H2020 – Secure societies - Protecting freedom and security of Europe and its citizens

SU-DRS02-2018-2019-2020– Technologies for first responders – Research and Innovation Action (RIA)

Emerging technologies for the Early location of Entrapped victims under Collapsed Structures & Advanced Wearables for risk assessment and First Responders Safety in SAR operations

D4.10 Design of PHYSIO DSS component, V2

Workpackage:	WP4 – Data aggregation, Analysis and Decision Support
Authors:	CNR
Status:	Final
Due Date:	30/04/2022
Version:	1.00
Submission Date:	30/04/2022
Dissemination Level:	PU

Search and Rescue Project Profile

Grant Agreement No.:	882897
Acronym:	Search and Rescue
Title:	Emerging technologies for the Early location of Entrapped victims under Collapsed Structures & Advanced Wearables for risk assessment and First Responders Safety in SAR operations
URL:	Website
Start Date:	01/07/2020
Duration:	36 months

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	ESCUELA ESPANOLA DE SALVAMENTO Y DETECCION CON PERROS (ESDP)	Spain

Document History

Version	Date	Author (Partner)	Remarks/Changes
0.10	01/02/2022	Simona Panunzi (CNR)	ToC
0.20	01/03/2022	Simona Panunzi (CNR)	Sections 1-6
0.21	01/03/2022	Alessandro Borri (CNR)	Revision of all Sections 1-6
0.22	21/04/2022	Giulia Sedda (UNICA)	Review 1- Minor changes to all sections
0.23	25/04/2022	Cesar Mediavilla Martinez (ATOS)	Review 2- Minor changes to all sections
0.24	25/04/2022	Simona Panunzi (CNR)	All comments and suggestions were addressed
0.30	29/04/2022	Iliana Malliou (NTUA)	Quality Control
1.00	30/04/2022	Christos Ntanos (NTUA)	Final version to be submitted

Executive Summary

The objective of the present document is that of presenting the design of the second version of the PHYSIO DSS component (PHYSIOlogical evolution of the victim Decision Support System), by highlighting the updating with respect to the first version. As already mentioned in deliverable D4.4, efforts in the first year were addressed to the design of the entire structure of the PHYSIO DSS as well as to the implementation in the chosen testing environment (Matlab) of all the functions and algorithms constituting the component. The present deliverable accompanies the second version of the PHYSIO DSS development, based on a client-server architecture provided as Web Services implemented in C++ which represents the programming language in the production environment. The logic of the PHYSIO DSS component has been extensively presented in deliverable D4.4, therefore the document briefly summarises, for completeness, the functions offered as services, neglecting the details that the reader can still access by consulting the D4.4. Section 1 is dedicated to the presentation of the component and of its role in the project. After a general description of the architecture of the PHISIO DSS component and of its functioning, sections 2, 3 and 4 describe the additions and changes in the PHYSIO DSS design compared to the first version. Section two describes the triage algorithms that have been implemented in this second version of the PHYSIO DSS component: the SORT triage, the SIEVE triage, the START and the JUMP START triage. Section 3 presents the changes made to the class of the Health measurements with the aim of integrate the PHYSIO DSS with the current architecture of the CONCORDE platform. Section 4 describes the new logic underlying the influence of the health measurements that are taken in the field on the physiological variables, in the process of determining the a-posteriori distributions of physiological variables and worsening rates.

Sections 5 briefly describes the table-top demonstration from the PHYSIO DSS point of view, held on February 23rd, whose aim was that of evaluating the Search&Rescue DSS. The table-top was organised in the framework of task T4.6 and the results will be discussed in deliverable D4.13. Section 6 will describe how the PHYSIO DSS will be tested in the Use Case 1 which will be hold in Poggioreale, Sicily (Italy) on April 28th.

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List of Abbreviations

Abbreviation /acronym	Description
ABCDE	Airway, Breathing, Circulation, Disability, Exposure
DSS	Decision Support System
SOT	Strategical, Operational, Tactical
ETD	Expected Time to Death
PSV	Physiological State Variable
GCS	Glasgow Coma Scale
RR	Respiratory Rate
BP	Blood Pressure
EO	Eye Opening
VR	Verbal Response
MR	Motor Response
START	Simple Triage And Rapid Treatment
S&R	Search & Rescue

1 Introduction

1.1 Objectives and Scope

The purpose of this document is to describe the second version of the PHYSIO DSS component. The PHYSIO DSS component is part of the Search&Rescue Decision Support System. Its design and development are the result of the work carried out in Tasks T4.4 and T4.5. The PHYSIO DSS component is a set of interconnected algorithms, functions and classes of homogeneous objects that integrated together provide decision support in the phase of prioritisation of the victims of an incident for a better real-time allocation of health resources, when there is a disproportion between needs and availability. The component returns its outputs in terms of probability distributions of twenty variables that characterise the health status of a victim in terms of the values of physiological variables and their rates of worsening. The output provides all the elements necessary to graphically represent each distribution and also provides some summary measures for a direct comparison of the severity of the victims. The PHYSIO DSS component is a fully modular tool that could be integrated into any marketable solution designed to provide support to crisis managers. In Search&Rescue, at the end of the integration process, data will flow directly from the sensors and instrumentation used in the field and will be collected in the Concorde platform. The necessary data will then be transferred to the DSS for immediate processing and result and again transferred to the field or commander centre via Concorde to support decision making. It is important to underline that although this is the second and final version of the component, the PHYSIO DSS will be tested for the first time in Use Case 1 (Victims trapped under the rubbles) at the same time as its delivery. The first evaluation of the DSS as a whole and, in particular, of the PHYSIO DSS took place during the first table-top organised in the framework of task T4.6, which was held last February, and some changes to the design and related development have already been incorporated into this second version. Further suggestions and improvements that must be considered necessary downstream from the validation during Use Case 1 and during the subsequent Use Cases where the component will be tested, will be taken into consideration and updated versions of the component will be released in the continuation of the third year of the project, even if no new deliverables are foreseen according to the Dow.

1.2 The PHYSIO DSS Component in the S&R project

The PHYSIO DSS component, together with the SOT (Strategical, Operational, Tactical) DSS, forms part of the Decision Support System of the Search&Rescue project. Its main objective is to support crisis managers in the decisions to be made in order to increase the efficiency of emergency health operations, providing suggestions in relation to the management of the incident and of the numerous victims. While the objective of the SOT DSS is to provide an optimal allocation of resources (such as ambulance units) to the incident, based on current needs, or to provide an optimal allocation of patients to vehicles to be transported to hospitals, based on an order of prioritisation, the PHYSIO DSS provides information on the health status of the victims for a more conscious prioritisation. Based on the predictions of the evolution of the physiological state of the victims and of the expected time to death, the component provides indications both on the prioritisation of victims and on the most effective treatment to deliver. The output of the PHYSIO DSS therefore could serve the SOT DSS, in particular the SOT DSS service 2, or could be used to optimise the treatment delivery in case of scarcity of resources.

What described for a victim, can be translated to the first responders. While a victim presents with some lesions caused by the incident, at the beginning of the event the health status of a first responder is not compromised and the physiological variables which represents his/her health state are strictly concentrated on the maximum values they can assume. However, his/her healthy status could change over time if he/she is injured during the rescue operations. Data from first responders flow directly to CONCORDE from the sensors embedded on first responders' SMART uniform (T5.2– First responder prototype uniform design and first aid device for kids) and could be used to predict the evolution of their physiological conditions.

As mentioned above, the DSS has been object of a table-top demonstration for its evaluation. During the tabletop, organised in the framework of task T4.6, all the functionalities of the both the PHYSIO and SOT DSS were showed to a committee of experts in crisis management with the aim of obtaining suggestions for future improvements. Part of the suggestions have been implemented into this second version and concerned mainly the relationship between the health measurements and the physiological variables (see Table 4.2). The DSS will be also evaluated in the forthcoming Use Case 1 and in the next Use Case 5 and 7 (Workpackage 8).

1.3 Overall description

For completeness we briefly describe the architecture of the PHYSIO component. For more details refer to deliverable D4.4 "Design of the PHYSIO DSS component", first version. The PHYSIO DSS is composed of a set of interconnected functions, classes of objects and algorithms which implement a simulation environment where different crisis scenarios (from the Event class), along with the associated victims, are generated. Each victim presents as series of anatomical lesions (from the Lesion class) with different levels of severity. The injuries cause the occurrence of physiological impairments along some or all of the physiological dimensions (the Physiological State Variables, PSVs, Table 4-1). The system computes therefore the a-priori distribution of the PSVs, based on the hypothetical lesions a victim has experienced, and of the rate of worsening depending on the type of lesion. The system then computes the evolution over time of the distributions of each PSV, as well as their updates based on the delivered treatments (from the Treatment/Manouvres/Medication class). Treatments indeed have a positive effect on certain Physiologic State Variables. A matrix associating injuries and PSVs and treatments to PSVs has been defined. PSVs distributions are updated also on the basis of the recorded measurements (from the Health measurement class) from the field by implementing a totally Bayesian approach. The functions Glasgow_Coma_Scale_computation, Sort_Triage, Sieve_Triage, Start_Triage and Jump_Start_Triage provide instead, from a series of symptoms and signs from the field, the automatic computation of the Glasgow Coma Score and of the triage scores from the SORT, SIEVE, START and JUMP START algorithms.

2 Design of the PHYSIO DSS Component, V2

2.1 New aspects of the PHYSIO DSS architecture

The new version of the PHYSIO DSS component includes the automatic computation of scores for victim's triage. While the component is based on a completely stochastic approach, the output of the services dedicated to the computation of these scores and indices returns a deterministic output and the services implement the algorithms present in the literature.

2.1 Triaging and scoring systems

Triage systems are methods used for the prioritisation of patient care as well as of victims during a disaster, based on the injuries/illness and severity. Patients are prioritised according to how urgent they require assistance. The results of triages affect therefore the order and the priority of resources in a situation where the demand for a resource is greater than the availability, since the resources are limited. Triage systems require the measurement (by means of instrumentations) and the observation of victim's vital signs or the assessment of the mental condition using a scoring system.

The PHYSIO DSS provides the implementation of the most common employed triaging and scoring systems in the world: the GLASGOW COMA SCALE, the SORT triage, the SIEVE triage, the START triage and the JUMP START triage. A description of the algorithms and the implementation performed are reported in the following subsections.

2.1.1 GLASGOW COMA SCALE

The Glasgow Come Scale (GCS) [1] is a scoring system used to determine the level of consciousness in people following head trauma. It is useful for describing the severity of brain injury with simple and reliable tests which evaluate three main functions, Eye Opening, Verbal Response and Motor Response, and the score system used is reported in following Table.

Eye Opening (EO)	**Score**
No eye opening	1
To pain	2
To speech	3
Spontaneously	4
Verbal Response (VR)	**Score**
None	1
Incomprehensible sounds	2
Inappropriate words	3
Patient confused	4
Patient oriented	5
Motor Response (MR)	**Score**
None	1
Extensor response to painful stimulus	2
Flexion to painful stimulus	3
Withdraws from pain	4
Localises to pain stimulus	5

Obeys commands		6
Glasgow Coma Scale (GCS) = EO + VR + MR		
Severe = GCS ≤ 8	**Moderate** = 9 ≤ GCS ≤ 12	**Minor** = 13 ≤ GCS ≤ 15

Table 2-1: **The Glasgow Coma Scale**

The Physio DSS function for the GCS is called "Glasgow_Coma_Scale_computation". It receives in input the scores related to the three evaluations (EO, VR and MR) and returns in output the GCS score, ranging from 3 to 15.

2.1.2 SORT triage

The SORT triage [2] attributes a colour code to a victim of an incident making use of the GCS score, of the Respiratory Rate (RR) and of the Systolic Pressure (BP) measurement. The SORT total score is the sum of the scores relative to GCS, RR and BP, as reported in the Table 2.2. The Red Code is assigned to the victim if the number is less than 10, the Yellow Code is assigned when the score is 11 whereas the Code is Green when the total score is 12.

GCS	**X**	**Respiratory Rate**	**Y**	**Systolic Pressure**	**Z**
13 – 15	4	10 – 29	4	≥ 90	4
9 – 12	3	≥ 30	3	76 – 89	3
6 – 8	2	6 – 9	2	50 – 75	2
4 – 5	1	1 – 5	1	1 – 49	1
3	0	0	0	0	0
Triage Sort Score = X + Y + Z					
Red Code ≤ 10		Yellow Code = 11		Green Code = 12	

Table 2-2: **The SORT triage scores**

The Physio DSS function for the SORT triage is called "Sort_Triage" and receives in input five elements: the values of the RR and BP and the scores assigned to EO, VR and MR. The output of the SORT triage is a colour code, represented by a number: number 3 for the Green Code; number 2 for the Yellow Code; number 1 for the Red Code.

2.1.3 SIEVE triage

The SIEVE triage [3] is used to assign a colour code to injured individuals by evaluating vital parameters (RR and Pulse) and several functionalities (walking and breathing). Figure 2.1 shows the diagram block of the implemented algorithm for the colour code assignment.

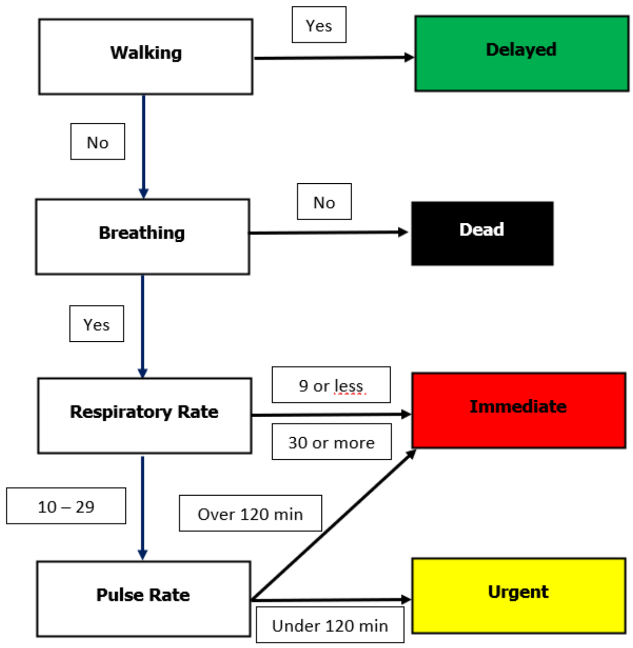


Figure 2-1: block diagram of the SIEVE triage algorithm

The Physio DSS function for the SIEVE triage is called "Sieve_Triage" and receives in input three values: the RR measurement, the PR measurement and other two values: 0/1 for the input relative to the "breathing" functionality (it is 0 if the victim does not breath) and 0/1 for the "walking" (if 1 the victim is able to walk 0 otherwise). The output of the "Sieve_Triage" function is the SIEVE triage colour code: for a Green Code it returns the number 3, for a Yellow Code it returns number 2, for Red Code number 1 and Black Code number 0.

2.1.4 START triage

The START triage [4] is a system for the assessment of injured adults (victims over 8 years of ages). The START triage algorithm evaluates the subject's walking ability, his/her respiratory rate, capillary refilling (CR) and obedience to simple commands. At the end of the evaluation processes, the victim is marked with a colour code: green (minor), yellow (delayed), red (immediate), black (death).

The Physio DSS function for the START triage is called "Start_Triage" and receives in input four elements: the RR measurement, the CR measurement, the "walking" value and the value related to the ability of the subject to follow simple commands (1 if the victim is able to follow commands and 0 if he/she isn't). The output of the "Start_Triage" function is the START triage colour code, represented by a number: for Green Code it returns number 3, for Yellow Code number 2, for Red Code number 1 and for Black Code number 0. The PHYSIO DSS implementation of the START triage algorithm follows the diagram reported in the Figure below:

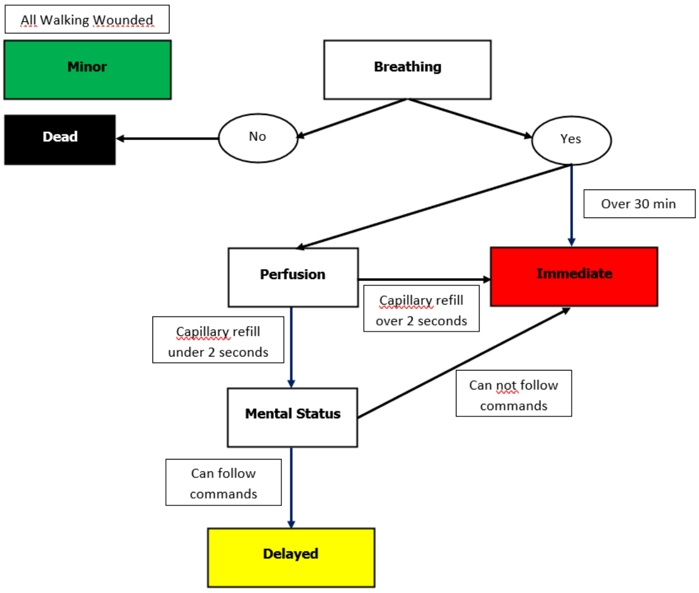
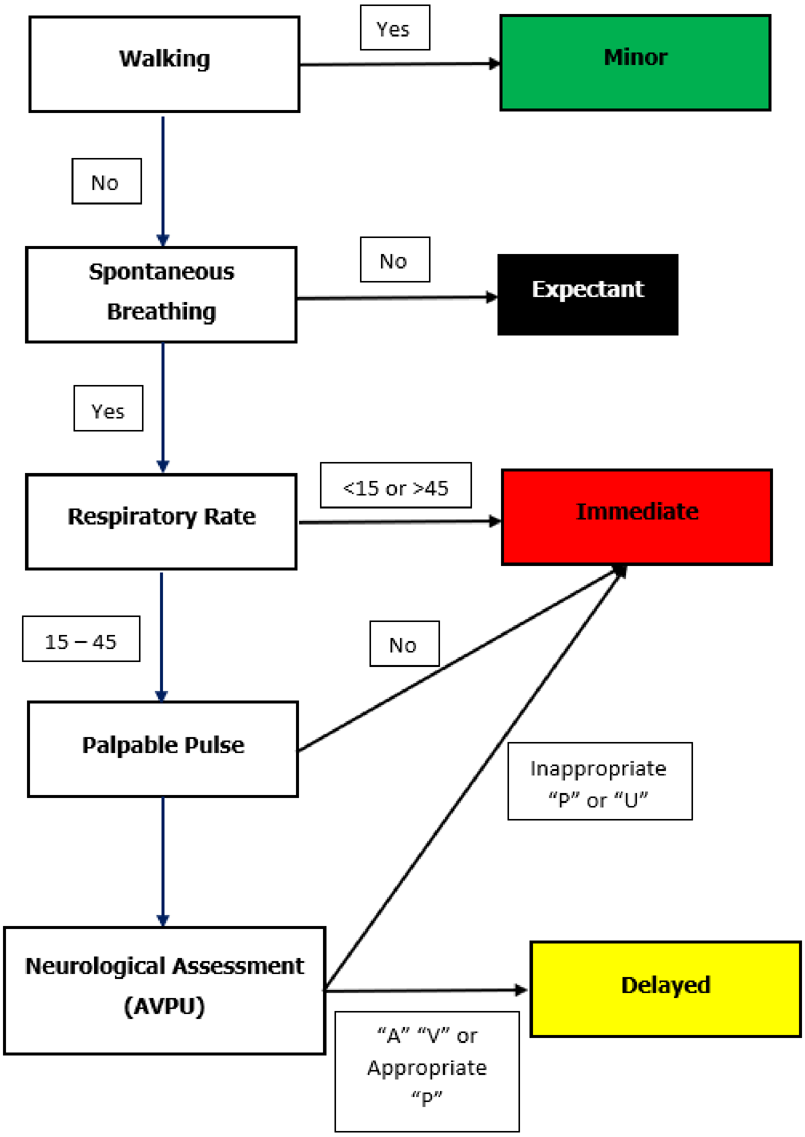


Figure 2-2: block diagram of the START triage algorithm

2.1.5 JUMP START triage

The JUMP START triage [5] is based on the same principles of the START triage, but it incorporates several modifications since it is used for triaging injured children. These changes take into account the physiological and behavioural differences between children and adults: children are more likely to have respiratory failure than adults, children could not be able to follow verbal commands and they exhibit different breathing rates. The evaluation of the ability to follow verbal commands present in the START triage algorithm is replaced with the AVPU scale (Alert, Verbal, Pain, Unresponsive) which allows to assess the level of consciousness in children.

The Physio DSS function for the JUMP START triage is called "Jump_Start_Triage" and receives in input four values: the RR, the "palpable pulse" variable (if 1 the victim presents palpable pulse, 0 otherwise), the "walking" value and the AVPU evaluation. The output of the "Jump_Start_Triage" function is the JUMP START triage colour code represented by a number ranging between 0 and 3: for the Green Code it returns number 3, for the Yellow Code number 2, for the Red Code number 1 and for the Black Code number 0. The logic implemented for the JUMP START triage is represented in the diagram block below (Figure 2.3).



Neurological Assessment	
A	Alert
V	Responds to Verbal Stimuli
P	Responds to Painfull Stimuli
U	Unresponsive to Noxious Stimuli

Figure 2-3: block diagram of the JUMP START triage algorithm

3 Updates in the PHYSIO DSS CLASSES and external inputs

3.1 The Health Measurements Class

The PHYSIO DSS component is a modular component in which the content of each class (lesions/injuries, Health measurements, Treatments) can be updated without the need for structural changes to the implementation structure.

The set of Health Measurement reported in table 3.1 have been updated with respect to the set reported in Table 3-6: The Health Measurements Class of the document "D4.4 Design of PHYSIO DSS component". The content of the class has been adapted to the current structure of the CONCORD platform, but any measurement from the field can in principle be taken into consideration if a set of relationships with the physiological variables is defined. For each measurement from the field the table reports the normal range as well as the domain of each measurement.

Type of data	Data Description	Unit of measurement	Range	Normal range [inf-sup]
Heart rate	Heart rate	heartbeat per minute	0-400	60-100
Systolic Pressure	Systolic Pressure	mmHg	0-300	110-129
Diastolic Pressure	Diastolic Pressure	mmHg	0-300	75-89
Temperature	Temperature	°C	30 - 42	36 – 37.5
Respiration rate	Respiratory rate	Breaths per minute	0-100	12-20
Blood oxygen saturation	O2 % hemoglobin saturation level in the blood	percentage %	50-100	94-100
GSC = pain + eyeOpening + verbalResponse + motorResponse	Glasgow Coma Scale	Score	3-15	15
Skin	Skin color (normal, pale, flushed)	score	Normal = 0 Pale = 1 Flushed = 2	Normal = 0
Breathing	Noisy breathing	score	Normal = 0 Labored = 1 Shallow = 2 Abnormal Sounds = 3	Normal = 0
Right Pupil/Left Pupil	Pupil size	Millimeters	2-10 mm	2-5 mm
Airway	Airway assessment	score	false/blocked = 0 true/open = 1	1
Capillary	Capillary tube blockage	score	false/abnormal = 0 true/normal = 1	1

Table 3-1: **The Health Measurements Class**

4 New aspects in the interconnection between the Physiological dimensions and MEASUREMENTS from the field

4.1 The set of the PHYSIO DSS Functions

The DSS PHYSIO component describes the evolution over time of ten physiological dimensions, each of them summarising and describing some human vital functions. Table below r**Error! Reference source not found.**eports the list of the considered Physiological variables. We recall that each physiological variable assumes continuous values between 0 and 1, with 1 meaning a complete physiological functioning. The used taxonomy is an extension of the ABCDE (Airway, Breathing, Circulation, Disability, Exposure) approach to assess and treat the patient [6].

PSV code	PSV name	Description
PSV1	A1	Airway patency
PSV2	B1	Reduced respiratory rate and drive
PSV3	B2	Tidal volume and mechanics
PSV4	B3	Oxygen transport
PSV5	C1	Heart pump function
PSV6	C2	Decreased central venous pressure and cardiac filling, and increased systemic vascular resistance
PSV7	D1	Central nervous System Function
PSV8	D2	Seizures
PSV9	D3	Blockers of acetylcholinesterase
PSV10	E1	Frostbite, hypothermia, burns

Table 4-1: Description of the physiological State Variables

4.1.1 A posteriori-distribution from the Health Measurements from the Field

The core of the DSS PHYSIO component is the computation of the a-posteriori distribution of the physiological variables by exploiting the real time information coming from the field. The information is relative to the measurements of the victim's health conditions: the updating of the knowledge on the victim health status with elapsing of time helps to better characterise and prioritise victims. The a-posteriori distributions of the physiological variables given either the measurements taken on the individuals in the field or given the type of treatments delivered by the care givers during the rescue operations are computed by applying a Bayesian approach which requires the application of the Bayes' Theorem [7] according to which:

$$p(X|Y) = \frac{p(Y|X)p(X)}{\int p(Y|X)p(X)dX} \qquad (1)$$

where X is one of the Physiological Variables, Y is a measurement from the field (e.g. Respiratory Rate, RR), p(X|Y) is the a-posteriori distribution of the PSV X given the observed value of the measurement Y, p(X) is the a-priori distribution of X and p(Y|X) is the conditional distribution of Y given the PSV X. Let remind that the distribution p(X) is the a-priori distribution derived by the "compute_a_priori" function, or is the a-posteriori distribution computed at a previous time as output of the last call to "compute_a_posteriori_given_health_meas" function. The function p(Y|X) is computed by an internal function (see deliverable D4.4). The same approach is followed for the computation of the a-posteriori distributions of the rates of worsening. To compute the probability distributions p(Y|X) it is necessary to define the dependences between each measurement and the physiological variables: the dependence exists when the measured value of a certain measurement is informative with respect to a particular physiological aspect. As an example, the colour of the skin (normal, pale, flushed) gives information on the C2 (Decreased central venous pressure and cardiac filling, and increased systemic vascular resistance) and E1 (Frostbite, hypothermia, burns) variables. While the first version of the PHYSIO component only established a dichotomous relationship between the measurements and the variables (the dependence either exists or does not exist), this second version explores a more detailed system of relationships. Each value related to a health measurement is transformed to a value ranging between 0 and 1. Values close to 0 indicate that the value of the health measurement is in the normality range whereas the more the values move away from the normal range, the more the transformation of the measured value approaches 1. For more details about the shape of the probability distribution of Y refer to deliverable D4.4. Table below, reports the system of dependences implemented. This was also object of the revision by the evaluation committee following the table-top demonstration carried out in task T4.6 "Evaluation of the DSS". To explain the content of the table let consider as an example the oxygen saturation measurement. It provides information about the variables A1, B1, B2, B3, C1, C2, D1 and D2 and the dependences are supposed to occur with 100% for A1, 30% for C1, 50% for C2, 70% for B1, 80% for B2, 80% for B3, 100% for D1 and 100% for D2. Furthermore, a certain value of the detected health measurement can be informative or non-informative according to the observed value: for example, the skin colour influences the E1 PSV when "Flushed" skin is recorded and influences the C2 PSV when the value is "Pale". Moreover, some health measurements, as the breathing assessment or capillary tube blockage, when transformed, do not assume continuous values in the range [0-1] but they are transformed into categorical variables assuming some values between 0 and 1 (i.e. 0, 0.5,1). This is also the case for the airway that can be open (0) or blocked (1).

Type of data	Affected PSV	Probability of Interaction [%]
Heart Rate (HR)	If in [inf-sup]→ E1 If < inf → B3, C1 if > sup→ B3, C1, C2	E1 (50%) B3(100%), C1 (100%) B3 (30%), C1 (100%), C2 (90%)
Oxygen Saturation (O2)	If in [inf-sup]→ A1, C1, C2, Always → B1, B2, B3, D1, D2	A1 (100%), C1 (30%), C2 (50%) B1 (70%), B2(80%), B3(80%), D1(100%), D2 (100%)
Temperature	If in [inf-sup]→ E1 if > sup → B3, C1, D1, D2, E1 If < inf →C1, C2, E1	E1 (30%) B3 (100%), C1 (100%), D1 (100%), D2 (100%), E1 (50%) C1 (100%), C2 (100%), E1 (50%)
Skin	Flushed → E1 Not Flushed → C2	E1 (30%) C2 (100%)
Breathing	If in [inf-sup] → A1, B1, B3 if > inf → B2, C1	A1(100%) , B1(100%), B3(50%) B2 (100%), C1 (100%)
GSC = pain + eyeOpening + verbalResponse + motorResponse	Always → D1, D2 if < 5 → A1, B1, B3	D1 (100%), D2 (100%) A1 (100%), B1 (100%), B3 (100%)
Respiratory Rate	If in [inf-sup] → A1 If < inf → B1, B3 if > sup→ B2, B3	A1 (100%) B1 (100%), B3(100%) B2 (80%), B3 (50%)
Blood Pressure	If in [inf-sup] → C2 if > sup → B3, C1, D1 If < inf → B3, C1, C2	C2 (100%) B3 (100%), C1 (100%), D1 (10%) B3 (100%), C1 (60%), C2 (100%)
Right Pupil/ Left Pupil	Always → D1, D2	D1 (100%), D2 (100%)
Airway	Always → A1, B3	A1 (100%), B3 (100%)
Capillary	Always → C1	C1 (100%)

Table 4-2: Relationship between Health measurements and PSVs

5 PHYSIO DSS evaluation

5.1 Description of the Table-Top Test cases

On February 23rd, 2022, a remote Table-top demonstration was held. During this event the PHYSIO and SOT DSS were presented to the members of the evaluation committee. A detailed description of the results will be the scope of the deliverable D4.13 to be submitted on June 2022. Here we briefly describe the content of the Table-Top test cases.

On the date of the event, both the SOT and the PHYSIO DSS components were concluded and the table-top had the scope of presenting the functionalities of the Search&Rescue DSS in order to get comments and suggestions for possible improvements. As for the PHYSIO DSS a series of test cases were prepared. After a detailed description of the component, all the services implemented were called and results were shown. An event (an earthquake) was generated along with the associated victims. For some test victims, the a-priori distributions of the physiological variables and rates of worsening were shown. The distributions were then updated on the basis of a series of values relating to different health measurements taken on the victims at different instants of time. In particular, it was shown how the distributions moved on the domain on which they are defined, highlighting the influence of information from the field on the victim's health state. The distribution of the values of the expected time to death, an output of the PHYSIO DSS that accompanies the other scores deriving from the triage algorithms, was also shown. It allows, along with the triage classifications, to support the decision in the prioritisation of victims. Figure 5-4 shows an example of output. The blue bars represent the a priori distribution of the victim's PSVs, calculated only starting from little information (type of event, distance of the victim from the site of the incident in terms of longitude and latitude deviations) while the yellow bars represent the a posteriori distribution after having acquired the information that the victim's airways are open. Figure 5-5 shows the distributions of the expected time to death in correspondence of the PSVs distributions of Figure 5-4. The test cases have also shown how the administration of the treatment is able to restore some PSVs linked to the considered treatment. As an example we have supposed to intubate a victim with respiratory problems and we showed as for the connected PSVs the distributions move towards

larger values. The same occurs for the distributions of the rates of worsening.

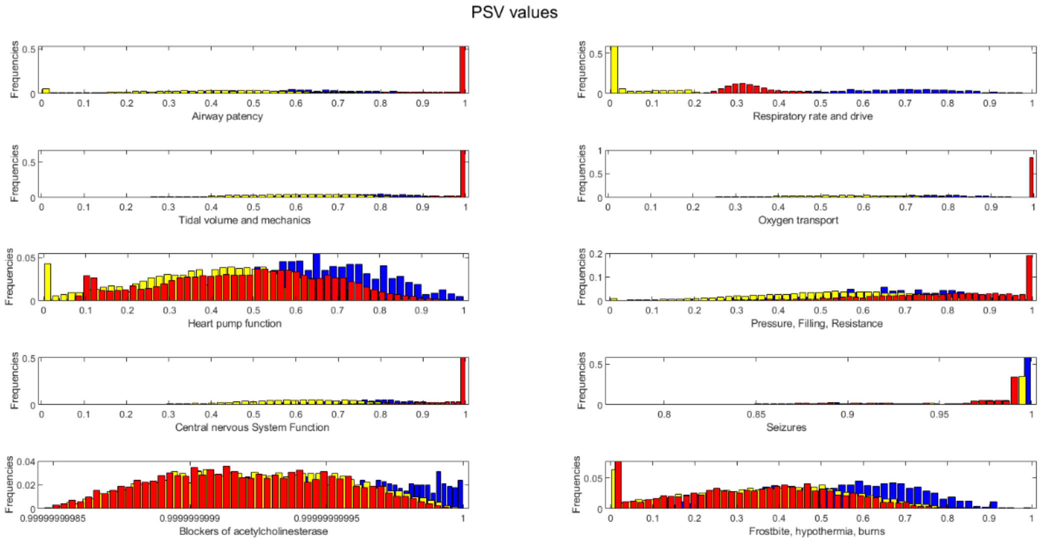


Figure 5-6 and

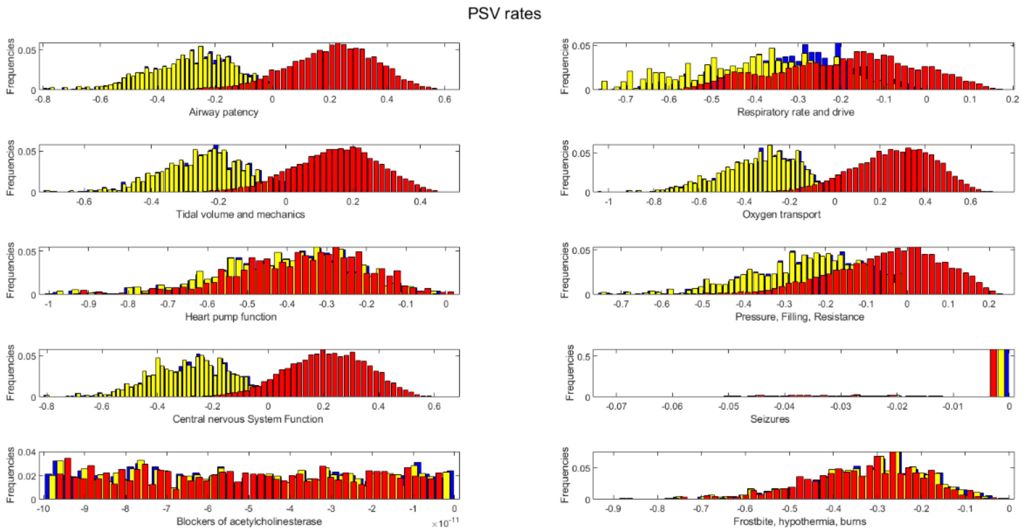


Figure 5-7 show (red bars) the updated distributions following the treatment administration. Another test case showed how the same measurement (a GCS of 3) on a victim, repeated several times, reduces the variability of the PSVs making the distributions more and more concentrated. The test demonstrates how subsequent information improves the knowledge by reducing uncertainty about the victim's physiological status.

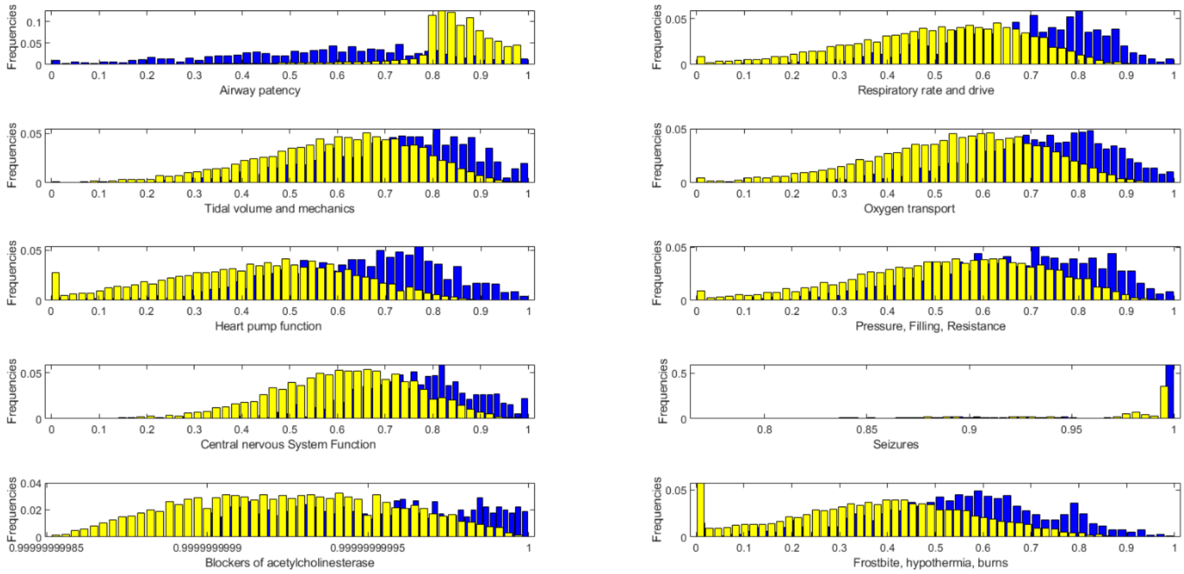


Figure 5-4: a-priori and a-posteriori distributions of the PSV's values after 30 minutes from the victim generation and after having observed that the airways are open

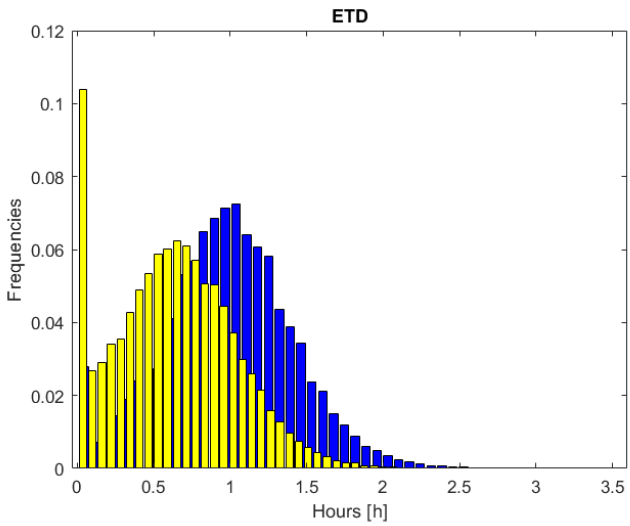


Figure 5-5: a-priori and a-posteriori distributions of the expected time to death

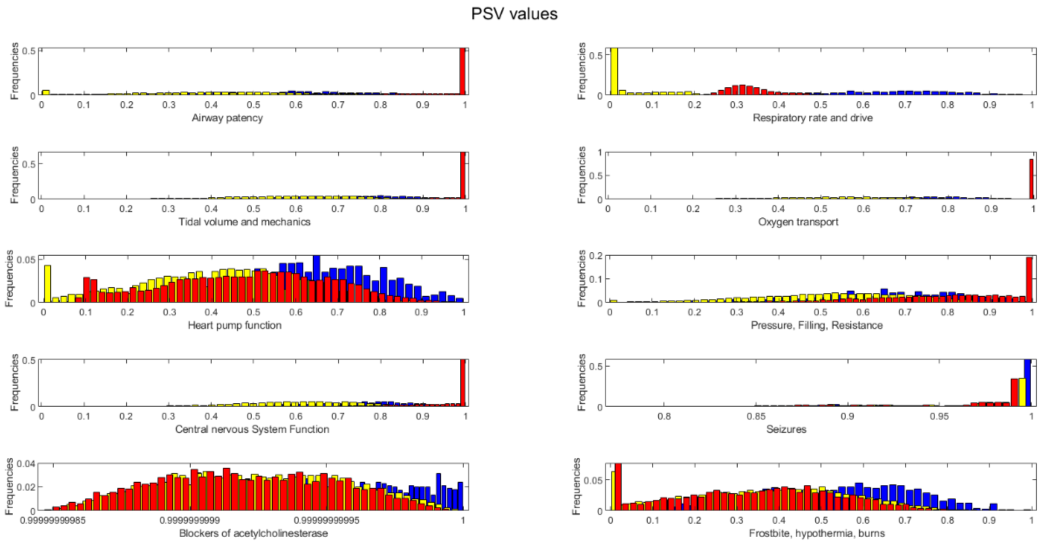


Figure 5-6: a-posteriori distributions (red bars) of the values of the PSVs after having intubated the victim

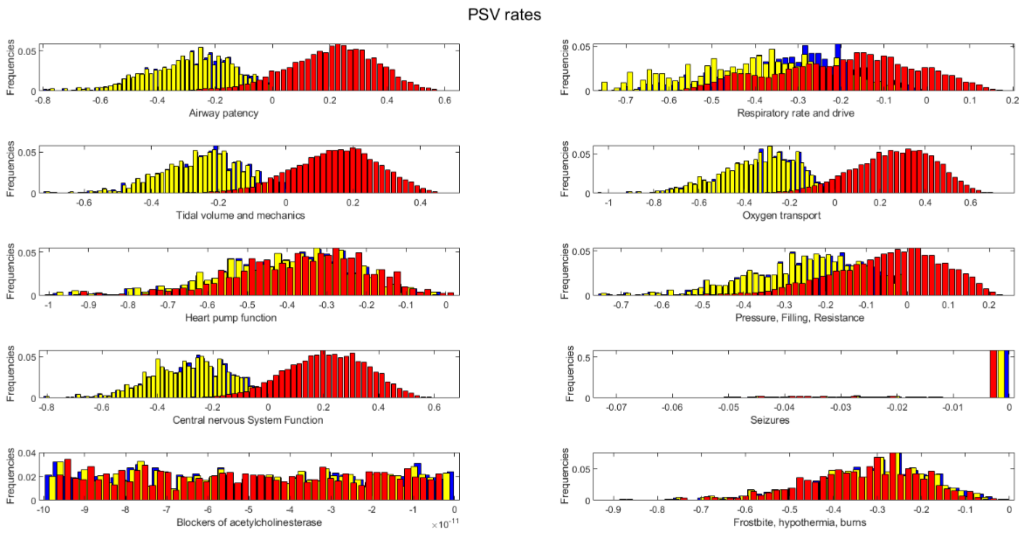


Figure 5-7: a-posteriori distributions (red bars) of the values of the rate of worsening after having intubated the victim

5.2 The PHYSIO DSS in the Use Case 1

The PHYSIO DSS component will be tested in the forthcoming Use Case 1 "Victims trapped under the rubbles". For the exercise a series of mock victims were created, and the victim's cards reported in Table 5-1 and Table 5-2 show the hypothetical values of the measurements of interest recorded on the victims. For each of them, CONCORDE will be able to call the PHYSIO DSS services to provide the centre/field commander with the predictions of their physiological evolution as well as with the automatic computation of the different triaging scores for a better prioritisation of the victims.

	ID 1	ID 2	ID 3	ID 4	ID 5
Event	Earthquake	Earthquake	Earthquake	Earthquake	Earthquake
Size	150	150	150	150	150
Gender	Male	Male	Male	Male	Male
Age	70	30	75	50	60
Lat [m]	80	40	30	70	10
Long [m]	80	40	30	70	10
hr	80	85	125	81	105
O2	99	98	90	95	65
temp	36	35	37	37.5	35.2
skin	0	1	1	2	1
breathing	0	2	1	0	0
eyeOpening + verbalResponse + motorResponse	[4,5,6]	[4,3,6]	[4,4,6]	[4,5,6]	[3,4,5]
Triage Score [Glasgow Coma Scale]	15	13	14	15	12
respiratory rate	16	18	24	22	16
Systolic pressure	130	115	80	125	85
Diastolic pressure	70	60	40	70	55
rightPupil	4	4	4	4	4
leftPupil	4	4	4	4	4
airway	1	1	1	1	1
capillary refill	1	1	0	1	0
pain	0	8	4	7	3
DESCRIPTION	normal	bone fractures	blood loss	normal	chest crush

Table 5-1: Relationship between Health measurements and PSVs

	ID 6	ID 7	ID 8	ID 9	ID 10	ID 11
Event	Earthquake	Earthquake	Earthquake	Earthquake	Earthquake	Earthquake
Size	150	150	150	150	150	150
Gender	Female	Female	Female	Female	Female	Male
Age	20	30	40	50	60	7 months
Lat [m]	10	50	20	40	80	80
Long [m]	10	50	20	40	80	80
hr	90	60	70	82	64	130
O2	98	80	93	95	98	99
temp	36.1	36.5	35.8	35.4	36.9	37
skin	0	0	1	0	0	2
breathing	0	3	0	0	0	1
eyeOpening + verbalResponse + motorResponse	[2,3,2]	[4,5,6]	[3,4,2]	[4,5,6]	[4,5,6]	•
Triage Score [Glasgow Coma Scale]	7	15	9	15	15	•
respiratory rate	15	30	18	16	16	40
Systolic pressure	180	130	140	110	130	•
Diastolic pressure	120	80	80	60	90	•
rightPupil	8	4	7	4	4	4
leftPupil	4	4	7	4	4	4
airway	1	1	1	1	1	1
capillary refill	1	1	1	1	1	1
pain	0	9	7	6	0	•
DESCRIPTION	head trauma	chest wound	head trauma	blood loss	normal	crying

Table 5-2: Relationship between Health measurements and PSVs

6 Conclusions

This deliverable, PHYSIO DSS Component Design, V2, briefly describes the architecture of the PHYSIO DSS component and describes the upgrades, with respect to the first version, in more detail. Since this second version (which is also the final version) is released shortly after the first table-top, held on February 23rd, 2022, and before the execution of the first Use Case of the S&R project, any shortcomings that may arise will be addressed and a new version that will incorporate the changes deemed necessary will be released progressively after the execution of the following Use Cases.

Annex I: References

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