SAFETY

simulation for medical practice

SIMULATION APPROACH FOR EDUCATION AND TRAINING IN EMERGENCY

R2.4 Body of Knowledge

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DOCUMENT VERSION 01

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Summary

Introduction and objectives

As defined by the SAFETY project, the Body of Knowledge (BoK) represents the conceptual framework and the technical specifications of the new courses, deriving from the analysis of the Desk Research (WP1) and the needs analysis of Gap Analysis (WP2). It will represent the reference point to restructure the courses.

The principal object is to define a reference framework for reforming the existing academic syllabi and courses.

According to the results obtained from the desk research, including good practices, and the needs analysis from the survey performed by students, academics and companies, the SAFETY consortium has now a better overview of the actual status on training in emergency (among EU SAFETY countries) and what should be considered to improve it with the new offer of training material and tools.

To this aim, the present document will include the main findings coming from WP1 and WP2 research activities in order to summarise those elements that can contribute to the WP3 on the new courses structuring.

Contribution from WP1 desk research analysis

Each Higher Educational Institution (HEI) partner conducted desk research on the educational offer in the emergency field in their country. Additionally, the Hospital Clínic (Barcelona, Spain) included European Scientific Societies in their research.
The Hospital Clínic also conducted research on current good practices regarding simulation in the emergency field.

DESK RESEARCH ON EDUCATIONAL OFFER

Protocol for Data Collection on educational offer

Information regarding the educational offer in the emergency field was collected through a guide to data collection. This data collection guide included the same questions as those on RedCap.

1. Each HEI partner used the data collection guideline as a guide to access the information from the internet if possible.
2. All questions from the guideline had an "information unavailable" or "other" answer option.
3. Each HEI partner had the option to initially collect the information on paper (on either the printed or electronic versions) but the information had to be transferred latter to RedCap (access to the service was provided to partners). The **final official way** to convey the information was **RedCap**.

Source of Information

For each country

- Those universities with medical and/or nursing school
- University hospitals and/or tertiary hospital
- Emergency services
- National Scientific Societies
    - Anaesthesiology
    - Emergency Medicine
    - Intensive Care Medicine
    - Cardiology
    - Obstetric

    - Paediatrics
    - Simulation
    - Resuscitation Councill
    - Prehospital Medicine /Paramedicine
    - Midwifery
    - Nursing

Simulation centres affiliated to National Simulation Society

- European Scientific Societies of
    - Anaesthesiology
    - Emergency Medicine
    - Intensive Care Medicine
    - Cardiology
    - Obstetric
    - Paediatrics
    - Simulation
    - Resuscitation Councill
    - Prehospital Medicine/ Paramedicine
    - Midwifery
    - Nursing

Steps-Desk Research

Each researcher followed these steps when conducting the desk research.

1. Search on the source of information (hospital, university, scientific society) official website
2. Search on the source of information (hospital, university, scientific society) social media
3. Searching these terms on google:
   Emergency + course + Source of information name (hospital, university, scientific society) + area of interest (anesthesiology, emergency medicine, intensive care medicine, cardiology, obstetrics, simulation, nursing, prehospital medicine).

The following criteria were followed when conducting the desk research:

- All the eligible emergency educational offer (courses, masters, workshops, webinars, etc) since 2019 until 2021 was included.
- The emergency educational offer was included **regardless** of the use of simulation.
- Educational offer was not included **just because it involved simulation**. It had to be related to emergency.
- If previous editions for some courses, masters or workshops were available, researchers only included one edition (the most recent one) for course, master, or workshop.
- If the same course, master, or workshop was offered by more than one institution (Hospital, University, etc), researchers only included the

course, master, or workshop once.

- Other ways of getting information different from the online one were avoided to reduce bias. The research methodology was meant to be reproducible by all the

research partners. Researchers were told that they did not have to obtain all the information, as long as they had conducted the research conscientiously.

- Each question had an information unavailable answer option. Therefore, if there was little information on a specific course, researchers were told that they did not have to obtain all the information, as long as they had conducted the research conscientiously.

Main findings from WP1

- Most of the offers came from public universities and hospitals
- Public hospitals, public universities, and public and private simulation centres showed a statistically significant difference regarding offers across the countries participating in SAFETY. Spain tended to have a higher number of courses offered by these institutions.
- Undergraduate nurses and physicians had the lowest percentage of courses targeting them.
- Public universities showed a statistically significant tendency to have more courses targeting undergraduate physicians and nurses.
- Public hospitals showed a statistically significant trend to have fewer courses targeting undergraduate physicians and prehospital emergency staff.
- Private universities showed a statistically significant tendency to have more courses targeting nurses.
- Public and private simulation centres showed a statistically significant trend to have more courses targeting prehospital emergency staff.
- Courses related to anaesthesiology-intensive care, obstetrics, cardiology, and emergency management showed a statistically significant tendency to be more frequent in Spain.
- Public hospitals showed a statistically significant tendency to have more courses related to anaesthesiology-intensive care, cardiology, and paediatrics.
- Public simulation centres showed a statistically significant tendency to have fewer courses related to emergency management.
- Half of the emergency educational offer included simulation
- It seems that the courses using simulation allows to approach NTS as unique teaching or with TS more frequently than “classic” courses without simulation

- Courses with NTS teachings were more related to “diagnosis and treatment” and” clinical reasoning”
- There was a significant tendency of courses including simulation not to be target to “team- patient communication” and “team-relatives communication”

Contribution from WP2 training needs analysis

The University of Foggia, in addition to the role of project coordinator, lead Work Package n.2, being responsible for investigating the state of the art of teaching in the field of critical medicine and emergency, as well as analysing the needs of students, academics and also companies specialised in simulation. To obtain this information, three ad hoc questionnaires were created and disseminated, aimed at students of the health professions (medicine, nursing, obstetrics), academics in the same field and companies working in the medical simulation field.
The main objective of the questionnaires is to evaluate the state of the art of the teachings in the field of critical and emergency medicine, the didactic deficiencies (both theoretical and practical), and the willingness to deepen the various topics concerning the medical emergency using the new didactic methodology proposed, that is the didactic courses in simulation.
Secondly, the differences that emerged between the group of students and academics, the ultimate recipients of the questionnaires in question, were assessed.

GAP ANALYSIS RESEARCH

Protocol for Data Collection

Survey context and participants

Since needs analysis is a complex phenomenon, a research design with mixed methods (both quantitative and qualitative) was used. For the study of complex phenomena, the use of multiple approaches can be useful to deepen the understanding of what is being investigated (Sandelowski, 2000) and contribute to overcoming the biases related to the limits inherent in each research method.
The population under investigation was represented by:

- Students of degree courses in Medicine and Surgery enrolled in the 5th and 6th year of the course;
- Students of the degree courses in Nursing and Obstetrics enrolled in the 3rd year of the course;
- Doctors in Specialized Training enrolled in the 1st and 2nd year of specialization.
- Academics (University Professors, Researchers, Hospital Tutors, Specialists in the field of Emergency Medicine)

The involvement of all the interested population within the countries involved in the SAFETY project was attempted; therefore, the method of recruiting the sample was the census.

The dissemination of the questionnaires took place starting from 22.03.2021 and ended on 15.06.2021, through the website and social channels of the project.

Tools and framework applied

Starting from January 2021, the preliminary actions for the construction of the questionnaire were the following:

1. Analysis of the literature available to highlight the existing tools, to be able to take a cue on the dimensions that tend to be investigated, on the type and number of questions generally used;
2. Identification of 2 members for each project partner who were involved in the implementation of WP2 and creation of focus groups for the development and sharing of the dimensions of the questionnaire, the structuring of the questions and to identify additional areas / elements to be investigated;
3. Sharing of the questionnaire developed with psychologists (UNIFG and UiS) experts in research methodology, in order to improve its structure (including the methods of formulating the questions and answers);
4. Translation of the questionnaire into the languages of the countries belonging to the consortium and into English to facilitate their dissemination;
5. Insertion of the questionnaire on Google Forms, to allow the dissemination of the link through the dedicated website and social channels and to allow it to be filled in online;
6. Administration of the questionnaire to n. 30 students and n. 8 academics outside the tool, to have their views on the clarity, neutrality and completeness of the questions and the tool in general. This phase took place in the months of February / March 2021;
7. Improvement of the tool on the basis of what emerged from the previous phase.

Thanks to all these steps, two questionnaires consisting of n. 49 questions:
The first 35 questions were aimed at investigating the state of the art of teaching, the presence of simulation courses within universities, the degree of preparation perceived by students and academics in the field of medical emergencies. Questions can be grouped according to the following sub-categories:

- Survey on university training offer (10 questions)
- Team work (5 questions)
- Usefulness in teamwork (5 questions)
- Health Emergency Management (6 questions)
- Learning of Technical Skills (8 questions)
- Simulation Learning (1 question)

No. 6 questions consist of 6 cards related to the Choice Experiment, in which different types of possible courses were proposed to be delivered on the basis of 9 different attributes:

- Technical skill 1 - Interpretation of laboratory and imaging tests
- Technical skill 2 - Management of emergencies (Cardiac arrest, Polytrauma, Patients with Shock, Obstetric Patients etc)
- Technical skill 3 - Application and management of monitoring, insertion and management of vascular accesses and catheters
- Non-technical skill 1 - Communication and Crisis Resource Management
- Non-technical skill 2 - Team leading and team working
- Hybrid Courses (In presence + e-learning courses)
- Feedback
- Duration
- Price

No. 8 questions necessary for the characterization of the sample and useful in order to subsequently cross-reference the specific variables (age, sex, nationality, type of training carried out, annual income).

Answering the questions was mandatory.

In the first 36 questions, the answers were articulated on Likert scales of 5:

(1 = Strongly disagree; 5 = Strongly agree)

(1 = Very little; 5 = Very much)

(1 = Not important at all; 5 = Very important)

(1 = Not prepared at all; 5 = Very prepared)

In the questionnaire addressed to academics, where the "I don't know" option was also provided for the variables subject to investigation, it was asked to refer to the students' university education.

In the questionnaire, before the questions, a brief presentation of the survey was included, which underlined:

- voluntary participation;
- the anonymity of the participants;

In this introductory part, they were asked to answer the questionnaire focusing on the university education received, not considering the post-graduate course and the subjects were thanked for their collaboration.

The link was available to interested parties from 22.03.2021 to 15.06.2021.

Main findings from WP2

The main objective of the questionnaires addressed to students and academics has been to evaluate the state of the art of the teachings in the field of critical and emergency medicine, the didactic deficiencies (both theoretical and practical), and the desire to deepen the various topics concerning the medical emergency. These objectives were achieved using the new didactic methodology proposed, that is the didactic courses in simulation.

The main data that emerged from this research was the importance that is attributed to the teaching method in simulation by both groups. Both students and academics assigned an average score higher than 4.5 on the Likert scale to learning procedural techniques (Technical Skills) and communication and teamwork techniques (Non-Technical Skills), if developed in simulation.

Interesting results emerged from the analysis conducted on the state of teaching in the field of critical and emergency medicine. The questions aimed at investigating the university training offer showed how students believe they have acquired good training skills for the approach and management of patients, compared to what academics believe. This mainly derives, in addition to the theoretical training obtained, from the possibility of participating in practical medical simulation sessions. An interesting fact was also the use of software and platforms for e-learning; taken up mostly in recent years due to the SARS-COV2 pandemic, it is accepted by both groups with greater preference from academics.

Regarding Technical Skills and their learning, students have shown a greater consideration of their abilities than the opinion of academics towards them. However, the figure is not high as a degree of satisfaction, averaging level 3, or slightly lower in many cases, of the Likert scale. This probably demonstrates that there is a lack in university courses with respect to the acquisition of procedural techniques deriving, most likely, from the lack of laboratories and / or environments suitable for the acquisition of these skills.

The opinion expressed regarding communication and teamwork in emergency situations (Non-Technical Skills) is interesting. Both groups showed a high degree of appreciation for the subject matter; academics have shown more awareness of the importance of acquiring the ability to work in teams and communicate effectively in emergency situations than students; students, on the other hand, perceive that they have a good preparation in teamwork and communication compared to what academics thought of them.

What emerged from the results from the first part of the questionnaire, about the importance of integrating the simulation within university courses in the health area, was further supported by the results obtained from the Choice Experiment, present in the second part of the questionnaire.

The new variables obtained through factorial analysis were related to the attributes contained in the choice cards, giving rise to interesting results.

With reference to the answers provided by the students:

- As the training received increases, there is a greater demand for courses conducted in e-learning mode, a greater demand for feedback and longer courses; on the other hand, there is less demand for courses containing technical skills and notions of team work.
- As the university educational offer increases, there is a greater demand for courses based on emergency management, from a procedural and team management point of view; there is less demand for courses conducted in e-learning mode and of a shorter duration.
- As preparation in teamwork increases, there is a greater demand for courses conducted in e-learning mode; on the other hand, there is less demand for courses based on emergency management, from a procedural and team management point of view.
- As the ability to manage health emergencies increases, there is a greater demand for courses conducted in e-learning mode and over several hours; the lower the demand for courses based on the learning of Technical Skills.
- As the acquisition of technical skills increases, there is a lower demand for courses based on the acquisition of the technical skills themselves; On the other hand, there is a greater demand for courses based on team working of a longer duration.
- A distinction was noted with respect to geographic distribution. Students from Northern European countries (Germany and Norway) require courses more based on learning procedural management and emergency team management, in which there is active feedback, compared to Southern European countries (Italy, Spain, Romania).
- Older students have a higher demand for courses based on technical skills, a lower need for those conducted in e-learning mode, and a higher demand for feedback during courses compared with younger students.
- Finally, the difference with respect to the different courses of study attended was assessed. Students enrolled in nursing studies require courses that are less based on learning how to manage emergencies from a procedural and team management point of view than students enrolled in degree courses in medicine and surgery. On the other hand, paramedics and doctors in specialist training require courses based more on these attributes than the students of medicine and surgery themselves.

These results confirm that higher quality training guarantees the knowledge necessary to make students more confident in approaching patients.

Students more advanced in training require fewer and fewer courses based on learning procedural techniques, as they have already been acquired along their path. On the other hand, by acquiring greater maturity, their request for courses geared to managing teamwork during emergencies increases and their willingness to discuss, manifested by a greater request for feedback, increases.

With reference to the answers provided by academics:

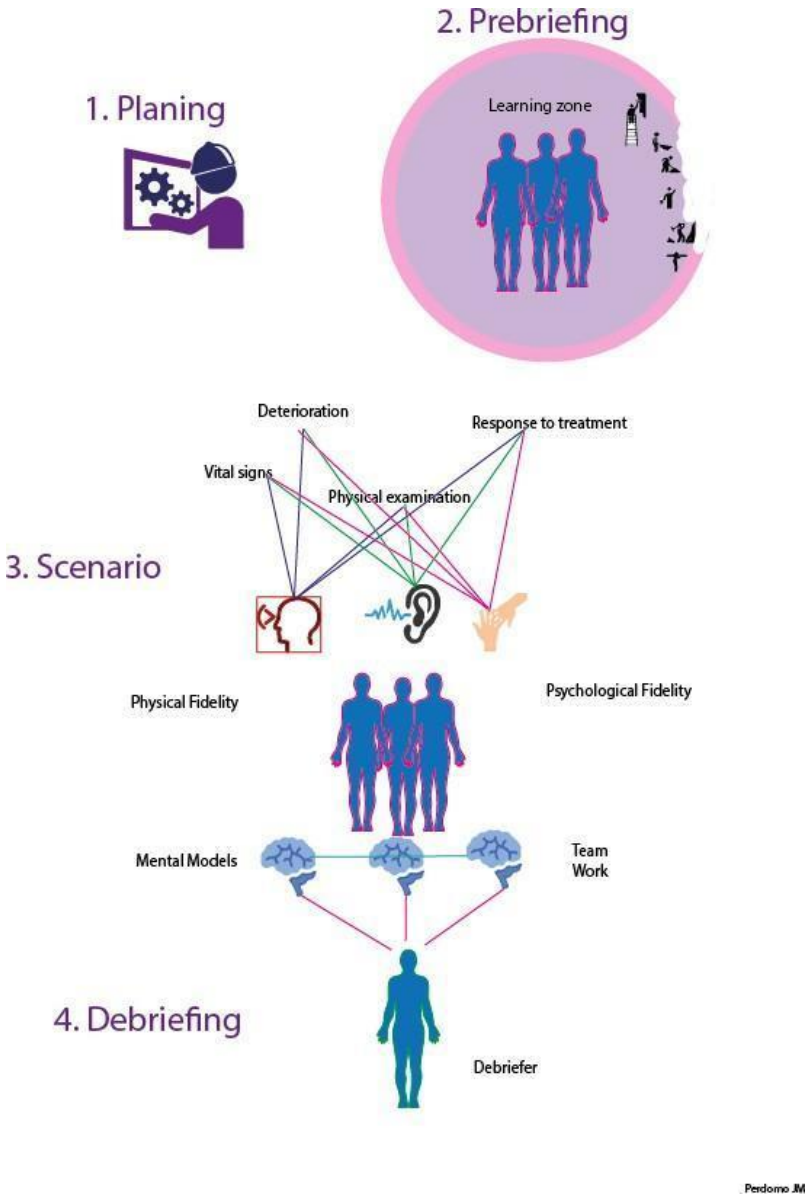
- A gender distinction was noted. Male academics required more courses conducted in e-learning mode and less based on learning procedural and emergency management for their students than their female colleagues.
- With increasing years of experience, academics are more likely to believe that courses more focused on learning procedural emergency management are useful and more willing to provide and receive feedback. On the other hand, more experienced academics consider learning team communication less useful during emergencies.

These results seem to highlight that academics, linked to the traditional teaching method, albeit supported by new technologies, tend to prefer the use of simulation for teaching technical skills to the detriment of non-technical skills and communication skills that are fundamental to management of a health emergency.

FOCUS on GOOD PRACTICES (WP1)

Definition

According to the European Union, a **good practice** encompasses a process or a methodology that represents an effective way of achieving a specific objective, one that has been proven to work well and produce expected results, and it´s therefore recommended as a model or as a useful example.



- **Good practices related to the scenario planning**
    - Link between daily clinical practice and scenario educational targets is recommended (methodology)
    - Scenario based on learner's background and context is recommended (methodology)
    - Simulation-based education programmes should be developed in alignment with formal curriculum, mapping or learning/training needs analysis undertaken in clinical or educational practice (methodology)
    - Simulation should be integrated into the existing curriculum rather than including simulation as additional, independent exercises (methodology)
    - There should be variation in the difficulty or complexity of the scenarios (methodology)
    - Domains (cognitive/affective/psychomotor) of learning involved in the activity should be described using educational theory (Bloom's taxonomy or higher). This encourages faculty to aim to provide holistic teaching of the skill (methodology)
    - The cycle of learning should be considered when planning simulation (methodology)
        - Knowledge acquisition
        - Skills proficiency
        - Decision making
        - Simulation in teams
        - Clinical experience
    - Simulation programme should include human factor approach (methodology)
    - Integration of desire of learning, individual roles and priority of the institution is recommended (methodology)
    - Multidisciplinary simulation should be promoted. Those who work together should learn together (methodology)
    - Link between the educational goal and the specific simulation technique to be used is recommended (methodology)
    - Definition of a realistic environment to achieve the educational objectives is recommended (methodology)
    - Definition of appropriate fidelity to achieve the learning objectives/outcomes is recommended (methodology)
        - Conceptual (i.e., vital signs and lab results reflect the diagnosis)
        - Physical/Environmental (i.e., setting of in-situ versus simulation

lab, equipment, tools, sensory props, manikin, moulage).
    - Psychological (i.e., evokes underlying emotions, beliefs, and self-awareness of learners).
- Link between the educational goal and the specific simulation device (task trainer, manikin, virtual reality, etc) is recommended (methodology)
- Identification of appropriate simulation modality to meet the learning objectives/outcomes is recommended (methodology):
    - Low technology (i.e., task trainer, case study, role play).
    - High technology (i.e., high complexity simulation manikin mimicking human body functions).
    - Simulated Patient (i.e., live patient versus virtual patient technology).
    - Virtual/Augmented Simulation (i.e., three-dimensional (3D) immersion using Head-mounted Display VR (HMD VR), haptic enhanced task trainers, computer screen-based, immersive rooms, interactive clinical case scenarios with branching case structure).
- Instructors should be properly assigned to the scenario, based on their experience, and learning goals of the course. An appropriate ratio instructors/learner is recommended (methodology)
- Clear standards of the criteria to be a simulation faculty member are recommended (methodology)
- Trainers should have specific training in simulation (methodology)
- The maintenance of a safety learning environment is the uttermost priority of trainers (methodology)
- Trainers should have a validation of experience in simulation recognized by the infrastructure manager and / or the educational and / or scientific manager (methodology)
- Trainers must have pedagogical experience enabling them to integrate simulation into a program (methodology)
- Trainers must be experts on the specific scenario subject (methodology)
- Senior trainers should be involved in simulation regularly (6 or more simulation sessions per year) (methodology)
- The skills of trainers should be regularly assessed (methodology)
- Instructors should have a continue personal development program (methodology)
- Junior trainers should attend to an introductory course which includes adult learning theories, simulation terminology, simulation technical aspects (methodology)
- Junior trainers should have specific training in debriefing, as debriefing is recognised to be the most important of learning in simulation (methodology)

- Junior trainers should observe or co-facilitate existing courses alongside a more experience instructor (methodology)
- Junior trainers should have a streamlined process to become senior instructor (methodology)
- Junior trainers must be supervised by the infrastructure manager (methodology)
- Simulation instructors should participate in ongoing continuing educational offerings, and/or targeted work with an experienced mentor (methodology)
- Proper location/physical space should be ensured for the prebriefing, scenario and debriefing (methodology)
- In case of in-situ simulation, the costs involved in-situ simulation should be considered (methodology)
- In-situ refresher training should be considered: Repetitive sessions known as low dose, High frequency training has been demonstrated not only to maintain competence, but also to improve performance (methodology)
- To perform a pilot test simulation experience before full implementation is recommended (methodology)
- BI studio: This tool helps the instructor to select and/or set scenarios according to the students' needs or goals meant to be achieved. The results and choices are done according to the Body Interact app (device, Take The Wind SA)
- During the planning period is recommended (methodology):
  - To define the target learner population
  - To define educational goals and their evaluation elements
  - To define the material and equipment required according to the desire realism
  - To define the human capital required
  - To define scenario duration and session sequence
  - To define the bibliography required before, during and after the scenario

- **Good practices related to prebriefing**
  - Promotion of psychological safety by having written statements and policies on confidentiality is recommended (written consent by participants) (methodology)
  - An explanation of how the session is planned to happen is recommended (methodology)
  - A reminder of confidentiality and fiction principles is recommended (methodology)
  - A reminder of ethical rules and professionalism contract is recommended (methodology)
  - An exposure of the type of technology to be used is recommended (methodology)

- A reminder of other psychological elements to make the participants feel comfortable: absence of judgment, absence of intentional tricks; is recommended (methodology)
- Participants' expectations should be explored (methodology)
- Logistic factors should be conveyed (methodology)
- It is recommended that roles and what to expect from participants, instructors, collaborators, observers, and technicians are explained (methodology)
- An introduction to the simulated environment should be considered (methodology)
- Writing o recording prebriefing plan should be considered (methodology)
- Instructors should be competent performing prebriefing (methodology)
- Prebriefing should be adapted to learning goals (methodology)
- Prebriefing should be adapted to participant's experience and knowledge (methodology)
- Preparation material should be provided to participants. The use of adult learning theories to prepare this material is recommended (methodology)
- The possibility of recording and/or observation by others (peers, external staff, etc) should be discussed (methodology)

- **Good practices related to the scenario**
    - Dedicated personnel should be responsible for the maintenance of equipment and associated records (simulation technician) (methodology)
    - Simulation technicians (methodology)
        - Should be competent in equipment, maintenance, and troubleshooting
        - Should be aware of the adult learning theories
        - Should maintain a safe learning environment
        - Should be involved in the designing of simulation cases
    - Consumables used in simulation must be clearly identified as no longer usable for patients. This is especially important in in-situ simulation (methodology)
    - Equipment used during in-situ simulation activity should be replaced to ensure that the clinical environment and drug stocks —where relevant— are left in a safe condition for continued delivery of patient care (methodology)
    - To keep updated the inventory of available equipment and its maintenance, as well as the stocks of consumables is recommended (methodology)
    - The recycling of consumables should be planned in accordance with the regulations (methodology)
    - It is recommended to maintain a competency-based training program for personnel to operate applicable equipment such as (methodology):
        - Simulator equipment
        - Medical equipment
        - Audio-visual equipment
        - Electronic health record systems
    - The equipment should provide the same experience to all participants (methodology)
    - It is recommended to deliver cues to draw attention of the participants to critical or noncritical information related to the context of the scenario or case (methodology)
    - A manual should be maintained to ensure consistency between design and delivery of the programme and reproducibility among instructors (methodology)
    - Testing of all simulation equipment should be undertaken before and after every session (methodology)
    - Body Interact is an interactive digital simulator for problem-solving and clinical reasoning using virtual patients. This tool has different patient options and ranges of difficulties. It also provides feedback on performance (device, Take The Wind SA)
    - QCPR feedback technology can be used to provide real time feedback to participant during scenario (device, Laerdal)
    - The SkillGuide can be used to provide participants with compression-

ventilation measurement and feedback during CPR scenarios (device, Laerdal)
  - CPRmeter App can be used to provide real-time coaching during the scenario (device, Laerdal)
  - VitalsBridge: The use VitalsBridge during simulation training can present vital signs onto a commercially available patient monitor (device, Laerdal) ASL 5000™ Lung Solution: This is a breathing simulator intended for high-fidelity ventilation management. It can simulate any respiratory condition you may encounter, on any ventilator in any mode of ventilation (device, Laerdal)
  - TruVent: This virtual simulation app can be used to teach ventilation management safely without the need for a ventilator or a simulator (device, Laerdal)

- **Good practices related to debriefing**
  - It is recommended to implement quality management processes to guarantee psychological safety and avoidance of inappropriate false reassurance (methodology)
  - Participants should feel comfortable during debriefing (methodology)
  - Debriefing should be learner-centred (methodology)
  - To maintain coherence between planned learning goals and debriefing (methodology)
  - Debriefing should be structured —incorporating various phases— but flexible (methodology)
  - The debriefing structure may follow one of the most frequent models:
    - Debriefing for Meaningful Learning (DML)
    - Debriefing with Good Judgment
    - Diamond
    - Gather, Analyse, Summarize (GAS)
    - PEARLS for System Integration (PSI) Frameworks
    - Promoting Excellence and Reflective Learning in Simulation (PEARLS)
    - Plus-Delta
    - Review the event, Encourage team participation, Focused feedback, Listen to each other, Emphasize key points, Communicate clearly, and Transform the future (REFLECT)
    - The 3D Model of Debriefing (Defusing, Discovering, and Deepening)
    - The Critical Incident Stress Debriefing Model
  - Objective performance indicators must be used (methodology)
  - It is recommended to promote discussions over teamwork (methodology)
  - Behaviours and interactions of a successful team must be subject to discussion (methodology)
  - The debriefing should occur immediately (less than 5 minutes) after simulation so that thoughts, feeling, and actions are captured without

degradation or distortion (methodology)
- Debriefing should be preceded by prebriefing (methodology)
- Conclusions and goals should be recorded to facilitate subsequent debriefings (methodology)
- Trainers should be trained in debriefing (methodology)
- Debriefing should be conducted by skilled instructor (methodology). Evidence from research suggests that the perceived skills of the debriefer have the highest independent correlation to the perceived overall quality of the simulation experience. The debrief should include the following communication skills (methodology)
    - Socratic approach
    - Open-ended questions
    - Active listening
    - Non-judgmental demeanour
    - Silence to encourage learner(s) input
- SimCapture: This software can enhance the effectively management, recording, and assessment during simulation training, both on-site and in-situ. It captures audio, video, annotations, patient monitors, and simulator data in a single web-based interface (device, Laerdal)
- QCPR feedback technology can be used to facilitate debriefing (device, Laerdal)
- SimPad PLUS with SkillReporter can be used to facilitate real-time feedback, records data and calculates overall performance (device, Laerdal)
- The SkillGuide can provide quick review of CPR performance to use during debriefing (device, Laerdal)
- The CPRmeter can provide instant access to objective key performance metrics, leading to quick feedback and debriefing (device, Laerdal)
- BI studio: This tool helps the instructor to see the results of the student's performance. The results and choices are done according to the Body Interact app (device, Take The Wind SA)

Good practices related to evaluation and improvement

- Additional debriefing should be conducted once the simulation session is finished (methodology)
- Implementation of learners' feedback is recommended (methodology)
- It is recommended to have a strategy to implement changes based on the analysis of learners' feedback (e.g., using the PDCA-cycle) is recommended (methodology)
- It is recommended to recognize the strengths and weaknesses of the established simulation program (methodology)
- It is recommended to included different levels of Kirkpatrick's evaluation (methodology)

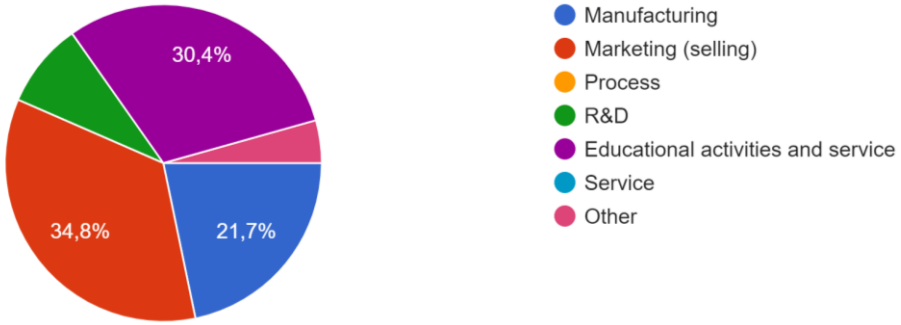
- Outcomes should be clearly defined and evaluated. Metrics for improvement should also be defined. Assessment describes the measurement of learner outcomes whereas evaluation describes the measurement of course or program outcomes (methodology)
- The existence of a referent responsible for coordinating research programs using simulation is recommended (methodology)
- The list of trainers performing research or scientific activities within the simulation program as well as their participation in national or international scientific meetings should be regularly updated.

Results from the Companies' needs survey

An ad hoc survey was prepared and spread to investigate entrepreneurs dealing with developing simulation tools for emergency training. This investigation was aimed at addressing the competences that the companies should look for when hiring new figures in their teams coming from the medical field.

Results from the Companies' survey
Step 1, Likert scale survey made by 4 groups of questions (score 1-5)

A total of 23 companies (from 14 EU countries) representing the simulation environment participated in the first step of the survey.
The main companies' size was represented by micro enterprises (with less than 10 employees) and the involved sector were the following:



Group 1. Replies connected to the aspects of the presence of medical staff within companies.

Regarding the possibility for a medical university study program to investigate alternative working possibilities, such as companies that need health professionals in their staff (wellness industry, bioscience and biotechnology and pharmaceutical industries).
More than **70%** of the companies agreed on the importance of this alternative working possibility.

50% of the companies interviewed presented a medical figure in their organization chart (MLS-Medical Science Liaison) with an essential role.

The companies interviewed declared to spend money and time in training medical staff, in particular, it resulted that almost 60% afford this cost in their human resources management.

Regarding the legislative and economic framework that every company must deal with in the field of medical training that must be part of the university programs, **70%** replied positively.
On the other hand, almost 60% of the involved companies, agreed on the difficulties to find medical personnel ready to leave the clinical-hospital activity and move to business activities for an alternative career.

GROUP 2 - Replies connected with the importance of research and communication within the company

Almost **60%** of the companies were positive about the presence of a manager in research and innovation in their team, as well as **65%** were very keen on having medical partnerships or university's collaborations.

Regarding the necessity to have excellent communication skills in the fields of research and training, **56%** of interviewed companies strongly agreed, whereas **48%** already have internal training programs for studying and improving communication skills for their employees.

70% of the companies also believed that effective communication improves collaboration between different entities (companies, healthcare centres, etc) and professionals to create networks.

GROUP 3 - Presence of companies in university's program

52% of the healthcare training companies are less involved in the training of undergraduate medical students, indeed, more than **65%** of companies agreed on the need for their involvement in the training program of medical students, especially those in the final years.
Moreover, 52% of companies are willing to be integrated into the university training program and to invest resources for the students' training.

More than **60%** of companies expressed their opinion on being part of students' university programs through lectures, workshops or internships suitable for the training of a medical-corporate figure (MSL).

Among interviewed companies, more than **43%** have managers that could train students in the role of "companies health expert" .

GROUP 4 - Medical training in simulation

Almost all interviewed companies (**n.19**) make use of simulation for training in safety and have software or simulation tools for carrying out training activities. They were positive to the integration between companies and universities for training students in the medical area using simulation.

Moreover, **n.16** companies (**69.6%**) strongly agreed on the fact that development of simulation software requires medical support to meet business needs with those strictly related to health training.

Almost all interviewed companies agreed on the need to have specific training on simulation and how it can be used at a training level.
Finally, **78%** of companies strongly agreed that simulation represents a good field where to invest in the future.

The second step of the company's needs survey consisted in an open interview to those companies who participated in the 1st step and expressed their interest in giving more in depth information.
This phase was developed delivering 4 open questions (through email or direct call), as follows:

1. What are the roles that a medical figure can play within your company? (e.g. researcher, development of new tools and equipment, trainer, Medical Science Liaison)

2. What are the necessary skills that these doctors should obtain during their studies in order to be able to offer the right contribution to your company?

3. What is the contribution that companies, through advanced or basic medical simulation, can provide for students' training? (existing or future ideas and projects). Give also examples of your collaboration or partnership with scientific societies or local universities

4. What can be the University's contribution, through their study courses, in developing or using simulation tools for students' training? (educational workshops, biomedical science courses, internships in companies).

The results are showed in the table below.

Question #1
● Instructor, course coordinator, program coordinator, researcher ● Development of new tools & technology ● Ideally a medical figure with a certain technical understanding, included in the development process, able to translate between requirements from healthcare personnel and technical realisation/implementation. Also knowledge of training necessities. ● No classical healthcare know-how in the company is needed due to the nature of the product, but feedback from users in healthcare is of paramount importance. "Translation" from user needs into technical specs is provided by the company. ● Simulation Instructor ● Networking into own professional community, internal consultant on professional matters (within the company), and liaison to the professional community as someone knowing the community from the inside. ● Trainer ● Researcher
Question #2
● Technical and non-technical skills in training with virtual patients and high-fidelity simulators, for the development of good health safety practices ● Pedagogical notifications & innovations ● Understanding of technology. ● Provide basic education on simulation, simulation technology and debriefing to be able to provide meaningful feedback in order to enhance product quality ● Simulation previous experience. Communication and debriefing skills ● If the role contains some budget responsibility, in any case a basic understanding of economics and the way a company is working. Definitely a certain affinity to hard- and software, competence in teaching methodology using new technology and a virtual learning environment. ● Communication and some technical skills, which can give them the ability to teach course participants effectively using our equipment. ● Technology and Informatics useful to improve teaching efficiency.
Question #3

- The future involves the inclusion of medical simulation on a mixed basis, which is why we always include this in our courses. We have worked with our partners such as Universidade Atlantica and Universidade da Beira Interior and we have two postgraduate courses with more than 35 editions in 5 years of work. These courses are always full subscribed.
- Finding solutions that improve learning targets and results in simulation training. Helsinki University Hospital simulation centers in various clinics (3), more than 60 centers globally.
- Perform scientific studies with prototypes, thus contributing to students' training but also enhancing product.
- Cooperation with educational entities is important, in order to provide all students with current technology, but also for companies to learn from a big number of simulations and be able to test new features, thus generating a positive feedback loop.
- Apply simulation on competencies development. Facilitate Peer to Peer training
- The training does most certainly enhance patient safety and guideline adherence, more generally speaking the quality of care. Also, by being trained in a realistic environment motivation rises. Stress in critical situations can be decreased by experiencing those situations before, in the training environment.
- Also, through close cooperation (see also next point) with Universities and hospitals a better interlocking between education, clinical work and industry can be obtained.
- We did several workshops for undergraduate and postgraduate medical students using high fidelity medical interventional simulators (laparoscopic, endoscopic, ultrasound) together with medical universities, when the university teacher (doctor) has been showing practical clinical skills using our simulator and has been proctoring students or young doctors when they've been using simulator.
- Information about simulation innovations, information about how other simulation centers very often companies representatives become crucial to contact with other teachers of simulation.

Question #4

- The university can and must be the standard that we want to introduce in the best way of learning, in error without consequences. In this way, even after they graduated in university terms, even when they began their professional activity, they would always continue to favor the way of learning with simulated practice.
- Their experience on challenging issues with clinical work, like communication etc.
- Universities should invest time in cooperation with companies, instead of expecting companies to pay in order for their products to be used in training. Being open to offering or recognising internships in companies from the healthcare simulation field. Although in patient care new technology is being used, in training of students often very old methods are employed.
- First of all, use it! Enhance or replace theory through practical sessions by using simulation. Offer theoretical background to simulation and debriefing, also as a basis for better professional activity and teamwork.
- Educational workshops, Clinical scenarios development

- Universities (and our company has cooperations with several German universities and university hospitals) should understand that it is necessary to bring in knowledge and also personnel to jointly develop products - for the end-users, together with the end-users. It does, however, cost some money - personnel, time. Educational institutions should contribute with knowledge and by accompanying scientific projects.
- Educational workshops, clinical skills courses with simulators, team training drills
- I think the contribution is very important as the universities have inside populations of all educational levels and all health professions.