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Clinical guidelines formalized (vers. a)

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CHANGE HISTORY

Ver.	Date	Status	Author (Beneficiary)	Description
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2.2.2	10.06.17	draft	Marina Polycarpou (MATERIA)	Draft revision
2.2.3	18.06.17	draft	Kimon Volikas (MATERIA)	Draft revision
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2.2.5	27.06.17	release	Ioanna Petridou, Marina Polycarpou, Kimon Volikas (MATERIA)	Release version 1
2.2.6	30.06.17	release	Eirini Tsiamaki (UoP)	Revision on existing recommendations
2.2.7	30.06.17	release	Emilia Papagiannaki (UoP)	Revision on preliminary findings
2.2.8	30.06.17	release	Ioanna Petridou, Marina Polycarpou (MATERIA)	Release version 2

EXECUTIVE SUMMARY

Frailsafe aims to combine the clinical data collected by the clinical partners, compare it with the existing knowledge, recommendations and guidelines resulting from validated research, and pair them with the VPM module of the project to come up with an integrated set of clinical guidelines/recommendations for individual users. Frailsafe will use data collection, analysis and modeling to create a tool for integrated assessment of an individual's frailty, both as a diagnostic and as a prognostic metric, in which all variables will be considered and each variable will have its own weight, thus creating a new metric in frailty assessment and prognosis.

By M18, Frailsafe volume of data is not adequate to produce Frailsafe guidelines. However, D2.2 includes:

- Introduction
- Section 1 - Existing guidelines based on the extensive literature review
- Section 2 - Frailsafe guideline-related preliminary data findings and preliminary recommendations
- Section 3 - Conclusions and future actions

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DOCUMENT INFORMATION

Contract Number:	H2020-PHC–690140	**Acronym:**	FRAILSAFE
Full title	Sensing and predictive treatment of frailty and associated co-morbidities using advanced personalized models and advanced interventions		
Project URL	http://frailsafe-project.eu/		
EU Project officer	Mr. Jan Komarek		

Deliverable number:	2.2	**Title:**	Clinical guidelines formalized (vers a)
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Date of delivery	**Contractual**	**30/06/2017 (M18)**	**Actual** 30/06/2017 (M18)
Status	Draft ☐		Final ☒
Nature	Report ☒	Demonstrator ☐	Other ☐
Dissemination Level	Public ☒	Consortium ☐	

Abstract (for dissemination) This delieverable reports on how Frailsafe will create frailty prevention and delay guidelines, and preliminaty guideline-related data and preliminary recommendations based on the data collected up to M18.

Keywords Clinical measurements, preliminary data, physiological parameters, guidelines, age, gender frailty, physical activity, diet, nutrition, cognitive, psychological, medical, social, activity/exercise

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1. INTRODUCTION

1.1 Project objectives

The 65+ age group in Europe will rise from over 85 million in 2008 to 151 million in 2060. Many of these people will manifest frailty phenotypes as they age. A common feature of frailty is a loss of muscle mass and strength, which makes those affected more vulnerable to falls and places them at greater risk of becoming disabled. The frail are also more likely to be hospitalised or to require long-term care. Frailty therefore has a huge impact on older people's quality of life and represents a significant burden for health and social care systems. 17% of the 65+ group in Europe are frail while 42% are 'pre-frail'. The frailty process may be delayed or even reversed, so early interventions are highly desirable. However, little is known about the determinants of frailty state changes (1)

FrailSafe is proposing a novel frailty management system based on a patient-specific approach that is part of a comprehensive plan to manage and support frailty in older people, as well as exploring different causes of frailty manifestation. The system focuses on monitoring older people's everyday life in order to capture frailty-related information, and through augmented reality combined with state-of-the–art data mining techniques, to build a self-adaptive personalized virtual patient model, aiming to assist older people in delaying and/or preventing frailty and frailty level transitions. This will be achieved by measuring adherence to personalized guidelines that include medical treatment and lifestyle recommendations as well as evaluating the frailty level improvement as an intervention outcome. Specificlly, a personalised guidance platform will transmit all the measurements to a prediction engine for giving appropriate feedback to the user on how to manage and reduce the risk for frailty.

D2.2 (and the whole of WP2) is related to the following project Medical Objectives (MO):

Table 1.1 Frailsafe Mos related to D2.2

MO1	Better understand frailty and its relation to co-morbidities
MO2	Develop quantitative and qualitative measures to define frailty
MO3	Use these measures to predict short and long-term outcome
MO4	Develop real life tools for the assessment of physiological reserve and external challenges
MO5	Provide a model sensitive to change in order that pharmaceutical and non-pharmaceutical interventions, which will be designed to delay, arrest or even reverse the transition to

	frailty, can be tested.
MO6	Create "prevent-frailty" evidence based recommendations for older people regarding activities of daily living, lifestyle, nutrition, etc. to strengthen the motor, cognitive, and other "anti-frailty" activities through the delivery of personalized treatment programs, monitoring alerts, guidance and education and estimate the influence of these interventions
MO7	Achieve all with a safe and acceptable to older people system

FrailSafe system will be developed and improved during the study's evolution with the incorporation of preliminary results and user feedback back to the technical partners of the project.

Using this large-scale data collection methodology, it will be possible to make comparisons between the clinical expression of different frailty levels and also between the performance of various measurements and tools to identify and even predict frailty, as well as between people who use Frailsafe and those who dont. A fully developed Frailsafe system will contribute to clinical work to prevent frailty and loss of autonomy both in individual and in population scale.

1.2 Scope of the deliverable D2.2

Deliverable 2.2 uses information capture, analysis and modelling and conducted an overall preliminary assessment of an individual's dietary, nutritional and physical activity. This was compared with current healthcare and European advices in order to identify where improvements could be made. Therefore, Frailsafe data combined with existing recommendations, led to FrailSafe preliminary recommendations set. It is expected that these recommendations will lead to formal guidelines by M27, when the final version of the clnical guidelines is due, and when Frailsafe will have collected and analysed a large volume of data.

Recommendations are directed to older adults, clinicians/researchers/doctors and families/care-givers. Moreover, preliminary recommendations were created both for prevention and for intervention purposes.

This report along with the collected data, is being delivered on M18. The first version of the D2.2 contains preliminary recommendations regarding clinical guidelines, while the second and final version of the deliverable (due M27) will contain formalized clinical guidelines.

The goal of Frailsafe at the end of the clinical assessments and trials, is to be able to distinguish the metrics which are significant in relation to predicting and preventing frailty, and to assign weights to each one so that a new metric is created, which will integrate all the significant variables found through the data analysis.

Frailsafe project will test the efficacy of a combination of tools so as to detect and quantify frailty. Decision making tools are essential to clinical practise. It is very important to detect non-frail and pre-frail participants in order to provide prevention recommendations while frail participants are important to detect in order to provide recommendations to delay the progression of frailty.It is necessary and vital to break the cycle of frailty. Other parameters are also important and were considered before conducting the analysis. After the preliminary data and the link with existing recommendations, parameters could be modified according to preliminary results or not modified at all,different weight to parameters might emerge etc.

Therefore, data will be gathered during the first phase of the study in order to provide sufficient data for the quantification of models whereas during the second phase the aim will be the evaluation and validation of frailsafe developments

Table 1.1 presents the types of clinical assessments carried out with the participants, the parameters tested and the tools which were employed to gather those data. For the analysis of the data, univariate analysis was used to analyse three variables: age, gender, and frailty in relation to cognitive function, housing environment, individuals' functionality, unintentional weight loss, physical activity, hypertantion and comorbitities, BMI, limb strength, BMI weight, anxiety, social factor, and wellness. Univariate analysis identifies potential patterns between the variable which will help in indicating whether age, gender and frailty change correspondingly with the aformentioned variables. This will contribute in the development of the VPN through which each variable will provide valuable insight so as to provide a personalized model for prevention of frailty.

Table 1.2: Frailsafe frailty-related variables which relate to clinical guidelines

Clinical Assessment	Parameters	Tools
Generalities	demographics, leisure, social life/communication assessment	Questionnaires
Medication history	Medical history and prescription	Questions, medical records
	Comorbidities	medical records Self-report and clinician estimation
	Medication list	drug prescriptions
	Autonomy, pain	self-reporting
	Physical activity	Questions
	Alcohol use	Questions
Clinical exam/ measurements	Blood pressure	B/P Monitor Values
	Arterial stiffness evaluation, waist, chest, height, weight and BMI measurements	Mobilograph, Measuring tape, electronic scale
Balance and gait evaluation	Lower limb strength,	Stopwatch, measuring tape, IMUs
	Balance	Stopwatch

Fried's criteria of frailty assessment: allocation into frailty categories	Weight loss, exhaustion/ physical activity, strength, walking speed	Questions, dynamometer
	Muscle strength	Dynamometer/tablet games
Mini-mental examination	Cognitive function	MMSE test
Sensory system evaluation	vision, hearing	Questions and clinician's estimation
Nutritional assessment	Weight loss	MNA short and extended form
	Sarcopenia	DEXA, MRI if available
Activities of Daily Living	Autonomy	Katz Index of Independence of ADL
		Lawton IADL scale
Adverse events	Functionality of daily activities	Phone follow-up questionnaire
Housing conditions	Autonomy	Home visits, user and clinician estimation
Movements and habits	Sleep and eating behaviour,indoor activity and bladder and bowel habits	beacons
	Location, mobility, activity profile	Mobile devices (tablets and mobile phone) - games
Cognitive evaluation	Cognitive function	MoCA test MMSE test

Emotional evaluation	Depression	GDS-15 items
Sleep	Sleep problems	Questions, self-reported by users
Health state		Self-reported during clinical assessment
Quality of life		Self-reported during clinical assessment
Pain self-evaluation		Visual Analogues Scale (VAS)
Anxiety self-evaluation		Visual Analogues Scale (VAS)
Personality and current social activity state	Cognitive deficits	Written scripts in native language
		social interaction using social media, Social media questionnaire
	Personality traits	Big Five

2. EXISTING GUIDELINES

In the context of Task 2.3 – Clinical guidelines for system development, a review of the literature was conducted in order to investigate the existing and most well-supported recommendations referring to the prevention/delay/slowing down of frailty related phenotypes.

Existing guidelines/recomendations available for clinician/researchers, users, families and caregivers, are presented in table 2.1 below. All main parameters are listed such as medical, physical, physiological, psychological, lifestyle, sarcopenia, comorbidities, etc. These parameters are also measured in Frailsafe project. Examples of existing guidelines applications are also listed in this table, along with how Frailsafe addresses these parameters.

Table 2.1: Existing guidelines and how Frailsafe will address relevant parameters

European guidelines	Target group of guidlines	Guideline implementation examples	How Frailsafe addresses parameter	Background/Comments
1. A personalized shared care and support plan should be created by outlining the goals of the treatment, management and creating urgent care plans (3)	Clinician/researcher Family/care giver	<u>Support plans include:</u> • Health and social care summary: symptoms, medication, social status diagnoses • A maintainance plan: goals, aspirations, actions to take, timescale, roles of people in his/her life and how/who can help. • An escalation plan for each indicidual and carer in order to help them identify which service they should	FrailSafe aims to integrate knowledge, pair up of VPM and result in individual guidelines for each patient	Personalized patient models can form the basis of prediction and suggestion capabilities that may indicate a foreseen risk and offer solutions that can be used for the reduction or even better prevention of future situations that may jeopardise the health of the specific patient.

European guidelines	Target group of guidlines	Guideline implementation examples	How Frailsafe addresses parameter	Background/Comments
		use (geriatrics service, falls service), who to call etc. • An urgent care plan, for possible crisis, which include his/her wishes, person to contact, actions to be taken etc.		
2. Electronic Health Records **When an older person is identified as frail, establish systems to share health records between doctors, hospitals, nurses etc, in order to receive monitoring, support and recommendations based on a patient centered approach. (3)**		Creating electronic health records of patients, taking into account medical parameters used for monitoring by healthcare personnel and sharing across different health care settings.	FrailSafe aims to integrate knowledge, pair up of VPM and result in individual guidelines for each patient. Also, VPM will be paired with a call center which will monitor the patients and handle alerts from the VPM.	The goal of user modeling may be to predict user behaviour, to gain knowledge of a particular user in order to tailor interactions to that user, or to create a database of users that can be accessed by others (3) In general, user modelling can be seen as a broad mixture of many disciplines including the

European guidelines	Target group of guidlines	Guideline implementation examples	How Frailsafe addresses parameter	Background/Comments
				interaction of the user with interfaces and devices as well as the analysis of user tasks and user characteristics (sensory, physical and cognitive abilities, psychological and behavioural). The notion of user profiling has been introduced in order to record the user context and personalize applications so as to be tailored to the user needs (3)
3. Urgent situations/adverse events interventions (3) • **Assess clinical condition** • **Assess current physical function** • **Assess current**	Clinician/researcher Family/care giver	Recommendations include transfer to a doctor/hospital or/and transfer to a care and nursing unit if unable to take care his/her self before or after the adverse event.	Telephone follow up procedures every 3 months or/and during the clinical assessment of the participants.	

European guidelines	Target group of guidlines	Guideline implementation examples	How Frailsafe addresses parameter	Background/Comments
cognitive/mood function	Clinican/researcher Family/caregivers User	Prevent adverse outcomes in frail individuals, such as infections, new medication, changes in physical and mental well being		
4. Evidence-based medication review checklists (2)	Clinican/researcher	STOPP/START criteria (5)		
5. Recommend a referral for frail old age who have complex co-existing psychiatric problems as well as difficult behaviour in dementia (2)	Clinician/researcher		Frailsafe takes into account a combination of parameters regarding frailty (6)	
6. Use your clinical judgment and personalized goals to apply disease-based guidelines to	Clinician/researcher			

European guidelines	Target group of guidlines	Guideline implementation examples	How Frailsafe addresses parameter	Background/Comments
individuals (2)				
7. For frail individuals, take into account presence of delirium and sudden immobility (2)	Clinician/researcher user Clinician/researcher user		During the clinical assessment, telephone follow ups and clinical assessment follow ups Frailsafe is interested in sarcopenia (16, 18) and two of Fried's criteria are walking speed and grip strength (1) These two criteria (along with 3 more) are used for grouping participants into frail, pre-frail and non-frail categories. (6) Frailsafe uses already a	These parameters are linked with quality of life and frailty (1,16,18) The main 2 clinical expressions of sarcopenia are low gait speed and diminished strength (1)

European guidelines	Target group of guidlines	Guideline implementation examples	How Frailsafe addresses parameter	Background/Comments
			dynamometer for evaluating grip strength as well as for training purposes by playing games on a tablet using the dynamometer.	
8. Polypharmacy **(9-10,2,21)**		Recommendations include a full re-evaluation of their medication.	Frailsafe takes into account medical history and one of the parameters is polypharmacy. Clinicians ensure during the clinical assessment as well as throughout the project that indeed the medication list is adapted to the needs of the individual.	Polypharmacy is linked with increase risk of falls and adverse side effects and hence frailty (2,9,10,19,21)
9. Nutriotion/diet **(2)**	Clinician/researcher	• regular physical exercise/ activity, more than 2hrs per week. • a health and		Weight loss, values outside the normal standards of each individual and reduced exercise are linked with

European guidelines	Target group of guidlines	Guideline implementation examples	How Frailsafe addresses parameter	Background/Comments
		balanced diet • a healthy weight (according to BMI of each individual)		frailty (6,11-15,17-19)
10. Drug interventions (2)	Clinician/researcher	Recommendations include always consulting their doctor for any changes/side effects of medication or new medication.		
11. Social life • **Recommendations are targeted to avoid social isolation and low mood** **(2)**	Clinician/researcher	• encouragement of joining a society/club • encouragement of social life with family, friends etc	One of the parameters of frailsafe regarding social life is membership to a club, social activity (social media, social contact, outgoing activity)	

European guidelines	Target group of guidlines	Guideline implementation examples	How Frailsafe addresses parameter	Background/Comments
12. Drugs/Medicine • **should be considered using validated medication checklists such as the STOPP and START guidelines.** **(2,5,)**		A referral to his/her doctor if during the clinical assessment some of the mentioned drugs are taken by the individual. .		some drugs are found to be linked with adverse outcomes such as delirium and confusion (6,9,10) Drug interventions are suggested to improve muscle mass and function. Testosterone improves muscle strength but is also linked with adverse effects especially on the cardiovascular system. Therefore, keeping always in mind a patient-centered approach. Also, growth hormone improves muscle mass (2,5)
13. Disability/physical **It is recommended by several organizations that clinicians should screen for:**	User	Recommendations include: optimising protein intake and correcting vitamin D		There is emerging evidence that frailty increases in the presence of obesity particularly in the context of other unhealthy behaviors, such

European guidelines	Target group of guidlines	Guideline implementation examples	How Frailsafe addresses parameter	Background/Comments
• **disability in self-care tasks (ADL)** • **and tasks that permit an individual live independently in a community (IADL: Instrumental Activities of Daily Living) on an annual basis people over the age of 70** • **Home based interventions and groups based interventions are suggested which can result in improvement in mobility and functional ability.** • **Also, resistance exercise is beneficial both in terms of preventing and treating the physical**		insufficiency		as, inactivity, a poor diet and smoking. An even more devastating condition in terms of frailty and subsequent morbidity is the so called 'sarcopenic obesity', a combination of obesity and low muscle mass (2,6,11,12-15,17-19,) Social vulnerability has been shown to correlate with frailty and mortality. Social factors play an important role in modulating the adverse outcomes of frailty (6) Social factors thus appear to influence health outcomes at a number of levels – biological, health

European guidelines	Target group of guidlines	Guideline implementation examples	How Frailsafe addresses parameter	Background/Comments
performance component of frailty. (2)				behaviours (including diet, exercise, and smoking), availability of social support, and access to quality healthcare (2)
14. Falls/Risk of falls • **Recommendations for physical exercise are vital.** **(2)**	User Clinician/researcher	using aiding tools for individuals who have difficulties due to pathological reasons (hip replacement etc). Recommendations for individuals who do not need aiding tools include regular physical exercise, a balanced diet (vitamins etc). Also, recommendations for re-evaluation of their medicines, as some drugs are linked with falls (mentioned above)	Sensorized strap/vest (IMU measurements) • Detection of falls and of fall of risk • Activity classification	Many drugs are associated with adverse outcomes in frailty (2). Examples are: • Antimuscarinics in cognitive impairement • Long active benzodiazepines, other sedatives and hypnotics increase risk of falls • Some opiate based increase the risk of delirium and confusion • Preventative chronic disease medication such as statins and warfarin for atrial fibrillation and sedatives and antihypertensitives

European guidelines	Target group of guidlines	Guideline implementation examples	How Frailsafe addresses parameter	Background/Comments
15. Frieds criteria (6)	Clinician/researcher User Family/care-givers		Sensorized strap/vest (IMU measurements) • Detection of falls and of fall of risk • Activity monitoring • Distances covered • Gait speed • calculates Respiratory Rate and Breathing Amplitude, in clinical terms, reflect mainly on medical and physical/functional aspects of frailty GPS logger • Gait speed • Activity pattern	A feature of frailty is loss of skeletal mass and function (sacropenia, Fried's phenotype model). Therefore, recommendations for physical exercise are vital. The Fried's Phenotype model describes a group of characteristics which are unintentional: weight loss, reduced muscle strength, reduced gait speed, self-reported exhaustion and low energy expenditure The first score elaborated and widely used was the Fried' clinical operational definition [6] which inludes

European guidelines	Target group of guidlines	Guideline implementation examples	How Frailsafe addresses parameter	Background/Comments
				• weight loss: self-reported weight loss of > 4.5kg or recorded weight loss of ≥ 5% per year. •Self-reported exhaustion: self-reported exhaustion on Center for Epidemiologic Studies depression scale (3-4 days per week or most of the time). • Low energy expenditure: energy expenditure < 383 kcal/week (for men) or < 270 kcal/week (for women). • Slow gait speed: standardised cut-off times to walk 4.57 m, stratified by sex and

European guidelines	Target group of guidlines	Guideline implementation examples	How Frailsafe addresses parameter	Background/Comments
				height. • weak grip strength: grip strength, stratified by sex and body mass index (6, 12-15, 17-19)
15. Encouriging healthy behaviours **Two integrating dementia risk reduction prevention policies:** • **In strategy documents include dementia aimed at preventing and other non-communicable chronic diseases such as type 2 diabetes, stroke and chronic obstructive-pulmonary disease)** • **Recommendations for health behaviours include: stop smoking, reduce**	Clinician/researcher Family/care-givers		• Stop smoking • reduce alcohol consumption • healthy diet, healthy weight, more active physically	Evidence has shown tha there is a link between smoking and dementia, frailty and disability. The same link exists for alcohol consumption (4) Physical activity reduces the risk of illness both in short and long term, it preserves memory and cognitive ability, it reduces the risk of falls and improving quality of life and health (12-15) Unhealthy behaviours can

European guidelines	Target group of guidlines	Guideline implementation examples	How Frailsafe addresses parameter	Background/Comments
alcohol consumption, adopt a healthy diet and have a healthy weight and be more active physically (4)				increase the risk of dementia (4)
16. Cognitive and psychological domains **Individuals with scores outside the pre-set normal values should be referred to a doctor for further examination and/or medication prescription.** **Additionally, a cognitive enhancement program is recommended for training/stabilizing his/her cognitive abilities for the maximum time possible.**		Referral to a doctor for further examination and/or medication prescription. Additionally, a cognitive enhancement program is recommended for training/stabilizing his/her cognitive abilities for the maximum time possible. Also, recommend a referral for frail old age who have complex co-existing psychiatric problems as well as difficult behaviour in dementia		Mini Mental state examination test (MMSE), Montreal cognitive assessment (MOCA) and Geriatric depression scale (GDS) Psychological, cognitive and social factors also contribute to this multidimensional condition. Together, these signs and symptoms seem to reflect a reduced functional reserve and consequent decrease in adaptation (resilience) to any sort of stressor and perhaps even in the absence of extrinsic

European guidelines	Target group of guidlines	Guideline implementation examples	How Frailsafe addresses parameter	Background/Comments
				stressors Whereas both frailty and cognitive decline share common potential mechanisms, disentangling the relationship between cognition and frailty may lead to new intervention strategies for the prevention and treatment of both conditions (2,3,6)
17. Comorbidities **researchers are increasingly evaluating the interactions of concurrently present impairments, such as strength and balance or vision and hearing or biomediators, such as interleukin-6 and insulin-like growth factor**	Clinician/researcher Family/care-givers		Frailsafe is interested in comorbidities especially for stroke, mild cognitive impairment and osteroporosis/osteoarthritis	researchers are increasingly evaluating the interactions of concurrently present impairments, such as strength and balance or vision and hearing or biomediators, such as interleukin-6 and insulin-like growth factor-I comorbidity heightens the

European guidelines	Target group of guidlines	Guideline implementation examples	How Frailsafe addresses parameter	Background/Comments
(4)				risk of disability and mortality, over and above the risk from individual diseases Particular pairs of chronic diseases are prevalent, and are synergistic in increasing risk for disability For example, the concurrent presence of heart disease and osteoarthritis of the knee increased the relative risk of developing mobility disability to 13.6, from a relative risk of 4.4 for those with osteoarthritis alone, or 2.3 for those with heart disease alone - compared to those with neither disease (4,6,20)

European guidelines	Target group of guidlines	Guideline implementation examples	How Frailsafe addresses parameter	Background/Comments
18. Physical exercise **Recommendations include aerobic endurance training and resistance training** **(7)**	Clinician/researcher Family/care-givers User		Regular exercise	Longitudinal studies demonstrate that regular physical exercise extends longevity and reduces the risk of physical disability. Aerobic endurance training can significantly improve peak oxygen consumption by ~10–15%. Resistance training is the best way to increase muscle strength and mass. (7,12-15)
19. Management/prevention • **Promoting physical activity and monitoring diet and**	Clinician/researcher		Personalized recommendations and guidelines will be provided to pre-frail and non-frail persons in order to prevent	Information on subjects' frailty should be updated and available, if possible, through a computer system covering each step

European guidelines	Target group of guidlines	Guideline implementation examples	How Frailsafe addresses parameter	Background/Comments
bodyweight • **Monitoring and assessment using specific tools for data collection** • **Use of the Geriatric Multidimensional Assessment method to avoid adverse events and progression to disability in hospitalized patients** • **Personalized discharge planning (DP) when hospitalized** • **Keeping updated frailty information** **(8)**			or slow down frailty.	of the healthcare network
20. IMI project SPRINT **whether frailty can be**	Clinician/researcher User	• healthy diet and a balanced BMI • physical		Weight loss, values outside the normal standards of each

European guidelines	Target group of guidlines	Guideline implementation examples	How Frailsafe addresses parameter	Background/Comments
prevented by a treatment programme which combines: • **exercise** • **dietary advice** • **modern technologies** **(1)**		exercise		individual and reduced exercise are linked with frailty (6,11-15,17-19)

3. PRELIMINARY DATA RELATED TO FRAILSAFE RECOMMENDATIONS/GUIDELINES

Through Frailsafe data acquisition, lifestyle information on older people was/is attained through (a) nutritional/diet questionnaire and (b) physical activity monitoring though embedded smart phone sensors and apps like accelerometers, podometers and tracking systems (steps, calories and active time, weight management tool, etc). Also overall physiological and cognitive morbidity is assessed.

Questionnaires, surveys and focus groups were/are conducted to investigate the FrailSafe metrics and get feedback from end users.(D1.1) Questionnaires regarding game activity were also conducted. Collection of feedback is an on-going and continuous task in Frailsafe. User feedback is an essential parameter taken into account when designing and conducting the pilot studies and the way they will be organized, supported and managed throughout the duration of the project. Our goal is to ensure reliable and ongoing feedback as part of the co-design method, as well as a safe and ethical procedure for the participants. (WP7). Existing recommendations were also considered in the design of the clinical assessment battery. Preliminary recommendations will also be considered in the same way for the future trials .

Preliminary data analysis was conducted and some preliminary results emerged (Inclusive data presented in D2.3). All these together with the measurements of D2.2 will ground the WP4 models with experimental data providing sufficient evidence for the quantification of the patient models and prediction framework.

Three parameters where taken into account when conducting the univariate analysis:

- Age
- Frailty
- gender

These parameters were divided into the following domains:

- Cognitive
- Environment
- Functional
- General
- Lifestyle
- Medical
- Nutrition
- Physical
- Physiological
- Psychological
- Social

- Wellness

Table 3.1 shows the paremeters and domains taken into account for the data analysis. Some of the preliminary findings are introduced in this table and were matched with previous findings and recommendations. Frailsafe does not have adequate data yet to provide independent guidelines, so for now only preliminary recommendations are presented.

Table 3.1: Preliminary findings and preliminary frailsafe recommendations

Domains* *complete list of domains in D2.3	**Tool/question**	**Preliminary-findings**	**Interpretation of preliminary data analysis**	**Frailsafe recommendations* NOTE: Frailsafe does not have adequate data to produce independent recommendations. However, preliminary data support following recommendations and guidelines in Table 2.0**
1.Cognitive	Moca Test	Parameter=Age Score <26 Old=21.37% Older=40.86% Oldest=49.48% Score 26-30% Old=78.63% Older=59.14% Oldest=50.52% Parameter=Frailty <26 Non-frail= 19.82% Prefrail = 34.43%	The older the participants, the lower the score in this cognitive function test Results confirm extisitng literature findings of positive correlation between cognitive decline and age. These results indicate that the non-frail participants score higher when compared to pre-frail and frail. Frail participants have lower scores.	• Referral to a doctor if scores are under normal values for further examination and/or pharmaceutical interventions. • Cognitive training program

Domains* *complete list of domains in D2.3	**Tool/question**	**Preliminary-findings**	**Interpretation of preliminary data analysis**	**Frailsafe recommendations* NOTE: Frailsafe does not have adequate data to produce independent recommendations. However, preliminary data support following recommendations and guidelines in Table 2.0**
		Frail= 63.51% 26-30 Non-frail=80.18% Pre-frail=65.57% Frail=36.49% Parameter=gender Score <26 Male=40.91% Female 33.50% Score 26-30 Male= 59.09% Female= 66.50%	These results show that there is a link between frailty level and cognitive function Results show that more men scored lower than 26 than women and fewer men scored betweem 26-30 than women.	
	Mini mental	*chart 1.0	Results indicate that the oldest participants have a lower score	• Referral to a doctor if scores are under normal values for further examination

Domains* *complete list of domains in D2.3	**Tool/question**	**Preliminary-findings**	**Interpretation of preliminary data analysis**	**Frailsafe recommendations* NOTE: Frailsafe does not have adequate data to produce independent recommendations. However, preliminary data support following recommendations and guidelines in Table 2.0**
		Parameter=Age Score 24-26 Old=12.69% Older=28.93% Oldest=41.46% Score 27-30 Old=87.31% Older=71.07% Oldest=58.54% Parameter=Frailty Score: 24-26 Non-frail=11.67%	while the old participants have higher scores in both scoring categories These results show that there is a link between frailty level and cognitive function Results indicate that the non-frail participants score higher when compared to pre-frail and frail participants.	and/or pharmaceutical interventions. • Cognitive training program

Domains* *complete list of domains in D2.3	**Tool/question**	**Preliminary-findings**	**Interpretation of preliminary data analysis**	**Frailsafe recommendations* NOTE: Frailsafe does not have adequate data to produce independent recommendations. However, preliminary data support following recommendations and guidelines in Table 2.0**
		Pre-frail= 26.58% frail=47.00% score: 27-30 Non-frail=88.33% Pre-frail= 73.42% frail=53.00% Parameter=gender Score 24-26 Male=23.24% Female=29.66 Score 27-	Results show that more female participants scored between 24-26 compared to men but more male scored between 27-30 compared to women.	

Domains* *complete list of domains in D2.3	**Tool/question**	**Preliminary-findings**	**Interpretation of preliminary data analysis**	**Frailsafe recommendations* NOTE: Frailsafe does not have adequate data to produce independent recommendations. However, preliminary data support following recommendations and guidelines in Table 2.0**
		30Male=76.76% Female=70.34%		
2.Functional	KATZ index	Parameter=Age Score 0-4.5 Old=1.48% Older= 0.83% Oldest= 8.94% Score 5-5.5 Old=19.26% Older= 13.33% Oldest= 20.33% Score 6 Old=79.26%	Results indicate that the old and older participants are more independent compared to the oldest participants who are more dependend There is a decline in functional status of the participants as they age	• Encouragement for more social/active life both in physical and cognitive domains of the user

Domains* *complete list of domains in D2.3	**Tool/question**	**Preliminary-findings**	**Interpretation of preliminary data analysis**	**Frailsafe recommendations* NOTE: Frailsafe does not have adequate data to produce independent recommendations. However, preliminary data support following recommendations and guidelines in Table 2.0**
		Older= 85.83% Oldest= 70.73% Parameter frailty *chart 2.0		
	IADL	Parameter=age Score 0-5 Old=0.00% Older= 0.00% Oldest=0.81% Score 6-11 Old=0.00% Older= 0.00% Oldest=6.5%	Results indicate that the old and older participants are more functional compared to the oldest participantsThere is a decline in functional status of the participants as they ageScores are not consistent but in the scoring category of 24-31, more women score here when compared to men.	

Domains* *complete list of domains in D2.3	**Tool/question**	**Preliminary-findings**	**Interpretation of preliminary data analysis**	**Frailsafe recommendations* NOTE: Frailsafe does not have adequate data to produce independent recommendations. However, preliminary data support following recommendations and guidelines in Table 2.0**
		Score 12-17 Old=2.22% Older= 7.50% Oldest=13.82% Score 18-23 Old=5.93% Older= 10.00% Oldest=15.45% Score 24-31 Old=91.85% Older= 82.5% Oldest=63.41% Parameter=gender		

Domains* *complete list of domains in D2.3	**Tool/question**	**Preliminary-findings**	**Interpretation of preliminary data analysis**	**Frailsafe recommendations* NOTE: Frailsafe does not have adequate data to produce independent recommendations. However, preliminary data support following recommendations and guidelines in Table 2.0**
		Scores 0-5 Female=0.42% Male=0.00% 6-11 Female=1.69% Male=2.82% 12-17 Female=4.66% Male=12.68% 18-23 Female=5.51%		

Domains* *complete list of domains in D2.3	**Tool/question**	**Preliminary-findings**	**Interpretation of preliminary data analysis**	**Frailsafe recommendations* NOTE: Frailsafe does not have adequate data to produce independent recommendations. However, preliminary data support following recommendations and guidelines in Table 2.0**
		Male=18.31% 24-31 Female=87.71% Male=66.20%		
3.General	Unintentional weight loss (participants who responded yes)	Parameter=age Old=11.85% Older= 7.83% Oldest=14.75% Parameter=frailty Non-frail=0% Pre-frail=7.69% Frail=31.63%	Results indicate that the older participants loose unintentional weight more often than the older and the old. Results show that pre-frail and frail participants lost unintentional weight compare to non-frails who did not loose weight unintentionally	• Healthy diet • Healthy, balanced weight • Physical activity • Preventative strategies and interventions

Domains* *complete list of domains in D2.3	**Tool/question**	**Preliminary-findings**	**Interpretation of preliminary data analysis**	**Frailsafe recommendations* NOTE: Frailsafe does not have adequate data to produce independent recommendations. However, preliminary data support following recommendations and guidelines in Table 2.0**
	Self-reported exhaustion (participants who responded yes)	Parameter=age Old=19.26% Older= 23.28% Oldest=36.80% Parameter=frailty Non-frail=0% Pre-frail=14.56% Frail=76.77%	Results indicate that the oldest participants reported exhaustion more often than the old and older participants. Results show that pre-frail and frail participants reported exhaustion when compared to non-frails that reported no exhaustion.The highest self-reported exhaustion is higher in the frail participants.	
4.Lifestyle	Physical activity	Parameter=age < 2 h per week Old=20.74% Older= 27.73%	Results indicate that the oldest participants exercise less when compared to old and older participants.	• Physical activity/training

Domains* *complete list of domains in D2.3	**Tool/question**	**Preliminary-findings**	**Interpretation of preliminary data analysis**	**Frailsafe recommendations* NOTE: Frailsafe does not have adequate data to produce independent recommendations. However, preliminary data support following recommendations and guidelines in Table 2.0**
		Oldest=44.63% >2 and 5 h/week Old=37.04% Older= 26.89% Oldest=21.49% > 5 h/week Old=35.56% Older= 36.13% Oldest=18.18% No activity Old=6.67% Older= 9.24% Oldest=15.57%		

Domains* *complete list of domains in D2.3	**Tool/question**	**Preliminary-findings**	**Interpretation of preliminary data analysis**	**Frailsafe recommendations* NOTE: Frailsafe does not have adequate data to produce independent recommendations. However, preliminary data support following recommendations and guidelines in Table 2.0**
	smoking	Parameter=age Current smoker Old=8.82% Older= 8.40% Oldest=3.31%	Results show that the old and older participants smoke more when compared to oldest pariticipants.	• Stop smoking • Encouraging healthy behaviours • Prevention strategies
	Alcohol units per week according to age group (old, older, oldest)	Parameter= female <=14 Old=95.7% Older= 98.51% Oldest=96.00% 14.1-21 Old=2.15%	Results indicate that only a few of the participants consume >14 alcohol units per week while the rest consume <14 alcohol units	• Encouraging healthy behaviours • Stop alcohol consumption or consume according to acceptable and healthy criteria

Domains* *complete list of domains in D2.3	**Tool/question**	**Preliminary-findings**	**Interpretation of preliminary data analysis**	**Frailsafe recommendations* NOTE: Frailsafe does not have adequate data to produce independent recommendations. However, preliminary data support following recommendations and guidelines in Table 2.0**
		Older= 1.49% Oldest=1.33% >21 Old=2.15% Older= 0.00% Oldest=2.67%		
7. Medical	Comorbidities	Parameter= frailty Number of significant comorbidities 0 Non frail=80.83% Pre-frail=75.32% Frail=69.00%	Pre-frail and frail participants have more number of comorbidities when compared to non-frails.	• pairs of chronic diseases are prevalent and are synergistic in increasing risk for disability. • Recommendations according to specific pairs

Domains* *complete list of domains in D2.3	**Tool/question**	**Preliminary-findings**	**Interpretation of preliminary data analysis**	**Frailsafe recommendations* NOTE: Frailsafe does not have adequate data to produce independent recommendations. However, preliminary data support following recommendations and guidelines in Table 2.0**
		1 Non-frail=16.67% Pre-frail=17.72% Frail=21.00% >=2 Non frail= 2.50% Frail=6.96% Frail=10.00%		
6.Nutrition	MNA	Parameter age: 0-7 Old 2.96% Older 2.50% Oldest 0.81%	Results show that participants in the first and second category are at risk of malnutrition (8-11 points) or malnourished (0-7 points)	Recommendations include • A healthy diet • a health weight • both prevention and intervention guidelines

Domains* *complete list of domains in D2.3	**Tool/question**	**Preliminary-findings**	**Interpretation of preliminary data analysis**	**Frailsafe recommendations* NOTE: Frailsafe does not have adequate data to produce independent recommendations. However, preliminary data support following recommendations and guidelines in Table 2.0**
		8-11 Old 11.85% Older 8.33% Oldest 15.45% 12-14 Old 85.19% Older 89.17% Oldest 83.74% Gender parameter: 0-7 Female 2.54%	Results indicate that more female participants have normal nutritional status	

Domains* *complete list of domains in D2.3	**Tool/question**	**Preliminary-findings**	**Interpretation of preliminary data analysis**	**Frailsafe recommendations* NOTE: Frailsafe does not have adequate data to produce independent recommendations. However, preliminary data support following recommendations and guidelines in Table 2.0**
		Male 1.41% 8-11 Female 11.02% Male 13.38% 12-14 Female 86.44% Male 85.21%		
7.Physical	Lower limp strength	Parameter age: 0-10 Old 28.91% Older 19.09% Oldest 17.48%	Results show: • older and oldest participants score less, have lower or higher values (according to values of each domain), have less physical activity and are more prone to	-training physical aspects of users, for example grip strength can be measured and trained using the dynamometer -physical exercise/training -healthy diet and weight (BMI according to each user)

Domains* *complete list of domains in D2.3	**Tool/question**	**Preliminary-findings**	**Interpretation of preliminary data analysis**	**Frailsafe recommendations* NOTE: Frailsafe does not have adequate data to produce independent recommendations. However, preliminary data support following recommendations and guidelines in Table 2.0**
		10.1-15 Old 53.13% Older 50.91% Oldest 43.69% >15 Old 17.97% Older 30.00% Oldest 38.83% Parameter frailty: 0-10	falls and fractures.	

Domains* *complete list of domains in D2.3	**Tool/question**	**Preliminary-findings**	**Interpretation of preliminary data analysis**	**Frailsafe recommendations* NOTE: Frailsafe does not have adequate data to produce independent recommendations. However, preliminary data support following recommendations and guidelines in Table 2.0**
		Non-frail 29.17% Pre-frail 17.76% Frail 20.29% 10.1-15 Non-frail 54.17% Pre-frail 50.66% Frail 39.13% >15 Non-frail 16.67% Pre-frail 31.58% Frail 40.58%		
8.Physiological	Blood pressure	*chart 4.0 and 4.1	Systolic and diastolic pressures are higher in pre-frail groups for women	• referral to doctor for abnormal values

Domains* *complete list of domains in D2.3	**Tool/question**	**Preliminary-findings**	**Interpretation of preliminary data analysis**	**Frailsafe recommendations* NOTE: Frailsafe does not have adequate data to produce independent recommendations. However, preliminary data support following recommendations and guidelines in Table 2.0**
9.Psychological	GDS	*chart 3.0 Parameter=frailty Scores 0-4 Non frail=90.68% Pre-frail=75.64% Frail=54.08% 5-6 Non frail=4.24% Pre-frail=11.54% Frail=18.37% 7-10	Results indicate that frail and pre-frail are more prone to have higher scores in the GDS Non-frail people report higher levels of good psychological status.	• Referral to psychologist/psychiatrist/neurologist according to scores • Medical interventions • Social life encouragement • Friends/membership to clubs/societies

Domains* *complete list of domains in D2.3	**Tool/question**	**Preliminary-findings**	**Interpretation of preliminary data analysis**	**Frailsafe recommendations* NOTE: Frailsafe does not have adequate data to produce independent recommendations. However, preliminary data support following recommendations and guidelines in Table 2.0**
		Non frail=5.08% Pre-frail=12.18% Frail=17.35% 10-15 Non frail=0.00% Pre-frail=0.64% Frail=10.20%		
10.Social	Leisure activities (times they go out of house per week)	Parameter=frailty 0-3 times Non-frail=12.50% Pre-frail=22.93% Frail=49.00%	Results show that non-frails and pre-frails are more outgoing compared (they go out of the house more times/more often) to frails. Old participants have more active social life than older and oldest	• encouragement of joining a society/club • encouragement of social life with family, friends etc

Domains* *complete list of domains in D2.3	**Tool/question**	**Preliminary-findings**	**Interpretation of preliminary data analysis**	**Frailsafe recommendations* NOTE: Frailsafe does not have adequate data to produce independent recommendations. However, preliminary data support following recommendations and guidelines in Table 2.0**
		4-6 times Non-frail=25.83% Pre-frail=21.66% Frail=14.00% 7-28 times Non-frail=61.67% Pre-frail=55.41% Frail=37.00%	people.	
11.Wellness	Quality of life	Parameter=frailty Scores 5-7.4 Non-frail=30.83% Pre-frail=35.44% Frail=40.00%	Non-frail people are more satisfied with their wellness than pre-frail and frail people even though they have slightly higher anxiety levels.	• Physical activity • Social life • Healthy diet • Balanced BMI • encouragement of joining a society/club • encouragement of social life with

Domains* *complete list of domains in D2.3	**Tool/question**	**Preliminary-findings**	**Interpretation of preliminary data analysis**	**Frailsafe recommendations* NOTE: Frailsafe does not have adequate data to produce independent recommendations. However, preliminary data support following recommendations and guidelines in Table 2.0**
		Scores 7.5-10 Non-frail=66.67% Pre-frail=58.86% Frail=49.00%		family, friends etc

3.1 Charts supporting preliminary recommendations

Some data charts related to the preliminary recommendations are presented below. Conclusive charts presented in D2.3.

Chart 3.1.1: Showing the link of parameter Age and Mini Mental State Examination test

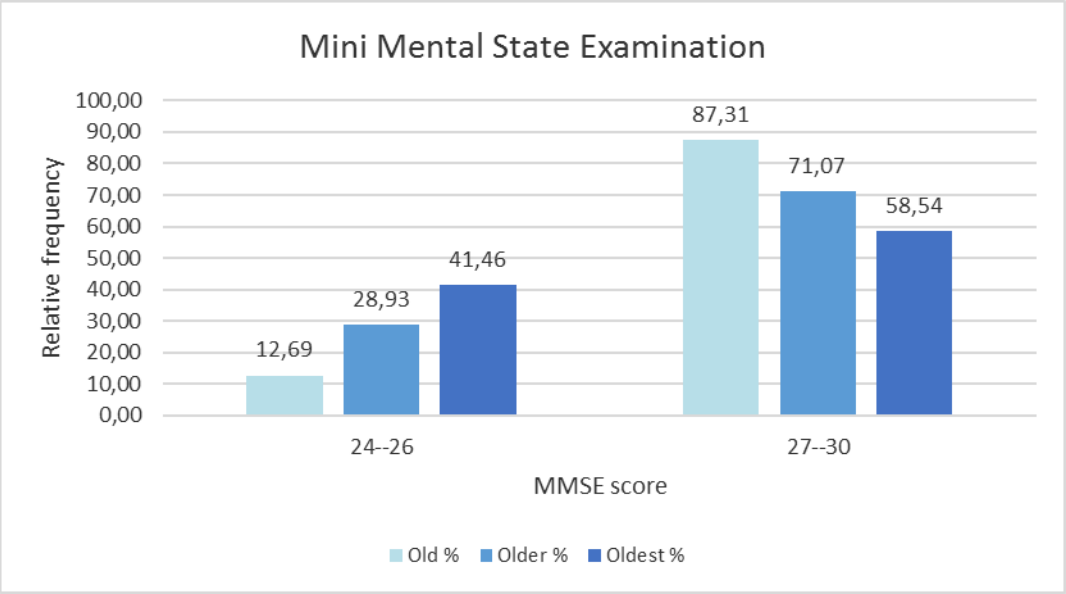


Chart 3.1.2: Showing the link of parameter frailty and KATZ index

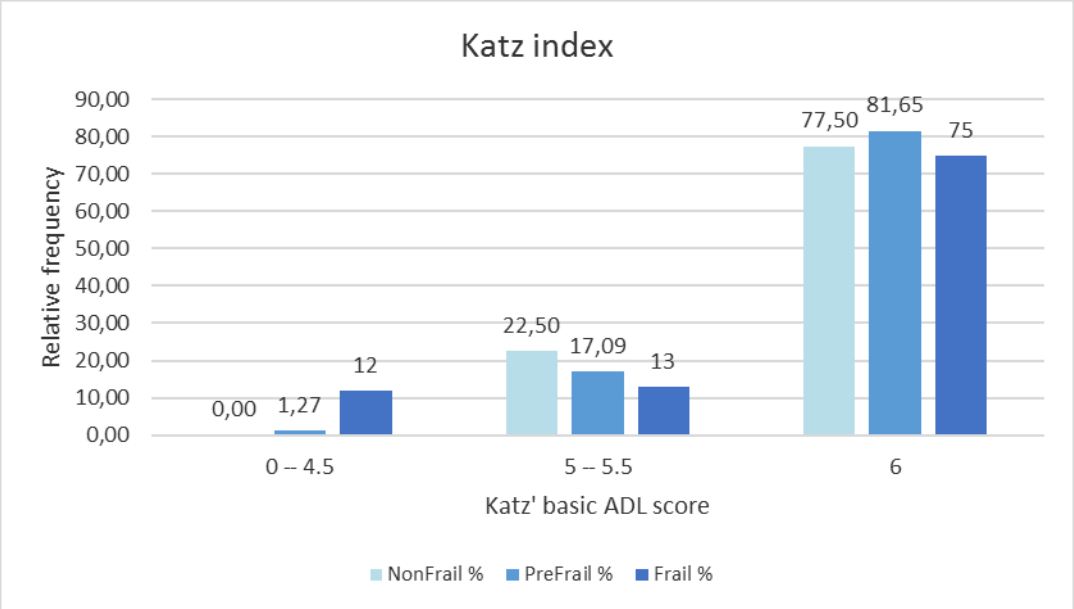


Chart 3.1.3: Showing the link of parameter frailty and GDS scale

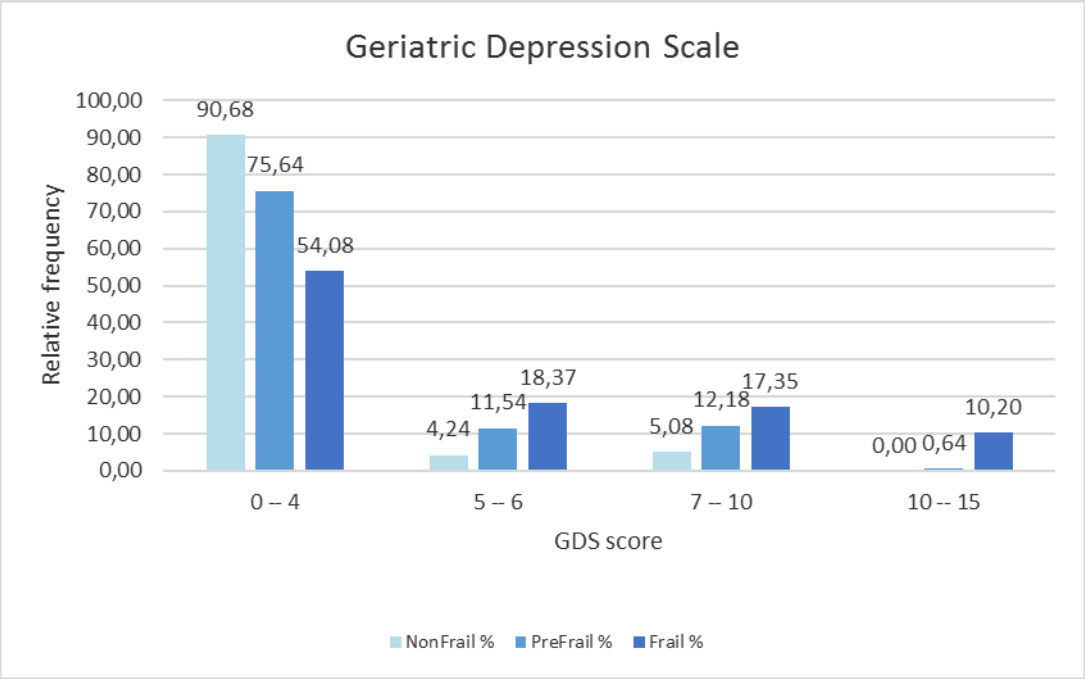


Chart 3.1.4: Showing the link of parameter gender and diastolic blood pressure

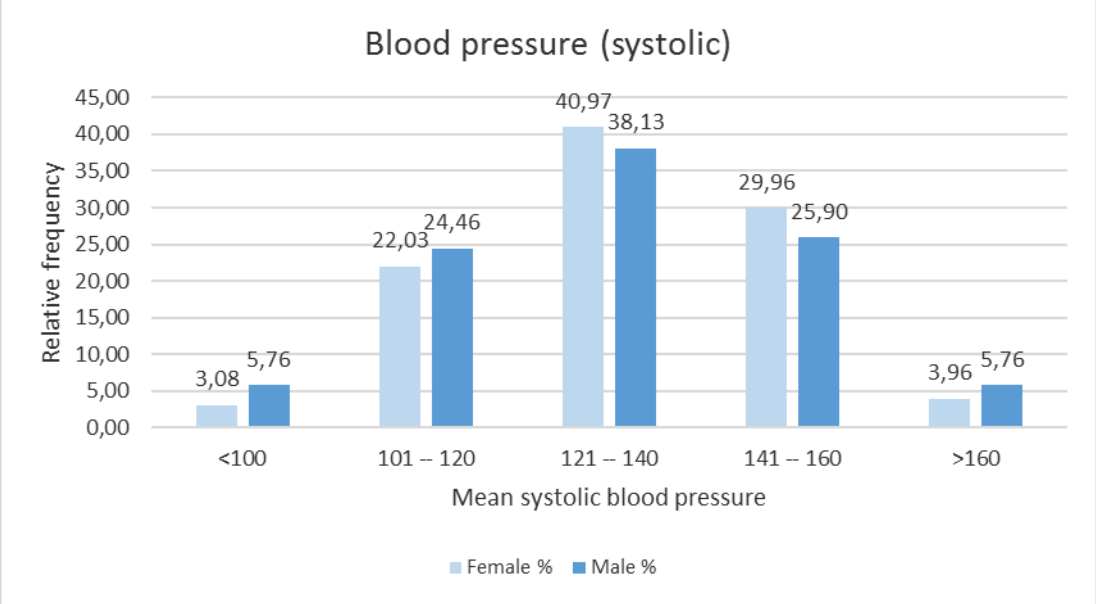
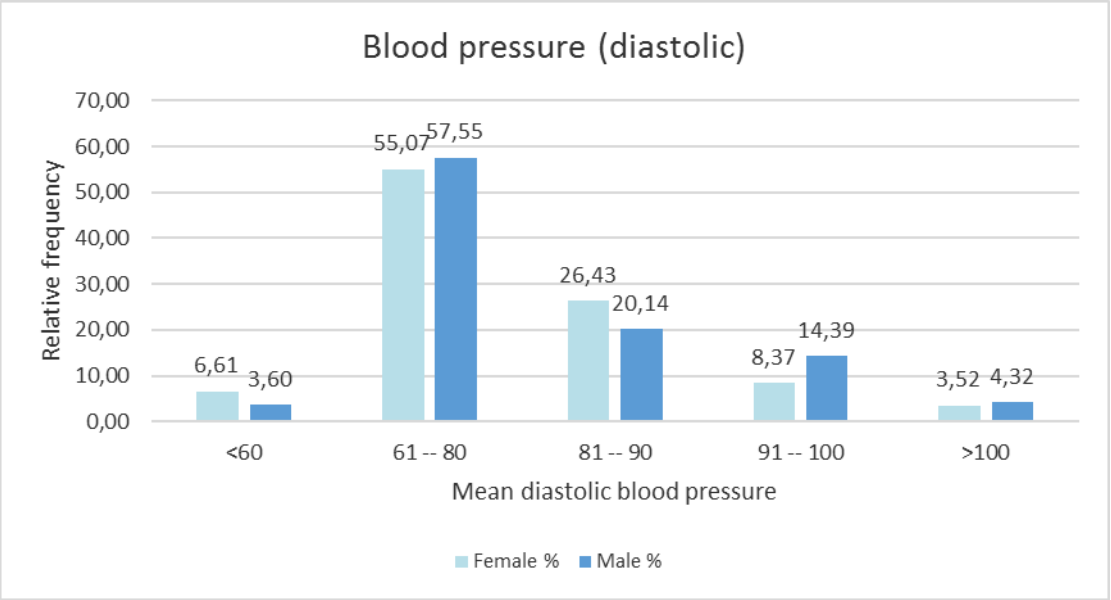


Chart 3.1.5: Showing the link of parameter gender and systolic blood pressure



4. CONCLUSIONS / FUTURE ACTIONS

Deliverable 2.2 used information capture, analysis and modelling and conducted an overall preliminary assessment of an individual's dietary, nutritional and physical activity. This was compared with current healthcare and European advices in order to identify where improvements could be made. Therefore, Frailsafe data combined with existing recommendations, led to FrailSafe preliminary recommendations set. It is expected that these recommendations will lead to formal guidelines by M27, when the final version of the clnical guidelines is due, and when Frailsafe will have collected and analysed a large volume of data.

Recommendations are directed to older adults, clinicians/researchers/doctors and families/care-givers. Moreover, preliminary recommendations were created both for prevention and for intervention purposes.

This report along with the collected data, is being delivered on M18. The first version of the D2.2 contains preliminary recommendations regarding clinical guidelines, while the second and final version of the deliverable (due M27) will contain formalized clinical guidelines.

The goal of Frailsafe at the end of the clinical assessments and trials, is to be able to distinguish the metrics which are significant in relation to predicting and preventing frailty, and to assign weights to each one so that a new metric is created, which will integrate all the significant variables found through the data analysis. Data collected so far by Frailsafe generally supports existing European guidelines for healthy ageing and preventing or delaying frailty.In some domains, preliminary findings are not clear but our sample and data volume is still small. We are expecting to have more concrete and reliable results before we can confidently create Frailsafe guidelines by M27.

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