HEARTFAID

D9 – Specification of all biomedical data, signs and symptoms relevant to heart failure.

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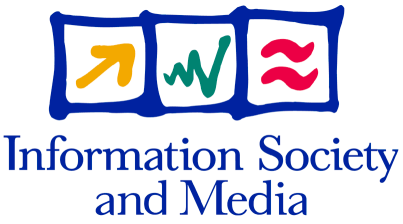

HEARTFAID

A KNOWLEDGE BASED PLATFORM OF SERVICES FOR SUPPORTING MEDICAL-CLINICAL MANAGEMENT OF THE HEART FAILURE WITHIN THE ELDERLY POPULATION

Project summary	
Project acronym:	HEARTFAID
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Thematic Priority:	Information Society Technology
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Consortium

- UNICAL- Università della Calabria (Italy)
- UNICZ- Università degli studi Magna Graecia di Catanzaro (Italy)
- UNIMIB- Università degli studi di Milano Bicocca (Italy)
- JUMC- Jagiellonian University Medical College (Poland)
- VMWS- Virtual Medical World Solutions Ltd (United Kingdom)
- FORTHNET S. A.- Hellenic Telecommunications and Telematic Applications Company S. A. (Greece)
- SYNAP- Synapsis s.r.l. (Italy)
- CNR- Consiglio Nazionale delle Ricerche (Italy)
- FORTH-Foundation for Research and Technology Hellas (Greece)
- RBI- Rudjer Boskovic Institute (Croatia)
- AUXOL- Istituto Auxologico Italiano (Italy)

D9 – Specification of all biomedical data, signs and symptoms relevant to heart failure.

Document summary	
Document title:	**D9 – Specification of all biomedical data, signs and symptoms relevant to heart failure.**
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Short description
This document collects the results of tasks T2.1 of WP2 and describes the biomedical data, signs and symptoms relevant to heart failure (HF).

Change record		
Version number	Changes	Release date
1.0	First draft of the document	10/10/2006
1.1	Minor content and format changes	09/11/2006
1.2	Minor changes	13/11/2006

Table of contents

1. Executive Summary

The deliverable number nine, "Specification of all biomedical data, signs and symptoms relevant to HF", collects the results of tasks T2.1 of Work Package WP2. The partners involved in preparing the document have been VMWS, JUMC, UNIMIB, AUXOL, UNICAL and UNICZ.
This document describes the biomedical data, signs and symptoms relevant to heart failure (HF).
Overall, such data, signs and symptoms can roughly be grouped as relevant to:

1) establishing the presence (i.e. establishing the diagnosis of HF) and the aetiology of the condition;
2) choice of management for the condition (i.e. choice of pharmacological and non-pharmacological treatment); evaluating tolerability, effectiveness and compliance to treatment; evaluating the prognosis of the disease;
3) acquire novel information concerning the condition (i.e. research and development concerning all of the above aspects of the condition).

Of note, secondary to the main characteristics of this disease, the same biomedical data, signs and symptoms can serve to one or more of the above purposes.

Moreover, given the ongoing development of new diagnostic and prognostic strategies in the field of HF, the list contained in this document is not intended to be exhaustive. Likely, from the first demo to the fully functioning version of the HEARTFAID platform, other biomedical data will be added.

This flexibility is seen, of course, an intrinsic and probably the most distinguishing characteristic feature of the HEARTFAID platform itself.

The document structure is subdivided into several parts, grouping the biomedical signs, symptoms and biomedical data relevant to HF according to the various environments, HF management practices and currently utilized medical tests.

2. Functional Organization of the HEARTFAID Platform.

As first outlined in section 8 of D5, the HEARTFAID project aims at developing a technological platform serving patients with CHF, the medical personnel involved in their management as well as patients' relatives involved in their care, all of them acting in their respective environments. The organization of this technological platform is outlined in Fig.1. This organization is solely functional, with services tailored to the CHF domain.

2.1 PROCEDURES *(columns).* Briefly, this innovative form of decision and informative support will help with procedures related to:

- *diagnosis* of CHF;
- clinical *standard management* and *prognosis* assessment of patients with CHF according to the most recent European Society of Cardiology (ESC) Guidelines (*European Heart Journal 2005; 26:1115-1140; European Heart Journal 2005; 26:384-416*);
- *research and development* in the medical and technical areas of knowledge overall pertaining to the CHF domain.

Procedures regarding *management* and *research* overlap: in fact, during the follow-up phase, while supporting the standard CHF management and prognosis assessment, the HEARTFAID Platform (HFP) will assist in collecting biomedical information for research and development purposes.

2.2 ENVIROMENTS *(rows).* With the current project we plan on developing a tool capable of collecting, integrating, and processing relevant biomedical data and information coming from the main settings actually encountered by patients with CHF.
These settings include:

- the *medical environment*, corresponding to HFP level of functioning 1 (i.e. office of the general practitioner), and HFP level 2 (i.e. specialized hospital, with cardiologists involved in outpatient and inpatient care, and with the possibility of running a variety of tests, such as blood tests, EKG, X-Rays, ultrasound imaging studies, etc);
- the *patient environment*, (i.e. patient's home) corresponding to HFP level 3;
- the medical and technological *research environment*, corresponding to HFP level 4.

A future development may be the HFP level 5, where data coming from a number of platforms (levels 1-4) might be integrated at the national or international level (i.e. randomized clinical trials, public health).

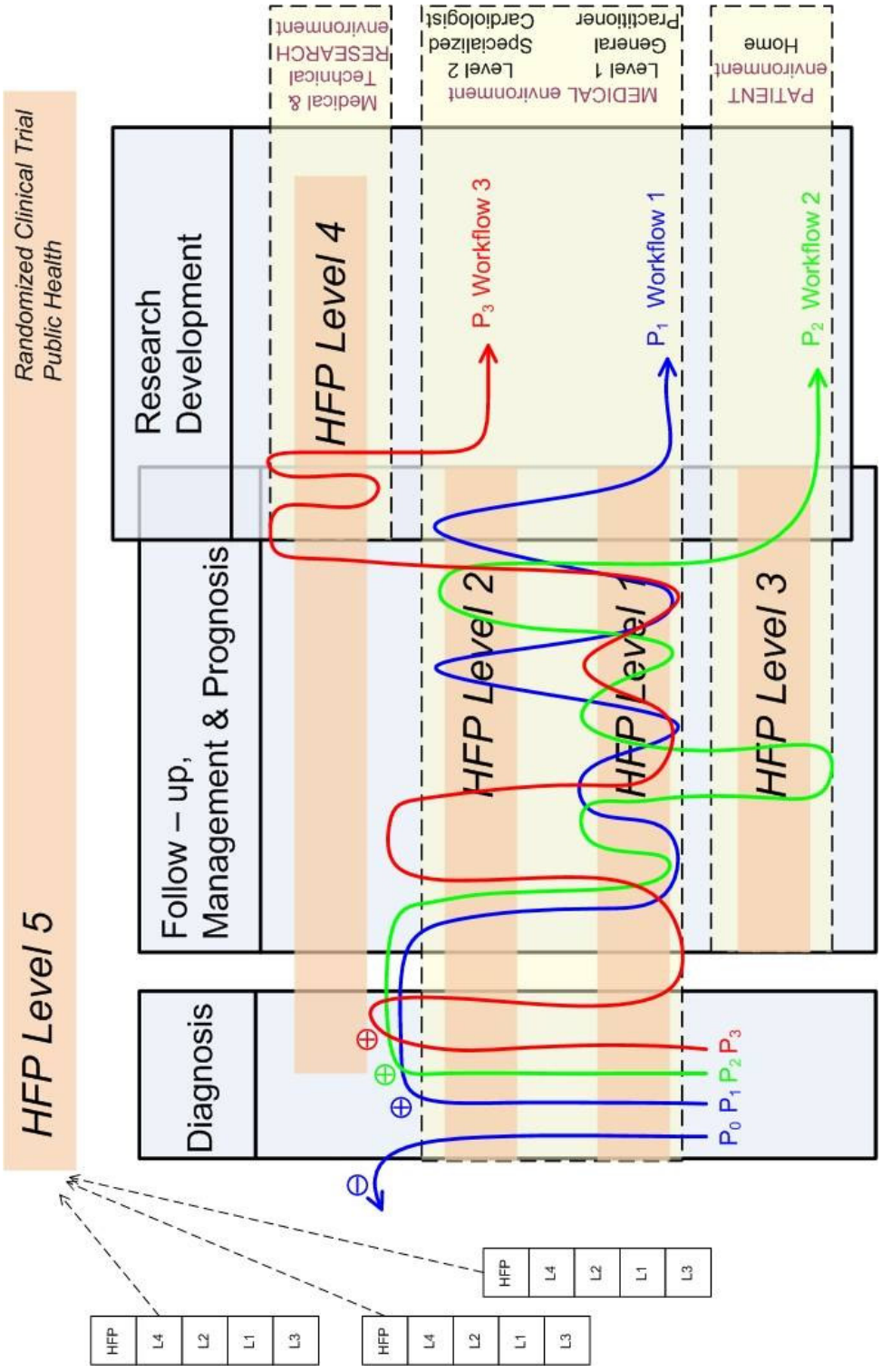

Figure – 1: Organization of the HEARTFAID technological platform (HFP). The basic levels of functioning of the HF platform are articulated in various workflows.

2.2.1 Workflow 1: medical environment.

In Fig 4. HFP level 1 and 2 and patients n. 0 and n. 1.

Processes of diagnosis, management, prognosis assessment with patients' data collected and medical recommendations provided both in the office of the family physician and in the specialized cardiology setting.

2.2.2. Workflow 2: medical environment and patient's home.

In Fig 4. HFP level 1, 2 and 3 and patient n. 2.

Processes of diagnosis, management, prognosis assessment, with patients' data collected and medical recommendations provided, as above, both in the office of the family physician and in the specialized cardiology setting.

Of notice, biomedical parameters, relevant symptoms and compliance to prescribed pharmacological and non pharmacological regimens will be monitored by HFP level 3 in patients' homes.

Serial measurements of selected biological parameters will be collected by the patients and by their relatives and will enter HFP level 3.

Furthermore, HFP level 3 will engage with the patients by providing informative material, reminders on medications' schedule, reminders on biomedical measurements.

2.2.3 Workflow 3: medical environment (HFP level 1 and 2) and research environment (either medical or technical) (HFP level 4).

Processes of diagnosis, management, prognosis assessment with patients' data collected (and medical recommendations provided) in the office of the family physician, in the specialized cardiology setting, and in the ultra specialized research setting.

As stated above, in workflow 3, while supporting the standard CHF management and prognosis assessment, the HFP will assist in collecting biomedical information for research and development purposes.

More sophisticated biomedical data entering the HF platform at this level may include, for example, continuous non invasive heart rate and beat-by-beat blood pressure measurement. The HFP might in future acquire data regarding innovative heart imaging studies, more thorough heart functional studies (as the cardiopulmonary test with breath-by-

breath assessment of O^2 consumption and CO^2 production, etc). This level will collect the largest variety of biomedical data.

Given the flexibility of the HFP, other Workflows are conceivable, for example for patients entering HFP levels from 1 to 4.

3. Specification of Biomedical Data, Signs, and Symptoms Relevant to Heart Failure.

Overall, such data, signs and symptoms can roughly be grouped as relevant to:

3.1 establishing the
- → the diagnosis of HF, the aetiology of HF,
- → best pharmacological and non-pharmacological treatment,
- → the best way to provide the appropriate treatment (various architectures of managed care, usual care plus home telemonitoring, etc).

3.2 managing the condition during the follow-up phase
- → evaluating the tolerability, effectiveness and compliance to treatment;
- → progression of the disease, morbidity, mortality;
- → assessing the prognosis of the disease;
- → assessing the costs of HF management.

3.3 acquiring new information concerning the condition → research contribution concerning all of the above aspects of the condition.

Of note, secondary to the main characteristics of this disease, the same biomedical data, signs and symptoms can serve to one or more of the above purposes.

Moreover, given the ongoing development of new diagnostic, treatment and prognostic strategies in the field of HF, the list contained in this document is not intended to be exhaustive.

In fact, from the first conceivement to the fully functioning version of the HEARTFAID platform other biomedical data will be added. This flexibility is seen, of course, an intrinsic and probably the most distinguishing characteristic features of the HEARTFAID platform itself.

To facilitate the identification of biomedical data, signs and symptoms relevant to various aspects of HF, in the following sections they will be listed with the italic character.

3.1 HEART FAILURE DIAGNOSIS

3.1.1 Definition: According to the ESC 2005 Guidelines on chronic HF (CHF), as there is NO ONE cut off value in ONE single test that can be used reliably to identify patients with heart failure.

According to the ESC guidelines, the diagnosis of HF relies on clinical judgment based on:

- ***symptoms*** (one or more, complained by the patient) **and/or** ***signs*** (one or more, detected by the physician during the physical examination) of HF (at rest and during exercise)

AND

- objective evidence coming by ***tests*** (preferably by echocardiography) of cardiac dysfunction (systolic and/or diastolic) at rest.

A ***response to treatment*** directed towards heart failure is not necessary although supportive of HF diagnosis. HF patients should show some improvement in symptoms and signs with treatment.

3.1.2 Sites of data collection for the diagnosis of HF. The diagnostic progress (hence the data collection/data entering needed for the diagnosis of HF) originates in the medical environment, virtually in all of the following settings:

- office of the general practitioner (GP),

- hospital
  - → office of the cardiologist
  - → office of another specialist
  - → emergency department
  - → any inpatient ward.

Of note, as the diagnostic process implies a combination of symptoms/signs of HF and of specialized tests, even if it can start out in the GP's office (symptoms/signs), it generally necessitates of tests performed in the specialized Cardiological environment.

3.1.3 Identification of the patient. Each patient, upon being entered in the platform, will be given a unique ID which will be associated with his/her last name, first name, date and place of birth, contact information, gender, age.

A new patient's record can be created and the identification data can be entered by all of the authorized users of the HEARTFAID platform who will remain responsible for the information and quality of the data entered.

3.1.4 Data collected by the physician. Regardless of the environment, after the patient will have signed the informed consent, the physician involved in the HF diagnostic process will collect data on:

a – the patient's consent to have his/her medical data subsequently searched to answer research questions, or to be searched as a case for future recruitment in clinical research studies;
b - the patient's medical history (either previous or ongoing medical problems);
c - the patient's symptoms;
d – the patient's physical examination;
e– the patient's list of medications and side effects;

3.1.5 Data entered by the physician or automatically entering the HEARTFAID platform

f – 12-lead ECG

g- Chest X-Ray

h – Echocardiography

i – Laboratory tests

l – 24-hour Holter electrocardiography

m – Exercise testing

n- Cardiopulmonary exercise test

o - 6 minute walking test

p – Questionnaires (i.e. Quality of life)

r – …. endless list

At the end of the baseline clinical and instrumental evaluation, based on the data collected, according to the ESC 2005 CHF guidelines, the physician will be able:

- formulate the diagnosis of HF,
- establish the aetiology (i.e. the cause) of this condition,
- prescribe the most appropriate non-pharmacological and pharmacological regimen,

- suggest the best workflow for the patient (follow-up visits at the GP's office + periodic visits/tests at the specialized hospital, follow-up visits at the GP's office + periodic visits/tests at the specialized hospital home telemonitoring).

a - the patient's consent to have his/her medical data subsequently searched to

answer research questions *Y/N*
or to be searched for future enrolment in clinical studies *Y/N*

b- medical history. Medical problems will be verbally reported or documented. They can be present (Y), not present (N), past (P).

b.1 Coronary artery disease (CAD) risk factors (RF)

- hypertension	*Y/N*	*if Y*	*date diagnosis: dd/mm/yyyy*
- high LDL cholesterol	*Y/N*	*if Y*	*date diagnosis: dd/mm/yyyy*
- low HDL cholesterol	*Y/N*	*if Y*	*date diagnosis: dd/mm/yyyy*
- high triglicerides	*Y/N*	*if Y*	*date diagnosis: dd/mm/yyyy*
- diabetes mellitus	*Y/N*	*if Y*	*type I vs type II date diagnosis*
- family history of CAD	*Y/N*		
- smoke	*Y/N/P*	*if Y*	*N cigarettes/day beginning date yyyy*
- overweight/ obesity	*Y/N/P*	*(according to selected definition)*	
- sedentary life	*Y/N/P*		

b.2 Other:

- physical activity	*…. Text*
- alcohol intake	*…. Text*
- dietary habits (salts, fats, etc)	*…. Text*

b.3 Either the verbally reported or the documented past or ongoing medical problems DIFFERENT FROM THE ABOVE LISTED ONES will be entered in the HEARTFAID platform as a list with the date of onset dd/mm/yyyy.

- ……. *date diagnosis: dd/mm/yyyy*
- ……. *date diagnosis: dd/mm/yyyy.*

The HEARTFAID platform will subsequently code them according to the coding system… (verify with the technical partners). Next to each diagnosis, some text can provide detailed information about it.

Optional: medical problems could be entered in separate sections corresponding to the main anatomical systems:

- *Cardiovascular and cerebrovascular …. Text*
- *Endocrine/metabolic …. Text*
- *Renal …. Text*
- *Hematological …. Text*
- *Respiratory …. Text*
- *Gastrontestinal …. Text*
- *Hepatic …. Text*
- *Psychiatric …. Text*
- *Neurological …. Text*
- *Dermatological …. Text*
- *Other …. Text*

Medical problems will be marked with a Y if active. In subsequent visits, active problems will appear as a list with the correspondent date of onset (dd/mm/yyyy). Such list of active medical problems may show up on top of the list containing medical problems no longer active, i.e. originally marked with a N.

In subsequent visits, newly diagnosed active problems with date of onset (dd/mm/yyyy) will be added to the list of the active problems; no longer active problems will be marked with a P (with date of ending dd/mm/yyyy) and will fall into the list of past medical problems.

Optional: the physician can request to sort the problems' list according to their active/past status, or according to the date of onset/end.

c- patient's symptoms.
The following symptoms (relevant to the diagnosis of HF) will appear as a list at any visit.

They will be marked with a:
- Y (if present at the time of consultation),
- N (if absent at the time of consultation and never experienced in the past),
- P (if absent at the time of consultation but experienced in the past).

c.1 Fatigue *Y/N/P*

c.2 Breathlessness *Y/N/P*

NYHA Class I → *No limitation: ordinary physical exercise does not cause undue fatigue, dyspnoea, or palpitations.*

NYHA Class II → *Slight limitation of physical activity: comfortable at rest but ordinary activity results in fatigue, palpitations or dyspnoea.*

NYHA Class III → *Marked limitation of physical activity: comfortable at rest but less than ordinary activity results in symptoms.*

NYHA Class IV → *Unable to carry out any physical activity without discomfort: symptoms of heart failure are present even at rest with increased discomfort with any physical activity*

c.3 Orthopnea

c.4 Nocturnal dyspnea

c.5 Recent (weeks/days) weight change, specify if increase/decrease

c.6 Peripheral oedema

c.7 → Other…

The above list can be completed with other symptoms complained by the patient (i.e. active) at the time of consultation

At any subsequent visit,
- a Y/N/P will be entered next to the symptoms relevant to HF always listed for the physician;
- a Y/N/P will be entered next to the additional symptoms;
- new active symptoms will be added to the active symptom's list

<u>d – physical examination</u>. Of note, fields in red will be used in subsequent visits to monitor progress.
Date: *dd/mm/yyyy*

ID operator performing it: *the same that signed in*
Location: *the same entered upon signing it*

Lying systolic/diastolic blood pressure SBP/DBP ..../.... mmHg
(numeric, first reading)
Lying systolic/diastolic blood pressure ..../.... mmHg
(numeric, second reading)

Lying heart rate *HR* *……* *beats/min*
(numeric, first reading)
Lying heart rate *……* *beats/min*
(numeric, second reading)

Sitting systolic/diastolic blood pressure SBP/DBP *…./….* *mmHg*
(numeric, first reading)
Sitting systolic/diastolic blood pressure *…./….* *mmHg*
(numeric, second reading)
Sitting heart rate *HR* *……* *beats/min*
(numeric, first reading)
Sitting heart rate *……* *beats/min*
(numeric, second reading)

Standing systolic/diastolic blood pressure SBP/DBP….…./….
(numeric, units: mmHg)
Standing systolic/diastolic blood pressure *…./….*
(numeric, units: mmHg)
Standing heart rate *HR* *……* *beats/min*
(numeric, first reading)
Standing heart rate *……* *beats/min*
(numeric, second reading)

Temperature *…….* *units?*
(numeric)
Respiratory rate *……* *respirations/min*
(numeric)
Arterial oxygen saturation *……. %*
(percentage)
Weight *…….* *Numeric, kg*
Height *…….* *Numeric, cm*
BSA (body surface area) *……..* *Numeric, m^2 (calculated by the platform)*
BMI (body mass index) *……..* *Numeric (calculated as weight/height^2)kg/ m^2*

General appearance *text*

Jugular veins *congestion* *Y/N* *if Y* *cm*
….

Carotids *bruit* *right* *Y/N*
left *Y/N*

Heart:
Rhythm *Regular* *Y/N*
S1 *Normal*
Abnormal

	Increased *Decreased*		
S2	*Normal* *Abnormal* *Increased* *Decreased*		
S3 present	*Y/N*		
S4 present	*Y/N*		
Systolic murmur	*Y/N*	*Intensity… (from 1 to 6/6)*	*site …. base* *apex* *other….* *(text)*
Diastolic murmur	*Y/N*	*Intensity… (from 1 to 6/6)*	*site …. base* *apex* *other….* *(text)*

Other: *…. text*

Lungs

Breath sounds:	*Normal* *Abnormal*	*site*	*…. text*
Crepitations	*Y/N*	*site … (text)*	
Effusion	*Y/N*	*site … (text)*	
Other	*…. (text)*		

Abdomen

Liver	*Pain* *Enlargement*	*Y/N* *Y/N*	*if Y ……(number) cm*
Other	*…..*		

Lower Extremities

Right	*Oedema*	*Y/N*	*if Y …. +,++,+++,++++*
Left	*Oedema*	*Y/N*	*if Y …. +,++,+++,++++*

Peripheral arterial/venous circulation *….. text*

Skin *….. text*

Head/Neck *….. text*

Bones/skeletal muscles ….. *text*

e – list of medications and side effects.

e.1 List of medications.

Drugs taken by the patient will be entered (generic/brand name) with the correspondent route of administration and dosage (one field per information).

Optional: fields about drugs could be searchable.

At subsequent visits the data:
drug name/ route of administration/ dose will appear again and each one of them can be modified.

If a drug has been discontinued, it will be marked with a P (past). Then, it would be important to specify if the drug has been discontinued because of a medical recommendation, a side effect, allergy, or no reason other than the patient's decision.

If a new drug has been started, the correspondent data on name/ route of administration/ dose will be added to the list.

e.2 List of side effects.

Drugs that have been thought to be responsible of any side effect will be entered with the correspondent route of administration, dose, and a brief description of the problems they induced.

If a medication of the c.1 list has been discontinued because of side effects will automatically fall in the c.2 list.

At subsequent visits the c.2 list will always show up.
This list can be updated at any visit with additional drugs and the correspondent route of administration, dose, symptom/signs prompted.

f – 12-lead ECG. Of note, fields in red may be used in subsequent visits to monitor progress.

Date dd/mm/yyyy *sinus rhythm Y/N*

Heart rate …. *beats/min*
PR interval …. *mm*
QRS duration …. *mm*

QT interval …. mm
Presence of abnormalities Y/N
Atrial flutter Y/N
Atrial fibrillation Y/N
Atrio-ventricular conduction abnormalities Y/N grade I A-V block Y/N
grade II A-V block type I Y/N
grade II A-V block type II Y/N
grade III A-V block Y/N

Intra-ventricular conduction abnormalities Y/N Left bundle branch block Y/N
Right bundle branch block Y/N

ECG signs of ischemia Y/N describe (text):
i.e. ST depression 3 mm in leads V3 – V6.
i.e. q wave in inferior leads

Left ventricular hypertrophy: Y/N (criteria: Sokolow-Lyon S1-S2 + R5-6).

g-Chest X-Ray. Of note, fields in red may be used in subsequent visits to monitor progress.

Date: dd/mm/yyyy

Normal Y/N
Cardiothoracic ratio ….. (numeric)
Pulmonary circulation congestion Y/N describe (text) …
Pulmonary oedema Y/N describe (text)….
Effusion Y/N describe (text) ….
Other ….. text

h – Echocardiography. *Of note, fields in red may be used in subsequent visits to monitor progress.*

Date: dd/mm/yyyy
Quality

Left ventricle

end-diastolic diameter ….. (numeric) mm

end-systolic diameter ….. *(numeric) mm*

interventricular septum diastolic thickness ….. *(numeric) mm*

posterior wall diastolic thickness ….. *(numeric) mm*

end-diastolic volume ….. *(numeric) ml*

end-systolic volume ….. *(numeric) ml*

ejection fraction ….. *(numeric) %*

Method : Simpson's 2D

4D

Right ventricle

end-diastolic diameter ….. *(numeric) mm*

TAPSE ….. *(numeric) mm*

Left atrium

Anteroposterior diameter ….. *(numeric) mm*

Aorta

Root diameter ….. *(numeric) mm*

Ascending aorta diameter ….. *(numeric) mm*

Aortic Valve

Aortic regurgitation *Y/N* *grade:* +,++,+++,++++

Aortic stenosis *Y/N* *gradient mean….. (numeric) mmHg*

gradient peak ….. (numeric) mmHg

Mitral valve

E max ….. *(numeric) m/s*

A max ….. *(numeric) m/s*

E/A ratio ….. *(numeric)*

Deceleration time ….. *(numeric) m/s*

Mitral regurgitation *Y/N* *grade:* +,++,+++,++++

Mitral stenosis	*Y/N*	*gradient mean…..*
(numeric) mmHg		
		gradient peak …..
(numeric) mmHg		
Diastolic dysfunction	*Y/N*	
(EROA, Doppler shift)	……	

Tricuspid valve

Tricuspid regurgitation	*Y/N*	*grade:*
		+,++,+++,++++
Pulmonary artery pressure	*….. (numeric) mmHg*	

Contractility	*Normal*
	Hypokinesis
	Akinesis
	Dyskinesis
Other	*…. text*

i – Laboratory tests. Of note, fields in red may be used in subsequent visits to monitor progress.

Date: *dd/mm/yyyy*

i.1 Blood

Glucose	*numeric*	*mg/dl*
Urea	*numeric*	*mg/dl*
Creatinine	*numeric*	*mg/dl*
Sodium	*numeric*	*mEq/L*
Potassium	*numeric*	*mEq/L*
Chloride	*numeric*	*mEq/L*
AST (SGOT)	*numeric*	*UI/ml*
ALT (SGPT)	*numeric*	*UI/ml*
Hemoglobin	*numeric*	*g/dl*
Hematocrit	*numeric*	*%*
Red blood cells	*numeric*	*N * 10 ^{9}/L*
White blood cells	*numeric*	*N * 10 ^{9}/L*
Platelets	*numeric*	*N * 10 ^{9}/L*
Total cholesterol	*numeric*	*mg/dl mmol/L*

HDL cholesterol	*numeric*	*mg/dl*	*mmol/L*
LDL cholesterol	*numeric*	*mg/dl*	*mmol/L*
Triglicerides	*numeric*	*mg/dl*	*mmol/L*
TSH	*numeric*	*mUI/ml*	
FT3	*numeric*	*pg/ml*	
FT4	*numeric*	*ng/dl*	
proBNP	*numeric*		
TNF	*numeric*		
Glycated Hemoglobin	*numeric*	*%*	
Creatinine clearance	*numeric*	*ml/min*	
Other:	….		

i.2 Urine

Date:	*dd/mm/yyyy*	
glucose	*Y/N*	
glucose	*numeric*	*mg/dl*
proteins	*Y/N*	
proteins	*numeric*	*mg/dl*
blood	*Y/N*	
blood	+,++,+++	
Ketons	*Y/N*	
Ketons	…. *Numeric*	*mg/dl*

l – 24-hour Holter electrocardiography. Of note, fields in red may be used in subsequent visits to monitor progress.

Date:	*dd/mm/yyyy*		
Sinus rhythm	*Y/N*	*if N*	*specify …. (text)*
24 heart rate:	*mean*		*…. numeric beats/min*
	minimum		*…. numeric beats/min*
	maximum		*…. numeric beats/min*
daytime heart rate:	*mean*		*…. numeric beats/min*
	minimum		*…. numeric beats/min*
	maximum		*…. numeric beats/min*

night- time heart rate: mean …. numeric beats/min

minimum …. numeric beats/min

maximum …. numeric beats/min

Maximum R-R …. numeric seconds

Isolated Ventricular ectopic beats …. numeric N/24 h

Ventricular couples …. numeric N/24 h

3 or more Ventricular ectopic beats …. numeric N/24 h maximum N ….. numeric

Maximum heart rate … numeric Beats/min

Isolated Supraventricular ectopic beats …. numeric N/24 h

Supraventricular couples …. numeric N/24 h

3 or more supraventricular ectopic beats …. numeric N/24 h maximum N ….. numeric

Maximum heart rate … numeric Beats/min

Other arrhythmias …. Text

Atrio-ventricular conduction abnormalities Y/N grade I A-V block Y/N

grade II A-V block type I Y/N

grade II A-V block type II Y/N

grade III A-V block Y/N

Intra-ventricular conduction abnormalities Y/N Left bundle branch block Y/N

Right bundle branch block Y/N

Signs of ischemia Y/N describe (text):

Heart rate variability:

SDNN	*ms*
SDANN	*ms*
rMSSD	*ms*
pNN50	*%*

Total power	….
HF	….
LF	….
VLF	….

m – Exercise test. Of note, fields in red may be used in subsequent visits to monitor progress.

Date: *dd/mm/yyyy*

Basal heart rate …. *numeric beats/min*
Maximum predicted heart rate *220-age in years…. numeric beats/min*

Maximum heart rate …. *numeric beats/min*
% of predicted heart rate …. *numeric %*

Basal systolic/diastolic blood pressure …./….. *numeric mmHg*
Maximum systolic/diastolic blood pressure …./….. *numeric mmHg*

Protocol

Maximum load *numeric …. Watts*
……. *METS*
Total minutes of exercise *numeric …. min*

Abnormalities in baseline ECG *Y/N describe …. text*

Criteria for test interruption ….. *text*

Test was positive for ischemia *Y/N describe ---- text*

Other abnormalities ….. *text*

n- Cardiopulmonary exercise test. Of note, fields in red may be used in subsequent visits to monitor progress.

Date: *dd/mm/yyyy*

Basal heart rate …. *numeric beats/min*
Maximum predicted heart rate *220-age in years….numeric beats/min*

Maximum heart rate …. *numeric beats/min*
% of predicted heart rate …. *numeric %*

Basal systolic/diastolic blood pressure …./….. *numeric mmHg*
Maximum systolic/diastolic blood pressure …./….. *numeric mmHg*

Protocol

Maximum load	*numeric …. Watts*
	numeric …. METS
Total minutes of exercise	*numeric …. min*
Abnormalities in baseline ECG	*Y/N describe …. text*
Criteria for test interruption	*….. text*
Test was positive for ischemia	*Y/N describe ---- text*
Other abnormalities	*….. text*

Peak VO2/Kg (peak oxygen uptake/Kg)	*…. numeric ml/Kg/min*
Peak VCO2/Kg	*…. numeric ml/Kg/min*
VO2 AT (oxygen uptake at the anaerobic threshold)	*…. numeric ml/Kg/min*
Basal RQ (respiratory quotient)	*…. numeric*
O2 pulse (ml O2/beat)	*… numeric ml/beat*
Basal saturation SO2	*…. %*
Peak SO2	*…. %*
Ve/VCO2	
Ve/VCO2 (ventilation/VCO2)	*…. numeric*

o. <u>Six-minute walking test</u>

Date……

	Baseline	End
BP (mmHg)	……	……..
HR (bpm)	……	……..
SpO_2 (%)	……	……..

walking distance (m) ……..

<u>p. Questionnaires-Quality of life</u>

Date……

- Minnesota Living with Heart Failure
  - *total score* ……
- SF-36 score
  - *physical functioning* ……
  - *role-physical* ……
  - *bodily pain* ……
  - *general health* ……
  - *physical component summary* ……
  - *vitality* ……
  - *social functioning* ……
  - *role-emotional* ……
  - *mental health* ……
  - *mental component summary* ……

3.1.6 Outcomes of the diagnostic evaluation

Of note, fields in red may be used in subsequent visits to monitor progress.

a - Diagnosis of heart failure *Y/N* *type* *Systolic*
Diastolic
Systolic + diastolic

b - Heart failure aetiology

(ESC guidelines, European Heart Journal 2005; 26:384-416).

(1) Decompensation of pre-existing chronic heart failure (e.g. cardiomyopathy)

(2) Chronic coronary artery disease and/or Acute coronary syndromes
(a) myocardial infarction/unstable angina with large extent of ischaemia and ischaemic dysfunction
(b) mechanical complication of acute myocardial infarction
(c) right ventricular infarction

(3) Hypertension and/or Hypertensive crisis

(4) Acute tachiarrhythmia (ventricular tachycardia, ventricular fibrillation, atrial fibrillation or flutter, other supraventricular tachycardia) or Bradycardia.

(5) Appearance or worsening of mitral or tricuspid regurgitation (endocarditis, rupture of chordae tendinae, worsening of pre-existing regurgitation)

(6) Severe aortic valve stenosis

(7) Acute severe myocarditis

(8) Cardiac tamponade

(9) Aortic dissection

(10) Post-partum cardiomyopathy

(11) Non-cardiovascular precipitating factors
(a) lack of compliance with medical treatment
(b) volume overload (salt, liquid) or excessive preload reduction (e.g. diuretics + ACE-inhibitors/nitrates).
(c) infections, particularly pneumonia or septicaemia
(d) severe brain insult
(e) after major surgery
(f) reduction in renal function
(g) asthma
(h) drug abuse
(i) alcohol abuse
(j) phaeochromocytoma

(12) High output syndromes
(a) septicaemia
(b) thyrotoxicosis crisis
(c) anaemia
(d) shunt

c - Heart failure treatment recommendations (according to the ESC 2005 CHF guidelines)

Systolic left ventricular dysfunction.

→ general advice and non-pharmacological therapy
→ pharmacological therapy

→ mechanical devices
→ surgery

with the aims of:

. preventing or controlling diseases (mostly hypertension and coronary artery disease) leading to HF,
. preventing progression of HF,
. decreasing morbidity
  * by improving quality of life
  * by reducing hospital admissions (secondary to acute decompensations of CHF, see below)
. decrease mortality (i.e. prolong life).

→ General advice and non-pharmacological measures: all of the patients.
→ Pharmacological therapy: choice and timing is based on symptoms severity (assessed by NYHA class in subjects with impaired systolic left ventricular function, i.e. with ejection fraction ≤ 40%).

The ESC algorithm suggests decision-making steps, although individual adjustments must be taken into account.

	For Survival/Morbidity	For Symptoms
NYHA I	ACE-I (ARB if ACE-I intolerant) aldosterone-antagonist if post-MI add beta blocker if post-MI ↑	Reduce/stop diuretic ↑
NYHA II	↑ ACE-I as first line (ARB if ACE-I intolerant) and titrate to target dose add beta blocker and titrate to target dose add aldosterone antagonist if post-MI ↓	↑ +/- diuretic (with ACE-I) depending on fluid retention + digitalis if atrial fibrillation
NYHA III	↓ ACE-I plus ARB (or ARB alone if ACE intolerant) beta blocker add aldosterone antagonist ↓	+ combination of loop and thiazide diuretics + digitalis if still symptomatic
NYHA IV	↓ Continue ACE-I/ARB beta-blocker aldosterone antagonist	+ combination of loop and thiazide diuretics + digitalis + consider temporary inotropic support

→ Rules and suggested actions for mechanical devices and surgery are beyond the scope of this document, but will be included in the actual HFP.

Diastolic left ventricular dysfunction. Rules and suggested actions for
→general advice and non-pharmacological therapy
→ pharmacological therapy
→ mechanical devices
→ surgery
when available, are beyond the scope of this document, but will be included in the actual HFP.

The final steps of the initial diagnostic evaluation will include:

The list of recommended medications
this list will contain
- the drugs/route/dose the patient is already on for other conditions
- the drugs/route/dose the patient is newly recommended because of the diagnosis of heart failure.

The list of the non-pharmacological recommendations:
- education of patient and his family
- stop smoking
- increase aerobic exercise (within or without a cardiac rehabilitation program)
- dietary control (amount of salt, fluid intake control, decrease the amount of alcohol/day)
- weight reduction in obese patients
- etc…

The best workflow for each individual patient at that time.

3.2 HEART FAILURE MANAGEMENT DURING THE FOLLOW-UP.

During the follow-up phase, authorized HEARTFAID platform users (the GP, the specialized cardiologist, the nurse, the patient himself/herself, the patient's relatives, etc depending on the workflow) will be able to update or enter selected sets of data.

3.2.1 Data relevant to workflow 1, 2 or 3: when the patient will be seen in any of the medical offices, the following items, besides contact information, will be updated:

a - willingness of the patient to have his/her medical data subsequently searched to answer research questions, or to be searched as a case for future recruitment in clinical research studies. See 3.1.

The Y/N answer given at enrolment show up again and it will be possible to update it at any visit.

b - medical history. See 3.1.

Of note, the date of first diagnosis of HF, type of HF (systolic and/or diastolic), and the cause of it will appear on top of the active medical problems list at any follow up visit.

A patient can enter the HEARTFAID program with an existing diagnosis of HF (established elsewhere). If the physician agrees with it, he/she will enter the program as the diagnosis has not been made yet. This is meant to provide the knowledge discovery functionality of the HEARTFAID platform with as many cases as possible in order to maximally sharpen the independent diagnostic ability of the platform itself.

c – symptoms. See 3.1

At any visit,

- a Y/N will be entered next to the symptoms relevant to HF(always listed);
- a Y/P will be entered next to the additional symptoms if, respectively, they will still be present, or they will no longer be present;
- new active symptoms will be added to the active symptom's list.

d – physical examination. See 3.1.

Starting from *general appearance, all of the information entered in the initial visit, will show up in the following visit and will be updated if changed.*

e – list of medications and side effects. See 3.1.

As stated, at any visit, each drug name/ route of administration/ dose will appear again and each one of them can be modified. If a drug has been discontinued, it will be marked with a P (past). Then, it would be important to specify if the drug has been discontinued because of a medical recommendation, a side effect, allergy, no reason other than the patient's decision.

If a new drug has been started, the correspondent data on name/ route of administration/ dose will be added to the list.

All of the previous data will be measured and entered at each visit.

Additionally, new test results will either be entered in the HEARTFAID platform by any of the authorized users or will enter the data base of the platform automatically.

f – 12-lead ECG See 3.1.
g- Chest X-Ray. See 3.1.
h – Echocardiography. See 3.1.
i – Laboratory tests. See 3.1.
l – 24-hour Holter electrocardiography. See 3.1.
m – Exercise testing. See 3.1.
n- Cardiopulmonary exercise test. See 3.1.
o - 6 minute walking test
p – questionnaires (i.e. Quality of life)
r – other

Also, a list of so called "events" relevant in cardiovascular medicine will be completed: this list will include:

- hospitalizations for cardiovascular reasons
  Y/N,
  From date dd/mm/yyyy to date dd/mm/yyyy
  Cause ….. text

- hospitalizations for reasons different from cardiovascular
  Y/N,
  From date dd/mm/yyyy to date dd/mm/yyyy
  Cause ….. text

- non fatal acute myocardial infarction Y/N,
  Date dd/mm/yyyy
  Procedures ….

- non fatal stroke *Y/N,*
  Date dd/mm/yyyy

reported by relatives:

- fatal event Y/N,
  Date dd/mm/yyyy
  Cause …. Text

- fatal acute myocardial infarction Y/N,
  Date dd/mm/yyyy
  Procedures ….

- fatal stroke *Y/N,*
  Date dd/mm/yyyy

At the end of any update the patient's progress will be monitored based on *NYHA class + signs/symptoms* (with/without echocardiogram results/other tests) and defined as:

Stable → same NYHA class, same signs/symptoms.
Improving → lower NYHA class, fewer/lighter signs/symptoms
Rapidly worsening → A RAPID (hours, few days) onset or worsening of symptoms and signs secondary to abnormal cardiac function DEFINES, according to the ESC guidelines on the diagnosis and treatment of acute heart failure *(European Heart Journal 2005; 26:384-416)* the ACUTE decompensation of CHF.
Slowly worsening → worsening of symptoms and signs secondary to abnormal cardiac function occurring over several days or months.

Subjects with acutely decompensated CHF usually need hospital admission.

3.2.2 Data relevant to Workflow 2: some signs/symptoms will be entered in the database by the patient or by his/her relatives. *Of note, fields in red may be used in subsequent visits to monitor progress.*

Date
Lying systolic/diastolic blood pressure SBP/DBP *…./….* *mmHg*
(numeric, first reading)
Lying systolic/diastolic blood pressure *…./….* *mmHg*
(numeric, second reading)
Lying heart rate *HR* *……* *beats/min*
(numeric, first reading)
Lying heart rate *……* *beats/min*
(numeric, second reading)

Sitting systolic/diastolic blood pressure SBP/DBP *…./….* *mmHg*
(numeric, first reading)
Sitting systolic/diastolic blood pressure *…./….* *mmHg*
(numeric, second reading)
Sitting heart rate *HR* *……* *beats/min*
(numeric, first reading)
Sitting heart rate *……* *beats/min*
(numeric, second reading)

Standing systolic/diastolic blood pressure SBP/DBP….…./….
(numeric, units: mmHg)
Standing systolic/diastolic blood pressure *…./….*
(numeric, units: mmHg)
Standing heart rate *HR* *……* *beats/min*
(numeric, first reading)
Standing heart rate *……* *beats/min*
(numeric, second reading)

Temperature *…….* *units?*
(numeric)

Respiratory rate (numeric) ..... *breaths/min*

Arterial oxygen saturation (percentage) ..... *%*

Weight ..... *Numeric, kg*

Urine output .... *Numeric, L/24 h*

% body water (by bioimpedance) (percentage) ..... *%*

Additionally, patients in Workflow 3 will potentially be reminded to take any dose of any prescribed medication and will potentially submit to the HEARTFAID platform a confirmation any time this has happened.

3.2.3 Prognosis assessment

Virtually all of the data (particularly those marked in red) collected in 3.1 and 3.2 during both the diagnostic phase and the follow-up, in the home and medical environment (GP's office and specialized setting) can be used individually or grouped for prognostic assessment.

3.3 RESEARCH AND DEVELOPMENT.

Virtually all of the data collected in 3.1 and 3.2 during both the diagnostic phase and the follow-up, in the home and medical environment (GP's office and specialized setting) can be used for research purposes.

Additionally, a number of other data can be collected specifically for research purposes (at the moment) in a dedicated environment (see Workflow 4). Some of these data seem particularly suitable for prognostic determination.

Parameters of cardiac autonomic modulation -(*all numeric):*
SBPmedia (m), DBPm, MAPm, pulse interval (PI)m, HRm
- blood pressure variability: *SBPstandard deviation (sd), DBPsd, MAPsd, VLFsbp, LFsbp, HFsbp, VLFdbp, LFdbp, HFdbp, VLFmap, LFmap, HFmap*
- heart rate variability: *PIsd, HRsd, VLFpi, LFpi, HFpi*
- baroreflex function: *alpha coefficient (AlfaLF, AlfaHF), transfer function (H-LF, H-HF), sequence technique: slope Seq++, slope Seq--, baroreflex effectiveness index (BEI).*

4. Conclusions

In conclusion, the deliverable number nine D9 ''*Specification of all biomedical data, signs, and symptoms relevant to heart failure''*

prepared by VMWS, JUMC, UNIMIB, AUXOL, UNICAL and UNICZ is collecting the results of task T2.1 in Workpackage 2.

It was intended to give a general overview of the most relevant biomedical signs, symptoms and data in the heart failure domain with specification of the environments in which they could be collected. Deliverable D9, based on the most recent ESC 2005 CHF guidelines, in line with the HEARTFAID deliverable D5 and medical partners' clinical experience in heart failure domain, describes the biomedical data, signs and symptoms grouped in a logical fashion. They are listed according to their relevance to the diagnosis, management and research in the field of HF. As HF is a particularly complex pathology, the prepared list is not exhaustive. The mentioned flexibility of the HEARTFAID platform will allow, however, the addition of new parameters.

The deliverable D9, will give input to task T2.2 and especially the sub-task T2.2.2 which deals with the sensors that will be used in order to acquire the biomedical data.