Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

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Commentary

Under the HAI lens: pandemic learning for research priorities for IPC – a call to action

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Introduction

In recent years, international reviews have identified key gaps in the evidence related to core components of infection prevention and control (IPC), and a need for high-quality research in context-specific settings and countries to address this [1]. Indeed, much of the evidence underpinning IPC recommendations is of low quality in vitally important areas, including, but not limited to, the use of personal protective equipment (PPE), isolation measures and environmental cleaning. The authors have experience of systematic reviews of the evidence for national and international IPC guidance, both before and during the pandemic in Australia and the UK. It is proposed that there is now a need for a new strategic look at the research agenda for IPC [1–3].

Infection risks and balancing harms

With any new and emerging infectious threat, such as that from severe acute respiratory syndrome coronavirus-2, primary control depends on effective IPC measures. These are usually the only interventions available until treatment or vaccination becomes available. Many general IPC measures to reduce the risk of nosocomial transmission are not new, but it is known that adherence is suboptimal [1,4,5]. Behavioural aspects of transmission-based precautions are therefore key considerations that are as important as the IPC measures themselves. Organizational and structural aspects of IPC are also important; in particular, improving the built environment is challenging in older healthcare estates [1]. Engineering, sustainability and behavioural insights research is needed into how to optimize IPC measures in the extant built environment to mitigate the risk of nosocomial infection and balance other environmental harms [6].

Evidence-informed decision-making is essential to ensure that IPC interventions are risk based and proportionate to care delivery needs, such as person-centred care, system flow, throughput and efficiencies. The effect of IPC interventions may have consequences for well-being, morbidity and mortality associated with health conditions other than infection [7]. In addition, there is a balance in providing compassionate care with proportionate IPC measures [8]. These important decisions should be based on methodologically rigorous research, addressing, where possible, all processes of care which can be confounders in transmission risk, complemented by implementation considerations including acceptability, values and preferences [9]. This requires programmed research that is cross-sectoral and cross-disciplinary to inform future policy.

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Pre-pandemic research agenda

A European expert group ranked 16 IPC priorities in the context of hospital-associated infection (HAI) and antimicrobial resistance (AMR) research [10]. The top ranked priority was the need for high-quality studies addressing the effectiveness of hospital-based IPC programmes, including their impact, cost-effectiveness and ideal composition. The European Joint Action on Antimicrobial Resistance and Healthcare-Associated Infections compared the AMR-related research priorities of seven participating countries with the comprehensive Joint Programming Initiative on Antimicrobial Resistance strategic research agenda [9]. IPC was one of three gaps identified, and key priorities were identified. In a subsequent European Union policy brief, the group noted that, from the limited evidence available to date, IPC may be one of the most cost-effective interventions to combat AMR, especially if priority areas are funded [10].

A UK-led group completed a similar exercise on priorities in 2019, and was remarkable in that it recognized the disconnect between research from the patient/carer perspective to date [11]. The top 10 priority areas for HAI research were: early identification of infections; point-of-care testing; optimizing IPC adherence in healthcare worker behaviour; cleaning agents and technique in multi-drug-resistant organisms; evaluation of the impact and harms of AMR stewardship policies; patient education for identifying and preventing HAI; environmental bacteria and impact on risks; impacts and harms of single-room provision on AMR; and prevention of urinary tract infection in older people. The authors noted the need for basic, translational, clinical and public health research to address these uncertainties.

Research agenda identified during the pandemic

During the pandemic, rapid evidence reviews and living systematic reviews were used to support development of IPC guidance nationally and internationally [3,12—14]. These reviews identified evidence gaps, which can be summarized as follows:

- Fundamental aerobiology and clinical transmission studies, including development of standard techniques for virus distribution and viability in particles; investigation of the contribution of inhalation vs inoculation (fomites) for transmission of respiratory viruses including aerosol-generating procedures.
- Risk factors for transmissibility to quantify risk, taking into account multiple factors and confounders, as well as the development and validation of IPC indicators (including workforce ratios) for modelling of risk.
- Effectiveness of IPC measures inclusive of clinical efficacy testing of PPE (including respiratory protective equipment), environmental measures (e.g. ventilation, filtration), environmental cleaning and the wider measures associated with respiratory and contact precautions. Trials need to consider unintended consequences (benefit and harms) inclusive of the sustainability agenda and environmental impact.
- Risk perception, behaviours and acceptability of IPC measures in healthcare workers, patients and the public. This should include healthcare worker welfare, leadership and culture.
- IPC in the built healthcare environment: optimal design in different hospital departments, single room and negative pressure isolation provision and ventilation.

The World Health Organization research blueprint outputs will also be important in taking stock of future research priorities [15].

Building IPC research capacity and capability

IPC is not seen as 'cutting-edge' science or innovation. During the pandemic, IPC measures have been referred to as 'non-pharmaceutical interventions', which reinforces the hierarchy of the science, and priorities, with reference to IPC. For example, as of 2nd August 2021, 648 drug trials were reported on coronavirus disease 2019, but only nine randomized studies of behavioural, environmental, social and systems interventions [16]. The challenges of designing and implementing gold standard clinical trials, and using more pragmatic designs instead, may present challenges for some reviewers of funding submissions. Specific funding streams for IPC research would greatly assist this issue.

Funding calls on IPC need to bring together clinical researchers, trialists, behavioural science, aerobiology, engineering, and workforce and management disciplines to help strengthen the underpinning evidence. There is a need for experienced trialists to work with those in IPC to maximize the potential of study designs to generate higher-level evidence. The resultant research capacity and capability built from such a funding call should then focus on the evidence needed for national IPC guidance. The approach of the International Severe Acute Respiratory and Emerging Infection Consortium, funded by the Wellcome Trust, may be helpful to this end [17]. An approach wherein protocols and study design are planned in advance, inclusive of ethical approvals, may be useful, so studies can be initiated at pace during an outbreak, epidemic or pandemic [18].

It is time for the collective infection societies to work with a range of other disciplines to agree IPC research priorities, and collaborate internationally to build future research capacity and capability. The Delphi approach may be a suitable tool for gaining international consensus on the IPC research priorities as a first step in launching the post-pandemic IPC research agenda.

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