The urgency of an infection prevention and control bundle against AMR – A proposal

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It's a small world after all. Nowadays, people are connected globally and so are the germs. The number of humans travelling across borders renders the world a small village, where people share fairly similar customs, habits and eventually diseases. The only difference is that the germs causing these diseases don't need a passport. They have now spread globally and, stubbornly and resiliently, become a multidrug-resistant phenomena.

A plethora of studies described germs crossing borders and showed the role played by the "inter-country" patients in transporting and exporting germs *(1,2)*. In addition, an abundance of studies showed risk factors for developing resistance to antibiotics. This includes misuse, overuse and underuse of antibiotics in both humans and animals. Similar to humans, pets and livestock travel under the name of imports and exports.

This multifaceted and multifactorial challenge grabbed the attention of health agencies and the World Health Organization to find means and put preventative measures in place that will help avoid or minimize the risks associated with the use of antibiotics combined with the emergence of resistance. One of these initiatives and recommendations is to have more effective prevention and surveillance methods of healthcare-associated infections. Comprehensive and efficient infection prevention and control programmes are contributing not only to the prevention of infections at institutional level, but to the fight of a global threat.

Evolution of infection control programmes with the need to change

Infection control programmes have evolved over the years to respond to the exigent need for safer patient care. Several studies were used to restructure these programmes and the infection control professionals' profiles. These resulted in refining the functions of these programmes, professionals' workloads, and the job description of the infection control professionals, which normally recommends the number of staff besides the type of skills required to manage these programmes. Pressures from the public, health agencies and patient associations were also important factors to drive the changes to infection control programmes.

In this day and age, antibiotic-resistant organisms threaten patients all over the globe; hence the need for change at a global level. Therefore, these programmes should be remodelled and methodically assessed to ensure that they are up to a globally convincing standard, and not portrayed as "idiot savants". An idiot savant is a person who is highly knowledgeable about one subject but knows little about anything else; an "idiot infection control programme" is one that is usually based on only one or more components of infection control practices. Though these are perfectly implemented, significant evidence-based elements are not fully implemented or not even taken into consideration. This suggests the urgency to propose a novel model in order to ensure that all infection control preventative measures are implemented and their expected outcomes are measured.

The need for an infection control bundle

It is no longer acceptable not to implement evidence-based infection control science. Consequences of inaction of evidence-based infection control science are not a new challenge in healthcare settings. For a long time, antimicrobial resistance has been linked to the misuse of antimicrobials, with poor compliance in recommended infection control practices *(3)*.

Essential and effective infection control practices and elements to be included in an infection control programme have been demonstrated in a plethora of studies. These include – but not limited to – standards precautions and transmission-based precautions, aseptic techniques, surveillance, antimicrobial stewardship programmes, outbreak investigation methods, environmental cleaning, reprocessing of medical equipment,

Figure 1: **Changing challenges in project strategy: a knowledge management model to improve hand hygiene compliance rate**

Figure 2: **Conceptual model for preventing healthcare-associated infections and the transmission of multidrug-resistant organisms**

laboratory support, education and staff training, behavioural sciences, new technologies, introduction of informatics and business intelligence, occupational health and care of the environment.

Science should be implemented fully, not in a fragmented way

Currently, few toolkits and methods exist to evaluate infection control programmes. These methods have not been proven to be perceived as bundles; rather they are mere checklists. Another disadvantage is that they include an overload of elements which render them broad and laborious at times. What makes a bundle unique is that it is composed of a small, straightforward set of evidence-based practices, generally three to five, that, when performed collectively and reliably, have been proven to improve patient outcomes *(4)*.

This article proposes essential elements to develop and evaluate an infection control programme using the bundle concept. Elements in this bundle – when implemented together – will sustainably improve infection control programme outcomes.

Infection control bundle – Proposed elements, rationales and assessment tools:

1. Science with conscience

The era of evidence-based practice leaves no doubt that an infection control programme should be based on well-designed and well-conducted research in order to provide safe patient care. Fortunately, infection control guidelines and recommendations from trusted sources exist. The Centers for Disease Control and Prevention, the World Health Organization and others grade the quality of evidence and the grading is explained and presented for each recommendation cited. This would imply the availability of evidence-based knowledge through trusted sources, which are accessible to policy-makers to guide the development of policies. Regrettably, on numerous occasions, infection control personnel are required to search for answers and evidence outside these guidelines because important details are sometimes lacking or simply because of concern around the delayed updates in these guidelines. Hence, it is a must that infection control personnel a) have access to latest evidence; b) are capable of critically appraising research findings to recognize flaws and to reject weak evidence; and c) have the mindset of designing an implementation plan or establishing the clinical application for each recommendation.

Coupled with the availability of evidence-based policies, an infection control professional must use a knowledge management process to ensure that policies are translated into practice and that a robust and valid mechanism exists to measure compliance and develop improvement strategies when necessary. Figure 1 illustrates a model on managing acquired knowledge. The model is presented as a schematic representation to serve as an example of how a practitioner can package challenges to transform them into a project strategy. (See Table 1 for assessment tools on this element)

Figure 2 exemplifies a conceptual model an infection control professional could use as a step-by-step plan when

Table 1: Recommended tools for each element of the infection control bundle

Science with conscience:
Evidence-based policies
Reliable and valid HAI surveillance systems (processes and outcomes and where bias and confounding factors are assessed and provide information on potential causalities, not just numbers)
Knowledge management processes
Antibiotic stewardship programme

Aseptic techniques and precautionary measures:
Clinical competency with the three domains (knowledge, skills and attitudes) for medical asepsis, surgical asepsis, standards precautions and transmission-based precautions
Clinical audits on: adherence to standards precautions, transmission-based precautions, safe use of PPE, hand hygiene, environmental cleanliness to include the evaluation of the terminal cleaning of patient rooms, linen management, occupational exposures and infectious diseases exposures
Active surveillance testing, flagging system for MDRO with communication plans

Healthy Environment:
Environment of care rounds
Indoor air, water and food quality assessment tool & inaction guidance tool
Engagement survey
Cultural survey
Infection control survey (knowledge and perceptions)
Plans for managing infectious diseases threats (i.e., pandemics, novel viruses, etc.)

Safe Equipment:
Inspection, testing, and maintenance plans tool
Product evaluation tool
Safe use of medical equipment and supplies tool
Products recalls and alerts policy and procedure

Competent staff
Occupational and non-occupational health programmes
Infection control professional competencies (technical skills, soft skills and leadership skills)
Continuous professional development programmes
Caregivers infection control competencies

attempting to prevent healthcare-associated infections and the transmission of multidrug-resistant organisms.

2. Aseptic techniques and precautionary measures

Aseptic technique is a method used to prevent contamination with microorganisms *(5)*.

It is divided into two types – clean technique and surgical technique – and for each technique there are established evidence-based recommendations professionals need to adhere to. These relate to cleaning hands, utilization of barriers, patient and equipment preparation, environmental controls and contact guidelines.

The invasiveness of the procedure dictates the level of technique required. For instance, taking blood pressure requires a clean technique while inserting central venous catheters necessitates a surgical aseptic technique, with evidence-based preventative interventions such as hand hygiene, the use of full barrier precautions, chlorhexidine skin preparation, etc. Nonetheless, these measures must be complemented with other evidence-based interventions targeting maintenance, due to the fact that insertion is not the only risk factor for central line-associated bloodstream infection *(6)*.

Standard precautions

Standard precautions are basic infection control practices intended to prevent the transmission of infectious agents in healthcare settings. They are intended to protect healthcare workers, patients, families and visitors, and the environment *(7)*.

Elements of standard precautions include hand hygiene, respiratory hygiene, cough etiquette, personal protective equipment, safe work practices, environmental cleaning, safe injection practices, and patient placement. The importance of standard precautions is represented with the fact that whether patients are infected or colonized by resistant germs, strict adherence to standard precautions will prevent their transmission. Again, plenty of science has explored each of the elements of standard precautions. It is a matter of people adhering to them.

Transmission-based precautions

Also called isolation precautions, as the name implies they are employed based on the mode of transmission of the pathogens. Highly pathogenic germs transmitted by contact route require contact precautions; those transmitted by droplet routes require droplet precautions, etc. When it comes to preventing the transmission of MDRO, the HICPAC MDRO guidelines provided a very comprehensive approach composed of administrative measures and adherence monitoring, education, judicious antimicrobial use to include but not limited to, formulary restriction, and automatic stop orders. Surveillance, description of precautions and environmental measures were also detailed in these guidelines. See Table 1 for assessment tools on this element.

3. Healthy environment – This element has two facets, the environment of care and the work environment.

4. The environment of care

The effect of the design and the environment of care on patient safety have been previously demonstrated. Sufficient studies showed healthcare built features corresponding to better patient safety indicators *(8)*.

Further studies identified indoor air and water quality as potential sources for infectious events and outbreaks. That being said, infection control programmes are urged to assess these features by adopting a mindset of evidence-based design and use a thorough infection control risk assessment

for any construction/renovation project, in order to assess a) the design before the start of the project and related hazards and risks; b) required mitigation strategies; and c) continuous monitoring during the project. Furthermore, IC professionals should have an input in deciding and evaluating environmental surfaces and products.

Plans must be in place to assess the indoor air and water quality and to ensure that desired parameters are within the limits for each location of the facility. These comprise airborne infectious isolation rooms, operating rooms and others. Additional plans also are needed for patient and visitors flow in the facility, waste management plans, and linen. Moreover, clear manuals and procedures should be available to address responsibilities, frequencies and methods to clean equipment and health environment.

The work environment

The formula for any successful patient safety programme, and particularly for an infection control programme, is a good work environment embodied in a culture that accurately promotes safety by not accepting mediocre outcomes. This would typically be manifested through teamwork, transparency, open communication, support, innovation, soft skills, recognition, social connections and a responsible and engaged workforce – who can and will report safety events without hesitation – modelled via the most important power, i.e., commitment from leadership. Infection control science would not flourish without these features. The Institute for Healthcare Improvement provides tips on how to develop a culture of safety, such as leadership walk rounds, a non-punitive reporting system and champions from clinical areas to foster such a culture *(9)*. See Table 1.

4. Safe equipment

Safe quality care means providing care in the most efficient and cost-effective fashion while maintaining patient safety alongside that of healthcare workers.

Expensive equipment and medical supplies do not necessarily yield safe quality care. Safe medical equipment entails a good evaluation process before procurement, taking into account desired outcomes, potential users' complications, regular maintenance/inspection and the cost. Infection risks and reprocessing methods like cleaning, disinfection or sterilization should be decided upon beforehand. Furthermore, evidence-based guidelines and recommendations should be considered in the decision process in these instances.

In conclusion, evaluating medical equipment and supplies entails the quality of care, the cost and science *(10)*. Another important aspect to consider is related to human factors and systems engineering. Even the best quality medical equipment, devices and supplies will never be considered safe unless they are being used in the context of a well-designed system and by trained and competent staff *(11)*. See Table 1 for assessment tools.

5. Competent staff – competent staff and healthy staff

Competent staff

An infection control programme is everyone's business. These words alone are proof that it takes a village to prevent infections. Preventing infections also requires solidarity, where all caregivers are united in the battle towards optimal patient safety, have enough shared beliefs and values, compassion and most importantly, act upon them.

The absence of competent caregivers in the workplace will result in the dissatisfaction and frustration of the most knowledgeable and qualified infection control professional. Competent staff includes any staff placed on an organizational chart of an institution. Whether it is a chief executive officer, a logistics officer, a nurse, a housekeeper or a surgeon, they all play a role in preventing infection and should be deemed competent in doing so. However, all institutions will require ardent infection prevention professionals who possess infection control knowledge and technical skills coupled with soft skills and leadership qualities.

Healthy staff

The benefits of a healthy workforce both to the employer and the employee are well attested. A healthy employee is not solely a disease-free employee; rather it includes an employee with a healthy lifestyle and living conditions coupled with occupational health and safety.

Conclusion

Healthcare-associated infections pose a very real threat to modern healthcare settings and systems. A recent population-level modelling analysis study, by Cassini A. et al (2018) *(12)* proved that the estimated burden of infections with antibiotic-resistant bacteria in the European Union and the European Economic Areas is substantially on the rise since 2007 compared with other infectious diseases, and the majority are healthcare-associated infections. This must be taken as a serious call-out to all public health decision-makers to gear all efforts towards prioritizing rigorous interventions for preventing these infections.

It is also worth commenting that the organizational culture and capabilities where infection control programmes are being implemented play massive roles in their success or failure. It is a bundle of having the will, the capability and the culture that makes an infection control programme successful. Thus, developing and managing an infection control programme without contemplating all these factors is a futile effort. ■

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