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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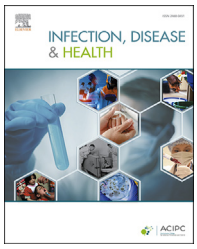

Discussion paper

Considering the precautionary principle and its application to MRSA and SARS-CoV-2 as emerging novel pathogens of their time

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Abstract In the 1980s Contact Precautions were introduced as a precautionary measure to control the emerging threat of antimicrobial resistance in hospitals, particularly methicillin resistant *Staphylococcus aureus* (MRSA). Today, antimicrobial resistance remains a concerning global public health threat, and a focus for hospital patient safety priorities.

In late 2019 a novel respiratory virus described as SARS-CoV-2, was reported. Just as MRSA had prompted control measures developed in the context of limited information and understanding of the pathogen, public health control measures against SARS-CoV-2 were promptly and strictly implemented.

Whilst SARS-CoV-2 control measures were successful at containing the virus, numerous detrimental socio-economic and health impacts have led to a rebalancing of harms versus benefits and loosening of restrictions. Conversely, evidence collated over the past 50 years, suggests that Contact Precautions are not superior to well-applied standard infection prevention and control precautions in controlling MRSA acquisition in hospitals. Several harms associated with Contact Precautions, affecting patient safety, financial costs, and organisational culture, are described. However, rebalancing of hospital MRSA control policies has been slow to materialise.

This commentary invites infection prevention and control policy makers to reflect and revise policies for the control of MRSA in hospitals so that harms do not outweigh benefits.

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Highlights

- The precautionary principle informed hospital MRSA control policies (contact precautions).
- It has again informed SARS-CoV-2 pandemic responses globally and in Australia.
- Harms associated with contact precautions for MRSA control outweigh benefits.
- Balancing of harms versus benefits of control measures is a requirement of ethical policy.
- This has occurred for SARS-CoV-2, but MRSA policies remain largely unchanged.

Introduction

The precautionary principle justifies anticipatory action to prevent the occurrence of harm despite incomplete scientific evidence [1]. This commentary discusses the application of the precautionary principle in pathogen control using the examples of methicillin resistant *Staphylococcus aureus* (MRSA) as it emerged in the latter part of the twentieth century, and the recently emergent severe acute respiratory syndrome coronovirus-2 (SARS-CoV-2). Although these are very different pathogens, and the precautionary principle has been applied in differing settings i.e., hospital vs the general community, the contrasting approach should prompt discussion and debate amongst those interested in the ethics of hospital infection prevention and control (IPC).

The emergence of MRSA and invention of contact precautions

As it became apparent in the 1980's that MRSA might be associated with increased morbidity and mortality compared with antibiotic sensitive *S. aureus* [2], policy-makers employed the precautionary principle [1] in developing contact precautions (CP) [3] for managing hospital patients identified as colonised or infected with MRSA. Patients were isolated in single rooms, and staff entering the room wore long-sleeved gowns, and gloves as personal protective equipment (PPE). To reduce the risk of infecting other patients, diagnostic and therapeutic procedures were scheduled for the end of the day, often cancelled when lists ran over time. Stricter cleaning measures were implemented for these patients than for others [3]. Patients described feeling 'different', with associated stigmatisation and other harms [4—6]. Despite this, CP are now widely implemented worldwide [2], even though there is little evidence that they are more effective than standard IPC precautions (including antimicrobial stewardship, hand hygiene, environmental and equipment cleaning, and aseptic technique) [7] in preventing MRSA acquisitions and infections in hospital [8—10].

SARS-CoV-2 pandemic

The current pandemic offers a more recent example of efforts to control the spread of an emerging pathogen. In late 2019 news came from China of the discovery of a novel respiratory virus named severe acute respiratory syndrome — coronovirus-2 (SARS-CoV-2) causing an infection known as COVID-19 [11]. Just as MRSA had prompted responses developed in the context of limited information and understanding of the pathogen, control measures against SARS-CoV-2 were promptly implemented [12]. On March 11th 2020 the World Health Organisation (WHO) Director General declared a pandemic, as the virus had infected more than 118,000 people in 114 countries and continued and sustained spread was considered likely. The need for countries to 'strike a fine balance between protecting health, minimising economic and social disruption, and respecting human rights' was stated [13].

In Australia, the precautionary principle was promptly and diligently applied. Measures included the cessation of international and domestic travel. State borders closed, funerals and weddings were cancelled, facemasks were mandated to be worn on public transport and when indoors except at home [12,14—16]. Hospitals and residential aged care facilities closed their doors to visitors, even for dying patients [15,17]. Hospital volunteer services were discontinued [18]. Out-patient appointments utilised virtual platforms rather than face-to-face, and community-based services provided emergency services only [19]. Elective surgery was curtailed [20].

Control measures; benefits, harms, inequity, and efficacy

Numbers of cases of COVID-19 infection were successfully limited by these measures [12]. However, several detrimental effects were reported. These diverse economic, societal, educational, and environmental harms may be considered justifiable because of the numbers of lives that were likely saved, and avoidance of the predicted over-burdening of the health system had restrictions not been imposed. However, health-related harms such as increased rates of depression and anxiety, increased alcohol and tobacco use, and reduced levels of physical activity will likely have continuing ongoing and far-reaching impacts on the public health [21]. It is reported that the impact of the pandemic has been borne inequitably due to restrictions being imposed without apparent consideration of the differential impacts on the socially marginalised [22]. Families and individuals already affected by lower income, or with pre-existing vulnerabilities such as disability or chronic illness, were more compromised by SARS-CoV-2 restrictions than those not previously experiencing these challenges [23].

Similarly, it is recognised that the hospital patients most likely to be colonised with MRSA, (and therefore managed under CP) are the disadvantaged and vulnerable, such as refugees [24] or aged care facility residents [25], patients who have chronic health conditions [26,27] including HIV [28], or who have been admitted to ICU [29]. These vulnerable

members of the community are therefore more likely to experience CP in hospital and bear the burden of CP consequences including psychological and non-psychological harm [5], increased healthcare adverse events [30], and reduced contact with their clinical team [4]. There are therefore parallels between these two different pathogens that demonstrate the disproportionate negative impacts that pathogen control measures can have on vulnerable groups, whether in hospital or in the wider community. The imperative to reduce these impacts in scale and duration is as relevant to hospital patients as it is to the rest of the community.

The financial costs of SARS-CoV-2 restrictions have been substantial [31]. Similarly, the aggregated financial costs of the application of CP for the management of MRSA will have been significant [8,10]. Whilst the environmental impact of the PPE required for CP had not previously attracted attention, the environmental impact of PPE manufacture, supply and disposal has recently been noted [32].

Crucially, whilst SARS-CoV-2 control measures have likely reduced COVID-19 hospitalisations, and deaths [12], strong evidence for the efficacy of CP in preventing MRSA transmission does not exist [8,33]. When CP are relaxed there is no significant increase in MRSA infections or colonisations [8,34,35].

Balancing benefits and harms

The last two years have seen increased recognition of the detrimental impacts of restrictive COVID-19 public health measures on individuals and communities. Political and public health leaders recognise the need to balance the benefits of the restrictions against the harms (particularly the socio-economic harms) caused by the restrictions, compared with possible harms caused by the virus itself [36]. This reassessment of risks and benefits of policies founded on the precautionary principle, including improving understanding of what burdens are borne and by whom, is a fundamental expectation of ethical public health policy and practice [1,37,38]. Ethical public health requires dynamic consideration of what burdens and inequalities are acceptable in achieving beneficial impacts of control measures, and to revise the approach to ensure that harms do not outweigh benefits [39,40].

In the case of COVID-19 response in Australia this rebalancing is evident. Conversely, the persistence of CP within infection prevention and control policy frameworks for MRSA suggests a failure to reassess the benefits and harms of a precautionary approach to MRSA in hospitals. This despite more than quarter of a century of criticism [9]. [[,30,41] The expected and necessary dynamic consideration of harms and benefits of CP has not been achieved, perhaps because CP are so embedded in clinical practice that they have possibly become ritualised [42]. This should not however, be a reason to allow the inertia of previous practice to continue unchallenged [43].

Since the end of 2021, the rebalancing of risks and benefits has resulted in significant relaxation of SARS-CoV-2 restrictions in New South Wales (NSW), Australia [36]. Ten days before Christmas 2021 hospitality venues were full of revellers excited to be socialising for the first time in two years. Predictably, COVID-19 case numbers increased exponentially, to the extent that testing stations had to close because the laboratories could not process the quantity of tests within contractually-agreed test result turn-around times [44]. Hospitals in NSW moved from having minimal numbers of patients with COVID-19 admitted to almost 3000 b y the end of January 2022 [16]. Healthcare staffing was compromised by staff becoming infected in the community or at work, and the isolation requirements that were applied to cases and close contacts [45]. Logistics and manufacturing industries were similarly affected and supermarket shelves were bare at times [46].

This predicament demonstrates the value of the precautionary principle and the need for careful consideration of the timeframe for reducing control measures. Care must be taken to avoid relaxing precautions before enough is understood about the novel emerging pathogen and its transmission pathways, as well as the capacity of the health system and other infrastructure to manage consequences of increasing numbers of cases and the impact of the related ongoing public health measures. The last 50 years' experience and research into MRSA as a healthcare associated pathogen has added the science that was lacking in 1983 when CP were introduced into MRSA policy frameworks [3].

Conclusion

This paper does not argue that CP were never justified. It argues that the continued use of CP in the control of MRSA transmission in hospitals should be reconsidered. The decision to relax of SARS-CoV-2 restrictions in NSW prior to Christmas 2021 was heavily influenced by political considerations and was arguably premature. However, in the context of MRSA there has been more than enough time, and more than enough evidence has been presented to justify removing CP from MRSA policy frameworks. It is recognised that it is much harder to change longstanding and widely accepted clinical practices than to modify recently introduced and controversial restrictions. However, it is now understood that standard IPC precautions applied consistently, and equitably in the care of all patients can effectively interrupt direct and indirect contact transmission of pathogens in hospitals, leading to significant reductions in morbidity, mortality, and healthcare costs. Infection prevention and control policy makers and clinical leaders have a responsibility to act and to apply the same balancing of risk and benefits to CP for the management of MRSA that has been applied to SARS-CoV-2 control, armed with the benefit of fifty years of experience with the pathogen.

Author statement

Dr Joanna Harris was responsible for conceptualization of this article, writing of the original draft, and subsequent review and editing. The article is an abridged version of a section of her successfully examined PhD thesis.
Dr Hazel Maxwell was responsible for supervision of the first author's PhD research and thesis writing and submission. As such Dr Maxwell was responsible for review and editing of the work during thesis preparation and again in preparation of the work for this submission for publication.
Professor Susan Dodds was responsible for supervision of the first author's PhD research and thesis writing and

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All authors have confirmed no conflicts of interest.

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