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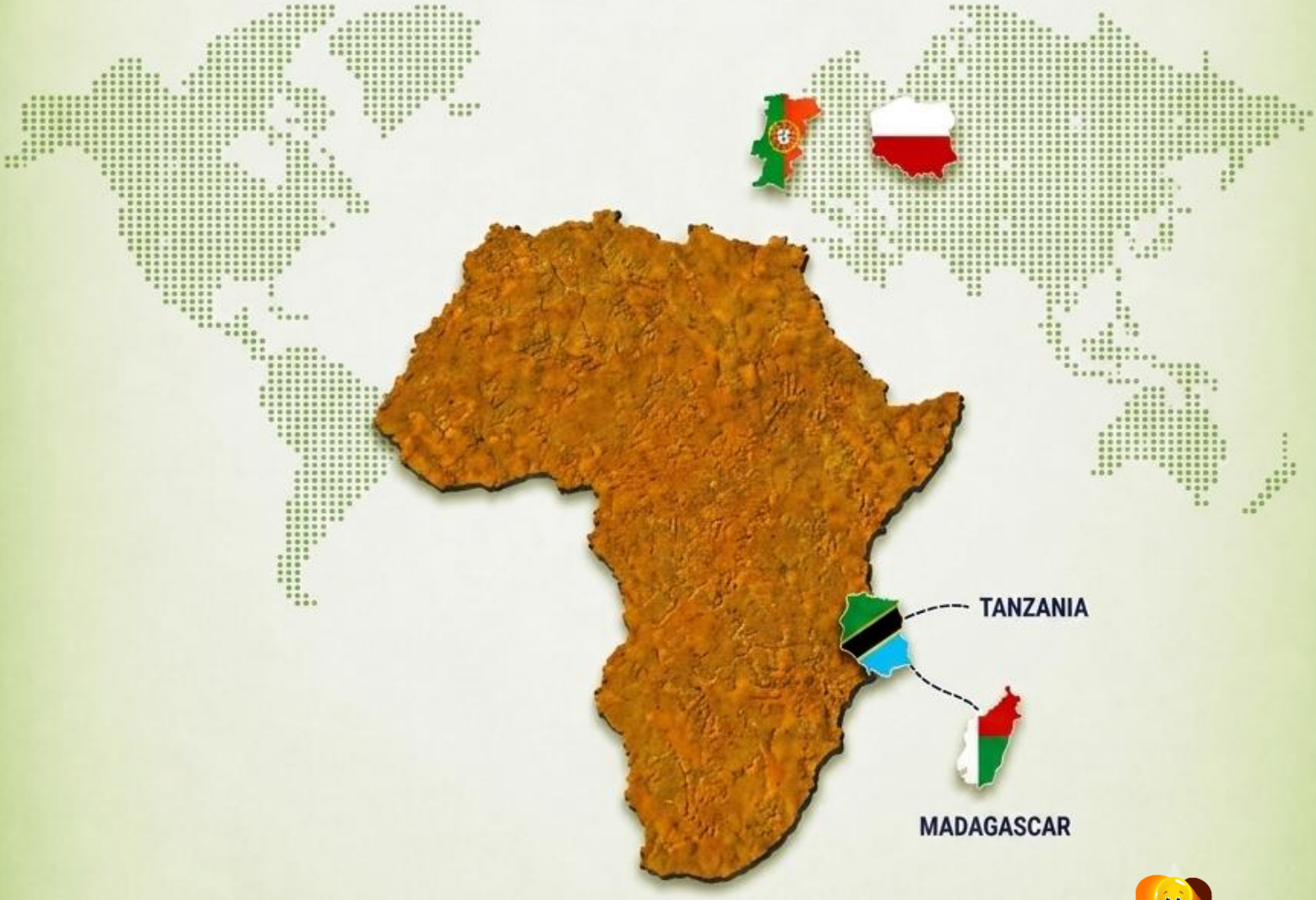
InfPrev4frica

E-BOOK FOR EDUCATORS

Capacitating Sub-Saharan African Higher Education Institutions
Sustainable and Innovative Infection Prevention and Control



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EDUCATORS

Capacitating Sub-Saharan African Higher Education Institutions for Sustainable and Innovative Infection Prevention and Control.

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Preface

In sub-Saharan Africa, healthcare-associated infections and antimicrobial resistance are reaching particularly worrying levels. The World Health Organisation warns that the African region is currently one of the most affected by bacterial resistance, a phenomenon exacerbated by limited access to laboratory diagnosis, a lack of structured infection prevention and control programs, weaknesses in epidemiological surveillance systems, and the inappropriate use of antibiotics.

Despite these challenges, evidence shows that a significant proportion of these infections can be prevented through the consistent implementation of infection prevention and control practices underpinned by scientific knowledge, clinical skills, and institutional cultures focused on patient safety. In this context, nurses play a key role, not only as direct care providers but also as facilitators of change and agents of health literacy.

It is precisely within this framework that the InfPrev4frica project stands out as an initiative of great scientific, educational, and social importance. By empowering higher education institutions in Sub-Saharan African countries to train nursing students in this field, the project addresses a concrete and urgent need, whilst simultaneously promoting equity in access to quality education. This eBook, developed as part of this project, reflects an effort at international academic cooperation that integrates knowledge, experience, and cultural sensitivity, resulting in an educational resource that transcends geographical boundaries.

One of the distinctive features of this work lies in its clear focus on pedagogical models and strategies centered on skills acquisition. In particular, the integration of simulation as a teaching and learning strategy represents a highly valuable innovation. Simulation makes it possible to recreate complex clinical scenarios in controlled environments, offering students the opportunity to develop a wide range of skills in a safe and reflective manner.

Furthermore, the InfPrev4frica model is distinguished by its co-participatory and adaptive nature. By actively involving different stakeholders – educators, students,

healthcare professionals and policy-makers – it ensures that the responses developed are contextually appropriate and operationally sustainable. This approach recognises that there are no one-size-fits-all solutions and that the effectiveness of interventions depends on their suitability to local contexts, including available resources, organisational cultures and the specific needs of populations.

It is also important to highlight the structuring effect of this work on health and education policies. By providing a structured, evidence-based and replicable model, this work can serve as a reference for the reformulation of curricula, the implementation of continuing education programmes and the development of institutional strategies for infectious risk management. Its scope is therefore not limited to the academic context but extends to clinical practice and the governance of health systems, with direct benefits for patient safety.

In an increasingly interconnected world, where threats to public health transcend borders, initiatives such as InfPrev4frica take on greater significance. The promotion of international partnerships, the sharing of knowledge and the joint development of interventions are fundamental pillars for tackling global challenges such as ARI. The book presented here is a concrete example of how collaboration between European and African institutions can generate innovation, strengthen capacities and contribute to the consolidation of health systems.

In short, this eBook is not merely an educational resource; it is a tool with the power to mobilise. By bringing together science, pedagogy and practice, it offers nursing educators and students essential tools for building a safer, more resilient and more equitable future.

May this foreword thus serve as an invitation to read it carefully, as well as to commit actively to its application and dissemination. The challenge is demanding, but the potential impact is immense.

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Abbreviations and Acronyms

AMR - Antimicrobial Resistance

AMS - Antibiotic Stewardship

BSI/CLABSI - Bloodstream Infection/Central line-associated bloodstream infection

CBHE – Capacity Building for Higher Education

CDAD - *Clostridium difficile* - associated disease

CUHAS - Catholic University of Health and Allied Sciences

e.g. - *exempli gratia* [for exemple]

ESEUL [ESEL] - Escola Superior de Enfermagem da Universidade de Lisboa

ESEUC [ESEnfC] – Escola Superior de Enfermagem da Universidade de Coimbra

EU/EEA - European Union and European Economic Area

FGD(s) Focus Group Discussion(s)

HAI - Healthcare-associated infection

HAI-PC - Healthcare-associated infection Prevention and Control

HAP - Hospital-acquired pneumonia

HEI(s) – Higher Education Institution(s)

HIC – Higher Income countries

i.e. - *id est* [that is]

ICU – Intensive Care Unit(s)

ISBAR - Identification, Situation, Background, Assessment and Recommendation

IV – Intravenous

LMIC – Low- and Middle-Income countries

MRC – Medical Research Council

OSCE - Objective Structured Clinical Examination

IAP - Intubation-associated pneumonia

PDCA - Plan, Do, Check, Act

PPE – Personal Protective Equipment

PUMS [UMP]– Poznań University of Medical Sciences

Q&A – Quality and Assessment

SBE- Simulation-based Experience

SBL – Simulation-based Learning

SSA – Sub-Saharan Africa

SSI - Surgical Site Infection

TPACK - Technological Pedagogical Content Knowledge

UA - Université d'Antananarivo

UMGA - Université de Mahajanga

UTI/CAUTI - Urinary Tract Infection/Catheter-associated Urinary Tract Infection

WHO – World Health Organisation

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INTRODUCTION

Maria do Rosário Pinto

Healthcare-associated infection (HAI) and antimicrobial resistance (AMR) represent two of the most critical challenges confronting global health security and the enhancement of health systems. HAIs contribute to increased morbidity, mortality, extended hospital stays, and heightened healthcare costs (WHO, 2022a), while antimicrobial resistance compromises the effectiveness of therapeutic regimens, thereby jeopardising the sustainability of contemporary medicine (WHO, 2015). These issues are particularly acute in low- and middle-income countries (LMICs), where structural deficiencies in health infrastructure, surveillance, workforce capacity, and infection prevention and control (IPC) systems lead to a disproportionate burden of preventable infections and resistance patterns (Allegranzi, 2011; WHO, 2016).

In the Sub-Saharan African (SSA) context, research has identified significant deficiencies in the implementation of health-care-associated infection prevention and control (HAI-PC) programs, as well as in AMR stewardship. These shortcomings are partly attributable to inadequate workforce training, limited supplies, and the absence of formalised educational structures (Africa Centres for Disease Control and Prevention [Africa CDC], 2022). In nations such as Tanzania and Madagascar, these challenges are exacerbated by fragmented nursing curricula and a lack of structured pedagogical resources, which impede the consistent integration of HAI-PC and AMR-related competencies in both pre-service and in-service nursing education (Frumence et al., 2021; WHO, 2023).

This e-book was developed within the framework of the InfPrev4frica Project, an international, multi-stakeholder initiative aimed at strengthening nursing education and professional practice concerning HAI-PC and AMR control in SSA health systems. To this end, it is aligned with key international and regional public health frameworks, including the World Health Organisation (WHO) Global Action Plan on AMR (WHO, 2015), the Africa CDC Framework for Infection Prevention and Control (Africa CDC, 2022), and directly supports the objectives of the ERASMUS+ Capacity Building in Higher Education (CBHE) action by contributing to the modernization, accessibility, and internationalization of nursing education in SSA. The development is based on an assessment of the local situation, which serves as a framework for understanding the context.

By addressing the priority area of enhancing curricula, pedagogical methodologies, and teaching practices by developing context-sensitive, competency-based educational tools focused on HAI-PC and antibiotic stewardship (AMS), the InfPrev4frica initiative promotes cross-institutional collaboration, knowledge transfer, and innovation between European and African partners. This aligns with ERASMUS+ objectives of fostering sustainable partnerships for excellence in education, strengthening institutional capacities, and advancing global public health. Furthermore, by emphasising digital and simulation-based pedagogies, the project supports the digital transformation of higher education systems, which is a central strategic goal of the ERASMUS+ program.

Therefore, this digital resource encompasses a comprehensive approach to the InfPrev4frica Model framework and best practice guidelines focusing on key areas of HAI-PC. It aims to offer scientifically grounded, pedagogically structured, and contextually pertinent guidance to facilitate the transformation of nursing curricula, instructional methodologies, and professional development initiatives. The initiative seeks to raise

awareness of the positive impact that the implementation of the InfPrev4frica Model and Simulation Scenarios will have on the nursing curricula of HEIs in SSA.

Target audiences of the project include: educators and curriculum developers, particularly those engaged in the reform of undergraduate and continuing education programs; trainers and facilitators implementing professional development activities in HAI-PC and AMR; students and early career professionals, as end-users of innovative, evidence-informed learning strategies; healthcare institutions and public health agencies, aiming to operationalise sustainable HAI-PC and antimicrobial stewardship programs through human resource capacity-building.

This e-book is designed to support educators and professors. Its structure comprises four chapters and accompanying appendices, arranged in a logical sequence from conceptual frameworks to pedagogical strategies. Chapter 1 provides contextual insights into the InfPrev4frica Project and delineates the global, regional (SSA), and national (Tanzania and Madagascar) burdens of HAIs and AMR. Furthermore, it emphasises the critical role of nurses in mitigating these threats and outlines the project's intended contributions to educational and practice transformation. Chapter 2 introduces the InfPrev4frica Model, developed through participatory methodologies, and analyzes its components and theoretical foundations. It examines how the model may support reforms in nursing education from both educator and student perspectives. Chapter 3 focuses on simulation-based learning (SBL) as a pedagogical approach to enhance competencies in HAI Prevention and Control (HAI-PC) and Antimicrobial Stewardship (AMS). It discusses the design, implementation, and assessment of simulation scenarios, with a focus on sustainable integration into educational environments. Chapter 4 outlines strategic pathways for adopting and institutionalising the model and its educational outputs within nursing curricula,

identifying organisational and individual-level enablers essential for successful implementation.

By strengthening pedagogical infrastructure and advancing nurses' professional development in HAI prevention and AMS, the InfPrev4frica initiative contributes to the long-term goal of improving patient safety, health workforce resilience, and health system performance across SSA.

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Chapter 1:

The InfPrev4frica Project

1.1. Healthcare-Associated Infection and Antimicrobial Resistance: Two Global Health Challenges

Barbara Czech-Szczapa & Grażyna Bączyk

HAI refers to a healthcare-associated infection resulting from medical care occurring during or after hospitalisation. HAI pose a significant challenge to healthcare systems worldwide (Allegranzi et al., 2011; Zimlichman et al., 2013; WHO, 2011; WHO, 2022a). Recent systematic reviews emphasise that implementing effective IPC programs can reduce the incidence of HAI by up to 70%, particularly in low-resource settings (Tartari et al., 2021). Usual causes include medical procedures, prolonged hospital stays, and inadequate hygiene. In developed countries, the incidence of HAI ranges from 5% to 10% of hospitalized patients, while in developing countries, it can exceed 15% (WHO, 2024). Nearly one-third of patients in intensive care units may be affected by HAI, with the incidence significantly higher in low- and middle-income countries (LMIC) compared to high-income countries (HIC). Antibiotic-resistant microorganisms cause 136 million cases of HAI globally each year (WHO, 2024).

HAI subcategories include urinary tract infection/catheter-associated urinary tract infection (UTI/CAUTI), hospital-acquired pneumonia/intubation-associated pneumonia (HAP/IAP), surgical site infection (SSI), bloodstream infection/central line-associated bloodstream infection (BSI/CLABSI) and *Clostridium difficile*-associated disease (CDAD). Each subtype of HAI has distinct risk profiles, transmission pathways, and prevention strategies, which are critical to inform local IPC planning and resource allocation (Centres for Disease Control and Prevention, 2025).

According to European data, the most frequent HAI in the intensive care unit (ICU) are UTIs (51,2/100.000 acute-occupied bed-days AOBD), BSIs (44,7 AOBD/100.000), followed by hospital-acquired pneumonia (42 AOBD/100.000) (Stewart et al., 2021). The most common pathogens causing HAI are *E.coli* and *S. aureus*. HAI occurrence is the most common in the ICUs, cardiothoracic surgery, and nephrology units, with the average onset on the 9th day of hospitalisation (range: 4-19 days). Surgical site infections are classified as superficial, deep, or penetrating. They significantly increase treatment costs and the risk of serious complications requiring reoperation. SSI incidence in Europe remains lower compared to global data (Stewart et al., 2021). All types of HAI may be the primary source of sepsis.

UTIs/CAUTIs are the most common but usually the least severe. Treatment costs for CAUTI can range from $1,000 to $3,000 per patient, depending on the severity of the infection, length of hospital stay, and treatment applied (McCleskey et al., 2022; Zimlichman et al., 2013). UTIs are mainly caused by: *E. coli*, *Klebsiella spp*., *Enterococcus spp*., and *Pseudomonas aeruginosa* (McCleskey et al., 2022).

The cost of treating HAP and IAP can range from $20,000 to $40,000 per patient. These costs include longer hospital stays, intensive treatment, and potential complications (Orlando et al., 2025). Respiratory tract infections, including pneumonia, are common HAI, especially among patients hospitalized in ICUs. The most common pathogens causing these infections include: *Pseudomonas aeruginosa*, *Staphylococcus aureus*, and *Acinetobacter baumannii* (Orlando et al., 2025). The emergence of multidrug-resistant organisms, such as *MDR Acinetobacter baumannii*, poses a significant treatment challenge in ICU settings globally (Liu et al., 2023).

SSIs are among the most common types of HAI, and their incidence is significantly higher in LMICs. In LMIC, the SSI rate averages 5.9% for surgeries and 11.7% for

cesarean sections. Typical SSI-causing pathogens include *Staphylococcus aureus* (including methicillin-resistant *Staphylococcus aureus* - MRSA), *Klebsiella pneumoniae*, and *Escherichia coli* (Rhee et al., 2017; WHO, 2016). Treatment costs for surgical site infections range from $3,000 to $25,000, depending on the type of surgery, the severity of infection, and the need for additional surgical interventions (Bucataru et al., 2023; Tomczyk et al., 2022; WHO, 2016).

Bloodstream infections are critical HAIs, responsible for the highest mortality rate. Meta-analyses indicate BSI-related mortality is considerably higher in LMIC compared to high-income settings, underscoring inequities in clinical response capacity (Tomczyk et al., 2022). The most common etiology includes *Staphylococcus aureus* (including MRSA), *Klebsiella pneumoniae*, *Pseudomonas aeruginosa*, and *Acinetobacter baumannii*. Treatment costs of CLABSI can range from $10,000 to $30,000 per patient, including longer hospital stays and intensive treatment (Rudd et al., 2020).

There are many risk factors of hospital infections: inadequate hand hygiene, lack of appropriate equipment for hand hygiene or access to personal protective equipment (PPE), as well as inadequate compliance with hospital procedures such as antibiotic policy, perioperative antibiotic prophylaxis, clothing policy, or preoperative hair removal (Liu et al., 2023). Patient risk factors include clinical condition, previous hospitalisations, comorbidities, non-compliance with pre- and postoperative recommendations, and colonization with antimicrobial-resistant flora (Liu et al., 2023).

A significant proportion of infections is caused by the patient's endogenous microbiome, e.g., associated with the insertion of any medical device into the human body. Length of hospitalisation, number of invasive procedures, and number of catheter days or tracheal tube days influence the risk of infection. HAIs are significant adverse events in healthcare, affecting over one in ten patients and contributing to

more than 3 million annual deaths globally (WHO, 2011; 2022a; 2024). LMICs are disproportionately impacted, with approximately 134 million adverse events leading to around 2.6 million deaths yearly. The incidence of adverse events in hospital settings is estimated at 42.7 million. Global estimates of HAI are hindered by inadequate surveillance systems, particularly in LMIC, leading to underreporting and variable data quality. WHO estimated that in HICs, seven patients acquire at least one HAI in acute care hospitals, while this number rises to 15 in LMICs (WHO, 2024).

The consequences of HAI can lead to prolonged hospital stay, long-term complications, and increased mortality. For example, the mortality rate for healthcare-associated sepsis is estimated at 24.4%, rising to 52.3% in the ICU. The economic burden on healthcare systems is substantial, leading to additional costs and resource strain. AMR complicates the situation, with an estimated 136 million HAI resistant to antibiotics occurring annually. Middle-income countries bear the highest burden, while low-income countries report significantly fewer cases (WHO, 2024).

The burden of HAI in European Union and European Economic Area countries (EU/EEA) is significant, with estimates indicating that they account for more deaths and disability than other infectious diseases. The estimated deaths due to AMR are also concerning, with projections suggesting millions of lives could be lost annually if current trends continue (WHO, 2024).

It should be emphasised that hospital infections cannot be completely avoided, but efforts should be made to minimize their incidence and impact on patients, medical workers, and economic consequences. Implementation of IPC strategies is vital to minimize the prevalence of HAI (Carlet et al., 2009).

IPC strategies refer to proactive attitudes in identifying HAI, engaging medical personnel, patients, and stakeholders in preventive procedures, and providing appropriate education (WHO, 2022a; WHO, 2024; Tomczyk et al., 2022; Tartari et al., 2021). Procedures should be standardised and based on evidence-based guidelines. Active epidemiological surveillance is crucial for patient safety and adequate quality of healthcare. It should be implemented at all levels of the health system (WHO, 2011; WHO, 2022a; WHO, 2024).

WHO has developed guidelines on the core components of effective IPC programs. In 2019, international minimal IPC standards were established as a starting point for building strong IPC programs. All countries and healthcare facilities are encouraged to implement minimal IPC requirements and strive for full implementation of all IPC components. The main aim is to provide information to policymakers and professionals responsible for developing and implementing IPC strategies, as well as to encourage cooperation among various stakeholders to improve health security (WHO, 2024).

Reports from 2023-2024 indicate that 9% of countries do not have an IPC program, and only 39% of countries implement full-scale IPC programs. Efforts to improve IPC are particularly important in LMIC, where appropriate investments could significantly reduce AMR-related mortality. The need to increase investments in IPC that could save lives and yield economic benefits should be emphasised (WHO, 2024). After 2024, the WHO adopted a global strategy for IPC that outlines key directions and goals to be achieved by 2030. Achieving these goals requires the commitment of all countries and cooperation among international partners (WHO, 2023).

In 2022, at the 75th World Health Assembly, the implementation of a global strategy action plan and monitoring of the situation regarding HAI worldwide were adopted (Figure 1). A year later, all member countries adopted these proposals, accepting the

extremely ambitious main goal of the strategy: by 2030, everyone accessing or providing health care is safe from associated infections (WHO, 2024).

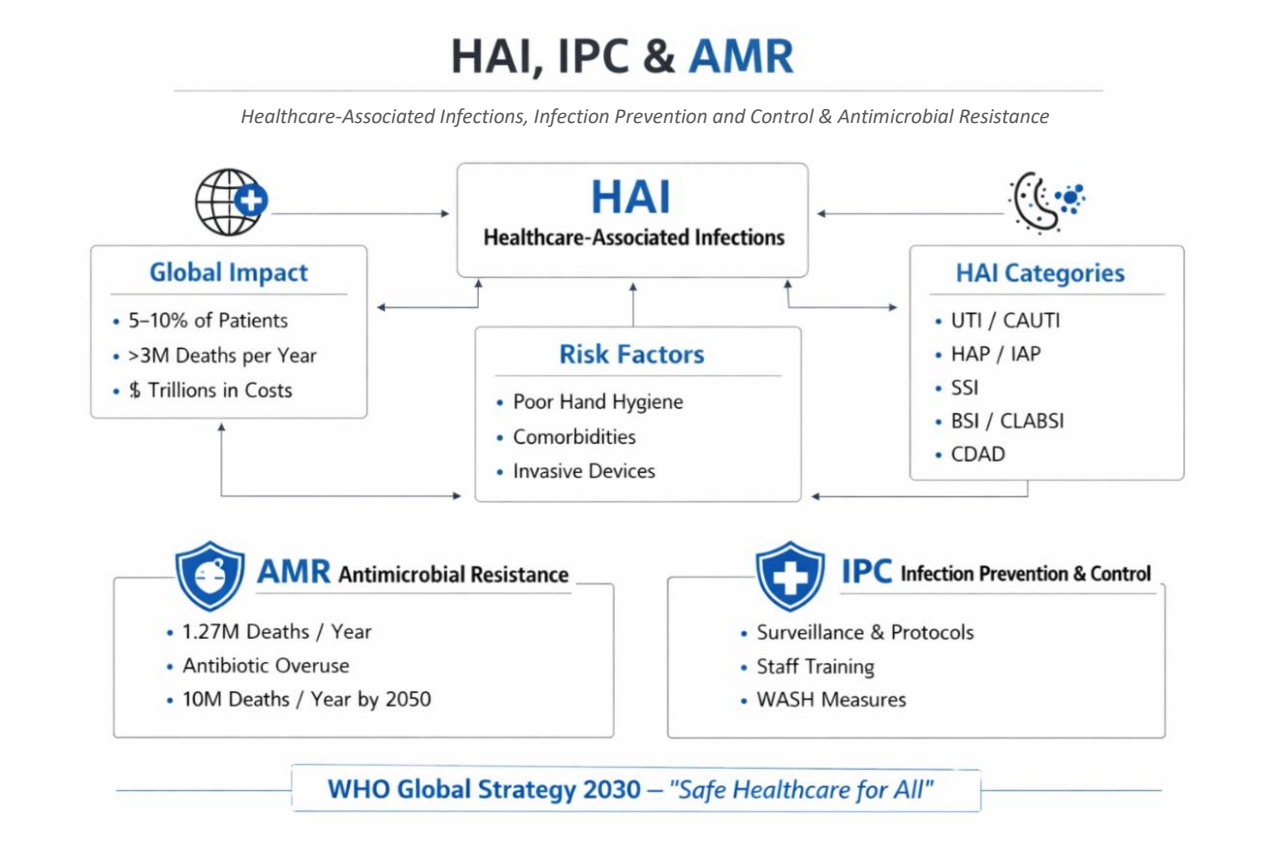

Figure 1 - The problem of Healthcare-Associated Infection and Antimicrobial Resistance (AI-generated figure)

Strategic directions for the development of the global strategy for preventing HAI and dedicated actions include eight key global objectives to increase the proportion of countries:

1. With a costed and approved national action plan and monitoring framework on IPC.
2. With legislation/regulations to address IPC.
3. Having an identified, protected, and dedicated budget allocated to the national IPC program and action plan.

4. Meeting all WHO IPC minimum requirements for IPC programs at the national level (through the WHO global IPC portal).
5. With national IPC programs at levels 4 or 5 according to the State Party Annual Reporting Indicator C.9.1 and levels D and E in the Tracking Actions for Country Self-Assessment Survey.
6. With (1) basic water, (2) sanitation, (3) hygiene, and (4) waste services in all healthcare facilities.
7. Those who have achieved their national targets on reducing HAI.
8. With a national HAI surveillance system.

The four core targets at the national level are to increase the proportion of:

1. Facilities meeting all WHO IPC minimum requirements for IPC programs.
2. Facilities with dedicated and sufficient funding for WASH services and activities.
3. Facilities providing training to all frontline clinical and cleaning staff upon employment and annually, and to managers upon employment.
4. Tertiary/secondary healthcare facilities having an HAI and related AMR surveillance system.

WHO highlights the importance of core IPC components for effective healthcare facilities, which are adapted from national levels to fit specific care types (WHO, 2024). A global survey conducted in 2019 assessed IPC implementation in 4 440 healthcare facilities across 81 countries, indicating IPC practices ranging from inadequate to advanced. Lower-income countries showed significantly lower scores, particularly in areas requiring expertise and resources, highlighting disparities in IPC capabilities. In 2023-2024, a follow-up survey evaluated 5 537 facilities using a simplified IPC assessment tool, confirming similar trends in IPC implementation. Overall, 75.5% of facilities met at least 50% of IPC minimum requirements, with only 15.8% fulfilling all

criteria. Discrepancies remained between income levels, with high-income countries consistently outperforming low-income ones.

These findings emphasise the need for targeted interventions to enhance IPC practices, particularly in lower-income settings. The WHO Infection Prevention and Control Assessment Framework tool is increasingly utilised for local and nationwide IPC assessments, helping to identify areas for improvement and monitor progress over time (WHO, 2024).

AMR is a phenomenon where bacteria, viruses, fungi, and parasites do not respond to antimicrobial drugs. As a result of resistance, infections become difficult or impossible to treat, and also increase the risk of spreading disease, severe illness, disability, and death (WHO, 2019; WHO, 2022a; WHO, 2024). The process of developing AMR occurs through genetic changes in pathogens, which are accelerated by human activity, especially the inappropriate use and overuse of antimicrobials in the treatment, prevention, or control of infections in humans, animals, and plants.

AMR infection has been classified as the third leading cause of death after cardiovascular disease. It has been shown that in 2019, about 1.27 million deaths occurred due to drug-resistant infections, and in 2020, there were almost 5 million deaths due to this reason. In 2050, this number is expected to increase to 10 million, exceeding the number of deaths from cancer (O'Neill, 2016; WHO, 2021a). Recent models estimate that without coordinated global action, the cumulative economic burden of AMR could exceed $100 trillion by 2050 (O'Neill, 2016).

1.2. The Impact of HAI and AMR in Sub-Saharan African Countries

Rose Mjawa Laisser & Eyeshope J. Dausen

HAI is a global problem with a higher burden in SSA (Fraser et al., 2021). These infections are associated with the delivery of care, in contrast to those present at the time of care. They are the leading cause of death and morbidity among patients receiving health care.

The incidence and prevalence of HAI, coupled with the rising AMR, are increasing. The burden of HAI is higher in LMICs compared to developed countries due to differences in their economic and environmental contexts. This infection is attributed to CLABSIs, CAUTIs, IAP, and SSIs (Alrebish et al., 2022). In one of the systematic reviews and meta-analyses by Melariri et al. (2024), it was indicated that Hospital-acquired infections develop in approximately one in 31 hospital patients (Centres for Disease Control and Prevention, 2024), while 0-20% of the reported infections occur in intensive care units. The situation poses significant challenges to healthcare systems, leading to increased morbidity and mortality in all age groups, and an economic burden to families, hospitals, and society at large. A higher rate of mortality (22.0%) among inpatients who suffer HAI has been reported for people under 18 years in SSA (Allegranzi, 2011; Haque et al., 2020). A pooled estimate of HAI prevalence was found to be 12.9%, with a wide range of prevalence between regions and within different hospital wards. Studies show that the prevalence of HAI varies significantly by region, with West Africa at 15.5%, Southern Africa at 6.5%, East Africa at 19.7%, and Central Africa at 10.3%. The highest rates of HAI are often seen in ICUs, followed by neonatal ICUs/wards and pediatric medical wards (Table 1).

Table 1 - Summary prevalence of characteristic dimensions of hospital-acquired infections in SSA from 2014 to 2023 in the pediatric population (under 18 years of age).

Items	N	n	P (%)	EP	95% CI	*p*-value
Overall HAI prevalence	223,199	7336	3.3	12.9	8.9–17.4	<0.001
Overall HAI prevalence in ICU	11,000	1755	16.0	25.0	11.0–42.2	<0.001
Overall HAI prevalence among pediatrics	132,514	1616	1.2	9.5	3.9–17.1	<0.001
Overall HAI mortality	4215	1118	26.5	22.2	14.2–31.4	<0.001
Overall HAI prevalence among neonates	60,205	2735	4.5	13.2	3.9–26.6	<0.001
Region-specific						
HAI Prevalence in West Africa	22,283	2107	9.5	15.5	8.3–24.4	<0.001
HAI Prevalence in Southern Africa	169,424	2963	1.7	6.5	3.3–10.7	<0.001
HAI Prevalence in East Africa	12,212	2142	17.5	19.7	10.8–30.5	<0.001
HAI Prevalence in Central Africa	3403	124	3.6	10.3	1.1–27.0	<0.001
Major types of HAI						
Bloodstream infection, prevalence	4500	2671	59.4	36.8	19.5–56.0	<0.001
Urinary tract infection, prevalence	2514	973	38.7	30.4	22.3–39.1	<0.001
Surgical site infection, prevalence	2437	692	28.4	43.7	25.4–62.9	<0.001

Key: HAI, Hospital-acquired Infections; ICU, Intensive Care Units; N, Sample size; n, number confirmed HAI; P (%), proportion in percentages; EP, Estimated prevalence in percentages from meta-analysis; CI, Confidence Interval; Neonates, children <28 days; Pediatrics, children ≥28 days, but <18 years.

Source: *In* The burden of hospital-acquired infections (HAI) in sub-Saharan Africa: a systematic review and meta-analysis (Melariri et al., 2024).

HAI are associated with multidrug-resistant pathogens, increasing the burden on patients' clinical and economic outcomes (Serra-Burriel et al., 2020). The increasing prevalence of infections, along with AMR, is a prominent issue in SSA (Okomo et al., 2019; Sindato et al., 2020; Tompkins et al., 2021; WHO, 2021a), with studies showing no differences between communities and health facilities. The prevalence of multidrug-resistant pathogens further complicates treatment and increases the likelihood of prolonged hospital stays, disability, and death. HAI are also associated with frequent infectious epidemic episodes.

Poor water, sanitation, and hygiene conditions, along with inadequate waste management, exacerbate the spread of HAI. The high morbidity and mortality rates associated with this problem contribute to population fragility and a decline in human development, while health-related costs have a significant impact on the country's

economy (Mbim et al., 2016; Okomo et al., 2019). An increase in social, economic, and environmental inequalities is also evident. In most of the SSA countries, such as in Tanzania and Madagascar; indicated that the main causes of morbidity and mortality were surgical site infections (Bayardorj et al., 2023; Ernest et al., 2021; Mawalla et al., 2011; Moyo et al., 2010; Okomo et al., 2019) together with urinary tract infections acquired in the hospital, with multidrug resistance (Adal et al., 2025). Severe bacterial infections in newborns were also identified as a leading cause of neonatal deaths (Devred et al., 2023; Huynh et al., 2021; WHO, 2021a).

Other factors that contribute to the increase in HAI and AMRs include poor or lack of knowledge about infection and the application of basic measures for its control (WHO, 2011, 2021b), and effective antimicrobial agents to be used (Katyali et al., 2023; Mboya et al., 2018; Rasamiravaka, 2020). HAI leads to prolonged hospital stays and additional diagnoses and treatments, further straining healthcare resources (Allegranzi, 2011). A note on the economic burden of HAI is substantial.

An estimated health-related loss of $13 billion per year, representing 1.14% of the region's Gross Domestic Product, is reported. The article reported that the cost of treating each HAI is estimated at $500, accounting for 5.6% of total health expenditure.

Further, the prevalence of AMR in SSA is a significant concern. Studies indicate that antimicrobial use in the region is high, with a notable proportion of prescriptions for prophylactic purposes, including surgical and medical prophylaxis. One study found that about 70.9% of infections with antibiotic-resistant bacteria were healthcare-associated (Gobezie et al., 2024). This raises concerns about the spread of AMR within healthcare settings and the potential for it to become a major public health challenge (European Centre for Disease Prevention Control, 2022; Gobezie et al., 2024). Around half of HAI are resistant to first-line and sometimes second-line drugs, contributing to

the threat of AMR. Drug resistance makes infections more difficult and costlier to treat, further increasing the burden on healthcare systems and on both patients and healthcare workers. Scientific evidence also highlights that implementing effective IPC measures plays a fundamental role and requires sustained action at all levels of the health system, by policymakers, health professionals, and those who use health services. One 2020 Tanzanian study reported a high prevalence of multidrug-resistant Gram-negative bacteria in critical care units at a Tanzanian hospital. It identified factors contributing to AMR and emphasised the need to improve environmental cleaning. The study highlighted the clinical implications of AMR and the importance of developing effective treatment and prevention strategies (Silago et al., 2020).

In summary, available evidence before the year 2025 reports that there are few studies estimating the prevalence of HAI in SSA, but also a concern that there is an excess burden in East and Central Africa. Surveillance systems are rarely in place in most SSA countries (Melariri et al., 2024). The report suggests that the size and distribution of HAI are critical in designing effective new interventions and targeting regions that continue to see a disproportionate burden (European Centre for Disease Prevention and Control, 2022; CDC, 2024).

1.3. The Role of Nurses in HAI Prevention and AMR Stewardship

Eyeshope J. Dausen & Paskalina Nzelu

Nurses, being front-line healthcare professionals, play an important role in both IPC and AMS. Their unique position at the bedside, unlike any other health professional (Blot et al., 2022), provides them with the opportunity and responsibility to influence infection prevention practices and the safe use of antimicrobial (Bunduki et al., 2024),

while other healthcare professionals from all cadres contribute to managing HAI and AMR issues, the nurses provide round-the-clock care. When managing high-risk invasive procedures, nurses appraise the risk and burden of HAI. They monitor patients' progress, educate patients and families, and ensure infection prevention protocols are followed. The nature of nursing means nurses continually come into contact with patients, making them important players in preventing HAI and promoting antimicrobial stewardship; ultimately, this role benefits the general population, particularly in SSA (WHO, 2019).

Nurses' Contact with Patients and Infection Risks

The opportunity for nurses to interact with patients constantly while doing their day-to-day activities, such as assisting with daily hygiene, administering medications, changing dressings, managing catheters, checking vital signs, and offering emotional support, increases the risk of HAI among themselves and their clients. Therefore, frequent training using effective teaching and learning methodologies in infection prevention and knowledge of how to prevent microbial resistance is mandatory. They must always be accountable and follow safety and institutionally approved IPC protocols (WHO, 2018c).

Nurses are often the first to observe early signs of infection, such as fever, elevated white cell counts, or changes in wound appearance. This close observation capability enables them to initiate timely interventions, such as notifying physicians, requesting cultures, and isolating patients suspected of carrying multidrug-resistant organisms. Their role in collecting specimens, such as blood, urine, or wound swabs, ensures timely and accurate diagnosis, guides targeted antimicrobial therapy, and reduces the misuse of broad-spectrum antibiotics (Open Resources for Nursing, 2023). As nurses

are also educators, they teach patients and their families about hygiene, wound care, and the importance of completing prescribed antibiotic courses. This education helps reduce the risk of recurrent infection and minimizes the development of AMR in community settings (Majumder et al., 2020).

AMR is a growing global health concern that threatens the effectiveness of antibiotics, leading to increased morbidity, mortality, and healthcare costs. Nurses, as front-line healthcare providers, play a role in combating AMR through their involvement in AMS programs. Their close interaction with patients and other members of the healthcare team positions them to contribute meaningfully to the rational use of antimicrobials (WHO, 2019). Nurses are often the first to notice signs of infection, such as fever, abnormal vital signs, or changes in wound appearance. By promptly recognising and reporting these signs, nurses support timely diagnosis and targeted antibiotic use, which helps prevent the misuse of broad-spectrum antibiotics that contribute to resistance. In addition, nurses advocate for appropriate antimicrobial use by encouraging blood tests (Open Resources for Nursing, 2023), such as collecting cultures before initiating antibiotic therapy, and supporting the timely review and dose escalation of treatment when it is no longer necessary.

Nurses ensure the accurate and timely administration of antibiotics, which is essential for achieving therapeutic effectiveness and reducing the risk of AMR. Many antibiotics require specific dosing schedules and administration routes, and nurses are responsible for adhering to these requirements. The nurses assess patients' eligibility to switch from intravenous (IV) to oral antibiotics, a practice that improves patient comfort, shortens hospital stays, and reduces the risks associated with prolonged IV therapy. Their judgment in implementing such transitions is core to the success of AMS interventions (Majumder et al., 2020). Another important contribution of nurses to

AMR stewardship is IPC. By practicing and reinforcing proper hand hygiene, using PPE, and applying aseptic techniques during procedures, nurses help prevent the spread of infections, including those caused by multidrug-resistant organisms (Hill et al., 2024). They also manage medical devices such as catheters and IV lines to prevent device-associated infections.

For example, by following clinical guidelines for catheter care and advocating for early removal when no longer necessary, nurses help reduce the incidence of healthcare-associated infections that often require antibiotic treatment (WHO, 2019). Patient and family education is another critical aspect of the nurse's role in AMR stewardship. Nurses provide information about the importance of taking antibiotics exactly as prescribed, the dangers of self-medication, and the need to avoid using antibiotics for viral infections such as colds and flu. They also educate patients on proper hygiene and wound care, helping prevent reinfections and unnecessary antibiotic use after discharge. This community-level education is essential for promoting responsible antibiotic use beyond hospital settings (Blot et al., 2022; Hill et al., 2024).

Nurses also contribute to AMS through documentation and participation in surveillance. By recording details of antibiotic administration, monitoring patient responses, and reporting side effects or treatment failures, nurses provide valuable information for prescribers to make informed decisions. Additionally, their participation in infection surveillance helps healthcare facilities track resistance trends and evaluate the effectiveness of stewardship programs (International Council of Nurses, 2024). As their role in leadership and policy-making grows, nurses influence antimicrobial stewardship. Many nurses today serve on AMS committees and quality improvement teams, where they contribute to guideline development, educate staff, and promote a culture of responsible antibiotic use. Their input in these roles ensures

that nursing perspectives are considered in institutional policies, thereby strengthening the overall impact of AMS initiatives (WHO, 2018a, 2019). Nurses are central to the success of antimicrobial stewardship efforts. Their roles span clinical, educational, preventive, and leadership domains, all of which are crucial in addressing the threat of AMR. By empowering nurses with knowledge, training, and institutional support, healthcare systems can harness their potential to reduce inappropriate antibiotic use and preserve the effectiveness of existing antimicrobials for future generations.

Beyond bedside care, nurses also play important roles in shaping policy, advocating for infection prevention, and leading quality improvement initiatives. Nurse leaders participate in hospital infection control committees, policy-making boards, and public health initiatives, contributing their clinical insights to the development of guidelines and protocols (Alharbi et al., 2024). Nurses advocate for safer staffing levels, improved access to PPE, and better working conditions, all of which affect infection risk. They also have opportunities to campaign for increased funding for infection prevention programs and stewardship training, ensuring that healthcare facilities remain equipped to tackle emerging threats. Many nurse-led quality improvement projects have demonstrated success in reducing infection rates. These include hand hygiene campaigns, catheter bundle implementations, and antimicrobial time-out protocols. By leading such initiatives, nurses demonstrate their capacity to improve outcomes and drive systemic change.

Importance of Training and Accountability

Effective infection prevention and antimicrobial stewardship demand that nurses possess a deep and evolving understanding of infection control principles, emerging

infectious diseases, antimicrobial mechanisms, and resistance patterns. Continuing education and structured training programs ensure that nurses are well equipped to handle these responsibilities (Harun et al., 2022).

Training in infection prevention includes topics such as standard and transmission-based precautions, hand hygiene, sterilization techniques, environmental cleaning, and PPE use. Simulation-based training is especially effective in preparing nurses for high-risk procedures, such as central line insertions or managing patients in isolation. Competency assessments and periodic refresher courses help reinforce these skills and ensure adherence to best practices (WHO, 2022b).

Antimicrobial stewardship training focuses on understanding different classes of antibiotics, indications for use, potential side effects, and the importance of avoiding unnecessary prescriptions (Majumder et al., 2020). For example, nurses learn the importance of dose-escalating antibiotic therapy based on culture results and switching from IV to oral therapy when appropriate.

Accountability is another critical component. Healthcare facilities often implement infection control committees, audit systems, and incident reporting mechanisms to promote accountability. Nurses are expected to document care accurately, report breaches in infection control, and participate in root cause analyses following HAI (National Health System England, 2023). In some institutions, nurse-led quality improvement initiatives track compliance with hand hygiene protocols and bundle care elements, contributing to measurable reductions in infection rates.

Leadership also plays a vital role. Nurse managers and infection control nurses serve as role models and mentors, fostering a culture of safety and accountability. They are often responsible for designing and delivering training, leading audits, and

implementing corrective actions (Alharbi et al., 2024). They are also accountable for monitoring and surveillance.

Infection surveillance is the continuous, systematic collection, analysis, and interpretation of health data essential to planning, implementing, and evaluating public health practice. Nurses are instrumental in this surveillance process due to their frequent monitoring of patient conditions. Nurses closely monitor vital signs, laboratory results, and patient-reported symptoms, making them the first to recognise signs of potential infection. Their ability to detect subtle changes in a patient's condition, such as increased temperature, changes in wound appearance, or onset of diarrhea, often leads to the early initiation of diagnostic testing and therapeutic interventions (Soucie, 2012).

Additionally, nurses are involved in tracking and recording HAI and adverse drug reactions. This data feeds into hospital-wide surveillance systems and helps identify trends, such as the emergence of a resistant organism in a particular ward or an increase in surgical site infections. This kind of data is critical in initiating outbreak investigations and refining infection control protocols (WHO, 2024). Nurses' role in surveillance also includes monitoring antimicrobial side effects. Many antibiotics have well-known adverse effects, such as nephrotoxicity or gastrointestinal disturbances. Nurses must be vigilant in recognising these symptoms early, facilitating timely communication with physicians, and avoiding further harm. The latter further highlights the need for, and the importance of, nurses in the SSA to have opportunities for continuous training and development.

Effective communication between nurses and the broader medical team ensures that decisions about infection control and antimicrobial use are based on real-time data. Nurses contribute to patient reviews and multidisciplinary team meetings, where they

provide insight into the patient's clinical status and response to therapy, thus influencing medical decision-making (Bonaconsa et al., 2024). Timing is particularly important for time-dependent antibiotics, where therapeutic levels must be maintained to be effective. A delay in administration may reduce drug efficacy and increase the likelihood of resistance. Nurses ensure punctual dosing by coordinating with pharmacy services and adjusting administration schedules during patient transfers or procedures (Majumder et al., 2020). The route of administration is another important factor. Nurses must assess whether patients can tolerate oral antibiotics and advocate for a switch from intravenous to oral administration when appropriate. This practice reduces the risk of catheter-related infections and shortens hospital stays. Nurses also maintain strict compliance with infection prevention practices during medication administration. This includes hand hygiene before and after patient contact, the use of gloves and gowns when necessary, and adherence to aseptic techniques when handling IV lines, catheters, and injection sites (Centres for Disease Control and Prevention, 2025). They are responsible for reconciling medications and documenting allergy histories. They ensure accurate documentation to prevent administration of contraindicated drugs, avoid duplicate therapy, and support safer prescribing practices. By ensuring physicians have up-to-date information, nurses help prevent errors that can lead to resistance or adverse outcomes.

During a patient's discharge, it is a critical component of infection control and antimicrobial stewardship. Nurses should ensure that patients continue to receive appropriate care after discharge and that the risk of readmission due to infection is minimized (Vaughn et al., 2022). The nurses assess the patient's readiness for discharge, ensuring that infections have resolved or are being adequately managed. They communicate with physicians to determine whether antibiotics can be

discontinued or changed, thereby contributing to dose escalation of antimicrobial therapy. In cases where patients are discharged with ongoing antibiotic treatment, nurses ensure a seamless transition of care. This includes coordinating with outpatient providers, providing clear instructions to patients and caregivers, and ensuring that prescriptions are filled correctly (Hall et al., 2020). Education is a priority under this category, and nurses must ensure that patients understand the importance of completing their antibiotic course, recognise signs of infection recurrence, and know when to seek medical help.

Additionally, nurses provide education and guidance on hygiene practices, wound care, and the management of medical devices such as catheters or feeding tubes. This education reduces the risk of post-discharge infections and supports patients in managing their health when they are at home.

In summary, when adequately trained, Nurses are indispensable professionals in the fight against infections and AMR. Their role spans patient care, surveillance, education, advocacy, and policy engagement. By leveraging their close contact with patients and deep understanding of clinical care, nurses influence outcomes at the individual, organisational, and societal levels. Investments in training, ongoing professional development, and supportive workplace environments are essential to enable nurses to fulfil these roles effectively. As healthcare systems continue to face the dual challenges of emerging infections and growing AMR, empowering nurses will be a critical step in safeguarding patient health and public safety.

InfPrev4frica's Contribution to Nursing Education and Practice

The InfPrev4frica Project's purpose is to build the capacity of Higher Educational Institutions in Tanzania and Madagascar, both in SSA, to develop nursing students'

competencies related to HAI and AMR. This was driven by the fact that the reality in these countries regarding HAI and AMR indicates higher incidence and prevalence, as is the case in other countries in Africa (Fraser et al., 2021). In Tanzania and Madagascar, evidence indicates that these conditions are the major causes of morbidity and mortality, coupled with an inadequate understanding of infections by staff and the community. The proper application of basic control measures and a lack of knowledge regarding antimicrobial use are other setbacks. Bridging the gaps for Nursing education could include appropriate training in improving measures, such as practicing proper hand hygiene using available guidelines and protocols. Effective utilization of these measures could reduce the prevalence of HAI and AMR (Figure 2).

Figure 2 - Bridging the gaps between education and practice. The philosophy underlying the InfPrev4frica Project (AI-generated figure)

The importance of Hand hygiene, cleaning measures, water and sanitation, and hygiene practices in healthcare settings, outlining strategies such as surveillance,

vaccinations, and antimicrobial stewardship, including appropriate policies to minimize HAI, is documented in Tanzania and in Madagascar HAI protocols and guidelines (European Centre for Disease Prevention Control, 2022; Republique Madagascar, 2018; United Republic of Tanzania, 2020). Research and its dissemination enable an understanding of reality and care in both countries.

For example, evidence-based results in Tanzania, identify surgical site infections as well as urinary tract infections to be most common infections caused by gram-negative bacteria as reported in previous section of this chapter where, suggestions mentions hand hygiene and environmental cleaning to help in reducing prevalence of HAI in SSA region (Bayardorj et al., 2023; Ernest et al., 2021; Mbim et al., 2016; WHO, 2018c). In Madagascar, a high incidence of national infections is evident, and the same study suggests the need to revise treatment guidelines (Devred et al., 2023).

In contrast, the current Nursing education and training approaches used in Tanzania and Madagascar may lack adequate strategies to enable the acquisition of adequate competencies that enable learners to internalize the importance of prevention of HAI and AMR, even though these topics are aligned in their curricula.

The InfPre4frica project has earmarked strategic alignment with SSA healthcare needs by developing an InfPre4frica model for learning and the use of simulation scenarios in teaching and learning. The burden of infection prevention and AMR affects both patients and healthcare workers in healthcare settings; thus, in line with the global IPC report (WHO, 2022a), multimodal improvement strategies were developed as a gold-standard approach to implementing IPC interventions in the field. Reports indicate that the unimodal strategy is more likely to yield short-term improvements but lacks

sustainability. The WHO multi-modal approach for IPC comprises five elements: system change, training and education, monitoring, and feedback.

Health/Nursing education in other contexts may follow this philosophy during the training of nurses and other healthcare workers; guidelines and protocols can be better adapted to this reality in accordance with the country's resources. Evidence so far has shown that health professional education challenges in the SSA include a mismatch between competencies and patient and population needs, poor teamwork, persistent gender stratification in professional status, a narrow technical focus, and weak leadership that fails to improve system performance (Frenk et al., 2010).

The critical role of nursing education in promoting prevention of HAI and AMR is noted to improve patients' safety and better clinical outcomes. The literature shows that, in learning, curriculum reforms are needed to ensure that graduates who influence the quality of the healthcare system and meet the population's relevant needs are produced. Community-based education is also important. Reforms from theory-based to competence - based curricula have been reported to maximise learning outcomes (Mthembu et al., 2014; Mtshali & Gwele, 2015; Wilson et al., 2014).

Collaboration and partnerships are noted to contribute to the clinical learning environment, competition for learning opportunities, and limitations in terms of clinical support. Careful planning of students' learning experiences is also important for student nurses to get maximum benefits from their training. Middleton and partners (2014) reported that nursing education demands the sharing of knowledge and information among professionals nationally and regionally, as this increases the sharing of best practices in nursing, particularly for the prevention of HAI and AMR in this context.

From the literature, we note that transformative teaching strategies are innovative ways of teaching (Adejumo, 2016; Appiagyei et al., 2014) to train large numbers of student nurses, while the complexity of healthcare demands critical thinking and competencies that meet these demands. Technology facilitates students' exposure to clinical scenarios that, in the absence of technology, a student may not encounter all the cases (Bell et al., 2013; Kiarie et al., 2014).

Findings from the InfPrev4frica assessment indicated pedagogical challenges in which University teachers teach the theoretical part and prepare students with objectives to practice in the clinical setting, sometimes without proper supervision due to staff shortages and a lack of adequate knowledge and skills in HAI and AMR. The curriculum shows that the number and structure of hours allocated to the content were unclear, and stakeholders were not satisfied with the balance between class and clinical hours. In-service training was limited, while challenges in equipment needs were evident. At most, the HAI challenge specifically focused on the knowledge gap in procedures, with a high incidence of the problem. The guidelines were available, but not clear whether they were followed. The summary of results shows that the teachers, students, and stakeholders find the need to have improvement in learning and practicing HAI topics, along with support in equipment and qualified staff (Santos et al., 2025).

Therefore, the InfPrev4frica project decided to prepare innovative strategies of learning and teaching using a multi-modal concept and simulation-based approach in teaching to enable students to obtain appropriate competencies required in Nursing education regarding HAI and AMR.

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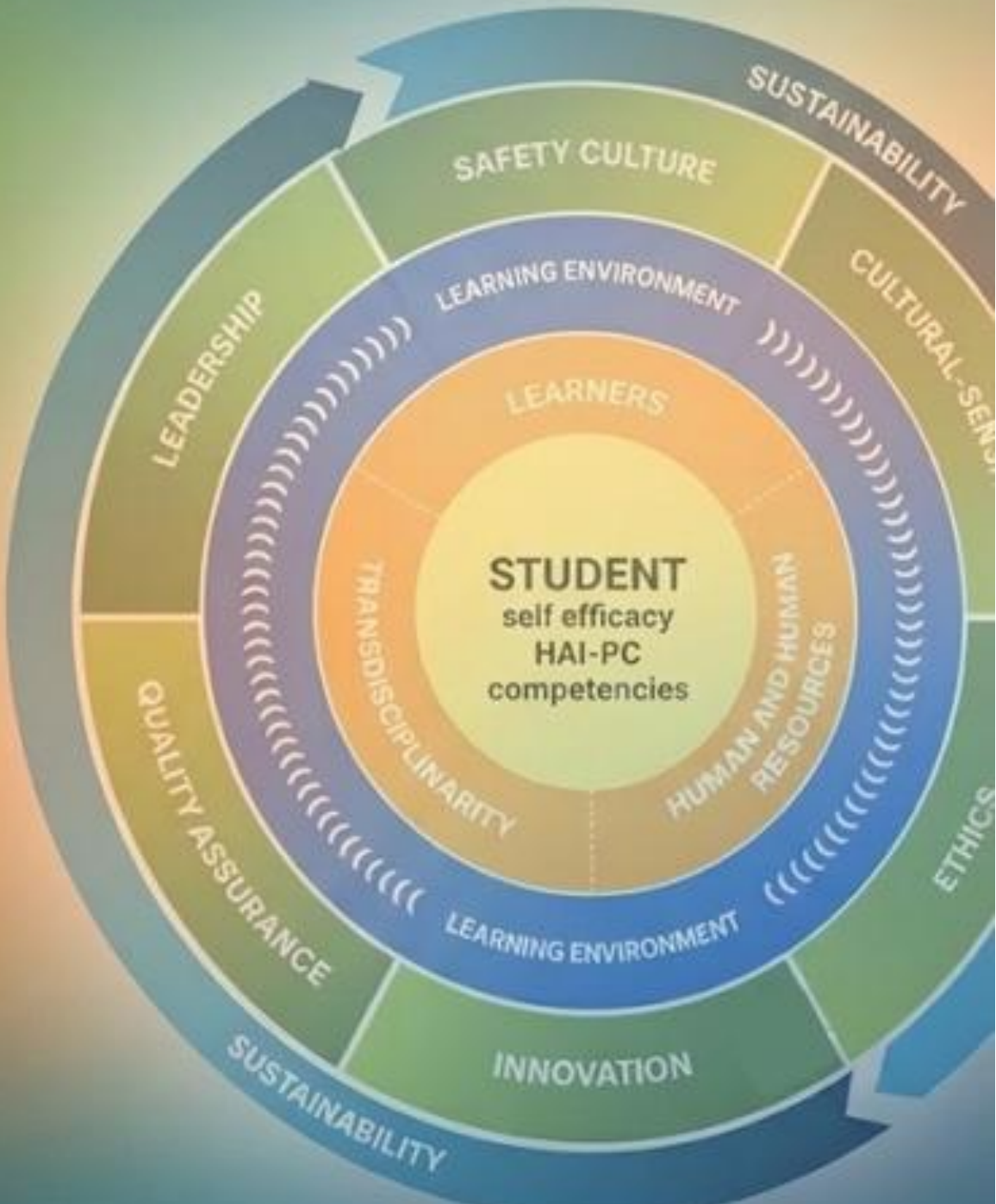
Chapter 2:
The InfPrev4frica Model and Goals



2.1 InfPrev4frica Model Development: Our Co-Participatory Development Journey

Filipa Ventura & Marcia Santos

The development of the InfPrev4frica Model followed a co-participatory and context-sensitive approach, anchored in the principles of co-design and collaborative innovation (Dollinger et al., 2018; Omland et al., 2025).

Methodology for the Development of the InfPrev4frica Model: A Co-Participatory Journey

This journey integrated insights from nursing educators, students, clinical mentors, and institutional stakeholders from SSA and Europe, and was methodologically grounded in the Medical Research Council (MRC) Framework for Complex Interventions (Skivington et al., 2021). Recent literature has also highlighted the relevance of applying the MRC Framework to educational and pedagogical innovations, particularly when these interventions are implemented in dynamic, real-world learning environments such as health professions education (Connell et al., 2025; Haji et al., 2014; Kong et al., 2024). It unfolded continuously and iteratively across three main phases: model conception, piloting and refinement, and evaluation (Figure 3).

Phase 1: Model conception through shared understanding

The model conception phase began during the project's Kick-off meeting in Lisbon (July 2023), with a strong foundation in the *InovSafeCare Model*. Representatives from the original *InovSafeCare* consortium presented the methodological roots and theoretical underpinnings that inspired InfPrev4frica. Specifically, Grazina Bacsyk (Polish team) and

Amaya Yurrebasco (Spanish team) shared the instruments and findings from the *InovSafeCare* qualitative and quantitative studies, while Maria do Rosário Pinto and Pedro Parreira (Portugal) presented the conceptual model and its schematic structure.

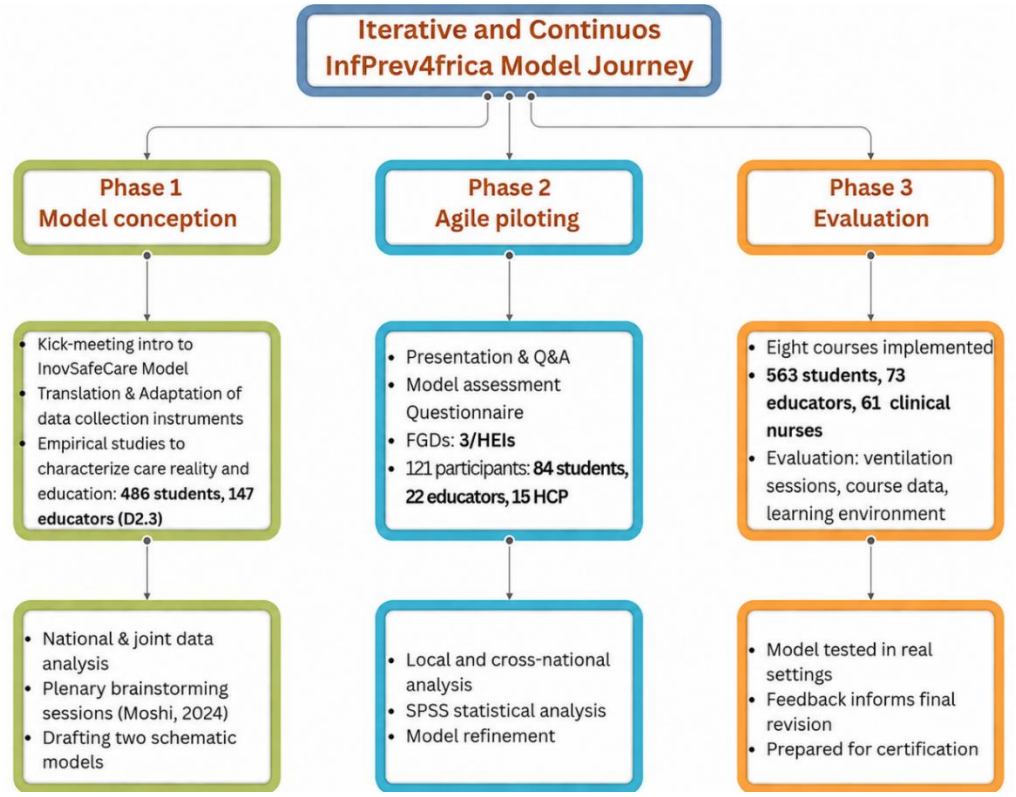


Figure 3 - An iterative process of development, piloting, refinement, and evaluation of the InfPrev4frica model

In parallel, the research instruments for InfPrev4frica were introduced to all partners and underwent collaborative review, followed by translation and cultural adaptation into Swahili and French. This process ensured methodological alignment and contextual relevance.

Empirical studies were then conducted at each of the Sub-Saharan HEIs, with a two-fold aim to explore the experiences and perceptions of nurse educators about the prevention and control of healthcare-associated infections in two countries of SSA

(qualitative study) and assess the empirical relevance of the *InovSafeCare* Model within the SSA context (quantitative study). This conception phase drew on a mixed-method, stakeholder-inclusive design:

- Focus groups were conducted with nursing students, academic staff, and clinical mentors at each HEI. These explored existing gaps in infection prevention education and professional practice.
- Structured questionnaires (adapted from *InovSafeCare*) gathered broader quantitative insights on student learning needs and teacher practices.
- Participatory discussions and workshops across all HEIs engaged stakeholders in iteratively drafting and reviewing model components.

A total of 147 nursing educators, including professors, lecturers, clinical instructors, and clinical nurses, were engaged across the four HEIs in Madagascar and Tanzania. Focus groups and in-depth interviews were conducted to explore participants' experiences and perceptions regarding HAI-PC. These qualitative methods provided essential insights into local challenges, institutional conditions, and educational expectations in infection prevention.

A total of 486 undergraduate nursing students completed the InfPrev4frica Questionnaire, with equal numbers from each country. Of these, 67.3% were female, and 32.7% male; 69.1% were enrolled in nursing, 19.3% in midwifery, and 11.5% in anesthesia. Students represented all academic years, and the mean age was 23.18 years (SD = 2.25).

Following data collection, national teams in Tanzania and Madagascar conducted internal analyses, integrating their deep understanding of their respective socio-cultural, educational, and healthcare contexts. These analyses were then brought together in joint reflection sessions held virtually among all SSA partners. This phase

culminated in a synthesis of cross-national findings, forming the evidence base for defining key themes for the pedagogical model.

Informed by this process and supported by the analytical reflection on the *InovSafeCare Model*, along with insights from other related frameworks such as *PrevInf* and *HAInovPrev* (developed in Asia and South America)[1], the InfPrev4frica team initiated the co-construction of its own pedagogical framework.

The second transnational meeting, held face-to-face in Moshi, Tanzania (February 2024), marked a pivotal moment in the co-design process. Using a structured brainstorming methodology (Rickards, 1973), a multicultural engagement strategy was applied across several sequential phases:

- A plenary session introduced collaborative working strategy.
- Four working groups were created, each composed of one representative from each partner institution.

These groups were asked to identify key concepts linked to three foundational domains of a pedagogical model: students, learning environments, and teaching and learning strategies. Additional dimensions could also be introduced by each group.

- Colors and visuals were used to organise terms, resulting in a consolidated concept map.

A second plenary session enabled further discussion and refinement of the compiled terms. These were systematised and subjected to a second round of group analysis, this time in two larger groups (with two members per HEI), with the aim of identifying key themes and structuring a draft conceptual framework.

[1] PrevInf and HainovPrev are ERASMUS+ Projects follow a similar framework developed in other geographical and cultural areas, namely Asia and South America. The images were mobilised to highlight that, although the InfPrev4frica Model may have its foundation in the InovSafeCare Model (as these examples have), it is mandatory that it translate and align with SSA's cultural diversity and the realities of care, teaching, and learning.

This collaborative effort led to the identification of a preliminary structure for the InfPrev4frica Model, informed by key pedagogical priorities common across SSA institutions. These included:

- Centrality of the student and the domain of HAI in the model;
- Strong connection between student competencies, self-efficacy, and professional identity development;
- Recognition of the interdependence between students' and educators' (professors, teachers, clinical supervisors, and mentors) competence development;
- Core structural dimensions including leadership, quality assurance, ethics and deontology, cultural sensitivity, safety culture, and innovation;
- Foundational contextual elements such as learning environments, resources, transdisciplinary responsibility, evidence-based practice, and diverse pedagogical approaches.

In the final plenary session, participants emphasised the importance of a culturally rooted conceptual framework: one that supports both IPC protocols (including AMS) and the pedagogical realities of SSA's nursing education systems. Such a framework would not only enable the development of high-quality care competencies but also support innovation and responsiveness to labour market needs.

Based on the collaboratively defined dimensions, three illustrative schematic representations of the model were developed. These were designed to visually depict the interconnections between the identified concepts. During a consortium streaming meeting held in March 2024, the team discussed visual options and agreed to pilot two versions, with the option to refine or combine them to better reflect the SSA context.

Phase 2: Agile Piloting and Iterative Refinement

Building upon the co-design outputs, the second phase involved agile piloting of the draft model to assess relevance, clarity, and contextual fit. This was carried out according to a multi-stage, agile strategy inspired by the MRC guidance on complex interventions and adapted to educational settings.

The pilot was implemented in all four SSA partner institutions, led by CUHAS and coordinated through preparatory online meetings. The agile piloting activities followed five distinct stages:

1. *Description of procedures, objectives, and informed consent*.

   Each session began with an explanation of the purpose of the piloting process and the ethical procedures involved, ensuring informed consent from all participants.

2. *Model exposition*.

   The InfPrev4frica Model was presented using a visual presentation co-developed by the consortium. A quality and assessment (Q&A) session was included either during or after the presentation, depending on participants' preferences.

3. *Individual assessment*.

   Immediately following the presentation, participants completed the InfPrev4frica Model Assessment Questionnaire, allowing for the collection of individual feedback on the model's content and relevance.

4. *Group assessment through focus group discussions (FGDs)*.

   Each institution organised three focus group discussions: one with teachers and two with students (up to 12 participants per group). These were moderated by trained consortium members, following a shared guide to ensure consistency across institutions.

5. *Institutional reporting*.

Each HEI compiled a report based on both questionnaire data and FGD, using a shared analytical framework to enable cross-case comparisons and thematic synthesis.

In total, 121 individuals participated in the agile piloting process: 84 students, 22 educators, and 15 healthcare professionals. The focus group discussions were first analysed locally using the institutions' respective languages and later translated into English. This ensured comprehension and authenticity in capturing participants' perspectives. Transcripts were validated by each university team, leading to an initial categorisation of FGD results.

The second stage of analysis involved small interinstitutional working groups, each comprising one or two representatives from each partner institution. European partners facilitated the content analysis through livestreaming sessions and local group work. These findings were presented, discussed, and validated in a consortium-wide livestreaming meeting.

Quantitative data from the individual assessments were analysed using SPSS (v29), with data collated globally, by country, and by institution. The Nursing School of the University of Lisbon led the triangulation and synthesis of results across all datasets.

The final phase of this agile piloting occurred during the 3rd Transnational Meeting in Mahajanga, Madagascar. UMGA, as the task leader, facilitated a final brainstorming session with SSA partners to refine the model components. Suggestions and feedback from the piloting participants were consolidated into an updated version of the InfPrev4frica Model for use in the evaluation phase under work package (WP) 4.

This process validated the model's relevance, cultural appropriateness, and pedagogical utility. Minor refinements included clearer visual elements and the

integration of a triad (i.e., educators, transdisciplinarity, and resources) as supportive dimensions to the student-centered structure. The commitment to sustainability, raised in several FGDs, underscored the need for curricular integration and institutional support to ensure lasting impact.

Phase 3: Comprehensive Evaluation and Consolidation

The third and final phase of the co-development journey focused on evaluating the revised InfPrev4frica Model and Simulation Scenarios within real educational settings. This phase aimed to test the model's pedagogical soundness, contextual fit, and practical applicability through full-course implementation at the partner SSA HEI.

Following approval by the Steering Committee, the revised model was integrated into eight nursing courses (two per HEI) across Tanzania and Madagascar, including topics aligned with the Model and the designed Simulation Scenarios. The selected courses enabled the full application of the InfPrev4frica framework across both theoretical and practical components, aligning with local curricula and academic calendars.

The evaluation followed a multi-source, participatory approach, combining:

- Ventilation sessions: informal, open-dialogue feedback groups involving students, educators, and nurses to capture experiential insights (Patton, 2015);
- Learning environment data: photos, observational notes, and documentation of simulation dynamics (Subramanian & Mahadevan, 2023);
- Performance indicators: anonymized course grades and dropout rates to assess learning outcomes.

This process engaged approximately 536 students, 73 educators, and 61 clinical nurses across both countries.

All evaluation activities were designed to minimize disruption to academic schedules and uphold ethical standards. Feedback gathered during this phase will inform the final refinement of the model and simulation scenarios. The updated versions were submitted to the institutional certification bodies of the pedagogical and scientific boards of each HEI.

This iterative and inclusive strategy ensured that the InfPrev4frica Model was not only evidence-informed but also deeply rooted in local realities, pedagogical cultures, and shared values. The final output is the product of continuous reflection and partnership, demonstrating the potential of co-design methodologies to foster ownership and contextual relevance in educational innovation. This laid the foundation for a preliminary conceptual model that reflects the shared realities and ambitions of SSA nursing education institutions. The draft model is presented in the following chapter.

Significance of the Co-Design Approach

The co-design approach adopted in developing the InfPrev4frica Model was essential to fostering a sense of shared ownership among its primary users, i.e., nursing students and educators in SSA. Through the active involvement of students as co-creators of educational content and learning strategies, and by engaging teachers as facilitators of student-centered learning processes and practice-oriented teaching, the model aligned with contemporary pedagogical frameworks that emphasise partnership, agency, and student–staff collaboration (Dollinger et al., 2018; Omland et al., 2025; Sutherland et al., 2023). This participatory methodology enhanced the model's contextual relevance and sustainability by incorporating local pedagogical practices, professional expectations, and healthcare realities from the outset. The iterative and collaborative nature of the process strengthened the connection

between academic institutions and clinical practice environments, contributing to context-sensitive and practice-responsive curricula (Kriz et al., 2021).

Furthermore, the project fostered the establishment of a transnational collaborative network that included both South–South partnerships, such as cooperation between institutions in Tanzania and Madagascar, and South–North partnerships, involving collaboration between SSA and European institutions. These partnerships were grounded in principles of mutual respect and equitable knowledge exchange, enabling the co-creation of context-sensitive solutions and the strengthening of institutional capacity across diverse educational and healthcare systems (Liwanag & Rhule, 2021; Sors et al., 2023). This networked approach enabled the co-creation of solutions that were pedagogically sound, culturally relevant, and institutionally feasible, thereby contributing to sustainable capacity-strengthening across diverse healthcare and educational systems. The InfPrev4frica e-book, as a tangible outcome of this co-participatory process, embodies the collective insights, needs, and contributions of all stakeholders involved, thereby offering a model of educational development rooted in inclusivity, responsiveness, and contextual integrity.

2.2 The InfPrev4frica Pedagogical Model

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Anchored in a contextualised and student-centered approach, the InfPrev4frica Model embodies an integration of scientific evidence, pedagogical innovation, and sensitivity to the realities of SSA. Although conceived as an innovative pedagogical framework, it goes beyond; it is a dynamic and adaptable proposal designed to guide nursing education and has the potential to extend to all healthcare education sectors.

Within undergraduate nursing education, competence development is understood as a progressive transition, strengthened by structured learning, critical thinking, and clinical reasoning, thereby fostering the acquisition and development of both technical and non-technical competencies (Benner et al., 2009; Benner et al., 2010).

Specifically, HAI-PC education must be continuous and embedded, not confined to a theoretical approach or guideline delivery. Students' knowledge, attitudes, confidence, and practice improve when teaching is interactive, practice-oriented, and reinforced through practice in safe learning environments before clinical training (Amavasi & Zimmerman, 2023; Chang et al., 2023; Matinho et al., 2022). In addition, recent work highlights that institutional support and broader culture shape whether students can transfer HAI-PC competencies into everyday clinical practice (Soosay Raj et al., 2025).

InfPrev4fricaModel, with a multi-level concentric structure, maps and assembles personal, educational, cultural and institutional factors that support students' integration and sustained application of HAI-PC competencies in real-world clinical settings. As shown in the illustrative image below, at its core is students' self-efficacy in HAI-PC competencies, encircled by four successive layers that emphasise interdependence: enhancing one element affects the others, whereas gaps may compromise progress. Sequentially, from the inside outward, there are the resources, human and non-human, and pedagogical, including transdisciplinarity; the learning environment; safety culture and leadership, cultural sensitivity and ethics, quality and innovation, which, together, form the third ring. All surrounded by sustainability, the last layer of the model (Figure 4).

Unveiling these interconnections, which will be explored below, the Model provides a practical reference for educators, students, institutional decision-makers, and policy stakeholders. It also enables a systematic evaluation of whether the key conditions for

developing and sustaining HAI-PC competencies are present and aligned across educational and healthcare settings.

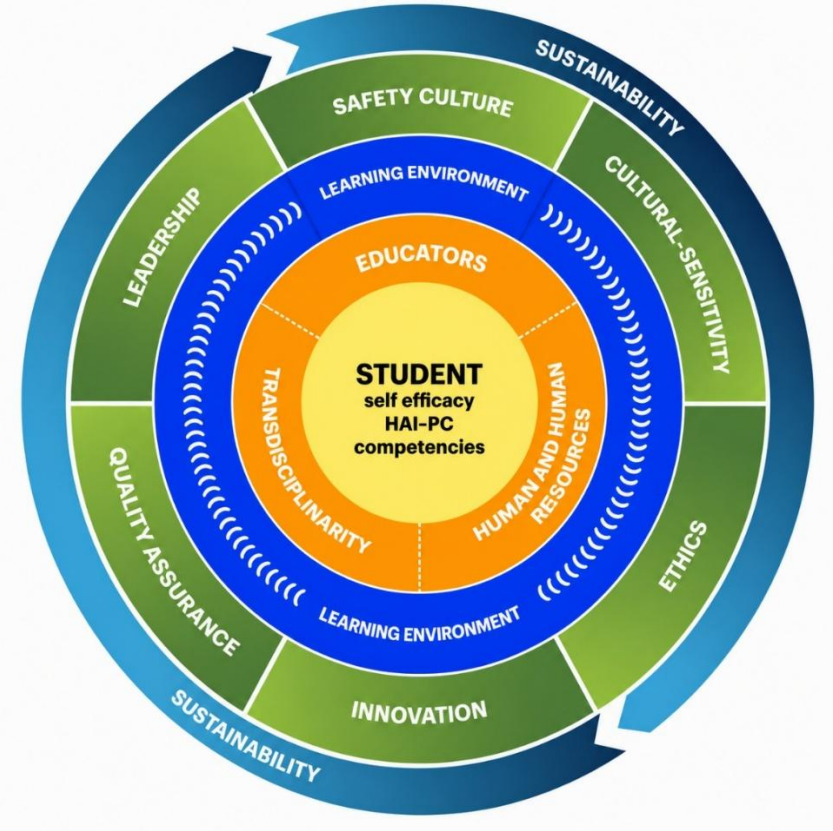

Figure 4 - Illustrative image of the InfPrev4frica Model

The Core of the Model: Student Self-Efficacy in the Acquisition and Development of HAI-PC Competencies

At the center of the model is the Student, the focus of attention of this core, in close connection with the concept of self-efficacy and with HAI-PC competencies. This triad points to a student-centered pedagogical perspective focused on the students and their development, fully aligned with constructivist principles. The constructivist principles view knowledge acquisition as an active, self-directed, social, and situated process in which the student, as an individual who perceives and interprets the world,

assigns meaning to it and evolves through the learning process (Fry, Ketteridge & Marshall, 2014; Maulana & Syihabuddin, 2025; Trawalter et al., 2021; Wulf, 2019). This learner-centered approach recognises students as active participants in their learning, and an active student constructs knowledge through action, engaging in practical activities and collaborating with peers and educators (MacLeod et al., 2022).

In fact, being a student is a multidimensional reality that encompasses both individual and social dimensions. In the model's illustration, self-efficacy mediates the relationship between students and HAI-PC competencies. When self-efficacy, a concept developed by Albert Bandura (1977), is added to this equation, confidence, perceived responsibility, and a professional identity under construction support the translation of the knowledge the student is acquiring into practice throughout the decision-making process (Bandura, 1977).

Conceptually, self-efficacy refers to an individual's belief in their ability to succeed and overcome obstacles. It promotes motivation and resilience in the face of healthcare challenges, thereby supporting their future role as healthcare professionals in HAI-PC (Bandura, 1977; Labrague, 2024). From SSA partners' perspectives, students are responsible for being really involved in their learning process, co-responsible for acquiring knowledge, skills and competencies for practice (Santos et al., 2025).

Beyond clinical skills, the model aims to cultivate self-efficacy in HAI-PC competencies, which brings us to the next core concept – competence. Defined by WHO (2021) as the combination and application of knowledge, skills, and behaviours required to perform a task, competencies are understood, within the InfPrev4frica Model, as the ones that enable undergraduate nursing students to provide safe, evidence-informed, and ethically responsible care across routine clinical contexts (WHO, 2020). In the context of IPC, a self-efficacious student is better positioned to respond confidently to HAI-PC

challenges and to manage complex healthcare demands by developing competencies that align with the role of a safe practitioner who contributes responsibly to their implementation (Figure 5).

Around the Core of the Model: Educators, Human and Non-Human Resources, and Transdisciplinarity

While the core of the model emphasises internal conditions that shape self-efficacy and competency development - such as prior mastery experiences, cognitive appraisal, motivation, and affective states - the external conditions identified in the scholarly literature (Bandura, 1977; Martins et al., 2018; Silva & Silva, 2015) surround it.

Resources, both human and non-human, and educators work in this model as complementary and integrative elements, reinforcing the central premise that the development of students' self-efficacy in HAI-PC competencies depends on the convergence of supportive educational conditions, resource availability, and collaborative, transdisciplinary frameworks that promote structured learning, critical reflection, shared practices, and adaptive action.

Human and Non-human Resources

Resources play a structural role within the InfPrev4frica Model, which SSA partners see as influencing society's behaviour, and they classify them as Human and Non-Human, including the qualification and number of educators/supervisors, the time allocated to teaching and training, and the availability of teaching and training materials. Human resources are therefore essential to self-efficacy in HAI-PC, but so are the physical, technical, and financial resources, such as simulation and training laboratories, as well as clinical facilities for internships and practice observation (Lowe et al., 2021; WHO, 2024b).

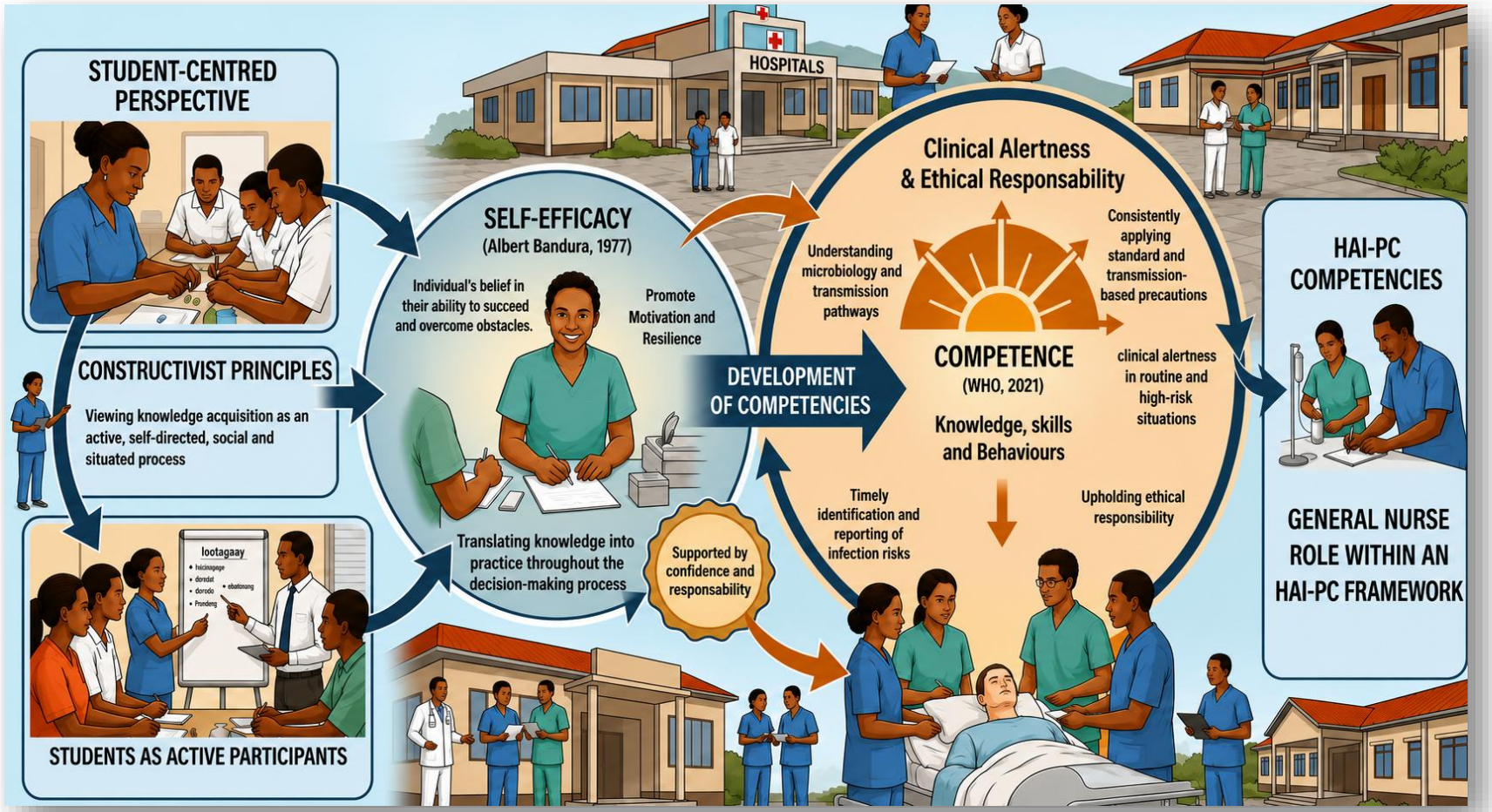

Figure 5 - InfPrev4frica Model: a Student-Centered Perspective
(AI-generated figure)

Non-human resources refer as well to digital platforms and tools, libraries, and equipment, namely HAI-PC-related equipment and facilities.

Achieving the model's objectives requires constructive alignment between human and non-human resources, ensuring coherence among learning objectives, teaching activities, and assessment methods. Sufficient, qualified human resources ensure alignment between programme design and evaluation, while adequate infrastructure supports effective implementation and fosters responsibility, engagement, and awareness (Choi & Kim, 2018; Duguet, 2015; WHO, 2020; 2024a). The combination and complementarity of educators' roles, transdisciplinarity, and resources are structural features of the InfPrev4frica Model, underscoring their critical role in addressing the unique challenges faced by the healthcare sector in this Region.

The Educators and Transdisciplinarity

Educators include professors, lecturers, pedagogical advisors, and clinical supervisors or mentors who operate at the intersection of theoretical and practical education and maintain direct contact with students, significantly influencing the development of self-efficacy and HAI-PC competencies.

These facilitators, whose expertise spans didactic-methodical and clinical domains, are also responsible for working with students to foster maturity (Chasani, 2022) and for developing pedagogical practices that cover the full range of actions through which educators enable learning (Duguet, 2015). Less effective approaches can weaken learning, whereas active pedagogies foster intrinsic motivation (Duguet, 2015). Engaging methods, such as problem-based learning, simulation, clinical placements, and case studies, should be prioritised over passive, transmission-based teaching. These methods should be tailored to the content, learning objectives, and the unique training

needs of nursing professionals, ensuring that students are prepared for the complexity and demands of clinical practice (Sommers & Bonnel, 2020; Walsh et al., 2020).

Beyond their mediating role, educators serve as important role models for students, both within academia and in clinical practice (Benner et al., 2010), particularly in the development of HAI-PC competencies (WHO, 2024a). In HAI-PC, professors and senior clinicians are influential role models, shaping students' understanding of safe care, clinical responsibility, and professional conduct. Their impact extends beyond explicit teaching, as students also assimilate the norms and expectations embedded in day-to-day clinical routines and the broader safety culture of the workplace (Ochili et al., 2025; WHO, 2024a).

Building on this, the InfPrev4frica model further fosters, within this layer, the development of academic and research competencies that connect practice and knowledge, alongside professional attitudes, pedagogical competencies, and management skills (Doi & Hosoda, 2017; Maruo et al, 2017; McAllister & Flynn, 2016). Accordingly, transdisciplinarity is essential to this process, as it integrates diverse knowledge, supports collaboration, and strengthens the connection between theory and practice.

This concept, discussed in the early stages of developing the InfPrev4frica model, promotes progressive competency development by treating HAI-PC as a complex issue requiring input from multiple disciplines, thereby justifying the combination of these two concepts, which are closely intertwined with the model's core. Within this framework, transdisciplinarity supports the acquisition of knowledge and the development of competencies for HAI-PC by integrating multiple disciplinary perspectives through active, contextualised learning linked to its application in

practice. This includes understanding microbiology and transmission pathways relevant to nursing practice; implementing standard and transmission-based precautions; maintaining vigilant oversight in routine and high-risk situations; upholding ethical responsibility for preventing avoidable harm; communicating effectively across multidisciplinary teams, which may require learning new technical terms or languages; and timely identification and reporting of infection risks or noncompliance with protocols (Levett-Jones et al., 2017; WHO, 2020).

This knowledge is progressively translated into clinical practice through reflection, collaboration, and the application of evidence-based strategies to ensure safer, higher-quality care, in line with WHO's recognition (2020; 2024a).

This implies coordinated teaching across domains, such as pathogen transmission, aseptic measures, and antimicrobial stewardship, throughout the curriculum, so that HAI-PC is repeatedly addressed and consolidated across diverse learning contexts in a dynamic process that reinforces prior understanding and expands it through new learning (Taber, 2024).

Moreover, transdisciplinarity involves crossing disciplinary boundaries, sharing knowledge and decision-making, focusing on real-world problems, and engaging stakeholders such as patients and communities (Bewer, 2017). Higher Education Institutions must ensure coherence across disciplines through coordination and collaboration, adopting integrative approaches to healthcare challenges (Martin et al., 2023) that align theory with practice, bringing together what is recommended in guidelines and school settings with what is developed in real-world contexts, thereby facilitating students' adherence to IPC standards in clinical practice (Burnett et al., 2025; Choi & Kim, 2018; Pinto et al., 2022).

The Learning Environment

The empirical work underpinning the InfPrev4frica Model led to a proposal that visually distinguishes the learning environment from the supportive elements for students' self-efficacy and competence development. Even so, the findings confirmed that competence development is shaped by the interaction between formal teaching and the realities of practice. Participants highlighted the importance of supervision, feedback, the institutional visibility of HAI-PC, and collaborative communication, all of which influence whether students feel able to act safely and responsibly in real clinical settings (Santos et al., 2025).

In nursing education, the learning environment comprises a restricted setting, namely the school-based context, and an extended setting, encompassing physical, social, and cultural contexts, namely the clinical environment, where students apply theoretical knowledge and develop professional competencies in authentic care situations (Leighton et al., 2021; Meyer et al., 2020).

Learning unfolds across institutional, both educational and clinical, and interpersonal contexts that shape how students interpret, internalise, and enact IPC standards (WHO, 2020; 2024). These contexts include factors that influence students' engagement, often beyond institutional control, and that influence how they translate acquired knowledge into competency development and meaningful action.

While interactive learning and active methodologies create a student-centered classroom environment that promotes engagement, critical thinking, and collaborative knowledge construction (Ghezzi et al., 2021; Stenseth et al., 2025), in the extended environment supervisory practices, interprofessional relations, institutional priorities, and the degree of psychological safety students experience when

confronting behaviours play a central role, alongside physical and managerial conditions (Leighton et al., 2021).

Within the model's philosophy, the development of HAI-PC competence is shaped by a dynamic interplay among the learning environment, transdisciplinary approaches, resources, and educational practice. The Facilitators presented in the previous layer and the Learning Environment are closely linked, each exerting an individual influence, while their combined effect determines whether outcomes are improved or compromised (Figure 6), as defended by SSA partners and the scientific community (Saziwa, 2026; WHO, 2020, 2024).

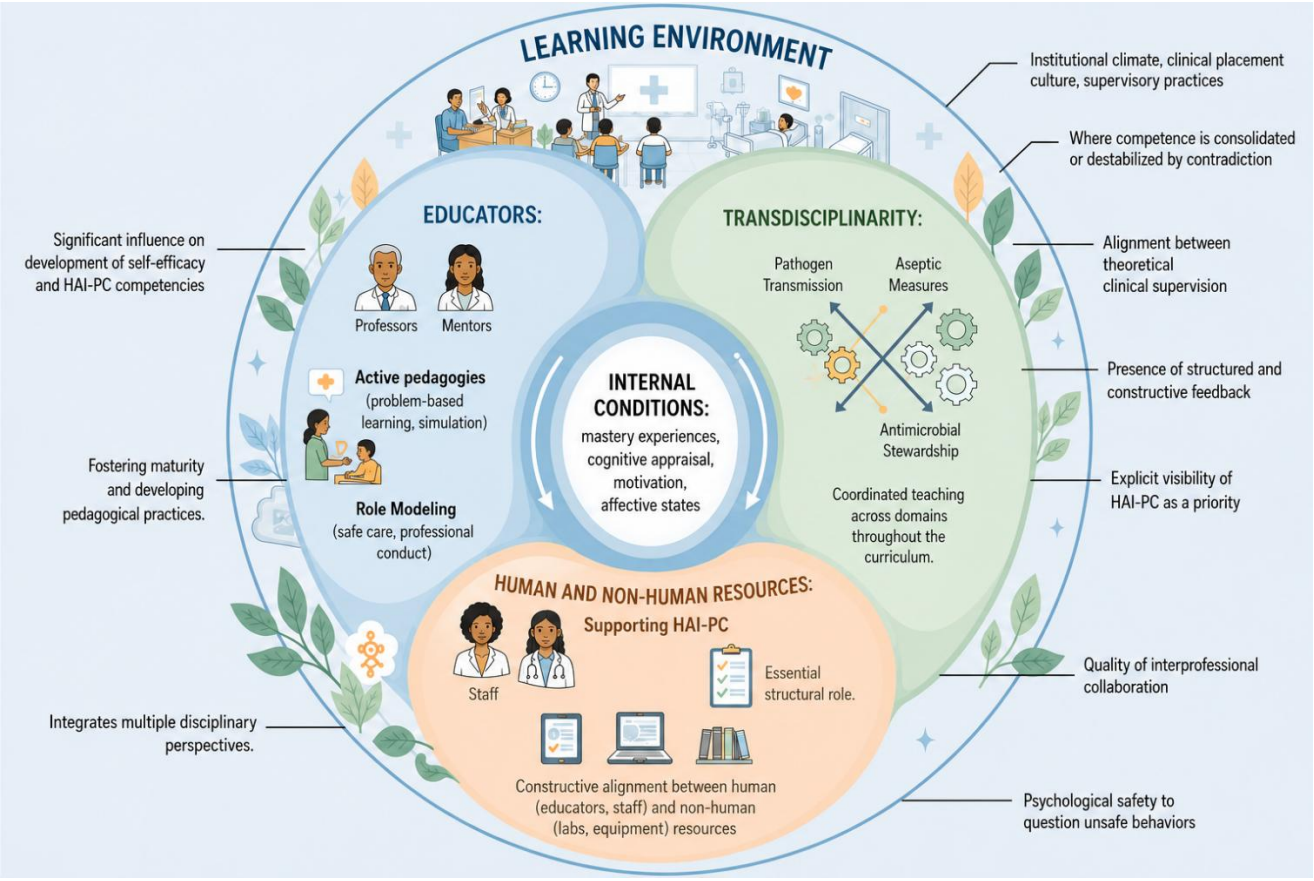

Figure 6 - Key Conditions for Students' Self-Efficacy and HAI-PC Competencies (AI-generated figure)

As the previous figure shows, students' self-efficacy is reinforced when they experience restricted and extended learning environments that align teaching, resources (both in the school and in the clinical settings), and professional standards (Amin et al., 2026; Benner et al., 2010; Yao et al., 2026). When alignment is present, the conditions for developing confidence are stronger, which facilitates the consolidation of the future professional identity.

Transdisciplinarity reinforces this process by bringing together different perspectives, promoting coherence across learning domains, and reinforcing the link between theory and clinical application, thereby supporting the internalization of professional norms and the development of HAI-PC competence (WHO, 2020; 2024). Another contribution to minimising this gap is brought by simulation. In fact, a pedagogical strategy implemented by educators requires a structured learning environment that anticipates real-life practice in a safe setting and, beyond safe procedural training, supports the development of clinical reasoning and decision-making skills, thereby better preparing students to adopt a reflexive attitude when transferring knowledge into practice.

To support the development of these competencies, the InfPrev4frica project also integrates structured simulation-based learning, in which realistic clinical situations are enacted through successive phases of preparation, performance, and debriefing.

Leadership and Safety Culture, Cultural Sensitivity and Ethics, Quality and Innovation: The Model's Third Layer

In the InfPrev4frica Model, this layer situates nursing education within a wider ethical, organisational, and relational environment that influences how safe practice is understood, enacted, and sustained, contributing to how self-efficacy and

competencies are developed and sustained. The focus is not only on what students know or can do procedurally, but on how they learn to act responsibly in contexts where safety, culture, ethics, quality, innovation, and leadership are deeply connected.

Students also need to internalize the values that guide sound judgement, respectful care, reflective action, and ongoing improvement. This is especially relevant in diverse and resource-constrained settings, where equitable and patient-centered care depends on the ability to respond ethically, flexibly, and with professional discernment.

Below, we explore the core values underpinning this layer. Through leadership, as a force that amplifies positive practice and helps translate institutional priorities into everyday practice, safety culture supports prevention and shared responsibility; quality assurance preserves consistency and improvement, while cultural sensitivity and ethics are requirements for humane and equitable care, and the moral basis of professional conduct. Innovation enables adaptation and renewal both at clinical and pedagogical levels (Figure 7).

Figure 7 – Core Values Underpinning the Model's Learning Environment (AI-generated figure)

Together, these elements create the conditions for students to learn, apply, and extend infection prevention and control in ways that are both professional and contextually grounded, contributing to strengthening the ongoing development of professional identity and the capacity to lead transformative change in practice.

Leadership and Safety Culture

Leadership plays a key role in making safety culture visible and effective. It does more than enforce orientations or set guidelines. It legitimises priorities, models accountability, sets direction, mobilises resources, and promotes adherence to IPC recommendations and, consequently, to outcomes for patients and staff (Braun et al., 2020). In this way, leadership shapes whether safety is genuinely enacted across academic and clinical environments or remains at the level of policy.

Safety culture is a multidimensional and complex concept that reflects an overarching commitment to quality and patient safety (Agency for Healthcare Research and Quality [AHRQ], 2019). It is shaped by shared individual and group beliefs, values, attitudes, perceptions, competencies, and patterns of behaviour (Joint Commission, 2017; AHRQ, 2019). Taken together, these dimensions constitute the shared orientation through which patient safety becomes embedded in everyday institutional life (Aiken et al., 2012; WHO, 2021b). This orientation is reflected in how people respond to risk, how errors are addressed, and how prevention is valued as part of normal practice. In IPC, this means that safe conduct must be treated as a professional responsibility rather than as an ideal reserved for optimal conditions.

Once again, the empirical work underpinning this model supports integrating a culture of safety into every nursing practice procedure to reduce or avoid harm to patients, with the participants stating that this means all activities to be done should be done

considering attitudes, values and perceptions that influence how a certain activity is actually done, rather than just how it should be done.

The relationship between safety culture and IPC is reciprocal. A strong safety culture supports the uptake of preventive measures, while successful implementation of those measures can further strengthen the culture of safety (Braun et al., 2020). For students, this means that safety should be presented as collective, expected, and non-negotiable. When that message is consistent, it becomes easier to internalize prevention as part of professional identity. Furthermore, interventions that modify safety culture, such as how health professionals engage with safety initiatives, can significantly affect their involvement in HAI-PC (Bernard et al., 2018).

Safety culture therefore helps stabilize self-efficacy by making safe action feel legitimate and feasible. All of this benefits from strengthened leadership capacities, which support students' growth by encouraging advocacy for safe care (Aiken et al., 2012; Frenk et al., 2010). Students who feel able to act responsibly are more likely to model good practice, influence peers, and contribute constructively within teams. In this sense, leadership links institutional governance to individual agency and gives the model an integrated direction towards its systemic and normative dimension.

To summarise, leadership serves as a consolidating and stabilising force for safety culture, which also helps stabilise students' self-efficacy, reinforcing the alignment between the elements at the core of the model and the learning environment. A self-efficacious student models best practices and influences peers, creating a positive cycle of behaviour.

Quality Assurance

Quality assurance comprises policies, practices, and review processes that enable institutions to monitor educational quality, identify gaps, and progressively enhance performance over time. In nursing education, it serves both an accountability function and a development role, helping to ensure that curricula, teaching strategies, and assessment methods remain consistent with professional expectations and evolving clinical realities (Connell et al., 2025; Melnyk & Fineout-Overholt, 2018; WHO, 2022a).

Central to sustaining HAI-PC competence, quality assurance ensures that educational processes remain responsive, coherent, and attuned to the realities of clinical practice. Through systematic evaluation, feedback, and curriculum review, institutions can assess whether students are developing the knowledge, skills, and professional judgements required to prevent HAIs effectively. Quality assurance is not merely an administrative requirement but a mechanism for maintaining the relevance and credibility of HAI-PC education over time.

Students should also cultivate a quality-oriented mindset. For students, robust quality assurance processes reinforce the message that HAI-PC is a valued and continuously monitored component of professional practice. When curricula are regularly reviewed, assessment criteria are transparent, and feedback is used constructively, students are more likely to trust the learning process and view their development as meaningful (Connell et al., 2025; Melnyk & Fineout-Overholt, 2018). This directly strengthens self-efficacy, as students gain confidence not only in their ability to perform HAI-PC tasks but also in their capacity to meet recognised standards of safe care.

Quality assurance also protects against drift between teaching and practice. Without ongoing review, even well-designed educational initiatives may lose coherence as

clinical expectations evolve. By contrast, when institutions embed a culture of continuous improvement, they strengthen both the institutional foundation for HAI-PC and learners' confidence in its consistent application. Thus, quality assurance serves as a sustaining force that supports self-efficacy and ensures that HAI-PC remains embedded in educational and clinical excellence.

Cultural Sensitivity and Ethics

Cultural diversity, a phenomenon of the contemporary world, requires culturally sensitive care. Integrating this concept helps students provide equitable, patient-centered, and humane care. The diversity of languages, beliefs, values, and social practices makes cultural sensitivity an essential condition for both nursing education and clinical care.

In this model, cultural sensitivity is understood not as a superficial acknowledgement of difference, but as a sustained capacity to engage respectfully and empathetically with people from diverse backgrounds, while integrating local knowledge into teaching and practice. It requires educators and students to recognise how culture shapes communication, learning, health-seeking behaviour, and responses to care, and to adapt educational and clinical approaches accordingly (Lowenstein & Christian, 2017; Sharifi *et al.,* 2019). When this sensitivity is present, care becomes more equitable, patient-centred, and humane, and education becomes more meaningful and contextually relevant (Lowenstein & Christian, 2017).

In teaching, it calls for methods that are responsive to local realities, languages, and learning needs, rather than relying on standardised approaches that may not resonate with students' lived experiences (Liwanag & Rhule, 2021; Santos et al., 2025; Sors et al., 2023). In clinical settings, it supports the delivery of HAI-PC in ways that preserve dignity,

respect privacy, and acknowledge social norms, even in environments such as shared wards where these values can be difficult to maintain. By grounding practice in cultural legitimacy, the model reinforces the idea that HAI-PC is rooted in the local context and is professionally necessary.

Ethics complements this perspective by providing the ethical foundation for action. It concerns the principles and values that guide behaviour, helping professionals distinguish between acceptable and unacceptable conduct in relation to patients, families, colleagues, and communities. In nursing, ethics is inseparable from empathy, adaptability, responsibility, and respect for human dignity. It also requires students to assume accountability for creating a safe, respectful, and healing environment, including HAI-PC. This responsibility becomes especially important in contexts marked by overcrowding, limited resources, and difficult working conditions, where ethical judgment is often tested by real-world constraints.

Within this framework, students must learn to understand IPC as part of their deontology, even when ideal conditions are absent. Ethics, in this sense, strengthens self-efficacy by broadening the question of whether students are able to perform a task correctly to whether they recognise their responsibility to ensure that care is safe, respectful, and just. Together, cultural sensitivity and ethics position HAI-PC as an expression of both contextual legitimacy and moral accountability (Singer, 2011).

Innovation

Conceptually, Innovation refers to the introduction and adaptation of new ideas, methods, or tools that improve learning, care, safety, and responsiveness to context (Flessa & Huebner, 2021). In the InfPrev4frica Model, it is a defining feature because it

allows education to remain flexible and relevant in settings marked by change and constraint.

Its circular structure signals that competence development is not linear or fixed but continuously shaped by changing educational and clinical realities. Innovation supports the introduction of new pedagogical strategies, teaching resources, and practice approaches that strengthen both learning and patient care (Kaba et al., 2025).

Innovation keeps the development of HAI-PC competence flexible, responsive, and steadily reinforced across contexts. Rather than treating learning as a fixed sequence, the model assumes that new pedagogical approaches and clinical experiences continuously reshape students' perceptions of what they can do. In this process, innovation helps transform uncertainty into capability and capability into confidence.

By introducing methods such as simulation, problem-based learning, digital tools, and peer-supported strategies, innovation broadens students' opportunities to practise and consolidate HAI-PC. These experiences are particularly important in resource-variable settings, as when students encounter flexible, realistic, and engaging learning environments, they are more likely to succeed, and these successes strengthen self-efficacy (Bandura, 1977).

It also sustains the model's cycle by enabling competence to be revisited, adapted, and deepened over time. As students move between classroom, simulation, and clinical practice, innovative approaches help maintain coherence between learning and application while addressing contextual constraints.

Extending to the development of practical solutions to challenges encountered in clinical settings is another contribution of innovative perspectives to HAI-PC. Students and educators can be encouraged to identify problems, generate contextually

appropriate responses, and test ideas that improve care delivery, infection prevention, and workflow organisation (Flessa & Huebner, 2021). Innovation is not limited to technology or pedagogy; it also includes creative problem-solving in everyday practice and the ability to translate emerging needs into workable improvements.

By stimulating this, innovation helps establish partnerships with relevant stakeholders, including healthcare institutions, educators, students, policymakers, and community actors. These collaborations broaden the scope of learning and create opportunities for co-designed interventions that are more likely to be sustainable and locally meaningful.

Within the InfPrev4frica model, innovation therefore supports not only pedagogical and clinical advancement; it also reinforces the model's dynamic movement, ensuring that self-efficacy continues to grow as students repeatedly translate knowledge into practice and strengthen the relationship-building and collective ownership of HAI-PC improvement.

Sustainability: The final Layer that Guarantees Continuity

This final layer completes the model by framing sustainability as the condition that enables its principles to endure beyond the life of a single initiative. The last concept added to the Model, sustained by the added value of the InfPrev4frica project, spans three years and includes equipment provision, academic exchanges, curriculum innovation, and this e-book development, aligned with societal needs. These efforts required significant resources, and, as partners defended, "it has to be sustainable, with sustainability being one of the model's layers."

Sustainability thus constitutes the layer that completes the illustrative image of the InfPrev4frica Model, while at the same time opening a perspective on sustained

continuity. Sustainability refers to institutional commitment, curricular integration, faculty support, and quality processes that enable continuity and implementation at the institutional level (Advance HE & Quality Assurance Agency for Higher Education, 2023), and it should extend beyond the duration of specific projects, whether funded or unfunded (Ankareddy et al., 2025; UNESCO, 2022). Sustainability determines whether competencies acquired during training are effectively institutionalized and transferred into routine educational and clinical practice (Advance HE & Quality Assurance Agency for Higher Education, 2023; UNESCO, 2022). However, this transfer needs to keep pace with changes in both epidemiological dynamics and health systems themselves. Institutions must monitor the updating of curricular content, informed by the most recent evidence.

For HAI-PC competencies to be sustainable, they must be embedded in curricular frameworks, faculty development initiatives, institutional policies and partnerships, namely with practice settings, as well as in the management of human and non-human resources, one of the dimensions associated with the development of both self-efficacy and the HAI-PC competencies referred to in another circle of the model.

Project-based innovations, such as simulation laboratories, new pedagogical approaches, or curriculum revisions, may generate short-term gains, but their long-term impact depends on structural integration and ongoing organisational commitment (Frenk et al., 2010; WHO, 2018b; WHO, 2022a).

Sustainability also depends on continuity of the workforce and of educational expectations (Ankareddy et al., 2025). In many SSA contexts, faculty turnover, workforce mobility, and resource variability may disrupt implementation. Mechanisms are therefore needed to preserve, over time, the acquisition and development of HAI-

PC competencies; standardise essential HAI-PC competencies across generational groups; ensure that clinical settings reinforce what is taught; and maintain continuity in clinical and school training. Sustainability turns HAI-PC competencies into a lasting institutional norm (Ogbolu et al., 2026).

In sum, the InfPrev4frica Model offers a coherent and adaptable framework for strengthening HAI-PC education by linking student self-efficacy, pedagogical support, learning environments, institutional culture, and sustainability. Built from and for the realities of SSA, it provides a pathway for transforming educational intent into sustained competence and safer clinical practice.

To illustrate the operationalisation of this model, the fictional journey of an educator through its different layers is presented below, showing how its principles can be experienced, interpreted, and implemented in real educational settings.

Walking Through the InfPrev4frica Model: An Educator's Story

Ravo, an educator from SSA, began preparing a lesson on PPE with the students' development in mind. His aim was not only to teach infection prevention and control but also to support the growth of self-efficacy and the organised acquisition of knowledge, both of which form a foundation for HAI-PC competence. For that reason, he chose active methodologies rather than a lecture-based approach, using guided discussion, short case prompts, and problem-solving questions to encourage students to think, compare, and justify their choices.

The lesson opened with the theory behind personal protective equipment and its role in reducing healthcare-associated infections. Ravo then presented a clinical scenario involving a patient requiring contact precautions and asked the students to determine

which PPE items were needed, when they should be used, and why. Rather than providing immediate answers, he encouraged reflection and debate. This made the classroom a space for active learning, where students were not passive recipients of content but participants in constructing knowledge.

As the discussion evolved, Ravo considered how best to bring the clinical world closer to the classroom. He thought about inviting clinical supervisors and mentors to attend the simulation, so that students could hear the expectations of those who guide practice on the ward and see how theory and practice connect. He also wondered whether it might be better, or at least equally valuable, to take students first into the clinical setting for observation. Perhaps both experiences would be needed at different moments: simulation to rehearse safely, and observation in context to compare what was taught with what was actually done. That uncertainty was part of his pedagogical reflection, because the best choice would depend on the learning objective, students' readiness, and the clinical environment.

As the students entered the clinical skills laboratory, the scenario took shape. Some hesitated before selecting gloves, gowns, masks, or face shields, while others moved too quickly. Ravo paused the activity and posed questions that linked procedure to clinical judgment and reflection:

- What changes if the patient needs only contact precautions?
- What happens if supplies are limited? How do the patient's condition and the environment influence the choice of protection?
- In this way, simulation became more than rehearsal; it became a structured space for reasoning, confidence-building, and decision-making.

Ravo also paid close attention to the learning environment. He deliberately slowed the pace, allowing mistakes to be discussed without shame and treating uncertainty as part of learning. When one student admitted never having considered contamination during gown removal, he treated the comment as a learning opportunity rather than a failure. He knew that psychological safety was essential for students to speak openly, test ideas, and build confidence.

The lesson also emphasised transdisciplinarity and resources. Ravo moved beyond the technical steps of PPE use to include microbiology, patient safety, workflow, and the reality of limited supplies. He ensured that the materials used in the simulation closely mirrored clinical practice, as learning would be less meaningful if the classroom materials felt disconnected from the ward. In this way, students could see PPE not as an isolated skill but as part of a wider system of knowledge and practice.

Later, during clinical placement, Ravo observed how powerful the real environment shaped learning. When he saw a staff member entering a patient room without changing PPE between tasks, he was reminded that students learn not only from what is taught, but also from what is modelled. He chose to intervene respectfully, using the moment to restate the rationale for safe practice and to preserve coherence between classroom teaching and clinical reality. At the same time, he became aware that individual teaching efforts depended on broader institutional forces. Safety culture, leadership, ethics, and cultural sensitivity all influenced whether infection prevention was treated as a shared responsibility or as a negotiable rule (Figure 8).

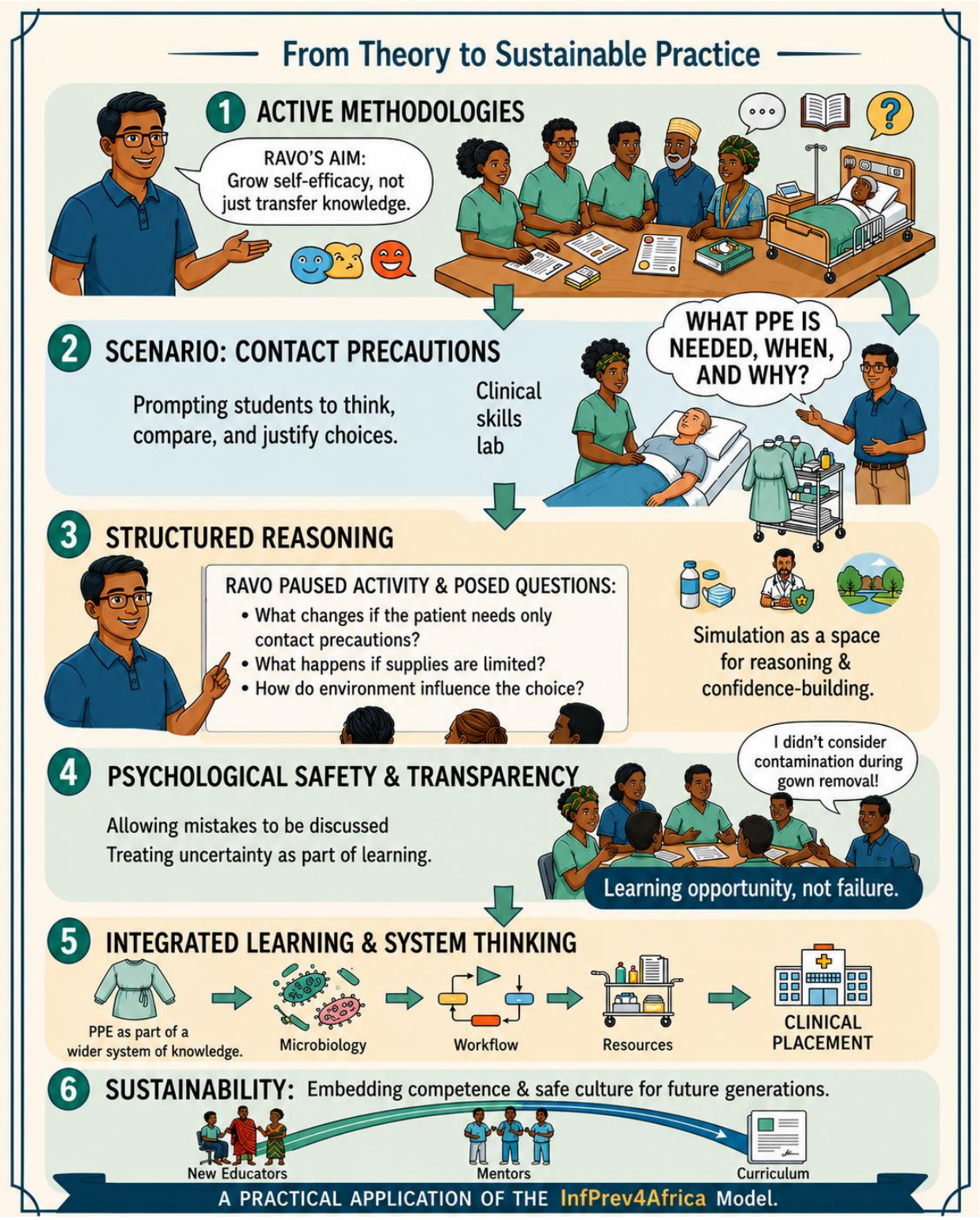

Figure 8 - A practical Application of the InfPrev4frica Model (AI-generated figure)

For Ravo, sustainability was the final concern. It was not enough for students to perform well in a single simulation or placement. He needed to know whether new educators would teach the same principles, whether clinical partners would continue to reinforce them, and whether the curriculum would keep HAI-PC visible over time. Sustainability meant embedding competence within the institution so that future cohorts would inherit a stable culture of safe practice.

By the end of this journey, Ravo had done far more than taught PPE use. He had guided students through the model's layers, from theory to simulation, from classroom to clinical settings, and from immediate learning needs to long-term sustainability. What began as a lesson on personal protective equipment became a lived example of how the InfPrev4frica Model works in practice.

2.3 How can the model support Nursing education in Sub-Saharan African countries?

Andriamiharisoa Stephanie Norotiana & Tovohandraina Hobiherinjato Jhonse

During their integration into the healthcare system, nursing students encounter multiple challenges inherent to confronting clinical reality. The transition from student to professional is frequently described as a period of "transition shock" marked by stress and role adaptation difficulties (Duchscher, 2009). Furthermore, the persistent theory–practice gap in nursing education affects the integration of knowledge and clinical performance (Maben et al., 2006). This situation is particularly evident in institutions within SSA, where structural constraints, workforce shortages, and limited educational resources may intensify these challenges (Frenk et al., 2010; WHO, 2018b).

In this regard, it is essential to provide adequate support and equip newly qualified nurses with context-specific competencies that enable them to perform effectively within the healthcare environments of SSA, while ensuring the delivery of high-quality care (Benner, 2010; Frenk et al., 2010).

In recent years, several studies have focused on improving pedagogy and andragogy in health education. Authors have consistently highlighted that the gap between theoretical teaching and clinical practice affects knowledge integration and professional readiness (Ajani, 2011). Educational innovation grounded in experiential learning and constructive alignment has been proposed as a strategy to bridge this gap (Kolb, 1984). Reforming and strengthening curricula in HEIs are therefore essential to improve HAI-PC practices.

The InfPrev4frica project, through a qualitative study conducted in four HEIs in SSA countries, designed a pedagogical model suited to the SSA context. This model aims to foster innovation in teaching and improve the acquisition of IPC-related competencies. It aligns with evidence-based education principles and promotes the development of self-efficacy and clinical reasoning skills (Benner, 2010; Melnyk & Fineout-Overholt, 2018).

The InfPrev4frica Model facilitates nursing students' learning of best practices in HAI prevention and AMR stewardship. It encourages awareness, critical reflection on maladaptive clinical practices, and the development of innovative solutions. Strengthening nurses' competencies in IPC and AMR is fundamental to improving patient safety and quality of care outcomes (Aiken et al., 2012; WHO, 2022a).

Simulation plays a central role in the pedagogical pathway proposed by the InfPrev4frica Model. SBL has demonstrated effectiveness in enhancing clinical

competence, decision-making skills, and safe practice behaviours in nursing education (Cant & Cooper, 2010; Hayden, 2014; Jeffries, 2016). By recreating realistic clinical scenarios in a controlled environment, simulation bridges theory and practice while promoting reflective and critical thinking (Lateef, 2010).

The combination of innovative pedagogical tools supports the critical analysis of clinical realities that may lead to adverse events related to HAI and AMR. Strengthening safety culture, leadership, and evidence-based practice directly improves patient outcomes (Institute of Medicine, 2000; Singer et al., 2003; WHO, 2021b).

Graduated students, as future health professionals, are thus expected to contribute to improved quality and safety of patient care, positioning themselves at the forefront of HAI prevention and AMR stewardship. Simultaneously, educators benefit from an innovative pedagogical model that facilitates the structured integration of IPC competencies into nursing curricula.

Simulation as a pedagogical strategy has a significant role in the pathway proposed by the InfPrev4frica Model, and the proposed Simulation Scenarios will offer students, teachers, and tutors/mentors a connection between the real-world clinical settings in SSA and students' reflexive and critical thinking skills, alongside clinical decision-making trained in a safe learning environment (Cant & Cooper, 2010; Jeffries, 2016; Lateef, 2010). The combination of these innovative pedagogical tools will enable critical analysis of realities that can lead to adverse events related to HAI and AMR, enhancing students' knowledge and skills in this area (Institute of Medicine, 2000; WHO, 2021b).

From the nursing educator's perspective

Educators agreed that the InfPrev4frica Model strengthens SSA HEIs to educate nursing students for sustainable and innovative IPC practices. To support their opinion, educators described the interest of the domains and specific concepts constituting the Model (Santos et al., 2025):

1. The InfPrev4frica Model is focused on student-centered learning

- Instructors had a positive opinion about the model, which is focused on student engagement and self-efficacy in learning, particularly in IPC (Kolb, 1984; Jeffries, 2016).
- The model is suitable for both learning and teaching. Lecturers said, "…*There are adopted issues from the National guideline together with WHO recommendations, but also it will be suitable for both lecturers and students*…"

2. About the integration of theory and practice

- Participants agreed that the model fosters the integration of theory and practice. It guides teachers in using clear learning objectives and structured content to improve skill acquisition and reduce the gap between theory and practice (Ajani & Moez, 2011; Maben et al., 2006).
- The linkage between concepts and domains will improve the integration of knowledge and competences of students and nurses, in terms of prevention and control of HAI, and the emergence of antibiotic-resistant bacteria.
- The lecturers said, "*The domains that have been mentioned in the model are sure to link very well because they have touched on the side of culture and the environment, and the type of resources to be available at the facility level.*"

3. The InfPrev4frica Model:

- Enhances the importance of evidence-based approaches for teaching according to the SSA context. The Model highlighted that the availability of some pedagogical equipment, such as a simulation laboratory, fosters the acquisition of skills. The innovative pedagogy increased engagement and preparedness for the clinical setting (Cant & Cooper, 2010; Hayden et al., 2014; Melnyk & Fineout-Overholt, 2018).
- Its potential is to improve the HAI-PC. Participants expressed optimism about the model's potential to improve IPC in healthcare settings and positively impact patient outcomes.
- Encourages safety and quality in practices. Working closely with quality assurance teams ensures high standards of care and adherence to evidence-based practices (Institute of Medicine, 2000; Singer et al., 2003; WHO, 2021b).
- Promotes a safety-first culture, particularly in infection prevention (WHO, 2022a).
- Inspires leadership and decision-making. Leadership is a key driver of successful HAI prevention strategies. The model fosters leadership development among students, particularly in infection control and prevention. The model encourages decision-making that is informed by both theory and practice in IPC (Aiken et al., 2012; Singer et al., 2003).
- Was designed based on the teachers' and students' opinions from SSA institutions, to ensure its applicability and its inclusivity. The model is flexible and adaptable to different regions of our country.

From the educator's perspective, the Model encourages them to develop an innovative strategy. It supports SSA HEIs in using evidence-based learning focused on the student.

Through clear learning objectives and structured curriculum content, educators could reduce the gap between training and practice, especially in the IPC topic.

From the nursing students' perspective

Students expressed appreciation for the InfPrev4frica Model's emphasis on fostering their engagement and enhancing self-efficacy, particularly in learning within IPC (Santos et al., 2025).

They enhanced the importance of practice for the integration of the knowledge, they said, *"Learning should include practical because it will be different. If you teach only theoretically, it will not be easy to grasp, but if a person works practically, it is easy to remember. "*

All domains of the Model encourage collaboration and teamwork. The model supports teamwork across healthcare domains and among educators and students. The transdisciplinary approach across various healthcare disciplines fosters the integration of knowledge and practice (Frenk et al., 2010; WHO, 2021b):

- The InfPrev4frica Model is suitable for the four SSA institutions. According to the students, it is easy to apply for teaching and for learning.
- The model respects and incorporates diverse cultural perspectives and learner backgrounds, ensuring inclusivity in healthcare education (Liwanag & Rhule, 2021; Sors et al., 2023).
- Some students said, "*...on the issue of cultural sensitivity in the community, we have different cultures, so it has also touched on people's culture."*

Nursing students' perspectives indicate that the InfPrev4frica Model is a multi-model approach with effective strategies for capacitating academic and clinical teachers and students to improve HAI prevention (Santos et al., 2025).

The Model guides teachers on best practices for transmitting knowledge, with clear objectives and an innovative approach.

The students agreed that the InfPrev4frica model brings innovation and strengthens the acquisition of skills in terms of HAI-PC (Cant & Cooper, 2010; Jeffries, 2016).

All domains of the Model are integral to ensuring innovative teaching and learning and to fostering students' self-efficacy in HAI-PC competencies.

In sum, the InfPrev4frica Model supports WHO's priority for the IPC and promotes active learning, relevance, and skill development by improving HAI-PC competencies in Nursing school. The Model provides patients and health workers with safety by increasing engagement and preparedness in clinical settings.

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Chapter 3:

Competence development in HAI Prevention and AMR stewardship through Simulation

3.1 Simulation-Based Learning: Concepts, Approaches, and Benefits

Jane Januarius Rogathi & Paulo Lino Kidayi

According to Lateef (2010), SBL is a learning approach that integrates real-world scenarios into a learning environment to help learners develop skills, knowledge, and attitudes through repeated practice and feedback without the risk of real-world consequences. Simulation has also been described as a strategy to support safe learning and competency development in healthcare education (Gaba, 2004; Jeffries, 2016).

SBL may use several approaches, depending on the available resources and the competencies which the student is required to develop. The approaches include role-playing, mannequin-based simulations (low- or high-fidelity), computer-based simulations, Virtual Reality or Augmented Reality, Scenario-Based Learning, Game-Based Learning/Serious Games, and Hybrid Simulations.

Role-playing occurs when learners act out specific roles in real-life scenarios (e.g., doctor-patient, teacher-student). Encourages empathy, communication, and decision-making skills (Bandura, 1977; Jeffries, 2016). Mannequin-Based Simulations are common in healthcare and emergency response; they use programmable mannequins to simulate human responses, and also High-fidelity versions simulate breathing, heartbeats, and even childbirth (Alinier et al., 2006; Hayden et al., 2014). Computer-Based Simulations use virtual scenarios with interactive elements, used for procedural and decision-making practice (Stenseth et al., 2025). Virtual Reality/ Augmented Reality, this method allows interaction with a 3D virtual environment. Used in fields like medicine, engineering, aviation, and defence (Schippers et al., 2025). Scenario-Based Learning uses Structured stories or case studies to simulate real-world

problems. Learners navigate through decisions and outcomes (often in branches) (Lee & Yang, 2025). Hybrid Simulations combine multiple methods, such as mannequins and role-play or virtual reality and case-based scenarios (Jeffries, 2016).

Specifically focusing on nursing education, SBL has become a transformative approach, offering students realistic, hands-on experiences that bridge the gap between theoretical knowledge and clinical practice (Alinier et al., 2006; Jeffries, 2016; Lateef, 2010). It involves the use of simulated clinical scenarios, ranging from low-fidelity models to high-fidelity manikins and virtual simulations to replicate real-life patient care situations in a safe, controlled environment (Schippers et al., 2025; Stenseth et al., 2025).

As healthcare becomes more complex, SBL equips nursing students with the necessary clinical skills, critical thinking, and decision-making abilities required for effective patient care (Fawaz et al., 2018). It allows learners to practice procedures, manage emergencies, and develop communication and teamwork skills without the risk of harming real patients.

Simulation in nursing education supports competency-based training, encourages active learning, and fosters student confidence by providing opportunities for repetition, reflection, and immediate feedback (Fey & Jenkins, 2015; Jeffries, 2016). It also helps educators assess student performance and identify areas for improvement.

By integrating SBL into curricula, nursing programs enhance student readiness for clinical settings, ensuring that future nurses are better prepared to deliver safe, efficient, confident, and compassionate care to clients and patients (Gaba, 2004; Jeffries, 2016).

SBL is underpinned by several well-established educational theories that emphasise experiential learning, constructivism, and social learning. Rooted in constructivist and experiential learning theories (Jeffries, 2016; Kolb, 1984), SBL creates safe, structured

environments where learners can engage in realistic clinical scenarios without putting patients at risk.

Experiential Learning Theory (Kolb, 1984) posits that learning is a process whereby learning occurs through a four-stage cycle: concrete experience, reflective observation, abstract conceptualization, and active experimentation. Simulations provide learners with concrete experiences and structured opportunities to reflect and experiment, thereby fostering deep learning. Constructivist Learning Theory asserts that learners build knowledge through experiences and interactions with their environment. SBL aligns with this theory by immersing learners in realistic scenarios that require active problem-solving and critical thinking. By engaging in simulations, learners construct knowledge in context, leading to greater retention and transferability (Jonassen & Rohrer-Murphy, 1999). Social Learning Theory (Bandura, 1977) highlights the importance of observational learning, imitation, and modelling.

Simulation often involves group work, peer observation, and role-playing, facilitating social learning processes. Learners gain insights not only through their own actions but also by observing others and receiving feedback. Situated Learning Theory (Lave & Wenger, 1991) posits that knowledge is best acquired in contexts that reflect its application. SBL places learners in authentic settings that simulate real-world tasks and environments. This helps learners understand how knowledge and skills apply in practical situations.

SBL has been widely validated in research across various educational settings. Numerous studies have demonstrated its effectiveness in enhancing knowledge retention, clinical reasoning, communication, confidence, and teamwork. SBL has been shown to

significantly improve both cognitive and psychomotor skills, especially when combined with structured feedback and opportunities for repeated practice (Stenseth et al., 2025).

By exposing learners to complex, real-life scenarios, SBL fosters critical thinking and prepares nursing students to make sound decisions in high-pressure clinical environments. Evidence from comparative studies indicates that nursing students engaged in simulation training demonstrate higher levels of clinical reasoning than those in traditional programs (Shinnick et al., 2012). Moreover, SBL boosts learner self-efficacy, helping students feel more confident and less anxious in real-world practice (Alinier et al., 2006; Malya et al., 2025a; Malya et al., 2025b).

SBL is also effective in fostering interprofessional collaboration, with simulations frequently integrating role-play and team-based scenarios that strengthen communication skills. Importantly, the safe and controlled nature of simulation allows students to identify and correct errors, ultimately leading to enhanced patient safety, reduced medical errors, and improved patient outcomes (Weinstock et al., 2009). Simulation-based interventions have also demonstrated positive effects on infection prevention and control practices, including adherence to hand hygiene (Lee & Yang, 2025; Rocha et al., 2025).

3.2 Applying SBL in Nursing Education for IPC and Antimicrobial Stewardship

Chuck Christina Mtuya & *Jane Januarius Rogathi*

SBL is particularly well-suited to strengthening nursing students' competencies in HAI-PC and AMS. These areas require integrating technical skills, ethical decision-making,

and interprofessional collaboration, which align closely with the experiential, reflective, and team-based nature of simulation pedagogy (Jeffries, 2016; Kolb, 1984).

The complexity of HAI-PC and AMS content—such as evolving pathogens, global health threats like AMR, and rigorous clinical protocols—demands training methods that go beyond traditional classroom learning. SBL provides immersive, realistic clinical experiences that allow students to apply theoretical knowledge to challenging, high-risk scenarios. These scenarios build procedural knowledge (e.g., hand hygiene or PPE use) and foster the development of clinical reasoning, prioritization, communication, and advocacy in infection control situations (Gaba, 2004; Lateef, 2010).

In the context of the InfPrev4frica project, SBL was strategically applied to bridge the persistent gap between infection control theory and practice in SSA nursing education. The pedagogical model developed through the project promotes SBL as a method for enabling students to practice in clinical scenarios (see Appendix I). In InfPrev4frica, twelve simulation scenarios were co-developed by partner HEIs (see Appendix II), focusing on high-priority topics in HAI prevention and AMS:

- Aseptic Technique while Performing Open-Wound Dressing;
- Equipment Decontamination for Surgical Procedures;
- Hand Hygiene in Performing Intravenous Medication Administration;
- Infection Prevention and Control during Leg Wound Haemorrhage Procedure;
- Infection Prevention and Control during the Management of Hospital Waste Triage;
- Infection Prevention and Control during Neonatal Resuscitation;
- Infection Prevention and Control during the Patient's Urinary Catheterisation;
- Prevention of Infection in Performing Peripheral Intravenous Catheterisation;
- Prevention of Respiratory Tract Infection during Sputum Suction in Pediatric Patients;

- Safety Procedures during Intravenous Medication Administration;
- Sharp Injury Prevention during Parenteral Medication Administration;
- Use of Personal Protective Equipment in the Face of Airborne Risk.

SBL in these contexts not only improves technical competence but also strengthens decision-making, teamwork, and adherence to patient safety protocols, thereby preparing nursing students to respond effectively to infection-control challenges in real-world healthcare settings (Jeffries, 2016; Sittner et al., 2015).

These scenarios offer a safe space for students to experience challenges related to HAI-PC, decision-making in uncertain or resource-limited conditions, and communication with colleagues and patients. The debriefing component after each simulation is crucial for reflective learning, helping participants identify what went well, what could be improved, and how to transfer these insights to real clinical practice (Fey & Jenkins, 2015).

Several studies support the use of simulation in HAI-PC and AMS training. For example, a study by Lee & Yang (2025) found that simulation training significantly improved compliance with infection control protocols among nursing students. In Tanzania, students perceived simulation-based education positively and reported gains in confidence and clinical reasoning (Malya et al., 2025a; 2025b). In a study using virtual reality as a simulation-based learning method, researchers in the Netherlands also showed that knowledge, attitudes, and practice improved (Schippers et al., 2025). In SSA, the studies also show that SBL improves compliance with HAI-PC among nurse educators and students (Rocha et al., 2025). Another study in Tanzania indicates that SBL strengthens students' confidence and reasoning, both critical components of infection-prevention competency in clinical practice (Malya et al., 2025).

3.3 Designing, Implementing, and Evaluating Simulation Scenarios

Jane Januarius Rogathi & Paulo Lino Kidayi

The design and implementation of simulation scenarios in InfPrev4frica followed best international practices and were adapted to local educational realities. Scenario development was guided by a structured planning process that included establishing clear learning objectives, aligning with curricular outcomes, and using contextually relevant materials (see Appendix I). This ensures that simulations are pedagogically sound and lead to measurable improvements in knowledge, skills, and professional behaviours (Jeffries, 2016; Sittner et al., 2015).

Planning Phase

The scenario development process adhered to the principles described by Hayden et al. (2014) and Sittner et al. (2015), and included the following key planning considerations:

- Clearly defined learning objectives, stating the content and/or competencies that students should know or be able to do after the simulation (e.g., applying standard precautions, recognising inappropriate antibiotic use).
- Scenario Fidelity: including a mix of low-, medium-, and high-fidelity tools, including mannequins, role-play, and virtual simulations. Fidelity was selected based on the intended learning outcomes and contextual feasibility, rather than technical sophistication alone (Alinier et al., 2006; Jeffries, 2016).
- Contextual and cultural relevance, specifically, the content should reflect common or high-risk HAI-PC/AMS challenges that nurses encounter in local settings, such as

managing multi-drug- resistant infections, executing isolation procedures, disinfection, and sterilisation of equipment.

- Role clarity, wherein students were assigned defined roles (e.g., nurse, infection control practitioner, pharmacist, or medical doctor) to encourage interprofessional thinking and collaborative problem-solving (Bandura, 1977).
- Briefing and psychological safety, so that each simulation began with an introduction to the scenario, clarified roles and expectations, and reinforced professional behaviour (Jeffries, 2016).
- Ethical considerations to respect student dignity and learning diversity, and to reflect the ethical complexities of HAI-PC and AMS practices in clinical care.

The InfPrev4frica scenarios addressed both technical procedures (e.g., insertion of an IV line, wound dressing) and non-technical skills (e.g., communication, clinical reasoning, prioritisation). The scenarios were planned based on the activities described below and were iteratively reviewed and piloted at each institution.

Scenario design and development began with identifying the core purpose of the simulation (e.g., HAI-PC skills in using PPE; development of critical thinking around AMS decisions and antibiotic use; or communication skills in teamwork on HAI-PC or AMS). The formulated objectives should adhere to the framework SMART (i.e., Specific, Measurable, Achievable, Relevant, and Time-Bound).

A needs assessment was then conducted. Namely, the learner needs were evaluated, as well as the curriculum gaps, and institutional priorities (e.g., What do students struggle with in IPC/AMS? What competencies must be reinforced based on current clinical trends? – e.g., rising AMR, infection outbreaks). Moreover, stakeholders such as infection control nurses, pharmacists, and clinical educators were consulted.

Accordingly, the selection of simulation modality and fidelity types was carried out. This involved choosing the type and fidelity of the simulation best suited to the objectives (e.g., Low-Fidelity, Medium-Fidelity, or High-Fidelity) and depending on the available resources in the setting (Alinier et al., 2006; Hayden et al., 2014).

Thereafter, the development of scenario content was performed. The team outlined the clinical narrative and timeline it included, namely: patient background (e.g., age, diagnosis, history of antibiotic use), presenting symptoms or events (e.g., fever, rash, culture results), expected learner actions (e.g., initiating isolation, contacting the AMS team) and embedded challenges or "curveballs" (e.g., a colleague not following hand hygiene). When developing content, it is important to include cues, prompts, or data (e.g., lab values, EHR entries) that students must interpret and comply with.

The logistics and resources plan outlines the practical elements, including location, facilitators, materials, and timing.

While designing the scenario, the team ensured alignment with the curriculum and standards. The materials should align with the Nursing competency frameworks and national and international competencies for HAI-PC and AMS guidelines and standards (Sittner et al., 2015). Moreover, the scenarios were developed to align with the curriculum course outlines and the expected results of the local certification and regulatory authorities.

A monitoring plan was developed in accordance with the institution's regulations to measure success. Particularly in SBL, it usually focuses on learner self-assessment or confidence scales, facilitator checklists and performance rubrics, knowledge quizzes, and reflection journals or peer feedback (Fey & Jenkins, 2015; Jeffries, 2016). All of this can be applied to the learner's review process.

Implementing the Simulation Scenarios

The implementation of the simulation scenarios in InfPrev4frica took into account various logistical realities, such as space availability, equipment access, and group size. Flexible approaches were adopted to ensure inclusivity and practicality; for instance, peer role-play and task trainers were used when high-fidelity mannequins were unavailable. Educators received preparatory training on both the content and the technical aspects of simulation facilitation, including how to manage unexpected learner responses and maintain the flow of the session (Jeffries, 2016; Sittner et al., 2015).

To maximise learning, several strategies were emphasised:

- Facilitator preparation: Instructors were trained to guide simulations, manage group dynamics, and create psychologically safe learning environments (Jeffries, 2016);
- Student engagement: Learners were encouraged to actively participate, communicate, and make decisions in real-time, rather than passively performing tasks (Kolb, 1984);
- Technical considerations: Equipment, simulation spaces, and audiovisual tools (when applicable) were tested in advance to avoid disruptions;
- Psychological safety: Mistakes were framed as learning opportunities, not failures, reinforcing an environment where students felt safe to explore and improve (Fey & Jenkins, 2015).

1. Briefing/Prebriefing

A successful simulation begins with a structured briefing, which sets the tone and prepares learners mentally and emotionally. Key components of briefing include:

- Establishing psychological safety: Reassure learners that the simulation is a safe space for learning, not judgment;
- Clarifying objectives: Reiterate the learning outcomes and what students are expected to focus on (e.g., initiating isolation, responding to antibiotic misuse);
- Explaining roles and context: Define student roles (e.g., nurse, infection control officer) and provide the clinical background of the patient or case;
- Reviewing rules and environment: Familiarise students with the equipment, layout, timing, and any technical or simulation-specific expectations (Jeffries, 2016; Sittner et al., 2015).

2. Running the Simulation

During the active simulation, the goal is to immerse learners in a realistic and challenging scenario. Key practices include:

- Facilitator role: Instructors may observe silently, offer cues, or portray roles (e.g., physician or family member) to enhance realism;
- Learner autonomy: Allow students to assess, decide, and act as they would in a clinical setting. Avoid over-coaching unless safety or learning breakdowns occur;
- Adaptability: Be prepared to adjust the scenario based on student responses or technical issues;
- Scenario fidelity: Maintain realism through props (e.g., PPE stations, mock medications), clinical documentation, and role-played behaviours (e.g., a colleague refusing hand hygiene) (Alinier et al., 2006; Gaba, 2004).

3. Monitoring Learner Performance

During the simulation, facilitators assessed learner actions against the intended learning outcomes. Checklists or rating scales were used to evaluate adherence to IPC protocols, the appropriateness of procedures, communication skills, and timely clinical decision-making (Sittner et al., 2015).

4. Managing Real-Time Challenges

In dynamic simulations, students may experience stress, confusion, or emotional responses. Facilitators monitored signs of distress and paused the simulation if necessary. In cases of silence or disorganisation, facilitators encouraged communication and fostered teamwork. Teaching was avoided during the simulation to preserve realism unless absolutely necessary for safety or clarity (Jeffries, 2016).

At the end of the simulation, learners were given a brief moment to decompress. They were then guided out of their roles and prepared for the debriefing session. Water, seating, and privacy were provided to support emotional and cognitive readiness.

5. Debriefing and Reflective Practice

Following each simulation, structured debriefing sessions were conducted to promote reflective learning. These sessions appreciated the development of the scenario, identified strengths and areas for improvement, and helped students process emotional reactions, especially after critical scenarios (Fey & Jenkins, 2015).

Three types of debriefing approaches were considered (Fey & Jenkins, 2015; Jeffries, 2016; Sittner et al., 2015; Gaba, 2004; Lateef, 2010):

1. Operational debriefing – focusing on tasks and scenario objectives.

2. Psychological debriefing – attending to learners' emotional responses.
3. Educational debriefing – used most commonly to foster clinical reasoning and decision-making.

Debriefing was closely linked to reflective practice, a core aspect of the simulation experience. Reflective practice is the process of thoughtfully considering one's own experiences in applying knowledge to practice, with the goal of continuous learning and self-improvement (Kolb, 1984; Jeffries, 2016; Fey & Jenkins, 2015). The aim is to deepen understanding of one's actions and outcomes, to foster professional growth and critical thinking, and to improve future practice through insight and self-awareness. Models used included, as suggested by Kolb (1984), Jeffries (2016), and Fey and Jenkins (2015):

- Gibbs' Reflective Cycle (Description → Feelings → Evaluation → Analysis → Conclusion → Action Plan)
- Kolb's Experiential Learning Cycle (Experience → Reflection → Conceptualization → Experimentation)
- Schön's Reflection-in-Action and Reflection-on-Action

These frameworks supported learners in analysing their actions, understanding outcomes, and identifying opportunities for professional growth (Kolb, 1984).

Assessment and Sustainability Phase

In SBL, the assessment of learner outcomes involves both formative and summative approaches to track student progress and competency (Jeffries, 2016; Sittner et al., 2015). Formative assessments provide immediate feedback during or after simulations to guide learners in improving their skills without impacting grades. Summative assessments, on the other hand, measure whether learners have met the

simulation's objectives and may be used for grading or certification. Various assessment tools — such as checklists, rating scales, reflective journals, self- and peer evaluations, and pre-/post-simulation quizzes, offer a comprehensive view of student performance, especially in critical areas like HAI-PC and AMS (Fey & Jenkins, 2015).

Monitoring strategies implemented in the InfPrev4frica project included:

- Formative assessment, which entailed ongoing feedback during the simulation experience to guide learning.
- Monitoring assessment, comprising structured tools such as checklists or rubrics to assess skill performance and decision-making.
- Self and peer reflection, through which learners were encouraged to engage in metacognitive reflection by reflecting on their own and others' performance (Kolb, 1984).
- Pre-/post-testing of knowledge or confidence, which was measured before and after simulations to track learning gains (Shinnick et al., 2012), used here to evaluate the scenarios developed.
- Long-term impact, assessed through institutions' follow-up evaluations, to evaluate knowledge retention and the application of skills in clinical practice.

Performance metrics further strengthened this process by focusing on key competencies, including the accuracy of clinical decisions, the use of structured communication frameworks such as ISBAR, and adherence to protocols and ethical standards.

Sustainability was also a core consideration. To ensure SBL becomes a long-term, scalable component of nursing education, partner HEIs implemented the following strategies:

- Faculty development includes training educators in simulation facilitation and debriefing techniques (Fey & Jenkins, 2015; Jeffries, 2016);
- Resource optimisation by utilising cost-effective materials such as reusable task trainers and virtual simulation platforms (Weinstock et al., 2009):
- Institutional integration through the embedding of simulation into curricula and student assessment (Hayden et al., 2014);
- Administrative engagement to demonstrate the impact of SBL on learning outcomes and patient safety to secure institutional support;
- Continuous quality improvement through the establishment of a feedback loop for scenario updates and tracking student performance over time to ensure relevance and impact (Sittner et al., 2015).

Student and faculty feedback gathered during the piloting process affirmed the value of simulation in enhancing learning outcomes, reinforcing core concepts, and increasing student motivation (Malya et al., 2025). As a result, partner HEIs are now working to incorporate SBL more systematically into their infection prevention curricula.

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Chapter 4:

Strategies for Implementing the InfPrev4frica Model and Outputs in Nursing Curricula

4.1 Organisational - Level Strategies

RANDRIAMANANTSOA Lova Narindra, ANDRIAMALALA Ony Zo Lalaina, Rose Mjawa Laisser & Livuka Nsemwa

Implementing the InfPrev4frica model requires a systemic, whole-of-institution transformation that goes beyond incremental curricular adjustment. This transformation aligns governance, curriculum design, assessment systems, clinical partnerships, and resource planning so that IPC and AMR become explicit graduate outcomes - defined, taught, assessed, audited in clinical placements, and continuously improved - rather than remaining peripheral or elective content.

From an implementation perspective, this strategy is grounded in Implementation Science, drawing on the Consolidated Framework for Implementation Research (CFIR) to address the inner setting of HEIs - leadership engagement, organisational readiness, implementation climate, and learning culture - so that IPC/AMR education is not dependent on individual champions or short-lived projects (Damschroder et al., 2009). Complementing this system's lens, evidence on IPC workforce capability indicates that effective competency improvement may be supported by structured, organisation-level approaches that integrate educational, managerial, and practice components (Chen et al., 2024).

Conceptually, the organisational logic aligns with Donabedian's quality framework, which links improvements in structure (governance, resources) and process (pedagogy, supervision, clinical placement practices) to better outcomes (competent graduates and safer care) (Donabedian, 2003). This alignment is consistent with global policy

direction: the WHO Global Patient Safety Action Plan 2021–2030 frames patient safety as a system responsibility and calls for strengthening enabling systems—including education—so that safe practice becomes routine (WHO, 2021b). The WHO Global Report on IPC further emphasises that structured IPC programmes are essential to reduce avoidable harm and strengthen system performance (WHO, 2022a).

In parallel, the IPC literature consistently highlights that multimodal strategies - combining education, audit and feedback, behavioural supports, and leadership/ accountability mechanisms - are central to the effective implementation of IPC interventions at the facility level (Haque et al., 2020; Sonpar et al., 2025; Zingg et al., 2015). For pre-licensure education, recent syntheses reinforce the need for structured and continuous IPC training within nursing programmes (Amavasi & Zimmerman, 2024) and demonstrate how gaps in training capacity become visible during public health emergencies (Burton et al., 2023). In many regions, mapping and situational analyses show substantial variability in IPC education and programme implementation, which strengthens the case for a coherent institutional strategy with governance and performance monitoring (Moghnieh et al., 2023; Tartari et al., 2021).

Accordingly, the InfPrev4frica model is operationalised through five interdependent axes designed to ensure institutional accountability and sustainability through measurable targets and closed-loop improvement cycles (Deming, 1986): (A) dissemination and stakeholder buy-in; (B) curriculum redesign and competence-based education; (C) faculty development and mentorship; (D) quality assurance and assessment; and (E) resources, simulation laboratories, and digital equity (Figure 10).

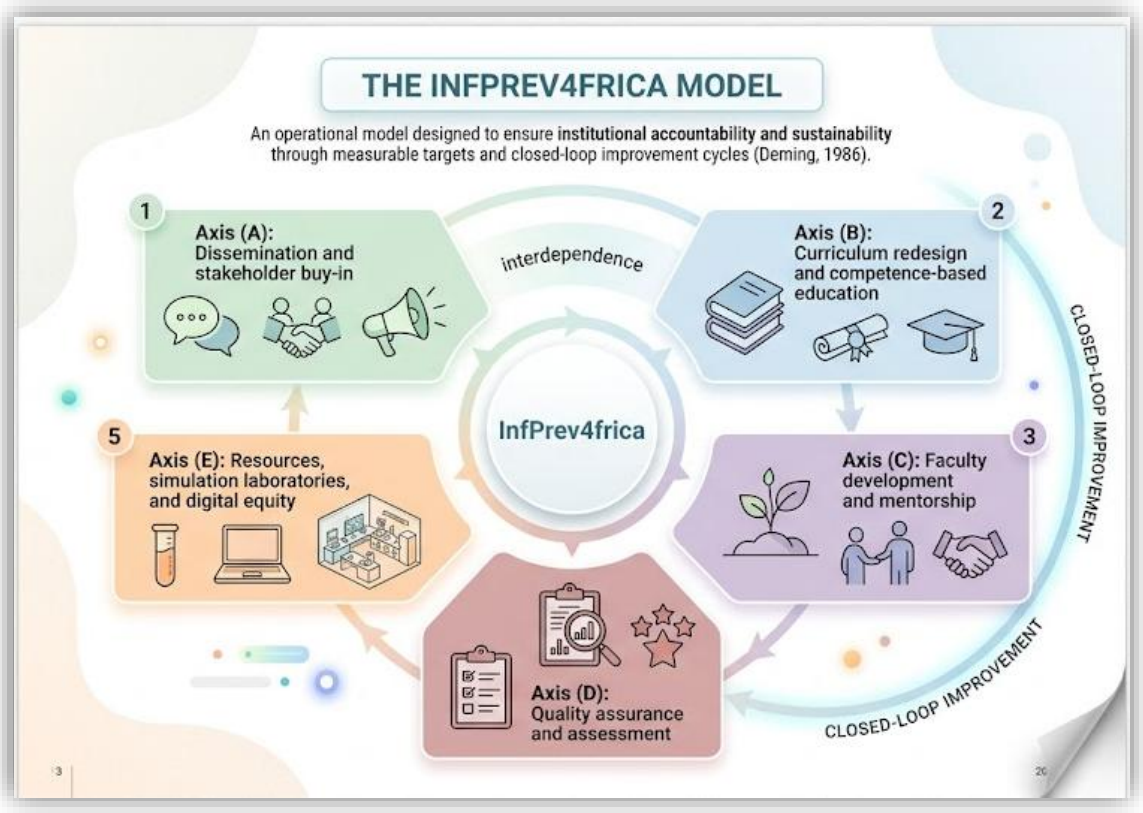

Figure 9 - Operationalisation of the InfPrev4frica Model through interdependent axes ensuring institutional accountability and sustainability (AI-generated figure)

Axis A: Dissemination and stakeholder buy-in

Sustained reform requires formal endorsement, structured engagement, and shared ownership across academic leadership, teaching teams, clinical partners, and students. Organisational determinants—governance arrangements, management support, and integration across hospital services—have been identified as critical for effective IPC programmes (Zingg et al., 2015). Evidence underpinning WHO recommendations also highlights leadership, accountability, and coordinated implementation structures as key enablers of multimodal IPC interventions (Sonpar et al., 2025).

A staged twelve-month engagement plan can support adoption while enabling early identification of constraints:

- Months 1–3 (initiation): formal launch with executive endorsement; establishment of a Joint University–Hospital IPC Education Committee with Terms of Reference; baseline IPC audit in partner facilities; rapid curriculum gap analysis mapping IPC/AMR outcomes to assessment points and placement expectations.
- Months 4–9 (demonstration and scaling readiness): structured stakeholder engagement (workshops, policy dialogues); piloting IPC simulation scenarios in core courses; deployment of a key performance indicator (KPI) dashboard to support transparency and institutional learning.
- Months 10–12 (consolidation): formal presentation of pilot outcomes; feedback forum; approval of a three-year roadmap; integration of PDCA (Plan, Do, Check, Act) cycles into governance and reporting routines.

Expected outcome: formal institutional adoption of InfPrev4frica evidenced by an approved roadmap, documented engagement activities, and an operational KPI dashboard.

Axis B: Curriculum redesign and competence-based education

Curricular reform should be competency-mapped and organised around measurable proficiencies, consistent with competence-based education principles (Frank et al., 2010). For IPC specifically, evidence supports the value of continuous and structured education in pre-registration nursing programmes (Amavasi & Zimmerman, 2024) and reinforces the importance of preparedness-oriented training, particularly under crisis conditions (Burton et al., 2023).

A coherent assessment of architecture is essential. Progression in competence can be conceptualized through Miller's Pyramid, linking knowledge to performance across classroom learning, simulation, and practice placements (Miller, 1990). The Objective Structured Clinical Examination (OSCE) provides a defensible approach for assessing clinical competence when supported by blueprinting, standardised scenarios, and trained raters (Harden, 2016).

Simulation-based education provides a protected environment for practicing high-stakes IPC behaviours (e.g., aseptic technique; donning/doffing PPE) without patient risk (Gaba, 2004). For HAI prevention, simulation-based training is supported as an educational strategy (Kang et al., 2022), and recent systematic review evidence consolidates its role across healthcare learners (Yoshikawa et al., 2025).

Each target course includes at least two standardised IPC simulation scenarios per semester and at least one IPC-focused OSCE, with structured debriefing embedded. Also, the competency-mapped syllabi were operationalised within Year 1, with validated rubrics/blueprints and defined remediation pathways for learners not meeting minimum standards.

Axis C: Faculty development and mentorship

Faculty capacity is a primary determinant of implementation fidelity and programme sustainability. A staged development pathway can be structured using Benner's novice-to-expert lens to support progressive skill acquisition in facilitation and assessment (Benner, 1984). Within simulation-based education, debriefing is a core mechanism for consolidating learning and professional judgment (Fanning & Gaba, 2007; Lateef, 2010).

Targets: foundational training across the majority of faculty in simulation pedagogy and IPC scenario facilitation; an advanced cadre for OSCE blueprinting and rater calibration; and routine auditing of facilitation/debriefing standards.

Expected outcome: a certified educator group able to sustain quality, mentor peers, and support ongoing curriculum refinement.

Axis D: Quality assurance and assessment

Quality assurance must be operational, measurable, and integrated across academic and clinical settings. OSCE and simulation-based assessments should meet psychometric expectations appropriate to decision stakes (Harden, 2016). Reliability is essential to interpretability; monitoring inter-rater consistency and reproducibility is particularly important in performance assessments (Downing, 2004).

Closed-loop feedback is enabled through governance: IPC audits in clinical placements, reviewed by the Joint Committee, should result in documented corrective actions using PDCA cycles (Deming, 1986). This aligns with evidence that facility-level IPC effectiveness depends on organisational structure and systematic oversight (Zingg et al., 2015), and with WHO emphasis on enabling systems for sustained safety improvement (WHO, 2021b, 2022a).

Expected outcome: a closed-loop Q&A system characterised by routine measurement, transparent reporting, and documented improvement actions across education and clinical placements.

Axis E: Resources, simulation laboratories, and digital equity

Sustained delivery requires phased resource planning aligned to pedagogical priorities. Technology should serve educational purposes, consistent with the TPACK (Technological Pedagogical Content Knowledge) perspective on integrating technological, pedagogical, and content knowledge (Mishra & Koehler, 2006). Initial investment should prioritize low- and mid-fidelity infrastructure and consumables essential for IPC skills, with progressive expansion as faculty capacity and maintenance systems mature. Evidence supports simulation-based education as a relevant component for HAI prevention (Kang et al., 2022; Yoshikawa et al., 2025).

Equity of access must be planned explicitly. Universal Design for Learning provides a principled basis for multiple access pathways, including low-bandwidth and asynchronous alternatives (Rose & Meyer, 2002). Regional mapping and global situational analyses further highlight variability in IPC education and implementation, reinforcing the importance of scalable resource planning that accounts for contextual constraints (Moghnieh et al., 2023; Tartari et al., 2021).

Expected outcome: an operationally efficient simulation infrastructure with equitable access pathways supporting consistent, high-quality IPC education.

Logic model

Inputs: trained faculty, simulation infrastructure/consumables, learning systems, governance mechanisms, and hospital partnerships.

Activities: curriculum mapping, simulation delivery, OSCE administration, faculty development, and placement audits.

Outputs: competency-mapped syllabi, validated rubrics/blueprints, trained instructors, and KPI dashboards.

Outcomes: improved IPC competence and safer behaviours during training, with fewer IPC-related incidents in placements.

Impact: strengthened patient safety culture and enhanced resilience to endemic and outbreak-related risks, aligned with WHO priorities (WHO, 2021b, 2022a).

Risk and mitigation

Risks include faculty turnover, equipment downtime, financial instability, and resistance to change.

Mitigation includes training-of-trainers approaches, documentation repositories, preventive maintenance and backup pathways, phased procurement, diversified funding, and early stakeholder engagement supported by demonstrable gains. These measures stabilize the institutional inner setting conditions required for sustained implementation (Damschroder et al., 2009).

4.2 Nursing Educator-Focused Strategies

Randaoharison Pierana Gabriel, Harimalala Lugie Nicolas, Paulo Lino Kidayi & Chuck Christina Mtuya

Nursing educator–focused strategies for HAI-IPC emphasise structured, evidence-based, and experiential approaches to strengthen student competence and patient safety outcomes (Amavasi & Zimmerman, 2024; WHO, 2022a). One key strategy is the integration of SBL, which allows nursing students to practice infection prevention procedures in a safe, controlled environment (Gaba, 2004; Jeffries, 2020; Lateef, 2010).

Through simulation scenarios such as hand hygiene and standard precautions, proper use of PPE, management of invasive devices, and patient care in isolation rooms or outbreak situations, students develop psychomotor skills, clinical decision-making abilities, and adherence to IPC protocols without posing risk to patients (Kang et al., 2022; Yoshikawa et al., 2025). The effectiveness of simulation in healthcare education has been supported by the theoretical and practical contributions of Jeffries (2020) as well as empirical evidence from SSA demonstrating improvements in hand hygiene competence following simulation-based interventions (Rocha et al., 2025).

Another important strategy is the use of structured communication frameworks to enhance clarity and consistency in interprofessional collaboration related to IPC concerns. The ISBAR framework provides a standardised method for communicating infection risks, patient deterioration, or breaches in infection control protocols. Teaching students to use ISBAR promotes concise and effective reporting, thereby reducing miscommunication and preventable errors. Research on communication and patient safety by Leonard et al. (2004), along with simulation research in SSA (Tjoflåt et al., 2021), supports structured communication as a critical patient safety strategy.

Evidence-based curriculum design is also central to strengthening HAI-IPC education. Nursing educators must align IPC teaching with international guidelines such as those from the WHO and the Centre for Disease Control, while contextualizing content to local protocols (WHO, 2022a; Tartari et al., 2021). Incorporating HAI data, AMS principles, and evolving infection trends into teaching modules ensures relevance and responsiveness to global health threats such as AMR (Haque et al., 2020; Sonpar et al., 2025). Case-based discussions and scenario analyses help bridge theory and practice, fostering critical thinking, prioritization, and clinical reasoning (Kolb, 1984; Benner,

1984). The importance of adapting nursing education to contemporary healthcare challenges has been emphasised by Fawaz et al. (2018), while experiential learning principles articulated by Kolb (1984) provide a theoretical foundation for active engagement in IPC education.

Faculty development and training further strengthen the implementation of IPC-focused SBL. Educators must be trained in simulation facilitation, structured debriefing techniques, and competency-based assessment methods specific to infection control practices (Fanning & Gaba, 2007; Jeffries, 2016). Ongoing professional development workshops that update faculty on evolving IPC guidelines and simulation technologies ensure high-quality instruction and consistent evaluation of student performance. Studies from SSA, including work by Moabi & Mtshali (2022) and Maboh et al. (2025), highlight the importance of contextualized faculty preparation for successful simulation integration in resource-limited settings.

Incorporating structured feedback and debriefing is another essential strategy. Debriefing after simulation sessions allows learners to reflect on performance, identify strengths and gaps, and analyze potential patient safety risks. This reflective process reinforces correct IPC behaviours and strengthens knowledge retention. The role of reflection in learning is grounded in Kolb's experiential learning theory (1984), supported by the simulation framework of Jeffries (2016), and reinforced by the work of Lateef (2010), who emphasised simulation as a powerful experiential modality in healthcare education.

Finally, competency assessment ensures that nursing students achieve measurable proficiency in IPC practices before entering clinical settings (Frank et al., 2010; Miller, 1990). Objective Structured Clinical Examinations can be designed to assess

competencies in hand hygiene, PPE use, environmental cleaning, and safe medication administration (Harden, 2016). The use of standardised checklists and structured assessment tools enables educators to identify learning gaps early and ensure clinical readiness (Downing, 2004). Collectively, these educator-focused strategies—integrating simulation, structured communication, evidence-based curriculum design, faculty development, and reflective debriefing—provide a comprehensive framework for strengthening HAI-IPC education and promoting safer clinical practice among nursing students.

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FINAL REMARKS

Maria do Rosário Pinto

This e-book serves as a tangible educational output of the InfPrev4frica project. It transforms the co-participatory development process into an accessible resource that consolidates the InfPrev4frica Model, the InfPrev4frica Simulation Scenarios, and implementation guidance for educators and professionals, which can be beneficial for universities and healthcare institutions. Its primary contribution is in systematizing context-sensitive knowledge and pedagogical strategies that support the development of educators' competencies in curriculum design, simulation facilitation, and debriefing. Additionally, it enhances the alignment between academic instruction and clinical practice, all within the framework of the pedagogical model's philosophy.

By documenting the project's conceptual foundations, methodological pathway, and practical outputs, the e-book supports immediate improvements in teaching and establishes a foundation for future developments, including curricular integration, faculty development, institutional adoption, and scale-up across SSA and beyond. In this regard, it serves both as a capacity-building instrument and as a mechanism for sustainability, facilitating adaptation, institutionalisation, and ongoing refinement of the project's innovations.

The InfPrev4frica Model provides a comprehensive, contextually sensitive framework to enhance IPC education in nursing programs in Sub-Saharan Africa, with particular emphasis on advancing educators' competencies. Rooted in a collaboratively participatory approach, the model acknowledges that the quality of student learning

is inherently reliant on the pedagogical, clinical, and institutional capacities of educators, supervisors, and mentors.

At its core, the model highlights the educator as a key agent of curriculum enactment, professional socialization, and practice translation. It therefore extends beyond the transmission of technical knowledge to include the development of competencies in facilitation of active learning, scenario-based teaching, reflective debriefing, transdisciplinary integration, and alignment between classroom instruction and clinical supervision. In doing so, it positions educators not only as content experts but as pedagogical leaders capable of fostering student self-efficacy and reinforcing safe clinical practice.

The model further underscores that an educator's competence cannot be separated from the conditions in which teaching occurs. Institutional support, access to resources, quality assurance mechanisms, and a culture of safety are essential to enable educators to sustain innovation, model best practice, and adapt teaching to resource-constrained environments. From this perspective, the InfPrev4frica Model contributes to the professional development of nurse educators by providing a structured basis for curriculum design, faculty development, and continuous pedagogical improvement.

Ultimately, the model affirms that strengthening infection prevention and control education necessitates investing in the competencies of educators as a strategic priority. By enhancing educators' capacity to design and implement student-centered and context-sensitive teaching strategies, InfPrev4frica facilitates more effective preparation of nursing graduates and contributes to safer, more resilient healthcare systems.

Appendices

APPENDIX I

InfPrev4frica Simulation-Based Learning Scenarios:

Implementation Guidelines

Simulation-Based Experiences (SBE) are purposefully designed to meet identified objectives and optimize the achievement of expected outcomes, involving careful planning and the use of uniform terminology. This promotes consistency in education and practice, allows participants to develop or enhance knowledge, skills and/or attitudes, and provides an opportunity to analyse and respond to realistic situations in a simulated environment.

For this, it should begin by:

- Setting the learning objectives, measurable results that participants are expected to achieve during an SBE,
- Creating a backstory, which provides the participants with a short descriptive narrative (a history and/or background) of the situation,
- Planning the process duration, organizing the estimated duration for

- prebriefing/briefing (to guide participants' success in the SBE): 5-7 minutes
- flow the SBE: 5-10 minutes
- debriefing (a reflective process immediately following the SBE): 15-30 minutes.

These guidelines on how to specifically write the information in the InfPrev4frica Scenarios template are a proposal for a systematic, yet flexible and cyclical planning, to enhance the achievement of expected outcomes.

TITLE OF THE SCENARIO:

It should shortly describe the main care area and the main topic of the SBE (*e.g. Caring for the patient submitted to aerosol therapy*)

TARGET AUDIENCE:

Learning stage of the participant (*e.g. 2nd year nursing students*)

THEORETICAL BACKGROUND:

All the information the students may need to prepare themselves for the SBE.

- Guidelines related to the subject/topic of the SBE
- Specific bibliography (preferably with the indication of the pages or chapters to study)
- Videos (e.g. *demonstration of the execution of the procedure*)
- Links to standardised information (*e.g. WHO or CDC guidelines*)
- Slides used in the theoretical approach of the subject/topic.

Examples:

"ATLS (Advanced Trauma Life Support) Student Course Manual" by the American College of Surgeons – 2018

American Thoracic Society Documents Guidelines for the Management of Adults with Hospital-acquired, Ventilator-associated, and Healthcare-associated Pneumonia, Am J Respir Crit Care Med Vol 171. pp 388–416, 2005 DOI: 10.1164/rccm.200405-644ST.

LEARNING OBJECTIVES:

Statements of specific, measurable results that participants are expected to achieve during an SBE. Statements may encompass different domains of learning that match the learners' level of knowledge and experience:

- Clinical learning objectives (*e.g. assess the patient's condition, follow the protocol, perform hand hygiene, choose the correct material for…*)

- Non-technical learning objectives (*e.g. communicate with the patient, demonstrate teamwork skills*)

SCENARIO OUTLINE:

An objective and concise description of the entire scenario, without any dispersing information. It should be adequate for the different degrees of complexity depending on the target audience, including:

- Description of the patient (*e.g. age, name, condition, previous personal and medical history, clinical data like lab results, usual medication*)

- Short description of the situation *(e.g. present clinical situation, like clinical diagnosis; alone or with family; place of admission/hospitalisation; time of the day*)

- Short description of the environment, if necessary (*e.g. equipment, unit conditions, environmental specific risks*)

- Clear description of the focus for the SBE (*e.g. the procedure, the decision, the intervention to be developed*)

Example:

Last week, Mrs Smith was admitted to a Pneumonology Hospital Unit due to difficulty breathing and chest pain, with the diagnosis of pneumonia. She's accompanied by her sister, who is the usual caregiver. Aerosol therapy was prescribed using Combivent® 1 formula twice daily. It is 11.30 AM, and the medication is scheduled for 12 PM. You are the registered nurse responsible for this patient, and your task is to ensure the safe administration of this medication.

EDUCATORS/FACILITATORS

Instructor's role:

Description of the tasks to be performed. It should consist of detailed information about what the instructor is expected to do, including the specific instructions to other colleagues and to the students, if applicable.

Examples:

Instructor 1 is supposed to

- Conduct a brief lecture to help students with the systematization of the important information/topics for the SBE

- Lead the prebriefing, including the explanation of the scenario outline to the student(s)

- Clarify the role of the student in the SBE (*e.g. Student A will be performing the role of the nurse, student B will perform the role of sister*)

- Follow the simulation template and take notes

- Guide the debriefing process.

Instructor 2 is responsible for

- For the use of the simulator

- Optimising the environment

When instructing the students:

Student operating the SBE:

specific instruction about what (s)he is expected to do

Examples:

. *You are a second nurse working at the Ward*

. You are the usual caregiver of your sister, and you know she has difficulty breathing when the venturi mask is on

. You are performing the role of the patient

Observers:

Instructions that will help the observers focus on the key topics, procedures, or steps, fostering their participation in the debriefing. It can include an observation guide, guiding questions, etc.

EQUIPMENT/RESOURCES NEEDED:

Material, equipment or resources needed to operate the SBE. It may include:

- List of the necessary equipment (clinical, environmental)
- List of the resources or environmental organisation needs (*e.g. technicians, informatic support, where to place the observers, a second room for debriefing*)

PROCEDURES CHECKLIST:

The expected procedures or interventions should be acutely described, to enable the validation of the learning outcomes. It may include a brief description of the desired progression of the scenario.

Example:

Student A (nurse) must prepare the medication and present it to the patient and the sister. The sister should inform the nurse about the difficulty the patient has in breathing with the mask. Nurse B is available to collaborate in the procedure.

While preparing the medication, asepsis must be ensured. The oxygen source is mobile (oxygen bottle), so safety measures should be checked before starting the flow to the aerosol.

The proposal of having a checklist in a table format is to foster the recording of the scenario's flow, like the one below:

Technical procedures check

Procedure/step	Done	Notes[1]
For example: correctly perform hand hygiene	✓	Ask observer 1 to comment (debriefing)
Select the adequate material to develop the procedure	x	Missed the gloves

Non-technical actions check

Action	Done	Notes[1]
For example: address the patient by her name	✓	
Introduce him/herself to the patient		

[1] Information that may be useful for the debriefing (*e.g.* a question to ask the observers)

Other actions

Action	Notes[1]
For example: sat down next to the patient before administration	Debriefing: Explain why

Suggested debriefing questions

APPENDIX II

InfPrev4frica Simulation-Based Learning Scenarios

DISCLAIMER

The scenarios presented have been developed based on the reality of sub-Saharan Africa in the field of infection prevention and control. Their content is grounded in evidence-based practice as of the date of their drafting, contextualised by the institutional settings in which they are situated, and takes into account the operational conditions of the region's health systems, particularly with regard to available resources, epidemiological profiles and organisational specificities. These scenarios do not constitute standard operating procedures, nor do they replace institutional guidelines, international and national guidelines, or recommendations issued by competent health authorities.

Any application of this content to other geographical or institutional contexts must be preceded by an analysis that involves adapting it to current/updated rules and regulations, available resources, and the local epidemiological context. It is recommended that its use be coordinated with current protocols and, where applicable, with the guidelines of international bodies (such as the World Health Organisation) and those of the competent national authorities.

The use of this material requires clinical judgement, appropriate supervision and respect for the ethical and legal principles in force.

SIMULATION SCENARIO:

TITLE: **Equipment decontamination for surgical procedures**

(This document should be given to the students at least one week before the simulation moment)

1. **Target audience**

Academic year: Third-year BSc Nursing students

2. **Theoretical background**

Content on effective surgical equipment decontamination to prevent infection and ensure patient safety.

Suggested bibliography:

- National infection prevention and control guidelines for healthcare services in Tanzania (2018, June).
- United Republic of Tanzania, Ministry of Health, Community Development, Gender, Elderly and Children (MoHCDGEC). (2020). *Standard operating procedures for infection prevention and control in Tanzania*.
- World Health Organisation. (2022). *Decontamination and reprocessing of medical devices for health-care facilities* (WHO-UHL-IHS-IPC-2022.4). World Health Organisation.

3. **Learning objectives**

At the end of the simulation scenario, each student should be able to:

- Communicate effectively with the team members to ensure clarity and compliance with decontamination protocols
- Use proper personal protective equipment (PPE) during the decontamination process to ensure the safety of both individuals and the team
- Perform accurate decontamination, including cleaning and disinfecting surgical equipment
- Document the decontamination process accurately, including the methods used and equipment status post-process
- Report and discuss any issues or deviations in the process promptly among the team.

4. Scenario outline

You have been assigned to perform decontamination of equipment after wound dressing in the surgical ward before it is handled in the sterilization unit. The equipment includes scissors, forceps, galipots, a kidney dish or other surgical equipment you may have to simulate the procedure.

Perform equipment decontamination using the steps in the decontamination process according to the guidelines.

5. Instructor's role

The instructor is expected to do the Briefing by clarifying the role of the students in the simulation-based experience and overseeing the Infection Prevention and Control guidelines:

- Student 1: Perform the procedure
- Student 2: Observe the Application of Decontamination according to infection prevention control guidelines and techniques

6. Equipment/resources needed

Needed in the laboratory room (organisation of the space):

A trolley with surgical equipment to be decontaminated

Available for the student to prepare/organise:

Decontamination Setup:

- ✓ Water for cleaning & soaking
- ✓ Liquid soap
- ✓ Five (5) buckets for decontamination
- ✓ Chlorine solution 10%

Safety Gear:

- ✓ Hard gloves
- ✓ Apron
- ✓ Eye protection
- ✓ Mask
- ✓ Boot

Documentation:

- ✓ Strapping for labelling the buckets
- ✓ Decontamination chart
- ✓ Wall Clock watch

7. Procedures checklist, grouped into:

a) Technical Procedures

Procedure/Step	Done (Y/N/P) [1]	Notes [2]
Preparation: Before		
Wear appropriate personal protective equipment		
Decontamination of surgical equipment: During		
Disassemble items with sliding or multiple parts		
Sanitize instruments with soap and water to remove blood or any other body fluid		
Clean instruments using a soft brush while immersed in water to avoid splashes		
Rinse with clean water		
Disinfect instruments by soaking them in a disinfectant solution, e.g., 0.5% chlorine solution, for 10 minutes		
Wash instruments with soap and water to remove disinfectant residue		
Rinse instruments in clean water to remove detergents or soap		
Post-procedure task: After		
Allow the instrument to dry		
After cleaning and disinfection processes, the item can be subjected to either high-level disinfection or sterilization		

b) Non-technical actions

Action	Done (Y/N/P)[1]	Notes[2]
Preparation: Before		
Document the material that has been received for decontamination		
Communicates the procedure to the staff/team		
Post-procedure task: After		
Document the clean material		
Communicate information about clean material to the team		
Communicate to the team any issues that may be observed regarding protocol deviations or equipment malfunctions		

Notes (to help you in the simulation moment: basic concepts to study, questions to pose to the teacher before the beginning of the simulation, …)

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[1] **Y**: done; **N**: not done; **P**: partially done (implies a note for the debriefing)
[2] Information that may be useful for the debriefing (*e.g.* a question to ask the observers)

SIMULATION SCENARIO:

TITLE: **Infection Prevention and control during leg wound haemorrhage procedure**

(This document should be given to the students at least one week before the simulation moment)

1. **Target audience**

   Academic year: BScN Students in their advanced principles of Nursing and medical-surgical nursing courses

2. **Theoretical background**

   Content on procedures for HIV protection.

Suggested bibliography:

- American College of Surgeons. (2018). *ATLS (Advanced Trauma Life Support) student course manual*.
- Derr, P., & Tardiff, J. (2006). *Emergency & critical care pocket guide*.
- Kelly, J. (2009). Review of *Trauma nursing: From resuscitation through rehabilitation* (4th ed.), by K. A. McQuillan, M. B. Flynn Makic, & E. Whalen. *Nurse Education in Practice, 9*, 367–368. https://doi.org/10.1016/j.nepr.2009.05.004
- Ministry of Health. (2018). *National infection prevention and control guideline*. Ministry of Health.

3. **Learning objectives**

   At the end of the simulation scenario, each student should be able to:

   - Manage haemorrhage to prevent blood exposure and reduce the risk of transmission to health workers
   - Use of appropriate PPE during assessment and management of haemorrhage
   - Use an aseptic technique throughout the procedure
   - Disinfect surface and equipment in contact with the patient's blood
   - Do safe disposal of the contaminated items
   - Evaluate the patient's verbal and non-verbal response to haemorrhage control interventions.

4. **Scenario outline**

You are a nurse working in a hospital emergency department. A 42-year-old male patient, Michael, arrives with a leg wound hemorrhage. Michael is HIV-positive and has Hepatitis B virus. He sustained an injury from a fall at home. Upon examination, the patient was stable, with a deep laceration on his lower leg, which is profusely bleeding. Call for assistance. Remember to protect for HIV & HBV transmission using PPE before attempting to control bleeding.

5. **Instructor's role**

The instructor is supposed to do the briefing by:

- Patient (student A): Actively participates by providing information about the injury and following instructions for wound care and follow-up
-Nurse (Student-B): Leads the hemorrhage control procedure, ensures proper technique and adherence to IPC protocols, communicates with the patient, and coordinates care delivery
-Assistant (student C): aids in hemorrhage control by providing emotional support, sterile gauzes, and preparing equipment
-Group of Observers
  - Students in group D observe the Prevention and Control of Infection procedures
  - Students in group E observe the rest of the procedure tasks
  - Students in group F observe communication

All observers pay attention to areas which need improvement.

6. **Equipment/resources needed**

Needed in the laboratory room (organisation of the space)*:*

- ✓ Leg haemorrhage manikin with active bleeding
- ✓ Running water/conditions for hand sanitizing
- ✓ Sterile gloves
- ✓ Protective gown/apron
- ✓ Goggles
- ✓ Standard mask
- ✓ Antiseptic solution (e.g., chlorhexidine or any available)
- ✓ Sterile gauze pads and dressings
- ✓ Hemostatic agents (e.g., hemostatic gauze if available)
- ✓ Bandages and adhesive tape
- ✓ Scissors and tweezers
- ✓ Waste disposal containers
- ✓ Pillow or leg traction

7. Procedures checklist, grouped into:

a) Technical Procedures

Procedure/Step	Done (Y/N/P) [1]	Notes [2]
Perform hand hygiene		
Do appropriate personal protective equipment (PPE) per organisation guidelines and availability, including gloves, goggles, mask, and apron		
Apply direct pressure to the wound using sterile gauze pads to control bleeding cautiously		
Ask assistant (student C) to help		
Use pillows or leg traction to elevate the injured leg above the heart level if possible		
Cleanse the wound with an antiseptic solution and sterile gauze for any potential infection debris.		
Repeat until the wound is clean		
Assess for bleeding before dressing. If bleeding continues, call the doctor		
Apply an appropriate wound dressing to the wound. Consider using a non-adherent dressing to minimize trauma during dressing changes, with assistance from student C		
Provide instructions to the patient regarding wound care, signs of infection, and when to seek medical attention for further evaluation		
Dispose of waste materials and contaminated equipment in designated containers and remove contaminated PPE (use protocol and waste management procedure per established guidelines)		
Clean/ disinfect the surface in contact with the patient's blood		
Document the assessment findings and interventions performed hand hygiene correctly according to guidelines		

b) Non-technical actions

Action	Done (Y/N/P)[1]	Notes[2]
Communicate Clearly with the Patient: Provide relevant information to reduce anxiety and promote cooperation, supporting IPC efforts		
Show Empathy and Compassion: Foster a trusting relationship to enhance the patient's compliance with infection prevention		

Notes (to help you in the simulation moment: basic concepts to study, questions to pose to the teacher before the beginning of the simulation, …)

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[1] **Y**: done; **N**: not done; **P**: partially done (implies a note for the debriefing)
[2] Information that may be useful for the debriefing (*e.g.* a question to ask the observers)

SIMULATION SCENARIO:

TITLE: **Use of Personal Protective Equipment in the face of airborne risk**

(This document should be given to the students at least one week before the simulation moment)

1. **Target audience**

Academic year: The second-year nursing students (Bachelor's Degree)

2. **Theoretical background**

Content on procedures for the use of PPE in the face of airborne risk.

Suggested bibliography:

- Centers for Disease Control and Prevention. (2014). *Sequence for putting on personal protective equipment (PPE).* https://www.cdc.gov/healthcare-associated-infections/ media/pdfs/ppe-sequence-p.pdf
- Hôpitaux universitaires de Genève, HPCI. (2017). *Guide des précautions standard* (HPCI_PS_2017_1). https://www.hpci.ch/sites/chuv/files/HPCI_Guide_PS_2017_1.pdf
- World Health Organisation. (2015). *Étapes pour enfiler l'équipement de protection individuelle (EPI) comprenant une blouse.* https://iris.who.int/bitstream/handle/10665/187662/WHO_HIS_SDS_2015.1_fre.pdf
- Centers for Disease Control and Prevention. (2023). *Donning PPE* [Video]. YouTube.
- *PPE training video: Donning and doffing PPE nursing skill* [Video]. (n.d.). YouTube.
- *Video on wearing and fitting a mask* [Video]. (n.d.). YouTube.

3. **Learning objectives**

At the end of the simulation scenario, each student should be able to:

- Select and describe the right personal protective equipment (PPE) based on the infectious agent
- Use the proper PPE correctly
- Prevent and control the risk of infections through the proper PPE donning and doffing.

4. **Scenario outline**

Mr Rabe, a 66-year-old man with acute respiratory distress, entered the infectious and parasitic diseases department and was diagnosed with a respiratory infection (tuberculosis). He is coughing and has congested bronchial secretions. He was prescribed oxygen therapy and bronchodilators. You are a nurse on duty responsible for this patient. You come in, introduce yourself, and carry out the nursing and treatment prescribed by the doctor. However, before caring for the patient, you'll need to put on PPE correctly to prevent and control Infection.

5. **Instructor's role**

The instructor is supposed to:

- Previously staging the environment and equipment to be used
- Lead the briefing, including the explanation of the scenario outline to the student(s) and a brief explanation to help students understand the running of the simulation and to clarify their role in the simulation-based experience:

. Student 1: will play the role of *the* patient. *E.g., you are in a semi-seated position on the bed, coughing and complaining of dyspnea.*

. Student 2: will play the role of the nurse

. The other students who are not taking part will observe the scenario, follow the procedure, and check the steps to be followed during the act in their checklist procedures, and take notes of their remarks

- Follow the simulation template and take notes
- Guide the debriefing process.

6. **Equipment/resources needed**

- ✓ Materials to perform doctors' prescriptions, e.g., oxygen mask and bronchodilator
- ✓ Eye protection/face shield (in case of use in aerosol-generating procedures)
- ✓ A medical cart
- ✓ A soap
- ✓ Alcohol-based hand sanitizer
- ✓ Mask
- ✓ Gloves
- ✓ Overblouse or gown
- ✓ Waste container
- ✓ One room in the lab skills to run the scenarios, and where the students will observe
- ✓ A second room for the debriefing

7. Procedures checklist, grouped into:

a) Technical Procedures

Procedure/Step	Done (Y/N/P) [1]	Notes [2]
Material preparation for individual protection: Gown Mask Gloves Eye protection (if applicable)		
Sanitize hands		
Sanitize by massaging each hand, paying particular attention to the spaces between the fingers, the palms of the hands, the edges of the nails, the pads of the fingers and wrists		
Put on the gown: Put on an overblouse, open side facing back Tie the cords at the neck, then cross them over the smock at the back to protect clothing Tie the drawstrings at the waist		
Put on a mask or respirator		
Loop the elastic bands around the ears		
Open and adjust gussets to cover nose and chin		
Adjust the rigid bar to fit the contours of the nose and cheekbones		
Disinfect your hands after donning the mask		
Put on gloves		
Place the right thumb inside the upper part of the cuff		
Make a fist with the right hand and stretch the glove over the fingertips of the left hand.		
With the fingers of the left hand extended, pull on the sleeve and glove until the hand fills the glove		
Perform the prescribed acts		
Put off gloves		
Evaluate if the outside of the gloves is contaminated		
If hands get contaminated during glove removal, immediately sanitize hands or use an alcohol-based hand sanitizer		
Using a gloved hand, grasp the palm area of the other gloved hand and peel off the first glove		
Hold the removed glove in the gloved hand		
Slide fingers of ungloved hand under remaining glove at wrist and peel off second glove over first glove		
Discard gloves in the proper waste container		
Put off the gown		
Identify if the front of the gown and the sleeves are contaminated		
If the hands get contaminated during gown removal, immediately sanitize hands or use an alcohol-based hand sanitizer		
Untie cords at the waist and neck		

[1] **Y**: done; **N**: not done; **P**: partially done (implies a note for the debriefing)
[2] Information that may be useful for the debriefing (*e.g.* a question to ask the observers)

Remove the gown, trying not to touch the outside		
Roll up overblouse, touching only the inside		
Dispose of it in the municipal waste bag/container		
Disinfect hands		
Put off eye protection (if applicable)		
Put off the mask or respirator		
Don't touch the front of the mask/respirator (contaminated)		
If hands get contaminated during mask/respirator removal, immediately sanitize hands or use an alcohol-based hand sanitizer		
Remove the mask by handling it with ear loops or ties		
Discard in a waste container		
Use an alcohol-based hand sanitizer immediately after removing all Personal Protective Equipment (PPE)		

b) Non-technical actions

Action	Done (Y/N/P)[1]	Notes[2]
General Communication Skills		
Address the patient by his name		
Introduce him/herself to the patient		
Prepare the patient: explain the procedure to the patient in order to reduce their fears		
Explain to the patient about protection: Cough and sneeze into a tissue or into the crook of the elbow if no tissue is available, or into a handkerchief in the immediate vicinity After using it, dispose of the tissue in a garbage can Sanitize hands with soap and water Sanitize hands after contact with secretions		

Notes (to help you in the simulation moment: basic concepts to study, questions to pose to the teacher before the beginning of the simulation, …)

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SIMULATION SCENARIO:

TITLE: **Infection Prevention and Control during Neonatal Resuscitation**

(This document should be given to the students at least one week before the simulation moment)

1. **Target audience**

Academic year: 3rd year BScN Students in their midwifery and Pediatric nursing courses.

2. **Theoretical background**

Content on infection prevention and control during neonatal resuscitation.

Suggested bibliography:

- American Academy of Pediatrics, & American Heart Association. (2021). *Textbook of neonatal resuscitation* (8th ed.). American Academy of Pediatrics.
- Cloherty, J. P., Eichenwald, E. C., & Stark, A. R. (2012). *Manual of neonatal care* (7th ed.). Lippincott Williams & Wilkins.
- European Resuscitation Council. (2021). European Resuscitation Council guidelines 2021: Newborn resuscitation and support of transition of infants at birth. *Resuscitation, 161*, 291–326. https://doi.org/10.1016/j.resuscitation.2021.02.014
- Goldsmith, J. P., & Karotkin, E. (2016). *Assisted ventilation of the neonate* (5th ed.). Elsevier.
- Ministry of Health. (2018). *National infection prevention and control guideline*. Ministry of Health.

3. **Learning objectives**

At the end of the simulation scenario, each student should be able to:

- Apply an aseptic technique during neonatal resuscitation to prevent infection in neonates
- Use of appropriate PPE during neonatal resuscitation
- Communicate and coordinate effectively with multidisciplinary team members during neonatal resuscitation, ensuring adherence to IPC protocols
- Document all procedures which have been done on the patient record.

4. **Scenario outline**

After a successful caesarean section, a female baby is born at 39 weeks' gestation. She did not cry and did not breathe well. The midwife on duty called for help, asking you to assist with the baby's breathing. Upon arrival, you assess the situation. The baby is a full-term baby girl, born at 39 weeks' gestation, weighing 3.2 kg, pale, floppy, and not breathing. The cord has already been clamped and cut. As part of the team, perform resuscitation on the baby.

5. **Instructor's role**

The instructor guides students through realistic scenarios, ensuring safety protocols, including Infection Prevention and Control (IPC), are followed. They provide feedback, highlighting strengths and areas for improvement. The instructor fosters a supportive environment in which students can reflect and improve their skills.

- Patient (Neonate manikin): Passive recipient of care, dependent on the resuscitation efforts of the medical team for survival.
- Student 1 will play the Primary Nurse: leads resuscitation efforts, ensures proper technique and adherence to IPC protocols, communicates with the team and the mother, and coordinates care delivery
- Student 2 will play the role of the Second Nurse: assists the primary nurse, provides additional support during procedures, and helps maintain IPC measures.
- Student 3 will play the mother of the neonate to provide the required support and information.

- Three groups of observers
  Students in group A observe the IPC procedures
  Students in group B observe procedures for the other tasks. Students in group C observe communication
  All groups pay attention to the areas of improvement.

6. **Equipment/resources needed**

Needed in the laboratory room (organisation of the space)*:*

- ✓ Neonate mannequin
- ✓ Neonatal resuscitation trolley/flat surface/resuscitation table

Available for the student to prepare/organise:

- ✓ Running water
- ✓ Liquid antiseptic soap
- ✓ Disposable wipes or a clean towel
- ✓ Clean gloves
- ✓ Sterile gloves
- ✓ Apron
- ✓ Mask (to the student)
- ✓ Resuscitation kit (Bag-mask device and penguin sucker)
- ✓ Waste disposal containers.
- ✓ Clean cloth to cover the baby

7. Procedures checklist, grouped into:

a) Technical Procedures

Procedure/Step	Done (Y/N/P) [1]	Notes [2]
Sanitize hands with running water and soap, and dry with disposable wipes/single-use hand towel or clean towel. Another option is to perform hand hygiene using Sanitizer		
Put on gloves: Open the glove package without touching the inside. Then, carefully slide your hands into the gloves, ensuring you only touch the outside surfaces and avoid contaminating the sterile area		
Ask or verbalize that the material is in perfect condition to use/clean		
Place the baby on his/her back on a clean, warm surface and cover except for the face and chest		
Stand at the head of the baby		
The baby's neck should be placed in the "sniffing position" to maintain an open airway		
If meconium is present and the baby is not crying, immediately start suction		
Perform correct suctioning using a suction device (eg, penguin sucker) Notes: Always do suction the mouth first, then the nose. Be careful not to suction vigorously or deeply (more than 5 cm in the mouth and more than 2 cm in the nose)		
Assess the baby's breathing: Watch the way the baby's chest rises and falls		
Place the mask on the baby's face so that it covers the chin, mouth and nose		
Make a firm seal between the mask and face: Hold the mask on the face with the thumb and index finger while the middle finger holds the chin up towards the mask		
Squeeze the bag carefully (with two fingers only or with the whole hand), depending on the bag's size and the student's hand		
Check the seal by ventilating two or three times and observing the chest rise		
If the baby's chest is rising, ventilate following the Helping Babies Breathe established guideline and observe the chest for rise and fall		
If the baby's chest is not rising, determine why, rectify the problem, and continue to ventilate		
Maintains the IPC procedures when taking off the ventilation mask to do the suction and re-use the mask again by: Carefully remove the ventilation mask, avoiding contact with the front surface Clean and disinfect the mask according to proper procedures Reapply the mask using clean hands to ensure no contamination		
Ventilate for 1 minute		
Quickly assess the baby for spontaneous breathing and colour. If breathing is normal, stop ventilating, give the baby to the mother and continue to monitor (Temp, breathing, heart rate)		
To ventilate a patient, ensure the airway is open and place the mask securely over the nose and mouth, creating a tight seal		
Deliver breaths by squeezing the bag with appropriate pressure and volume, watching for chest rise to confirm effective ventilation		

[1] **Y**: done; **N**: not done; **P**: partially done (implies a note for the debriefing)
[2] Information that may be useful for the debriefing (*e.g.* a question to ask the observers)

b) Non-technical actions

Action	Done (Y/N/P)[1]	Notes[2]
Introduce him/herself to the baby's mother		
Communicate with the mother to address any concerns or questions		
Educate the mother on IPC regarding general baby care and the follow-up plan		
Document any observed changes in the patient's condition in the patient's file		
Coordinate the team and seek assistance when appropriate, especially with IPC protocols		
Communicate with the healthcare team regarding the care provided and observe changes in the patient's condition		

Notes (to help you in the simulation moment: basic concepts to study, questions to pose to the teacher before the beginning of the simulation, ...)

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SIMULATION SCENARIO:

TITLE: **Infection prevention and control during management of Hospital Waste Triage**

(This document should be given to the students at least one week before the simulation moment)

1. **Target audience**

   Academic year: Second-year nursing students (nurse, anaesthetist, midwifery).

2. **Theoretical background**

   Content on the management of hospital waste triage.

Suggested bibliography:

- Chartier, Y., Emmanuel, J., Pieper, U., Prüss, A., Rushbrook, P., Stringer, R., Townend, W., Wilburn, S., & Zghondi, R. (2014). *Safe management of wastes from health-care activities* (2nd ed.). World Health Organisation. https://iris.who.int/bitstream/handle/10665/85349/9789241548564_eng.pdf

- Ministère de la Santé Publique. (2017). *Politique nationale de gestion des déchets médicaux et de la sécurité des injections à Madagascar*. https://www.washinhcf.org/wp-content/uploads/2021/07/Madagascar_PNGDM_SSEnv-ce-05_01_18.pdf

-Ministère de la Santé Publique. (n.d.). *Guide technique de gestion des déchets médicaux*. https://www.washinhcf.org/wp-content/uploads/2021/07/Madagascar-HCWMGuide-technique-VF.pdf.

3. **Learning objectives**

At the end of the simulation scenario, each student should be able to:

- Be aware of the health hazards related to healthcare waste
- Classify the different types of healthcare waste
- Know how to dispose of healthcare waste in the appropriate garbage
- Ensure compliance with local regulations and hospital policies on waste management.

4. **Scenario outline**

Mrs Anna was admitted to the Department of Infectious Disease for treatment of an infected abdominal wound resulting from a previous hernioplasty. The treatment involved draining purulent exudate. During the procedure, the bed linen was soiled with blood and needs to be changed. In the tray are the compresses (containing exudate and blood), the paper wrappings of the sterilised material, syringes, and the empty saline bottle used. You are the nurse responsible for the safe management of the waste and linen.

5. **Instructor's role**

The instructor is responsible for:

A. Previously staging the environment with a wall clock and equipment to be used (Bed, tray, garbage bins):
A1. The patient unit is prepared with a bed sheet soiled with (fake) blood, a tray with compresses (with exudate and blood), the paper wrappings of the sterilized material used, 2 syringes, the used gloves and the empty saline bottle, all on a disposable pad base.
A2. There is a chair for the patient to be seated (while cleaning the unit)

A3. Personal protective equipment/gloves, healthcare waste containers and waste disposal devices: red bins, green bins, and yellow bins. New bed sheets.

B. Perform a Briefing, explaining to students, including taking the simulation scenario seriously to imitate the real situation in the hospital setting.

B1. Students' role:

Student one: (s)he is the nurse who has to substitute what needs to be replaced and manage all the materials, placing them in the appropriate waste container, assuring safety;
Student two: (s)he is the patient (that is not soiled with any residue, either on clothing or skin) and is already seated in a chair and is curious about what happened and talks to the nurse about his disease, while (s)he is managing the waste

B2. Scenario outline: Explain the patient's health condition; what nurse intervention is necessary to perform; who the nurse is and who the patient is; and the material available to perform the simulation

- Taking the needed notes related to the learning objectives.

6. **Equipment/resources needed**

A nursing tray already prepared with

- ✓ A disposable pad base
- ✓ The saline bottle (empty)
- ✓ 2 syringes
- ✓ Gauze (with fake blood and exudate)
- ✓ Clean paper from the sterile material wrapping
- ✓ Used gloves
- ✓ Kelly forceps, dressing scissors, kidney tray

Available for the student to prepare:

- ✓ Personal Protective Equipment (PPE) – gloves, mask, grown
- ✓ Garbage Bins: red, green and yellow or healthcare waste (containers/safety box)
- ✓ Disinfectant (for surfaces)

7. **Procedures checklist, grouped into:**

a) Technical Procedures

Procedure/Step	Done (Y/N/P) [1]	Notes [2]
Choose the proper PPE		
Choose a new sheet		
Choose the proper waste containers/bins		
Procedure/Step		
Sanitizes hands		
Put on the PPE selected in the correct way		
Dispose of waste correctly: Non-infected material in the proper bin (Paper, …) Infected material in the proper bin (Compresses, syringes, …) Clothes in the proper local (Bed linen, …)		
Disinfect the tray surface		
Steps for removing PPE: Gloves in the proper place Other (if used) in the proper place Comply with sterility rules		

b) Non-technical actions

Action	Done (Y/N/P)[1]	Notes[2]
Address the patient		
Introducing to the patient		
Explain the procedure		
Communicate with the patient while managing the waste		
Assure patient position/comfort before leaving		

Notes (to help you in the simulation moment: basic concepts to study, questions to pose to the teacher before the beginning of the simulation, …)

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[1] **Y**: done; **N**: not done; **P**: partially done (implies a note for the debriefing)
[2] Information that may be useful for the debriefing (*e.g.* a question to ask the observers)

SIMULATION SCENARIO:

TITLE: **Prevention of infection in performing peripheral intravenous catheterization**

(This document should be given to the students at least one week before the simulation moment)

1. **Target audience**
   Academic year: Third-year BSc Nursing students.

2. **Theoretical background**
   Theoretical content about peripheral intravenous catheterisation.

Suggested bibliography:

- Centers for Disease Control and Prevention. (2011). *Guidelines for the prevention of intravascular catheter-related infections*. Centers for Disease Control and Prevention. (Updated 2017)
- *National infection prevention and control guidelines for healthcare services in Tanzania*. (2018, June).
- Perry, P., & Hall, S. (2013). *Fundamentals of nursing* (8th ed.). Elsevier.
- United Republic of Tanzania, Ministry of Health, Community Development, Gender, Elderly and Children (MoHCDGEC). (n.d.). *Standard*.

3. **Learning objectives**

At the end of the simulation scenario, each student should be able to:

- Demonstrate the proper technique for inserting a peripheral Intravenous (IV) catheter, including skin preparation, vein palpation and selection, catheter placement, and securing the catheter.
- Practice skills like tourniquet application, skin stretching for vein stabilisation, and angle of insertion.
- Demonstrate how to secure the catheter to the skin to minimise movement and reduce the risk of complications.
- Understand the procedures for post-insertion care, including dressing application, labelling, and documentation.

4. **Scenario outline**

Mr Jumbe, aged 40, is admitted with a urinary tract infection requiring intravenous antibiotics. Students must insert a peripheral intravenous catheter (PIVC) in accordance with infection prevention and control protocols.

5. **Instructor's role**

The instructor is expected to do the Briefing by clarifying the role of the students, including time to perform the simulation-based experience and overseeing the Infection Prevention and Control guidelines.

- Student 1: Execute procedure including material selection, insertion, labelling, and waste disposal
- Student 2: Observe technique.

6. **Equipment/resources needed**

Needed in the laboratory room (organisation of the space):

✓ Mannikin for I.V insertion
✓ Torniquet
✓ Antiseptic

Available for the student to prepare/organise:
A tray with:

✓ Patient-side equipment: I.V. catheter, tourniquet, antiseptics.
✓ Waste disposal: Colour-coded buckets, safety box

7. **Procedures checklist, grouped into:**

a) Technical Procedures

Procedure/Step	Done (Y/N/P) [1]	Notes [2]
Sanitize hands		
Prepare all required items		
Put clean examination gloves on both hands		
Check the IV solution (bottle or plastic bag) to be sure it is the correct infusion and intact		
Open the infusion set and assemble the parts using aseptic technique (do not touch the ends of the tubing)		
Insert the infusion set into the solution bottle or bag		
Remove the protective cover from the solution bottle or bag without touching the opening		
Remove the protective cap covering the insertion spike without touching the spike, then insert it into the stopper of the IV bottle or the opening of the IV bag		
Fill the infusion tubing		
Identify the best vein(s) for inserting an IV needle or a plastic catheter		
Swab the site of injection for 30 seconds and wait until it dries (if the venipuncture site is dirty, first wash it with soap and clean water and dry)		
Insert the needle or catheter with the bevel up using the dominant hand		

[1] **Y**: done; **N**: not done; **P**: partially done (implies a note for the debriefing)
[2] Information that may be useful for the debriefing (*e.g.* a question to ask the observers)

Look for blood return in the tubing and carefully advance the cannula until the hub rests at the venipuncture site		
While stabilizing the cannula, release the tourniquet and roller clamp to permit a rate of flow sufficient to keep the IV-line open		
Secure and label the cannula with the date and time of insertion		
Connect IV fluid		
Adjust the flow rate to the correct number of drops per minute (Don't leave a needle(s) on infusion bottles)		
Sanitize hands with soap and running water after removing PPEs		
Clean and disinfect the trolley		
Remove any blood-contaminated waste items		
Remove gloves by inverting them and placing them in a plastic bag or waste container		

b) Non-technical actions

Action	Done (Y/N/P)[1]	Notes[2]
Preparation: Before		
Ask the patient if (s)he is comfortable or needs anything from the relatives		
Insertion of an I.V. line: During		
Inform the patient and obtain consent for the procedure		
Post-procedure task: After		
Assure the patients' comfort		

Notes (to help you in the simulation moment: basic concepts to study, questions to pose to the teacher before the beginning of the simulation, …)

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SIMULATION SCENARIO:

TITLE: **Sharp Injury Prevention during Parenteral Medication Administration**

(This document should be given to the students at least one week before the simulation moment)

1. **Target audience**
   Second-year nursing students (nurse, anesthetist, midwifery).

2. **Theoretical background**
   Content on sharp injury prevention during parenteral medication administration.

Suggested bibliography:

- World Health Organisation. (2010). *WHO best practices for injections and related procedures toolkit.* World Health Organisation. https://www.ncbi.nlm.nih.gov/books/NBK138491/pdf/Bookshelf_NBK138491.pdf
- Guide technique de gestion des déchets médicaux.(n.d.). https://www.washinhcf.org/wp-content/uploads/2021/07/Madagascar-HCWMGuide-technique-VF.pdf
- Riddell, A., Kennedy, I., & Tong, C. Y. W. (n.d.). *Management of sharps injuries in the healthcare setting. BMJ.* https://www.bmj.com/content/bmj/351/bmj.h3733.full.pdf
- Royal College of Nursing. (2017). *Essential practice for infection prevention and control.* https://www.rcn.org.uk/Professional-Development/publications/pub-005940
- Quynh, A. T. T., & Einhellig, K. (2017). *Practices for prevention needlestick and sharps injuries among nursing students. Belitung Nursing Journal, 3*(3), 183–190. https://www.researchgate.net/publication/331212809_PRACTICES_FOR_PREVENTION_NEEDLESTICK_AND_SHARPS_INJURIES_AMONG_NURSING_STUDENTS

3. **Learning objectives**

   At the end of the simulation scenario, each student should be able to:

   • Safely perform the skill for administering parenteral medication;
   • Apply the correct practice in the prevention of needlestick and sharps injuries;
   • Prevent and manage complications due to sharp injury
   • Discuss how to act if a sharp injury occurs (first aid, blood sample collection, report the event).

4. **Scenario outline**

Ms Rasoa, 30 years old and in good general health, presents with abdominal pain following Caesarean section surgery. The doctor prescribed analgesia via the intramuscular route. The patient is lying on the bed in a supine position. You are the nurse responsible for preparing, administering, and safely disposing of the medication after administration.

5. **Instructor's role**

The instructor is responsible for:

- Previously, staging the environment and equipment to be used: In the ward, there is a water point, and the mobile trolleys contain the tools needed for injection and the waste containers; There is a cupboard where all the consumables needed to perform medication administration are stored.

- Perform a Briefing, explaining to students:

B1. Students' role:

Student 1: will play the role of the nurse, being responsible for assessing the patient's condition and assure safety conditions for the procedure (Prepares the trolley mobile carts with the consumables and the medication needed to implement the care; Prepares the medication; Follow the correct hand hygiene technique (sanitize hands), and change gloves (when appropriate); Perform the safe injection; After handling consumables dispose waste in appropriate containers)

Student 2: will play the role of the patient. (s)he talks with the nurse about her pain and concerns about her newborn

B2. Scenario outline: Explain the patient's health condition; what nurse intervention is necessary to perform; who the nurse is and who the patient is; and the material available to perform the simulation

- Taking the needed notes related to the learning objectives.

6. **Equipment/resources needed**

- ✓ Waterpoint, soap, single-use hand towel, garbage
- ✓ Hydroalcoholic solution
- ✓ Personal protective equipment (PPE) (if adequate to the procedure)
- ✓ Material for the injection (adequate to the availability on site)
- ✓ Healthcare waste: containers for waste and safety box
- ✓ Healthcare trolley mobile carts
- ✓ Garbages: red bins, green bins, yellow bins

7. Procedures checklist, grouped into:

a) Technical Procedures

Procedure/Step	Done (Y/N/P) [1]	Notes [2]
Medication Preparation		
Comply with sterility rules		
Select the adequate material for the procedure (needles, syringe, sharp container/safety box)		
Do not recap the needle before the injection		
Proper disposal of waste (needles, ampoules)		
Medication Administration		
Use of personal protective equipment (if applicable)		
Select the anatomical area properly		
Comply with sterility rules (disinfect the site of administration)		
Do not disassemble needles from syringes after injection		
After Medication Administration		
Sharp container near/close		
Proper disposal of waste (needles, syringes, and sharp material)		
Fill the container no more than 3⁄4 full		
Correct handrub at the end of patient care		
If an unexpected sharp injury occurs:		
Student applies first aid (cleaning/disinfecting the injured area)		
Follow the protocol for sharp injury (if it exists): report the incident; fill out an incident report; seek medical attention; collect blood samples…		

b) Non-technical actions

Action	Done (Y/N/P)[1]	Notes[2]
Be vigilant during the preparation of medication		
Introduces him/herself to the patient		
Explain the procedure to the patient		
Address the patient by name		
Do relaxation techniques and distraction methods		
Assessment of the patient before, during and after the medication administration		

Notes (to help you in the simulation moment: basic concepts to study, questions to pose to the teacher before the beginning of the simulation, …)

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[1] **Y**: done; **N**: not done; **P**: partially done (implies a note for the debriefing)
[2] Information that may be useful for the debriefing (*e.g.* a question to ask the observers)

SIMULATION SCENARIO:

TITLE: **Infection prevention and control during patient's urinary catheterization**

(This document should be given to the students at least one week before the simulation moment)

1. **Target audience**

Academic year: Nursing students in their 2nd year.

2. **Theoretical background**

Content on patient urinary catheterization procedure and infection prevention and control.

Suggested bibliography:

- Centers for Disease Control and Prevention. (2024). *Catheter-associated urinary tract infection (CAUTI) basics*. https://www.cdc.gov/uti/about/cauti-basics.html
- Devsanté. (n.d.). *Sondage vésical: Matériel et technique*. https://devsante.org/articles/sondage-vesical-materiel-et-technique/
- Hygiène, Prévention et Contrôle de l'Infection. (2019). *Prévention des infections urinaires*. https://www.hpci.ch/prevention/recommandations/contenu/pr%C3%A9vention-des-infections-urinaires
- Medical Education Leeds. (2020, June 14). *Basic clinical skills: Urinary catheterisation (female)* [Video]. YouTube.
- Panacée Conseil & Formation Santé. (2021, May 21). *Pose d'une sonde urinaire* [Video]. YouTube.

3. **Learning objectives**

At the end of the simulation scenario, each student should be able to:

- Choose the proper material to insert the indwelling urinary catheter
- Perform indwelling urinary catheterisation according to the principles of infection prevention and control
- Communicate effectively with patients and reassure them.

4. **Scenario outline**

A 51-year-old woman named Rasoa, accompanied by her daughter, presents to the emergency department. She reports 12 hours of hypogastric pain and no spontaneous urination. During the doctor's assessment, he identifies a bladder globe due to urinary retention and calls the nurse to perform catheterisation. Your task is to ensure the catheterisation is performed correctly and humanely.

5. **Instructor's role**

The instructor is supposed to:

- Previously staging the environment and equipment to be used
- Lead the briefing, including the explanation of the scenario outline to the student(s) and a brief explanation to help students to understand the running of the simulation and to clarify their role in the simulation-based experience:

. Student 1 will play the role of the patient

. Student 2 will play the role of the helper during the procedure

. Student 3 will play the role of a nurse and must do the catheterisation correctly and in a humanised way

. Observing students: they will observe the scenario, follow the procedure and check the steps to be followed during the act. They should take notes of their remarks.

- Follow the simulation template and take notes
- Guide the debriefing process.

6. **Equipment/resources needed**

✓ One room in the lab skills to run the scenarios, where the students will observe
✓ A second room to make the debriefing

✓ The manikin for the procedure
✓ A medical cart
✓ Large sterile tray
✓ Small sterile tray
✓ Sterile compresses
✓ Sterile gloves
✓ Sterile syringe 10 mL
✓ Sterile needle
✓ Foley latex probe (adequate size)
✓ Garbage bag
✓ Sterile linen
✓ Urine bag sterile
✓ Proper antiseptic/saline solution
✓ Water sterile
✓ Folding screen
✓ Waterproof mattress for protection
✓ Stainless steel kidney bean
✓ Drum with sterile gauze and swab
✓ Lubricant and fixing device/material

7. Procedures checklist, grouped into:

a) Technical Procedures

Procedure/Step	Done (Y/N/P) [1]	Notes [2]
Preparation: before		
Check the patient's file		
Prepare the materials (catheter; antiseptic, gloves, ...)		
Check the conformity of all materials (expiration date, packaging integrity, etc.)		
Sanitise hands: by massaging each hand, paying particular attention to the spaces between the fingers, the palms of the hands, the edges of the nails, and the pads of the fingers and wrists		
Urinary catheterisation: during		
Put the patient in the gynaecological position, with legs bent and spread.		
Put an impermeable, non-sterile cover under the patient		
Rub hands with Hydroalcoholic solution (HS)		
Put on sterile gloves		
Connect the probe to the collection bag or urine bag (ALWAYS keep the drainage system closed), after the second student opens the sterile package		
Fill the syringe with sterile water in the quantity indicated by the manufacturer on the probe, then test the balloon		
Lubricate the catheter with Urethral Gel (using an impregnated compress, if necessary)		
Take two compresses soaked with antiseptic to put on both sides of the upper lip so as not to touch the patient's skin		
Disinfect the labia majora, labia minora and meatus uris with antiseptic-soaked compresses/ sterile solution (saline, for example)		
Spread the labia with the fingers of the left hand		
With the right hand, disinfect on both sides each time with another cotton pad		
Move from the pubic area to the labia minora		
From the top to the down		
Then place the perforated sterile field		
Place two compresses on either side of the labia minora to avoid touching the skin with the gloves		
Gently insert the catheter into the urinary meatus until urine is released		
Inflate the balloon by injecting sterile water		
Withdraw the probe until it stops		
Remove sterile gloves		
Attach the probe to the thigh		
Move the collection bag to the slope-down position		
Position the patient to be comfortable		
Post-procedure tasks: after		

[1] **Y**: done; **N**: not done; **P**: partially done (implies a note for the debriefing)
[2] Information that may be useful for the debriefing (*e.g.* a question to ask the observers)

Put on gloves (non-sterile, if necessary)		
Do the waste sorting, contaminated/uncontaminated, and tidying		
Remove the gloves		
Sanitize hands		
Note the date of probe insertion and catheter type in the patient's file		

b) Non-technical actions

Action	Done (Y/N/P)[1]	Notes[2]
Preparation: before		
Greet the patient and accompanying person with respect and friendliness, and introduce yourself		
Explain the procedure to the patient in order to reduce her fears and encourage her to relax		
Encourage the patient and her daughter to ask questions		
Ensure that privacy is respected		
Reassure the patient and obtain their consent		
Urinary catheterization: during		
Ask the patient how (s)he is feeling and act immediately if there are any problems		
Post-procedure tasks: after		
Assure the patient's comfort		
Explain protective measures to the accompanying person (importance of not mobilising the probe due to the risk of trauma)		

Notes (to help you in the simulation moment: basic concepts to study, questions to pose to the teacher before the beginning of the simulation, …)

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SIMULATION SCENARIO:

TITLE: **Aseptic technique while performing Open-Wound dressing**

(This document should be given to the students at least one week before the simulation moment)

1. **Target audience**

Academic year: Third-year BSc Nursing students

2. **Theoretical background**

Theoretical contents about decontamination of equipment and wound dressing .

Suggested bibliography:

- Ministry of Health, Community Development, Gender, Elderly and Children. (2018). *National infection prevention and control guidelines for healthcare services in Tanzania*.
- Ministry of Health, Community Development, Gender, Elderly and Children. (2020). *Standard operating procedures for infection prevention and control in Tanzania*.
- Perry, P., & Hall, S. (2013). *Fundamentals of nursing* (8th ed.). Elsevier.

3. **Learning objectives**

At the end of the simulation scenario, each student should be able to:

- Demonstrate proper technique in wound cleaning and dressing application to prevent contamination
- Apply infection control principles throughout the dressing process to minimize the risk of contamination
- Utilize Personal Protective Equipment (PPE) correctly to ensure patient and healthcare provider safety
- Accurately document wound characteristics and dressing procedure
- Communicate effectively with the team members to ensure clarity and compliance with the open-wound dressing procedure protocol.

4. **Scenario outline**

Mr. Amir, aged 30, was involved in a motor accident and brought to the hospital's outpatient department. On examination, he had a wound, and the doctor prescribed a wound dressing to assist the patient and prevent further infection. Please prepare and perform the procedure in accordance with the guidelines.

5. **Instructor's role**

The instructor is expected to clarify the role of the students in the simulation-based experience and oversee the Infection Prevention and Control guidelines:

- Student 1: Leads the procedure;
- Student 2: Assists with the procedure;
- Student 3: Observes the application of wound dressing according to Infection Prevention and Control guidelines and technique.

6. **Equipment/resources needed**

Needed in the laboratory room (organisation of the space):

- ✓ Mannikin with wound
- ✓ Antiseptic solution
- ✓ Bucket for proper waste disposal
- ✓ Dressing material

Available for the student to prepare/organise:

Personal Protective Equipment:

- ✓ Pair of clean gloves
- ✓ Sterile Gloves
- ✓ Mask
- ✓ Aprons

Solutions/Antiseptics

- ✓ Normal Saline Solution
- ✓ Povidone Solution

Dressing Materials:

- ✓ A tray with sterile dressing pack, drum with sterile gauze and swab, plaster or Strapping
- ✓ Sterile surgical blade Waste disposal
- ✓ Colour-coded bucket (black, yellow and Red)

7. Procedures checklist, grouped into:

a) Technical Procedures

Procedure/Step	Done (Y/N/P) [1]	Notes [2]
Correctly sanitise hands and apply the Personal Protective Equipment		
Assess the level of comfort using a numeric pain scale of 0-10		
Assess the presence of infectious wound signs		
Select the adequate equipment and material to develop the procedure		
Open the sterile pack		
Clean the wound with an appropriate solution		
Apply dressing		
Secure the dressing		
Correctly dispose of the materials used according to the guidelines		
Correctly remove the Personal Protective Equipment		
Correctly sanitize hands after the procedure		

b) Non-technical actions

Action	Done (Y/N/P)[1]	Notes[2]
Preparation: Before		
Address the patient		
Introduce him/herself to the patient		
Obtain consent		
Ask for any clarification		
Position the patient comfortably		
Open wound dressing: During		
Ask the patient if he is comfortable starting the procedure		
Post-procedure task: After		
Write the date and time the dressing was applied on tape in Ink		
Assist the patient in a comfortable position		
Document		

Notes (to help you in the simulation moment: basic concepts to study, questions to pose to the teacher before the beginning of the simulation, …)

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[1] **Y**: done; **N**: not done; **P**: partially done (implies a note for the debriefing)
[2] Information that may be useful for the debriefing (*e.g.* a question to ask the observers)

SIMULATION SCENARIO:

TITLE: **Hand Hygiene in Performing Intravenous Medication Administration**

(This document should be given to the students at least one week before the simulation moment)

1. **Target audience**

Academic year: The 2nd year nursing students (nurse, anaesthetist, midwifery).

2. **Theoretical background**

Content on hand hygiene procedure.

Suggested bibliography:

- Community Infection Prevention and Control. (2021). *Hand hygiene: Infection prevention and control policy for domiciliary care staff*. https://www.infectionpreventioncontrol.co.uk/wp-content/uploads/2021/05/DC-04-Hand-hygiene-April-2021-Version-2.00.pdf
- Royal College of Nursing. (2017). *Essential practice for infection prevention and control*. https://www.rcn.org.uk/Professional-Development/publications/pub-005940
- World Health Organisation. (2009). *How to handwash?* https://cdn.who.int/media/docs/default-source/patient-safety/how-to-handwash-poster.pdf
- World Health Organisation. (2010). *Résumé des recommandations de l'OMS pour l'hygiène des mains au cours des soins* [Summary of the WHO recommendations on hand hygiene in health care]. https://iris.who.int/bitstream/handle/10665/70469/WHO_IER_PSP_2009.07_fre.pdf.

3. **Learning objectives**

At the end of the simulation scenario, each student should be able to:

- Identify the 5 moments for hand hygiene
- Choose the adequate products available for hand hygiene
- Sanitize hands according to the WHO-recommended method
- Safely perform the administration of intravenous medication
- Discuss hand hygiene during patient care activities.

4. **Scenario outline**

You are the nurse responsible for administering intravenous medication. You must ensure correct hand hygiene throughout the process. Your patient is Mr Rabe, 40 years old, in good general health condition. Before you do the administration, you need to perform hand hygiene and ensure proper safety conditions.

5. **Instructor's role**

The instructor is responsible for:

A. Previously staging the environment and equipment to be used: In the ward, there is a water point, soap, hydroalcoholic solution, and the trolley mobile carts containing the tools needed for intravenous injection and the waste containers

B. Perform a Briefing, explaining to students:

B1. Students' role:

Student 1: will play the role of the nurse, being responsible for checking drug indications carefully, assessing patient condition, following asepsis rules, the steps and indications of hand sanitizing.
Student 2: will play the role of the patient, who is lying on the bed in a dorsal position

Observer Students: Note their suggestions for improving the simulation

B2. Scenario Outline: Explain the patient's health condition; what nurse intervention is necessary to perform (hands hygiene before medication administration); who is the nurse and who is the patient; and the material available to perform the simulation

C. Taking the needed notes related to the learning objectives.

6. **Equipment/resources needed**

- ✓ Medication (previously prepared in a 5cc syringe)
- ✓ Healthcare trolley mobile carts
- ✓ Waterpoint, soap, single-use hand towel
- ✓ Disinfectant, hydroalcoholic solution and alcohol.
- ✓ Personal Protective Equipment (if applicable)
- ✓ Healthcare waste: containers for waste and safety box; Garbage: red bins, green bins, yellow bins

7. **Procedures checklist, grouped into:**

a) Technical Procedures

Procedure/Step	Done (Y/N/P) [1]	Notes [2]
Select the adequate material to perform the procedure: Water/soap Hydroalcoholic solution/Alcohol Single-use hand towel Containers for waste (red, green, yellow bins, safety box)		
Remove jewelry, watch		

[1] **Y**: done; **N**: not done; **P**: partially done (implies a note for the debriefing)
[2] Information that may be useful for the debriefing (*e.g.* a question to ask the observers)

Correctly perform hand hygiene		
Wet hands with water		
Apply enough soap to cover all hand surfaces		
Rub hands palm to palm		
Right palm over left dorsum with interlaced fingers and vice versa		
Palm to palm with fingers interfaced		
Backs of fingers to opposing palms with fingers interlocked		
Rotational rubbing of the left thumb clasped in the right palm and vice versa		
Rotational rubbing backwards and forwards with clasped fingers of the right hand in the left palm and vice versa		
Rinse hands with water		
Dry hands thoroughly with a single-use towel		
Use a towel to turn off the tap		
Comply with sterility rules during intravenous administration: Disinfect the point of injection Proper waste disposal Hand Rub at the end of care		

b) Non-technical actions

Action	Done (Y/N/P)[1]	Notes[2]
Address the patient by his/her name		
Introduce him/herself to the patient		
Explain the procedure that will be performed		
Evaluate and reassure the patient		

Notes (to help you in the simulation moment: basic concepts to study, questions to pose to the teacher before the beginning of the simulation, …)

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SIMULATION SCENARIO:

TITLE: **Safety Procedures during Intravenous (IV) Medication Administration**

(This document should be given to the students at least one week before the simulation moment)

1. **Target audience**

Academic year: 3rd year of BScN students in their advanced principles of Nursing and medical- surgical nursing courses

2. **Theoretical background**

Content on the procedures for IV medication administration.

Suggested bibliography:

- Ernstmeyer, K., & Christman, E. (Eds.). (2023). *Nursing advanced skills*. WisTech Open. https://www.ncbi.nlm.nih.gov/books/NBK594492/
- Infusion Nurses Society. (2021). *Infusion therapy standards of practice* (8th ed.). *Journal of Infusion Nursing, 44*(1S). https://doi.org/10.1097/NAN.0000000000000396
- NHS Greater Glasgow and Clyde. (2020, April 2). *NHSGGC - Introduction to intravenous medicine administration* [Video]. YouTube. https://www.youtube.com/watch?v=QZaQVOSwuxk.

3. **Learning objectives**

At the end of the simulation scenario, each student should be able to:

- Conduct the Intravenous (IV) medication preparation according to infection prevention and control principles
- Administer the IV medication according to infection prevention and control principles
- Reduce the likelihood of catheter-related infections during and following IV insertion
- Communicate with the patient during the procedure.

4. **Scenario outline**

You are a nurse on duty in the medical-surgical unit in a peripheral (rural) area with limited resources. John, a 50-year-old male, has been admitted for treatment of a urinary tract infection (UTI). You need to prepare and administer IV antibiotic injections to him. He is otherwise healthy and has no known drug allergies. His vital signs are stable. As part of his treatment plan, he needs to receive IV ceftriaxone 1000 mg once daily for three days. The patient already has a peripheral catheter in the left arm.

5. **Instructor's role**

The instructor is supposed to do the Briefing by:

Nurse on duty: will be portrayed by a performing student.
Action: to prepare and to administer IV ceftriaxone 1000g to Mr. J, demonstrating safety procedures for IV medication.

Patient (Mr. J): the IV-hand manikin. Action: for IV insertion.

Student 2- Action: To mimic the physiological responses and reactions of a real patient, providing lifelike experiences for healthcare professionals to respond, such as responding to pain.

For Observers: portrayed by experienced Nurses.
Two observers are designated to document instances of good performance.
Two observers are assigned to record areas needing improvement.

6. **Equipment/resources needed**

Needed in the laboratory room (organisation of the space):

- ✓ Hand washing area (sink, tap, and liquid soap)

Available for the student to prepare/organise:
- ✓ Antiseptic solution
- ✓ Cotton swabs
- ✓ Saline flush solution
- ✓ Medication tray
- ✓ Syringes
- ✓ Drug -Ceftriaxone
- ✓ Water of injection
- ✓ Safety box for material discharge/disposal
- ✓ Bin for waste disposal with correct code colour
- ✓ Clean Gloves
- ✓ File/notebook for documentation

7. Procedures checklist, grouped into:

a) Technical Procedures

Procedure/Step	Done (Y/N/P) [1]	Notes [2]
Correctly perform the hand hygiene procedure		
Review the patient's medical record and the prescribed medication orders		
Introduce yourself to the patient and explain the procedure		
Verify the patient's identity using two unique identifiers		
Prepare the necessary and adequate material to perform the procedure while maintaining Infection prevention and control (IPC): Gather required equipment, ensuring all items meet IPC standards Clean and disinfect the work area Practice hand hygiene and wear appropriate Personal Protective Equipment (PPE) Use appropriate PPE: Gloves		
Assess the patient's IV insertion site for signs of infection or complications		
Double-check the medication order against the patient's record		
Verify the medication, dose, route, and expiration date		
Prepare the medication (ceftriaxone) accordingly, maintaining IPC: Review the prescription for the correct ceftriaxone dose, route, and frequency Gather and prepare sterile equipment (syringe, vial, and diluent) as per IPC guideline* (*approved in your institution)* Disinfect the top of the ceftriaxone vial with an alcohol swab Reconstitute the medication by injecting the diluent into the vial and mixing gently Draw up the prescribed dose of ceftriaxone into the syringe Label the syringe with the medication name, dose, and preparation time, if needed		
Dispose of waste items in biohazard or sharps containers in accordance with IPC guidelines		
Maintain sterility by avoiding contact with the syringe tip or needle		
Assess the IV catheter for the patient adhering to aseptic technique: Inspect the IV site for redness, swelling, or leakage		
Disinfect the IV port with an alcohol swab		
Flush the IV catheter with sterile saline, checking for resistance or blockage		
Observe the patient for any pain or adverse reactions		
Administer the medication for approximately 2-4 min		
Dispose of the syringe/sharps into the safety box		
Monitor the patient for any adverse reactions during the infusion		
Dispose of gloves and other waste in the right bin		
Perform hand hygiene correctly		
Document the medication administration, including the time, dose, and any observations.		

[1] **Y**: done; **N**: not done; **P**: partially done (implies a note for the debriefing)
[2] Information that may be useful for the debriefing (*e.g.* a question to ask the observers)

b) Non-technical actions

Action	Done (Y/N/P)[1]	Notes[2]
Communicate Clearly with the Patient: Provide relevant information to reduce anxiety and promote cooperation, supporting IPC efforts		
Show Empathy and Compassion: Foster a trusting relationship to enhance patient compliance with infection prevention		

Notes (to help you in the simulation moment: basic concepts to study, questions to pose to the teacher before the beginning of the simulation, …)

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SIMULATION SCENARIO:

TITLE: **Prevention of Respiratory Tract Infection during sputum suction in pediatric patients**

(This document should be given to the students at least one week before the simulation moment)

1. **Target audience**

Academic year: Nursing students in their 3rd year.

2. **Theoretical background**

Content on sputum suction in pediatric patients .

Suggested bibliography:

- Association of Pediatric Chartered Physiotherapists. (2015). *Guidelines for nasopharyngeal suction of a child or young adult*. https://apcp.csp.org.uk/system/files/guidelines_for_nasopharyngeal_suction_0_1.pdf
- Hôpitaux Universitaires de Genève. (2022). *Technique clinique relative au désencombrement rhino-pharyngé avec le système « mouche-bébé »*. https://www.hug.ch/vdoc/HUG_000000605.pdf
- Pasrija, D., & Hall, C. A. (2023). *Airway suctioning*. StatPearls Publishing. https://www.ncbi.nlm.nih.gov/books/NBK557386/
- A D. (2014, January 4). *Oropharyngeal suction 2013* [**Video**]. YouTube.

3. **Learning objectives**

At the end of the simulation scenario, each student should be able to:

- Choose the proper material to perform a Sputum Suction on a child
- Perform a Sputum Suction to a child according to the principles of infection prevention and control
- Communicate effectively with the mother and reassure her
- Coordinate the intervention with the multidisciplinary team members.

4. **Scenario outline**

A 23-year-old woman named Salohy knocks on the nurse's room door with her 4-month-old child. The child was diagnosed with bronchiolitis and now finds it difficult to breathe due to airway secretions. Coughing doesn't clear secretions. After the child is examined (by the doctor or the nurse), sputum suction must be performed in accordance with infection prevention and control principles.

5. **Instructor's role**

The instructor is supposed to:

A. Previously staging the environment and equipment to be used

B. Lead the briefing, including the explanation of the scenario outline to the student(s) and a brief explanation to help students understand the running of the simulation and to clarify their role in the simulation-based experience:

. Student 1 will play the role of the mother: You are tired and anxious about your baby (who is crying with respiratory issues).

. Student 2 will play the role of a nurse: You will perform upper airway suctioning in accordance with infection prevention and control standards and principles and encourage the mother (see 6. about equipment needed and 7. for checklist procedures).

. Student 3 will play the role of the helper: You will assist the nurse during the procedure, for example, opening the sterile gloves and the suction probe...

. The other students will be the observers: Observe the scenario, follow the procedure, check the steps to be followed during the act and take notes of their remarks

C. Follow the simulation template and take notes

D. Guide the debriefing process.

6. **Equipment/resources needed**

One room in the skills lab will be used to run the scenarios, where the students will observe. A second room to make the debriefing.

- ✓ A manikin (pediatric)
- ✓ Sputum suction machine
- ✓ Wall-mounted or portable suction source
- ✓ Vacuum jar
- ✓ Oxygen supplier (ramp or bullet)
- ✓ Available for the student to prepare/organise:
- ✓ Flat surface
- ✓ Neonatal resuscitation trolley with Hydroalcoholic solution (HS)
- ✓ Medical mask
- ✓ Sterile gloves
- ✓ Tissues
- ✓ Suction probe CH 6 or 8
- ✓ Penguin sucker
- ✓ Physiological saline solution
- ✓ Small syringe (2ml or 5 ml)
- ✓ Other PPE (if necessary)

7. Procedures checklist, grouped into:

a) Technical Procedures

Procedure/Step	Done (Y/N/P) [1]	Notes [2]
Preparation: before		
Prepare adequate material to develop the procedure:		
Hydro-alcoholic hand solution		
Medical mask		
Sterile gloves		
Tissues		
Wall-mounted source or portable suction machine		
Vacuum Jar		
Suction catheter CH 6 or 8		
Physiological saline solution		
Small syringe (2ml or 5 ml)		
Containers for waste (red bins, green bins, yellow bins; safety box)		
Check the conformity of all materials (expiration date, packaging integrity, etc.)		
Sanitize hands: Wash by massaging each hand, paying particular attention to the spaces between the fingers, the palms of the hands, the edges of the nails, the pads of the fingers and wrists		
Reassure the mother and explain the procedure to her		
Sputum suction: during		
Put on adequate Personal Protective Equipment (PPE), if applicable		
Rub hands with hydro-alcoholic hand solution		
Put on sterile gloves		
Attach the appropriate size of suction catheter to the suction tubing		
Set the negative power to between 40 mmHg and 100 mmHg (40-60 newborns/ 60-100 children)		
Estimate the length of the catheter to be inserted: Measure the distance between the tip of the nose and the tip of the earlobe Make sure that the catheter doesn't touch the skin		
Place the child in dorsal or lateral decubitus position, with head turned to one side		
Insert the catheter gently into the mouth until the measured distance is reached		
The negative pressure should not be applied while inserting the catheter		
Apply suction while taking out the catheter		
Slowly rotate the catheter to ensure proper removal of the secretion, and limit the attempt to about 5-10 seconds		
Wash the probe in saline solution when needed		
Repeat it again and again until there is no secretion left		
Post-procedure tasks: after		

[1] **Y**: done; **N**: not done; **P**: partially done (implies a note for the debriefing)
[2] Information that may be useful for the debriefing (*e.g.* a question to ask the observers)

After suctioning, rinse the catheter and discard it, respecting the waste sorting		
Do the waste sorting, contaminated/uncontaminated, and tidying		
PPE withdrawal and correct waste sorting		
Sanitize hands		
Rub hands with HS		
Reposition of the child: Position that facilitates breathing Attend to comfort		
Note the care and appearance of secretions in the patient's file/document		

b) Non-technical actions

Action	Done (Y/N/P)[1]	Notes[2]
Prepare the mother:		
Explain the procedure to the mother in order to reduce her fears and encourage her to relax		
Ensure that her privacy is respected		
Greet the mother, introduce yourself to her and the accompanying person with respect and friendliness and introduce yourself		
Warn the patient and their mother, explaining what is going to be done and encouraging them to ask questions		
Reassure the patient and obtain their consent		
Check the patient's file		
Ask the patient how they are feeling and act immediately if there are any problems		

Notes (to help you in the simulation moment: basic concepts to study, questions to pose to the teacher before the beginning of the simulation, ...)

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InfPrev4frica

InevSafeCare Project Extention

The InfPrev4frica Consortium hopes this e-Book supports your work as an educator and contributes to meaningful learning and reflection.

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