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D4.3 – e-Coaching Platform for Family Psycho-social Support and Training

WP4 – Patient centred-supportive palliative care ecosystem augmentation

Submission Date	30 September 2021
Responsible Partner	WITA

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Glossary

COPD	**Chronic Obstructive Pulmonary Disease**
HF	Heart Failure
PC	Palliative Care
PWA	Progressive Web App
VP	Virtual Patient
VR	Virtual Reality
WHO	World Health Organization
Apps	Applications

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Executive Summary

The present document is a deliverable of the InAdvance project, funded by the European Commission's Research and Innovation Action (RIA) under its H2020 Programme for Health, Demographic change, and Wellbeing.

The overall aim of InAdvance is to improve the benefit of PC through the design of effective, replicable and cost-effective early PC interventions centered-on and oriented-by the patients. Interventions are defined for/orientated on patients, families, informal caregivers, and front-line care professionals. In order to achieve this main goal, InAdvance will produce evidence-based outputs to assist care professionals, service managers and policy and decision-makers in their scalability and replicability. Among others, InAdvance , aims to provide eHealth tools addressed to empower the palliative care patient's ecosystem.

The deliverable aims to describe the outcomes of Task 4.2. Psycho-social support augmentation. **The objectives of this task are to develop contemporary but simple-to-use tools for e-coaching/educational mobile platform to support relatives, aiming to reduce anxiety and increase their knowledge which in turn will improve the quality of the provided support to the patients they care for.** In addition, this task examines how the use of simple collaborative technologies such as shared notes and social media or other tools may be used to uplift the confidence and positive feelings of the patient (and his/her family/informal caregivers) towards technology and care provision.

Following the Deliverable 3.2 Report on individual and contextual factors, and the outcomes of interviews with patients, caregivers, and health professionals reflecting their needs, we decided to focus on simple to use applications by training the user in an easy and enjoyable way. Shared notes and social media were not high in our priorities since studies have shown that there are no or only small effects in changing the knowledge, attitudes, and behavior of users when comparing social networks to no information or information available through other channels (Strømme et al., 2014). Our attention was rather focused on mobile applications and Virtual Reality (VR) applications to introduce and intrigue the users in trying new education technologies. We have also developed applications to be used not only by patients and caregivers but also health professionals and medical students.

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1. Introduction

According to the World Health Organization (WHO) palliative care is "an approach that improves the quality of life of patients and their families facing the problems associated with a life-threatening illness, through the prevention and relief of suffering by means of early identification and impeccable assessment and treatment of pain and other problems, physical, psychosocial and spiritual" (WHO, 2019). Over the recent years, palliative care has matured and has been accepted as a successful health intervention addressing pain and various symptoms of distress (somatic, psychological, and spiritual) (Chochinov, 2006). Different approaches have been developed and implemented on an international level based either on a voluntary basis or via official health services.

Palliative care may include opioid medication to encounter acute pain, steroids, or muscle relaxants. It can also include alternative ways of tackling pain like acupuncture, meditation, or massage. It was not until the 90's that Virtual Reality (VR) was suggested, as an alternative to drugs way, of pain and stress management (Riva, 1997). And only recently, Gaming was presented as an effective way of intervention to assist patients and their families and caregivers to discuss about difficult and important issues of illness and end of life (Scoy et al., 2016). Mobile Applications have also recently entered the Health Market presenting an easy and simple choice for training or gaining knowledge in various health issues. Mobile Apps revolutionised the delivery of healthcare services and have been proved as beneficial for chronic disease management, education, and training as well as healthcare (Lohnari et al., 2016). It is apparent that technology is of high importance for palliative care especially after COVID-19 pandemic and the restrictions in face-to-face meetings and live trainings. Technological applications can bring information and knowledge at the tip of the finger for patients and their caregivers; they can educate and train medical students and health professionals; they can provide self-care management; reduce stress, and all these in a simple, easy, and fun way.

In this deliverable, we will describe the development of Mobile Apps based on Virtual Patients (VPs) for patients' and caregivers' education in the context of InAdvance. We will present the VR tools for stress and pain management using 360° videos and mindfulness techniques. VR scenarios aiming to train health professionals, medical students and caregivers in empathy and communication skills, will be introduced. Finally, a tool for preventing bed sores will be presented, developed to assist health professionals and caregivers in monitoring bedridden patients to act timely and thus prevent bed sores.

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2. Mobile Application for caregivers and patients' education (AUTH)

As the utilization and the access to mobile devices have increased and self-care in chronic conditions is highly promoted (Franek, 2013), several Virtual patients' (VPs) scenarios have been developed and became accessible through an easy-to-use mobile application.

Virtual patient (VP) is a computer-based software that enables the simulation of different clinical scenarios ranging from frequent cases to critical situations (Isaza-Restrepo et al., 2018). VPs have been used to expose medical students to rare clinical scenarios or difficult to deal with in real clinical practice (Ellaway & Masters, 2008; Friedrich, 2002) with emerged benefits in medical education (Berman et al., 2016; Isaza-Restrepo et al., 2018; Saleh, 2010).

In this case, we have used VPs scenarios through a Mobile App to train patients and their caregivers in (a) disease awareness, (b) symptoms' management and (c) psychosocial support.

2.1 Mobile Application using VPs

There is a fine balance in internet usage in Europe, with an estimated 49% in mobile and 47% in desktop usage (StatCounter Global Stats., 2021). This led the idea of utilizing virtual patient scenarios in as many different environments as possible, developing a mobile web app that can run on every mobile platform, may it be Android smartphones or iPhone, as well as desktop computers. The preferred approach was the design and development of a progressive web app (pwa) (Richard & LePage, 2021). A pwa is a web application that has the main advantages of a web app, which are: a) the ubiquitousness, b) the use of well-established technologies that run on a widely diverse spectrum of platforms and, c) the advantage of a traditional app, thus the installability and close integration with the operating system.

The developed application is a web app that the users can install in their smartphone, get notifications just like an ordinary mobile app, but could also run as a web app on any desktop computer, managing to reach as many users and platforms as possible. The interface is simple and easy to navigate offering basically three main screens: i) **Home**, which is the greeting page, **ii) Scenarios**, with all the available virtual scenarios and, **iii) Info**, with some details about the INADVANCE project and links to other technologies that have been developed (VR, 360°, etc.), as seen in *Figure 1*. In the Scenarios screen the user can choose scenarios from three categories:

(a) disease awareness,

(b) symptoms' management and

(c) psychosocial support,

as seen in *Figure 2*. Furthermore, each scenario provides a review path, so the user can trace their path for each question/answer of the scenario, as seen in *Figure*

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3. Lastly, in *Figure 4* a typical view of a scenario and how it is structured is presented.

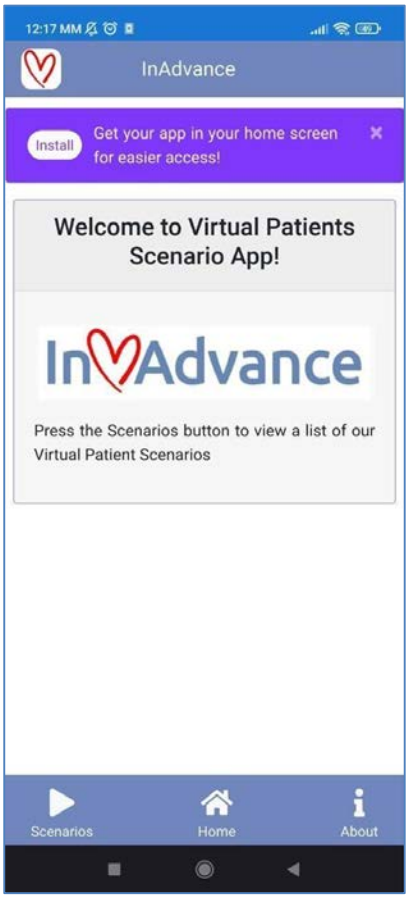

Figure 1 Home Page

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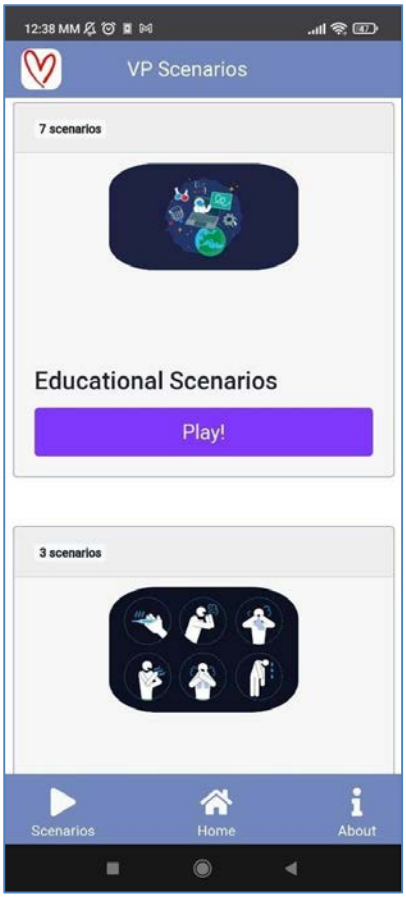

Figure 2 Scenarios

In more detail, the designed scenarios aim to train patients and caregivers on seven (7) different clinical conditions including diabetes, dyslipidemia, heart failure (HF), atrial fibrillation, hypertension, Chronic Obstructive Pulmonary Disease (COPD) and chronic kidney disease. More scenarios were developed to facilitate the management of real-life situations that often arise in COPD, HF and patients with multimorbidity.

Benefits of psychosocial support have been already documented in different categories of chronic patients and their caregivers (Ågren et al., 2012; Chan et al., 2016; Marques et al., 2015). Thus, multiple scenarios were developed to promote education and management skills on stress, insomnia, grief/mourning as well as emotional awareness.

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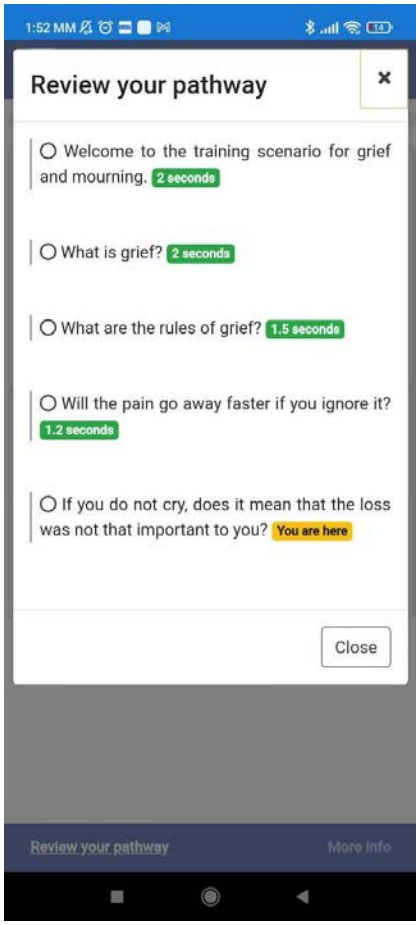

Figure 3 Review pathway of a scenario

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Figure 4 Snapshot of a scenario

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3. Virtual Reality (VR), (AUTH)

The term Virtual Reality (VR) refers to the simulation of the environment in a realistic way through an advanced human-computer interface (Zheng et al., 1998). In this simulated environment, the objects and the surroundings appear to be real, offering the user an immersive interaction with their surroundings. In order to perceive this immersive and virtual environment, the use of a VR headset is required. The most common applications of VR involve the entertainment industry (video games, 3D cinema, and social virtual worlds). Other applications include social sciences and psychology (virtual reality exposure therapy) (Gerardi et al., 2010; Gonçalves et al., 2012). In the field of healthcare, VR has a variety of applications. More specifically, these applications include the treatment of mental health disorders, surgery, medical therapy, preventive medicine, visualization of databases, skill enhancement and rehabilitation, and medical education and training (Aziz et al., 2018).

Virtual Reality (VR) has been applied for pain management to relax patients or as a method of distraction during medical procedures. Researchers have noticed that Virtual Reality creates a form of analgesia by influencing the body's pain modulation system without still locating the exact mechanism behind this reaction (Mahrer & Gold, 2009). There is also evidence that using Virtual Reality in palliative treatment alongside with the suggested medication supports pain and symptoms management at all stages (Perna-Forrest, 2017; Anon, 2019).

In the case of the InAdvance project, the focus has shifted on the field of a) medical training through the enhancement of empathy and b) in pain management through mindfulness relaxation techniques. A complete VR platform has been developed containing 360° videos that promote relaxation and pain management (see section 4.1) and a series of training scenarios targeting the enhancement of communication skills and empathy for healthcare professionals and medical students (see section 4.2).

3.1 VR 360° videos and Mindfulness techniques for stress and pain management (AUTH)

Mindfulness based interventions have been shown to be effective in helping people to develop resilience to a wide range of stressful situations (Shonin, Van Gordon & Griffiths, 2013; Kriakous, Elliot, Lamers & Owen, 2020). Mindfulness is the ability that each human has to be aware of its own emotions in the moment (Zenner & Herrnleben- Kurz, 2014). Practicing mindfulness increases awareness of what the person senses and feels, without judging and interpreting these feelings. There are many ways to practice mindfulness involving breathing techniques, guided imagery and more, to relax the body and mind in order to better manage pain and reduce stress (Kabat-Zin, 2003).

In the context of InAdvance, VR360° videos have been built to increase awareness, support pain management, and reduce stress through recorded guided instructions that accompany soothing and relaxing imagery. By guiding users to focus on what they see, hear, sense, and feel in the moment while following

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breathing instructions, this App aims to facilitate patients and caregivers to better handle pain and stress. VR 360° videos can transport the users to a beautiful and calm, virtually created location, where they feel safe to relax and enjoy the "view".

360° videos are a category of video recordings where the video is recorded simultaneously in every direction (Kopf et al., 2016). They are also called immersive videos due to the engaging experience they provide for the viewers. They are usually recorded either with several cameras, each one filming in a specific direction, or with the use of an omnidirectional camera, a specific kind of camera that has a field of view that covers approximately the entire sphere or at least a full circle in the horizontal plane. 360° videos offer to the user control over the viewing direction during the playback of the video. They can be viewed through the user's personal computer, or via smartphones and VR devices. When using one of the latter, the user can benefit from the gyroscope of the device and to pan the video based on the orientation of the device.

InAdvance 360° videos are provided to users with an Oculus Quest 2 device. The user listens to a series of soothing guiding instructions, and they are transported through the application to the national park of New South, Australia (Image 1) or the Tasman National Park is a national park that is located in eastern Tasmania, Australia (Image 2). The scenery involves a tropical forest with a large waterfall in the first video and a beach with calming waves in the second. The user can look around them and notice the motion of the leaves, the running water along the waterfall, the changes in the colors of the sky or the waves smoothly, the open horizon and a number of other details all of which help offer the sensation that are present in this location, relax and enjoy the moment.

Figure 5 Tropical Forest with a waterfall

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Figure 6 Sunny beach with calming waves

For the design and development of this application, the Unity3D platform was used, where the selected 360° video along with the calming instructions were embedded. The guidelines were recorded by a specialist in mindfulness interventions. The Oculus SDK was used to successfully incorporate the use of the controllers providing the user with the opportunity to interact with the platform through them. As a result, the virtual hands of the user directly follow the movement of their hands while holding the controllers. The videos that were chosen and purchased (*www.atmosphaeres.com*) for the needs of the project are in 4K quality (4096 × 2160), a resolution sufficient to provide lifelike sensation of the surrounding environment.

Figure 7 Oculus Quest 2

Although the application was built for a specific device, the methodology by which has been designed via Unity 3D platform, offers the opportunity of using other VR devices like HCT Vice and Pico for its realization.

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3.2 VR scenarios for empathy training (caregivers and health professionals (AUTH)

Patient-centered care is one of the main elements of high-quality care. Empathy during healthcare professional and patient relationship is cornerstone in order to promote patient-centered care (Kiosses, Karathanos & Tatsioni, 2016). Thus, training healthcare professionals to engage patient-centeredness in their clinical environments and encounters with patients, transforms their way of relating with them in a more empathic, engaging and collaborative way.

Research shows that empathy during healthcare professional and patient relationships is linked with more accurate diagnosis, fewer burnout effects, more satisfying patients, less useless medical tests, shorter rehabilitation period, more trustful and genuine relationships (Batson, Fultz & Schoenrade, 1987; Kim, Kaplowitz & Johnston, 2004; Hojat, Louis, Markham, Wender, Rabinowitz & Gonnella, 2011). Hence, being empathic facilitates the professional, the patient and the healthcare system in general.

Although there is a lot of controversy among researchers of the definition of empathy, we use the original definition of Carl Rogers, the founder of a person-centered approach in counseling and psychotherapy. Carl Rogers states that: empathy is the ability to deeper understand one person's experience in the world, as if you were that person, without losing the "as if" condition (Rogers, 1995).

The VR scenarios, developed in the context of this project, are aiming to improve healthcare professionals' empathic performance and communication skills. Several VR scenarios have been created representing different medical conditions. Each scenario transfers the user at the medical office where a patient is waiting. The patients describe their health problem, and the user (doctor, medical student) should choose between 3 suggested responses. There is no right or wrong answer, but a more or less empathic answer. With every choice they make, the virtual patient responds accordingly. There are four interactions in every scenario. At the end of each session, users receive feedback according to their choice of answers from a virtual empathy expert. During these virtual interactions, the user has the chance to clarify what empathy is and how it can be promoted. *Image 5* portrays one of the scenarios and how this unfolds according to the doctor-patient interaction.

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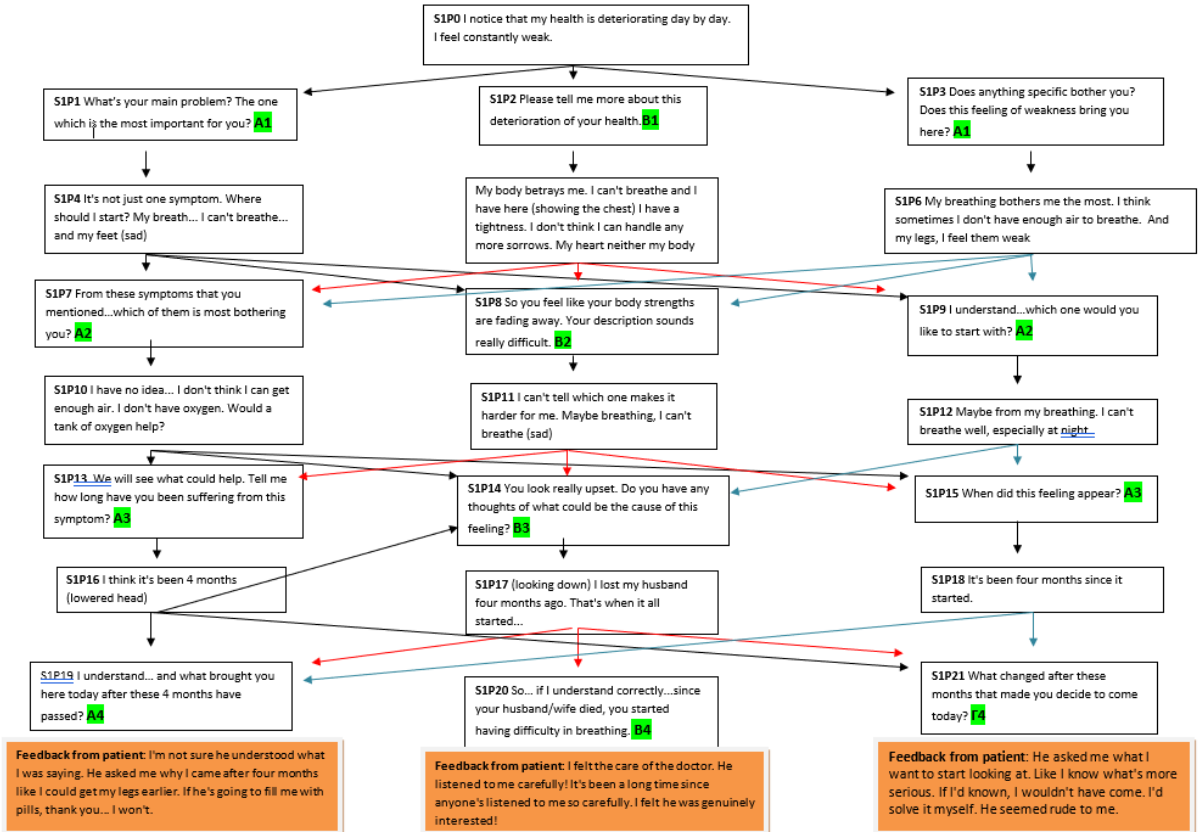

Figure 8 Diagram of a VR scenario

The VR application consists of five different scenarios (two of them involve a male patient, while the rest three concern a female patient). The virtual environment where the user is transported to, simulates the digital and innovation hub (living lab), stationed at Hippokration General Hospital of Thessaloniki where actual empathy training will take place. Upon the initiation of the application, the user finds themselves in the first room along with an empathy expert, who guides the user along the experience. At first, the expert informs the user of the procedure and gives some useful tips. The user is then prompted to proceed to the next room where they can initiate the scenario. Once the user reaches the second room, the scenario unfolds through a series of information that the user receives from the virtual patients and in response to which they are required to select between three options (Figure 7).

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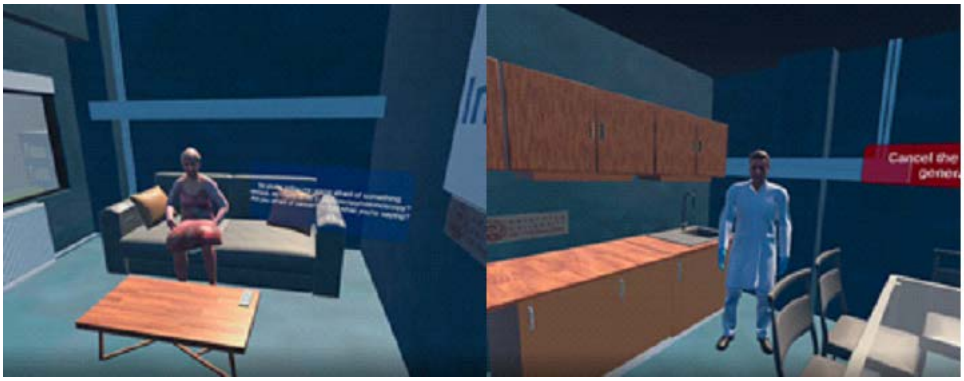

Figure 9 VR scenarios for empathy training

All the dialogues are provided in a text box inside the virtual environment and verbally for a more immersive experience. To increase the users' engagement, the virtual patients are designed to react based on the chosen answer. Once the scenario is completed, the user can return to the first room to receive feedback on their answers from the empathy expert.

For the implementation of the application, the Unity3D platform was used. The 3D model of the living lab was designed through the Unity3D platform. Rigged avatars were purchased and used for the simulation of the patients and the empathy expert. Individual animations were realized for each avatar separately (Image 4). While in the virtual world, the user interacts with their surroundings and navigates through the rooms with the use of two controllers. The device used for the design and prototyping of the application is the Oculus Quest 2 device.

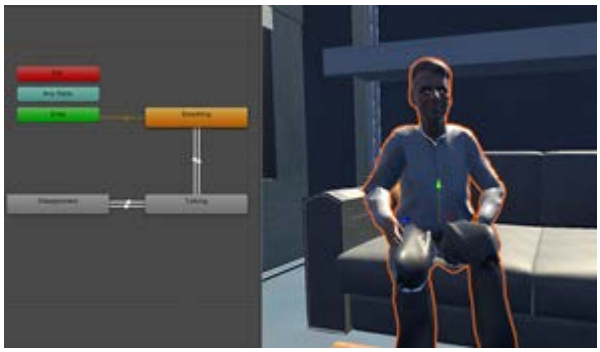

Figure 10 Avatar Animation

All the scenarios are co-created with relevant stakeholders and are continuously improved according to their feedback. The VR scenarios will be pilot tested and evaluated in the following months but have been already pre-tested among the developers and mental health professionals of the Medical Physics and Digital Innovation Lab (AUTH) as well as among the collaborative team of doctors at the Hippokration General Hospital of Thessaloniki receiving positive feedback.

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4. Bed Sores Application (WITA)

Bed sores application is targeting health professionals and caregivers providing them with a tool to better care for their patients.

4.1 Sensor

A problem that primarily occurs in older adults is the presence of pressure ulcers, also called bed sores, whose name is taken from the place where these are often generated.

A Bed sore is a skin damage resulting from a prolonged pressure of a part of the body where a bony prominence is located. Bony prominences are those points where the bone is immediately below the skin surface. The damage interests the skin but also the underlying tissue. The most common sites are the skin overlying the sacrum and coccyx.

Our intent is to monitor the position of the person while lying in bed to verify if the position of the body has been sensibly changed within a certain amount of time, in order to prevent ulcer formation. The change in position could be a rotation to the opposite side or a transition from supine to lateral, but also a change to the slope of the body, while in supine position, large enough to relax the pressure to the coccyx.

Our approach is based on a stereo camera mounted at the top of the bed with an eye-bird view of the mattress below. The use of depth measurements covers both the need for privacy and the possibility to keep monitoring in absence of light.

There are two different activities running in our algorithm. The first one splits the bed into three zones: head, chest and feet; and keeps track of the major details of the body like leg positions, hips detection, or movements that help in determining the overall body position and collecting statistics of body “activities”. These statistics are used to create a patient profile.

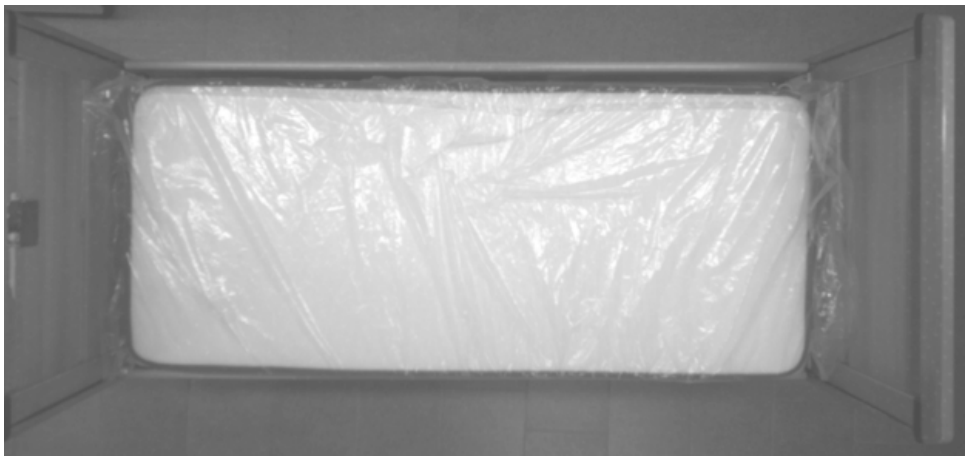

Figure 11 Eye-bird view of the bed (IR sensor for demonstration).

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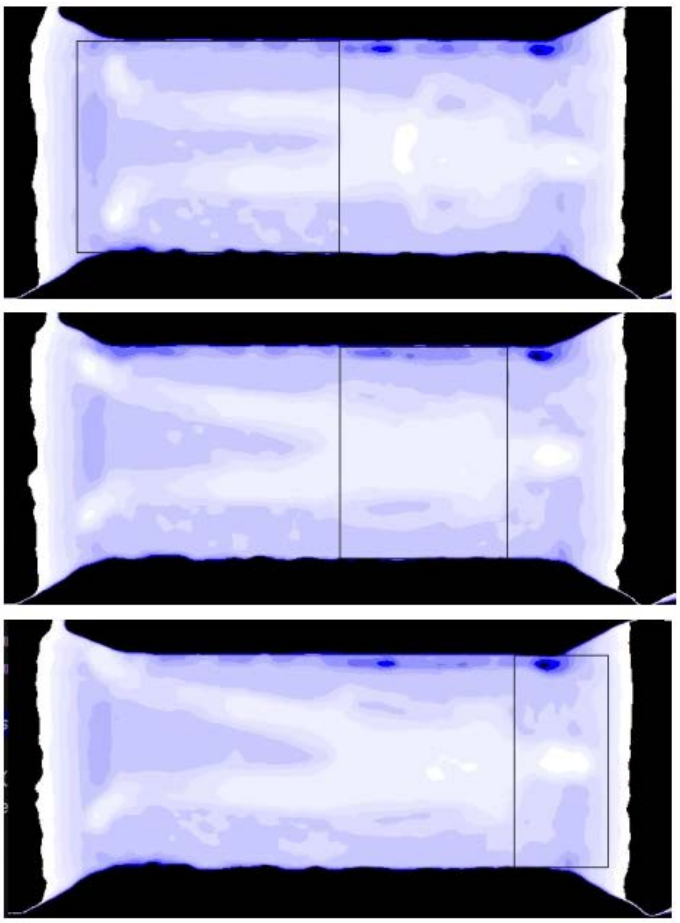

Figure 12 The three zones in which the bed view is split: Legs, Chest and Head

This analysis sets the scenario for the second activity that interests the chest, where we determine the slope of the body. This part relies on the person's body measures since it is based on geometric information strongly related to the body shape. Therefore, an initial calibration phase is needed for every new potential user.

We perform multiple profile scans in the chest zone to obtain a representation of the chest shape with which we can do some mathematical analysis. The target is to separate the torso from the arms (if not overlapped to the torso) to obtain more precise numbers.

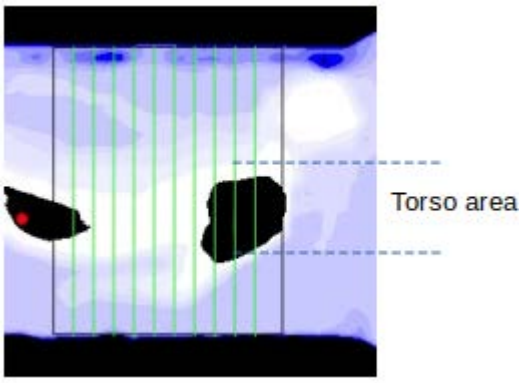

Figure 13 The marks of the different scans and the indication of the target area occupied by the torso

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Once we have this, we can use the shape of the torso to perform some interpolation to obtain polynomial curves whose parameters allow us for position information extraction.

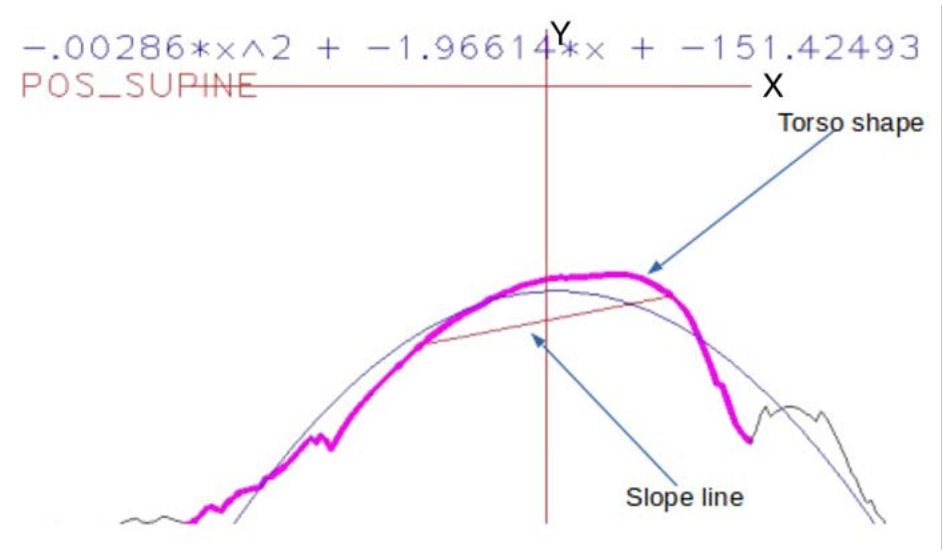
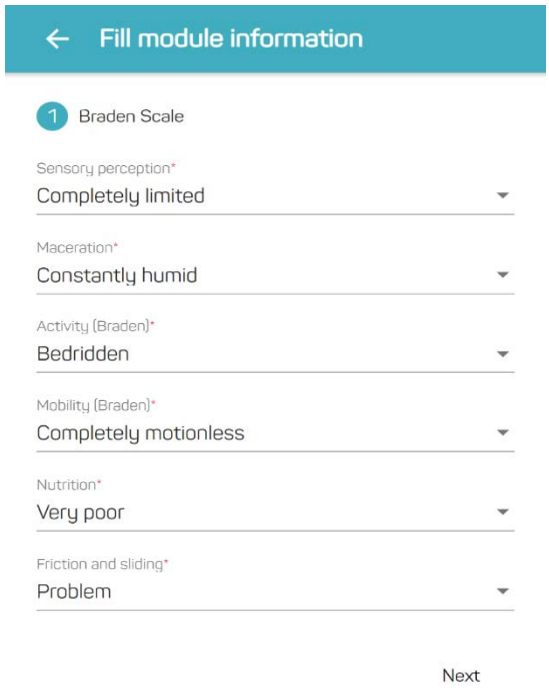


Figure 14 The shape of the chest with the torso part highlighted from which the slope is determined. X is the bed cross section, Y the body section approximation

4.2 Patient Profile Statistics

The module is comprised of multiple parts:

- Data gathering, in which the nurse will fill out a wizard.



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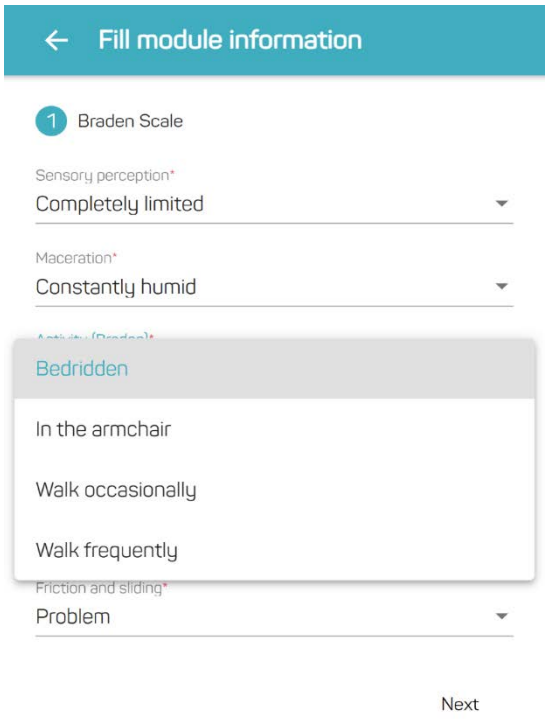

- Assessment, where the data gathered will be quantified as scores with a total indicating the risk level.

This risk level is translated into a timer, while a sensor will send a notification if the patient doesn't move/is in a bad position to prevent bed sores. The data gathered in the wizard is based on these three scales:

1. The Braden Scale:

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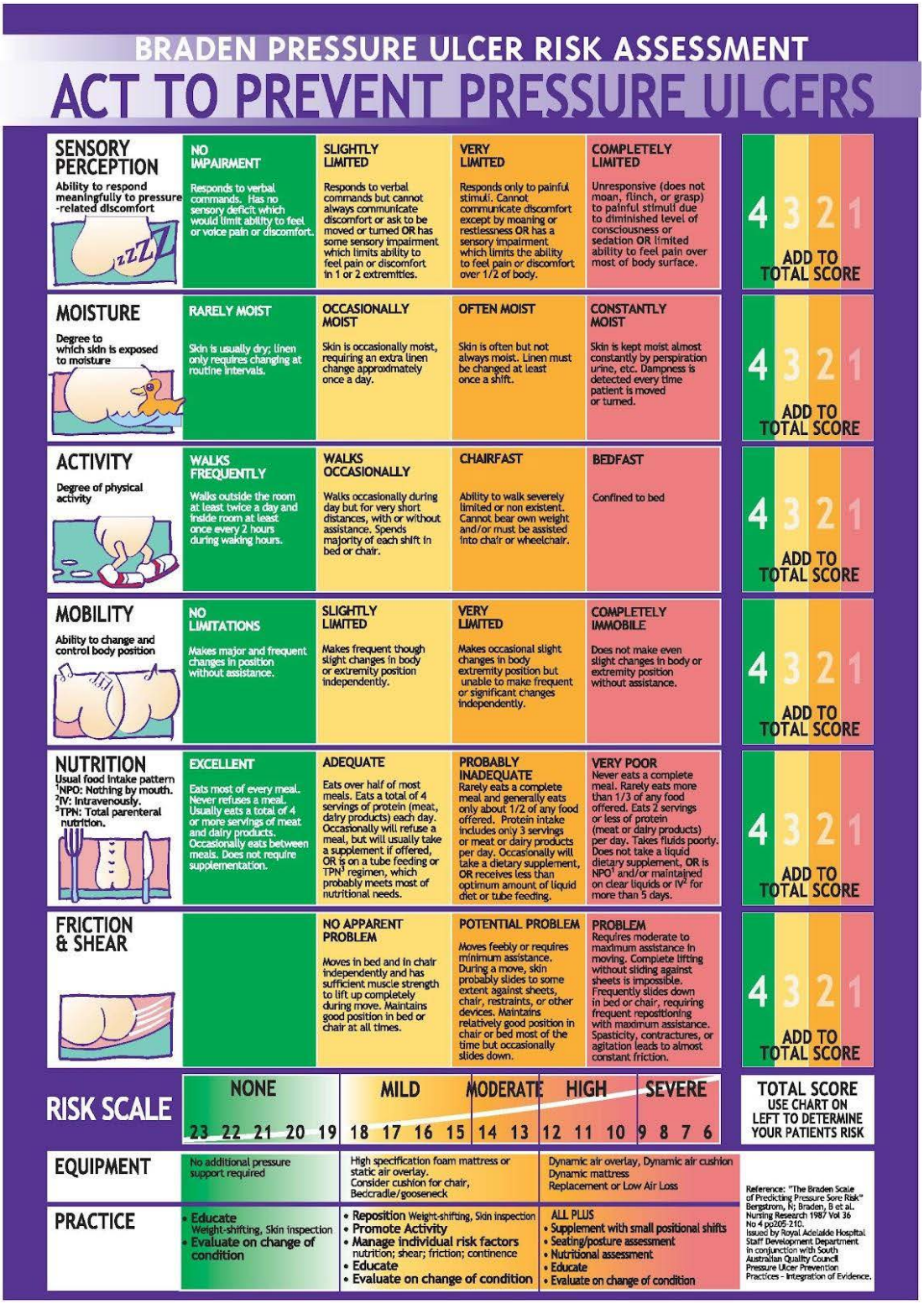

BRADEN PRESSURE ULCER RISK ASSESSMENT

ACT TO PREVENT PRESSURE ULCERS

SENSORY PERCEPTION Ability to respond meaningfully to pressure -related discomfort	NO IMPAIRMENT Responds to verbal commands. Has no sensory deficit which would limit ability to feel or voice pain or discomfort.	SLIGHTLY LIMITED Responds to verbal commands but cannot always communicate discomfort or ask to be moved or turned OR has some sensory impairment which limits ability to feel pain or discomfort in 1 or 2 extremities.	VERY LIMITED Responds only to painful stimuli. Cannot communicate discomfort except by moaning or restlessness OR has a sensory impairment which limits the ability to feel pain or discomfort over 1/2 of body.	COMPLETELY LIMITED Unresponsive (does not moan, flinch, or grasp) to painful stimuli due to diminished level of consciousness or sedation OR limited ability to feel pain over most of body surface.	4 3 2 1 ADD TO TOTAL SCORE
MOISTURE Degree to which skin is exposed to moisture	RARELY MOIST Skin is usually dry; linen only requires changing at routine intervals.	OCCASIONALLY MOIST Skin is occasionally moist, requiring an extra linen change approximately once a day.	OFTEN MOIST Skin is often but not always moist. Linen must be changed at least once a shift.	CONSTANTLY MOIST Skin is kept moist almost constantly by perspiration urine, etc. Dampness is detected every time patient is moved or turned.	4 3 2 1 ADD TO TOTAL SCORE
ACTIVITY Degree of physical activity	WALKS FREQUENTLY Walks outside the room at least twice a day and inside room at least once every 2 hours during waking hours.	WALKS OCCASIONALLY Walks occasionally during day but for very short distances, with or without assistance. Spends majority of each shift in bed or chair.	CHAIRFAST Ability to walk severely limited or non existent. Cannot bear own weight and/or must be assisted into chair or wheelchair.	BEDFAST Confined to bed	4 3 2 1 ADD TO TOTAL SCORE
MOBILITY Ability to change and control body position	NO LIMITATIONS Makes major and frequent changes in position without assistance.	SLIGHTLY LIMITED Makes frequent though slight changes in body or extremity position independently.	VERY LIMITED Makes occasional slight changes in body extremity position but unable to make frequent or significant changes independently.	COMPLETELY IMMOBILE Does not make even slight changes in body or extremity position without assistance.	4 3 2 1 ADD TO TOTAL SCORE
NUTRITION Usual food intake pattern [1]NPO: Nothing by mouth. [2]IV: Intravenously. [3]TPN: Total parenteral nutrition.	EXCELLENT Eats most of every meal. Never refuses a meal. Usually eats a total of 4 or more servings of meat and dairy products. Occasionally eats between meals. Does not require supplementation.	ADEQUATE Eats over half of most meals. Eats a total of 4 servings of protein (meat, dairy products) each day. Occasionally will refuse a meal, but will usually take a supplement if offered, OR is on a tube feeding or TPN[3] regimen, which probably meets most of nutritional needs.	PROBABLY INADEQUATE Rarely eats a complete meal and generally eats only about 1/2 of any food offered. Protein intake includes only 3 servings or meat or dairy products per day. Occasionally will take a dietary supplement, OR receives less than optimum amount of liquid diet or tube feeding.	VERY POOR Never eats a complete meal. Rarely eats more than 1/3 of any food offered. Eats 2 servings or less of protein (meat or dairy products) per day. Takes fluids poorly. Does not take a liquid dietary supplement, OR is NPO[1] and/or maintained on clear liquids or IV[2] for more than 5 days.	4 3 2 1 ADD TO TOTAL SCORE
FRICTION & SHEAR		NO APPARENT PROBLEM Moves in bed and in chair independently and has sufficient muscle strength to lift up completely during move. Maintains good position in bed or chair at all times.	POTENTIAL PROBLEM Moves feebly or requires minimum assistance. During a move, skin probably slides to some extent against sheets, chair, restraints, or other devices. Maintains relatively good position in chair or bed most of the time but occasionally slides down.	PROBLEM Requires moderate to maximum assistance in moving. Complete lifting without sliding against sheets is impossible. Frequently slides down in bed or chair, requiring frequent repositioning with maximum assistance. Spasticity, contractures, or agitation leads to almost constant friction.	4 3 2 1 ADD TO TOTAL SCORE
RISK SCALE	NONE 23 22 21 20 19	MILD 18 17 16 15	MODERATE 14 13	HIGH 12 11 10	SEVERE 9 8 7 6
EQUIPMENT	No additional pressure support required	High specification foam mattress or static air overlay. Consider cushion for chair, Bedcradle/gooseneck	Dynamic air overlay, Dynamic air cushion Dynamic mattress Replacement or Low Air Loss		TOTAL SCORE USE CHART ON LEFT TO DETERMINE YOUR PATIENTS RISK
PRACTICE	• Educate Weight-shifting, Skin inspection • Evaluate on change of condition	• Reposition Weight-shifting, Skin inspection • Promote Activity • Manage individual risk factors nutrition; shear; friction; continence • Educate • Evaluate on change of condition	ALL PLUS • Supplement with small positional shifts • Seating/posture assessment • Nutritional assessment • Educate • Evaluate on change of condition		Reference: "The Braden Scale of Predicting Pressure Sore Risk" Bergstrom, N; Braden, B et al. Nursing Research 1987 Vol 36 No 4 pp205-210. Issued by Royal Adelaide Hospital Staff Development Department in conjunction with South Australian Quality Council Pressure Ulcer Prevention Practices - Integration of Evidence.

https://jessbrantnerwvudietetics.files.wordpress.com/2014/01/braden.jpg

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2. The Norton Scale:

Norton Scale

Physical Condition	Good	4
	Fair	3
	Poor	2
	Very Bad	1
Mental Condition	Alert	4
	Apathetic	3
	Confused	2
	Stuporous	1
Activity	Ambulant	4
	Walks with help	3
	Chairbound	2
	Bedfast	1
Mobility	Full	4
	Slightly Impaired	3
	Very Limited	2
	Immobile	1
Incontinence	None	4
	Occasional	3
	Usually Urinary	2
	Urinary and Fecal	1

Generally, the risk factor is coded this way:

Greater than 18	Low Risk
Between 18 and 14	Medium risk
Between 14 and 10	High Risk
Lesser than 10	Very High Risk

https://www.researchgate.net/profile/Stanislaw-Stawicki/publication/36447782/figure/fig7/AS:309877827227652@1450892039165/Norton-scale-for-pressure-ulcer-risk-assessment-This-scale-was-created-in-England-in.png

3. The Waterlow Scale:

WATERLOW PRESSURE ULCER PREVENTION/TREATMENT POLICY

RING SCORES IN TABLE, ADD TOTAL. MORE THAN 1 SCORE/CATEGORY CAN BE USED

BUILD/WEIGHT FOR HEIGHT	♦	SKIN TYPE VISUAL RISK AREAS	♦	SEX AGE	♦
AVERAGE BMI = 20-24.9	0	HEALTHY	0	MALE	1
ABOVE AVERAGE BMI = 25-29.9	1	TISSUE PAPER	1	FEMALE	2
OBESE BMI > 30	2	DRY	1	14 - 49	1
BELOW AVERAGE BMI < 20	3	OEDEMATOUS	1	50 - 64	2
BMI=Wt(Kg)/Ht (m)^2		CLAMMY, PYREXIA	1	65 - 74	3
		DISCOLOURED GRADE 1	2	75 - 80	4
		BROKEN/SPOTS GRADE 2-4	3	81 +	5

MALNUTRITION SCREENING TOOL (MST) (Nutrition Vol.15, No.6 1999 - Australia

A - HAS PATIENT LOST WEIGHT RECENTLY
YES - GO TO B
NO - GO TO C
UNSURE - GO TO C AND SCORE 2

B - WEIGHT LOSS SCORE
0.5 - 5kg = 1
5 - 10kg = 2
10 - 15kg = 3
> 15kg = 4
unsure = 2

C - PATIENT EATING POORLY OR LACK OF APPETITE
'NO' = 0; 'YES' SCORE = 1

NUTRITION SCORE
If > 2 refer for nutrition assessment / intervention

CONTINENCE	♦	MOBILITY	♦
COMPLETE/ CATHETERISED	0	FULLY	0
URINE INCONT.	1	RESTLESS/FIDGETY	1
FAECAL INCONT.	2	APATHETIC	2
URINARY + FAECAL INCONTINENCE	3	RESTRICTED	3
		BEDBOUND e.g. TRACTION	4
		CHAIRBOUND e.g. WHEELCHAIR	5

SPECIAL RISKS

TISSUE MALNUTRITION	♦	NEUROLOGICAL DEFICIT	♦
TERMINAL CACHEXIA	8	DIABETES, MS, CVA	4-6
MULTIPLE ORGAN FAILURE	8	MOTOR/SENSORY	4-6
SINGLE ORGAN FAILURE (RESP, RENAL, CARDIAC,)	5	PARAPLEGIA (MAX OF 6)	4-6
PERIPHERAL VASCULAR DISEASE	5	**MAJOR SURGERY or TRAUMA**	
ANAEMIA (Hb < 8)	2	ORTHOPAEDIC/SPINAL	5
SMOKING	1	ON TABLE > 2 HR#	5
		ON TABLE > 6 HR#	8

MEDICATION - CYTOTOXICS, LONG TERM/HIGH DOSE STEROIDS, ANTI-INFLAMMATORY MAX OF 4

SCORE
10+ AT RISK
15+ HIGH RISK
20+ VERY HIGH RISK

Scores can be discounted after 48 hours provided patient is recovering normally

www.judy-waterlow.co.uk

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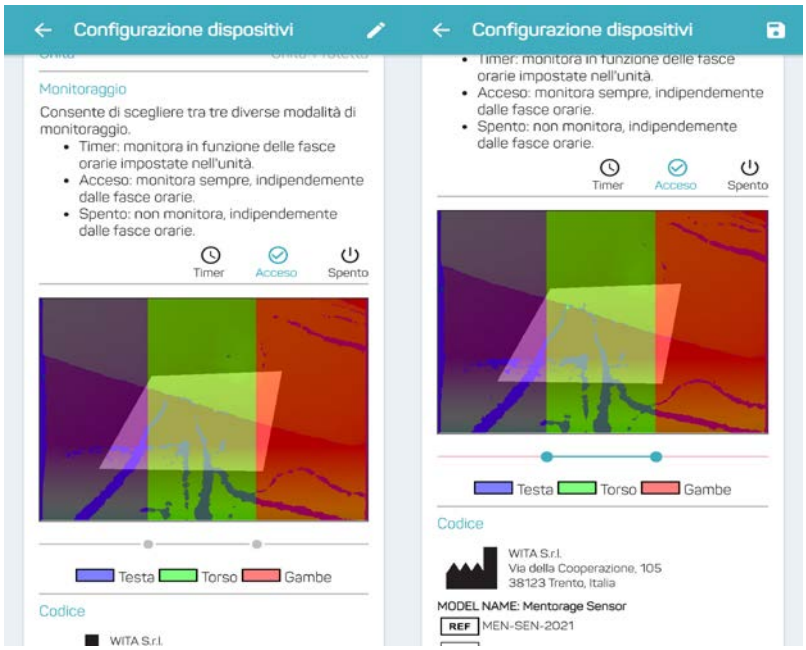
https://www.researchgate.net/profile/Joan-Webster/publication/42542118/figure/fig1/AS:276975580139524@1443047532538/Waterlow-pressure-ulcer-scale.png

Other data taken into account:

- Weight and height,
- Bed used,
- Nutrition level,
- Headrest present.

Here is a sequence of 4-page steps required for setting up the three zones required for the sensor to work:



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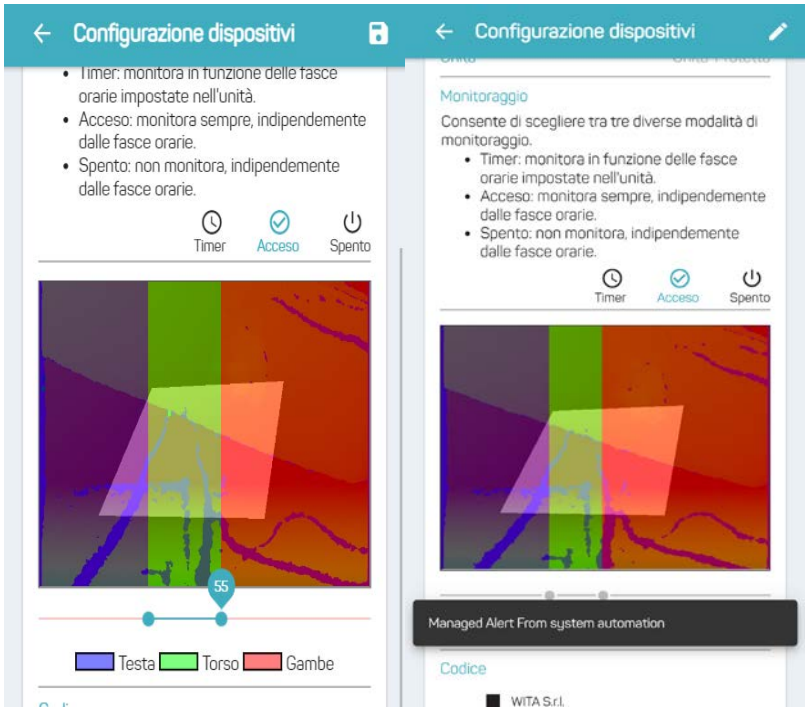

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5. CONCLUSIONS

The use of technology in healthcare has led to better diagnosis and treatment of patients, thus leading to improved quality of life over the years. Palliative care, focusing mainly on the physical interaction of patients with their caregivers and health professionals, is lately turning to technology tools and applications to support the wellbeing of all the stakeholders. Mobile applications for self-management of symptoms and stress reduction, Virtual Patients for education and Virtual Reality apps targeting both education and relaxation, have been added to the arsenal of Palliative Care experts. The pandemic of COVID-19 and its restrictions on physical interactions have added one more advantage to the use of Mobile and VR apps for education and psychological support and this is the safety of having these services at your own place. Using them at your own pace and repeating them as many times as you want adds one more positive point.

There is a lack of palliative medicine specific resources for smartphones and no studies have been published which examine the potential benefits of mobile technology for learning, clinical practice and professional development. This provides an opportunity for further research and development. Academic institutions could work with technological developers to improve access to, and dissemination of, key information for practice. Considered development of mobile technology has the potential to improve patient care, data sharing and education within the palliative medicine specialty.

Virtual reality and Mobile applications are an innovative and novel approach in the field of Palliative Care. Mobile Apps for palliative care have increased during the last years mainly targeting clinicians (Meghani et al., 2017). Research on their effectiveness is still at the beginning and limited. Regarding Virtual Reality, the existing research, although limited, has shown that it has positive effects on pain management and symptom control along with the medical treatment of the patients (Li et al., 2011; Niki et al., 2019).

The target of the Task 4.2, presented here in D4.3, was to create the mobile and VR tools that will be tested and evaluated for their effectiveness and usability during the clinical trials in WP5. The ambition of this work is that all the developed tools will be proved useful to patients, caregivers and health professionals, improving their wellbeing and the provided palliative care. It also aspires that the patients will benefit by reducing their stress levels and having better pain management and symptoms control. Finally, it aspires to reinforce doctors and medical students with better skills of empathy and communication.

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