Human Factors & Ergonomics tools for the analysys of patient safety incidents

WHO Collaborating Centre in Human Factors and Communication for the Delivery of Safe and Quality care

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Presentation outline

HFE tools for systems analysis of patient safey incidents

1) narrative and visual timelines

2) checklists and diagrams for the analysis of care delivery problems, contributory factors and latent failures

3) strategies to treat risks and prevent the recurrence of incidents with local and systems interventions on human, techological and organizational factors

4) stepwise analysis of case examplar

1) Narrative and visual timelines

A timeline is the description of a sequence of facts in a specified time span

Narrative timeline

A chronicle of facts describing a specific situation in a defined context, with the sequence of interactions between actors, tools and environment

+ Power of the story
+ Contextual details
+ Typical of case studies

Visual timeline

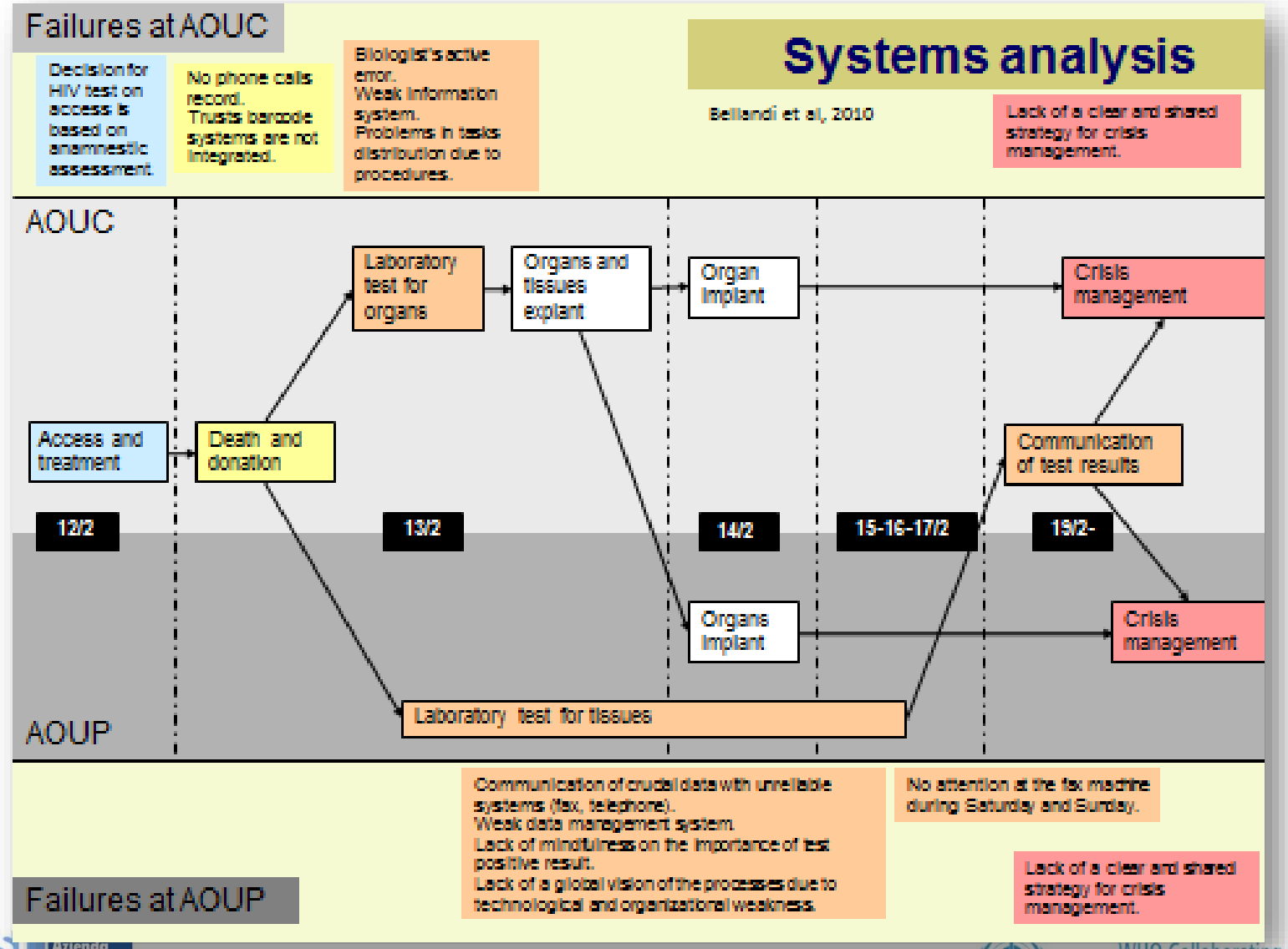
A visual representations of activities, tasks or actions taken by different actors along a line that represent the time span of the described events

+ Relations between actions and consequences
+ Quick look at the full picture
+ Connect facts with care problems and contributiry factors

1.2) Example of a narrative timeline

35-year-old woman, was hospitalized on February 7 at 7:27 pm due to a blood pressure increase at 39 + 6 weeks of physiological first pregnancy, following access to the AE for the same reason on February 4, on the occasion of which she had been visited and discharged with normal PA values.
At the entrance the obstetric visit, the ultrasound and the clinical evaluation show a stable situation, during the night the patient rests regularly.
In the morning, after the measurement of the parameters by the midwife on shift, the patient goes to the bathroom and noticing blood loss she calls the midwife at 6.45 am. Given the situation, the obstetrician immediately calls the gynecologist on duty and checks the heartbeat of the baby who is bradycardic. Once the extent of the loss and the bradycardia are noted, the operating room is alerted and the neonatologist on duty for the emergency cesarean which is performed within a few minutes but unfortunately the newborn is extracted lifeless at 7 am. around 8 o'clock the death due to the massive detachment of the placenta is ascertained. The operation ends at 9:22 am and the patient returns to the ward in stable conditions. The intervening doctors and the midwife communicate the incident to the woman and her husband.

1.2) Example of a visual timeline



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2) Checklists and diagrams for incidents analisys

Checklists and diagrams provide guidance for the analysis of contributory and latent factors related to one or more care delivery problem

Checklists

A list of risk factors based on literature and experience, that may contribute to the conditions in which people interact withn a clinical setting

+ Standardization of the analysis
+ Guide data collection and priorities for improvement
+ Complete exploration of work systems

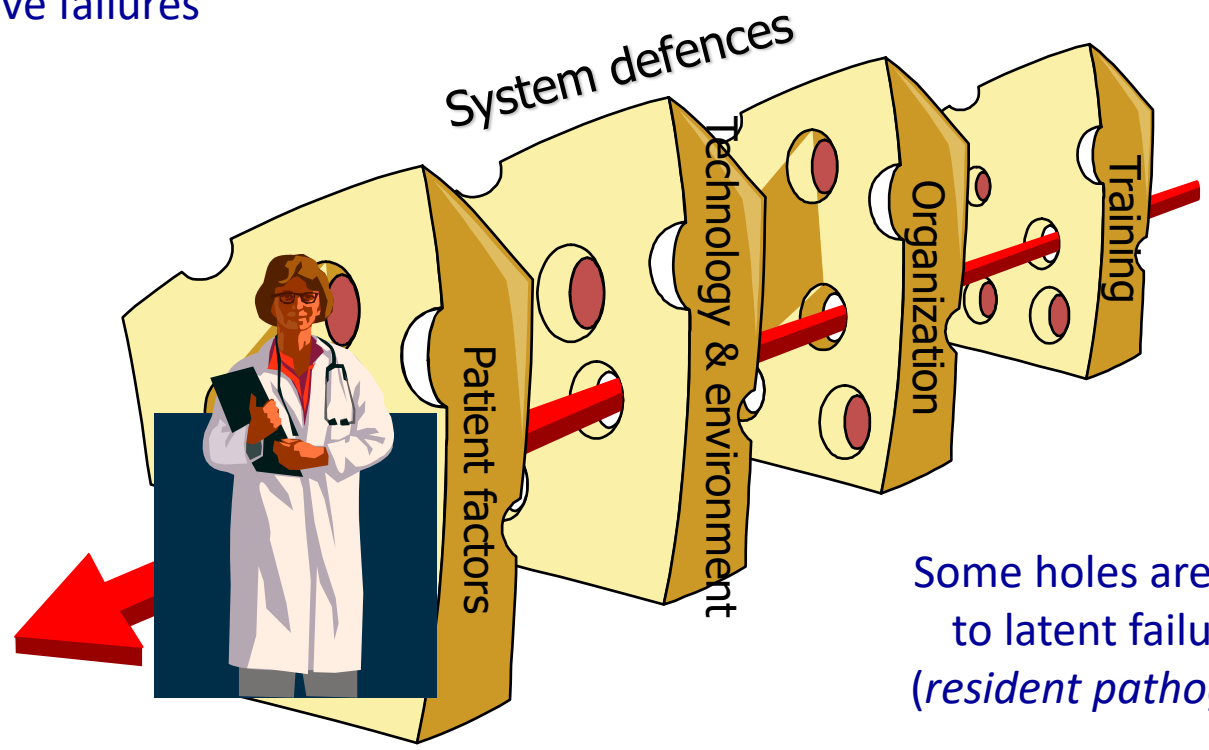
Diagram

A visual representations of the risk factors contributing to the adverse patient's outcome and their inter-relations

+ Relations between different risk factors
+ Quick look at the full picture
+ Spatial relations between risks and adverse outcomes

2.1) From the swiss cheese model >>

Some holes are due to active failures



Some holes are due to latent failures (*resident pathogens*)

Adapted from Reason, 1990

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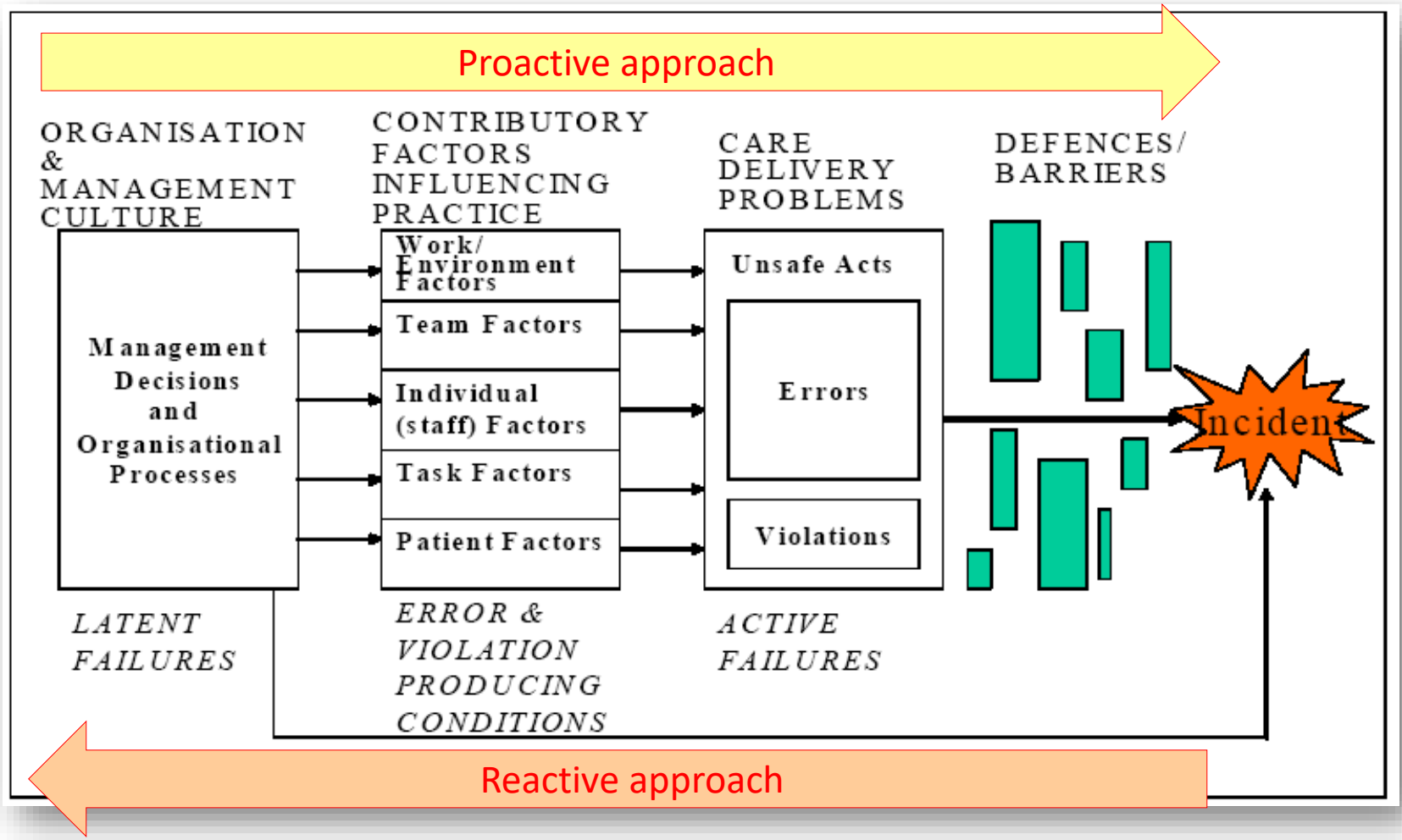
2.2) >> to the London Protocol



Vincent, 2010

2.3) Updated list of contributory factors

Contributory factor	Description
Patient characteristics	Conditions (complexity and seriousness) Language and communication Personality and social factors
Task/Activity	Design and structural clarity of the task/activity Availability and use of procedures Availability and accuracy of diagnostic test results Support in decision making
Human factors of the healthcare workers	Knowledge and skills Competence Physical and mental health
Team	Verbal communication Written comunication Supervision and help opportunities Team structure (compatibility, consistency, leadership, etc.)
Technologies	Involvement in the selection and design Equipment availability Usability and reliability Ordinary and extraordinary maintenance
Work environment	Staffing and skills mix Workloads and shift organization Administrative and management support Physical environment
Management and work organization	Financial resources and constraints Organizational structure Policies, standards and objectives Safety culture and priorities
Institutional context	Economic and regulatory context Health policy Links with external organizations

Bellandi et al, 2020

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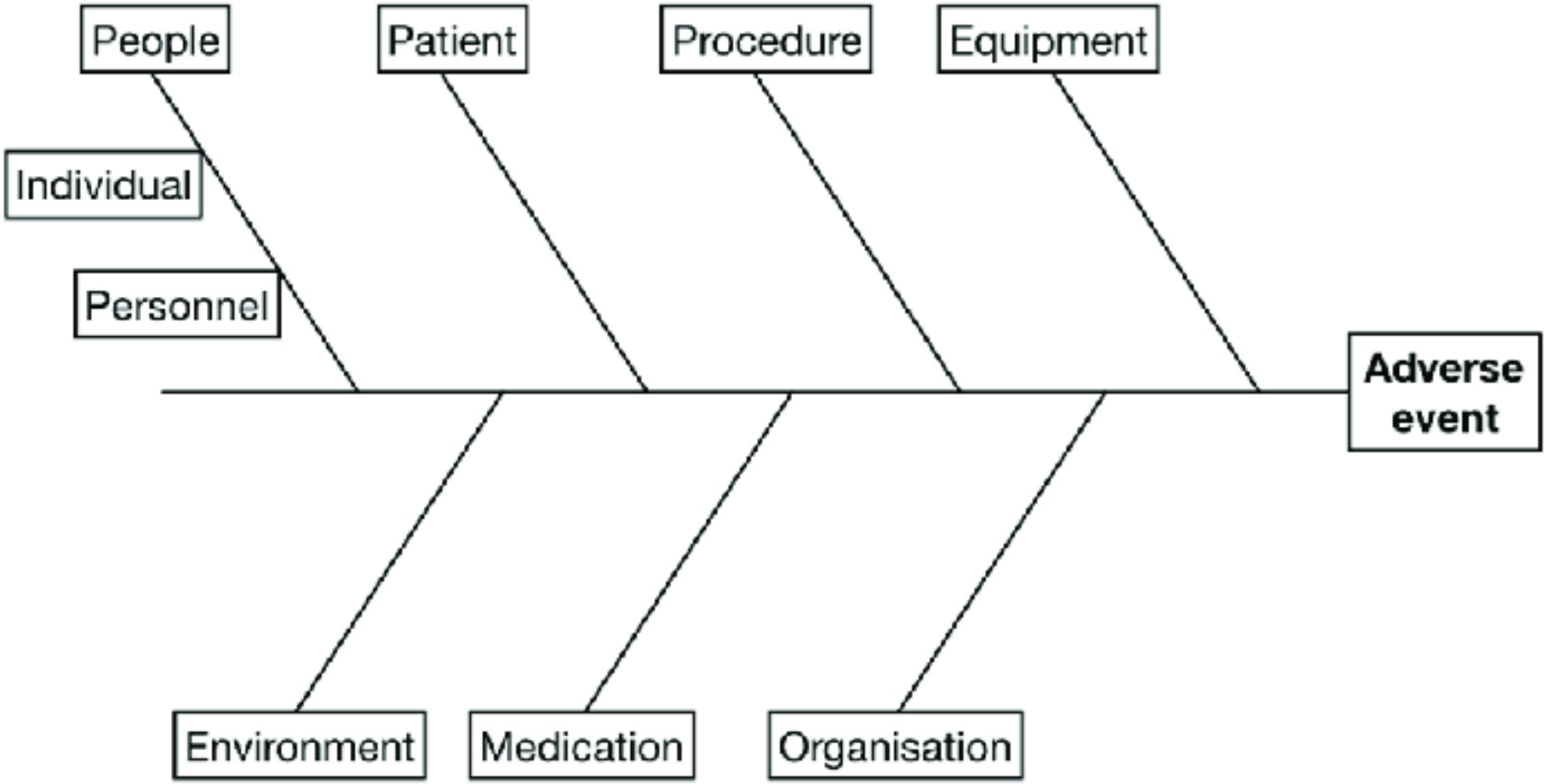
2.4) Contributory factors on a fish-bone diagram



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3) HFE strategies to prevent risks

Physical Interactions

Health-care facilities, furnitures and devices design
Noise and lighting assessment and improvement
Slips, trips and falls prevention
Hospital layout and wayfinding

Cognitive Interactions

Decision making and Human errors analysis
Interfaces usability assessment
and user centred design
Reporting and learning systems

Organizational Interactions

Team training and teamwork assessment
Analysis and redesign of patient clinical pathways
Assessment of safety culture
Design and implementation of systems
for patient safety management

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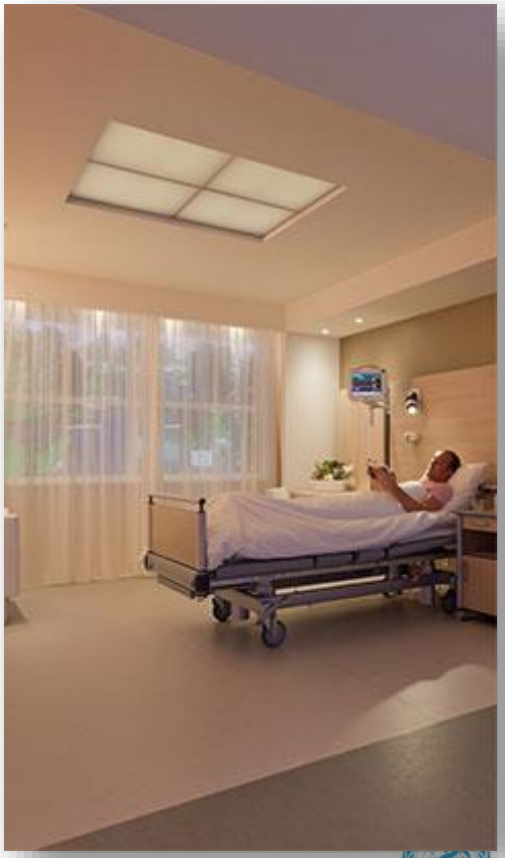
3.1) HFE strategies to prevent risks – physical interactions

€€ Environment and devices **aligned with user habits and needs** (user centered design finally applied to healthcare environment, information systems and interfaces)



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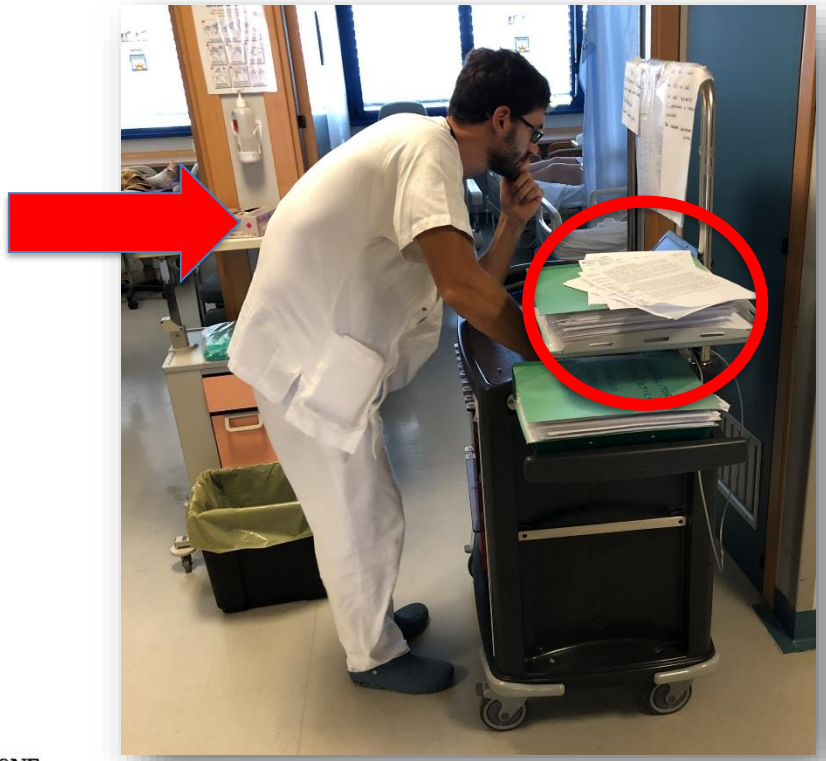
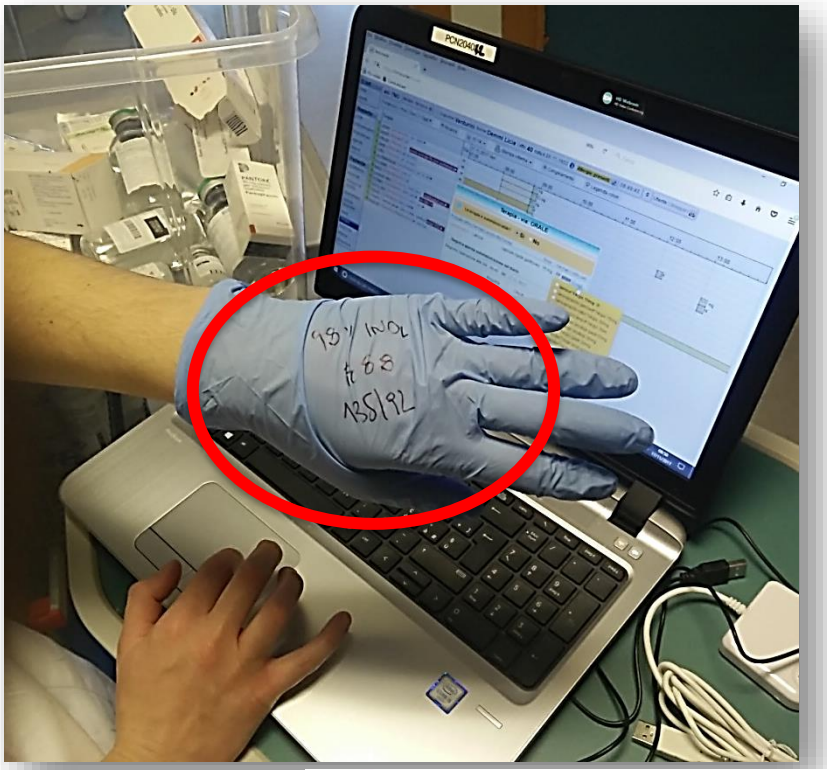
3.2) HFE strategies to prevent risks – cognitive interactions

€€ Cognitive walkthrough in the wild and **scenario based ethical design** (researchers on the ground, patients and professionals on the board)





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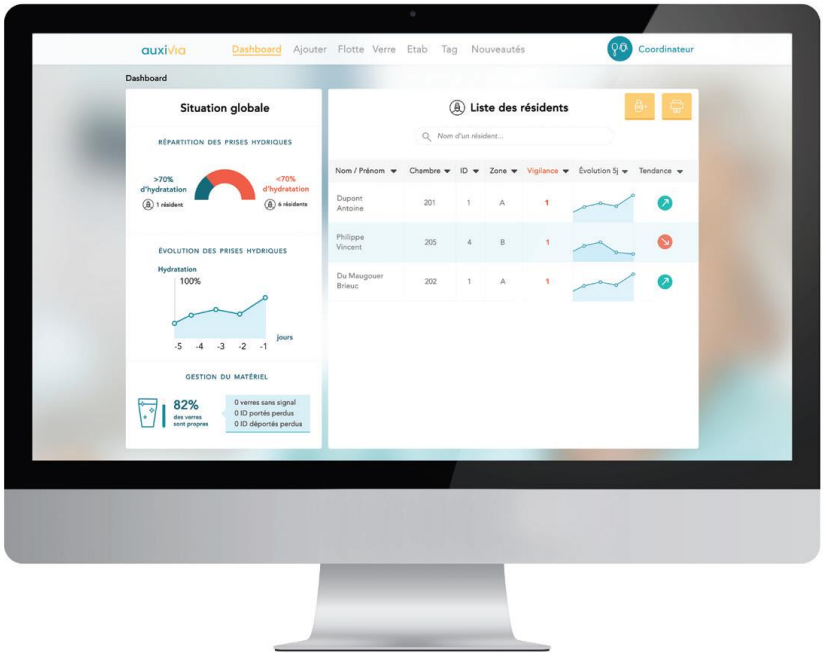
3.3) HFE strategies to prevent risks – organizational interactions

€€€ Mixing **traditional and digital consultations** (mobile health intervention)



Gazza, C., Pelayo, S., Kovacs, B., Schiro, J., & Marcilly, R. (2019). Studies in health technology and informatics, 265, 37-41.

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4.1) Stepwise analysis of case examplar – surgery > narrative

On 15/03/2022 the dermatologist present in outpatient surgery on 14/03/2022 was contacted by telephone by the Pathological Anatomy Unit regarding a histological sample from the Outpatient Surgery and relating to a dermatological surgery for the removal of a skin neoformation. Upon opening the container, the pathologist found the anatomical piece missing, but the presence of a very small fragment of material deemed not sufficient to be examined.
The doctor went to the pathological anatomy laboratory together with the nurse who was with him in the room on the day of the surgery, at the request of the pathologist, to check the contents of the container. They observed that the red ring was still present on the cap which must be removed in order to close the container and allow the inner basket, where the sample to be examined is inserted, to release from the cap and descend into the fixative. Probably the piece had not been placed directly in the container, but placed on a gauze and inadvertently disposed. The dermatologist then re-evaluated the case, communicated what happended to the 73 years-old male patient and given the nature of the neoformation, he dediced to increase the frequence of follow-up consultations without any additional procedure or treatment.

4.1) Stepwise analysis of case examplar – surgery > ICPS

Incident Type
Clinical Process/Procedure >> Problem >> Incompleteness / Inadequacy

Incident characteristics
Origin of incident >> When >> Step of the process >> Hospital >> Ambulatory Surgery >> During the procedure

Patient outcomes
Severity of consequences >> moderate

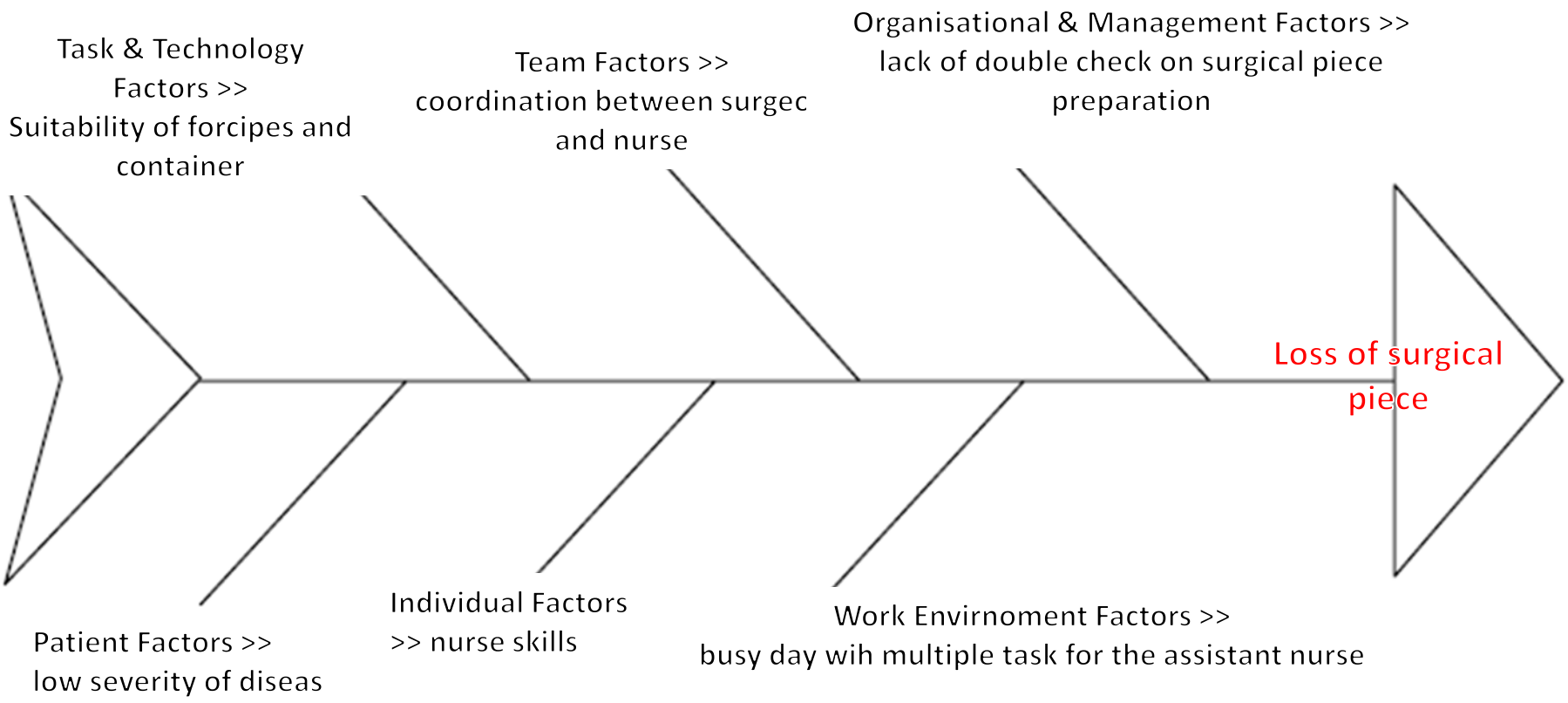
Contibutory factors
Human factors >> Communication >> Problems of communication and coordinatio between staff

Mitigating factors
Staff factors >> Effective and timely communication of mishap

4.1) Stepwise analysis of case examplar – surgery > timeline

Step	Description
1	Patient admitted for a surgical procedure to remove a nevus
2	The surgeon removes the nevus and put it on a gauze on the surgical table
3	The nurse pick-up the surgical piece to insert it into the container, but it probably remains fixed on the forceps and inadvertently disposed
4	The nurse close the container without completing the required action to release the fixative liquid on the bottom of the container
5	The nurse sends the container to the laboratory of patological anatomy
6	The patologist realizes that the surgical piece is missing and calls the dermatologist
7	They realize the problem, decide to call the patient and report the incident
8	The dermatologist revise the case according to guidelines, communicate what happened to the patient and shared the decision to increase the frequency of follow-up visits without any additional procedure or treatment

4.1) Stepwise analysis of case examplar – surgery > fishbone



4.2) Stepwise analysis of case examplar – medication > narrative

On 15 June, 102 doses of Comirnaty vaccine (= 17 bottles, 6 doses per bottle) were booked.
In the refrigerator for the temporary storage of vaccines there were 19 bottles of Comirnaty at the beginning of the sessions, as 2 had remained from the previous sessions.
The vaccination session continued regularly until around 6 pm, when before opening the penultimate bottle, a check was made of the last people on the booking list and those who had reservations after 7 pm were called, as the activities were ahead of schedule. Therefore, between 18.30 and 19.00 the 12 patients showed up, all in second doses, to whom the bottles 16 and 17 were intended. Since there was a fairly large number of people waiting, already evaluated by the doctor, the latter went to the nursing station to request administration. The preparation nurse was interrupted just as she was preparing bottle 16, so she incorrectly reported the number 17 on the checklist that supports the dilution and preparation of the 6 doses per bottle. When she handed the checklist, the 6 syringes ready for administration and the bottle to the nurse in charge of administering, she realized that the progressive bottle number 17 was indicated on the checklist, while on the bottle label the number was correctly indicated as 16. Therefore, she returned the checklist and the bottle to her colleague, who prepared a new checklist with the number 16. The nurse in charge of administration then returned to her station to proceed with the first patient who was already ready in the chair. The already diluted bottle 16 remained on the table in the preparation station, the nurse in charge of the preparation took it thinking it was 17 and proceeded to prepare the next 6 doses, with a minimum content of residual active ingredient in addition to the physiological solution .

4.1) Stepwise analysis of case examplar – medication > ICPS

Incident Type
Covid-19
Medication/infusion >> Problem >> Frequency/Concentration/Wrong dose

Incident characteristics
Origin of incident >> When >> Step of the process >> Outpatient services >> Visit/examination

Patient outcomes
Severity of consequences >> none

Contibutory factors
Human factors >> Cognitive factors >> Perception/Situation awareness
Organizazional factors >> Workload
External factors >> Product characteristics

Mitigating factors
Organizational factors >> Avaliability of effective protocols
Staff factos >> Identification and correction of mishap

4.1) Stepwise analysis of case examplar – medication > timeline

Step	Description
1	Patients book for antiCovid vaccination
2	On the day of the scheduled vaccination, 12 patients are called to anticipate the appointement
3	The 12 patients present aproximately at the same time at the vaccination centre, whith the result to create a cue
4	The doctor in charge asks the nurses to speed up the preparation of vaccine doses
5	The nurse appointed for preparation of individual doses wrote the wrong number on the checklist
6	The nurse appointed for administration realizes the problem when she notes that the number on the checklist does not correspond to the number on the vaccine bottle and she asks the colleague to correct
7	The nurse appointed for administration used for a second time a bottle of vaccine already diluted to prepare the next 6 dosis
8	6 patients received the vaccine with a minimal part of active principle

4.1) Stepwise analysis of case examplar – medication > fishbone