list-style-type: none"><li>▪ acute care sector</li><li>▪ intensive care unit (ICU)</li><li>▪ non-ICU</li><li>▪ accident and emergency</li><li>▪ primary care</li></ul>
-------------------	---

	<ul style="list-style-type: none"><li>▪ general practitioners</li><li>▪ community residential</li><li>▪ homecare</li><li>▪ testing.</li></ul>
<b>Outcomes</b>	<p><b>Primary outcomes:</b></p> <p>PPE requirements,<sup>(1)</sup> including:</p> <ul style="list-style-type: none"><li>▪ hand sanitiser (gel)</li><li>▪ standard and extended cuff gloves</li><li>▪ eye protection</li><li>▪ face shield</li><li>▪ gown</li><li>▪ aprons</li><li>▪ masks:<ul style="list-style-type: none"><li>○ FFP2 (N95, P2, KN95) respirators</li><li>○ FFP3 (N99, and P3) respirators</li><li>○ Type II (surgical) mask.</li></ul></li></ul>
<b>Types of studies</b>	<p><b>Include:</b></p> <ul style="list-style-type: none"><li>▪ modelling studies</li><li>▪ calculators</li><li>▪ tools</li><li>▪ journal articles or technical reports which detail PPE demand models/calculators/tools.</li></ul> <p><b>Exclude:</b></p> <ul style="list-style-type: none"><li>▪ Observational studies, cohort studies, case studies.</li><li>▪ Animal studies.</li><li>▪ Commentary papers, editorials, media reports and opinion pieces, short briefs, review papers, and meta-analysis or book chapters.</li></ul>

## 2.4 Data extraction

Data extraction templates are detailed in Appendix 2, with three separate templates for the following document category; journal article, technical report, and model. For each of the document types, data extraction will be conducted using a predefined Microsoft Excel file under the following overarching headings, as highlighted in Appendix 2:

- characteristics
- disease area/population
- overview
- model/calculator/tool features.

This data extraction method allows all documents to be summarised in a consistent manner. For each document included, data will be extracted by one reviewer and cross-checked by a second reviewer.

Data from pre-print publications may contain errors and or older data, which may be corrected and or updated when the final published version becomes available in a peer-reviewed journal. Prior to the final version of this report being published on the HIQA website, pre-print publications will be checked to identify if final published versions have become available since the original search was conducted. Any discrepancies identified will be corrected.

## 2.5 Summarise findings

A descriptive overview of the identified models will be drafted with all extracted data presented in a report. A PRISMA flow chart will also be presented.

## 3. Quality assurance process

Identification and data extraction will be led by a health economist with modelling experience. A second analyst will be assigned to assist and ensure that the summary accurately reflects the body of literature identified. All summaries will be reviewed by a member of the senior management team, to ensure processes are followed and quality maintained.

## **4. Timelines**

This evidence summary will be conducted in line with the processes and timelines outlined for Phase 2 of HIQA's COVID-19 response. Work will commence on 17 August 2021 and a final draft will be completed by 3 September 2021 and circulated to the relevant parties.

## **5. References**

1. Hennessy M, Walker E. Health Service Personal Protection Equipment Demand & Expenditure Estimation 2021 Department of Health, 2020.

## Appendix 1 Search strategy

### Embase (OVID) Search Strategy Completed 19 August 2021

#	Searches
<b>1</b>	exp protective equipment/
<b>2</b>	exp respiratory protection/
<b>3</b>	exp protective clothing/
<b>4</b>	(personal protective equipment or PPE).ab,ti.
<b>5</b>	1 or 2 or 3 or 4
<b>6</b>	(model* adj7 (PPE or personal protective equipment)).ab,ti.
<b>7</b>	(modeling or modelling or calculator*).ab,ti.
<b>8</b>	exp mathematical model/
<b>9</b>	exp algorithm/
<b>10</b>	6 or 8 or 9
<b>11</b>	(require* or demand or demands or quantity or quantities or need or needs or consumption or provision or shortage or supply or supplies or usage or stockpil*).ab,ti.
<b>12</b>	5 and 10 and 11
<b>13</b>	limit 12 to yr="2011 -Current"

### Medline (EBSCO) Search Strategy Completed 19 August 2021

#	Query
<b>S14</b>	S5 AND S9 AND S12
<b>S13</b>	S5 AND S9 AND S12
<b>S12</b>	S10 OR S11
<b>S11</b>	(MH "Health Services Needs and Demand+")

<b>S10</b>	AB ( require* OR demand or demands OR quantity or quantities OR need OR needs OR volume OR consumption OR provision OR "stock management" OR shortage OR supply OR supplies OR "burn rate" OR usage OR stockpil* ) OR TI ( require* OR demand or demands OR quantity or quantities OR need OR needs OR volume OR consumption OR provision OR "stock management" OR shortage OR supply OR supplies OR "b" )
<b>S9</b>	S6 OR S7 OR S8
<b>S8</b>	(MH "Algorithms+")
<b>S7</b>	(MH "Models, Statistical+")
<b>S6</b>	AB ( model* OR calculator* OR tool* ) OR TI ( model* OR calculator* OR tool* )
<b>S5</b>	S1 OR S2 OR S3 OR S4
<b>S4</b>	AB ( personal protective equipment OR PPE ) OR TI ( personal protective equipment OR PPE )
<b>S3</b>	(MH "Protective Clothing+/SD/SN")
<b>S2</b>	(MH "Respiratory Protective Devices+/SN/SD")
<b>S1</b>	(MH "Personal Protective Equipment+/SN/SD")

**Google Scholar, Open Grey Search Strategy Completed 19 August 2021**

#	Searches
1	(PPE OR personal protective equipment) AND (model OR modelling)

**EuropePMC (OVID) and MedRxiv Search Strategy Completed 19 August 2021**

#	Searches

**1** (ABSTRACT:"model\*" AND ABSTRACT:personal protective equipment OR PPE) AND (SRC:PPR)

## Appendix 2 – Data extraction templates

Appendix 2.1: Template data extraction for journal articles.

Characteristics	Disease Area/Population	Overview	Model/Calculator/Tool features
Author	Disease area.	Explanation of models aim.	Model design/layout.
Journal	Setting (e.g. acute or community care).	Overview of the model.	Input parameters.
DOI			PPE Outputs.
Country	Population demographics (if applicable).		
Publication status/date			

Appendix 2.2: Template data extraction for technical reports.

Characteristics	Disease Area/Population	Overview	Model/Calculator/Tool features
Title	Disease area.	Explanation of models aim.	Model design/layout.
Study design	Setting (e.g. acute or community care).	Overview of the model.	Input parameters.
Organisation			PPE Outputs.
Country	Population demographics.		

Website/URL			
Publication date			

**Appendix 2.3: Template data extraction for models.**

<b>Characteristics</b>	<b>Disease Area/Population</b>	<b>Overview</b>	<b>Model/Calculator/Tool features</b>
Title	Disease area.	Explanation of models aim.	Model design/layout.
Model source	Setting (e.g. acute or community care).	Overview of the model.	Input parameters.
Website/URL	Population demographics.		PPE Outputs.
Last updated			
Study design			

**Published by the Health Information and Quality Authority (HIQA).**

**For further information please contact:**

**Health Information and Quality Authority**

**George's Court**

**George's Lane**

**Smithfield**

**Dublin 7**

**D07 E98Y**

**+353 (0)1 8147400**

**[info@hiqa.ie](mailto:info@hiqa.ie)**

**[www.hiqa.ie](http://www.hiqa.ie)**