

TRIME

Multi-stage monitoring triage at home for Cardiovascular Diseases (CVDs)

Challenger

The **General Hospital of Pyrgos ANDREAS PAPANDREOU** was initially founded in 1886, and was fully rebuilt in 2004. The Hospital is located in the area of Syntriada, two kilometers outside the town of Pyrgos. extends over a plot of 80,000 m², has a capacity of 280 beds.

The Hospital has 14 fully equipped operating theatres, a 25-bed Artificial Kidney Unit, a 9-bed Intensive Care Unit and a fully equipped X-Ray Diagnostic Department with CT Scanner servicing more 150000 citizens. The last years although the hospital is the main healthcare unit of the capital city Pyrgos and all surrounding towns, still faces continuous staff shortages leading to low care services delivery. Several departments remain to be low staffed, struggling to cope with the needs of the patients and all visitors seeking care attendance in the hospital. New contracts with external healthcare professionals provide short-term solutions. Facing this challenge, a more radical solution is suggested through shifting some care services at home, prior to visiting the hospital or especially supporting the outpatient monitoring at home, decreasing, in that way, the readmissions.

Challenge description

Remote home monitoring (RHM) models have been established to: 1) avoid unnecessary hospital admissions (appropriate care at the appropriate place), and 2) to efficiently monitor patients at home who either face chronic conditions (cardiovascular have the greatest prevalence and mortality rates) or had recently treatment / operation and have more critical monitoring needs.

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RHM of patients in rural communities is a rapidly developing modality to monitor rural patients. In cases of metropolitan hospitals like General Hospital of Pyrgos the need of remote triage can be most efficient in terms of resources utilization but also lifesaving in emergency cases with high severity.

More than 15% of patients that visit Emergency Rooms (ER) in the associated hospital, do not necessarily, require hospital level care, and can receive basic care at home. The limited resources of hospitals are continuously under challenge, due to insufficient healthcare facilities in neighbouring areas, and the rural geographical environment of the Prefecture of Ileias in the Western Greece, that needs to serve more than 150.000 inhabitants as targeted population.

Having an early needs analysis, during the early stage of this program, we concluded that >20 patients daily could avoid visiting the hospital, while > 1 out of 4 CVD patients that need regular monitoring could significantly improve their health condition and avoid high mortality rates

after post operations or severe incidents through remote monitoring and telecare @home. The Health-related Quality of Life (HRQoL)¹ scale will be used for the needs of the evaluation of the implemented solutions.

Targeted population

The proposed solution should facilitate healthcare professionals of the challenger organization to remotely monitor patients prior to admissions in the hospital (first-stage triage) and outpatients, once they have left from the hospital and need care services as part of a monitoring plan. The focus is especially on CVD patients (both diagnosed or people at risk of experiencing CVD) irrelevant of age or gender. CVD cases are the most common cases reported in the hospital and occupy most resources. Although, age is not an exclusive factor, most patients experiencing CVD are aged > 55 years old, hence all considerations regarding user-friendliness should be regarded.

Challenge main objectives

The main objective of this program is to develop a digital solution for the multi-stage monitoring triage at home for cardiovascular (CVD) patients, reducing hospital visits / re-admissions and improving citizens quality of life.

The solution is anticipated to facilitate healthcare professionals with tools to consult patients in need, remotely, and provide diagnosis and care where needed, based on real measurements reported on web systems. In fact, real measurements and relevant data should be collected by reliable equipment and transferred, in-real time, and be presented on a web system, that supports also the teleconsultation services.

Solution functional requirements

Compulsory functional requirements

The solution shall:

- Enable remote monitoring of patients experiencing basic post-operative or chronic conditions (e.g. atrial fibrillation) and need healthcare support at home.
- Enable direct communication between patients and the care professionals of the Hospital, through safe and encrypted communication protocols over proprietary servers and not commercial third-parties.
- Implement data access and analytics tools to collect, store, analyze, and visualize patient data generated during remote consultations and monitoring. This may include dashboards, reporting tools, and analytics software to track patient outcomes, identify trends, and make data-driven decisions to optimize the telecare program's effectiveness.
- Record and transfer in real-time ECG measurements and related biomarkers,
- Utilise telemetry systems for providing real measurements based on medical-grade equipment.
- Implement robust data security measures to protect patient confidentiality and comply with healthcare regulations. This includes encryption of data in transit and at

¹ Yin S, Njai R, Barker L, Siegel PZ, Liao Y. Summarizing health-related quality of life (HRQOL): development and testing of a one-factor model. *Popul Health Metr.* 2016 Jul 11;14:22. doi: 10.1186/s12963-016-0091-3. PMID: 27408606; PMCID: PMC4940947.

rest, access controls, authentication mechanisms, regular security audits, and compliance with relevant data protection standards.

- Include data aggregators for collecting and transmitting data in real-time.
- Include in the measurements all basic vital signs, plus ECG and stethoscope measurements for accurate diagnosis of CVD cases.
- Ensure robust non-centralized medical telecommunication infrastructure is in place to support video conferencing, telemonitoring, and other telehealth services (only military-grade and appropriate for protecting sensitive personal health data are allowed to be used).
- Provide basic medical records for all collected data to be stored and be shared.
- Enable all users to login from a web system consisted of the teleconsultation subsystem, and the telemetry subsystem, (Compulsory)
 - create different roles per user.
 - use strong encrypted user authentication protocols.
- Comply with all ethical, legal, regulatory, technological and data access requirements as described in sections 1.8.1, 1.8.2, 1.8.3.

Desirable functional requirements

The solution could:

- Support real-time threshold-based personalized services for providing classification of specific health conditions like CVD.
- Support personalised medical records and plans.
- Support both citizens with chronic needs and more emergency cases where they require prompt care delivery (more frequent condition for high volume admissions in hospitals e.g. sudden heart pain).
- Include Notifications system, for emergency alerts.
- Consider inclusivity both for seniors and younger patients, ensuring that the proposed system is user-friendly even for the least ICT experienced users and all diagnostic equipment is wireless for advanced ease-of-use.
- Analyse the impact of remote home monitoring models against care delivery in hospitals and other traditional healthcare settings.

Pilot scope

Type and number of targeted end-users

End-user type	Role	Number
Healthcare professionals	<i>They have to provide requirements, recruit patients, use and validate the solution</i>	4
End-Users	They will make use of the telemedicine solution and the diagnosing equipment remotely.	>30

Language

All communication, surveys, solution implementation, forms and reporting from the side of healthcare professionals and end users will be in Greek. The system / solution will also need to be in Greek.

Other aspects

- All diagnosing equipment needs to be medical-grade, and CE certified.
- For the needs of the pilot stage, the solution provider should use at least three sets of devices that can be used by the healthcare professionals and their patients. Each set should include at least a data aggregator, a screen for supporting the teleconsultations, a body temperature thermometer, a blood pressure monitor, a stethoscope, an ECG, and a glucose meter. The hospital can provide their available equipment to the awarded company. If such equipment happens to be invalid for the purposes of the pilot, the awarded SME must commit to provide the appropriate devices for the pilot, which will be returned to the company immediately after.
- Measurements should be in real-time (store-and-forward approaches are out of the scope of the present project).

Pilot set up conditions

The pilot implementation is expected to last approximately 4-6 months, adequate time to identify opportunities, identify missing requirements that have not been identified, give the time to citizens and professionals to meet these new solutions (awareness stage) and an early training to professionals.

The monitored patients at home should reach >8-14 patients monthly. A trained nurse will assist in delivering care once each case has been diagnosed with telemetry nodes.

Exact performance indexes will be defined during the first two months of the project, so these can keep track of the progress and performance of the delivered services.

Ethical, legal or regulatory

- Ensure that the telecare program complies with General Data Protection Regulation (GDPR) or relevant privacy laws in Greece. Patients' personal health information must be securely handled and only accessed by authorized personnel.
- Obtain informed consent from patients participating in the pilot program. Patients should be fully informed about the nature of the telecare services, how their data will be used, and any potential risks or benefits.
- Ensure that healthcare professionals of General hospital of Pyrgos, providing telecare services are properly licensed and credentialed in accordance with state or national regulations. This may include physicians, nurses, therapists, and other healthcare providers.
- Develop clear protocols for handling emergencies and urgent situations during telecare consultations. Ensure that patients have access to local emergency services and that healthcare providers can quickly escalate care if needed.
- Ensure compliance with regulatory requirements and guidelines governing telehealth services, data privacy, security, and healthcare practice standards.

Technological

The solution shall:

- Be hosted on servers physically located within the geographic region of the pilot.
- Implement secure technology platforms and encryption protocols to protect patient data during telecare consultations. Regularly assess and update cybersecurity measures to mitigate the risk of data breaches or cyberattacks.
- Implement mechanisms for evaluating the effectiveness and outcomes of the telecare pilot program. Monitor patient satisfaction, clinical outcomes, and adherence to ethical and regulatory standards to inform future implementation and expansion efforts.
- The solution should be fully functional as web standalone SaaS.

Data access

- No prior data is expected to be available, meaning all users will start as new users in the system.

Expected impact and KPIs

The selected solution is expected to:

- Provide patients with home-based monitoring, clinical care, and support, hence reducing unnecessary transfers > 15%,
- Off-load burden from primary care practices. Reduction in the number of physical visits of patients to the hospital by 15%.
- Facilitate and increase the number of remote examinations by >10% for a more frequent and accurate monitoring and diagnosis.
- Increase in the quality of life of remote patients, using the Health-related Quality of Life (HRQoL) scale, during the total intervention period.
- Decrease the cost of healthcare for patients > 15%.

Business opportunity

Market size

- This project could be replicable, beyond the challenger hospital to 3 more hospitals (public and private) in the Region of Western Greece, as the needs are similar changing in volume. University Hospital of Rio accommodates > 1000 admissions per shift, servicing a broad population of > 300K citizens.
- At the national level there are >10 hospitals with expressed similar needs that could further employ the triage system prior to admissions and in conjunction with the remote monitoring to reduce both unneeded admissions but also monitor outpatients remotely. It is expected that for a medium-scale hospital up to 40-50 patients could be monitored remotely. The monitored conditions can be extended beyond CVD to several other cases, using the suggested technologies.

Adoption Plans

In Doctorshello, we consider the remote monitoring of chronic patients a high priority service that needs to be supported by suitable technologies/trained staff. Upon successful completion and pilot implementation of the selected solution in the Challenger hospital, we aim to assist

and scale up the solution and explore new opportunities for collaborations and market adoption.