Review Article

Maintaining Infection Control Standards: Challenges in a Resource-Constrained Environment- A narrative review

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ABSTRACT

Standard Infection Control Protocols (SICPs) are the foundations of safe healthcare delivery for both the patient and the healthcare worker. It houses the key to the prevention of cross-infection in such environments. These protocols are generally designated "Universal Standard Precautions," known to be strictly adhered to in high-income countries (HICs). However, their implementation in resource-constrained environments (RCEs) reveals a profound chasm between policy and practice. This narrative review synthesizes evidence to explore the multifaceted challenges that undermine SICP adherence in low- and middle-income countries (LMICs) and under-resourced settings within high-income nations. A close review and analysis of the challenges confronting the practice of SICPs in RCE settings reveals the root cause to be; a failure of the system. This is expressed as chronic infrastructural instability, fractured supply chains, an unsupported health workforce, and pervasive socio-cultural and economic barriers. This review, therefore, unveils the challenges bedeviling compliance and the possible route of repair that can create a positive paradigm shift in favour of compliance with SICPs.

Keywords: Standard Infection Control(SICP), Resource Constrained Environment (RCE), Healthcare Workers(HCW).

INTRODUCTION

Standard Infection Control Protocols (SICP) in healthcare settings are a key fundamental principle for success in preventing healthcare-associated infections and mitigating the spread of antimicrobial resistance1. It is the insurance for both patients and healthcare workers' safety in the course of interaction. SICP encompasses hand hygiene, the use of personal protective equipment (PPE), safe waste management, environmental cleaning, and aseptic techniques. These are universally endorsed by bodies like the World Health Organization (WHO)[2] as non-negotiable practices for safe care. Theoretically, these protocols are simple, low-cost, and highly effective, yet, in practice, their consistent application remains an acute fundamental challenge in resource-constrained environments (RCEs).

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The term "resource-constrained" extends beyond low-income nations; it encompasses under-resourced public hospitals in middle-income countries, rural clinics in high-income nations, and facilities overwhelmed by humanitarian crises. In these settings, the burden of healthcare-associated infections (HAIs) is disproportionately high, with prevalence rates 3 to 20 times greater than in high-income countries (HICs)3 This disparity is not incidental; it is a direct consequence of the failure of leadership in these societies to create a functional system or environment where SICPs are practicable and sustainable. The confluence of suboptimal infrastructure, inadequate access to water, sanitation, and hygiene, and insufficient numbers of trained personnel further exacerbates these challenges1,4.

The Challenges of SIPC

Absence of Basic Infrastructure: The major barrier to the practice of standard infection control protocols in RCEs is the absence of non- negotiable amenities such as clean running water, reliable electricity, and adequate spatial design.

Water Sanitation and Hand Hygiene

Hand hygiene is the single most critical measure for effective practice of the Infection Control Protocol (IPC), yet it becomes impossible to sufficiently observe it without access to safe water. A WHO/UNICEF report estimated that one in four healthcare facilities globally lacks a basic water service, affecting over 1.8 billion people5. In such facilities, healthcare workers (HCWs) may resort to using alcohol-based hand rub (ABHR) exclusively. While ABHR is effective, it cannot replace soap and water when hands are visibly soiled, and its supply chain is itself vulnerable. Furthermore, inadequate sanitation—including a lack of functioning toilets and sewage systems—creates a perpetual source of environmental contamination that no amount of bedside hygiene can fully mitigate. Yowin et al.6 reported that a high prevalence of E.histolytica infection among patients screened, in a general hospital setting in south-south Nigeria, in their four-year retrospective review. Children were reported to be more affected, particularly during the dry seasons. The absence of portable water, which results in poor hand hygiene habits, was highlighted as one of the predisposing factors for the spread of the causative organism.

Epileptic Electricity and Poor Spacing/Ventilation of Health Buildings

Reliable electricity is essential for sterilizing equipment, operating ventilation systems (particularly negative-pressure rooms for airborne pathogens), and maintaining the cold chain for vaccines and reagents7. Frequent power outages in RCEs render autoclaves and refrigerators unreliable, forcing facilities to resort to unsafe re-sterilization practices or the use of single-use items in a manner they were not designed for8,9.

Simultaneously, overcrowding negates the most fundamental IPC principles10. Overburdened facilities in RCEs often operate at double or triple their intended capacity11. The lack of isolation rooms means patients with drug-resistant tuberculosis, viral hemorrhagic fevers, or other highly contagious conditions are nursed in open wards, lying on mats between beds3,12. In such an environment, the distinction between a "clean" and "contaminated" zone—a prerequisite for aseptic technique and PPE use—becomes functionally meaningless.

Inconsistency in the Supply Chain of Medical Essentials and Consumables.

Even when infrastructure exists, maintaining a consistent supply of IPC consumables is a persistent challenge. RCEs are often at the mercy of complex, underfunded procurement systems, donor-driven supply cycles, and geopolitical instability.

The COVID-19 pandemic starkly illustrated this vulnerability. Global supply chains collapsed, and RCEs faced acute shortages of masks, gowns, and gloves13,14. During the pandemic, healthcare workers were compelled to reuse single-use Personal Protective Equipment (PPEs), such as N95 masks for days or weeks, or unreliable alternatives. It is sad to note the absence or inconsistent supply of essentials such as basic cleaning agents like chlorine or hospital-grade disinfectants. This results in a cycle where the environment itself becomes a persistent reservoir for pathogens with high rates of antimicrobial resistance15.

The Growing Monster of Manpower Shortage in RCEs

The practice of observing infection control standards in carrying out tasks in healthcare settings is in itself cognitively demanding and monotonous in nature. This becomes a burden for the HCW, who is already saddled with a lot of responsibilities due to acute manpower shortage, particularly in the face of the global migration crisis of the day. The WHO estimates a projected shortfall of 10 million health workers in Low and Middle Income Countries (LMICs) by 203016. This chronic understaffing translates into unsustainable patient-to-nurse ratios. A nurse who is already overburdened in the face of an acute shortage of basic IC materials will be forced to observe the standard more strictly in life-threatening cases while accommodating some compromise in routine healthcare treatments in terms of material utilization.

Furthermore, High Income Countries(HICs) are known to have dedicated IPC staff, whereas, in LMICs, the job of IPC monitoring is an add-on to the already

overburdened HCW who very likely has no formal training on the job. The likely consequence of the absence of dedicated leadership and continuous education in IPC is the gradual decay of previous knowledge and ritualistic practice of sub-surface IPC rather than evidence-based SIPC protocols.

The Painful Bite of Socio-Cultural and Economic Realities

One of the harsh realities of the socio-economic crunch on service delivery in REs is the inevitable need for involvement of family members in the delivery of care, particularly in-patients. Due to understaffing, family members provide bedside care, including feeding, bathing, and even administering medications. They, in most cases, lack knowledge of IPC and have rarely received formal training on hand hygiene or effective use of PPE; consequently, bypassing the SICP framework. This invariably places them at risk of cross-infection in a healthcare environment17,18.

Another harsh reality of the involvement of family members in providing care for patients in RCEs is the burden of purchasing basic consumables and their own supplies, such as gloves, syringes, and disinfectants, from local pharmacies. Consequently, families that cannot afford to buy a new sterile glove for each dressing change may reuse or go without. Thus, placing an regressive economic burden on the poor and maintains a system where those with the least resources receive the lowest safety standards.

Furthermore, cultural and traditional practices may influence perceptions of hygiene and disease transmission. This may result in resistance from family members in incorporating IPC protocols and may require an informal education of the family members about the importance of standard care practices in order to overcome such barriers.

The Vicious Cycle of Failed Governance and the Consequences of Neglect

A close assessment of the origins and persistence of a weak, capricious government's poor adherence to SIPC protocols in RCEs reveals a vicious cycle: government failure to prioritize basic healthcare preventive measures leads to detrimental outcomes. In most RCEs, governmental focus tends toward expensive curative facilities rather than preventive care, resulting in chronic underfunding of preventive infrastructure.

This neglect creates a vicious cycle; Poor IPC leads to high rates of hospital-associated infections (HAIs), which in turn drives the emergence and spread of antimicrobial resistance (AMR). The combination of unregulated antibiotic use, poor hygiene, and overcrowding, along with AMR, is an ideal condition for the selection and transmission of multidrug-resistant organisms (MDROs)19. Treating these infections requires expensive, last-line antibiotics that are often unavailable or unaffordable. This, in turn, leads to prolonged hospital stays, humongous health expenses for families, and high mortality. The economic cost of managing HAIs and AMR could have been prevented by basic IPC. This economic cost further drains the fragile health system, leaving even less for the foundational infrastructure needed to break the cycle.

Towards a Paradigm Shift: Rethinking Solutions

Reviewing the literature supports the view that HCWs are willing to be 100% compliant with IPC protocols, but requires adequate and consistent evidence, supply of basic IPC materials20. Many recent studies repeatedly suggest that the traditional approach to improving IPC in RCEs, such as periodic training workshops and punitive audits of HCWs, is insufficient to change the tide. A more holistic approach is definitely required. This holistic approach involves building a resilient IPC system, spanning from a positive improvement in budgetary allocation for preventive health, and an unbroken chain of supplies of basic IPC materials, to a well-structured system of improving manpower needs in healthcare facilities in the society21-23.

This means prioritizing capital investments in solar-powered water systems, on-site waste treatment, and robust energy grids as core health infrastructure, not ancillary projects.

Secondly, the focus of supply of these basic IPC materials should preferably be locally sourced, rather than investing in fragile international just-in-time logistics. Decentralizing the production of these items can buffer against global shocks.

Thirdly, the place of an IPC workforce, both as a committee and as individualized employment and training, must be prioritized by the government and the health authorities. These persons should be empowered to enforce compliance with regulations and to ensure adequacy of IPC materials. Training in IPC competencies should be included in the curricula of undergraduate students in all Health-related institutions.

Conclusion

Maintaining standard infection control protocols in resource-constrained environments is beyond enforcing behavioural change or increasing knowledge and awareness of the same

It is a journey that must begin with the leadership at the top of society—policymakers, enforcers, and every arm of government—fostering understanding and commitment that influence outcomes in the management of health institutions. Training and reorientation of IPC practitioners are important, but

they represent only one, and often the easiest, path to positive change in IPC compliance. To attain this goal, all arms of government must be engaged.

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