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# Estimation models of cost evaluations for Patient Safety policies

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# Agenda

- Definitions, background and policies
- Patient safety tools
- Cost effectiveness of patient safety tools: evidences
- Costs related to misuse of surgical safety check lists: evidences from the Italian NHS
- Conclusions



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# Patient Safety: definition



*“Patient safety is the prevention of errors and adverse effects to patients associated with health care”*

Reference: [www.euro.who.int](http://www.euro.who.int)



# Background

- Patient safety has received considerable public, professional, political, and scientific attention
- In health systems there are strategies and tools used to reduce the probability of occurrence of adverse events and reduce their impact on the patient

# Policies for improvement



- Report Institute of Medicine (IOM): “To Err is Human: Building a Safer Health System” (2000)
- In UK, the Department of Health (DoH) has published two report on patient safety: “An organisation with a memory” and “Building a safer NHS for patients”
- In 2001, AHRQ has published “Health Technology Assessment on best practices” for patient safety
- In 2004, World Health Organisation (WHO) launched the campaign “World Alliance for Patient Safety” in order to improve the safety in health care
- In 2004, Organisation for Economic Co-operation and Development (OECD) has promoted initiatives dedicated to the development of indicators for patient safety

# Policies in the Italian NHS



- 2003: “Risk management in health. The problem of errors” - Technical Committee on Clinical Risk - Ministry of Health
- 2005: Monitoring of sentinel events – Minister of Labour, Health and Social Affairs
- 2006-2008: National Health Plan puts patient safety as core of policies for the development of programs to improve the quality and implementation of clinical governance in the NHS
- 2008: Intesa 20/03/08 of Permanent Conference for relations between the Government, the Regions and the Autonomous Provinces of Trento and Bolzano on the clinical risk management and patient safety
- 2009: Decree 11/12/2009 on the *Establishment of an Information System for Monitoring Errors in Health Care (Simes) for the collection of information related to sentinel events*
- 2011: Guidelines to manage and communicate adverse events in health care



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# Patient safety tools (1/2)

## Surgical Safety check list

- In 2008, the WHO has published and distributed the WHO guidelines "Guidelines for Safe Surgery" and the **safety checklist in the operating room** to support the surgical team, in order to promote adherence to the implementation of safety standards to prevent avoidable adverse events;
- In Italy, the **Ministry of Health has promoted the use of the checklist** in the operating room and has spread Manual with 16 Recommendations accompanied by a checklist adapted to the context of Italy

## Root Cause Analysis

- It is a tool for identifying **prevention strategies**. It is a process that is part of the effort to build a culture of safety and move beyond the culture of blame
- In Root Cause Analysis, basic and contributing causes are discovered in a process similar to **diagnosis of disease** - with the goal always in mind of preventing recurrence

## Failure Modes and Effects Analysis (FMEA)

- is a systematic, **proactive method** for evaluating a process to identify where and how it might fail and to assess the relative impact of different failures, in order to identify the parts of the process that are most in need of change

## Safety Walk Round (SWR);

- It is a technique of risk assessment, which includes visits and **interviews by managers to operators on security issues** and on causes that can lead to adverse events.
- The interviews, individuals or groups, are intended to identify existing or potential hazards that can lead to adverse events for patients and measures which could be introduced to prevent the occurrence and ensure the safety of patient

# Patient safety tools (2/2)



- Other checklists;
- Multiple strategies/techniques;
- Behavioural interventions (improvement of teamwork, safety culture, etc.);
- ICT-based solutions.



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# Cost-effectiveness



## *Patient safety tools*

Surgical Safety check list

Root Cause Analysis

Failure Modes and Effects Analysis (FMEA)

Safety Walk Round (SWR)

Other checklists

Multiple strategies/techniques

Behavioural interventions

ICT-based solutions.

# Surgical safety checklist (1/2)



- The use of the checklist reduces the **number of deaths and postoperative complications**.
- These conclusions are obtained from three studies
- The **reduction in post-operative complications** following the introduction of the checklist ranges from 28.1% (Mitchell, 2011) to 31.2% (De Vries, 2010) to 36.4% (Haynes, 2009);
- **Reductions in mortality range** from statistically no change in the study by Mitchell, 2011 to nearly 50% in the study by De Vries, 2010 and by Haynes, 2009

## Surgical safety checklist (2/2)



- The study by Semel (2011) found the checklist was a “cost saving quality improvement strategy”, but noted that the *results are dependent on the baseline rate of surgical complications* and assumptions about the *reduction in complications* following checklist use
- Semel concluded that a hospital would realize a return on investment **if at least five major surgical complications are prevented** within the first year of using the checklist – assuming that the hospital has a baseline complication rate of 3%

# Other Checklists

Herzer KR, 2014



- The study compared a **program which included a checklist for correctly inserting central venous catheters vs current practice**. The checklist included basic hand hygiene, exercising full barrier precautions, cleaning the skin with chlorhexidine, avoiding the femoral site when possible, and removing any unnecessary catheters
- Compared with current practice, **the program is strongly dominant** and reduces bloodstream infections and deaths at no additional cost;
- The probabilistic sensitivity analysis showed that there was an almost 80% probability that the program **reduces bloodstream infections and the infections' economic costs to hospitals**;

# Failure mode and effect analysis



- The study by Hover AR, 2013 evaluated failure mode and effects analysis (FMEA) in order to reduce inpatient neurosurgery infections;
- Infection rate was reduced by 41%;
- The FMEA interventions resulted in 14 fewer expected infections, \$ 270 in savings, a 168-day reduction in expected length of stay, and 22 fewer readmissions;
- The authors concluded that FMEA implementation was cost-effective.





# Walk around

- The reviews of Weaver SJ, 2013 and Morello RT, 2013 show that the intervention with walk rounds can improve perceptions of safety culture
- Walk rounds can reduce patient harm

# ICT solutions

Avery AJ, 2012



- The study compared simple feedback vs a pharmacist-led information technology intervention (PINCER), composed of feedback, educational outreach, and dedicated support
- ICER of PINCER vs simple feedback was £ 65.60 at 6 months and £ 66.53 at 12 months
- The PINCER intervention resulted a **cost effective method** for reducing a range of medication errors in general practices with computerised clinical records

# Behavioural interventions

Huis A, 2013



- The control group received a state-of-the-art strategy including education, reminders feedback and optimizing materials and facilities. The experimental group included a strategy to improve nurses' adherence to **hand hygiene guidelines**
- The experimental strategy was significantly more effective in improving hand hygiene compliance. The mean difference effect was 8.91% (95% CI, 0.75-17.06). This extra increase was achieved at an average cost of € 5,497 per ward
- The incremental cost per extra percentage of hand hygiene gained on ward level was € 622
- The experimental strategy resulted **cost-effective**

# The review by Etchells E, 2012 (1/4)



- The review identified 5 cost-effectiveness analysis
- The study by Karnon J, 2009 studied the impact of **various strategies** for reducing potential adverse drug events. Pharmacist-led medication reconciliation dominated over a strategy of no reconciliation
- The study by Shermock KM, 2009 compared the **strategy of erythropoietin** to reduce transfusion related adverse events to standard care in critically ill patients. The strategy of giving erythropoietin had an incremental cost of US\$ 4,700,000 to avoid one transfusion-related adverse event

## The review by Etchells E, 2012 (2/4)



- The study by **Maenthaisong R, 2006** compared chlorhexidine gluconate and povidone-iodine for catheter site care. Chlorhexidine gluconate was a dominant strategy over povidone-iodine in both central-line catheter and peripheral-line catheter sites, showing a **cost savings of 304.49 baht (CAN\$9.98)** per central line catheters and 13.56 baht (CAN\$0.45) per peripheral catheter, with fewer infections
- The study by **Waters HR, 2011** compared the Keystone ICU Patient Safety Program in six hospitals to usual care. The Keystone ICU Patient Safety Program included a program which included **interventions to improve safety culture, teamwork, and communication** and specific interventions to improve compliance with evidence-based care to reduce central line associated blood stream infections. **The intervention cost about \$5,404 per case** of central line associated blood stream infection averted, and the cost of a central line associated blood stream infection is \$12,208 to \$56,167. Therefore the intervention can be considered **economically dominant**

# The review by Etchells E, 2012 (3/4)



- The study by **Regenbogen SE, 2009** compared **eight strategies**: no sponge tracking, standard counting, universal radiography without counting, universal radiography with standard counting, selective mandatory radiography for high risk operations, bar-coded sponges, and radiofrequency-tagged sponges
- Standard counting was predicted to prevent 82 per cent of retained surgical sponges with an incremental cost of US\$1,500 (CAN\$1,676) for each surgical foreign body detected, compared to a strategy of no counting
- Bar-coded sponges would prevent 95 per cent of retained surgical sponges, with an incremental cost of US\$95,000 (CAN\$106,132) for each surgical foreign body detected, compared to a strategy of standard counting
- Selective mandatory radiography for high-risk operations, universal radiography without counting, and universal radiography with standard counting were less effective and more expensive than bar-coded sponges

# The review by Etchells E, 2012 (4/4)



**Table 4: Cost effectiveness of PS Improvement Strategies**

SAFETY TARGET	INTERVENTION	COMPARATOR	INCREMENTAL COST EFFECTIVENESS RATIO
Catheter-associated bloodstream infection (111), ((115))	Chlorhexidine gluconate skin preparation	Povidine skin preparation	Dominant; economically attractive
	Keystone ICU Patient Safety program <sup>2</sup>	Usual care	Dominant; economically attractive
Potential adverse drug events (103)	Pharmacist medical reconciliation	Standard care	Dominant; economically attractive
Retained surgical foreign body prevention (116)	Standard surgical count	No count	\$1,500 to avoid one retained surgical sponge; probably economically attractive
Retained surgical foreign body prevention (116)	Bar-code-identified surgical sponges	Standard surgical count	\$95,000 to avoid one retained surgical sponge; uncertain economic attractiveness
Transfusion-related adverse events (109)	Erythropoietin	Standard care	US\$4,700,000 (CAN\$6,816,309) to avoid one transfusion related event; economically unattractive

# Summary of evidence from literature (1/2)



Reference	Intervention	Comparator	Results
Waters HR, 2011	Keystone ICU Patient Safety Program	Usual care	The program is a dominant strategy
Shermock KM, 2009	Erythropoietin	Standard care	Erythropoietin is not cost effective
Karnon J, 2009	Pharmacist-led medication reconciliation	No reconciliation	Pharmacist-led medication reconciliation is dominant strategy
Regenbogen SE, 2009	Strategies: no sponge tracking, standard counting, universal radiography without counting, universal radiography with standard counting, selective mandatory radiography for high risk operations, bar-coded sponges, and radiofrequency-tagged sponges		Selective mandatory radiography for high-risk operations, universal radiography without counting, and universal radiography with standard counting were less effective and more expensive than bar-coded sponges
Maenthaisong R, 2006	Chlorhexidine gluconate	Povidone-iodine	Chlorhexidine gluconate is a dominant strategy



## Summary of evidence from literature (2/2)



Reference	Intervention	Comparator	Results
Herzer KR, 2014	Program with a checklist for correctly inserting central venous catheters	Current practice	Program is <b>dominant strategy</b>
Hius A, 2013	Hand hygiene	State-of-the-art strategy	Hand hygiene is <b>cost-effective</b> (ICER=€ 622)
Hover AR, 2013	Pre failure mode and effects analysis	Post failure mode and effects analysis	Post FMEA is <b>cost-effective</b>
Avery AJ, 2012	Pharmacist-led information technology intervention (PINCER)	Simple feedback	PINCER is <b>cost-effective</b> (ICER= £ 65.60 at 6 months)
Semel ME, 2011	Surgical safety checklist	Existing practice	The checklist would <b>save money</b> and improve the quality of care



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# Estimation of costs associated with incorrect use of surgical safety checklist in Italian NHS (1/3)



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- Main aim of the study is to estimate the impact on LOS and related extra costs of surgical sentinel events occurred in Italian NHS hospitals due to an uncorrected use of the surgical safety checklist issued by the MoH;
- In order to obtain the necessary information (additional hospital stay and average length of stay), the hospital discharge data were utilized from NHS hospitals (an hospital day estimated in 780€);
- 15 sentinel events were considered (out of 34) from the database Information System for Adverse Event Monitoring (Simes) of the MoH divided into three types:
  - A. Surgical procedure in the wrong body part (N=2 events)
  - B. Procedure in the wrong patient (N=2 events)
  - C. Instrument or other material left in the surgical site which required further surgery or other procedures (N=11 events)

# Estimation of costs associated with uncorrect use of surgical safety checklist in Italian NHS (1/3)



Case	Hospital stay	Mean hospital stay	Additional hospital stay	Cost of additional hospital stay
1	5	5	-	€ -
2	42	23	19	€ 14,820.00
3	14	14	-	€ -
4	12	10	2	€ 1,560.00
5	30	15	30	€ 23,400.00
6	26	19	7	€ 5,460.00
7	77	10	67	€ 52,260.00
8	27	16	11	€ 8,580.00
9	185	18	167	€ 130,260.00
10	34	6	28	€ 18,872.00
11	35	4	31	€ 20,894.00
12	7	15	-	€ -
13	26	9	17	€ 11,458.00
14	2	2	-	€ -
15	30	13	17	€ 11,458.00
	<b>547</b>	<b>179</b>	<b>396</b>	<b>€ 299,022.00</b>

## Estimation of costs associated with uncorrect use of surgical safety checklist in Italian NHS (1/3)



- The estimated cost of the un-correct use of the surgical sentinel events checklist was **€ 2.392.176**
- This value was determined by dividing the total "cost of additional hospital stay" for the 15 cases, obtaining as average value **€ 19,934.80** which has been multiplied by **120 sentinel events**



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# Conclusions (1/2)



- Patient safety is a relevant issue to improve the quality of assistance
- The interventions for patient safety allow to avoid additional costs
- The review of literature shows that the tools for patient safety are cost-effective and in some cases they are dominant compared to usual approaches

# Conclusions (2/2)



- The tools promote and improve the risk management;
- It is important the promotion of safety in training;
- Ensure the communication between health operators to improve tools for safety;
- Ensure continuous improvement of tools;