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## **Characteristics associated with patient delay during the management of ST-segment elevated myocardial infarction, and the influence of awareness campaigns**

**Abbreviated title:** Patient delay factors during STEMI and effects of awareness campaigns

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## Summary

*Background.* – The delay between the occurrence of symptoms and the call seeking medical assistance is an important component of the pain-to-balloon delay in patients with ST-segment elevation myocardial infarction (STEMI). Factors affecting this “patient delay” have been poorly studied, and campaigns to raise emergency call awareness have barely been evaluated.

*Aims.* – To evaluate the factors related to patient delay, and the effects of public awareness campaigns undertaken in our region.

*Methods.* – Data from the regional registry of STEMI in Limousin, France, were analysed, and we performed a survey to assess medical history, clinical signs, context, socioeconomic situation and perception and behaviour of the patient. “Late callers” (i.e. third tertile, > 154 minutes) were compared with “early callers” (i.e. first and second tertiles, ≤ 154 minutes) using univariate and multivariable statistical methods. The influence of public awareness campaigns was studied by comparing the patient delays before and after a regional campaign.

*Results.* – Among 481 patients, the median patient delay was 87 minutes. “Late callers” were older (odds ratio [OR] 1.02 per year, 95% confidence interval [CI] 1.00 to 1.03), more often had symptom onset between 00:00 and 05:59 a.m. (OR 1.86, 95% CI 1.10 to 3.12) and more often sought assistance from a general practitioner (OR 2.58, 95% CI 1.66 to 4.04) or attended the emergency room (OR 4.10, 95% CI 2.04 to 8.32). Sweats and considering the situation to be severe were factors associated with a reduced delay. After awareness campaigns, there was no change in patient delay, but the proportion of patients calling the Emergency Medical Services increased from 55% to 62% ( $P < 0.001$ ).

*Conclusions.* – Patient delay is multifactorial. The impact of previous campaigns is mixed. Psychological and behavioural aspects are determinant, and should be taken into consideration to develop awareness messages that target specific groups.

## Résumé

*Contexte.* – Le délai patient, entre le début des symptômes et le premier contact médical, représente une large partie du délai douleur-ballon chez les victimes de syndromes coronariens aigus avec élévation du segment ST (SCA ST+).

*Objectifs.* – Nous avons évalué les facteurs liés au délai patient et les effets d'une campagne régionale de sensibilisation.

*Méthodes.* – Les données provenaient du registre régional des SCA ST+ du Limousin (France) et nous avons de plus recueilli par questionnaire les antécédents, les signes cliniques, le contexte, les conditions socioéconomiques, la perception et comportement des patients. Des groupes "appel précoce" (1<sup>e</sup> et 2<sup>e</sup> tertile, < 154 minutes) et "appel tardifs" (3<sup>e</sup> tertile > 154 minutes) ont été comparés par analyse univariée puis multivariée. L'influence de la sensibilisation a été étudiée en comparant les délais avant et après ces campagnes régionales.

*Résultats.* – Sur 481 patients, le délai d'appel médian était de 87 minutes. Les facteurs indépendamment liés au délai tardif étaient : l'âge (OR 1,02, IC95 % 1,00 à 1,03), l'horaire entre 0h et 6h (OR 1,86, IC95 % 1,10 à 3,12), le recours à un médecin généraliste (OR 2,58, IC95 % 1,66 à 4,04) ou au service des urgences (OR 4,10, IC95 % 2,04 à 8,32). Le symptôme «sueurs» et le sentiment de gravité étaient associés à un délai précoce. Après les campagnes de sensibilisation, le délai patient n'était pas modifié mais la part d'appel au 15 est passée de 55 % à 62 % ( $P < 0,001$ ).

*Conclusions.* – L'allongement du délai patient est multifactoriel. L'impact des campagnes de sensibilisations est mitigé. Les aspects psychologiques et comportementaux semblent déterminants et devraient être pris en considération pour adresser des messages ciblés vers des publics spécifiques.

## **KEYWORDS**

STEMI;

Patient delay;

Prehospital delay;

Chest pain;

Public awareness campaign

## **MOTS CLÉS**

SCA ST+ ;

Délai patient ;

Délai préhospitalier ;

Douleur thoracique ;

Campagne de sensibilisation du public

*Abbreviations:* CI, confidence interval; EMS, Emergency Medical Services; OR, odds ratio; STEMI, ST-segment elevation myocardial infarction.

## Background

Ischaemic heart disease is the main cause of death worldwide [1]; its most serious form is ST-segment elevation myocardial infarction (STEMI), which requires urgent intervention to restore myocardial perfusion. The organization of care is essential for timely management, because reperfusion delay is prognostic [2]. The initial care provider (Emergency Medical Services [EMS]/emergency telephone number, general practitioner, emergency service, etc.) largely determines the patient's path. Indeed, in case of severe chest pain or suspicion of myocardial infarction, the current recommendation is to call the national emergency number ("112", "911" or similar numbers in different countries).

To minimize patient delay and to increase public awareness of how to recognize the common symptoms of STEMI and to call the emergency number, two public campaigns were conducted in our region in 2013 and 2015 to alert the public to call 112 quickly in case of chest pain.

The purpose of this study was to highlight the characteristics (epidemiological, socioeconomic and clinical) of patients who do not request assistance quickly when experiencing a STEMI, to better target the populations requiring the most adapted education to decrease the delay. A second objective was to assess the efficacy of a regional campaign encouraging the public to call the EMS rapidly in case of chest pain.

## Methods

### The SCALIM registry

Our first data source was SCALIM, which contains data on all STEMI cases occurring in Limousin < 24 hours after the onset of symptoms. Initiated on June 2011, this registry has as its main objective to assess the patients' paths and the delays of all patients presenting STEMI in the region of Limousin, France. The "patient delay" was calculated from the onset of symptoms to the time of contact, seeking assistance. The distance (in minutes) between the patient's home and our centre was calculated using Google Maps for the fastest route.

For the present analysis, patients included were adults from the SCALIM registry who had initially been treated at Limoges University Hospital for STEMI onset between 01 June 2011 and 31 December 2012 (Period A) or between 01 January 2016 and 31 December 2017 (Period B). These periods were used to assess the evolution of patient delays and paths before and after a public campaign advertised in the same area between the two periods.

## **Telephone survey**

The telephone survey aimed to obtain additional information on socioeconomic status, as well as the circumstances in which the STEMI had started. A questionnaire was submitted by telephone.

Questions submitted in 2012–2013 to patients from period A (2011–2012) were included in the questionnaire submitted in 2018 to patients from period B (2016–2017), but the latter also contained questions about the awareness campaigns. The questionnaire covered various topics (medical history, clinical data, context, socioeconomic factors and perception and behaviour of the patient). In May 2018, the questionnaire was also sent via post with a reply envelope to patients inaccessible by telephone. Socioprofessional categories were based on French National Institute for Statistical and Economic Studies (INSEE) nomenclature of occupations and socioprofessional categories [3].

The following cases from the SCALIM registry were excluded from the survey: deceased patients; those who might have difficulty answering the telephone questionnaire (patients aged > 90 years, those with cognitive impairment and those who did not speak French fluently); and those who declined to participate.

Data collection was done after informing the patient of the study objectives, and as part of the Cardiology Department of the University Hospital of Limoges, which declares its research activities to the French National Commission for Data Protection and Liberties (CNIL). Data were anonymized after collection.

## **Public awareness campaigns**

Two public campaigns were conducted in our region in November 2013 and November 2015, to raise public awareness about the necessity to call the EMS rapidly when experiencing chest pain. The campaigns comprised newspaper, radio and television advertisements and billboard posters in the main cities in the region, as well as newsletters to general practitioners and other healthcare providers, including pharmacists.

## **Statistical analysis**

The "patient delay", expressed in minutes, was defined according to the recommendations of the European Society of Cardiology as the delay that elapsed between the onset of symptoms and,

depending on the patient's path, the call to the EMS or admission to a hospital centre (Fig. 1) [2]. The patient delay and the medical delay (related to health system efficiency) are the two components of the overall time elapsing between the first onset of symptoms and the recanalization of the culprit coronary artery.

Patient characteristics were compared between the two periods of study (2011–2012 versus 2016–2017). Based on the distribution of patient delay, all cases were categorized as "early callers" or "late callers". The "early callers" group corresponded to the first and second tertiles of the distribution of patient delay, and the "late callers" group included those in the third tertile of patient delay.

Continuous variables are expressed as means  $\pm$  standard deviations, and qualitative variables are expressed as numbers and percentages. All time periods are reported as means with their corresponding 95% confidence intervals (CIs). The normality of distributions of quantitative variables was tested using Shapiro's test. The comparison between "early callers" and "late callers" was performed using the unpaired Student's *t* test, Fisher's test or the  $\chi^2$  test, as appropriate. For quantitative variables that did not have a normal distribution, the Wilcoxon-Mann-Whitney test was used. The level of significance was  $P < 0.05$ . To compare a continuous variable, with skewed distribution, with a categorical variable of more than two levels, we applied a Kruskal-Wallis test followed by multiple paired tests. In this case, the *P* values were adjusted using the Bonferonni correction. A multivariable analysis of the variables of the entire study population was performed by logistic regression, and odds ratios (ORs) and 95% CIs were reported. We selected for an initial model variables with a *P* value in univariate analysis  $> 0.25$ ; then, we established the final model by a backward stepwise selection. In addition, another model that included the variables collected through the survey was performed by the same method. The evolution between the two periods (2011–12 and 2016–17) was assessed by comparing patient delay and choice of initial caregiver. Statistical analyses and diagrams were performed using R software, version 3.4.4. (R Foundation for Statistical Computing, Vienna, Austria).

## Results

During the two study periods, 545 patients were enrolled in SCALIM, of whom 481 actually had a confirmed diagnosis of STEMI without initial cardiopulmonary arrest, and were therefore included in the analysis. Of these, 208 (43.2%) were from period A, 273 (56.8%) were from period B, 37 had died

at the time of administration of the questionnaire, 32 were unable to answer reliably and 141 refused to participate or could not be reached by telephone or post (Fig. 2). A subset of 271 (56.3%) patients took part in the survey. There was no significant difference in sex, age, medical history, cardiovascular risk factors, dates, times or locations between patients in period A compared with those in period B. The comparison of patients participating in the survey versus those who did not answer showed significant differences in terms of age ( $62.9 \pm 24.5$  vs  $65.9 \pm 33.5$  years, respectively;  $P = 0.02$ ), male sex (77.9% vs 66.7%;  $P < 0.01$ ), proportion of "late callers" (28.8% vs 40.0%;  $P = 0.01$ ) and family history of cardiovascular disease (25.1% vs 11.4%;  $P < 0.001$ ).

## Patient delay

The patient delay ranged from 0 to 1397 minutes, with a global median value of 87 minutes (Q1 36; Q3 216). Median (Q1; Q3) delays for patients calling and not calling the EMS were 62 minutes (25; 149) and 138.5 minutes (68.75; 328.5), respectively. Fig. 3 shows the distribution of patient delay. The "early callers" and "late callers" were separated at the threshold of 154 minutes (2 hours 34 minutes, i.e. the third tertile). In the "early callers" group, the median patient delay was 50 (24.5; 86.5) minutes, whereas it was 309 (215.25; 493.25) minutes in the "late callers" group.

## Univariate analysis

Table 1 compares "early callers" and "late callers" for each of the variables collected via the SCALIM registry, and Table 2 compares the groups for additional variables collected from the survey. The proportion of women and mean age were significantly higher in the "late callers" group.

Regarding the time of onset of symptoms, the patient delay was on average shorter when this occurred between noon and 6 p.m. The highest rates of "late callers" were found when symptoms occurred between midnight and 6 a.m.

In the "late callers" group, initial care by the emergency department or a general practitioner was more frequent than initial care by the EMS.

Rates of "no" or "mild" pain and "progressive-onset" pain were significantly more frequent in the "late callers" group. Similarly, retired or non-active patients were more frequent among the "late callers". The comparison with other socioprofessional categories did not show any significant difference. The proportions of patients who self medicated and patients who were alone during

symptom onset were higher in the "late callers" group. Conversely, considering the situation to be severe, a heart issue or related to a heart attack, anxiety and sweating were more frequent among "early callers".

The study of the other variables did not show a statistically significant difference between the two groups.

## **Multivariable analysis**

A first multivariable analysis included all the data in the registry available for the whole study group. The final model (Fig. 4) highlighted older age, time of symptom onset between 0:00 and 5:59 a.m. and the initial care provider as factors significantly associated with a longer patient delay.

In a second model, including data from the survey (Fig. 4), the significant factor associated with "late callers" was initial caregiver other than the EMS, with the presence of sweats and the patient feeling that the situation was severe being associated with a shorter delay.

## **Effects of the regional campaign**

Table 3 presents the comparison between patients in periods A (2011–2012) and B (2016–2017); between these periods, the two awareness campaigns were undertaken in our region.

There was no difference between the two periods regarding patient delay and proportion of "late callers". The initial care provider was more often the EMS and the emergency department, and less often the general practitioner during period B ( $P < 0.001$ ). The proportion of patients planning to call the EMS (emergency telephone number 112) in the event of a recurrence did not change significantly (from 86% to 87%;  $P = 0.97$ ).

## **Discussion**

The present study shows that in patients with STEMI, patient delay was > 50 minutes for two-thirds of cases, almost > 90 minutes for half of the cases and 2.5 hours for the last third of the cases (the "late callers" group). This is a long period compared with that optimally recommended for the management of STEMI [2]. The distribution of this variable was similar to that in other studies of prehospital delays [4, 5].

Older patients are more likely to have an increased patient delay. Several studies have also highlighted the influence of age on patient delay [4-8]. Clinical manifestations are less typical in the older population [9, 10]. Care seeking may be delayed in the elderly because of cognitive impairment, motor and sensory disorders, frailty, social isolation or frequency of chronic pain that minimizes the event.

Our univariate analysis showed higher rates of females in the “late callers” group, but this association was no longer significant after further adjustments. Others studies have shown that women are more likely to have prolonged prehospitalization delay [4, 5, 7, 8]. In 2015, a review [11] showed that women were more likely to experience atypical symptoms during the onset of STEMI. Data from the French FAST-MI programme also showed that women and patients admitted to hospital through an emergency department were associated with higher case-fatality rates [12] (especially in the early stage of hospitalization), which could be consistent with our results. The prolonged delay between onset of pain and first medical contact could explain this observation, besides a particular risk profile in women [13].

Socioeconomic factors do not appear to be independently associated with patient delay, whereas retirement was trending towards being more frequent among “late callers”, but was confounded by the age factor. This result is consistent with another French study that focused on the delay between pain onset and electrocardiography [6]. Ageing is known to be associated with delay, and is a confounding factor, explaining this result in retired patients. Furthermore, another study has shown an association between a low level of education and prehospital delay [14].

We did not show any statistical relationship between patient delay and the variable “living alone”, which is not consistent with some previous papers [6, 15]. One study [16] suggested that the favourable association of marriage with prehospital delay is more complex, and would not apply to women.

The associated symptom “sweating” is another determinant acting independently to reduce the care-seeking delay. This factor has been found in other studies [17, 18], but its association independent of other factors should be confirmed.

The feeling that the situation was severe was independently associated with the “early callers” group, and is an important determinant of prehospital delay [19], but other psychological mechanisms may exist [20]. The psychological factors influencing patient delay in STEMI have also been studied

according to various theoretical frameworks [21]: the Health Belief model, models inspired by symbolic interactionism and the model of self-regulation of behaviour [21, 22]. These models are conceptual frames to help us to understand a patient's reactions in case of health problems. For example, a qualitative study [23] presented a model of reaction to an acute phase of a myocardial infarction in women, highlighting "maintaining control" factors that can lengthen the delay (attribution to benign cause; beliefs about acute myocardial infarction in general and acute myocardial infarction in women in particular; denial; concern for others ["fear of disturbing"]) and "relinquishing control" factors pushing women to seek help (persistence of symptoms and anxiety). More generally, among the strategies initially adopted by those who experience a myocardial infarction, waiting or ignorance of the symptoms are found in > 75% of them [24].

Major cardiovascular risk factors did not appear to be significantly influential in our study, whereas another study reported hypertension and diabetes as factors associated with prolonged patient delay [10].

Surprisingly, patients with a history of cardiovascular disease did not call for help more quickly than others. Some studies provided similar results [5, 18, 25], although others found shorter delays in patients with a history of myocardial infarction or angioplasty [7, 8]. One of the hypotheses is that patients who have already experienced a myocardial infarction expect to have similar symptoms in case of recurrence, whereas this is not always the case.

We found that the period between midnight and 6 a.m. was a significant and independent factor associated with delayed call; this result is supported by other studies [8, 26].

Experimental studies evaluated the impact, in case of recurrence, of personalized prevention measures in patients with a history of myocardial infarction. In 2012, a study including 1944 patients randomized between a control group and an experimental group showed a significant reduction in prehospital delay in the experimental group [27]. By comparison, in 2009, a similar study design including 3522 patients did not show a significant difference [28].

A choice other than EMS as the initial care provider is a patient delay lengthening factor. This result has been found in other French [5] and European [18, 26] studies. Also, a study on factors associated with delay in transfer of patients with STEMI showed that, even after the first medical contact, patients who did not call EMS (15/112) and those with prolonged patient delay have, in addition, an increased transfer delay in reaching the catheterization laboratory [29]. In another words,

patients who have a delayed call have a “double-penalty” as they are those seeking suboptimal assistance, so that both delays, before and after the call until angioplasty, could be increased. This supports the importance of the initial care provider in the patient pathway. The probability of being a “late caller” is higher in patients who directly go to the emergency room compared with those who call their general practitioner because, in the former case, the time to go to the emergency room is added to the delay to decision to seek medical assistance. Another reason could be that the longer patients wait, the more severe the symptoms are, and the more likely it is that patients will choose to directly go to the emergency room rather than to a general practitioner. Furthermore, this result should be interpreted with caution because of the small sample size, resulting in obvious 95% CI overlap.

Self medication during the first symptoms of STEMI was more common in the “late callers” group, but this association did not persist in the multivariable analysis.

Our study did not show any significant reduction in the delay after the regional campaign. However, we found an increase in first contact with the EMS. The lack of efficacy of the campaign in decreasing the patient delay is probably multifactorial, including the lack of sufficient coverage to sensitize the whole population, the need for more repetitive advertising to change patient behaviour and the fact that the campaign had two messages: “call fast, call 112”, and it is plausible that the second message was better retained than the first. New campaigns focusing on the necessity to call quickly should take our results into consideration. The evaluation of a public campaign carried out in Spain in 2012–2013 identified increased use of the EMS number and an increase in treated patients, but did not observe any significant effect on time delays [30]. By comparison, a campaign carried out in Switzerland for a long period between 2005 and 2008 significantly reduced prehospital time in STEMI and non-STEMI. However, this decrease was not significant in the subgroups of women, those aged > 75 years and patients with atypical symptoms [31].

## **Practical implications**

The awareness campaigns could be improved by targeting specific patient profiles at high risk of STEMI and making late calls. According to our data, the campaigns could mostly focus on elderly patients, those who already have experienced a myocardial infarction and those with cardiovascular risk factors. It could be useful to refine the prevention messages: reiterate the value of a call to the EMS at any time, including at night, especially for the older patients; and inform about typical and

atypical symptoms, especially in women. The patient and their relatives should be encouraged to call the EMS if the symptoms persist beyond 15 minutes.

## **Study limitation**

Our study has limitations. First, it was a single-centre study, and our findings need further confirmation in other geographical areas, as cultural dimensions may also affect results. We were unable to know if the patients studied had been hit directly by the campaigns, so the effect of the campaigns on patient delay is difficult to address directly. The intermediate (56%) rate of responders to our survey is also a limitation, as it may generate a selection bias. Some characteristics of "late callers" match with those of "non-responders" – mostly demographic and socioeconomic variables. In particular, the probability of being a "late caller" was higher in elderly patients. It is likely that elderly patients are also most difficult to be reached (by telephone or mail) for reasons of social isolation, cognitive and sensory impairment or physical disability. Hence, the results of our survey should be interpreted with caution.

## **Conclusions**

At the occurrence of signs of STEMI, several factors might influence the delay for in seeking assistance. Psychological and behavioural factors seem to be determining and complex. Other main factors are age, the time period of symptom onset and the choice of initial care provider. The impact of previous public awareness campaigns is mixed. We propose to target awareness messages to specific groups of patients, such as elderly people, and with a special educational emphasis on those who already have risk factors or a cardiovascular history. The awareness campaigns should also highlight atypical presentations and stress that the best option is to call the emergency telephone number (112/911).

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## **Disclosure of interest**

The authors declare that they have no conflicts of interest concerning this article.

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## Figure legends

**Figure 1.** Definition of patient delay and study goal. EMS: Emergency Medical Services; STEMI: ST-segment elevation myocardial infarction.

**Figure 2.** Flow diagram of inclusion and exclusion of patients. STEMI: ST-segment elevation myocardial infarction.

**Figure 3.** A. Patient distribution. B. Box plot of patient delay.

**Figure 4.** Results of multivariable logistic regression models of the factors associated with patient delay. A. Whole population; variables included sex, age, history of hypertension, symptom onset time slot and initial care provider. B. Subgroup responding to the survey; variables included sex, age, history of hypertension, symptom onset time slot, initial care provider, history of depression, psychotropic treatment, no or mild pain, progressive-onset pain, retrosternal chest pain, epigastric pain, upper limb pain, associated symptoms (nausea/vomiting, sweats, anxiety), alone during symptom onset, retirement, interpretation of symptoms as severe, cardiac or MI, and self medication. CI: confidence interval; EMS: Emergency Medical Services; OR: odds ratio.

**Table 1** Comparison of “early callers” and “late callers”.

	No. with available variable	All patients ( <i>n</i> = 481)	Early callers ( <i>n</i> = 319)	Late callers ( <i>n</i> = 162)	<i>P</i>
<b>Baseline characteristics</b>					
Male sex	481	73.0	76.5	66.0	0.017
Age (years)	481	64.2 ± 14.7	62.6 ± 14.3	67.3 ± 15.1	< 0.001
Current smoker	481	37.8	39.8	36.4	0.49
History of hypertension	481	46.6	43.9	51.9	0.10
History of diabetes	481	17.9	19.4	14.8	0.26
History of dyslipidaemia	481	35.8	36.1	35.2	0.92
Overweight	481	20.2	21.3	17.9	0.40
Familial history of CVD	481	19.1	20.7	16.0	0.27
More than two main CV risk factors	481	35.5	34.2	38.3	0.42
History of ACS	481	11.2	12.2	9.3	0.36
History of CABG or PCI	481	10.8	11.6	9.3	0.54
History of PAD	481	1.5	1.6	1.2	1
History of stroke	481	3.3	3.8	2.5	0.59
At least one CV history	481	16.0	16.9	14.2	0.51
<b>Event characteristics</b>					
Symptom onset	481				0.07
Between 0:00 and 5:59		16.8	14.4	21.6	
Between 6:00 and 11:59		35.3	35.4	35.2	
Between 12:00 and 17:59		23.9	27.0	17.9	

Between 18:00 and 23:59		23.9	23.2	25.3	
Weekend or holiday	481	33.7	32.0	37.0	0.31
Home located > 30 minutes from hospital	481	34.1	32.6	37.0	0.36
Initial care provider	481				< 0.00001
EMS/firefighters <sup>a</sup>		59.2	67.7	42.6	
General practitioner		28.5	22.9	39.5	
Emergency department		8.2	6.3	13.0	
Others <sup>b</sup>		3.7	3.1	4.9	

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Data are expressed as % or mean  $\pm$  standard deviation. ACS: acute coronary syndrome; CABG: coronary artery bypass grafting; CV: cardiovascular; CVD: cardiovascular disease; EMS: Emergency Medical Services; No.: number of patients; PCI: percutaneous coronary intervention; PAD: peripheral arterial disease; STEMI: ST-segment elevation myocardial infarction.

<sup>a</sup> In France, in more remote/rural areas, firefighters can be called for health issues; they can make the connection with the EMS to reduce transport delays.

<sup>b</sup> Ambulance used to get to hospital or patient already hospitalized because of an issue other than STEMI.

**Table 2** Comparison of additional characteristics from the survey.

	No. with available variable	All patients ( <i>n</i> = 271)	Early callers ( <i>n</i> = 193)	Late callers ( <i>n</i> = 78)	<i>P</i>
<b>Baseline characteristics</b>					
History of depression	271	18.5	16.1	24.4	0.12
History of angina	271	8.9	8.8	9.00	1
Current psychotropic treatment	271	22.5	20.2	28.2	0.20
Completed high school	269	45.0	46.4	41.6	0.50
Socioprofessional category	271				0.07
Worker		39.5	43.5	29.5	
Retired		56.5	53.4	64.1	
Unemployed		4.1	3.1	6.4	
Living alone	270	21.9	21.8	22.1	1
At least one child	266	84.6	85.3	82.7	0.58
<b>Event characteristics</b>					
No or mild pain (NRS < 4)	267	26.1	14.3	33.3	< 0.001
Retrosternal chest pain	270	77.4	80.2	70.5	0.11
Epigastric pain	270	15.2	13.0	20.5	0.14
Back pain	270	14.1	14.1	14.1	1
Upper limb pain	270	41.9	45.3	33.3	0.08
Jaw pain	270	17.4	18.2	15.4	0.72
Radiation of pain	270	67.8	68.8	65.4	0.67
Progressive-onset pain	270	40.4	33.3	57.7	< 0.001

Associated symptoms	270				
Nausea/vomiting		22.6	20.2	28.6	0.15
Weakness		21.9	22.3	20.8	0.87
Dyspnoea		22.6	21.2	26.0	0.42
Asthaenia		29.6	29.0	31.2	0.77
Sweats		33.3	40.9	14.3	< 0.0001
Anxiety		30.4	34.7	19.5	0.018
Place of symptom onset	271				0.68
At home		79.0	79.3	78.2	
At family or relative's home		3.0	3.6	1.3	
At work		7.4	6.7	9.0	
Other		10.7	10.4	11.5	
Alone during symptom onset	271	33.2	29.5	42.3	0.047
Difficulties in calling for assistance	271	6.6	5.7	9.0	0.42
Symptoms interpreted as severe	269	60.2	68.6	39.7	< 0.00001
Symptoms interpreted as a cardiac issue	271	50.2	54.9	38.5	0.016
Symptoms interpreted as MI	270	39.6	45.8	24.4	0.001
Self medication	271	18.8	15.0	28.2	0.016
Patient called for help themselves	267	26.2	24.9	29.5	0.45
Memory of awareness campaign	171	71.3	71.7	70.6	1

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Data are expressed as %. MI: myocardial infarction; No.: number of patients; NRS: numeric rating scale.

**Table 3** Comparison of patients' attitudes between the two time periods (before and after awareness campaigns).

	All patients ( <i>n</i> = 481)	Period A (2011–2012) ( <i>n</i> = 208)	Period B (2016–2017) ( <i>n</i> = 273)	<i>P</i>
Patient delay (minutes)				
Overall				0.53
Mean (95% CI)	178 (156 to 199)	165 (136 to 195)	188 (158 to 218)	
Median (Q1; Q3)	87 (36; 216)	94 (32.75; 216.25)	83 (40; 216)	
Minimum–maximum	0–1397	0–1397	1–1341	
EMS/emergency telephone number 112 <sup>a</sup>				0.12
Mean (95% CI)	132 (109 to 155)	114 (87 to 142)	144 (110 to 177)	
Median (Q1; Q3)	62 (25; 149)	53 (17.5; 160.5)	67 (29; 133.75)	
No EMS <sup>a</sup>				0.62
Mean (95% CI)	245 (207 to 283)	229 (175 to 283)	260 (206 to 315)	
Median (Q1; Q3)	138.5 (68.75; 328.5)	136 (69; 279)	141 (68.5; 366)	
General practitioner				0.42

Mean (95% CI)	254 (206 to 301)	223 (163 to 284)	285 (210 to 360)	
Median (Q1; Q3)	136 (72; 328)	134 (60.25; 277)	141 (78.5; 404)	
Emergency service				0.25
Mean (95% CI)	259 (175 to 343)	361 (75 to 647)	226 (151 to 302)	
Median (Q1; Q3)	167 (69; 354)	237 (122.25; 445.25)	167 (64.5; 313)	
Others				0.34
Mean (95% CI)	150 (79 to 222)	154 (82 to 226)	141 (-122 to 404)	
Median (Q1; Q3)	116.5 (53.5; 205.25)	171 (68; 213)	51 (35; 100)	
Late callers group (> 154 minutes) (%)	33.7	35.6	32.2	0.50
Patient behaviour				
First medical provider (%)				< 0.001
EMS/emergency telephone number 112	59.2	55.3	62.3	
General practitioner	28.5	33.6	24.5	
Emergency service	8.5	4.8	11.3	
Others	3.7	6.2	1.8	

Plan to call EMS in case of recurrence ( $n = 271$ ) (%) 86.3

86.0

87.0

0.97

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CI: confidence interval; EMS: Emergency Medical Services.

<sup>a</sup> Patient delay comparison (EMS versus no EMS as initial care provider):  $P < 0.0001$ .

Figure 1

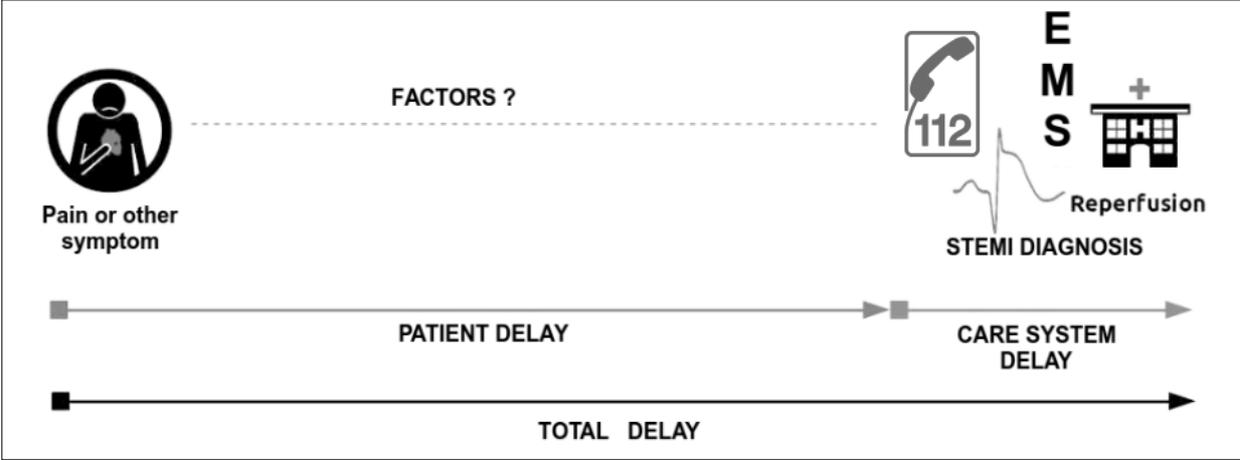


Figure 2

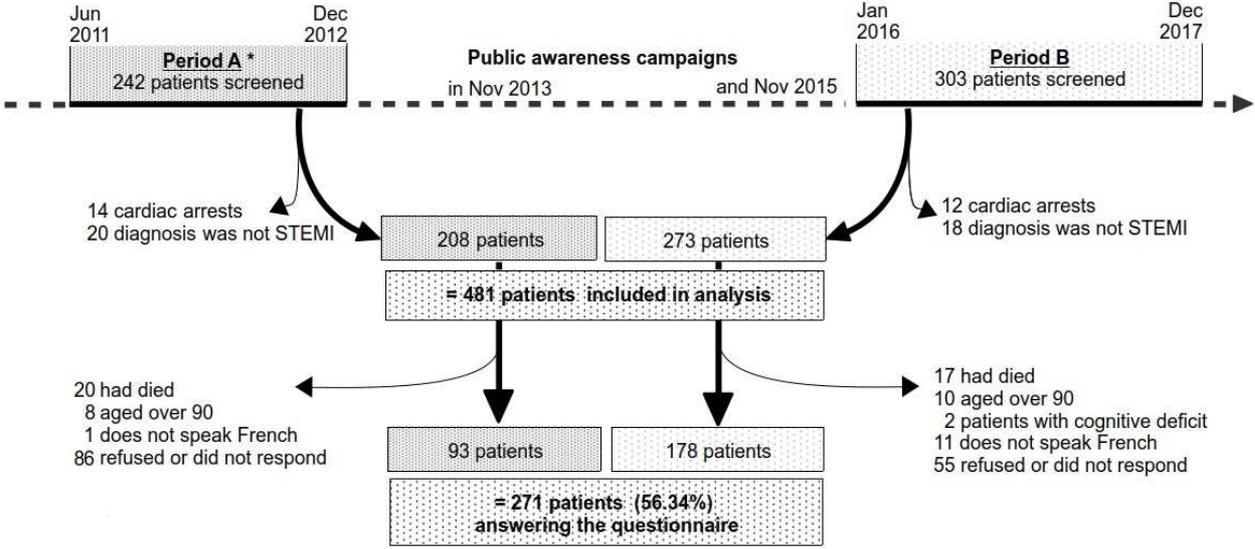
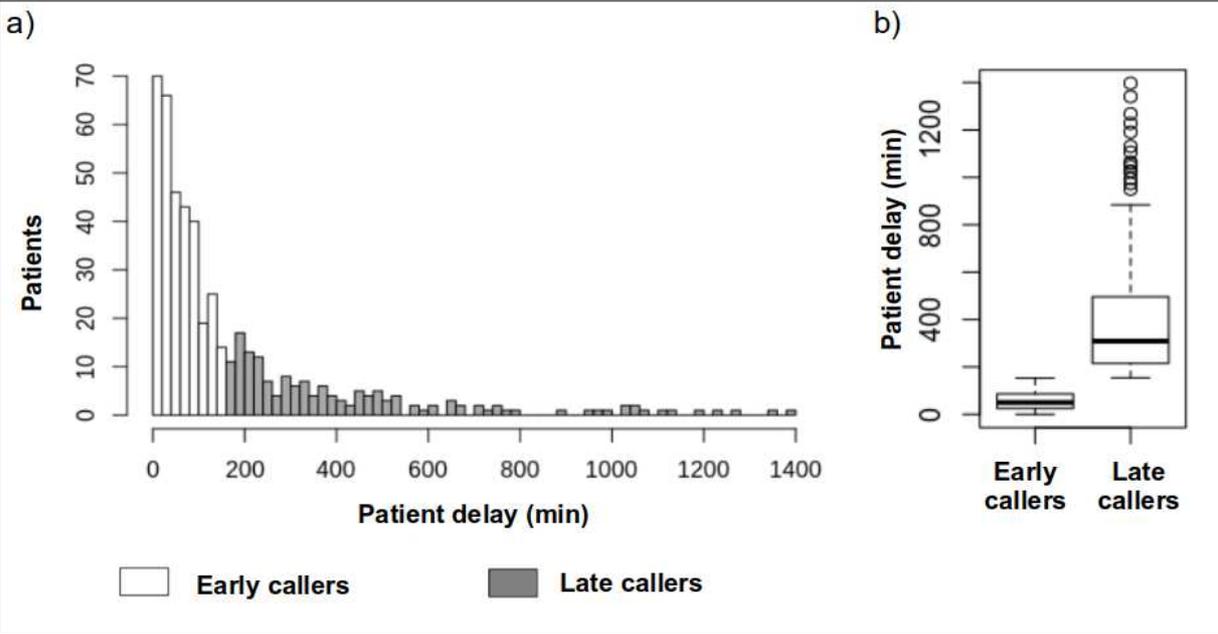


Figure 3



**Figure 4**





Pain or  
other symptom

Factors ?



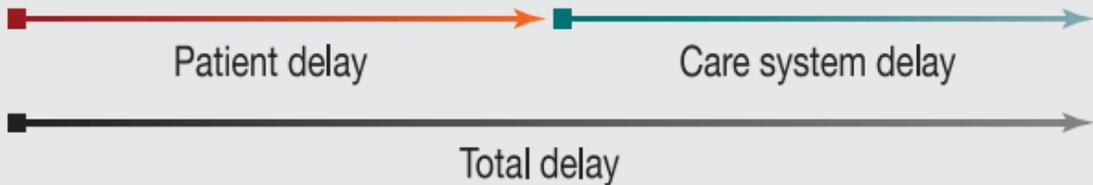
EMS



Reperfusion



STEMI diagnosis



Jun 2011

Dec 2012

Jan 2016

Dec 2017

**Period A\***

242 patients screened

**Public awareness campaigns**  
in Nov 2013 and Nov 2015

**Period B**

303 patients screened

- 14 cardiac arrests
- 20 diagnosis were not STEMI

- 12 cardiac arrests
- 18 diagnosis were not STEMI

208 patients screened

273 patients screened

**481 patients included in the analysis**

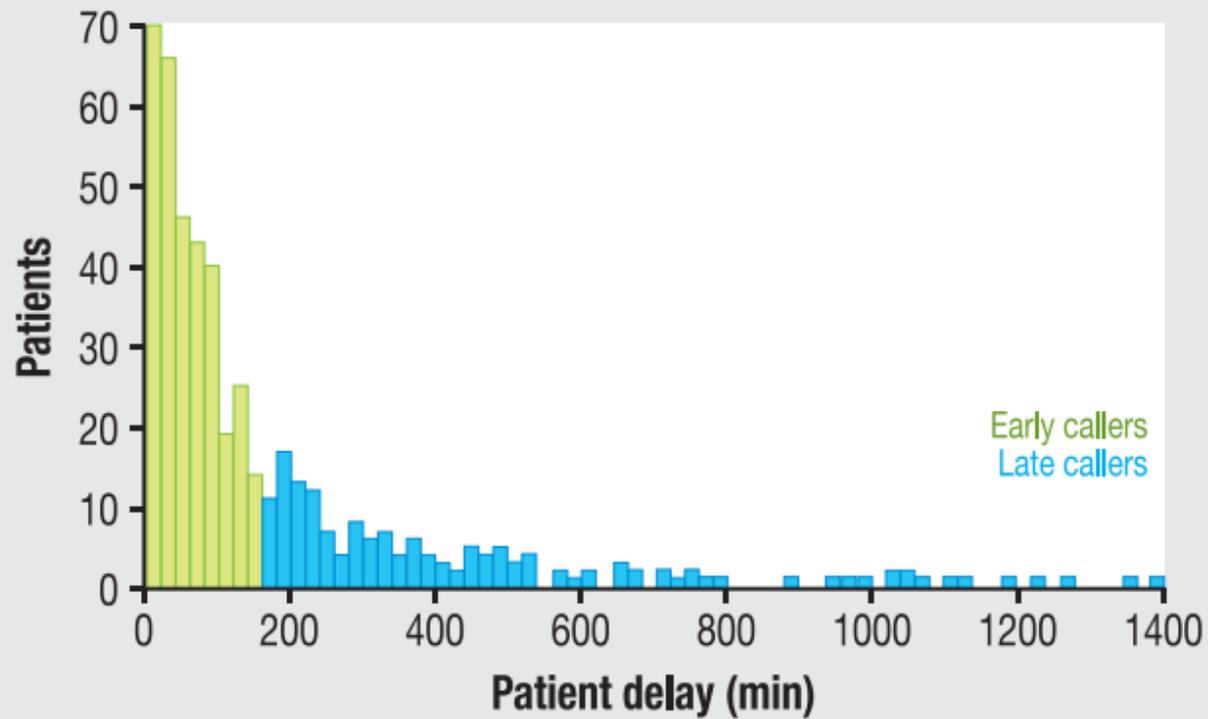
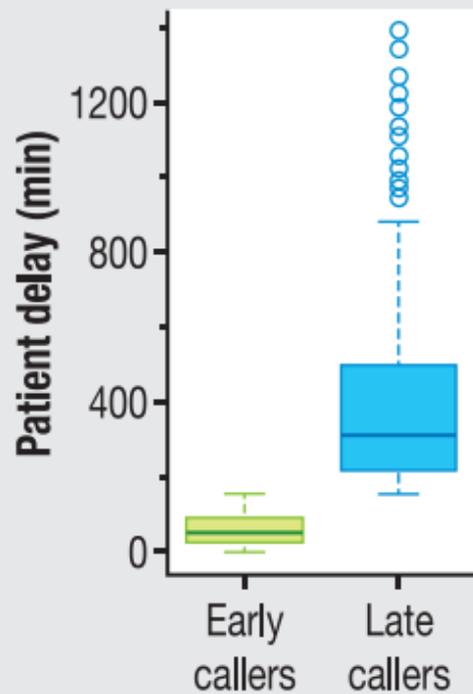
- 20 died
- 8 aged over 90
- 1 does not speak French
- 86 refused or did not respond

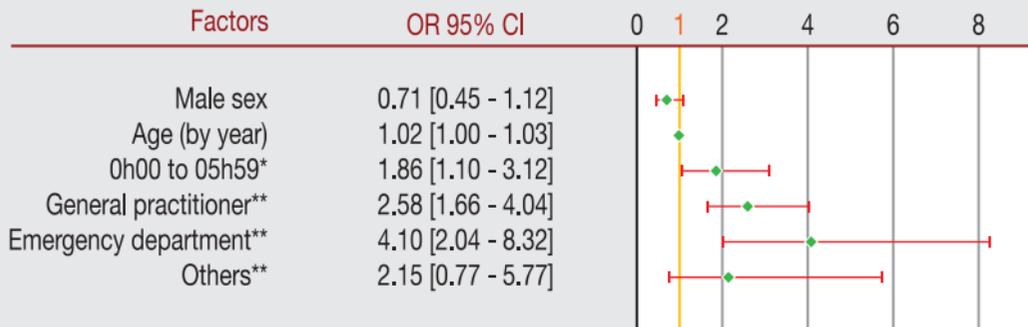
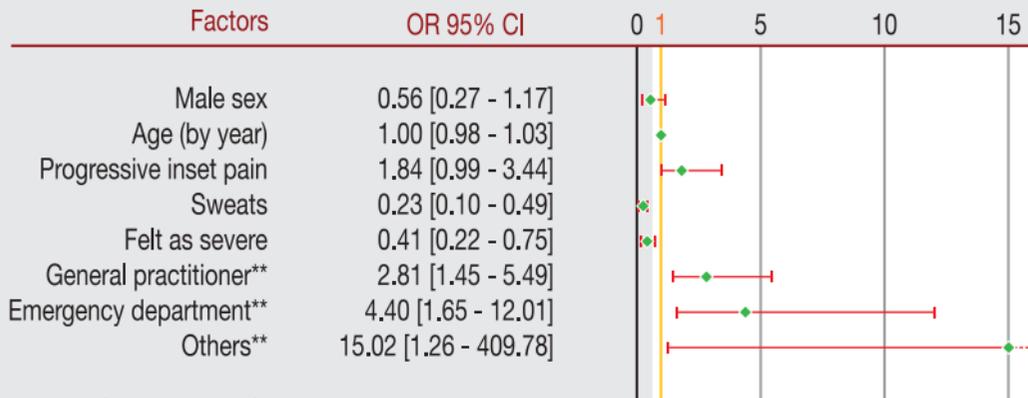
- 17 had died
- 10 aged over 90
- 2 with cognitive deficit
- 11 do not speak French
- 55 refused or did not respond

93 patients

178 patients

**271 patients (56.34%) answering the questionnaire**

**A****B**

**A****B**

\* symptoms onset (vs 12h00 - 17h59)

\*\* first care provider (vs EMS)