SIMMED
Società Italiana di Simulazione in Medicina

# CONGRESSO NAZIONALE

Milano
14-15 novembre
2024

HU HUMANITAS UNIVERSITY

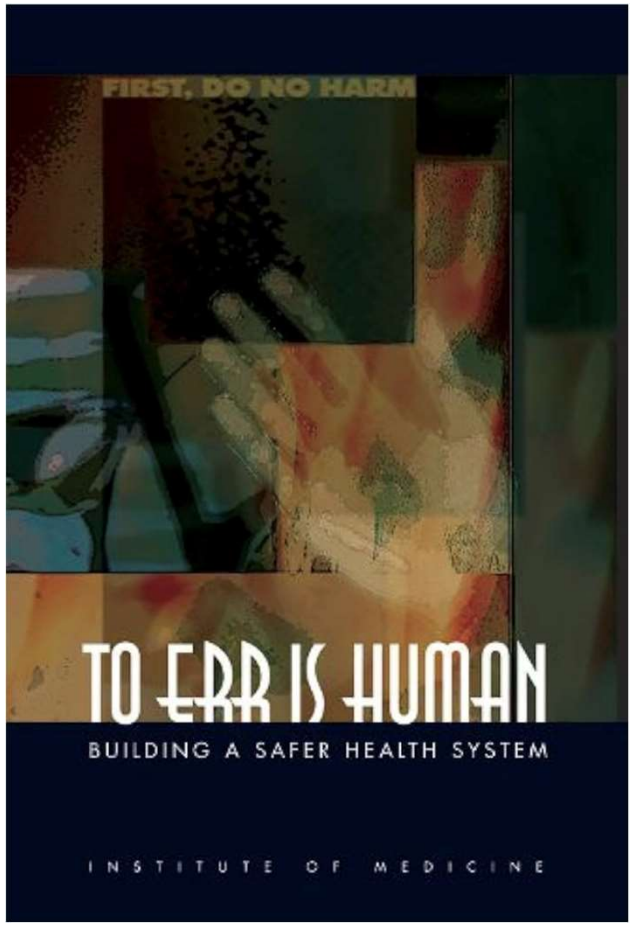
**Infection control, oltre l'ospedale**

**Bari 20-21 settembre**

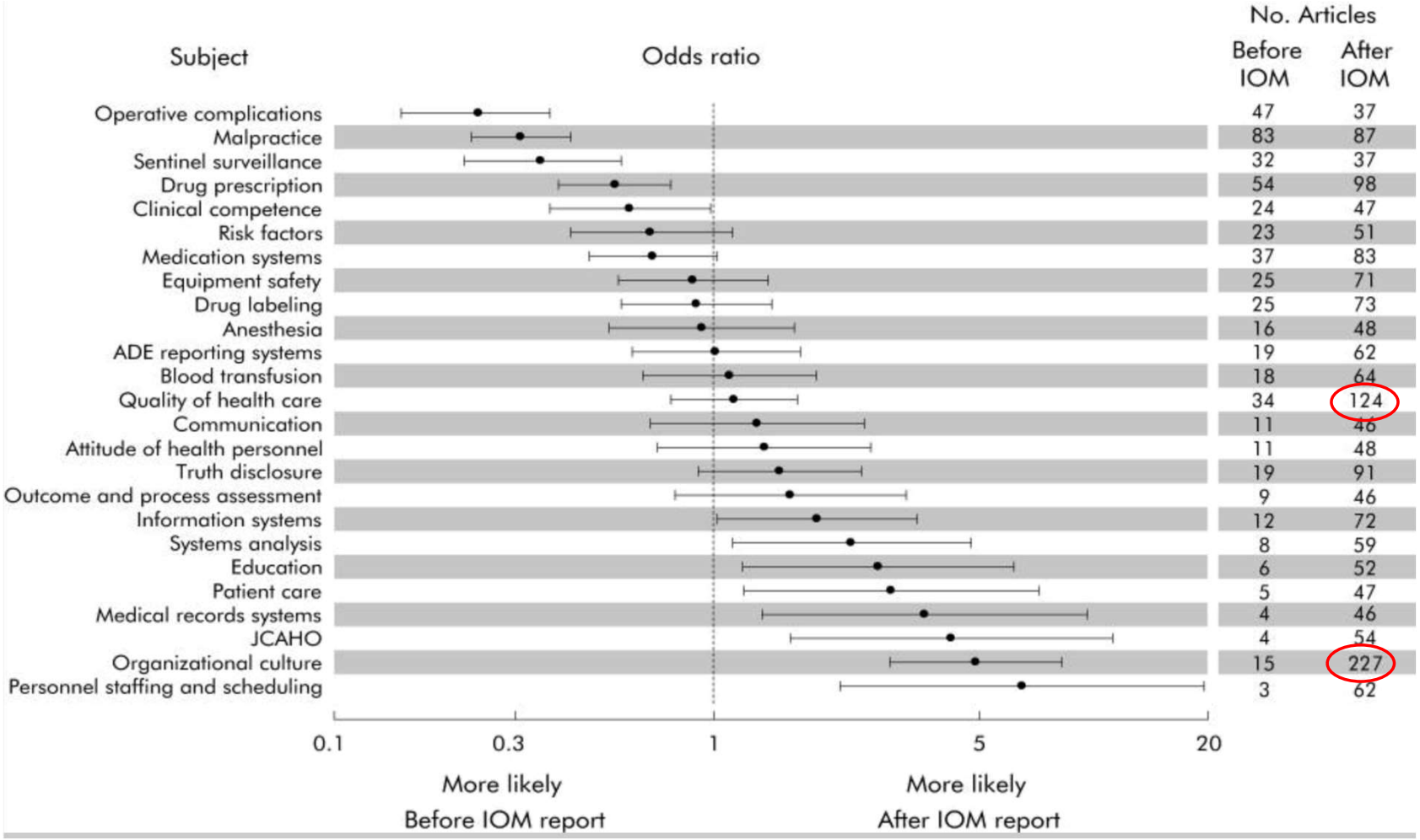
Emanuele Capogna

# La simulazione traslazionale nei programmi di prevenzione e controllo delle infezioni

# To err is human 1999




*Institute of Medicine (US) Committee on Quality of Health Care in America. To Err is Human: Building a Safer Health System. Kohn LT, Corrigan JM, Donaldson MS, editors. Washington (DC): National Academies Press (US); 2000. PMID: 25077248.*




*Stelfox HT, Palmisani S, Scurlock C, Orav EJ, Bates DW. The "To Err is Human" report and the patient safety literature. Qual Saf Health Care. 2006;15(3):174-178.*

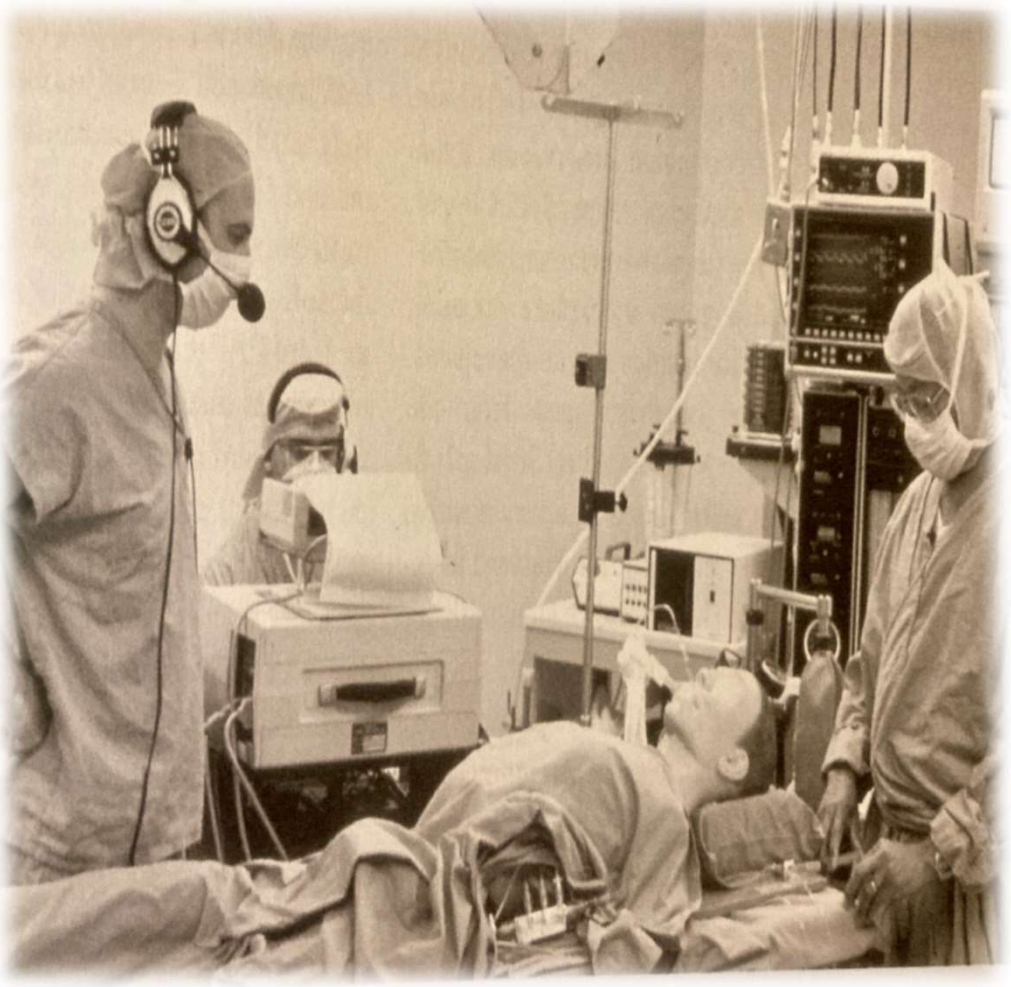
Negli Stati Uniti ogni giorno, circa uno su 31 pazienti negli contrae almeno un'ICA.


L'Italia supera la media europea con una prevalenza di pazienti con almeno un'ICA del 9,8% rispetto al valore del 7,1% nei paesi UE/SEE.

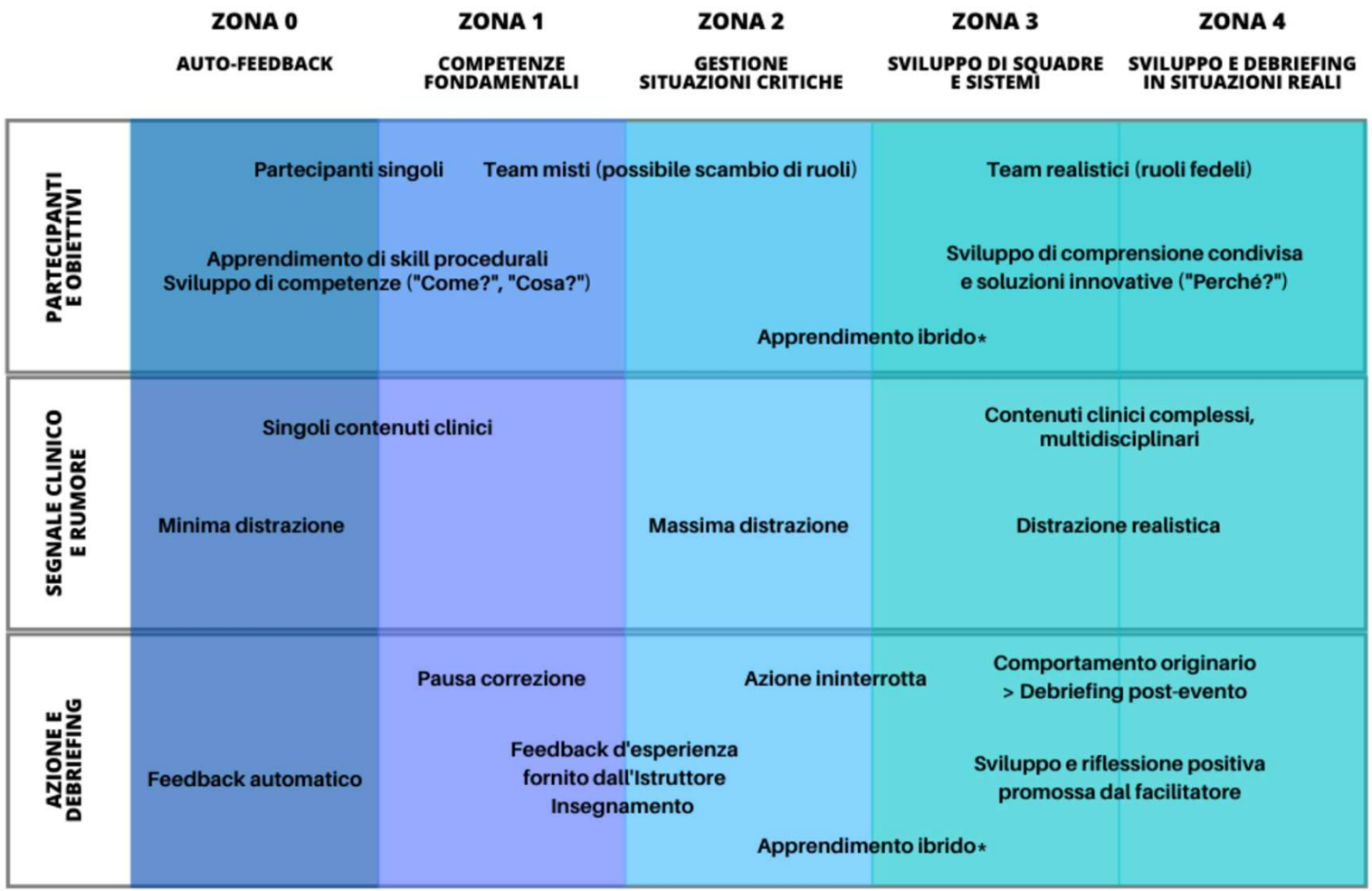
ecdc
EUROPEAN CENTRE FOR DISEASE PREVENTION AND CONTROL

*National and State Healthcare-Associated Infections Progress Report. Centers for Disease Control and Prevention website. www.cdc.gov/hai/data/portal/ progress-report.html. Published 2022.*
*Rapporto completo ECDC: www.ecdc.europa.eu/en/publications-data/PPS-HAI-AMR-acute-care-europe-2022-2023*

"La simulazione è una tecnica, non una tecnologia, per sostituire o amplificare esperienze reali con esperienze guidate, spesso immersive in natura, che evocano o replicano aspetti sostanziali del mondo reale in modo completamente interattivo."

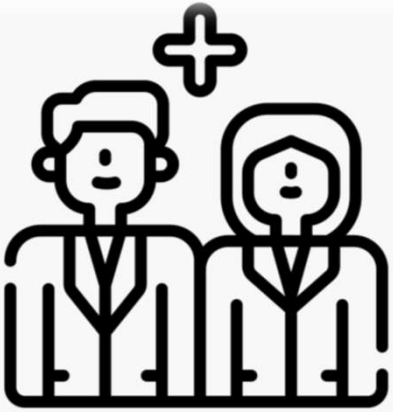


*Gaba DM. The future vision of simulation in healthcare. Simul Healthc. 2007;2(2):126-135.*




*L'apprendimento ibrido comprende elementi di più zone per soddisfare i bisogni formativi

*Roussin CJ, Weinstock P. SimZones: An Organizational Innovation for Simulation Programs and Centers. Acad Med. 2017 Aug;92(8):1114-1120.*

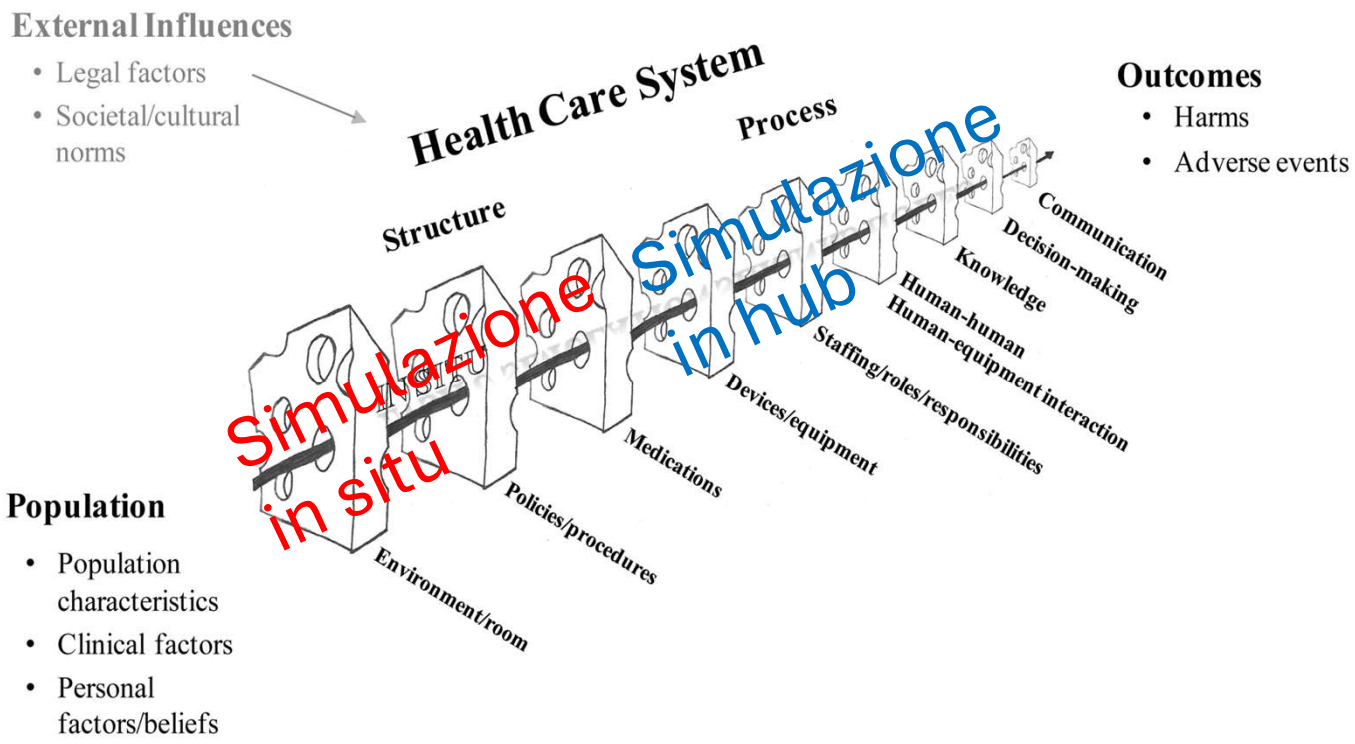


*Kang M, Nagaraj MB, Campbell KK, et al. The role of simulation-based training in healthcare-associated infection (HAI) prevention. Antimicrobial Stewardship and Healthcare Epidemiology. 2022;2(1):e20*

# Simulazione in situ

Le simulazioni in situ sono quelle “che si svolgono nel **reale ambiente** di cura del paziente nel tentativo di raggiungere un **elevato livello di fedelta` e realismo**”.

Questa tipologia di simulazione ha la capacità rispetto alla simulazione in un centro di simulazione di **intercettare più errori latenti.**



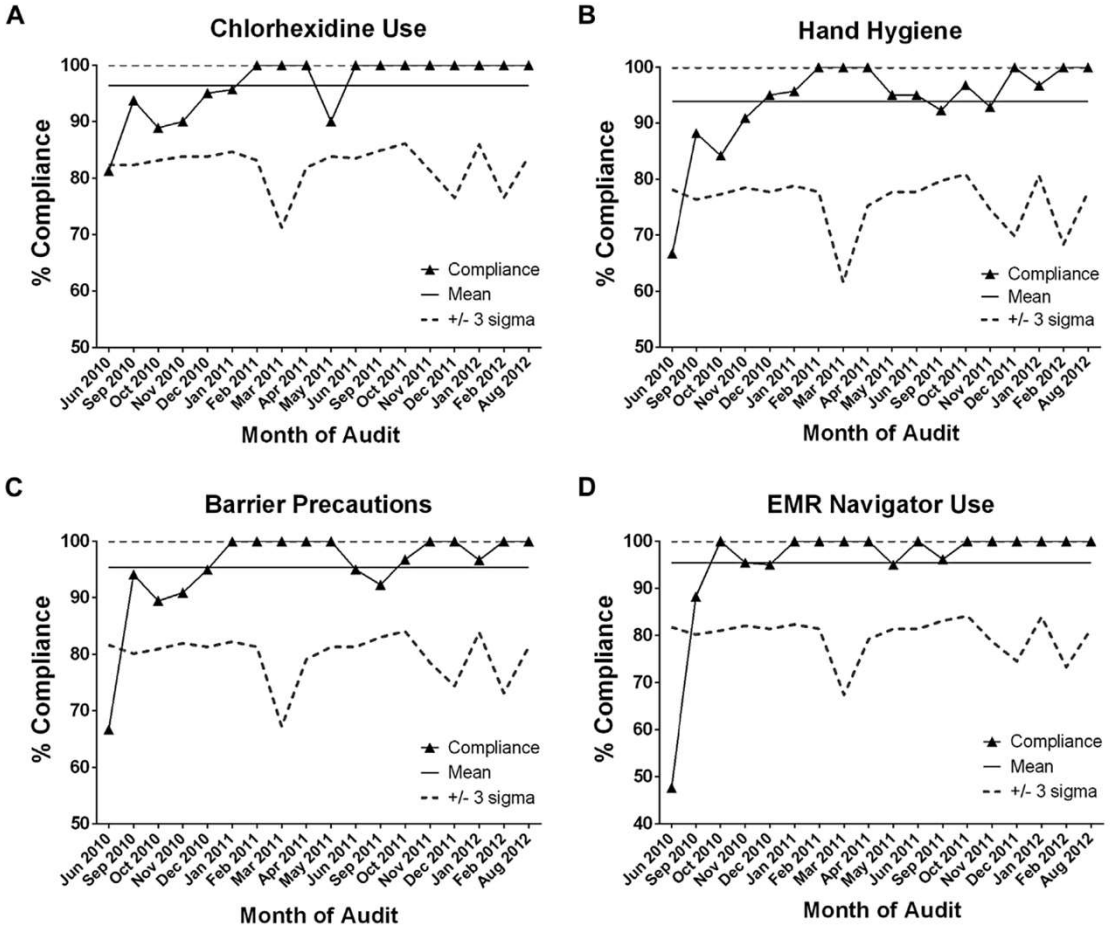

*Guise JM, Mladenovic J. In situ simulation: identification of systems issues. Semin Perinatol. 2013 Jun;37(3):161-5.*

**Table 1.** Year 1 Simulation-Based Intervention Costs Adjusted to 2008 Dollars

| Item | Units | Cost/Unit | Total Cost |
|---|---|---|---|
| Ultrasound* | 1 | $19,475.07 | $19,475.07 |
| Central line simulator* | 1 | $1,353.40 | $1,353.40 |
| CVC kits | 210 | $35.73 | $7,429.80 |
| Simulator supplies | 16 | $439.35 | $6,960.00 |
| Ultrasound cover probes | 90 | $14.10 | $1,256.40 |
| Sterile gowns | 150 | $2.98 | $442.50 |
| Sterile drapes | 15 | $50.08 | $743.70 |
| Supply cart* | 1 | $1,633.20 | $1,633.20 |
| Supplies total | | | $39,294.07 |
| **Other Expenses** | **h** | **Cost/h** | **Total Cost** |
| Simulator facility rental | 330 | $45.00 | $14,850.00 |
| Salary support | | | |
| Instructor | | | $50,500.00 |
| Research assistant | | | $7,272.00 |
| Total costs | | | $111,916.07 |

*Onetime cost.

*Cohen, Elaine R. BA; Feinglass, Joe PhD; Barsuk, Jeffrey H. MD; Barnard, Cynthia MBA, MSJS; O'Donnell, Anna RN, BSN; McGaghie, William C. PhD; Wayne, Diane B. MD. Cost Savings From Reduced Catheter-Related Bloodstream Infection After Simulation-Based Education for Residents in a Medical Intensive Care Unit. Simulation in Healthcare: The Journal of the Society for Simulation in Healthcare 5(2):p 98-102, April 2010.*

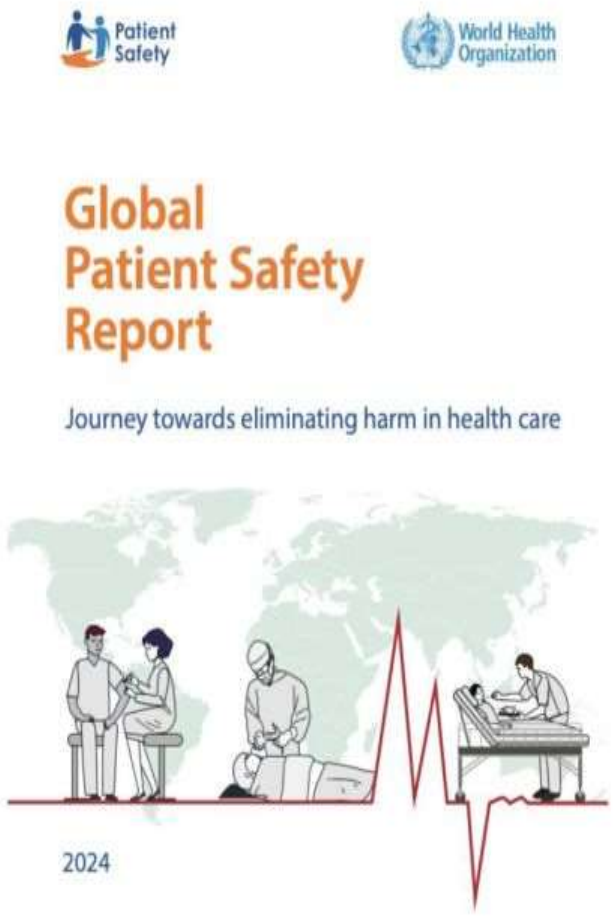



*Allen GB, Miller V, Nicholas C, et al. A multitiered strategy of simulation training, kit consolidation, and electronic documentation is associated with a reduction in central line-associated bloodstream infections. Am J Infect Control. 2014;42(6):643-648.*

## Strategia 5.2.

Il piano d'azione globale sulla sicurezza dei pazienti 2021-2030 **raccomanda** l'uso di metodi di insegnamento innovativi e **tecniche di simulazione per l'educazione e la formazione sulla sicurezza dei pazienti.**

Attualmente solo **il 10% degli Stati membri** ha segnalato di avere abbastanza **formatori** specializzati capaci di fornire tale formazione.




*Global patient safety report 2024. Geneva: World Health Organization; 2024.*

La simulazione traslazionale è un termine che si utilizza per descrivere un sottoinsieme delle attività di simulazione che si concentrano direttamente sul **miglioramento dei processi e degli outcomes dell'assistenza sanitaria.**

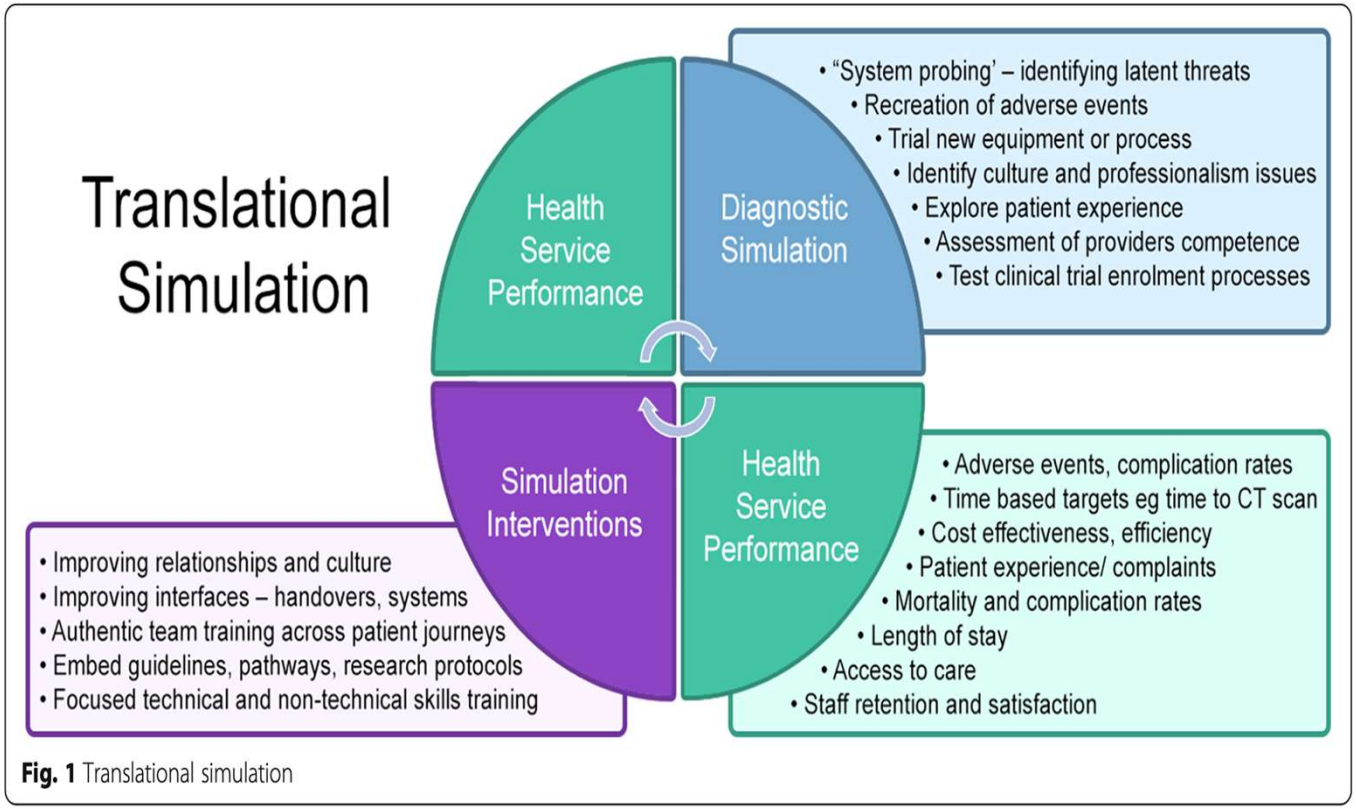
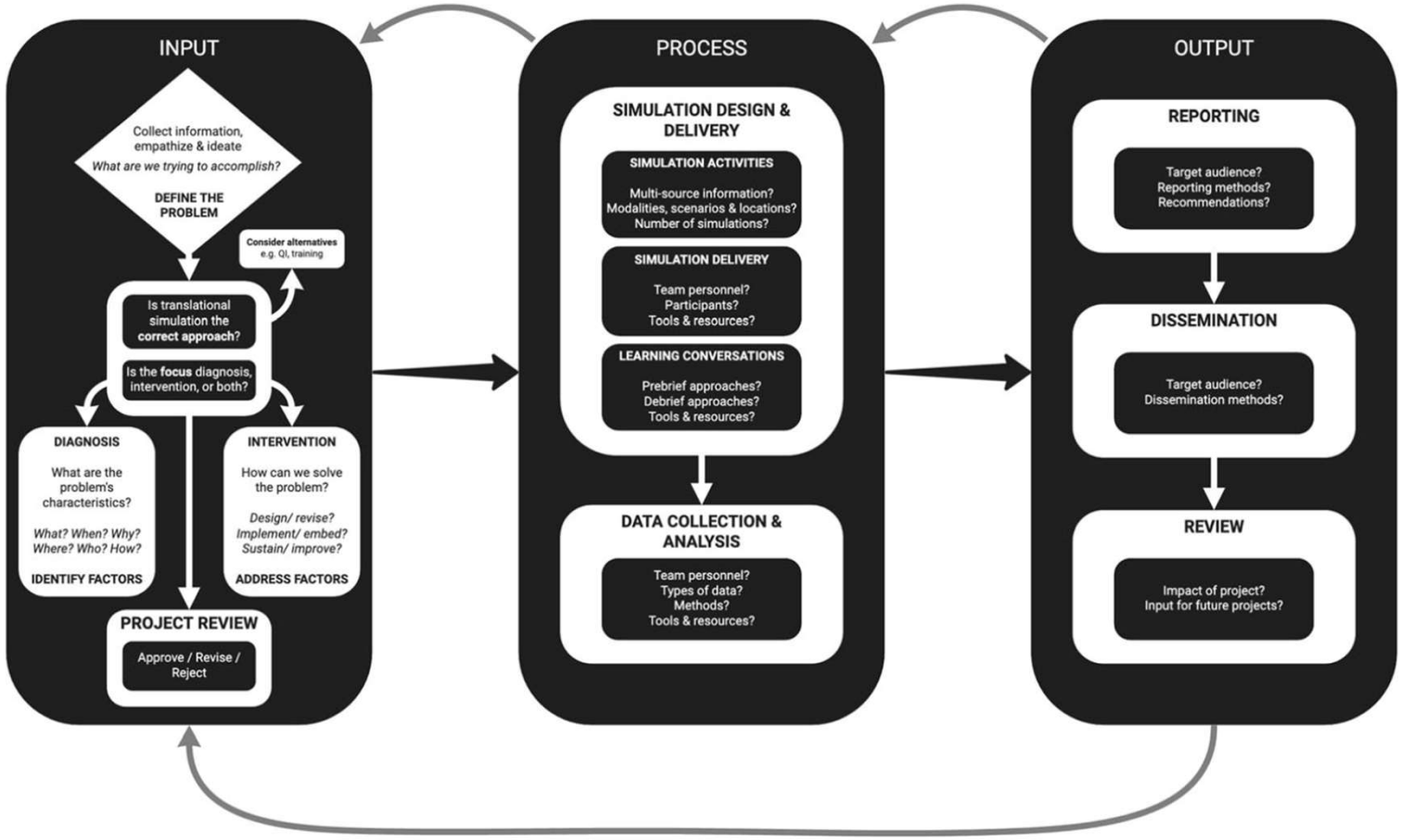


**Fig. 1** Translational simulation

*Brazil V. Translational simulation: not 'where?' but 'why?' A functional view of in situ simulation. Adv Simul (Lond). 2017 Oct 19;2:20.*

# Simulazione traslazionale: dal concetto all'azione



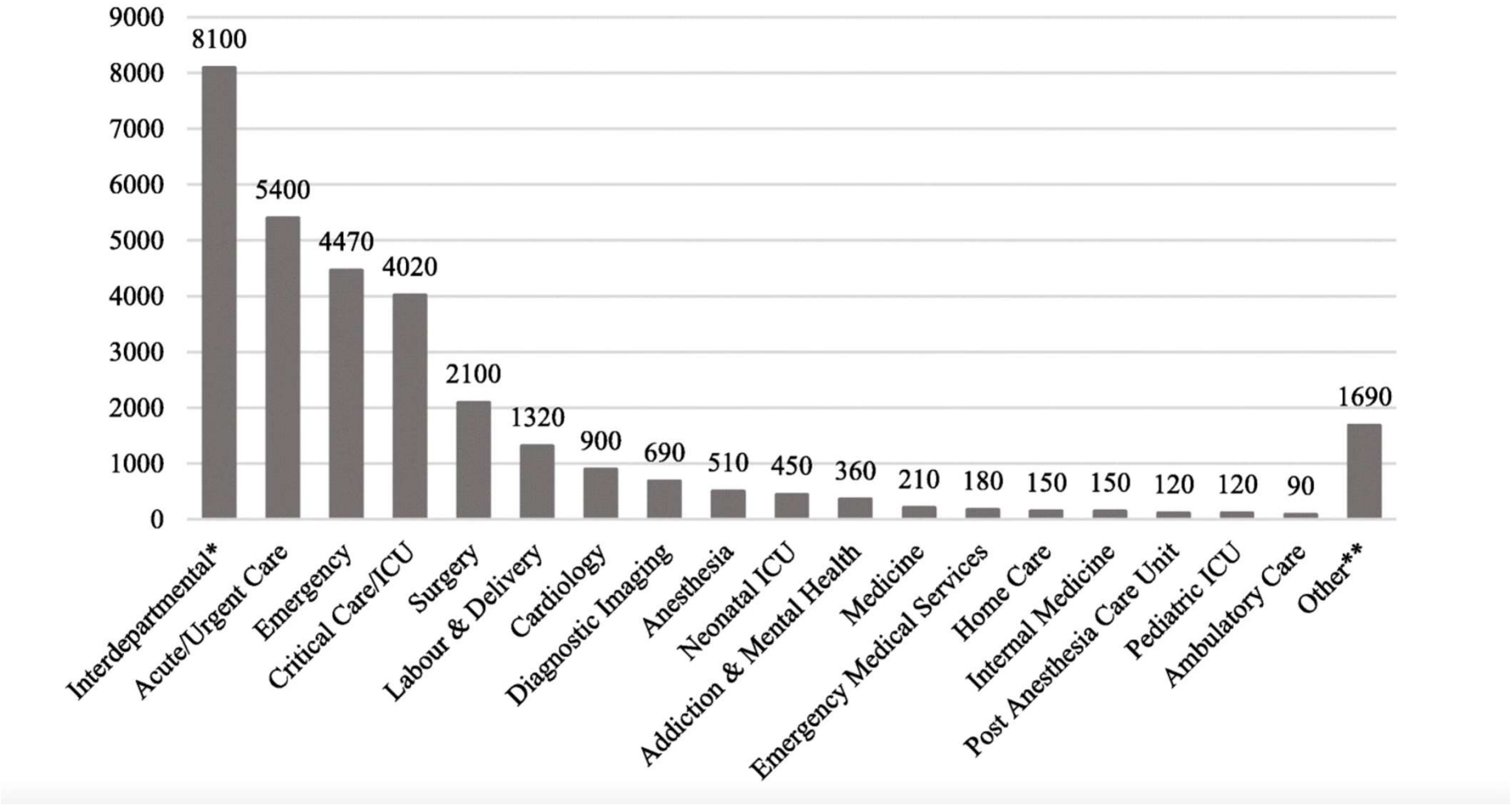

*Nickson, C.P., Petrosoniak, A., Barwick, S. et al. Translational simulation: from description to action. Adv Simul* ***6****, 6 (2021)*

La simulazione in sanità non solo come strumento di formazione, ma anche un mezzo per prevenire e ridurre gli errori.

**Table 1** Exploring translational simulation in practice-examples

| Application | Examples |
|---|---|
| Responding to COVID-19 | Modified guidelines and processes for cardiac arrest, airway management, maternity care, patient triage when healthcare resources were overwhelmed.<br>Testing novel devices for 'COVID safe' procedures. |
| Testing clinical processes | Optimizing airway emergency cart design.<br>Reducing time to intervention for stroke and myocardial infarction patients.<br>Reducing time to transfer to the operating theatre.<br>Improved multidisciplinary response to paediatric anaphylaxis. |
| Designing physical infrastructure | New building design<br>Human-centred device/equipment design |
| Building teams, shaping culture and relationships | Major trauma care, operating theatre teams, maternity emergencies<br>Identifying 'latent social threats'.<br>Building rituals for team-based performance reflection. |
| Supporting healthcare improvement | Exploring and shaping the context of care<br>Research test bed |

*Brazil V, Reedy G. Translational simulation revisited: an evolving conceptual model for the contribution of simulation to healthcare quality and safety. Adv Simul (Lond). 2024;9(1):16. Published 2024 May 8.*




*Dubé, M., Kaba, A., Cronin, T. et al. COVID-19 pandemic preparation: using simulation for systems-based learning to prepare the largest healthcare workforce and system in Canada. Adv Simul* ***5****, 22 (2020).*

# Media Fill test

**L'allestimento di prodotti sterili iniettabili** richiede tecniche, procedure e metodi di lavoro per minimizzare il rischio di contaminazione.

La **validazione** del processo di manipolazione asettica avviene tramite una **simulazione** di allestimento eseguita con un apposito terreno di coltura e controlli microbiologici ambientali in farmacia ospedaliera.

*Linee guida SIFO 2012-2016*

# Scenario prodotto da I.A

**1. Define the Scope of the Simulation**
**Objective: Prevent and control the spread of Legionella in a hospital setting.**
Outputs: Infection rates, effectiveness of interventions, and resource usage.

**2. Model the Environment**
Ward Layout: Number of wards, beds per ward, shared facilities (e.g., bathrooms and HVAC systems).
Water System Mapping: Identify points susceptible to Legionella growth (e.g., hot water tanks, cooling towers).

**3. Simulate Legionella Transmission**
Transmission Model: Consider how Legionella can be aerosolized and inhaled, particularly through water systems.
Infection Dynamics: Model the probability of infection based on exposure levels and individual susceptibility.

**4. Implement Intervention Strategies**
•Regular Water System Maintenance: Simulate scheduled and unscheduled maintenance of water systems.
•Temperature Control: Implement controls to keep water temperatures out of the 20-50°C range where Legionella thrives.
•Chlorination: Simulate the effects of regular chlorination on reducing Legionella concentrations.

**5. Incorporate Realistic Hospital Operations**
•Patient Flow: Simulate patient admissions, transfers, and discharges.
•Staff Movement: Model how staff move between wards and facilities, potentially spreading contamination.

**6. Evaluation Metrics**
•Infection Rates: Monitor simulated infection rates over time.
•Cost-Effectiveness: Analyze the costs associated with interventions versus the benefits of reduced infection rates.
•Sensitivity Analysis: Test how changes in parameters affect outcomes.

**7. Programming the Simulation**
Language and Tools: Consider using Python due to its robust libraries for scientific computing (e.g., NumPy for numerical operations, pandas for data manipulation, and Matplotlib for visualization).
Modules: Use discrete event simulation (DES) frameworks like SimPy, or agent-based models with Mesa.

**8. Run Simulations and Iterations**
Base Case Scenario: Run the simulation without interventions to establish a baseline.
Intervention Scenarios: Implement various interventions and compare outcomes to the baseline.
Iterative Improvements: Refine the model based on results and expert feedback.

**9. Visualization and Reporting**
Output Visualization: Use graphs and charts to visualize data over time.
Reporting: Generate reports detailing simulation outcomes, insights, and recommendations.

**10. Validation and Verification**
Data Validation: Ensure the simulation uses accurate and relevant data.
Expert Review: Have domain experts review the model and its outcomes.

This is a high-level outline. Each step can be expanded with more detailed sub-steps and technical specifics depending on your specific requirements and the complexity of the hospital environment you are modeling. **If you need a specific part of this simulation coded or detailed further, let me know!**

"Gli intellettuali risolvono i problemi ; i geni li prevengono."

*ALBERT EINSTEIN*

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