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Stent for Life - A Value Based Initiative

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Doctor of Business Administration

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Research Unit - Instituto Universitário de Lisboa

Doctor Maria Luísa Mendes Teixeira, Professor, Mackenzie Presbyterian University,
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BUSINESS
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*I dedicate this work to my wife Ângela and my daughters Carolina and Maria,
Companions of all hours, thank you for being who you are.*

*I could not forget my mother Inês, and also other three significant persons who
are not able to see the final result of this work, and I know they would be very
proud. My father Ângelo, my mother-in-law Rosa and my uncle António*

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Resumo

A Iniciativa *Stent for Life* (SFL) criada em 2008, teve por missão a redução da mortalidade por enfarte com elevação do segmento ST (STEMI) na Europa através do aumento de realização de angioplastia primária (PPCI). Em 2016 a iniciativa passou a envolver outras regiões do globo e passou a denominar-se *Stent Save a Life*. Portugal integrou a SFL em 2011 também com o intuito de melhorar a performance em PPCI. De modo a analisar o percurso da SFL em Portugal e se os seus resultados acrescentaram valor, propusemo-nos comparar indicadores de qualidade ao longo dos anos da sua vigência e se foram afetados pela pandemia Covid-19. Realizaram-se três ensaios, o primeiro analisou os indicadores de performance e demonstrou que a população ficou mais atenta aos sinais de enfarte evidenciado pelo aumento de chamadas para o 112 e menor recorrência a instituições sem PPCI. No entanto o atraso do doente e do sistema não diminuíram, tendo até aumentado particularmente durante a pandemia. O segundo ensaio centrou-se no impacto económico que o SFL teve nos primeiros anos de avaliação, demonstrando poupança principalmente devido à diminuição da mortalidade e morbilidade contribuíram para a diminuição de custos indiretos. O terceiro veio introduzir o conceito de dignidade organizacional através da forma como os profissionais de saúde avaliaram positivamente o impacto do SFL. Procedeu-se à validação de uma escala de dignidade organizacional para instituições de saúde. Conclui-se que o SFL é uma iniciativa baseada em valor cujo exemplo pode ser aplicado a outras áreas da saúde.

Palavras Chave: Stent for Life, Enfarte agudo do miocárdio, saúde baseada em valor; Covid-19; Impacto Económico; Dignidade Organizacional

Abstract

Stent for Life Initiative (SFL), created in 2008, had as mission to reduce ST-segment elevation myocardial infarction (STEMI) mortality in Europe by increasing the access to primary angioplasty (PPCI). In 2016, this initiative became global and was extended to other regions of the world and was renamed Stent Save a Life. Portugal joined the SFL in 2011 also with the aim of improving performance in PPCI. In order to analyse the course of the SFL in Portugal and whether its results added value, we propose to compare quality indicators over the years of its existence and whether they were affected by the Covid-19 pandemic. We carried out three studies, the first analysed the performance indicators and demonstrated that the population was aware to myocardial infarction signs, evidenced by the increase in calls to 112 and less recurrence to institutions without PPCI. However, patient and system delays have not decreased; in fact, they have even increased, particularly during the pandemic. The second essay focused on the economic impact that SFL had in the first years of evaluation, demonstrating savings mainly due to the decrease in mortality and morbidity which contributed to indirect costs reduction. The third one introduced the concept of organizational dignity assessed by healthcare professionals who positively evaluated the impact of the SFL on it. An organizational dignity scale for health institutions was validated. It was concluded that the SFL is a value-based initiative whose example can be applied to other areas of healthcare.

Keywords: Stent for Life, Acute Myocardial Infarction, value-based healthcare; Covid-19; Economic Impact; Organizational Dignity

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List of Abbreviations

ACS - Acute coronary syndromes
ACSS - Central Administration of the Health System
AMI - Acute myocardial infarction
APIC - Portuguese Association of Cardiovascular Intervention
AVE - Average variance extracted
BRU - Business Research Unit
CABG - Coronary Artery By-pas Graft
CathLab - Catheterization laboratories
CFA - Confirmatory Factor Analyses
CNCDC - Portuguese Cardiology Data Collection Centre
CODU - Centre for Emergency Patients
COVID-19 - coronavirus disease-19
D2B - Door-to-balloon time
DGS - Directorate- General of Health
DM - Diabetes Mellitus
DRG - Diagnosis-related group
EAPCI - European Association of Percutaneous Cardiovascular Intervention
ECG - Electrocardiogram
EFA - Exploratory Factor Analysis
EMS - Emergency medical services
EPRA-DO - Organizational Dignity Evaluated by Employees Scale
ESC - European Society of Cardiology
FMC - First medical contact
FMEA - Failure Mode and Effect Analysis
GDP - Gross domestic product
HFMEA - Health Failure Mode and Effect AnalysisTM
INE - National Statistical Institute
INEM - National Institute for Medical Emergency
ISCT - Integrative Social Contracts Theory
ISCTE - Instituto Superior de Ciências do Trabalho e da Empresa
JCAHO - Joint Commission on Accreditation of Healthcare Organization
MI – Myocardial

MoU - Memorandum of Understanding

OHCA - Out-of-hospital cardiac arrest

PCI - Percutaneous coronary intervention

PPCI – Primary Percutaneous Coronary Intervention

PPCI-H - Primary percutaneous coronary intervention hospital

PSC - Portuguese Society of Cardiology

RNSCA - National Registry of Acute Coronary Syndromes

SARS-CoV-2 - Severe acute respiratory syndrome coronavirus-2

SEM - Structure Equations Model

SEM PLS-PM - Partial least squares structural equation modelling

SFL - Stent for Life Initiative

SPSS - Statistical Package for Social Sciences

SSL - Stent Save a Life

STEMI - ST-elevation myocardial infarction

STEMINEM - Program in acute coronary syndromes targeting Emergency medical services healthcare professionals, denominated

TV – Television

UN - United Nations

VBHC - Value Based Healthcare

VSLY - Value of a Statistical Life year

WHO - World Health Organization

CHAPTER 1

Introduction

1.1. Stent for Life initiative

Cardiovascular disease is the leading cause of death in Europe (Wilkins et al., 2017). This condition is constituted by a group of clinical syndromes going from chronic coronary syndromes, acute coronary syndromes, and cardiac arrest. All these conditions have atherosclerosis as pathophysiological process. Etiologically, deposits of atheroma originate a coronary artery narrowing, conditioning a decrease in coronary blood flow, which will decrease the oxygen supply to the myocardium. The unbalance between the myocardium oxygen demands and the amount that really it gets, leading to myocardium, suffering, denominated ischemic heart disease. Acute coronary syndromes (ACS) are mostly secondary to an atherosclerotic plaque disruption that leads to thrombus formation and decrease of myocardial blood flow, resulting in transient or persistent myocardial ischemia. Clinically, myocardial ischemia presents a group of symptoms which usually allows its identification. Chest pain, or pain equivalent, such as dyspnoea, nauseas, epigastric or left arm pain, are the most characteristic symptoms.

Myocardial infarction (MI) is defined as myocardial ischemia leading to cardiomyocyte necrosis defined by an increase and/or decrease of sensitive/ultrasensitive cardiac biomarkers, preferably high-sensitive cardiac troponin, with at least one value above the 99th percentile of the upper reference limit (Collet et al., 2021). According to its presentation, MI can be divided into two types, ST-segment elevation MI (STEMI) and non-ST-segment elevation MI. STEMI is the most life threatening, once the acute vessel closure leads to irreversible damage to the heart muscle, which may lead to impairment in heart function and may predispose patient arrhythmias.

An electrocardiogram can demonstrate the presence of ongoing MI represented by a deviation of the ST segment from the isoelectric line. Reperfusion treatment through reopening the closed artery can save or limit damage to the heart muscle portion at risk, and decrease the probability of malignant arrhythmias, which are the main cause of death associated to the first hours of MI progression (Ibanez et al., 2018).

The initial step of the treatment is the diagnosis which is based on the recognition of symptoms and performing a 12-lead ECG that detects persistent ST-segment elevation. The goal of STEMI treatment is to reduce pain and to salvage as much myocardium as possible by a reperfusion treatment, which has shown to reduce mortality if administered within the first 12 hours after onset

of symptoms (Boden et al., 2007). Implementation of a reperfusion strategy in STEMI as soon as possible is the milestone on STEMI treatment and should be well organized in order to permit the administration of reperfusion treatment in a targeted time. Evidence-based guidelines, recommend primary percutaneous coronary intervention (PPCI) as the leading reperfusion approach for STEMI treatment if it is executed timely, and highlight the need to promptly access to reperfusion in order to reduce morbidity and mortality in these individuals (Ibanez et al., 2018).

Nevertheless, the decision on what kind of reperfusion to perform is time dependent and if diagnosis is performed out of a PPCI centre, it has to be decided what brings patient more benefit, whether to administer an immediate intravenous fibrinolytic treatment or transfer the patient to a capable PPCI centre, if the presumed delay to perform PPCI is longer than 120 minutes. These 120 minutes time threshold have been suggest to be comparable to a pharmacoinvasive strategy - prehospital fibrinolysis followed by an early angiography (less than 24hs) (Armstrong et al., 2013). Reperfusion delay at any point of the process and with any of the reperfusion treatments, PPCI-related or fibrinolysis-related, is associated to increased mortality (Betriu & Masotti, 2005; Terkelsen et al., 2010; Widimský et al., 2003).

Besides ischaemic heart disease, particularly STEMI, is the leading cause of death worldwide, it has also considerable socioeconomic impact due to significant healthcare expenses as well as loss of productivity (Carter et al., 2019; Mensah et al., 2019; Timóteo et al., 2020). As referred, the last guidelines on STEMI reperfusion, recommend PPCI as the leading reperfusion approach for STEMI treatment if it is executed timely, and highlight the need to promptly access to reperfusion in order to reduce morbidity and mortality in these individuals (Ibanez et al., 2018). Despite the existence of clear scientific evidence, the strategies used in reperfusion varied across Europe, which led to the creation of Stent for Life initiative (SFL) (Kristensen et al., 2014; Widimsky et al., 2009; Widimsky et al., 2010). This initiative was implemented in Europe in 2008 by the European Association of Percutaneous Cardiovascular Interventions (EAPCI) and it was supported by national cardiac societies and stakeholders (Widimsky et al., 2009). SFL purposes were: (I) to have more than 70% of all STEMI patients treated by PPCI; (II) to attain PPCI rates of more than 600 per million inhabitants per year; and (III) to make PPCI an available service 24-hour 7 days a week (24/7) at all invasive facilities to cover the countries' STEMI population needs. Therefore, SFL's primary goal was to increase timely access to PPCI, to reduce mortality and morbidity in STEMI patients.

This initiative held programmes that intended to improve the existing regional systems and to create new systems that would allow for a better execution of the European Society of Cardiology (ESC) guidelines for STEMI treatment. Initially, only five European countries implemented SFL (Knot et al., 2009) and, following the example of other countries, Portugal implemented it in February 2011

(Pereira et al., 2014). In the meantime, there were similar initiatives being created in the United States of America (Bradley et al., 2009; Jacobs et al., 2007).

Without resorting to new drugs or new medical equipment, the SFL ambitious plan was to reduce mortality by making available and increasing the efficiency of PPCI. The successful results of this initiative based on action plans that were developed at the country or region level, with the execution and outcomes in several healthcare scenarios, were published previously (Kaifoszova et al., 2016; Kristensen et al., 2012; Pereira et al., 2021). Lives were saved by the successful partnership between the SFL initiative and their local collaborators. Besides there were increased healthcare costs, they were indirectly compensated by indirect cost savings, leading to a net cost reduction demonstrating that socioeconomic savings compensate for the increased healthcare costs and investments (Bastian Wein et al., 2020).

As referred previously, one of the major goals of SFL was to treat more STEMI patients with PPCI, by having at least 600 PPCI procedures per year per million inhabitants. Nevertheless, STEMI's incidence is different across European countries, therefore individual countries' objectives had to be adjusted according to the specific national incidence (Kristensen et al., 2014). As stated by the Portuguese Directorate-General of Health (DGS), the ratio of PPCI per year per million inhabitants tripled in a decade, from 106 (2002) to 338 (2013) (Directorate-General of Health, 2018).

Besides the improvement in the number of treated patients, the improvement of STEMI treatment quality was also aimed by the SFL initiative, this can be achieved through reduction of time to reperfusion. Delays should be kept as short as possible, to reduce complications and mortality. There is evidence strongly suggesting that reducing time to treatment improves therapeutic effect and the STEMI patients' prognosis, mainly the reperfusion time; that is, *time is myocardium*. Mortality increases with the delay to reperfusion (Nielsen et al., 2011). The difficulties to obtain good PPCI performance is different between countries, therefore the action plans were tailored for each country to fulfil the specific needs. Taking into account that time to reperfusion is the milestone for STEMI patients, both educational and logistical actions were taken, and this involved simultaneously, healthcare professionals, health authorities, patients and their relatives.

1.1.1. Stent for Life initiative Portugal implementation methodology

At the moment of SFL initiative implementation in Portugal, in 2011, the first step was to create a local task force to discuss the major problems obstructing good PPCI performance in Portugal, and to create an action plan for developing a network. This group was constituted by several stakeholders, some clinicians (physicians, technicians and nurses), representatives from cardiac devices industry, from management area and from media (Candiello et al., 2022).

This task force was also responsible for developing standard protocols for diagnosis and treatment in cooperation with the stakeholders, and assigning roles between them. First it was decided to apply a Failure Mode and Effect Analysis (FMEA) which is a proactive and prospective analysis tool adopted to healthcare by the Joint Commission on Accreditation of Healthcare Organization (JCAHO), where is named as Health Failure Mode and Effect AnalysisTM, (HFMEA). Applied to medical sector this tool identifies in the different stages of a given clinical process or the trajectory of a disease, the failures that may occur assuming a systematic methodology which consists of answering three fundamental questions: 1- What are the potential failure modes, 2- What are their causes and 3- What are their effects (DeRosier et al., 2002).

As result a of this analysis three different main areas were identified as in need for specific intervention: (1) patient population: patients were unable to recognise myocardial infarction's (MI) symptoms, which made them take too long to ask for help and to go the hospital by their own means, rather than dialling 112 (national emergency medical services -EMS- number); (2) EMS: the EMS was not contacting interventional cardiology centres directly and it was not sending electrocardiograms (ECGs) to these centres systematically; and (3) hospitals: there were long system delays which affected hospital performance and not all national regions had 24/7 PPCI (Pereira et al., 2014).

Treatment delays are the most reliable indicators to assess STEMI care quality. There should be delays tracking of in every STEMI care hospital network and regular monitoring to ensure that all indicators of quality-of-care are met and maintained over time. The delay components in STEMI are referred in STEMI guidelines (Ibanez et al., 2018) and are showed in Figure 1.1.

The global time to treatment can be subdivided into several components and defined as: Patient delay - delay between symptom onset and first medical contact (FMC); System delay –delay between FMC and reperfusion therapy. The system delay can itself be divided in delay between FMC and diagnosis, which could be a good indicator for the quality-of-care by measuring how long it took to have the first ECG with the diagnosis confirmation, and also the delay from diagnosis to treatment. The system delay reflects more the organisational part of the process and may be more readily modifiable by organisational actions than patient delay, and it is an indicator of quality of care and a predictor of outcomes, as well (Pereira, Pinto, et al., 2018).

Within each sector, several programmes were created to overcome these difficulties, and an action plan was defined to be attained in three years. It had three main goals: (1) to increase more than 70% STEMI patients treated with PPCI; (2) to achieve PPCI rates greater than 500 per million inhabitants per year; and (3) to improve the PPCI network centres with a 24/7 catheterisation service (Pereira et al., 2014).

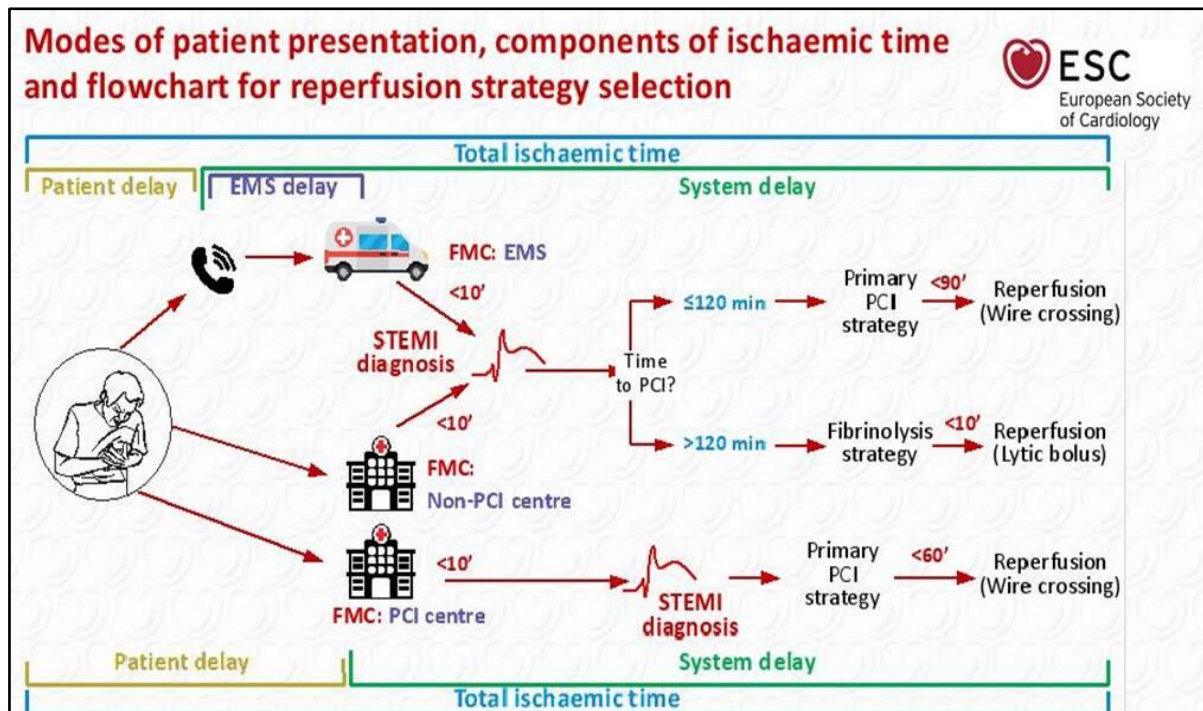


Figure 1.1 - Components of delay in STEMI (Ibanez et al., 2018)

To obtain an up-to-date, realistic representation of how patients with acute myocardial infarction were treated in Portugal in 2011, a survey called Moment 0 was applied in all primary PPCI centres that have an interventional cardiology department open on 24/7 basis (Pereira et al., 2021). This survey was done in May 2011, involved 201 patients and it aimed to register all patients submitted consecutively to coronariography due to STEMI suspicion in one month. Patients transferred after being submitted to thrombolytic therapy were excluded from the analysis. This observational registry assessed patient and system delays during the study period, and information about the number of patients who dialled 112 for direct assistance from the National Institute for Medical Emergency (INEM), which is the responsible service for pre-hospital transportation, was collected. Additional important information was gathered, as the kind of FMC and the means of transportation to get the patient to a PPCI centre, and if the patient was treated before arrival at the PPCI centre in another hospital. The demographic data variables, such as gender and age, and history of cardiovascular disease were also collected (Pereira et al., 2014).

This survey results gave a snapshot of how STEMI patients were treated and confirmed the main obstacles to the PPCI programme in Portugal. These obstacles were: prolonged symptom onset to FMC interval, the low number of patients who dialled 112, and the high number of patients who attended centres without PPCI facilities, which were more than half (Pereira et al., 2021). To overcome these obstacles, and accomplish the action plan defined previously, the SFL Portugal Task Force put into practice three central actions: (1) to launch the *Act now. Save a life* national public

campaign, to raise awareness to MI's symptoms and to encourage people to dial the EMS number (112) immediately after their beginning; (2) to collaborate with INEM, to improve the communication between pre-hospital services and hospitals with PPCI, and also to provide means of transportation to PPCI hospitals from hospitals with no interventional cardiology units; (3) to implement a national plan for all STEMI patients enabling them to have access to PPCI, through INEM and its operational centre, the Referral Centre for Emergency Patients (CODU) (Pereira et al., 2014).

1.1.2. Patient delay - public campaigns

Public awareness campaigns affect individual decision-making processes and eventually lead to new behavioural attitudes. In the health field, mass media campaigns have been used as an attempt to alter several health behaviours in the populations (Wakefield et al., 2010). As examples we can cite campaigns which aimed to prevent heart-disease as a consequence of tobacco use, others addressed illicit drug use and alcohol abuse, cancer screening and prevention, and dangerous sex-related behaviours (Stead et al., 2019).

Typically, media campaigns have placed messages to reach larger audiences, most frequently on radio or television (TV), but also outdoor publicity, such as posters and billboards, and printed media, as newspapers and magazines. Generally, there is a passive exposure to these messages, resulting from a routine use of media. Nowadays campaigns incorporate new technologies (e.g., the internet and mobile phones) (Knot et al., 2009).

STEMI early phase is critical for patients' prognosis. It is vital that they and their relatives recognise MI's symptoms and take fast action by dialling the EMS to be transported to the nearest 24/7 PPCI hospital. This will positively affect Patient Delay (Pereira, Calé, et al., 2018).

Wide population knowledge about acute myocardial infarction symptoms, has the main key role in time to treatment (every minute counts). Contact the EMS through 112, is the most significant action on acute myocardial infarction treatment (including PPCI) and on cardiopulmonary basic resuscitation, which probably is the most important part of the entire process. The experience from The Netherlands shows, that wide knowledge in the population is capable of dramatically improving the situation in this field (Candiello et al., 2022; Knot et al., 2009).

Programmes to get increase population awareness were developed under the international SFL slogan *Act now. Save a life*. Informative materials were produced to support the campaign, with the help of a media agency, flyers, posters and videos were distributed. As there were limited resources available to finance the campaign, the Portuguese SFL Task Force decided to reach the population with the support of other industries with socioeconomic impact, mainly through companies that contact with population in daily lives activities. SFL Portugal contacted professional associations such

as the Portuguese Pharmaceutical Society, shopping centres, supermarkets, and companies in the telecommunications, oil, energy sectors and also local government bodies. The SFL Champion and SFL Project Manager scheduled meetings, to present the SFL mission, the current picture regarding STEMI treatment access, and to ask for collaboration. If a new partnership arose, a protocol was signed between a company representative and the SFL Initiative. Some informative materials were given, and some actions were arranged like announcements through website, intranet, information leaflets, newsletters, store counters with leaflets, among others. Employees were trained on what to do in presence of acute myocardial infarction symptoms, and in the partner companies, it was performed Cardiovascular screenings to the employees. Also, some cardiovascular screenings were performed by medical, technicians and nurse students, under Task Force member supervision, in public places such as gas stations, supermarkets, pharmacies, schools, theatres, shopping centres, city halls and Portuguese Parliament. As long as screenings were performed, information was given about MI symptoms recognition, recognise PPCI as the ideal treatment and to dial 112 as the correct thing to do if MI was suspicious (Pereira et al., 2014).

Other way was to promote the inclusion of messages in the mass media. Taking advantage of some members of the Task Force, and the public actions mentioned, it was possible to attract media attention, and most of these educational activities, had coverage in newspapers, with some TV and radio interviews with the SFL Champion (Pereira et al., 2014).

The SFL team invited some public figures, as famous TV presenters, singers and actors to be ambassadors of this cause, explaining that they could use their name and image to reduce mortality from acute myocardial infarction in Portugal, and also by appealing to their sense of social responsibility. All of them who were contacted agreed to give their pro bono endorsement to educational videos. These advertising in public spaces or through messages in the media, increased awareness and certainly contributed to change behaviours. For example, movies with ambassadors in cinemas and theatres, educational films on outdoor TV screens scattered by Lisbon, advertisement on buses. The SFL website and the ACT NOW Facebook page were also created. Some of those messages, images and movie clips, are still available in Stent Save a Life site (<https://stentforlife.pt/>) (Pereira et al., 2014).

As said, all campaign was conducted with limited resources available to fund it. So SFL team based their actions on volunteers, credibility, partnership development, with several societal areas (commercial, research, media...), and governmental organisations. Partner companies gave their time for free, and their investments were mainly spent on educational materials as videos and short movies with the SFL ambassadors, leaflets, pins and magnets (Pereira et al., 2014).

To support these campaign actions, market research in 2013 was set up in partnership with Instituto Superior de Ciências do Trabalho e da Empresa (ISCTE), in order to understand if the SFL's

campaign *Act now. Save a life* was recognised by the Portuguese public. And to analyse the Portuguese population the awareness regarding MI's risks, symptoms and to know what people would do when confronted with a real situation, namely if they ask for the proper help by dialling the EMS number, 112.

This research was not published but showed that 23% of people in Portugal had heard about the *Act now. Save a life* campaign, 95% of individuals refer that in a situation of emergency would dial 112, 77% of individuals refer knowing to identify the symptoms of an MI and Stroke, but with respect to symptoms there is a great difficulty to describe the difference between Stroke and MI symptoms. One third of respondents does not know or consider that MI is a disease from male gender.

SFL maintained an ongoing campaign on TV, radio and press, during the five-year term (Pereira et al., 2021).

1.1.3. System delay – network organization

STEMI treatment paradigm have changed in last decades, American and European guidelines recommend organizing resources to develop coordinated networks between EMS and PCI Hospital to offer all the patients the best reperfusion treatment available in a timely manner (Gulati et al., 2021; Ibanez et al., 2018). Several examples of countries who develop this kind of networks demonstrate to increase patients with reperfusion by PPCI, to reduce delay for treatment and reduce mortality, reinfarction incidence and heart failure (Alexander et al., 2017; Ibanez et al., 2018).

This kind of network organisation will allow patients to be treated at the right place and in the right time. So, networks for STEMI should be base in a timely and correct diagnosis and also, efficient coordination between EMS and health institutions. Knowing that networks have to be organised according to local realities and with the available resources, there are some characteristics which are transversal to all of them, such as catheterisation laboratories (CathLab) working 24/7, with a team on call and a policy of not refuse patients. Centres which integrate the network should be capable to diagnose STEMI and perform, or assure, proper reperfusion. Theoretically there are two models well known worldwide to organise this kind of network, the STEMI PPCI centre and Hub & Spoke (Candiello et al., 2022).

The STEMI PPCI centre model is the preferred strategy of reperfusion, and its' organisation is based on coordination between EMS and PPCI centres allowing the reduction of time to treatment, mainly system delay, and improving survival (Candiello et al., 2022). The decrease of time to PPCI is achieved based on some milestones: Performing and interpreting ECG in pre hospital setting, performing ECG within 10 min after medical/ambulance arrive (Dorsch et al., 2008; Kubica et al., 2022; Mahadevan et al., 2022; Qiu et al., 2011), transport patient directly to a PPCI centre avoiding

centres without PPCI capability, activation of PPCI team, particularly if the event is off-hours, and taking the patient directly to CathLab avoiding stop in emergency cardiac unit (Dorsch et al., 2008; Kubica et al., 2022; Mahadevan et al., 2022; Qiu et al., 2011).

The Hub & Spoke model is based in a network of several centres with different complexities connected by an efficient EMS. The role of each centre in the network is defined based in reperfusion strategy, resources available, localisation and how long last to transfer patients to a PPCI centre. Centres with PPCI capability 24/7 within the 30 minutes to CathLab activation will be considered Hubs. Centres with no possibility to perform PPCI will be considered Spokes. The reperfusion strategy of this centres it will be affected by transfer time to the nearest PPCI centre. If it is possible to transfer patients within 120 minutes post ECG diagnostic, all patients should be transferred systematically. On the contrary, if it is not possible to accomplish this time, a pharmacoinvasive strategy should be preferred and thrombolysis should be performed. In this model, EMS will work in a coordinated manner with all centres in the network to achieve the fastest way to transfer STEMI patients to Hub centres (Candiello et al., 2022).

This network should have a quality system with feedback to all participants on time to treatment achieved, and also to perform periodic meetings to analyse results and train all network stakeholders (Candiello et al., 2022).

Portugal is a small country and almost all regions are at 120 minutes of distance from a PPCI centre. Nevertheless, the Hub and Spoke method was adopted. So, concerning the pre-hospital system organisation, the priorities were to reorganise the network, to optimise the transmission of a pre-hospital ECG recording to the emergency cardiologist, and to promote inter-hospital transfer by the EMS from local centres without PPCI to PPCI hospitals. Programmes targeting the EMS firstly intended to empower the EMS to contact centres with PPCI, send ECGs, and manage the transport from hospitals without PPCI to hospitals with PPCI facilities (Pereira et al., 2021; Pereira et al., 2014).

Furthermore, an educational programme on acute coronary syndromes (ACS), directed to EMS healthcare professionals (STEMINEM), was developed. In-hospital systems organisation included the expansion of 24/7 PPCI network. To improve Alentejo region's coverage a new catheterisation laboratory at Hospital de Évora opened in 2012. In addition, several hospital training meetings were held by the STEMICARE programme, targeting medical emergency teams to improve coordination and communication, to reduce the delay from hospital arrival to catheterisation laboratory entrance (Pereira et al., 2021; Pereira et al., 2014).

Specific methods were established to evaluate how successful this initiative was, by enabling qualitative assessment of system and patient delays, as well as economic and market assessment studies (Pereira et al., 2021; Pereira et al., 2014; B. Wein et al., 2020).

To monitor the efficiency and quality of SFL team interventions in terms of delays to treatment, the SFL Portuguese team used the Moment Surveys, described before (Pereira et al., 2021; Pereira et al., 2014). These observational registries assessed patient and system delays in May each year. It was decided to conduct surveys in this date because it was the date when the first one, “Moment 0”, was conducted. The surveys were conducted in all primary PPCI centres in mainland Portugal that had an interventional cardiology unit operating on a 24/7 basis, aiming to register all consecutive patients catheterised for STEMI suspicion (Pereira et al., 2014).

Moment 0 was performed in May 2011 and subsequent surveys (Moment 1, 2, 3 and 4) were held in 2012, 2013, 2014 and 2015 including 187, 176, 206, 228 and 200 patients, respectively (Pereira et al., 2021). Information on demographic variables was collected, such as gender, age, and cardiovascular disease history. Data was obtained on the number of patients who dialled 112 for direct assistance from INEM.

The kind of FMC and the mean of transportation used to transfer the patient to a primary PPCI centre were also recorded. Information whether the patient was treated in another hospital before the arrival at the primary PPCI centre was collected. The time from onset pain to primary angioplasty was compared between groups for each year (2011 versus 2012, 2012 versus 2013, 2013 versus 2014 and 2014 versus 2015). Comparisons were also made between the observed delays and recommended guidelines time frames. The recommended delay from FMC to the first ECG is inferior or equal to 10 minutes. From FMC to reperfusion therapy (door to balloon time) the delay should be inferior or equal to 90 minutes, although in PPCI hospitals the goal should be inferior or equal to 60 minutes (Ibanez et al., 2018). Regarding the clinical outcomes of the performed interventions, no data was collected.

The results of the annual surveys were published in national and international scientific journals and presented at the Portuguese National Congress of Cardiology and at SFL meetings. In addition, they are integrant part of Pereira (2017) doctoral thesis. The conclusions taken from the findings were very important to plan and set improvements alongside the years.

We can cite some of the findings described in this document (Pereira, 2017). Patient delay is still high in Portugal, as the surveys reveal. Between 2011 and 2015 the results show no improvement, with medians of 114 minutes and 119 minutes, respectively. Nevertheless, it was described a trend to a decreasing pattern on patient-delay between 2011 and 2013, which was reverted in 2014 and 2015. It was also observed that the only variable that presented statistically significant differences during the survey was *time from symptom onset to ECG after FMC*, as this time decreased from 2011 to 2014, probably because it was implemented that all patients with thoracic and high abdominal pain should perform an ECG immediately after triage, and most of emergency department integrated a cardiopulmonary technician in their teamwork. However, in 2015, the values registered were

similar to those observed before the SFL campaign. The data demonstrated longer delays occur with elderly (75 years or older) and female patients, suggesting that these populations should be the target of the awareness programmes. The data highlighted the need to strengthen the message that patients must call for help as soon as possible, when symptoms start, even if it is during the night. Symptoms onset at night (between midnight and 8 am) led to a 50% increased risk of patient delay. Arrival at a primary PPCI hospital by their own means was another predictor of patient delay, as well as going to a primary health care centre before. Less delay was associated to patients who dialled 112 and arrived at a primary PPCI hospital by ambulance. The need to dial 112 as fast as symptoms start requires greater awareness. The risks they incur need to be understood by the patients if it is not done. System delay is also high in Portugal. In 2011 only 32% of patients were treated in less than 90 minutes and this drop to 22% in 2015. Again, female and elderly patients were at greater risk of delays. First presentation to a non-primary PPCI centre increased system delay, while patients dialling 112 had less delay. The results suggest that the diagnosis should be reached in the ambulance. Emergency medical services could perform an ECG in the ambulance, leading to a prompter diagnosis of all patients including the elderly. STEMI patients' direct transfer to a primary PPCI hospital might shorten the system delay and improve clinical outcomes. Larger system delays were more likely to be experience by patients at the Centro region of Portugal, pointing to the need of STEMI network geographic adjustments to improve equity in access to primary angioplasty. Monitoring quality and quantity of primary PPCI is important in every SFL country. Portugal's surveys have unmasked the lack of improvement in system and patient delays between 2010 and 2013, despite a 24% increase in the number of primary PPCI.

In 2016 the Stent - Save a Life! initiative - followed the Stent for Life programme which was effective from 2008 to 2016, in 23 countries, mainly in Europe. This initiative significantly improved the patient access to the lifesaving PPCI, reducing mortality and morbidity in patients suffering from an AMI. The primary intention of Stent Save a Life is to extend SFL mission globally, following the increasing needs and adapting it to the specific demands of the various regions of the world (Candiello et al., 2022).

At the ending of Stent for Life initiative, the SFF Portuguese team carried out another survey in 2016, Moment 5, which was used to analyse the results of SFL activities in Portugal in the five of existence. This study aimed to compare the results from 2011 (Time 0) and from 2016 (Time 5), in order to assess the evolution of the SFL initiative during the five years of its activities in Portugal (Pereira et al., 2021). The study used a series of annual study Time Points, in which a prospective cross-sectional study was conducted in all PPCI-capable hospitals in mainland Portugal that were included in the Via Verde Coronária (the national coronary fast-track system). Data on 1340 patients with suspected STEMI of less than 12 hours duration and referred for PPCI, were collected during a

one-month period each year from 2011 to 2016. This study aimed to compare the results from 2011 (Time 0) and from 2016 (Time 5), in order to assess the evolution of the SFL initiative during the five years of its activities in Portugal. The authors, considering there were no significant changes in any of the main endpoints (patient delay, system delay and door-to-balloon time) throughout the five years of this study, referred that, at first sight, the SFL initiative in Portugal was unsuccessful. However, they considered that these endpoints were not good indicators for a short to medium term evaluation of the initiative. According to them, the proportions of patients who called the EMS number, went to healthcare centers without PPCI facilities by their own means or were primarily and/or secondarily transported by EMS, are more sensitive ways to assess whether the SFL initiative. These indicators presented positive changes observed by the increased proportion of patients who call 112 for medical assistance (by 11.4% in five years). The proportion of patients who attended healthcare without P-PCI facilities by their own means reduced 12%. It was also mentioned that patients who were transported by the EMS, were treated significantly earlier than those who arrived by their own means even for those who directly attended PPCI-capable hospitals (Pereira et al., 2021).

1.1.4. Portuguese economic context

It is important to keep in mind that all this process of implementation was carried out under an economic and financial crisis in Portugal.

Europe was affected by a financial crisis that started in 2008. The Portuguese economy traditionally had weak economic growth, between 2001 and 2010 the average gross domestic product (GDP) growth was 0.8%. In 2009, Portugal was in recession and the situation worsened with a steady rise in unemployment and by the European context a public debt crisis, which led to increased difficulty to Portugal to finance its debt (Perelman et al., 2015). This situation led the Portuguese government to request international financial assistance from the European Commission, the European Central Bank and the International Monetary Fund. In May 2011 the Portuguese government signed a Memorandum of Understanding (MoU), a document where the Portuguese government was committed to some austerity measures that should be applied for the period 2011–2014.

These measures included the increase of tax and the reduction of public spending, as well as structural reforms in several areas, including labour, goods, and services (Maresso et al., 2015). The MoU considered 34 measures and actions concerning the health sector (Campos & Simões, 2014). Those measures combined strategies to improve efficiency in the National Health Service (NHS) and cost-containment actions (Barros, 2012). Mostly, the measures were centred in reducing medications

prices, reducing contracts with private healthcare sector and reduction on salary of professionals in public functions, such the most of health caregivers. Some of the measures were directed to cost containment, such as health budget reduction, increase of co-payments, reduce cost sharing of prescriptions and cutting costs for patient transportation, in fact reduced public expenditure in the healthcare sector.

Other measures had the finality to increase efficiency, such as electronic prescription of medicines to reduce waste, or redefinition of the conventioned sector to clarify relationships between public and private. Nevertheless, some perverse effects were also noticed, such as a negative impact on access, and decrease on health patterns of Portuguese population, with increases on anxiety, MI rate, 30-day mortality indicators and waiting lists for elective surgeries (associated to unemployment, whose rate increased hugely on this period) (Perelman et al., 2015). All these measures lead to a decrease on public investment in the NHS, for instance, delayed in replacement or requalification of obsolete equipment, which may have caused a stagnation in the quality of care (Legido-Quigley et al., 2016).

Also there was an enormous social contestation; on one hand population interpreted this measures as a loss of acquired rights, once they have aggravated costs for users, such as elimination of patients' right access to the transport, increasing payment for medical services decrease on tax deduction on health services; on the other hand health care professional who saw their careers and salaries frozen, had to work more hours without actualization on salary, became somehow demotivated, which contributed certainly for a reduction on quality of care observed on that period.

1.1.5. Coronavirus disease-19 Pandemic

On December 2019, a new coronavirus (SARS-CoV-2) was identified in Wuhan (China) caused coronavirus disease-19 (COVID-19) (Zhu et al., 2020). In 2020, COVID-19 spread rapidly worldwide and the World Health Organisation (WHO) officially recognised it as a global pandemic on March 11 (Mensah et al., 2019; World Health, 2020). This infectious disease has a clinical spectrum ranging from asymptomatic infections to serious illnesses.

According to the WHO, the majority (about 81%) of COVID-19 patients can be asymptomatic or oligosymptomatic, and around 14% of the infected individuals require hospital care due to breathing difficulties, of which approximately 5% may need mechanical breathing support (World Health Organization, 2020a). According to recent statistical data on the pandemic more than 621 millions of people worldwide were infected, and the number of deaths had reached 6.55 millions, and still growing. In Portugal these numbers reach 5.5 millions of people infected and 25 thousand deaths (World Health Organization, 2022).

As it is a highly contagious disease, at the beginning, when there was no effective vaccine, to contain its proliferation, a large part of human activities had been prohibited all over the world. On 2020 March 18th, the Portuguese government declared the first State of Emergency and decreed prohibitions to all citizens on exits to public roads, lockdowns in companies, commerce, tourism, universities, schools, and restrictions in the movement of people among countries and regions. Exceptions were made to those who work in hospitals or health centres, financial institutions, security, distribution of food and those need to go shopping goods of basic necessities as groceries and medications (Presidencia da República, 2020).

COVID-19 caused considerable stress and constrains on health care systems worldwide. There was an enormous impact of this disease on the performance of health care systems and on societal behaviour. The pandemic did not only affect patients who suffered from this new disease, but probably all others who needed consultations or regular treatment due to their health condition, and also healthcare systems human resources and logistics. To deal with COVID-19 patients, and to reduce infection risks, many planned procedures and preventive consultations had to be cancelled or postponed, affecting particularly patients with chronic diseases (COVIDSurg Collaborative, 2020; Mainous et al., 2020).

Patients with chronic coronary artery disease (CAD) are particularly susceptible to medical care restriction, as the pathophysiological process of CAD leads to higher risk for acute myocardial infarctions (AMI). AMI hospital admissions decreased since the beginning of the COVID-19 pandemic, which was demonstrated by clinical data (Garcia et al., 2021; Scholz et al., 2020). Nevertheless, an increase in severe AMI cases with major cardiac complications, higher troponin levels, mortality, and higher patient delay were observed compared to pre-pandemic period (Baumhardt et al., 2021; Primessnig et al., 2021). Significantly, over 50% of these AMI patients had been diagnosed with CAD previously. In other countries, a comparable description of AMI cases has also been reported (Garcia et al., 2021; Oliveira et al., 2022)

In Portugal, during the most difficult phase of the *first wave*, a considerable number of Portuguese hospitals had to increase hugely the capacity of their intensive care and adapt a large part of overall hospital capacity to treat COVID-19 patients. This adaptation on national healthcare service has compromised the diagnosis accessibility and treatment in several health areas, with short and long-term consequences that were not yet fully understood. Elective admissions, interventions, and diagnostic tests considered not urgent were cancelled to allocate most resources to the great increase of severe infected patients' admission.

Nevertheless, most care programmes for urgent conditions such as AMI and stroke were still running during this period, but the patients' numbers attending hospitals for these conditions have fallen, mainly in the first weeks of the lockdown (Garcia et al., 2021; Oliveira et al., 2022).

The general belief was that patients experiencing AMI symptoms were not seeking for hospital help due to fear of high-risk exposure to SARS-CoV-2 infection. Reports all over the world have suggested a decrease in the number of STEMI patients going to hospitals (Pereira et al., 2022; Rodríguez-Leor et al., 2020), nevertheless we have limited information on how the STEMI networks have been affected regarding delays to reperfusion, revascularisation strategies, and clinical outcomes (Rodríguez-Leor et al., 2020).

These facts raise the question, why, despite every effort implementing awareness campaign directed to the public and educational programmes to healthcare professionals, time to treatment did not decrease, on the contrary, there was a progressive increase?

1.2 Value Based Healthcare

Michael E. Porter and Elizabeth Teisberg defined Value Based Healthcare (VBHC) as patient-relevant outcomes divided by the costs per patient over the full cycle of care to achieve those outcomes, which may be represented as an equation ($\text{Value} = \text{Quality}/\text{Cost}$) (Porter & Teisberg, 2006). VBHC is the optimal and sustainable balance between high quality of care, high quality of life at sustainable costs. Value is created only when health outcomes improve, descriptions of value-based health care that focus on cost reduction are incomplete, reinforcing that costs reduction is very important but not sufficient. VBHC focuses on maximizing results for every monetary unit spent, improving the quality of healthcare, reducing medical errors and generating value. The benefits of a value-based healthcare system extend to patients, providers, payers, society as a whole (Porter & Teisberg, 2006).

In value-based medicine, the emphasis is on what is obtained and not the number of procedures performed. The management of diagnostic and treatment resources must be based on knowledge of the patient, advances in medicine, the cost-effectiveness of the resources used, based on access to independent, safe, and timely knowledge, applied personally to patients, generating value or significance for them, the profession, the hospital and the health system. It is a healthcare delivery model in which providers, including hospitals and healthcare professionals, should be paid based on the health outcomes of patients. So, VBHC may be used to reward the best performing healthcare organizations, and also to set caregivers remunerations (Porter & Kaplan, 2016).

Managing a chronic disease or condition such as cancer, diabetes, high blood pressure, chronic obstructive pulmonary disease, ischemic heart disease or obesity can be costly and time consuming for patients. Value-based models of care focus on helping patients recover from illness and injury more quickly and avoid chronic illness in the first place. As a result, patients make fewer healthcare systems visits, medical tests and procedures, and spend less money on prescription drugs as their health improves in both the short and long term. Providers achieve greater effectiveness, great self-

satisfaction, greater patient satisfaction and more efficiency in care. Payers have better cost control and risk reduction (International Consortium for Health Outcomes Measurement, 2019).

In this way, value-based health care promotes a more efficient and cost-effective care model for all actors within the system (Kaplan & Porter, 2011), as it encourages the reduction of inefficiencies and costs to the extent that patients they can be treated in a timely manner and with higher levels of quality and interdisciplinary articulation, thus avoiding comorbidities and chronic disease states that affect their quality of life and also the demand for resources, technology, and level of specialty for their care (Kaplan & Porter, 2011).

Likewise, and as a central axis, this approach benefits all users within the system, since regardless of their origin or condition, they are treated according to their needs and context, thus providing them with more equitable care and relevance (Lee & Porter, 2013). Similarly, service providers are able to optimize their clinical and quality practices with the implementation of this model since they understand what is truly important to the patient and the procedures through which this can be accomplished. Likewise, the model represents an opportunity to negotiate forms of payment based on the generation of value, that is, on the provision of superior results for users according to the money invested (Porter & Kaplan, 2016).

These principles can lay the foundations for a deep reflection on the characteristics of work within the organization or system and, how healthcare professional interpret their own job and workplace, without forgetting that the final objective is to improve outcomes for patients, to facilitate their work and promote a cost-effective health system.

Taking into account the revisited SFL and its results in the 5 years it was active in Portugal (Pereira et al., 2021), we can assume it was a value-based initiative. Nevertheless, some questions may be raised: we don't know if these good outcomes are long-lasting in time, particularly taking in account the unexpected Covid-19 pandemic; We don't know if it is cost-effective; and we don't know how healthcare professionals interpret its effect.

1.3. Study objective

1.3.1. General study objective

It was our objective to confirm that SFL is still a value-based initiative by confirming the maintenance of the outcomes attained in 5 years of SFL on contributing to an improvement in the performance of primary angioplasty in Portugal.

1.3.2. Specific objectives

- To monitor the impact of long-term awareness campaign, as well as the unexpected Covid-19 pandemic, in performance and quality indicators of primary angioplasty in Portugal, in qualitative terms (the various components of the patient and system delays).
- To access the economic evaluation of the SFL initiative in Portugal in its early years of implementation, between 2010 and 2013; 2) how Covid-19 has impacted the STEMI admissions and treatment.
- To analyse the influence of the organisational dignity and the quality of the SFL, on the contribution of that initiative to hospital firm's and users' dignity, evaluated by healthcare professionals of Portuguese hospitals.

1.4. Methods

1.4.1. Study Design

In order to answer to these raised questions, we intended to analyse SFL under three perspectives (Figure 1.2).

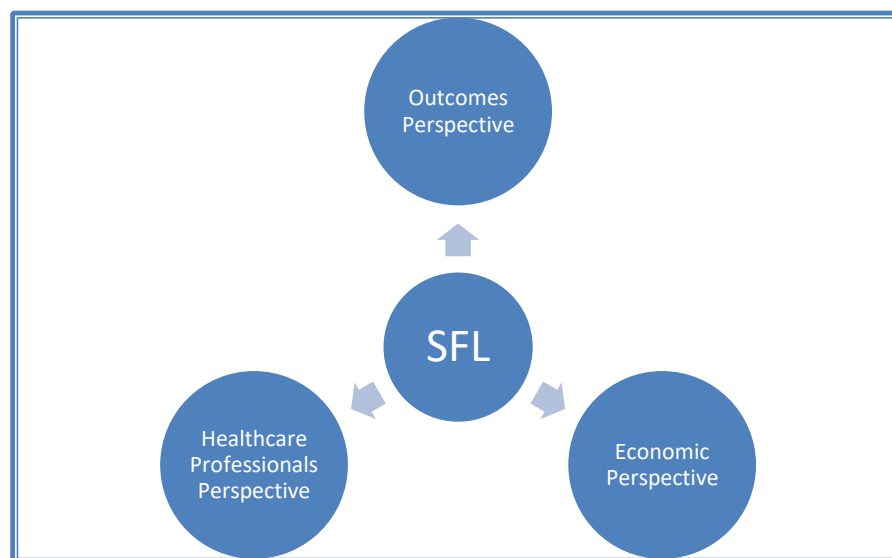


Figure 1.2 - Study Design

Outcome perspective: to verify the effectiveness of SFL actions through the years, namely the awareness campaign effect on population knowledge on MI and the action to take in case of an acute myocardial infarction. The campaign, lasted for the all period of duration of SFL, but it lost some intensity all over the years. Also, to analyse pandemic's impact on SFL performance indicators.

Economic perspective: another goal of SFL Portugal was to verify if the economic impact of the initiative. In any society with limited resources, demonstrating the economic impact of all actions which intend to improve health results is a milestone. Society and political decision-makers must be convinced that it is worthy to spend money in healthcare programs like SFL.

Healthcare professional perspective: to analyse the influence of the organisational dignity and the quality of the Stent for Life Initiative (SFL), through the contribution of that initiative to hospital firms' and users' dignity, evaluated by healthcare professionals of Portuguese hospitals.

Chapter 2. Stent For Life Portugal Evolution Through Years and Covid-19 Impact.

Study Moments, were prospective transversal studies conducted for one-month per year (2011-2016), in all hospitals with a PPCI programme in mainland Portugal, integrated in the STEMI fast track (the national STEMI network), used to assess the campaign effect over the years for the duration of SFL initiative. The same methodology, named by us *Moment Covid*, gathered in 2020, was used to assess data from the first months of Covid-19 in Portugal, March to May. Data from 1381 patients suspected of suffering STEMI with less than 12 hours of evolution and referred to PPCI, admitted in 18 main land Portuguese cardiology centres, were collected during a one-month period each year, from 2011 to 2016, and during one and a half month, matching with the first lockdown in Portugal 2020. All enrolled patients gave their informed consent for PPCI and data collection to the Portuguese Cardiology Data Collection Centre (CNCDC) of Portuguese Society of Cardiology (PSC). These surveys obtained express consent from the Coordinator of the National Data Collection Centre in Cardiology. The collection of information for the CNCDC is authorized by the National Data Protection Commission and the ethics committees of respective hospitals.

Four groups were constituted: Group A (patients included in Moment 0 – 2011); Group B (patients included in Moments 1 and 2 – 2012&2013); Group C (patients included in Moments 4 and 5 – 2015&2016) and group D (patients included in Moment Covid – 2020).

Continuous variables were analysed using central tendency and dispersion measures, mean and standard deviation (SD), if normally distributed, or median and interquartile range (IQR) if not normally distributed, such as patient and system delay. Kolmogorov-Smirnov test was used to assess normality of data, and Levene test to assess equality of variances. T-student test was used to compare means of variables presenting normal distribution or equality of variances. Variables which were not normally distributed were compared with Mann-Whitney U test for two independent

samples. Categorical variables were presented as percentage and the proportions were compared by chi-square test or Fisher's exact test. Two-sided p-values < 0.05, were considered statistically significant. All statistical analysis was performed using SPSS software for Windows version 21.

Chapter 3 - Stent for Life - Economic Impact 2010-2013. Did Covid19 change it?

Based on national databases, STEMI admissions within 12 hours of onset, mortality and readmission rate were analysed. Changes in clinical outcomes, financial outcomes and burden of disease were estimated based on the increased use of PPCI throughout 2011-2013 and compared to baseline. Financial outcomes consider changes in fixed costs, variable direct and indirect costs and the burden of the disease. The improvement in STEMI mortality and morbidity was calculated in terms of increased worker productivity. The model then compared the improvements in worker productivity against increased spending needed to support the incremental PPCI load. Financial outcomes consider changes in fixed costs, variable direct and indirect costs and the burden of the disease. To compare Covid-19 impact on STEMI admissions, the baseline evolution between 2010-2013 was compared to 2019-2021 triennia.

Chapter 4 - A Dignity Approach to Hospital Health Services: a study on organisational dignity and Stent For Life Initiative in Portuguese hospitals.

The study was a cross-sectional study with the participation of 127 health professionals from 16 Portuguese public hospitals. Using the Delphi method, the EPRA-DO organizational dignity scale was adapted to assess organizational dignity in hospitals organizations. To evaluate the SFL quality, users' dignity, and hospital firm's dignity, a global rating scale was used, in which participants selected grades from 0 to 10. The data were collected by Google forms link from December 2021 to April 2022. Exploratory Factor Analyses (EFA) was applied to identify dimensions of organizational dignity for hospitals from de healthcare professional's evaluation. Confirmatory Factor Analyses (CFA) was applied to verify the dimensions identified by EFA. Structure Equations Model (SEM) was applied for the hypothesis test. EFA was calculated by SPSS 21. To analyse CFA and SEM, PLS-PM was applied.

Ethical Considerations

This study was carried out within the scope of a doctoral program at the Instituto Superior das Ciências do Trabalho e da Empresa (ISCTE) and was approved by the work supervisor, Professor Luís Martins, Associate Researcher at BRU-ISCTE - Business Research Unit.

On Chapter 2, patients data used on Moment Covid survey followed the same methodology used in previous studies of Stent for Life Initiative. Express consent was obtained from the Coordinator of the National Data Collection Centre in Cardiology (CNDC). The collection of

information for the CNCDC is authorized by the National Data Protection Commission and the ethics committees of respective hospitals.

On Chapter 3 there were no direct data of patients, and the data gathered had the express consent obtained from the Coordinator of the National Data Collection Centre in Cardiology (CNDCC).

On Chapter 4 it was requested authorization and collaboration to Portuguese Association of Interventional Cardiology (APIC) to disclose the questionnaire and collect responses. The survey was approved by Portuguese Association of Interventional Cardiology (APIC) board. This organization disclosed they to its' associates in its monthly newsletter with an introductory text and a link to the Google forms. The first publication was carried out in the December 2021 issue remained open until the April 2022 publication. Additionally, a monthly reminder e-mail was sent to the lab director of each centre to encourage their colleagues to answer the questionnaire. By responding to the questionnaire all participants declared they were informed about the purpose of the study, they were aware of the confidentiality of personal identification and demographic data, and their participation in the study was entirely voluntary.

CHAPTER 2

Stent For Life Initiative in Portugal: progress through years and Covid-19 Impact

2.1. Chapter resume

During SFL Initiative in Portugal lifetime, positive changes in STEMI treatment were observed, by the increase of number of Primary Angioplasty and improvements in patients' behaviour towards myocardial infarction, with an increase in those who called 112 and the lower proportion attending centres without PPCI. Despite public awareness campaigns and system educational programmes, patient and system delay did not change significantly over this period. This research intended to address the public awareness campaign effectiveness on peoples' behaviour facing STEMI and how Covid-19 has affected STEMI treatment. Data from 1381 STEMI patients were collected during a one-month period each year, from 2011 to 2016, and during one and a half month, matching first lockdown in Portugal 2020.

Four groups were constituted: Group A (2011); Group B (2012&2013); Group C (2015&2016) and group D (2020). The proportion of patients who called 112, increased significantly (35.2% in group A; 38.7% in Group B; 44.0% in Group C and 49.6% in Group D, $p=0.005$); significant reduction was observed in the proportion of patients who attended healthcare centres without PPCI (54.5% in group A; 47.6% in Group B; 43.2% in Group C and 40.9% in Group D, $p=0.016$), but there were no differences on groups comparison. Total ischemic time, measured from symptoms onset to reperfusion increased progressively from group A (250.0 [178.0-430.0]) to D (296.0 [201.0 – 457.5.8]) $p=0.012$, with statistically significant difference between group C and D ($p=0.034$).

During the term of the SFL initiative in Portugal, patients resorted less to primary health centres and called more to 112. These results can be attributed the public awareness campaign. Nevertheless, patient and system delays did not significantly change over this period. In late years of SFL, probably for low efficacy of campaigns and in 2020 due to the Covid-19 pandemic.

2.2. Introduction

The Stent for Life (SFL) programme which was effective from 2008 to 2016, in 23 countries, mainly in Europe, significantly improved the patient access to the lifesaving primary percutaneous coronary intervention (PPCI), thereby reducing mortality and morbidity in patients suffering from an acute

myocardial infarction (AMI), also known as ST elevation myocardial infarction (STEMI) (Kristensen et al., 2014). In Portugal this programme was active between 2011 and 2016 (Pereira et al., 2021). The denomination changed in 2016 to Stent Save a Life (SSL), which had as primary intention to extend this mission globally, following the increasing needs and adapting it to the specific demands of each world region.

The principles are the same as in Stent for Life: to improve the delivery of care and patient access to PPCI, reducing mortality and morbidity in patients with acute coronary syndromes (ACS). In addition to increasing the number of PPCI per million inhabitants, other objective of SFL and SSL is to reduce reperfusion times, which is crucial given the total ischaemic time, (time from symptom onset to reperfusion therapy), has prognostic impact (Bates & Jacobs, 2013; Denktas et al., 2011; Polańska-Skrzypczyk et al., 2015).

The Portuguese SFL initiative, since it was implemented, carried out a public awareness campaign to raise public consciousness of myocardial infarction's (MI) symptoms and to persuade people to call 112 (Portuguese Emergency Medical Services – EMS number) immediately. This campaign was developed under the international SFL slogan 'Act now. Save a life'. Its main impact was on patient delay with great improvement observed when compared the baseline results to those obtained one year later (Pereira et al., 2014). However, this improvement was attenuated through the years and five years after implementation of SFL, time to treatment and its components, patient and system delay came to values near to those observed at baseline in 2011. Nevertheless, other indicators, such as the percentage of patients who called the EMS number, went to healthcare centres without PPCI facilities by their own means or were primarily and/or secondarily transported by EMS, are more sensitive ways to assess whether the SFL initiative led to positive changes (Pereira et al., 2021).

In 2013, we carried out market research in collaboration with ISCTE - Instituto Universitário de Lisboa, to assess the result of the campaign and the knowledge of the population about ST elevation myocardial infarction (STEMI) and what is the correct action after the onset of symptoms. In 2016 another market research, was ordered to a well-known Portuguese agency of market research, Pitagorica, with the same purpose. Both studies were unpublished, only the first was presented in several cardiology meetings, and press releases of results were made. These studies may help to explain the reason for the draw-back in patient delay.

In December 2019, a new coronavirus (SARS-CoV-2) was identified in Wuhan (China) caused COVID-19 (Zhu et al., 2020). In 2020, COVID-19 spread rapidly worldwide and was officially recognized as a global pandemic by the World Health Organization (WHO) on March 11 (World Health Organization, 2020b). This infectious disease has a clinical spectrum ranging from asymptomatic infections to serious illnesses. According to the WHO the majority (about 81%) of the

patients with COVID-19 can be asymptomatic or oligosymptomatic, and around 14% of the cases detected require hospital care because the infected individuals show breathing difficulties, of which approximately 5% may need mechanical breathing support (World Health Organization, 2020a). Recent statistical data on the pandemic show that more than 659 million people worldwide were infected, and the number of deaths had reached 6.679 million, and still growing. In Portugal these numbers reach 5.5 million of people infected and 25 thousand deaths online December 22; 16:30 min (World Health Organization, 2022).

As it is a highly contagious disease, with no effective vaccine available at the beginning, a large part of human activities had to be prohibited all over the world to contain its proliferation. On 2020 March 18th, the Portuguese government declared the first State of Emergency and decreed prohibitions to all citizens which included exits to public roads, lockdowns in commerce, companies, schools, universities, tourism, and restrictions in the movement of people among regions and countries. Exceptions were made to those who work in hospitals or health centres, financial institutions, security, distribution of food and to those who needed to go shopping for basic necessary goods such as well as groceries and medications (Presidencia da República, 2020).

The COVID-19 caused considerable and multifactorial stress on health care systems worldwide. The most evident issue was related to the treatment of the respiratory syndrome directly caused by the SARS-CoV-2 infection. During the most difficult phase of the *first wave*, a considerable number of Portuguese hospitals had to expand their intensive care capacity exponentially and adapt a large part of their overall hospital capacity to treat patients with COVID-19. This adaptation on national healthcare service compromised the accessibility of diagnosis and treatment in major health areas, with short- and long-term consequences that are not yet fully understood. Elective admissions, diagnostic tests, and interventions considered not urgent were cancelled to allocate resources to the huge increase in infected patients' admission.

Nevertheless, most of health-care programmes for urgent conditions such as acute myocardial infarction (AMI) and stroke continued active during this period, but the numbers of patients attending hospitals for these conditions fell, mainly in the first weeks of the lockdown. The general belief was that patients experiencing symptoms compatible with AMI were not attending hospitals due to fear of being exposed to an environment with high risk of SARS-CoV-2 infection. Reports all over the world have suggested a decrease in the number of patients presenting to hospitals with STEMI (Pereira et al., 2022).

The Covid-19 pandemic brought new challenges to countries health systems in treatment of infected patients and as well as on the way to prevent its spread. Also, as we said before, some reports highlighted a decrease in the number of STEMI patients attending hospitals in Europe and North America (De Filippo et al., 2020; Garcia et al., 2020; Rodríguez-Leor et al., 2020). However, we

have limited information on how this decrease affected STEMI networks in terms of delays to reperfusion (Rodríguez-Leor et al., 2020). On this topic, particularly, patient delay may be affected by patient awareness to identify symptoms and act properly. As said before, the Portuguese SFL initiative, since it was implemented, carried out a public awareness campaign to raise public awareness of the MI's symptoms and to encourage people to call 112 immediately (Pereira et al., 2014). Nevertheless, patient delay was, in 2016, already as long as in 2011 (Pereira et al., 2021).

The objectives of this study were to address the effectiveness of public awareness campaign on peoples' behaviour facing STEMI and how Covid-19 has impacted STEMI treatment in the Portuguese Healthcare.

2.3. Methods

In 2011, the SFL task force identified three main vectors to design an action plan with specific interventions: 1) the population: developing an awareness campaign to teach how to recognise infarction symptoms, to call 112 as quick as possible and not to go to the hospital by their own means, 2) EMS: establishing that EMS directly contact centres with PPCI units, sent ECG to these units in advance and get EMS collaboration to carry out the secondary transport between the hospitals without and with PPCI unit. Additionally, it was initiated an educational program in acute coronary syndromes (ACS) targeting EMS healthcare professionals, denominated STEMINEM. 3) hospitals: Besides the meetings aiming to simplify the implementation of a national network of PPCI 24/7, it was initiated the educational program in ACS, *Stent network Meeting* which targets emergency department healthcare professionals, denominated STEMICARE.

To evaluate the success of these actions, specific assessment methods were established: qualitative assessment of *patient and system delay – Study Moments*, as well as market research assessment studies.

Two market researches studies, were made to assess population knowledge in early and late years of SFL activities in Portugal. The first was carried out in 2012-2013, by a partnership between SFL and ISCTE, with the aim to know the recall level of the *Act Now Save a Life* campaign developed by SFL, and to access the awareness level of Portuguese population regarding MI symptoms and the need to dial the national emergency number 112. The methodology used was a phone interview, applying a structured questionnaire with open and closed questions, directed to 1000 subjects, living in Portugal, ≥ 18 years old, both genders selected by quota sampling, based on NUTS II and age.

The second was carried out in 2017, by a well-known Portuguese market research agency – Pitagorica – ordered by Stent Save a Life Portugal with the name *The Portuguese people and Myocardial Infarction*. This study had a broader scope concerning Portuguese healthcare usage, but

mainly to evaluate population knowledge on MI, and its perception on MI severity and associated risk factors. The research was applied to Portuguese population over 15 years old, by telephone interview. The sample was collected in November 2017 and consisted of 1044 subjects, (confidence level of 95.5%, and margin of error of 3.09%).

The *Study Moments* were prospective transversal studies during one-month per year (2011-2016), conducted in all hospitals with a PPCI programme in mainland Portugal and integrated in the STEMI fast track (the national STEMI network), to assess the campaign effect over the years for the duration of SFL initiative. The same methodology, *Study Moments* named by us *Moment Covid*, gathered in 2020, was used to assess data from the first months of Covid-19 in Portugal, March to May.

Data from 1381 patients suspected of suffering STEMI with less than 12 hours of evolution and referred to PPCI, admitted in 18 main land Portuguese cardiology centres, were collected during a one-month period each year, from 2011 to 2016, and during one and a half month, matching with the first lockdown in Portugal 2020. All enrolled patients gave their informed consent for PPCI and data collection to the Portuguese Cardiology Data Collection Centre (CNCDC) of Portuguese Society of Cardiology (PSC) (Directorate-General of Health, 2018; Sociedade Portuguesa de Cardiologia, 2018).

Four groups were constituted: Group A (patients included in Moment 0 – 2011); Group B (patients included in Moments 1 and 2 - 2012&2013); Group C (patients included in Moments 4 and 5 – 2015&2016) and group D (patients included in Moment Covid – 2020).

This study aims to compare the results of Group A with Group B, to evaluate the effect of campaign in the early period of Portuguese SFL; Group B with Group C, to evaluate the effect of a long period campaign; and Group C with Group D to evaluate the Covid-19 effect.

Time assessment was done according the methodology used previously in Portuguese SFL studies (Pereira et al., 2021; Pereira et al., 2014). The first medical contact (FMC) was defined as the time of arrival of medical and/or paramedical staff to assist the patient for prehospital care or the time of arrival at a hospital. *Patient delay* was defined as the time between symptom onset and FMC, it was considered a continuous variable and expressed in minutes. *System delay* was defined as the time from FMC to the beginning of reperfusion therapy, either with balloon, wiring or mechanical thrombectomy, and it was considered a continuous or categorical variable (cut-off value = 90 minutes).

Door-to-balloon time (D2B) was defined as the time from admission to a PPCI capable hospital to the reperfusion therapy and it was evaluated as a continuous or categorical variable (cut-off value = 60 minutes). Total ischemic time was defined as the time between the symptom onset and reperfusion and was evaluated as a continuous or categorical variable (cut-off value = 120 minutes).

2.3.1. Statistical Analysis

Continuous variables were presented as mean standard deviation (SD), the normality of data was assessed by Kolmogorov-Smirnov test, and the equality of variances was assessed by Levene test. T-student test was used to compare the mean of variables presenting normal distribution or equality of variances (e.g., age). Categorical variables were presented as percentage and the proportions were compared by chi-square test or Fisher's exact test. Continuous variables that were not normally distributed, including patient delay and system delay, were presented as median and interquartile range (IQR) and compared with Mann-Whitney U test for two independent samples, and with Kruskal-Wallis H test for more than two independent samples. Two-sided p-values < 0.05, were considered statistically significant. All statistical analysis was performed using SPSS software for Windows version 21.

2.4. Results

In the years 2011, 2012/2013, 2015/2016 and 2020, 1380 patients, from 18 national interventional cardiology centres, were enrolled. The demographic data and medical history of these patients are presented in Table 2.1. No statistically significant differences were observed concerning demographic data or previous history of coronary disease.

Time to treatment variables are expressed on Table 2.2. Total ischemic time, measured from symptoms onset to reperfusion increased progressively from group A [250.0 (178.0-430.0)] to D [296.0 (201.0 – 457.5.8)] $p=0.012$, with statistically significant difference between group C and D $p=0.034$.

Nevertheless, total delay within the limits set by the ESC and the American College Cardiology/American Heart Association guidelines, was achieved only by a small proportion of patients varying from 8.2% in Group A, with a little increase to B (10.0%) decreasing to 4,0% on group D, without statistically significant differences in groups comparison (Figure 2.1)

When we look for patient delay, we found significant differences only between groups A&B. Although there were no statistically significant differences, an increase of patient delay was observed from group B to C and from C to D, achieving on D a value similar to the one observed on group A, with a decrease in median time, which was 113.5 (63.5-211.5) in group A and 94.5 (49.8-199.3) in group B $p=0.024$.

The proportion of patients who called 112, increased significantly (35.2% in group A; 38.7% in Group B; 44.0% in Group C and 49.6% in Group D, $p=0.005$) (Figure 2.2). Despite the continuous increase all over the years, there were no significant differences when groups were compared (A&B;

B&C and C&D). Something similar occurred to the proportion of patients who called *Linha Saúde 24*, an official health call centre which advises patients about what to do when they have health issues.

Table 2.1 - Demographics and clinical background

	(Group A) (N=187)	(Group B) (N=410)	(Group C) (N=487)	(Group D) (N=297)	p-value	p-value A vs B	p-value B vs C	p-value C vs D
Female gender, n (%)	41 (21.9%)	93 (23.3%)	124 (25.9%)	72 (24.8%)	0.677	0.710	0.368	0.731
Age (years), mean (SD)	62.1 (13.7)	62.1 (13.4)	63.5 (12.9)	63.5 (13.7)	0.275	0.987	0.109	0.798
Age $\geq$ 75 years, n (%)	34 (18.4%)	78 (19.5%)	106 (22.4%)	65 (22.7%)	0.498	0.748	0.294	0.919
Medical history of PCI, n (%)	18(9.9%)	44 (10.9%)	56 (11.8%)	31 (10.9%)	0.918	0.713	0.668	0.707
Medical history of CABG, n (%)	1 (0.6%)	3 (0.7%)	9 (1.9%)	4 (1.4%)	0.430	0.802	0.141	0.640
Medical history of MI, n (%)	17 (9.7%)	49 (12.2%)	49 (10.4%)	32 (11.3%)	0.789	0.396	0.406	0.691
Medical history of DM, n (%)	28 (16.2%)	87 (21.6%)	122 (25.8%)	55 (20.3%)	0.047	0.137	0.141	0.087

PCI: Percutaneous coronary intervention; CABG: Coronary Artery By-pas Graft; MI: Myocardial; DM: Diabetes Mellitus

Table 2.2 - Time to treatment variables

Time (min) Med (Q25-Q75)	(Group A) (N=187)	(Group B) (N=410)	(Group C) (N=487)	(Group D) (N=297)	p-value	p-value A vs B	p-value B vs C	p-value C vs D
Time from symptom onset to FMC - patient-delay	113.5 (63.5-211.5)	94.5 (49.8-199.3)	110.0 (55.8-210.0)	120.0 (60.0-240.0)	0.061	0.024	0.237	0.225
Time from FMC to ECG	16.0 (8.0-39.0)	13.0 (6.0-30.0)	14.0 (5.0-32.0)	15.0 (7.0-32.0)	0.222	0.046	0.633	0.372
Time from general emergency service without PPCI to admission to PPCI hospital	110.0 (85.0-164.0)	117.0 (88.0-210.0)	126.0 (93.8-195.0)	144.5 (100.0-225.0)	0.098	0.385	0.525	0.176
Time from admission to PPCI hospital to reperfusion door-to-balloon time	54.0 (30.0-99.5)	54.5 (30.0-85.0)	57.5 (30.0-96.0)	63.0 (32.0-108.0)	0.346	0.904	0.669	0.189
Time from admission to PPCI hospital to CathLab		17.0 (10.0-63.0)	25.0 (5.0-70.0)	30.5 (2.0-81.0)	0.108	NA	0.018	0.624
Time from FMC to reperfusion - system delay	115.0 (79.0-179.5)	120.0 (89.0-187.5)	130.0 (94.5-197.5)	150.5 (109.0-231.3)	<0.001	0.410	0.098	0.005
Time from symptom onset to reperfusion - total ischemic time	250.0 (178.0-430.0)	254.0 (165.0-386.8)	269.0 (181.0-409.0)	296.0 (201.0-457.5)	0.012	0.332	0.154	0.034

FMC: First medical contact; EMG: Electrocardiogram; PPCI: Primary Percutaneous Coronary Intervention; CathLab: Catheterization laboratories.

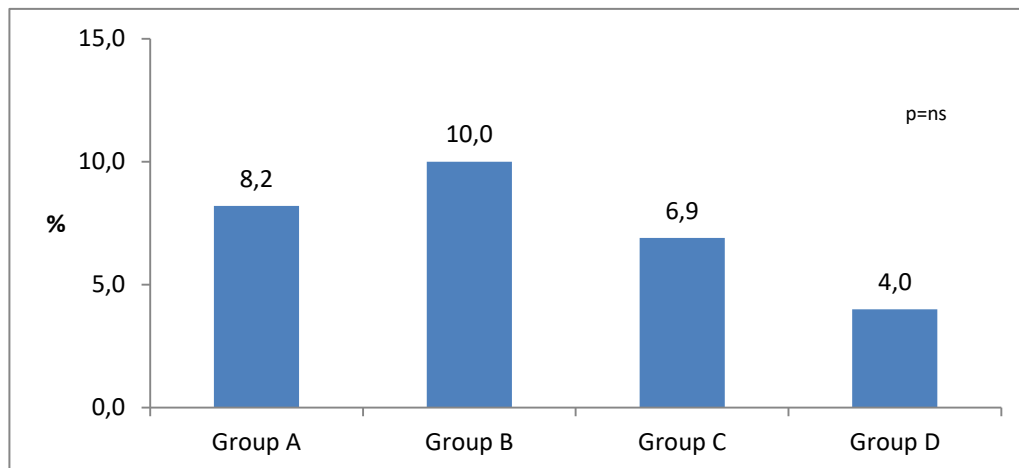


Figure 2.1 - Proportion of patients who met recommendations of the European Society of Cardiology for Total Ischemic Time < 120 minutes

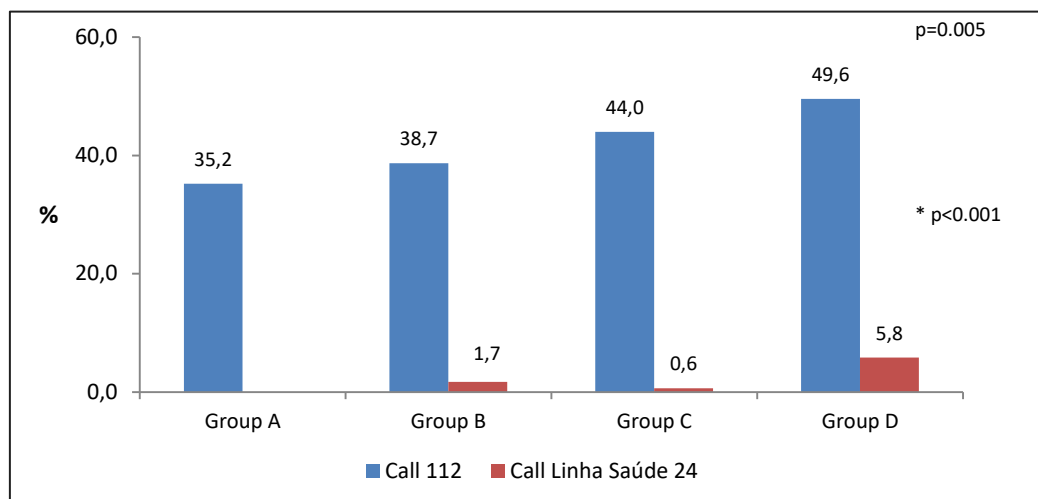


Figure 2.2 - Proportion of Patients Call for Help by calling 112 and *Linha Saúde 24*

This variable was not registered in Moment 0, so it was not possible to compare groups A&B, significant difference was observed between groups C&D $p<0.001$ (Figure 2.2). On the other hand, significant reduction was observed in the proportion of patients who attended healthcare centres without PPCI (54.5% in group A; 47.6% in Group B; 43.2% in Group C and 40.9% in Group D, $p=0.016$), but there were no differences on groups comparison. We found significant differences, as well, on those patients who attended primary care centres ($p<0.001$) with significant differences between groups A&B (20.3% - 9.7% $p<0.001$), B&C (9.7% - 5.1% $p<0,009$). Between C&D the difference was not statistically significant, but showed the same tendency (5.1% - 2.4% $p<0.07$) (Figure 2.3).

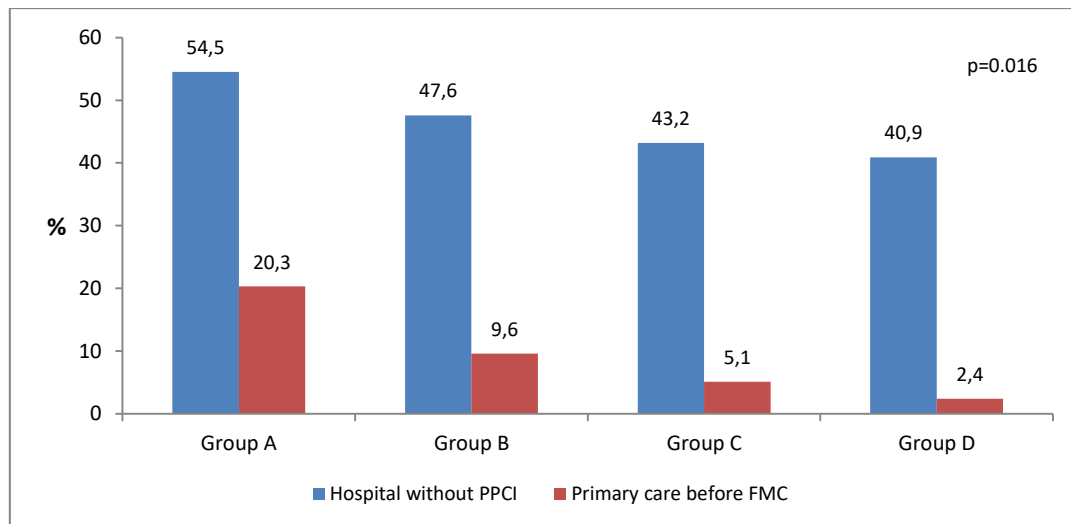


Figure 2.3 - Proportion of patients who attended healthcare facilities without possibility to perform Primary Percutaneous Coronary Intervention (PPCI); and proportion of patients who attended primary care before First Medical Contact (FMC)

System delay was assessed by measuring FMC to treatment and its subdivisions, FMC to ECG (time to diagnosis); time from admission to PPCI centre to reperfusion (door to balloon). Total system delay presented significant differences ($p < 0.001$) for the overall periods, and only between groups C&D $p = 0.05$, with an increase on median time, which was 115.0 (79-179.5) min, on group A; 120.0 (89.0-187.5) min, on group B; 130.0 (94.5-197.5) min on group C and 150.5 (109.0-231.3) on group D. Although there were no statistically significant differences, patients who seek for help at a general emergency service without PPCI presented a slight increase on time from general hospital to admission in PPCI hospital for all groups. The same occurred with D2B time, which has remained practically unchanged for all groups. Time from admission in PPCI hospital to CathLab, was also measured to Groups B, C and D. This variable was introduced to assess how long patients take from arrival to PPCI hospital to enter in CathLab. It was registered an increase trough the periods, with statistically significant differences between group B to C (Figure 2.4).

Time from FMC to ECG presented an improvement comparing A to B groups reflected by a decrease of 3 min in median time (16 to 13 min, $p = 0.046$). From B to C, and from C to D there was a worsening, reaching a similar time between A (16 min) and D (15min) groups (Figure 2.5). Total ischemic time, Patient Delay, System Delay and Door-Balloon are demonstrated in Figure 2.6.

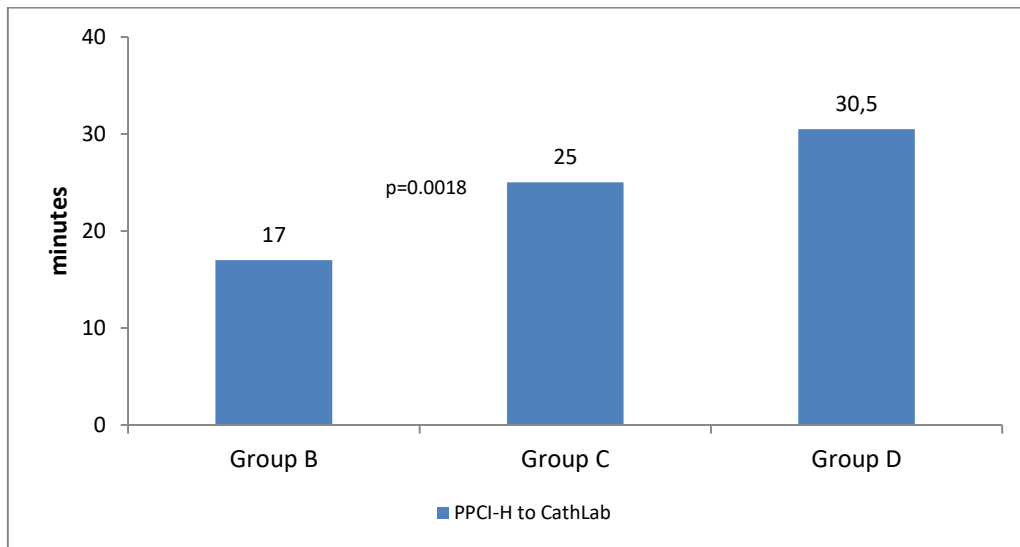


Figure 2.4 – Time in minutes from arrival to primary percutaneous coronary intervention hospital (PPCI-H) to Catheterization laboratories (CathLab)

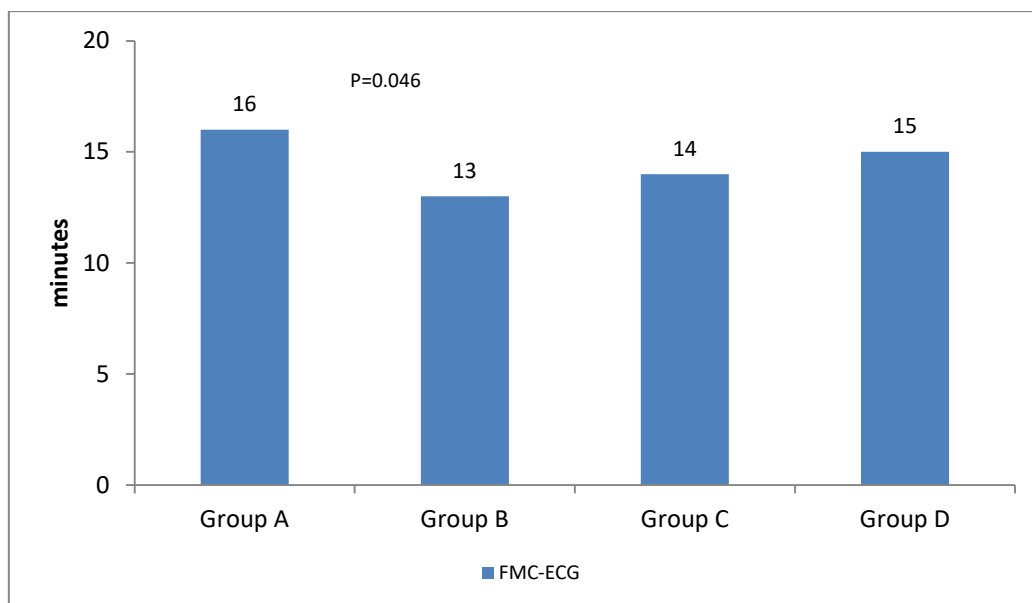


Figure 2.5 - Time to diagnosis confirmation measured in minutes. FMC - ECG: time from first medical contact to electrocardiogram

For system delay components, proportion of patients who were within the limits set by the guidelines, for FMC to ECG (≤ 10 min) was 32.7% on group A, with a significant increase to 43% on group B ($p = 0.025$), and remained constant in groups C and D (40% for both groups) Door-to-balloon (≤ 60 min) remained nearly unchanged for all groups.

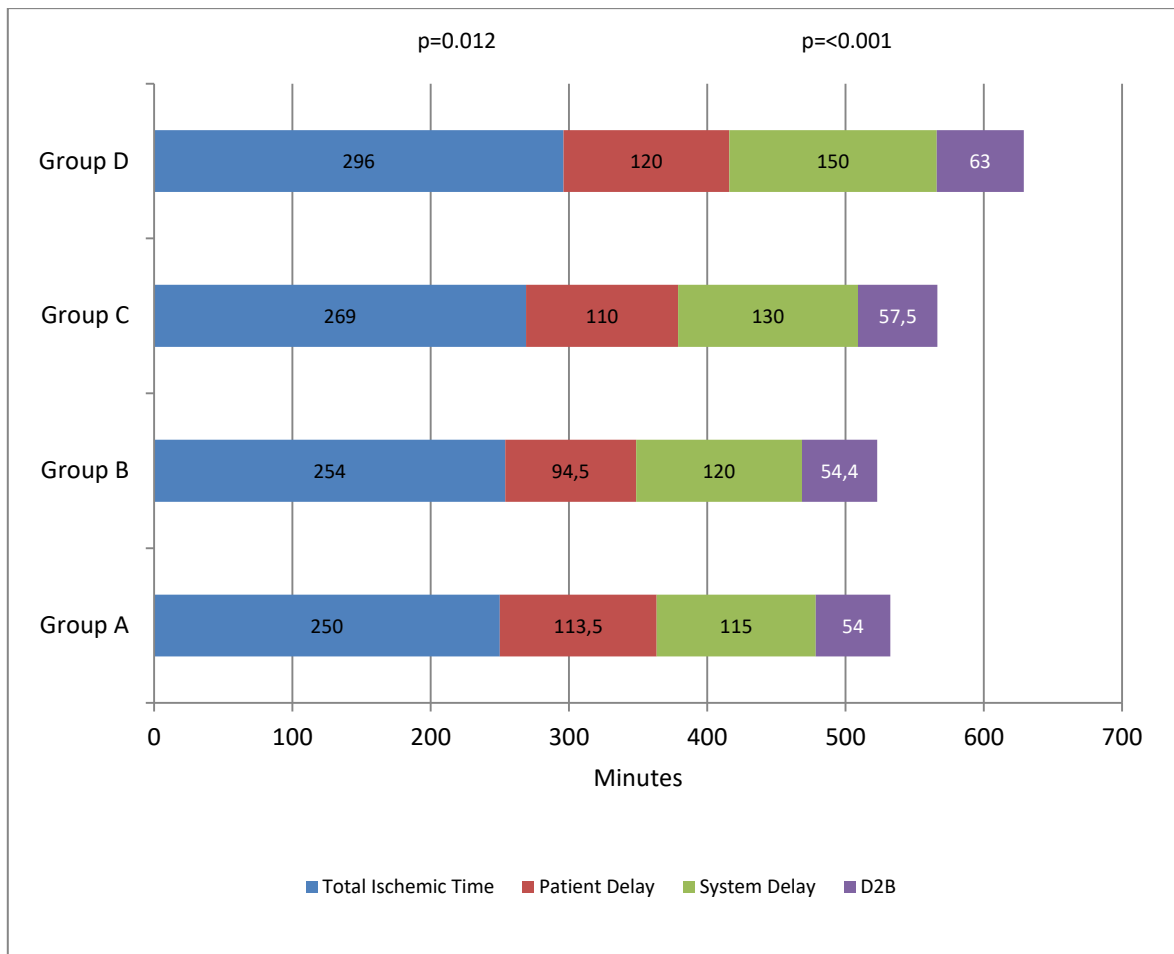


Figure 2.6 - Time to treatment and its subdivisions in minutes. Total ischemic time: Time from onset symptoms to revascularization; Patient Delay: Time from onset symptoms to first medical contact; System Delay: Time from first medical contact to revascularization

Regarding global FMC to balloon time, system delay (≤ 90 min) it decreased through the period with significant differences globally ($p<0.001$) it was 31.6% on group A, 27.2% on group B, 22.0% on group C and 13.9% on group D with a significant differences between groups C and D.

For total ischemic time (≤ 120 min) there was significant differences ($p=0.05$) and it was achieved only by a small proportion of patients, shifting from 8.2% in Group A, with a little increase to B (10.0%), decreasing to 4,0% on groups C and D, without statistically significant differences between groups. Figure 2.7 represents the proportion of patients who were within the guideline's limits.

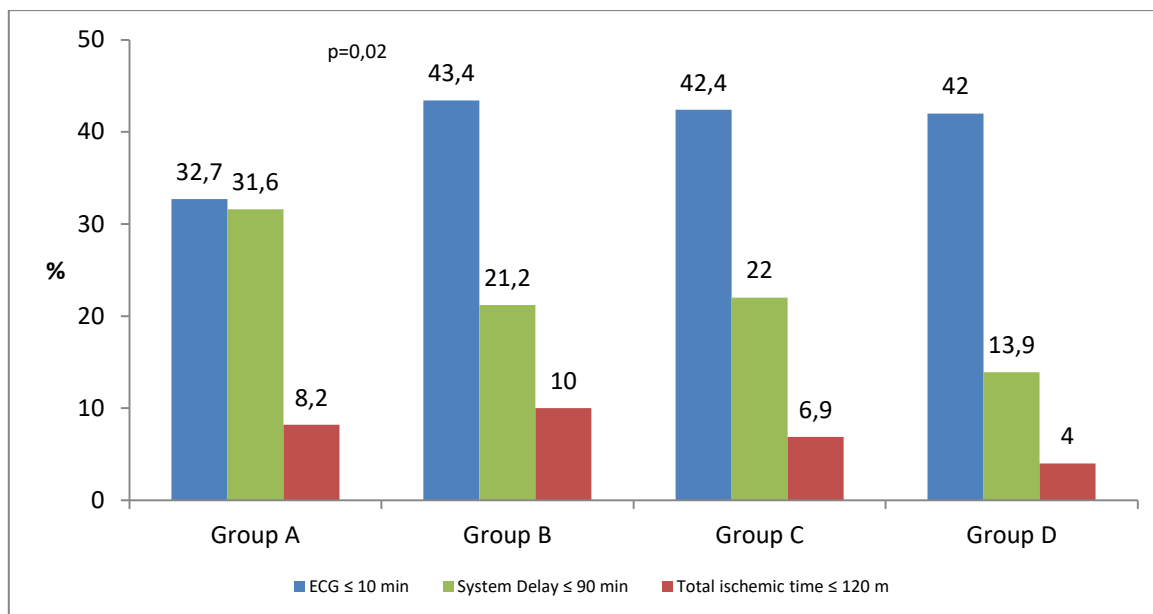


Figure 2.7 - Proportion of patients who met recommendations of the European Society of Cardiology for First medical contact to electrocardiogram (ECG ≤ 10 min); First medical contact to reperfusion (system delay ≤ 90 min; time from onset symptoms to reperfusion)

Market research studies

In 2013 the first market research, was conducted in partnership with ISCTE, with the main goals of to know the recall level of the Act Now Save a Life Campaign and to know the awareness level of Portuguese population regarding MI's symptoms and the need to dial the EMS number 112, when facing a MI.

Only 23% of respondents said they knew about the campaign, this result was independent of region, age group or gender. When they were asked how they have heard about the campaign, 49% didn't know and 23% said it was on TV (Figure 2.8).

Only 10% knew the campaign was about MI. One third of the responders did not know how to distinguish the difference between myocardial infarction and stroke. Most of the responders (95%) recognised 112 as the EMS number and 91% answered that they would use this number to call an ambulance in case of MI. However, only 24% of the responders were aware of MI symptoms, and 23% of the subjects thought that MI is a typical male disease (Figure 2.9).

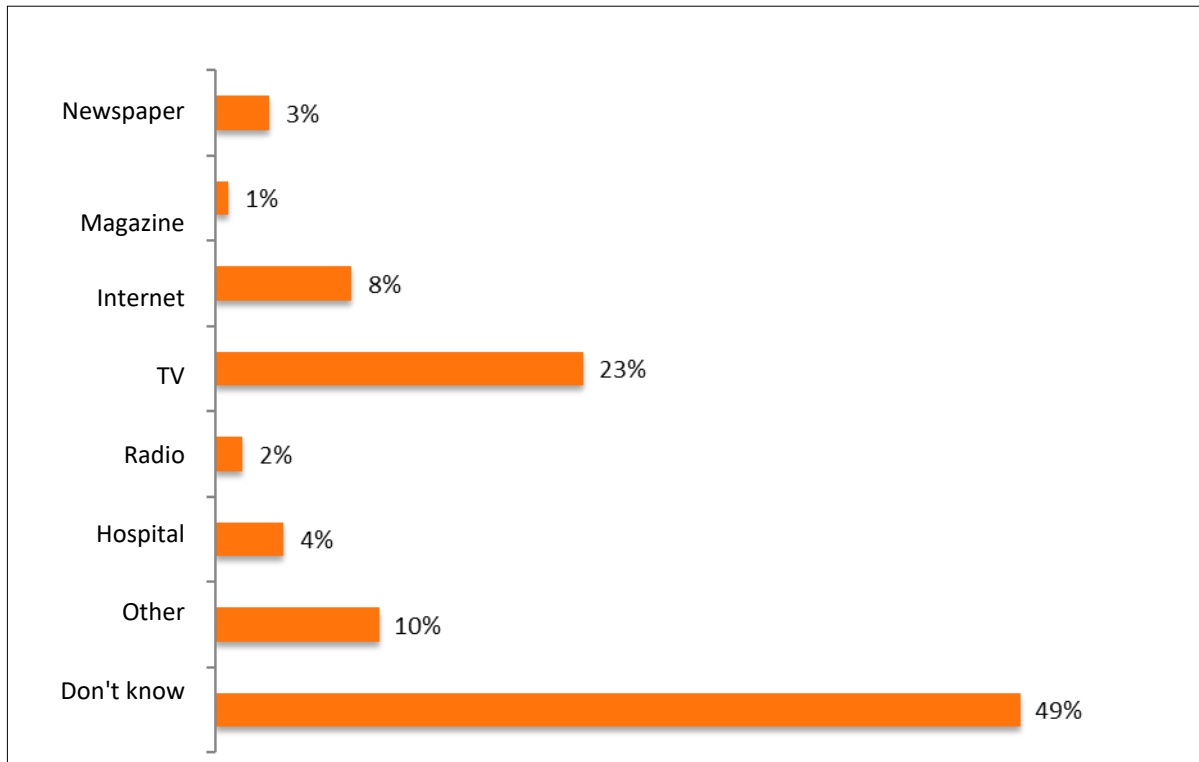


Figure 2.8 - Population knowledge about *Act Now Save a Life* campaign

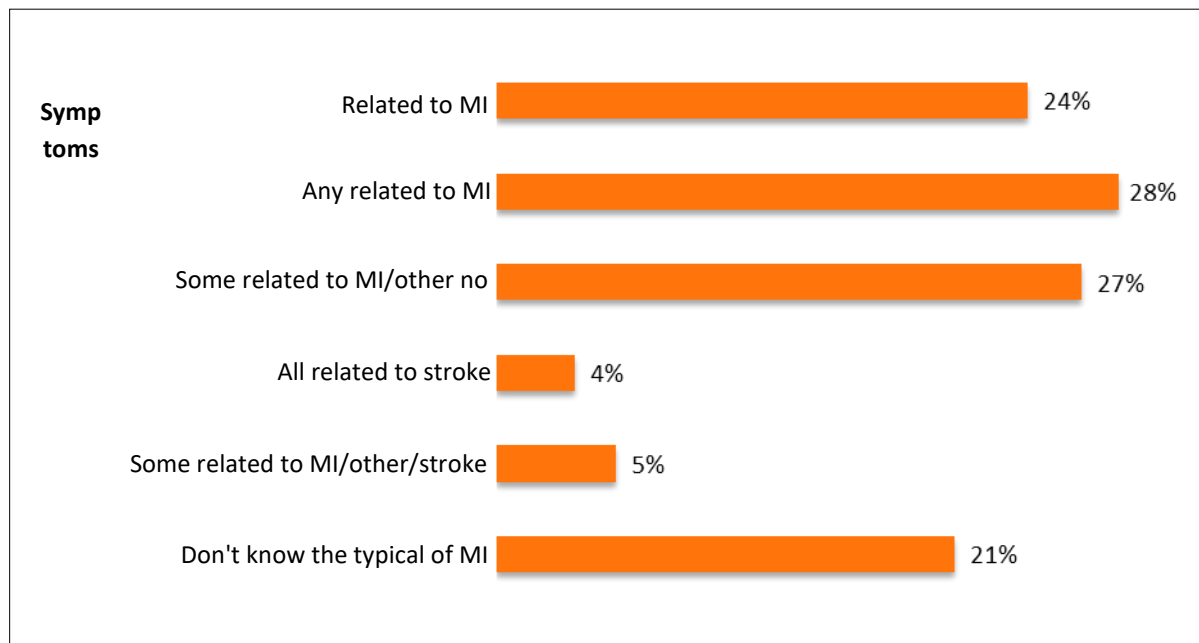


Figure 2.9 - Population knowledge about MI symptoms

In 2017 a Pitagorica market research ordered by Stent Save a Life Portugal with the name The Portuguese people and Myocardial Infarction was applied to sample of 1044 participants representative of Portuguese population over 15 years old, by telephone interview. This study assessed population's knowledge on MI, and its perception on MI severity and associated risk factors. The results had never been published.

From the 1004 participants, 53% were women and 47% were men. Regarding to age, 55% of respondents were over 45 years old and 21% over 65 years old.. 58% were married and 29% single. Looking at social class 19% were of an upper/middle social class, 65% middle and lower/middle, and 14% from lower class. Regarding cardiovascular risk factors, 24% were hypertensive, 15% have dyslipidaemia, 9% were diabetic and 59% declare to be healthy. Family history of MI have been reported for 30%, 68% declare have no MI family history, and 2% did not know the family history.

Referring to healthcare habits, 73% of the respondents had been to the doctor less than 6 months ago, 39% of whom had done it less than a month ago and 12 did not go to the doctor over 1 year ago. The main reason for going to the doctor are routine consultations, 62%, 16% went to the doctor to monitor a chronic disease/pathology, and 14% due to a symptom but without urgency. Within a period of a year, 79% of the respondents declare to go between 1 and 5 times to the doctor, with 57% going to an emergency room hospital/clinic/health centre for the last time, more than a year ago. Flu/cold was the main reason for the last visit to the hospital emergency room.

Regarding prevention habits, almost totality, 97% usually measure blood pressure, 99% refer to perform clinical tests frequently and 91% perform electrocardiograms regularly. Regarding prevention habits, it was possible to observe that 97% measure blood pressure, of which 46% perform an annual assessment; 99% performed clinical analyses, of which 61% were evaluated annually and 91% have performed electrocardiograms, of which 27% are assessed annually, no differences between gender; 60% of respondents said they practice physical activity regularly (Figure 2.10).

Concerning habits and activity, less than half declared to be smokers (42%) and 19% assumed to smoke less than 20 cigarettes a day, 72% reported drinking alcohol habits, but only 18% stated to do it frequently. More than 80% were coffee drinkers and almost half of these (46%) drunk about 1 2 coffees a day. Only 3% of the respondents slept more than 9 hours a day, while the majority (91%) slept between 5 and 9 hours. Concerning physical exercise practice, 40% mentioned not to practice any physical activity, from those who did it, 23% performed more than five hours a week. About half of the responders (48%) mentioned they try to follow a healthy diet. However, 48% of the respondents also refer to eating without any kind of restrictions, including sweets.

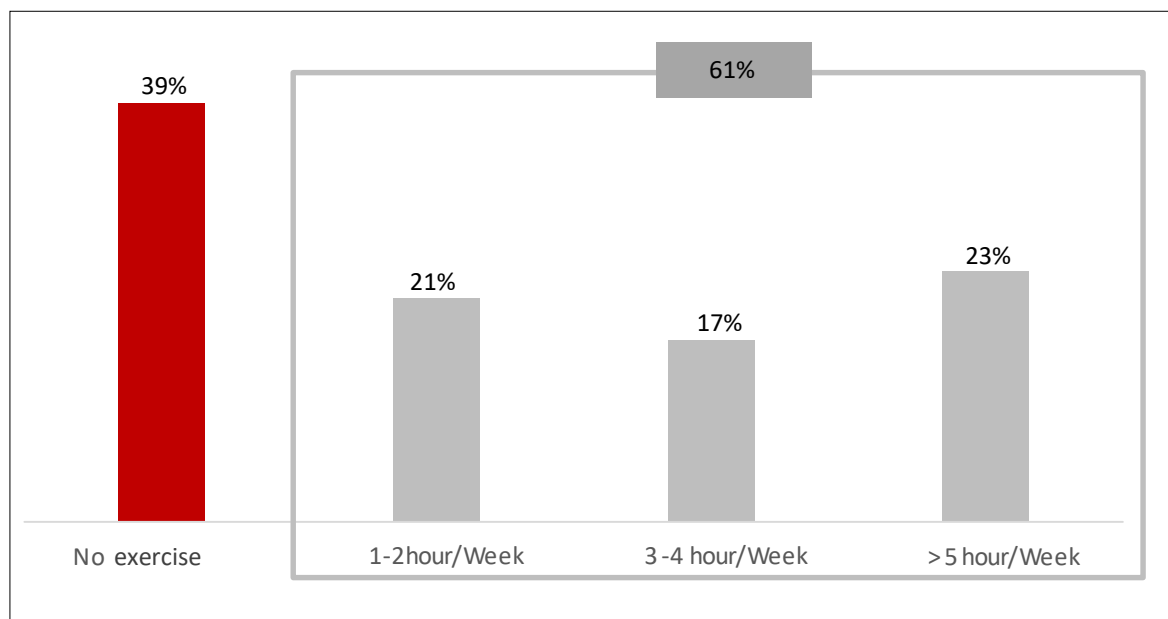


Figure 2.10 - Physical activity habit

When asked about their knowledge about MI, heart problems, blocked veins and closed arteries are the most commonly used definitions to define it, with 20%, 18% and 13% responses respectively. More than 40% states that *injury to the heart muscle caused by obstruction of a coronary artery* is the best sentence which corresponds MI definition. The main cause associated with myocardial infarction was overweight/fat for 92%. A vast majority (92%) stated that there are risk factors associated with myocardial infarction and some of which may to be avoided (66%) consider that all types of people are prone to having a myocardial infarction (Figure 2.11). More than 60% associated chest pain, sweating, nausea and vomiting to myocardial infarction, 40% associated the same symptoms to anxiety. In a scenario with these symptoms 38% would call 112 and 27% for a hospital emergency.

The criteria most considered as risk factors for MI are excess weight and unbalanced diet (both 99% responses). Tabaco is one of the most significative ischemic disease risk factors, 57% of the respondents were non-smoker, and from those who had tabaco habits, 23% were active smokers and only 4% declare to smoke more than 20 cigars per day (Figure 2.12.)

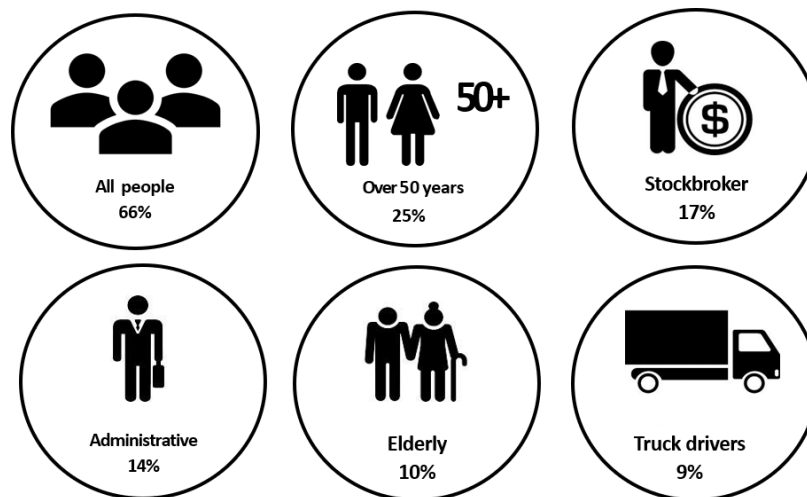


Figure 2.11 - Majority considers that all kind of people is prone to suffering a MI

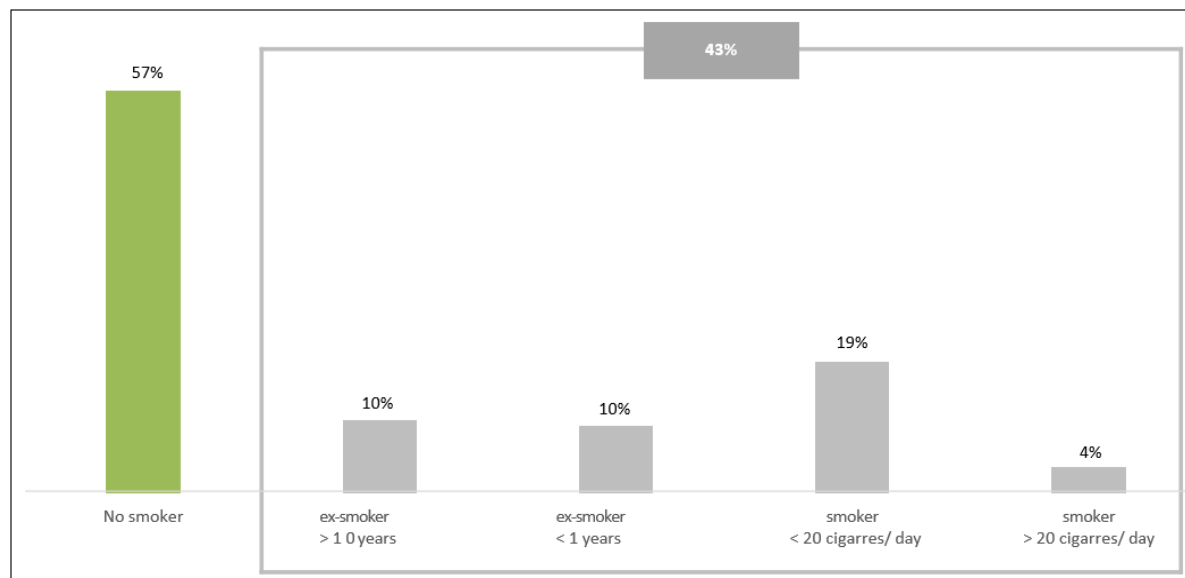


Figure 2.12 - Tabaco habit

More than half (55%) said that myocardial infarction can occur at any time age. The symptoms most referred to as indicators of a myocardial infarction are chest pain (95%) arrhythmias/palpitations (89%) and paralysis/ numbness in the arm (86%). Three out of 4 considered that the symptoms of a myocardial infarction are the same between men and women. For 68% of the respondents, the electrocardiogram is the best way to diagnose a heart attack followed by clinical evaluation (52%) and the echocardiogram (42%) (Figure 2.13).

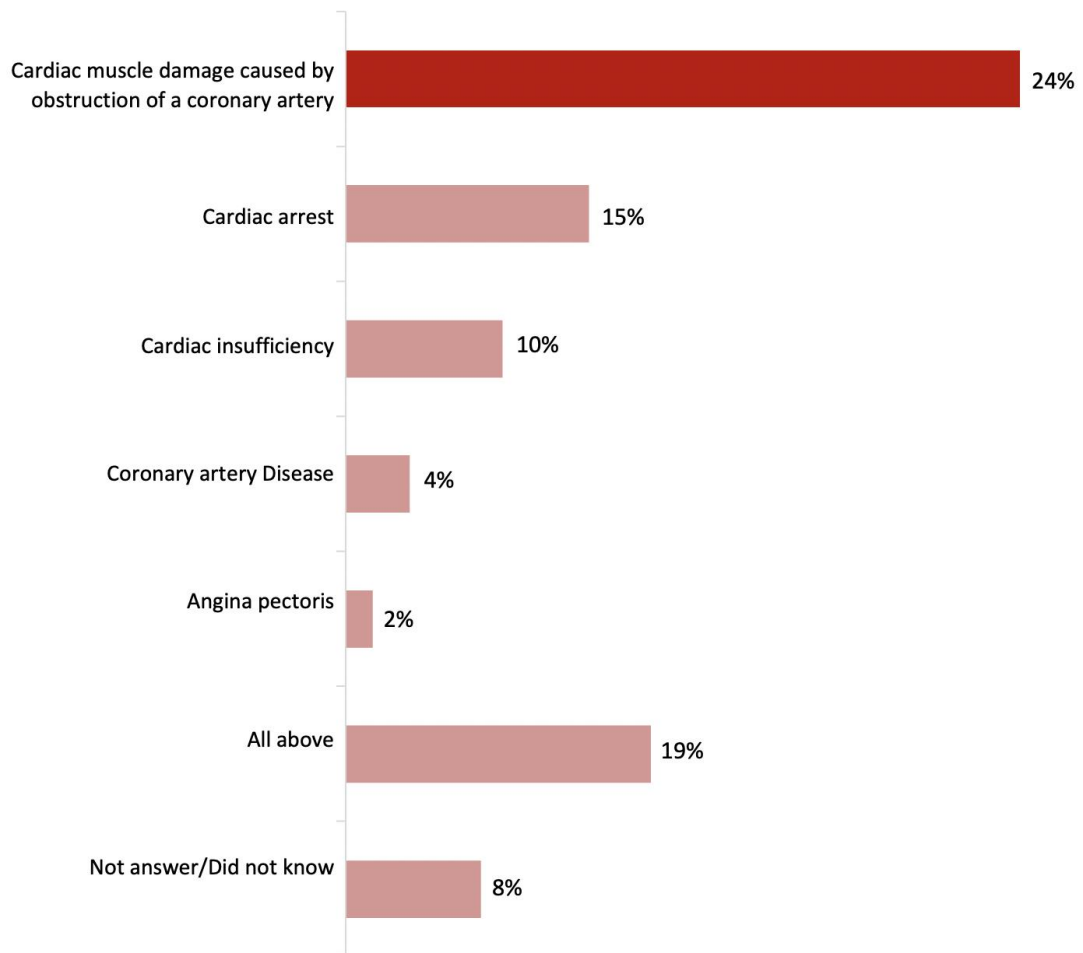


Figure 2.13 - Obstruction in an artery coronary is the main cause associated to MI

When confronted with a group of symptoms description, 64% identified them as MI symptoms, nevertheless 31% said they were related to stroke and 40% related them with anxiety (Figure 2.14).

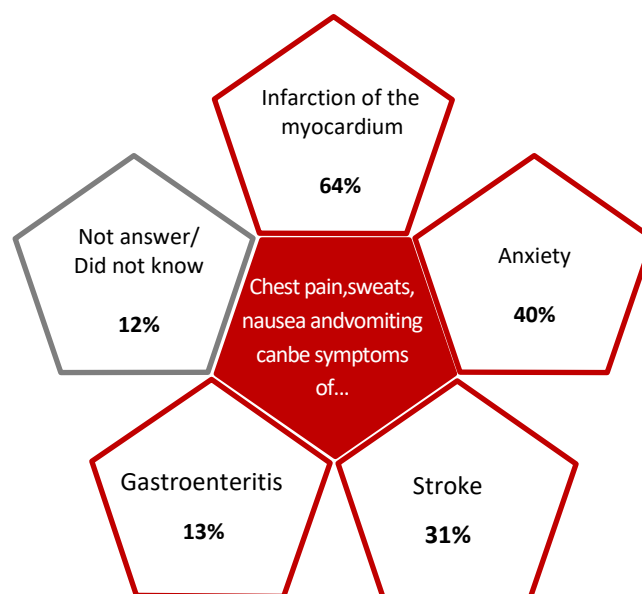


Figure 2.14 - About 2 out of 3 respondents associate the symptoms presented with a MI

When the questions were about actions to take facing MI, an overwhelming majority of respondents (96%) considered MI an extremely serious disease, with 95% to state that this is a medical emergency that requires immediate treatment. When confronted with a series of statements regarding cardiovascular disease, 62% agreed that cardiovascular disease cardiovascular diseases are the main cause of death in Portugal and Europe, with 30% however, stating that in Portugal, the mortality rate from cardiovascular disease is lower than other diseases

If they felt that they were facing a symptom of a myocardial infarction, the majority of respondents 77% would call 112 this being the measure that they would take in 1st place. If they witness to this same scenario in another person, the priority would be to call the INEM. The existence of a defibrillator in the workplace is a reality for only 16% of the respondents, with 75% stating that does not exist and 9% don't know (Figure 2.15).

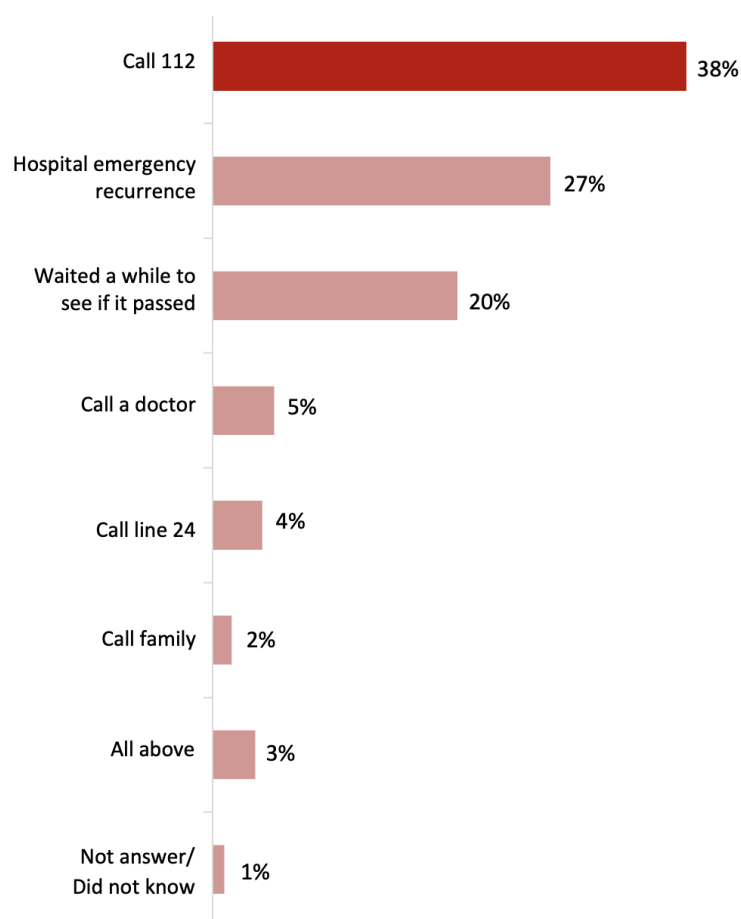


Figure 2.15 – Action to take facing a MI

About myocardial prevention, the majority of respondents (86%) consider that myocardial infarction can be prevented; the most mentioned factor for the prevention is healthy food, 90% of

responses, followed by physical exercise with 85%. More than half (51%) say that the prevention of myocardial infarction is something they are concerned about on a daily basis.

2.5. Discussion

The Portuguese Association of Cardiovascular Intervention joined the SFL initiative in February 2011. This initiative was launched in 2008 by the European Association for Percutaneous Cardiovascular Interventions and EuroPCR and national cardiology societies of the participating countries (Widimsky et al., 2009). The purpose of this initiative was to reduce mortality and morbidity in patients who suffer a STEMI in European countries, by improving patient access to PPCI, which is the recommended procedure to treat this kind of patients (Ibanez et al., 2018).

Before SFL, and despite having an acceptable coverage of PPCI centres and road networks, Portugal, had one of the lowest rates of PPCI implementation in Europe (Pereira et al., 2014). SFL objectives were: (i) to increase the use of PPCI to more than 70% of all STEMI patients; (ii) to achieve PPCI rates of more than 600 per million inhabitants per year; and (iii) to offer 24-hour 7 days a week (24/7) PPCI service at all invasive facilities in order to cover the countries' STEMI population needs.

The best benefits of reperfusion therapy in STEMI are achieved when this therapy is performed as soon as possible after the symptom onset, preferentially within the first 6 hours (Ibanez et al., 2018). Therefore, its main objective was to increase timely access to PPCI, in order to reduce mortality and morbidity in patients with STEMI.

The SFL task force identified some barriers which needed interventions. First, patients' knowledge about recognising myocardial infarction symptoms was not adequate which made them ask for help too late. Also, patients didn't act correctly toward a MI, mostly they went to the hospital by their own means, instead of calling 112. Before SFL only 33% of the patients used the EMS number, 112, to call for assistance (Pereira et al., 2014).

Second, the EMS and hospital networks performance presented long system delays (Pereira et al., 2014). In order to overcome these difficulties, several actions were designed and implemented concerning people's awareness to MI, and some measures targeted health professionals and to the national health system to increase their performance.

The public *Act now. Save a life* campaign was launched, with the help of a communication agency. Informative materials, including flyers, posters and videos, were produced to support the campaign. Public figures were invited to be ambassadors and partnerships were set up with the Portuguese Pharmaceutical Society, major national companies in different business areas (energy, entertainment, supermarkets, etc.) and local government bodies. During the five-year period, the campaign was ongoing in the press, on radio and television.

In 2013 the first market research, was conducted in together with ISCTE. This research was carried out on 1000 subjects, representing the Portuguese population and its distribution. Its main objectives were to know the recall level of the Act Now Save a Life Campaign developed by SFL to know the awareness level of Portuguese population regarding MI's symptoms and the need to dial the EMS number 112.

The majority of the responders (95%) knew the EMS number and 91% answered that they would use this number to call an ambulance in case of AMI. This finding may justify the improvement observed when comparing groups A and B, where a higher number of patients who call 112 was observed. However, only 24% of the responders were aware of AMI symptoms, and 23% of the subjects thought that MI is a typical male disease, demonstrating that some campaign messages were not effective.

Other findings which may be related with campaign effectiveness was the decrease in the proportion of patients who attended healthcare centres without PPCI, as well as patients who attended primary care centres, leading to an improvement on patient delay, which decreased from a median of 113.5 (A) to 94.5(B). It is known that the sooner reperfusion therapy in STEMI is attained the better is the patient prognosis (Bates & Jacobs, 2013; Denktas et al., 2011; Polańska-Skrzypczyk et al., 2015). Shortening patient delay allows to decrease time to diagnosis and consequently to perform treatment earlier. The predictors which contribute the most for longer patient delay in Portugal were identified previously, by Pereira et al. (2018), which are: *age ≥ 75 years old*, *symptom onset between 0:00 AM and 8:00 AM*, and *primary care unit before FMC*, on the other hand *call 112-EMS* and *EMS transport to the PPCI facility* was associated to shorter patient delay. Based on this information, it is possible to plan more efficient mass media campaigns, focused on minimizing the impact of these factors and targeting the specific groups (e.g. older patients). These actions should be important to reduce the patient delay, and allow timely treatment of STEMI patients.

The Pitagorica market research held in 2017, whose results are presented in this study, assessed population knowledge on MI, and its perception on MI severity and associated risk factors. The results were unpublished till now. Of the 1044 respondents, 95% associate chest pain with MI and the vast majority (96%) were aware that this pathology is an extremely serious disease that needs immediate treatment. Demonstrating the better knowledge about this pathology is the fact that 68% of the respondents answered that MI is diagnosed through an electrocardiogram, and 42% answered that the infarction results from the occlusion of a coronary artery. When asked about what they would do in the presence of a sign or symptom of Acute Myocardial Infarction, more than half of respondents (57%) stated that calling 112 would be the first option, although when asked about what they would do when faced with the symptoms of chest pain, with sweating, nausea and vomiting, only 38% reported calling 112.

Given the symptoms presented, going to a hospital emergency would be the common practice for 27% of respondents in this study. Pereira et al (2021) referred that findings similar to these ones were in line with the positive results observed in the behaviour of the Portuguese in the face of MI symptoms during the period in which the SFL initiative was in effect. Between 2011 and 2016, there was an increase in patients who called 112 (35.2% vs 46.6%) and a decrease in the percentage of patients who went by their own means to hospitals without interventional cardiology (54.5% vs 42.4%). We found similar results, with an increased proportion of patients calling 112 (group A 35.2% vs group D 49.6%). A decrease on proportions of patients who attended healthcare centres without PPCI (54.5% in group A vs group D 40.9%), and of those patients who attended primary care centres (group A 20.3%; group B 9.7%; group C 5.1%; and group D 2.4%).

Nevertheless, when we compared patient delay between groups B&C, despite apparent improvement in patients' knowledge reflected by the increase calling to 112, the decrease in attendance recurrence to healthcare centres without PPCI, and to primary care centres, an increase was observed on patient delay. This may be related to lack of knowledge of MI symptoms, which led people to seek help later. It is well known if it is intended to change people's behaviour, it is necessary to change what they think about a certain topic (Cavill & Bauman, 2004; Nancy & Dongre, 2021). For campaigns to produce behavioural changes and better results, they must be long lasting, their message must be reinforced, monitored and adjusted. In the other hand, another problem which may explain patient delay over the first five years may be related with an ad fatigue effect of the campaign.

This effect has been described before and is associated to campaigns which last too long on time without changing the message, and also when the message is repeated too much times. So, ad fatigue occurs when your audience sees your ads so often that they become bored with them and stop paying attention, reducing its effectiveness (Collinson et al., 2015). In 2016, SFL finished its programme and a new initiative was launched, Stent Save a Life (SSL), sharing the same mission, principles and objectives of SFL, with the intention extend them worldwide. The new direction of SSL Portugal made changed the campaign name to *Each Second Counts* and reduced some public actions, maintained active the site <https://www.stentsavealife.pt/>, as the main vehicle of message diffusion. As not all the population accede, the campaign effectiveness is probably decreasing through the recent years.

In addition to the reduction of the campaign effect, patient delay increased even more in group D, which certainly is related with Covid-19 pandemic. Several studies worldwide (Pereira et al., 2022; Pessoa-Amorim et al., 2020; Rodríguez-Leor et al., 2020) report a significant decrease in patients admitted to hospitals with STEMI and consequently decrease in PPCI. We found this effect in

Moment Covid survey, the patients admitted on first three weeks after the lockdown, March 18 to April 8, represented only 25% of the patients admitted between March 18 and May 6.

The decrease on STEMI admissions may be explained by the fear of becoming infected, which led people to avoid going to the hospital. An Italian study compared out-of-hospital cardiac arrest (OHCA) during pandemic period with same period of 2019, and referred an increase of 58% in OHCA, which supports the hypothesis of patients being avoidant of hospital attendance (Baldi et al., 2020).

As it is known the best benefits of reperfusion therapy in STEMI are achieved when this therapy is performed, preferentially within the first 2 or 3 hours after the symptom onset (Ibanez et al., 2018).

Total ischemic time is the sum of patient delay, calculated from symptom onset to FMC and system delay, from FMC to PPCI. A total ischemic time longer than four hours has been identified as an independent indicator of mortality within a year of STEMI (De Luca et al., 2013; Newby et al., 1996).

In our study total ischemic time had been increasing progressively from group A to D, with major difference between groups C and D. The same was observed in system delay progression. Pereira et al explained the increase in system delay, which reflected in total ischemic delay, as a consequence of widening access to less populated and more remote regions. The time of the system started earlier and is necessarily longer due to an increasing proportion of patients in remote regions calling the EMS number and receiving a prompt response. Thereby, improvements in prehospital management and patient transport may contribute to worsen system delay, because FMC contact was earlier and the counting to the system side starts at this point, even though it may also mean a substantial improvement in the system itself (Pereira et al., 2021).

In general, delay to treatment in 2020 (Group D) has increased, significantly or not, in all partial times, patient delay, system delay, even in door-to-balloon, which was very stable all over the years.

Covid-19 is the reason for this finding. At this period, despite an increase in patients' education about MI recognition and how to proceed if MI occurs, there was a feeling of fear to get infected with a new disease, barely known, with high mortality rate, which lead patients to contact medical help later. The increased calling to *Linha Saúde 24* means that patients seek for a diagnosis confirmation before getting the right help. The patient delay in group D increased 10 min in median, comparing with group C. On system side, indicators were even worse, system delay increased 20.5 min in median, D2B increased 6.5 min and time from admission to CathLab increased 5 min. Total ischemic increase 29 min in median.

Additionally, indicators of quality as the proportion of patients who were within the guidelines' limits decreased, with exception of *Time from FMC to ECG* ≤ 10 min, which registered similar proportions. D2B ≤ 60 min decreased 5.4%, system delay ≤ 90 min decreased 8.1% and total ischemic

time ≤ 120 min, decreased 2.9%. These findings are compatible with the constraints that health services were submitted to, such as shortage of intensive care units, beds, ventilators and appropriated therapeutic. Also, human resources were constantly under pressure, at risk to be contaminated, which made them use unusual Personal Protective Equipment, taking longer time to dress and preparation. Similar situations were felt and lived worldwide (De Filippo et al., 2020; Pessoa-Amorim et al., 2020; Rodríguez-Leor et al., 2020).

2.5.1 Conclusion

During the term of the SFL initiative in Portugal, there were positive changes in indicators of patient delay, such as lower proportions of patients who resorted to primary health centres and local hospitals without PPCI facilities, as well as an increase in the proportion of those who called the EMS number. These results were more significant in early years of SFL implantation, mostly as a result of the public awareness campaign. In the subsequent years this effect was attenuated, probably because the campaign became too repetitive or less intense, which may lead the audience to become bored and stop paying attention, weakening its efficacy. System delay did not significantly change over this period.

Moreover, it was even worse due to an unexpected situation, the Covid-19 pandemic. Covid-19 exposed health systems weaknesses, and clearly demonstrate that something unexpected can be a huge draw-back in healthcare programmes. This leads to deterioration of healthcare standards that have been refined over the years. These lessons must be taken into account in the future strategies and decision-making, particularly in strengthening current educational programmes aiming to shorten patient and system delays and be prepared for the unexpected.

Stent for Life - Economic Impact 2010-2013

Did Covid-19 Change It?

3.1. Chapter resume

Portugal integrated the Stent for Life Initiative (SFL) in 2011 as one of the European countries with lower rate of primary percutaneous coronary angioplasty (PPCI). It is known that the earlier PPCI is implemented, mortality and morbidity decrease. Programs like SFL, showing efficiency gains related to less heart failure, less medication and devices usage, and less indirect costs such as productivity loss, may convince political decision-makers that it is worthy to spend money in them. Covid 19 brought a huge impact on societal behaviour and on healthcare system performance leading to worse results in myocardial infarction prognosis. This work intended to assess the economic evaluation of the SFL initiative in Portugal in its early years of implementation, between 2010 and 2013, and also how COVID-19 has impacted the STEMI admissions and treatment.

Based on national databases, STEMI admissions within the 12 hours of onset, mortality and readmission rate were analysed. Changes in clinical outcomes, financial outcomes and burden of disease were estimated based on the increased use of PPCI throughout 2011-2013 and compared to baseline. To compare COVID-19 impact on STEMI admissions, the baseline evolution between 2010-2013 was compared to 2019-2021 triennia. The proportion of patients treated with PPCI from raised from 71.4% in 2010 to 84.5% in 2013. In 2019 PPCI reached 93.1%. In 2020, it was 90.7%, which may reflect the hospitals overload at that period. In 2021 it was 95.1%. Mortality rates associated to each therapy in 2010 were: no-reperfusion, 15.3%; thrombolytics, 11.8%; and PPCI, 4.7%. In 2013 it was: 14.4%; 7.9%; 4.8%.

The treatment change in treatment mix from 2010 to 2013 has saved a total of 414 lives. Despite PPCI have higher cost per procedure, SFL has contributed to the reduction of STEMI burden disease with 63 million euros net saving. PPCI was slightly reduced in 2020, but in 2021 had already increased, suggesting the Portuguese SFL effect was successful.

3.2. Introduction

Portugal integrated the Stent for Life Initiative (SFL) in 2011 as one of the European countries with lower rate of primary percutaneous coronary angioplasty (PPCI) (Kristensen et al., 2014). Since the first moment, the main goal of the Portuguese SFL was to increase the number of patients with ST

elevation myocardial infarction (STEMI) submitted to PPCI. Evidence shows that the earlier PPCI is implemented, the better the clinical results are, in terms of mortality and morbidity (Ibanez et al., 2018). Time to treatment is crucial for the success of these programs, and may be affected basically by two barriers, patient delay and system delay, which were also main targets of the Portuguese SFL task-force, who established an action plan set on two milestones, one directed to the public in order to clarify symptoms of acute myocardial infarction (AMI) and how to act in their presence, and other directed to health professionals and emergency system to improve system performance in STEMI care (Pereira et al., 2015; Pereira, Calé, et al., 2018; Pereira et al., 2014; Pereira, Pinto, et al., 2018).

Healthcare has been changing and has changed since 2011. Not only the focus on efficiency and cost-effectiveness has been raising but the historical event of COVID-19 during 2020 and the impact it has had in the healthcare system is undeniable (Juneau et al., 2022).

In any society with limited resources, demonstrating the economic impact of all actions which intend to improve health results is key. Society and political decision-makers must be convinced that it is worthy to spend money in programs like SFL providing they show efficiency gains related to less heart failure, less medication and devices usage, and less indirect costs such as productivity loss (Pereira & Pereira, 2020; Timóteo et al., 2020).

COVID-19, in the other hand, overloaded the Healthcare System and moreover, patients were reluctant to reach hospitals which in a condition like STEMI, where time for PPCI is key for better results, may jeopardize all the work that has been done in the previous years. It has been already identified that there was a reduction in cardiac procedures during the pandemic and that the all-mortality for percutaneous coronary intervention has increased during this period (Leyva et al., 2021; Tam et al., 2021).

This work intends to assess: 1) the economic evaluation of the SFL initiative in Portugal in its early years of implementation, between 2010 and 2013; 2) how COVID-19 has impacted the STEMI admissions and treatment.

3.3. Methods

3.3.1. Databases

Different databases were combined for this analysis:

- National Registry of Acute Coronary Syndromes (RNSCA) (2010-2013 and 2019-2021), ClinicalTrials.gov identifier NCT01642329, from Portuguese Society of Cardiology (SPC)
- DRG Hospitalizations Registry (2010 and 2013) from Central Administration of the Health System (ACSS).

Within the DRG Hospitalizations Registry, STEMI cases were selected as inpatient cases with primary or secondary diagnostic ICD-9-CM 410.xx. The selected patients were then scrutinized regarding the procedures that were performed during the inpatient stay (Table 3.1).

Acute Coronary Syndromes (ACS) registries provided more detailed information on the distribution of STEMI admissions by age group, incidence of ACS admissions within the 12 hours of onset, mortality distribution per age-group and readmission rate.

Table 3.1 - ICD-9-CM codes considered for procedure identification

Procedure	ICD-9-CM Procedure Codes
PCI	00.66
	36.06
	36.07
	36.09
Thrombolytics	36.04
	99.10

PCI: Percutaneous coronary intervention

3.3.2. Economic Evaluation of SFL in the early years of implementation

Changes in clinical outcomes, financial outcomes and burden of disease were estimated based on the increased use of PPCI throughout 2011-2013 and compared to a baseline where admissions and mix of treatment were constant since 2010. The model (Figure 3.1) assumes the only drivers to the improved PPCI rates are STEMI initiatives, improved emergency medical services, Hub and Spoke protocols, additional catheterization labs, and additional interventional cardiologists.

Change in clinical outcomes is supported by the clinical importance of timely STEMI admissions and PPCI as the preferred treatment according to the guidelines (Ibanez et al., 2018). It is widely supported that the non-admitted population would have a higher mortality rate than those patients who were admitted (Kolansky, 2009; Ribeiro et al., 2003). This improvement in STEMI mortality and morbidity was calculated in terms of increased worker productivity. The model then compared the improvements in worker productivity against increased spending needed to support the incremental PPCI load.

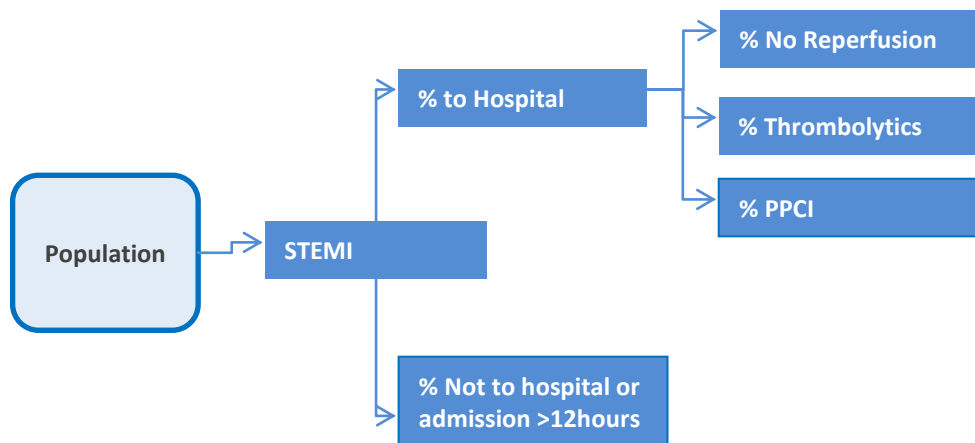


Figure 3.1 - Grouping patients by treatment

Financial outcomes consider changes in fixed costs, variable direct and indirect costs and the burden of the disease. If the indirect costs reduce due to a more productive workforce (economic benefit of mortality and morbidity reduction from increased PCI) exceeds the increase in direct and fixed costs, cost savings would result. Fixed costs consider the building of new Cath Labs, hiring interventional cardiologists and reorganization of STEMI network.

Direct Variable Cost Data

Variable direct costs consider the costs incurred from increased procedure volume.

Cost per procedure considers the price of the DRGs established in Portaria 20/2014 from 29th January (Ministério da Saúde, 2014). For each procedure, the cost is estimated as the weighted average of the prices of the different DRGs in which the patients were classified (Table 3.3). The estimated values include not only the procedure but all the in-patient costs associated (physician and staff salaries, pharmaceutical and interventional supplies and other items such as bed costs and facility overhead). In 2013, the Diagnosis-related group (DRG) version in use was the AP-DRG 27.

Indirect costs measure the cost from productivity loss in the working population due to STEMI. It is measured by the amount of money the individual would have been paid if not sick or dead. It is expected that by reducing mortality and morbidity from the increased PPCI volumes reduce, the indirect cost of lost productivity reduces.

The loss of productivity was measured using gross domestic product (GDP) per capita (World Bank, 2013), from not working due to either mortality or morbidity. For the loss due to mortality, the present value of an individual's productivity loss for those in the employed population between the ages 25 to 65 years was determined. For morbidity, both the productivity loss from the individual not working temporarily as he/she recovers and the present value of the loss from those dropping out of the workforce were measured. For those temporarily not working, it was estimated that a STEMI

patient admitted and treated with a PPCI would be able to return to work at fully capacity in no more than one month (Kovoor et al., 2006).

Then the work-time-missed was adjusted for the other treatment types based upon the differences in readmission rates (Aasa et al., 2010; Widimsky et al., 2007). An estimate of the percentage of patients who drop out of the workforce was also included and estimated to be 9.5% based on similar analysis (Warraich et al., 2018).

At last, the reduction in the burden of disease was also estimated. Burden of Disease shows the reduction of health from disease due to mortality and morbidity as measured with the value of a Statistical Life year (VSLY) and disability weights (Chew et al., 2009; Miller, 2000).

The burden of disease from mortality was calculated as the present value from death age to Portugal's average life expectancy of 80 years using the VSLY. For burden of disease from morbidity, the disability weights to indicate the loss of perfect health due to the disease were used. According to Aasa et al. (2010) and Callea et al. (2012) a STEMI patient treated with PPCI has a disability weight of 24%. For patients treated with thrombolytics this disability weight was 27%. The other treatment groups (no reperfusion and Coronary artery by-pass graft) were adjusted according to mortality and readmission differences.

Impact of COVID-19 on STEMI admissions and treatment

To compare the impact of COVID-19 on STEMI admissions, the baseline evolution between 2010-2013 was compared to 2019-2021 triennia. Admission rates, treatment mix and mortality were compared to understand not only the evolution between 2013 and 2019 but also the impact the pandemic had on admissions, perfusion candidates and treatment mix.

3.4. Results

According to the national DRG registry the incidence of acute coronary syndromes in 2010 was 166 per 100,000 population and 180 per 100,000 population in 2013. Out of the ACS patients admitted to hospitals, 83.2% were admitted within the first 12-hours of on-set of symptoms, a percentage that raised to 87.2% in 2013. In 2010, 45.9% of the ACS admissions were STEMI, a number that reduced to 39.4% in 2013 (Table 3.2).

Table 3.2 presents these values and evolution of treatments performed on admitted STEMI patients. There has been an evolution on admitted patients who were submitted to PPCI from 71% in 2010 to 85% in 2013. Accordingly, the number of patients who were submitted to thrombolytics and those who did not receive reperfusion reduced, in total, from 28.6% (20.7%+7.9%) to 15.5% (11.3%+4.1%) between 2010 and 2013.

Table 3.2 - Evolution of ACS and STEMI admissions between 2010 and 2013 in Portuguese Hospitals

	Baseline	Early Years of SFL Implementation		
	2010	2011	2012	2013
Incidence of ACS per 100,000 inhabitants*	166			180
% of ACS admitted <12h	83.2	85.1	86.2	87.2
% of STEMI admissions	45.9	42.3	42.6	39.4
Treatment Mix				
No-reperfusion	20.7%	15.0	12.5	11.3
Thrombolytics	7.9	8.2	10.6	4.1
PPCI	71.4	76.8	76.9	84.5

Source: DRG; RNSCA. ACS: Acute coronary syndromes; PPCI: Primary Percutaneous Coronary Intervention; STEMI: ST-elevation myocardial infarction

The mortality rates associated to each of the therapies in 2010 were collected from the National Registry of ACS: no-reperfusion, 15.3%; thrombolytics, 11.8%; and PPCI, 4.7%. In 2013 the mortality rate was: no-reperfusion, 14.4%; thrombolytics, 7.9%; and PPCI, 4.8%. The shift in the treatment mix to therapies with lower mortality rates is expected to reduce STEMI mortality. It is estimated that the change in treatment mix from 2010 to 2013 has saved a total of 414 lives in this period (Bastian Wein et al., 2020). On the morbidity side, it is assumed that PPCI patients return to work after one month. As for the remaining patients, the percentage of people who drop out of the workforce is estimated to be 9,5% (Aboa-Eboulé et al., 2007; Kanichay et al., 2010).

3.4.1 Economic Evaluation of SFL in the early years of implementation

On the cost side, namely, fixed costs, over the time-period, there was a slight increase in the number of practicing interventional cardiologists from 73, in 2010, to 79, in 2013. However, the number of Cathlabs declined from 32 to 28. The increment in fixed costs was considered negligible for the analysed purposes of this analysis, and so it was excluded. The estimated cost per procedure can be in Table3.3.

Considering the incremental number of PPCI cases at a higher cost per procedure, it is estimated that Stent for Life initiative has increased the variable costs in around 3.2 million euros in which were included hospitalization, intervention, pharmaceuticals, diagnostics and other costs.

As for the indirect costs associated to a reduction of productivity losses due to mortality or morbidity an annual loss of €16,303 equivalent to the GDP per capita in 2013 was considered. It was estimated that Stent for Life initiative has saved around 414 lives which translate in savings around

16.2 million euros. The reduction in morbidity is also significant with a total saving of 6.5 million euros.

Table 3.3 - Cost per procedure

Procedure	Estimated Cost
No-reperfusion	€3,626
Thrombolytics	€2,858
PPCI	€5,335

Source: Estimated from the weighted average of prices of DRGs registered for each therapy. Prices were for each DRG were detailed in the Decree-Law 163/2013, 24th April 2013. PPCI: Primary Percutaneous Coronary Intervention

These results are detailed in Table 3.4 - Estimated variable costs in 2013, (million euros). It is estimated that, in 2013, a total of 19.4 million euros was saved with the change in treatment mix for STEMI. The cumulative savings of the three year of analysis (2010-2013) is estimated around 37.2 million euros.

As for the burden of disease, the VSLY considers a disability weight of 0.24 for STEMI patients treated with PPCI, i.e., it is assumed that STEMI patients lose 24% of perfect health in one year. VSLY is estimated around €31,328, for STEMI patients. This means that society would be willing to pay €31,328 to avoid mortality and morbidity associated to STEMI. Overall, the Stent for Life initiative has reduced the burden of disease associated to STEMI from 756 to 693 million euros, a net saving of 63 million euros.

Table 3.4 - Estimated variable costs in 2013, (million euros)

Variable Costs	Costs if SFL Initiative were not implemented	Actual Results from SFL Initiative	Incremental Costs
Direct Healthcare Costs	20.2	23.4	3.2
Indirect Costs - productivity loss (Mortality)	189.1	172.9	(16.2)
Indirect Costs - productivity loss (Morbidity)	206.9	199.6	(6.5)
Total Costs	416.2	396.8	(19.4)

3.4.2 Impact of COVID-19 on STEMI admissions and treatment

Table 3.5 presents the evolution of STEMI admissions and treatment mix between the first triennia of the analysis 2010-2013 and the most recent triennia 2019-2021, as well as the mortality associated to each treatment.

The percentage of ACS admissions within the first 12-hours of symptoms had increased in the first years of SFL program. In 2019, however, it had reduced to 2010 baseline again, suggesting that the effects of the campaign were not maintained along the years. As such, the STEMI candidates to reperfusion that are highly dependent on getting to healthcare services within these 12-hours of onset of symptoms had slightly increase in the first 3 years of campaign.

Table 3.5 - Evolution of ACS and STEMI admissions during COVID-19 pandemic (2019-2021) in Portuguese Hospitals

	Baseline	Early Years of SFL			COVID-19 Pandemic		
	2010	2011	2012	2013	2019	2020	2021
Incidence of ACS per 100,000 inhabitants*	166			180			
% of ACS admitted <12h	83.2	85.1	86.2	87.2	83.4	84.4	80.3
% of STEMI admissions	45.9	42.3	42.6	39.4	44.4	47.4	46.9
Treatment Mix							
No-reperfusion	20.7	15.0	12.5	11.3	5.4	7.3	4.9
Thrombolytics	7.9	8.2	10.6	4.1	1.5	2.0	0.0
PPCI	71.4	76.8	76.9	84.5	93.1	90.7	95.1
Intra-Hopitalar Mortality associated to each Treatment							
No-reperfusion	10.6	11.6	13.7	14.4	11.5	9.1	NA
Thrombolytics	0.0	4.0	3.8	7.9	0.0	11.1	NA
PPCI	4.7	5.2	4.1	4.8	2.5	2.7	

Source: DRG; RNSCA. ACS: Acute coronary syndromes; STEMI: ST-elevation myocardial infarction PPCI: Primary Percutaneous Coronary Intervention

On the other hand, it is seen an evolution of the treatment mix in those patients that were candidates to reperfusion, with an increase in the percentage of patients that were treated with PPCI from 71.4% in 2010 and 84.5% in 2013. In 2019, the number of PPCI in patients candidate to reperfusion already reached the 93.1%. In 2020, this number decrease to 90.7, which may reflect the overload of hospitals at that period which prioritized other patients and procedures, The increase to 95.1% in 2021, suggests that the acceptance and change in practice in hospital has been consistent not only in the early years of SFL but in the years after.

As per the evolution of the mortality, it says more about the practice than about the change in treatment mix. No-reperfusion mortality rates has been quite stable, in the other hand, PPCI mortality has decreased from 2013 to 2019, suggesting that the practice in hospitals has brought better results for the procedure.

3.5. Discussion

The implementation of the SFL Initiative in Portugal in 2011, allowed an increase in the number of STEMI patients treated by PPCI on a timely manner, which can be seen by the increase of the number of PPCI per million of inhabitants, which was 264 in 2010 and 338 in 2013 (Pereira et al., 2014), reaching 385 in 2021. Besides this improvement in quantity of PPCI, quality results were also achieved, with more patients dialling the emergency system number seeking for help, and significant decreases in patient delay and system delay times (Pereira et al., 2014).

The approach developed by the SFL initiative to enhance PPCI in patients with STEMI mostly saved lives by the reduction of STEMI-associated mortality. One of the aims of this project was to improve the efficiency of the way to treat patients with acute myocardial infarction, not by implementing new technologies or devices but to treat them by PPCI in a faster and safe manner. During the analysis period we saw an incremental number of patients who were admitted in <12 hours and treated by PPCI, with significant decreases in the number of patients who were no-reperfused and in those who were treated with thrombolytics. This shift on treatment procedures presumes a reduced mortality and morbidity associated to STEMI. These results allowed estimating a reduction on mortality, with a total of 414 lives saved in this triennium. Similar results were found in other countries where health-networks and awareness campaigns on STEMI symptoms and proper behaviour on population were taken (Birkemeyer et al., 2013).

A study recently published (Bastian Wein et al., 2020) compared the associated health and socioeconomic impact. It was a project within the Stent for Life initiative where an economic project was launched and applied to four model regions: Romania, Portugal, the Basque Country in Spain, and the Kemerovo region in the Russian Federation. The Portuguese results are the same presented in our study.

In all regions studied, absolute mortality rates were reduced by between 3.1% and 10.1%. Also, it was verified a change in the distribution of treatment patterns with an increase of PPCI per million population of between 29% and 303%, with higher growth rates for those countries where the starting points were lower. As referred, these achievements were attained through public awareness campaigns which were focused in reducing time to first medical contact, and by reorganizing prehospital and intra-hospital processes to improve time of first medical contact to balloon and at the end time to treatment (Bastian Wein et al., 2020).

For most of the regions analysed this involved the increase of PPCI capacity by building new catheterization laboratories (Cath Lab), training of additional interventional cardiologists, as well as providing new protocols for the emergency services. The Basque Country results with increased numbers of PPCI and reduction in mortality were achieved with the same number of catheterization

laboratories and cardiologists (Regueiro et al., 2015). In Portugal something similar happened, the clinical results were obtained without additional investments in CathLabs and cardiologists.

We must bear in mind that Portugal in 2011-2013 was under International Monetary Fund intervention, which impose the government several investments restrictions and public programs funding (Morais Nunes et al., 2019). So, it was mostly impossible to improve infrastructures, particularly to implement new Cath Labs, despite it was considered by the Portuguese SFL to be required one more CathLab, at centre region, to cover this country region, which was the only one where populations take more than 120 minutes to reach a PPCI centre (Pereira, Pinto, et al., 2018).

Changing practice, to reach better outcomes, is usually associated to an increase on cost to the healthcare system. Interventional, new innovative procedures usually represent an extra cost to the system that needs to be evaluated to understand the economic impact of the measures taken and whether the costs incurred were worth them. The economic results should be taken in consideration when these kinds of actions assume national proportions, and it is important to convince governmental institutions that these programs are advantageous and worthy (Aluko et al., 2022). In Portugal the main costs associated to SFL implementation were the increment in PPCI, a procedure that is more costly than the no-reperfusion or thrombolysis.

The increment in variable direct costs of the healthcare system was surely compensated by the reduction in mortality and morbidity as seen in the previous chapter. In these cases, where structural changes are decided, decision makers cannot look at hospital costs only, but to the savings and benefits they are bringing to the society, and this is where mortality and morbidity benefits fit in. We can see from this analysis that there was a clear economic benefit from reducing mortality and morbidity in the society that largely compensate the direct (hospital) costs. According to this analysis, in 2013, a total of 19.4 million euros was saved with the change in treatment mix for STEMI and a cumulative saving in the three year of analysis (2010-2013) is estimated around 37.2 million euros (Bastian Wein et al., 2020).

Almost ten years later of the SFL implementation in Portugal, the COVID-19 pandemic affected the whole world with huge impacts in the healthcare systems and healthcare provision. In one hand, healthcare services were full of capacity and no being able to treat all the needs, on the other hand there was a general fear of reaching healthcare services, which in a procedure like PCI where time counts has a huge impact. Nevertheless, the PPCI number per million inhabitants is increasing even in 2020. According to Portuguese Association of Cardiovascular Intervention it was 352 in 2019, 356 in 2020 and 385 in 2021.

3.5.1. Conclusion

The results from this study suggest there are two main considerations, the impact SFL program had on the population and the impact SFL program had on coronary services. If we consider the main outcome that is population dependent: ACS patients admitted <12-hours, we can see a small impact in the early years of SFL program that was not held in the later years (2019-2021) and were probably affected by the COVID-19 pandemic as well.

On the other hand, there seems to be a consistent change in the treatment mix within patients' candidates to reperfusion, with a steady increase in the early years of SFL program that was even higher between 2019-2021. The change in practice appears to also have a positive impact on the intra-hospital PPCI mortality that reduced in 2019-2020. Despite we were not able to reproduce the economic model used in the early years of SFL, which is a limitation, these findings, associated to no implantation of new Cath Labs, and maintenance of interventional cardiologists' number, allow us to assume SFL initiative is still cost-effective.

The implementation of the SFL Initiative in Portugal in 2011, had a positive impact on the treatment of STEMI patients in Portugal. There was an increase in the number of patients treated with PPCI which results in less mortality and morbidity in the Society. Considering all the costs of treatment mix change and the benefits in 2013, a total of 19.4 million euros were saved. The COVID-19 pandemic had a small impact in the SFL results though. Even before the pandemic, the number of patients reaching hospital on time had decreased back to 2010 numbers. The change in treatment mix was affected in 2020 at the peak of the pandemic, with a reduction of PPCI done in candidates to reperfusion but in 2021 had already increased compared to 2019, showing that the change in treatment mix in Portugal was a success since the SFL program implementation in 2011.

A Dignity Approach to Hospital Health Services: a study on organisational dignity and Stent For Life Initiative in Portuguese hospitals

4.1. Chapter resume

Dignity has been considered a component of responsiveness in health systems evaluation (Adelabu et al., 2022; WHO, 2000). We propose to expand the dimension of dignity in order it has a main role in the health systems performance evaluation, particularly in hospital services performance evaluation. In addition to this proposal, the current study aims to analyse the influence of the organisational dignity and the quality of the Stent for Life Initiative (SFL), on the contribution of that initiative to hospital firm's and users' dignity, evaluated by healthcare professionals of Portuguese hospitals. The study was a cross-sectional study with the participation of 127 health professionals from 16 Portuguese public hospitals. Using the Delphi method, the EPRA-DO organizational dignity scale was adapted to assess organizational dignity in hospitals organizations.

To evaluate the SFL quality, users' dignity, and hospital firm's dignity, a global rating scale was used, in which participants selected grades from 0 to 10. The data were collected by Google forms link from December 2021 to April 2022. Exploratory Factor Analyses (EFA) was applied to identify dimensions of organizational dignity for hospitals from de healthcare professional's evaluation. Confirmatory Factor Analyses (CFA) was applied to verify the dimensions identified by EFA. Structure Equations Model (SEM) was applied for the hypothesis test. EFA was calculated by SPSS 20. To analyse CFA and SEM, PLS-PM was applied.

The Hospital Organizational Dignity scale was composed of 21 items and three factors. The three factors showed construct, convergent and discriminant validity. The hypothesis that the quality of SFL positively influences hospital firm's and users' dignity was supported, with the hypothesis that hospital organizational dignity positively influences the users' dignity being supported too, but that it positively influences the hospital firm's dignity was not confirmed. Both SFL and organizational dignity influence users' dignity. We encourage researchers to carry out new studies to improve the dignity approach to Health Services. The Dignity Approach to Hospital Health Services can help healthcare managers to improve the hospitals' performance in promoting humanized treatment to users and healthcare professionals in times of inhumane health services.

4.2. Introduction

Dignity must be a guide for health activities (Horton, 2004). The main goal of health systems is to improve the population's health status, but it is insufficient for measuring its performance. Financial fairness and responsiveness have been considered two other goals that complete health system quality (Murray & Frenk, 2000). Responsiveness includes respect for people which means respect for dignity, individual autonomy, confidentiality (Murray & Frenk, 2000), and communication (WHO, 2000).

Dignity has been considered a component of responsiveness in health systems evaluation (Adelabu et al., 2022; WHO, 2000). We propose to expand the dimension of dignity to include it as main role in the health systems performance evaluation, particularly in-hospital services performance evaluation. Additionally this study aims to analyse the influence of the organisational dignity and the quality of the Stent for Life Initiative (SFL), through the contribution of that initiative to hospital firms' and users' dignity, evaluated by healthcare professionals of Portuguese hospitals.

The concept of dignity has assumed different meanings throughout history (Lanzón, 2019) and changed from a concrete to an abstract conception (Jacobson, 2009). In antiquity, dignity was understood as a concept of socio-political characteristics (Lauxen & Barretto, 2018). In the shift to the Middle Age, with the advent of Christianity, it began to be recognised as an intrinsic human being value, a concept that reached its peak in the Modern Age, with Kant (Comparato, 2015).

In Kantian philosophy, the human being is the only one endowed with reason capable of morality. Morality deals with duties to oneself and others. "Morality is the only condition that can make a rational being an end in itself since only through it, is possible to be a legislating member in the kingdom of purposes. Therefore, morality, and humanity as capable of morality, are the only who have dignity." (Kante, 2007, p. 77).

Dignity involves the recognition of the dignity of other human beings, "the respect that I have for others, or that others can demand from me, is also the recognition of dignity in other men, this is, of priceless value, which has no equivalent for which the object of esteem could be exchanged. The evaluation of something as no value is contempt" (Kant, 2013 p. 231-232). In Kant, autonomy is inherent to the human being because he is endowed with reason, capable of making moral choices, and this autonomy is inalienable "autonomy is, therefore, the basis of human nature and of all rational nature" (Kant, 2007, p. 79). Kantian dignity inspired the Universal Declaration of Human Rights (UN, 1948) which states that "All human beings are born free and equal in dignity and rights. Endowed with reason and conscience, they should act towards one another in a spirit of brotherhood."

Dignity in the Kantian concept is considered abstract (Jacobson, 2009). Concrete dignity is contingent, of a social nature and is constructed in social interactions. The dignity of the self consists of self-respect arising from the treatment one receives from others, which means that the individual's dignity, the perception of self-worth, is built in social interactions. The way respect and value are transmitted either through individual or collective behaviour is named relational dignity (Jacobson, 2009). In studies on dignity in health, it is essential to distinguish between human dignity and social dignity. Human dignity makes sense when discussing the right to health, a right for all, while social dignity refers to dealing with the treatment and services offered to users (Jacobson, 2007).

Every human interaction involves individuals or groups in procedures with the potential to promote or violate dignity. Violations of dignity can occur in situations where someone is in a position of vulnerability, while the other remains indifferent, showing preconception, arrogance, hostility or irritability. This situation is common in relationships in which there are asymmetries between actors. The violation of dignity causes loss and damage to the individual. The promotion of dignity can occur when an actor expresses trust, compassion, solidarity, reciprocity, harmony, empathy, honesty, whether at the individual or collective level (Jacobson, 2007).

Interactions between hospital staff and users are permeated by asymmetric relations of power in which users are the vulnerable part. The dignity relationships between health system staff and users have been evaluated inside responsiveness evaluation (Adelabu et al., 2022; WHO, 2000). We propose that dignity in those relationships should be specifically evaluated in a separate way.

With the aim of evaluating and implementing human dignity practices in organizations, Aguado et al. (2017) propose a strategic model based on the Integrative Social Contracts Theory (ISCT), Maslow's hierarchy of needs, Herzberg's Two-Factor Theory and in the Stakeholders Theory. The proposal considers human dignity and morality as key elements for the development of business strategies, operations and daily decision-making. From this perspective, the relationship between companies and society consists of a moral macro-contract aligned with hyper-norms that protect human dignity and social well-being. Hyper-norms are established universal principles, such as the Universal Declaration of Human Rights, the International Convention on Civil and Political Rights. Macro-contracts guide the relationships between companies and different communities, which, in turn, give rise to micro-contracts between companies, national and international economic organizations, between companies and civil organizations, between departments of the same company and other relationships in which businesses are inserted.

Micro-contracts should reflect micro-norms that constitute shared understandings of moral norms, which in turn reflect hyper-norms. In summary, hyper-norms should guide macro and micro-contracts and micro-norms. Maslow's hierarchy of needs theory supports the stages of business

evolution, in order to develop the dignity of the firm, based on the principle that the people who are part of and interact with the company, wish to reach the state of self-realization. Herzberg's Two-Factor Theory helps to differentiate companies in terms of promoting human dignity in the internal environment: those that focus mainly on hygienic factors and those that stand out for motivational factors. The company's dignity can be assessed from the perception of employees who experience the internal environment and are aware of how hyper-norms are considered in macro and micro contracts. We propose that hospitals firm's dignity should be evaluated by their physicians, nurses, technicians and other employees.

The theory of organizational dignity, based on social dignity, proposes that relations between companies and stakeholders occur through practices that can promote or violate the dignity of stakeholders. These practices convey the company's culture of dignity guided by ethical values and focused on the interests of stakeholders. Organizational dignity is assigned to organizations by stakeholders who assess it in terms of moral, legal, and pragmatic standards. When assessing organizational dignity, stakeholders do it through the perceived dignity of the practices they experience and the perceived dignity of practices pointed at other stakeholders (Teixeira, 2008).

Organizational dignity, based on social dignity, proposes to evaluate the dignity of an organization by the different perspective of firm's dignity which is based on human dignity. By the organizational dignity perspective, the organizations must evaluate their dignity based on their own stakeholders' evaluation. But which stakeholders? The key stakeholders, without whom organisations can't survive (Clarkson, 1995). Success of an organisation depends on key stakeholders' satisfaction (Bryson, 2004). Healthcare staff and users are the hospitals key stakeholders (Chmielewska et al., 2022). We propose that hospitals must evaluate their practices toward staff and users by the perspective of organisational dignity.

Summarizing our proposal, the studies on dignity regarding hospitals' service, should be evaluated by the organizational dignity and firm's dignity perspectives. Moreover, we propose that the evaluation of organizational dignity positively influences the evaluation of a hospital firm's dignity, as health service' practices are the concrete unit with whom stakeholders interact. It is based on the experience with those practices, stakeholders can evaluate the hospital firm's dignity.

4.3. Methods

To present the model and hypothesis for this study it is necessary to understand the SFL.

Ischemic heart disease, particularly ST-elevation myocardial infarction (STEMI), is the leading cause of death worldwide, with significant socioeconomic costs due to significant health expenditure as well as loss of labour productivity (Deuze & Witschge, 2018; Leal et al., 2006). Evidence-based

guidelines recommend primary percutaneous coronary intervention (PPCI) as the leading reperfusion strategy for the treatment of STEMI if it is timely performed, and emphasize its importance to reduce morbidity and mortality in this population (Ibanez et al., 2018). Despite the clear scientific evidence, reperfusion strategies vary widely across Europe, which led to the constitution of SFL (Kristensen et al., 2014; Widimsky et al., 2009; Widimsky et al., 2010). This initiative was implemented in Europe in 2008 by the European Association of Percutaneous Cardiovascular Interventions (EAPCI), supported by national cardiac societies and stakeholders (Widimsky et al., 2009). SFL targets were: (i) to increase the use of PPCI to more than 70% of all STEMI patients; (ii) to achieve PPCI rates of more than 600 per million inhabitants per year; and (iii) to offer a 24-hour, 7 days a week (24/7) PPCI service at all invasive facilities in order to cover the countries' STEMI population needs. Therefore, its main objective was to increase timely access to PPCI, in order to reduce mortality and morbidity in patients with STEMI. SFL was initially implemented in five countries (Knot et al., 2009) and, following the lead of other countries, in February 2011 it was implemented in Portugal (Pereira et al., 2014). Similar initiatives were also developed in the United States of America (Bradley et al., 2009; Jacobs et al., 2007).

Instead of new drugs or medical devices, the SFL ambitious goal to reduce mortality was achieved by improving the efficiency and availability of PPCI. Results of this successful initiative with the development of action plans at country or region level, their implementation and outcomes in various healthcare settings, were previously published (Kaifoszova et al., 2016; Kristensen et al., 2012; Pereira et al., 2014). The joint effort of the SFL, and their local partners successfully saves lives. Moreover, the increase in healthcare costs was outweighed by indirect cost savings, leading to a net cost reduction demonstrating that socioeconomic savings clearly outweigh the increase of healthcare investments and costs (B. Wein et al., 2020).

As referred previously, one of the major goals of SFL was to increase the number of patients with STEMI treated with PPCI, aiming to perform 600 PPCI procedures/per year/per million population. However, the incidence of STEMI is not the same in all European countries, and the goals had to be adjusted according to the national incidence. According to data published by the Portuguese Directorate-General of Health (DGS), the PPCI/year/million population ratio improved threefold in a decade, increasing from 106 in 2002 to 338 in 2013 (Pereira et al., 2016). Besides the improvement in the number of treated patients, the SFL also aimed to improve the quality of STEMI treatment, by reducing reperfusion time. Delays should be kept as short as possible, to reduce complications and mortality. Evidence has shown that the therapeutic effect and the prognosis of patients with STEMI strongly depends on the time to treatment, especially the reperfusion time; that is, "time is myocardium". Any delay in reperfusion will increase mortality (Nielsen et al., 2011).

Considering that time to reperfusion is the milestone of treatment for STEMI patients, both educational and logistical actions were taken, and simultaneously involved patients, their relatives, healthcare professionals and health authorities. The entire cardiology community agreed with SFL objectives, and it was easy to have these healthcare professionals committed with SFL values.

Hypothesis

Based on the firm's dignity, organizational dignity concepts, and SFL, we hypothesized that (Figure 4.1):

H1: The quality of SFL positively influences the contribution of that initiative to the hospital users' dignity, evaluated by healthcare professionals of Portuguese hospitals.

H2: The quality of SFL positively influences the contribution of that initiative to the hospital firm's dignity, evaluated by healthcare professionals of Portuguese hospitals.

Organizational dignity must be evaluated by key stakeholders. In this study, we choose hospital healthcare professionals to assess hospital practices under the approach of organisational dignity. WHO (2003) points out the importance of medical staff in assessing the hospital's social goals achievement.

Organisational dignity evaluated by employees has five dimensions: practices of employee promotion, practices of social responsibility, practices of respect for employee rights, the offer of quality products and services, and non-misleading practices (transparency) (Teixeira & Oliveira, 2021). We advocate that firm's dignity is influenced by organisational dignity. Regarding the firm's dignity, the hyper-norms are reflected in macro and micro contracts. These contracts are established between the firm and its stakeholders, then these hyper-norms should be reflected in practices toward them. Regarding this rationale, we consider that organisational dignity evaluated by employees can influence their evaluation of the hospital firm's dignity and factors that influence it. We hypothesised that:

H3: Practices of organisational dignity toward healthcare professionals positively influence the contribution of SFL to the hospitals firm's dignity, evaluated by healthcare professionals of Portuguese hospitals.

When employees evaluate the practices of organisational dignity toward them, they take into account practices toward clients (Teixeira, 2008), we hypothesized that:

H4: Practices of organizational dignity toward healthcare professionals positively influence the contribution of SFL to the user's dignity, evaluated by healthcare professionals of Portuguese hospitals (Figure 4.).

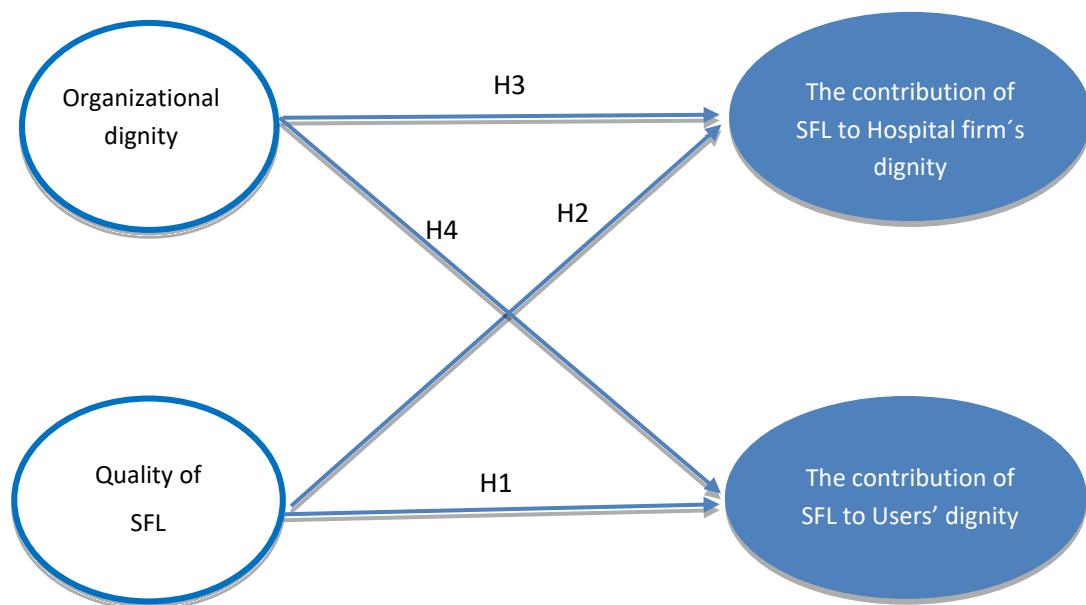


Figure 4.1 - Research model

4.3.1. Sample Size

Portugal has 16 public hospitals qualified to perform PPCI; 5 of them are located in the North region, 3 in the Centre, 6 in Lisbon and Tagus Valley and 2 in the South. According to the Portuguese Association of Cardiovascular Intervention (APIC), there are 80 Interventional Cardiologists. The correct number of nurses and Cardiac or Radiology technicians, who work in interventional cardiology settings, is still being determined, but we can estimate about 100 nurses and 80 technicians. Despite only 16 hospitals qualified to perform PPCI, their geographic distribution allows adequate coverage of the country (Pereira et al., 2021).

A sample of 127 health professionals from 16 Portuguese public hospitals was included in the study. This sample is higher than 74 cases calculated by G-Power for four predictors, regarding effect size 0,15 and power of 0,95. The sample consisted of 67 (53%) males, with a mean age of 43.3 ± 9.49 years, professionally composed by 42 (33%) physicians, 30 (24%) cardiac technicians, 17 (13%) radiology technicians and 38 (30%) nurses. From the point of view of regional distribution, 31 (24%) worked at centres in the North region, 24 (19%) in the Centre region, 60 (47%) in the Lisbon and Tagus Valley region, and 12 (10%) in the South. The respondents' overall professional experience had a median of 12 years with an interquartile range of 6-18 years.

4.3.2. Data collection

We requested APIC authorisation and collaboration to disclose the questionnaire and collect responses. The questionnaire was distributed to APIC members through its monthly Newsletter, with an introductory text and a link to the Google forms. The first publication was carried out in the December 2021 issue remained open until the April 2022 publication. Additionally, a monthly reminder e-mail was sent to the lab director of each centre to encourage their colleagues to answer the questionnaire.

4.3.3. Instruments

The EPRA-DO organisational dignity scale for companies developed by Teixeira et al. (2014) , was adapted to assess organisational dignity in hospital organisations. The EPRA-DO scale, Likert type, with five points (1) strongly disagree, 2) disagree, 3) indifferent (or neutral), 4) agree and 5) strongly agree), has 24 items divided into five factors: practices of employee's promotion, practices of social responsibility, practices of respect for employees' rights, offer of quality products and services, non-misleading practices (transparency). EPRA-DO scale is a scale used to measure organisational dignity services evaluated by employees.

The EPRA-DO scale questions were adapted for hospital services evaluated by healthcare professionals using the Delphi method, respecting the particularities of the method (Niederberger & Spranger, 2020), with three rounds performed. The panel of experts comprised ten health professionals who work in providing care and/or management in a hospital context. In the first round, they were asked to analyse the content of each question, according to its applicability to the hospital organisation, and to assign percentages of agreement with the content of each question, considering 5% and multiples of 5%. In addition to this assessment, they were asked to suggest modifications if they considered the content inadequate, or suggest new questions they deemed necessary. A concordance index of 85% was used as a criterion for maintaining the questions.

At the end of the first round, 18 questions were adjusted, one was excluded from the original questionnaire, and five remained unchanged. After the second round, nine more questions were adjusted, with subdivisions and consequent duplication of four. Six new questions were included at the end of the third round.

The 33-item scale was sent to thirty health professionals in interventional cardiology, consisting of physicians, senior diagnostic and therapeutic technicians in the areas of cardiopneumology and radiology, and nurses, so that they could assess the clarity of the writing, assigning a score of 0 -100. For the 30 surveys sent, we obtained 25 valid responses. The clarity of the wording of the questions received a median of 100%, with an average greater than 92%.

To evaluate the SFL quality, users' dignity, and hospital firm's dignity, a global rating scale was used, in which participants assigned grades from 0 to 10.

Data analysis

The data were analysed applying descriptive and multivariate statistics. Exploratory Factor Analyses (EFA) was used to identify dimensions of organisational dignity for hospitals from the healthcare professional's evaluation. Confirmatory Factor Analyses (CFA) was applied to verify the dimensions identified by EFA. Structure Equations Model (SEM) was used for hypothesis test. EFA was calculated using SPSS 20. To analyse CFA and SEM, PLS-PM was applied.

The PLS-PM measurement model must meet some criteria to increase the model's accuracy. The average variance extracted (AVE) is equal to or higher than 0.5 (Fornell & Larcker, 1981), composite reliability equal to or higher than 0.7 (Nunnally, 1978), and *t* value between each indicator and related latent variable at a minimum level of 0.5 (Gefen & Straub, 2005) confirm the convergent validity. The discriminant validity, as assessed by analysis of the factor loading for each factor, must be higher in the latent variable to which it belongs, and lower in the other variables (Gefen & Straub, 2005). Another criterion for discriminant analysis is the square root of the AVE of each latent variable, which must be higher than the correlation between the latent variables (Chin, 1998).

4.3.4. Ethical considerations

This study was carried out within the scope of a doctoral program at the Instituto Superior das Ciências do Trabalho e da Empresa (ISCTE) and was approved by the work supervisor, Professor Luís Martins, Associate Researcher at BRU-ISCTE - Business Research Unit (IBS), and the scientific board of the Doctoral Business Administration program.

By responding to the questionnaire all participants declared they were informed about the purpose of the study, they were aware of the confidentiality of personal identification and demographic data, and their participation in the study was entirely voluntary.

4.4. Results

4.4.1. Hospital Organizational Dignity Scale Evaluation

Exploratory factor analysis

The 33 hospital organisational dignity scale variables were submitted to EFA, with varimax rotation and principal component extraction, generating a parsimonious scale and identify the underlying dimensions. The result indicated data factorability with a KMO of 0.899 and Bartlett's effectiveness

test with significance <0.5. The scale was composed of 21 items and three factors (Table 4.1) and an explained variance of 62.973.

The first factor with eight variables and Cronbach's Alpha 0.928 refers to the provision of health services, to the accomplishment of obligations with users and employees through the provision of quality health services and respect for the rights of both.

The second factor, with eight variables and Cronbach's Alpha 0.883, comprises practices supporting employee career development. In turn, the third factor, with five variables and Cronbach's Alpha 0.800, deals with responsibility towards society, offering humanised treatment to users and revealing the performance results of hospital activities.

Table 4.1 - Dimensions of the Hospital Organizational Dignity Scale

Dimensions	Component		
	1	2	3
1 Provides quality services to patients/users	.765	.002	.359
2 Facilitates community access to health care	.744	.184	.123
3 Ensures the health of employees	.720	.278	.182
4 Establishes transparent relationship with patients	.709	.260	.392
5 Ensures hygiene and safety conditions at work	.677	.171	.270
6 Respects the rights of users/patients	.670	.182	.187
7 Fulfils contractual obligations with its collaborators	.619	.319	-.020
8 Gives priority to the payment of its work obligations	.594	.308	-.128
9 Promotes collaborators based on their merit	.123	.841	.238
10 Promotes the career progression of its collaborators	.202	.824	.057
11 Enables the participation of its collaborators in career progression processes.	.184	.817	.192
12 Simplifies the career progression processes of its collaborators.	.198	.755	.385
13 Rewards the post-graduate academic training of its collaborators.	.159	.693	.193
14 It encourages the professional development of each collaborator.	.460	.651	.262
15 Engage its collaborators in change processes	.416	.623	.264
16 Encourages the personal development of collaborators	.492	.614	.200
17 Supports social solidarity institutions	.043	.194	.811
18 Promotes social responsibility actions	.110	.340	.684
19 Offers humanised care to patients/users	.597	.045	.610
20 Discloses performance indicators related to its activity	.306	.287	.561
21 Invests in environmental sustainability	.346	.284	.527

4.4.2. Confirmatory Factor Analysis

The CFA confirmed the three factors identified by the EFA. The three factors presented construct validity with Cronbach's Alpha >0.8 and composite reliability > 0.7. Convergent validity was attested by the t value between the indicators and the latent variable >0.5. The three factors showed discriminant validity according to the criteria proposed by Chin (1998) (Table 4.2).

Table 4.2- Construct and Discriminant Validity: of the Hospital Organizational Dignity Scale

	Factor	Factor 2	Factor 3
Factor 1	0.748		
Factor 2	0.639	0.816	
Factor 3	0.668	0.632	0.748
Cronbach's alpha	0.886	0.928	0.805
Composite Reliability	0.910	0.941	0.864
Average Variance Extracted (AVE)	0.559	0.666	0.559

4.4.3. Model analysis and hypothesis testing

The variables Hospital Organizational Dignity, Quality of the SFL, Contribution of the SFL to Hospital firm's Dignity and Contribution of the SFL to Users' Dignity showed Cronbach's alpha.>0.8, composite reliability >0 .9 and AVE >0.7. Discriminant validity was confirmed following Chin's criteria (1998) (Table 4.3).

Table 4.3 - Construct and discriminant validity of model variables

	Organisational Dignity	SFL	Hospital firm's Dignity	Users' Dignity
Construct and discriminant validity of model variables	0.867			
SFL	0.231	1.000		
Hospital's Dignity	0.208	0.832	1.000	
'Users' Dignity	0.256	0.776	0.864	1.000
Cronbach's alpha	0.938	1.000	1.000	1.000
Composite Reliability	0.900	1.000	1.000	1.000
Average Variance Extracted (AVE)	0.752	1.000	1.000	1.000

The quality of the SFL and Hospital Organizational Dignity explained the SFL contribution to the hospital firm's dignity at 0.688 and the SFL contribution to the dignity of the user at 0.602 (Table 4.4)

Hypotheses H1, H2 and H4 were supported by presenting a significant p-value <0.5. Hypothesis H3 was not supported (Table 4.5).

Table 4.4 - R-square and adjusted R-square

R ²	R-square	Adjusted R-square
Factor 1	0.746	0.744
Factor 2	0.810	0.808
Factor 3	0.699	0.697
Hospital Dignity	0.693	0.688
User Dignity	0.608	0.602

Table 4.5 - Organizational Dignity and Quality of the SFL Direct Effects

Specific direct effects	Hypothesis	Beta	t-value	p-value
Stent for Life-> User's Dignity	H1	0.757	10.549	0.000
Stent for Life -> Hospital Dignity	H2	0.828	12.210	0.000
Organizational Dignity -> Hospital Dignity	H3	0.016	0.346	0.729
Organisational Dignity -> User's Dignity	H4	0.081	2.198	0.028

4.5. Discussion

In this study, we propose to expand the dimension of dignity instead of considering it as a component of responsiveness as proposed by WHO (2000), so it can assume a key role in the performance evaluation of the health system, particularly the performance of hospital services. In our proposal, hospitals should evaluate the dignity of their practice evaluation in the assessment of their firm's and organizational dignity. Why must both perspectives be considered in the hospitals' dignity evaluation? The answer to this question is that both views are different from each other, but complementary.

A hospital firm's dignity is related to the embedded hyper-norms inside macro and micro-contracts, and organisational dignity is related to dignity perceived by stakeholders when they interact with the hospital, and experience service practices.

From the stakeholders' experience it is possible to evaluate the Hospital Organizational Dignity, including employees, and from employees' experience is possible to evaluate Hospital Firm's Dignity. This study innovates the literature on the evaluation of hospitals' performance by expanding the dignity's dimensions and removing it from the responsiveness construct.

The dignity approach allows hospital managers to shed light on a performance topic - dignity - and to make decisions which can improve de services' quality. Based on that proposal this study aimed to analyse the influence of organisational dignity, and quality of SFL on the contribution of that initiative to hospital firm's dignity and users' dignity, evaluated by healthcare professionals of Portuguese hospitals.

According to Instituto Nacional de Statistical (2021), on health statistics for 2019 in Portugal, there were 238 hospitals throughout the country. Of these, 127 were private hospitals, 108 public hospitals and three public-private partnership hospitals. Public hospitals included 103 universal access hospitals and five military or prison hospitals. Treatment of acute myocardial infarction (STEMI) needs specific facilities, Cath Labs, with trained teams which should be available 24h per day, 7 days a week. These requirements are present mainly in public hospitals. Some private hospitals also offer these conditions, but the treatment of STEMI is very limited in these institutions. In mainland Portugal, only 16 hospitals are qualified for this kind of intervention. Nevertheless, its geographic distribution allows adequate country coverage (Pereira et al., 2021).

We considered that if the evaluation of the stent for life contribution to hospital firms' and users' dignity is positive, the firm's and users' dignity are probably is evaluated positively. This study addresses the question, *What contributes more to hospital firms' and users' dignity?* The organisational dignity? Or one specific initiative toward user's health, like Stent for Life? To measure organizational dignity from the perception of employees there is an EPRA-DO scale developed for measuring services dignity (Teixeira et al., 2014).

This scale was adapted to the Portuguese language of Portugal (Teixeira & Oliveira, 2021) as its original version was developed Portuguese Language of Brazil. Nevertheless, health services have specific features which make them different kinds of organizations. To measure hospital organisational dignity by the perceptions of healthcare professionals, the EPRA-DO scale was adapted.

EPRA-DO scale has five factors: practices of employee promotion, practices of social responsibility, practices of respect to employees' rights, the offer of quality products and services, and non-misleading practices (transparency). The new scale Hospital Organizational Scale has 21 items and three factors. The first factor regards the user's and healthcare professionals' rights to receive healthcare services of quality and adequate working conditions, respectively. The other two factors are related to career development practices and to practices of social solidarity. The feature of this new scale indicates that the first factor refers to specific service offered, which means, the reason for the hospital's existence. This finding suggests that the first topic employees of specific services consider when they evaluate organisational dignity is the quality of the service offered by the organizations that translates the reason for their existence.

This is an important finding to the organisational dignity literature. The Hospital Organizational Scale features indicate that to evaluate organizational dignity of a specific service it is necessary to develop an appropriate scale. We encourage the development of new organizational dignity scales for specific services and new studies to analyse if the quality of services that translate the reason of its existence is a key factor of specific services' organizational dignity.

The quality of SFL has influenced positively its contribution on hospital users' dignity from the healthcare professionals of Portuguese hospitals point of view. Positive influence was also found on the evaluation of hospital firm's dignity. As was expected the organizational dignity has positively influenced the SFL contribution to users' dignity, nevertheless, this influence of SFL was higher than the influence of organizational dignity. Facing this result, it is possible to infer that healthcare professional consider that one healthcare initiative, which contributes to save the users' life, is more important to respect the users' dignity than the quality of the services offered by the hospital, or the practices to develop healthcare career, and social solidarity.

Organizational dignity did not influence the SFL contribution to hospital firm's dignity. The main limitation of this study is the non-inclusion of variables to measure de hospital firm's dignity and users' dignity. With the absence of those variables we could not analyse the direct effect of hospital organizational dignity on hospital firm's dignity, and users' dignity.

Despite this limitation, it was possible to infer that organizational dignity influences positively on hospital firm's dignity. Nevertheless, new studies are necessary to identify the direct effect of organizational dignity on users' dignity and hospital firm's dignity. Another limitation is the fact of not include the users evaluation in the study. Users are another key stakeholders (Bryson, 2004) as well as healthcare professionals. It is important to compare the evaluation of hospital dignity from both.

4.5.1. Conclusion

Dignity has been considered as component of responsiveness on health systems evaluation. We propose to expand the dimension of dignity, giving it has a main role on the health systems performance evaluation, particularly on hospital services performance evaluation. In this study we aimed to analyse the influence of the organizational dignity and the quality of the SFL, on the contribution of that initiative to hospital firm's and users' dignity, evaluated by healthcare professionals of Portuguese hospitals. We conclude that the Both SFL and organizational dignity influence users' dignity.

The Dignity Approach to Hospital Health Services can help healthcare managers to improve the hospitals' performance by promoting humanized treatment to users and healthcare professionals in times of inhumane health services (Moyer et al., 2014).

New studies are necessary to position organizational dignity at the centre of health services management and evaluation. We strongly encourage researchers to carry out new studies to increase the dignity approach to Health Services and to help managers to improve the quality of services for society.

Centres participating in the research:

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CHAPTER 5

Conclusion

By joining the Stent For Life initiative in 2011, Portugal's primary objective was to increase the access of patients with acute myocardial infarction to the treatment currently recognized as offering the best results in terms of prognosis, reducing the mortality and morbidity associated with this pathology. The European initiative aimed to ensure that more than 70% of patients with STEMI were treated by PPCI, to reach rates of around 600 PPCI per million inhabitants and to provide a PPCI service with 24 hours a day, 7 days a week (24/7) coverage. In Portugal there was already a network of CathLabs that provided almost complete coverage of the entire country, with the exception of the Alentejo region. Also, performing PPCI was already the most used treatment method with only 7.9% of STEMI undergoing thrombolysis.

The number of primary angioplasty per million inhabitants was in fact low (264/million inhabitants), but probably because the incidence of STEMI in Portugal is lower than the one seen in other European countries, namely in northern Europe, and also because the Portuguese population took a long time to ask for specialised help. The SFL Portugal task force identified some priority actions, one of which was to educate the population in order to alert people to STEMI symptoms recognition, and inform them about the best attitude to take in the face of these symptoms, which always will be to call 112, so that the appropriate treatment is implemented as soon as possible. A public campaign directed to the population called Act Now Save a Life was carried out by direct contact with population, regular presence in the media, television, radio and newspapers, and some advertising spots with the support of public figures. This whole campaign was carried out in a context of scarce resources, as the SFL did not have its own funding.

Together with this campaign, training actions were also carried out targeted at health professionals in order to improve the other delay component, the system delay. Some of the practical effects of these actions, such as patients transfer by INEM, carrying out an ECG in the ambulance with transmission to the PPCI centre, INEM's direct contact with the cardiologist at the centre with PPCI, the inclusion of cardiac technician in hospitals' emergency departments, resulted in a prompt system response to patients with STEMI.

All the results of the actions implemented were monitored over time, either by surveys directed at the PPCI centres or by carrying out market studies, making it possible to observe the evolution of interventions, identify weak points and try to correct them.

Stent For Life initiative in Portugal lasted for five years (2011-2016) and the aim of this work was to evaluate how SFL impacted on three perspectives: Outcomes, Economic and Healthcare professionals' perspective.

During SFL's lifetime, there were positive changes on STEMI patient's treatment, with an increase in the number of patients treated by PPCI (264 PCI/million inhabitants 2010 to 385 in 2021). This was one of the main goals of SFL initiative, which results in less mortality and morbidity with positive impact in the Society. Good results in quality indicators were obtained. Despite patient delay didn't decrease, as we could expect, some indicators had significant improvements, particularly lower proportions of patients who attended to local hospitals without PPCI facilities and primary health centres, as well as an increase in the proportion of those who called the EMS number. Although population literacy on MI had improve through the years, demonstrating improvements on knowledge about MI symptoms and how to act when facing MI suspicion, people still last too long to call for help.

This apparently contradictory finding occurs probably because aware campaigns are not enough to product behaviour changes. To get to effective changes a health campaign should follow a specific sequence that moves the target audience from awareness of an issue towards a behaviour resulting in a specific health outcome. In some way that's what SFL tried to do, first by giving information about how recognize MI symptoms and then informing that the best and safety action was to call 112. Success in changing behaviour is more likely to be attained when the campaign is promoted or supported by regional or country authorities. Also, socio cultural status and personal believes seem to influence the change on target public behaviour. So people may interpret the messages as don't having nothing to do with them, or to misinterpretation leading to a non-interiorization, and consequently to no behaviour changes.

We also observed an increase in patient delay which can be attributed to Covid-19, mainly because some patients feel fear of becoming infected and avoided to ask for help in hospitals.

System delay did not significantly change over this period, and, as we could see, it was even worse, on one hand because of patients seek for help from the medical emergency, which makes them enter the system earlier as explained by Pereira 2018, on the other hand due to the unexpected Covid-19 pandemic. Covid-19 brought disruption to healthcare in various ways; by the necessity to adapt to treat acute patients, some facilities were transformed in intensive unit cares, reducing the number of beds to attend other situations, and also less urgent services like ambulatory procedures were cancelled or postponed, while barriers imposed by restrictions, transport closures and stay-at-home orders prevented some patients from attending appointments. Covid-19 exposed health systems frailties, and clearly demonstrate that something unexpected can be a huge drawback in healthcare programmes. This leads to deterioration of healthcare standards that have been

constructed over the years, with implications not completely known yet. These lessons must be taken into account in the future strategies and decision-making, particularly in strengthening current educational programmes aiming an effective behavioural change to shorten patient and system delays and be prepared for the unexpected.

The scarcity of resources is a constant in society. In order to provide quality health services, it is not enough to use the best available scientific evidence. It is imperative to do it as efficiently as possible, seeking to provide the best care at the lowest cost associated. So, we contribute to the sustainability of health systems and society itself. This matter has been of concern, especially to health economists and decision-makers for long time. The adoption of new technologies, new procedures, in addition to demonstrating safety and efficacy, should also demonstrate efficiency before being adopted to practice. In this research, besides the quality results achieved and described in chapter 2, with more patients dialling the emergency system number seeking for help, and significant decreases in patient delay and system delay times, an improvement in quantity of PPCI performed was related to higher number of saved lives by the reduction of STEMI-associated mortality.

One of the aims of this project was to improve the efficiency of the way to treat patients with acute myocardial infarction, not by implementing new technologies or devices but to treat them by PPCI in a faster and safe manner. During the analysis period we saw an incremental number of patients who were admitted in <12 hours and treated by PPCI, with significant decreases in the number of patients who were no-reperfused and in those who were treated with thrombolytics. This shift on treatment procedures presumes a reduced mortality and morbidity associated to STEMI.

As referred, these achievements were attained through public awareness campaigns which were focused in reducing time to first medical contact, and by reorganizing prehospital and intra-hospital processes to improve time of first medical contact to balloon and at the end time to treatment. It must be highlighted that this results with increased numbers of PPCI and reduction in mortality were achieved with the same number of catheterization laboratories and cardiologists.

In Portugal the main costs associated to SFL implementation were the increment in PPCI, a procedure that is more costly than the no-reperfusion or thrombolysis. The increment in variable direct costs of the healthcare system was surely compensated by the reduction in mortality and morbidity. In these cases, where structural changes are decided, decision makers cannot look at hospital costs only, but to the savings and benefits they are bringing to the society, and this is where mortality and morbidity benefits fit in.

Almost ten years later of the SFL implementation in Portugal, the COVID-19 pandemic affected the whole world with huge impacts in the healthcare systems and healthcare provision. In one hand, healthcare services were full of capacity and no being able to treat all the needs, on the other hand

there was a general fear of reaching healthcare services, which in a procedure like PCI where time counts has a huge impact. Nevertheless, the PPCI number per million inhabitants is increasing even in 2020. According to Portuguese Association of Cardiovascular Intervention it was 352 in 2019, 356 in 2020 and 385 in 2021.

From the economic point of view the implementation of the SFL Initiative in Portugal, had a positive impact on the treatment of STEMI patients in Portugal. Considering all the costs of treatment mix change and the benefits in 2013, a total of 19.4 million euros were saved. This is even more outstanding if we have in mind that in the period of analysis Portugal was under intervention of International Monetary Fund, which imposed serious economic constraints, with a very reduced possibility to make investments in health sector. The Covid-19 pandemic had a small impact in the SFL results though. Even before the pandemic, the number of patients reaching hospital on time had decreased back to 2010 numbers. The change in treatment mix was affected in 2020 at the peak of the pandemic, with a reduction of PPCI done in candidates to reperfusion but in 2021 had already increased compared to 2019, showing that the change in treatment mix in Portugal was a success since the SFL program implementation in 2011.

Finally, we studied the concept of organizational dignity. Dignity has been considered as component of responsiveness on health systems evaluation. We propose to expand the dimension of dignity, giving it has a main role on the health systems performance evaluation, particularly on hospital services performance evaluation. In this study we aimed to analyse the influence of the organizational dignity and the quality of the SFL, on the contribution of that initiative to hospital firm's and users' dignity, evaluated by healthcare professionals of Portuguese hospitals. We conclude that the Both SFL and organizational dignity influence users' dignity.

The Dignity Approach to Hospital Health Services can help healthcare managers to improve the hospitals' performance. New studies are necessary to position organizational dignity at the centre of health services management and evaluation. This study contributes for the literature on the evaluation of hospitals' performance by expanding the dignity's dimensions and removing it from the responsiveness construct.

To measure organizational dignity from the perception of employees there is an EPRA-DO scale developed for measuring services dignity (Teixeira et al., 2014). To measure hospital organisational dignity by the perceptions of healthcare professionals, the EPRA-DO scale was adapted. The new scale Hospital Organizational Scale has 21 items and three factors. The first factor regards the user's and healthcare professionals' rights to receive healthcare services of quality and adequate working conditions, respectively. The other two factors are related to career development practices and to practices of social solidarity.

The feature of this new scale indicates that the first factor refers to specific service offered, which means, the reason for the hospital's existence. This finding suggests that the first topic employees of specific services consider when they evaluate organisational dignity is the quality of the service offered by the organizations that translates the reason for their existence. This new scale may be used to evaluate hospitals organizational dignity in other settings.

Based on these considerations we can say SFL initiative was a healthcare programme which based only in operating changes in behaviour and on approach method towards myocardial infarction allow to attain patient-relevant outcomes in STEMI patients by increasing the access to PPCI, increasing the number of patients who *call 112* and decreasing in mortality and morbidity, as well as costs saving. In addition, we also observed that by recognising dignity for users and organizational dignity, the benefits of this initiative extend to patients, providers, payers, society as a whole.

All principles value-based healthcare were attained, so we can consider it as a value-base healthcare initiative, and it can be an example to follow by other interventions in healthcare system.

This study had three perspectives and we found some limitations that have to be mentioned. In the first study, causes of patient delay should have been further investigated, namely to clarify if some variables such as age, gender, social status and education were predictors of patient delay. These variables and this kind of analysis should be considered in future researches on the subject.

In the second study there were two main limitations, first we couldn't replicate to present the model used to calculate economic impact in 2010-2013, mainly because we couldn't have access to the same databases used before, namely DRG database, and second because of inadequate filling of Acute Coronary Syndromes' database, we couldn't analyse some variables previously analysed, such as patients with indication to treat

And finally, the main limitation of the third study was the non-inclusion of variables to measure the hospital firm's dignity and users' dignity. With the absence of those variables, we could not analyse the direct effect of hospital organizational dignity on hospital firm's dignity, and users' dignity. Another limitation is the fact of not include the users evaluation in the study. Users are another key stakeholders, as well as healthcare professionals. It is important to compare the evaluation of hospital dignity from both.

5.1. Future perspectives

Nevertheless, there is always space for improvements. Empower populations to take care of their health status is one of the most effective ways to improve health outcomes. Awareness campaigns provide crucial information on recognition of symptoms and early diagnosis of healthcare problems,

as well as information how to manage them, particularly how to seek help and prompt treatment initiation. To reach key audiences, promoters usually use some communication channels, including social media and other digital platforms, print, radio, and broadcast TV. Nevertheless, campaign messages don't last forever, unless they can be repeated timely. In the other hand, ad fatigue effect of the campaign may contribute to explain patient delay over the first five years. This effect has been described and associated to campaigns which last too long on time without changing the message, and also when the message is repeated over and over that the audience become bored with it and stop paying attention, reducing its effectiveness.

One way to try to overcome this problem may be to use digital approaches and tools such as social media, mobile devices, which is a presently a current way of sharing and transmission information. The extensive public availability and utilization of digital platforms may be used as a significant opportunity to improve emergency cardiovascular care and patient outcomes through a prompt recognition of severe conditions, seeking for right help and correct treatment implementation. Social media permits to all its users to share information, including posts, location identification and status updates (Rumsfeld et al., 2016a). Smartphones capable of wireless services and connection to the Internet are the main vehicle where this social informative traffic occur based on lots of mobile applications (Rumsfeld et al., 2016a, 2016b; Smith & . 2015).

These devices and digital platforms can offer qualified information in an accessible format, specific to language, geography, and skill set that allows people; to act *just in time*. A mobile app with medical information and links to health resources, based on image with relevant health content can be very important for public aware (Bevelander et al., 2014; Carter et al., 2014; Kovic & Lulic, 2011).

Digital platforms also allow constant and instantly information update which facilitate a dialogue or visual exchange between public individuals and the health system (eg, emergency medical personnel or healthcare providers) (Skorning et al., 2012). These interactions and knowledge exchange can be followed digitally and monitored to facilitate their effectiveness assessment. The Institute of Medicine report entitled *Strategies to Improve Cardiac Arrest Survival: A Time to Act* recommends accelerating *research on the evaluation and adoption of cardiac arrest therapies* and specifically calls for health services research related to *the use of innovative technologies* (e.g., mobile and social media strategies...) (Committee on the Treatment of Cardiac Arrest: Current et al., 2015).

Nevertheless, having a mobile app, developing social media content, does not mean that they will be adopted or will be effective in getting better results on patient health or health systems. One example was the recent App *Stayaway Covid*, which had low adherence from the public. The potential for applying these tools to improve health and health care is exciting but requires evidence of their effectiveness and could be limited by issues related to privacy and patients' willingness to

provide access to their specific data. There is also a potential for unplanned consequences because of factors such as inaccurate information being provided via digital tools or inequitable access to this information.

The main purpose for this App is to improve patient delay. Its contents should empower public in prompt recognition of MI symptoms and promote timely and accurate treatment to these patients. The App should have information on MI symptoms, risk factors and treatment options. This content should be supervised by experts, and medical team from the Portuguese Cardiovascular Interventional group (APIC) should be involved. For patients facing symptoms, a mechanism of triage should guide them to an accurate diagnosis and, if MI is confirmed the app should be able to advise the contact with the emergency medical system with a message *Call 112*

Another functionality of this App should be the ability to improve care of patients with sudden cardiac arrest. In these patients the immediate initiation of cardiopulmonary resuscitation manoeuvres (CPR) is mandatory, and should be initiated as soon as possible. The AHA has released several 1-minute online videos as part of its Hands-Only CPR campaign since 2012. These videos, which highlight the need to call 911 in the event of a sudden cardiac arrest and demonstrate how to do compression-only CPR properly, have cumulatively generated >3.3 million views.

In presence of sudden cardiac arrest, the App should provide videos how to perform CPR by bystanders. At same time it should be able to transmit the exact location to EMS and also to notify potential volunteers proficient in PCR via text message when a suspected cardiac arrest occurs. People with CPR capabilities should have the App in their mobile device and if they are approximately 400 m of distance they could go to the location and initiate timely CPR. Other action for the App is to identify the availability of automatic external defibrillator nearby which makes its usage possible. An important example is eyewitness CPR and AED use. As noted previously, prompt initiation of bystander CPR and AED use are associated with improved outcomes after out-of-hospital cardiac arrest (OHCA).

To implement this project some partnerships should be made: First, with APIC, in order to obtain its agreement and theoretical support in medical content. Second, a market consultation should be made in order to choose a developer company to design and put in practice the App. Also, an economic viability study should be made.

An eventual flow chart of the process is presented in Figure 5.1.

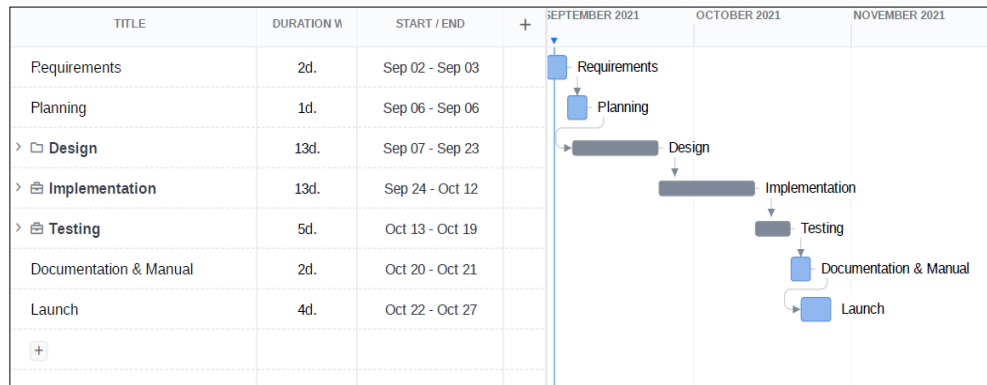


Figure 5.1 - App chronogram development and implementation process

Regarding costs of implementation, we don't have a formal proposal from any company, but an informal appreciation from an entrepreneur in the field, including all phases in the chart, as design in hybrid environment (i.e. android and apple platforms), implementation, testing, and launch, it will take about 30 thousands euros. This is an expensive cost, but we would take in account the impact of reduction in mortality and morbidity achieved by usage of this technology.

The project needs to be tested on the field to confirm people's adherence and is effectiveness. In a second phase it would be interesting to develop identic methodology to improve system delay.

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