



Anticipated prehospital decision delay in response to different symptom clusters in acute coronary syndrome: Results from the Spanish Cardiobarometer study

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ABSTRACT

Background and objective: Reducing patient decision delay – the time elapsed between symptom onset and the moment the patient decides to seek medical attention – can help improve acute coronary syndrome survival. Patient decision delay is typically investigated in retrospective studies of acute coronary syndrome survivors that are prone to several biases. To offer an alternative approach, the goal of this research was to investigate anticipated patient decision delay in the general population in response to different symptom clusters.

Methods: We developed scenarios representing four commonly experienced symptom clusters: classic (chest symptoms only), heavy (a large number of very intense symptoms including chest pain), diffuse (mild symptoms including chest pain), and weary (mild symptoms without clear chest involvement). The scenarios were administered in random order in a representative survey of 1002 adults ≥ 55 years old from the non-institutionalized general population in Spain. We measured help-seeking intentions, anticipated patient decision delay (waiting >30 min to seek help), and symptom attribution.

Results: Patient decision delay was most common in the diffuse scenario (55%), followed by the weary (34%), classic (22%), and heavy (11%) scenarios. Attributing the symptoms to a cardiovascular cause and intentions to call emergency services were least frequent in the weary and diffuse scenarios. Women were less likely to intend to seek help than men in the classic (OR = 0.48, [0.27, 0.85], diffuse (OR = 0.67, [0.48, 0.92]), and weary (OR = 0.66, [0.44, 0.98]) scenarios, despite being more likely to attribute symptoms to cardiovascular causes. Participants with traditional cardiovascular risk factors (e.g., diabetes, hypercholesterolemia, hypertension) reported faster help-seeking, whereas participants with obesity and history of depression were more likely to delay.

Discussion: The diverse manifestations of acute coronary syndrome generate fundamentally different appraisals. Anticipated patient decision delay varies as a function of socio-demographic characteristics and medical history, supporting findings from studies with patients who experienced ACS. Measuring anticipated patient decision delay in the general population can help reveal potential barriers to help-seeking and capture effects of population interventions.

1. Introduction

Despite significant improvements in the past decades, acute coronary syndrome (ACS) remains a leading cause of mortality and disability, producing more than 9 million deaths annually worldwide (Mensah et al., 2023). Timely administration of treatment is key for managing ACS (Byrne et al., 2023). Longer delays in the time between symptom start and administration of treatment have been associated with worse clinical outcomes and higher mortality (Fu et al., 2020). To illustrate, in

patients with ST-segment elevation myocardial infarction (STEMI) treated with primary angioplasty, each 30 additional minutes of delay were found to increase the risk of death by 7% (De Luca et al., 2004).

The term prehospital delay is used to describe the time elapsed from the moment the symptoms start until treatment is received and can be divided into two major components: patient decision delay (PDD) and health system delay (Mackay et al., 2014). PDD describes the time between symptom onset and the moment the patient decides to seek medical attention, whereas health system delay refers to the time

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<https://doi.org/10.1016/j.socscimed.2024.117263>

Received 19 April 2024; Received in revised form 6 August 2024; Accepted 21 August 2024

Available online 23 August 2024

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between the moment the patient contacts the health system until treatment is administered. PDD is estimated to contribute the largest proportion of the total time to treatment (Wechkunanukul et al., 2017), suggesting that improving patient decision making in ACS is key for further boosting patient outcomes. However, most studies measure total prehospital delay, without differentiating the PDD component and its unique determinants (Mackay et al., 2014).

Both mass media and personalized approaches can be successful at reducing prehospital delays by addressing some of the decision determinants involved, such as psychological barriers (Hoschar et al., 2020). However, research in this area is typically carried out in retrospective studies of ACS survivors or patients who contacted emergency services for chest pain (Arrebola-Moreno et al., 2020; Wechkunanukul et al., 2017). Such studies are prone to recall and survivorship biases and can only offer partial understanding of what factors drive people to delay help-seeking. To illustrate, cognitive impairment post-ACS and the large emotional impact of the event can distort patients' memories of events (Zhao et al., 2020). More importantly, retrospective studies leave out the most vulnerable populations by excluding patients who did not survive or were too ill to participate in a study.

An alternative approach exists, whereby healthy people at risk of the disease are asked to report anticipated (i.e., hypothetical) decision delays in response to symptoms (Pedersen et al., 2018; Petrova et al., 2020, 2021). This approach has been widely used to study help-seeking delays for cancer symptoms, producing useful results that have informed population campaigns (Lai et al., 2021; Power and Wardle, 2015). The minority of studies that adopted such an approach in ACS have focused on help-seeking for a hypothetical heart attack (Blakeman et al., 2023; Daponte-Codina et al., 2022) or acute chest pain (Wang et al., 2023). However, about 55% of patients who survive an ACS do not initially attribute their symptoms to a cardiac cause (Birnbach et al., 2020), something that is associated with longer delays (Arrebola-Moreno et al., 2020a) and shows that it is important to understand people's reactions to unlabeled symptom experiences.

Patients' responses to chest pain may also vary depending on its intensity and the presence of other symptoms. Whereas chest pain is the most frequently experienced symptom in both men and women, about 20–25% of ACS patients do not experience chest pain at all (van Oosterhout et al., 2020). In addition, women are about 30% less likely to experience it than men (van Oosterhout et al., 2020), contributing to a large gender gap in patient decision delay and ACS outcomes (Bugiardini et al., 2017; Haider et al., 2020; Stehli et al., 2021). Hence, to study anticipated PDD in the general population, it is necessary to consider how ACS symptoms cluster to generate different presentations of ACS and how these are perceived and acted upon by different socio-demographic groups. Previous research shows that both socio-demographic characteristics and medical history influence help-seeking for ACS. In particular, older individuals, women, individuals with lower socio-economic background, and with a history of diabetes, hypertension, heart failure, or smoking experience longer delays, whereas those with a history of angina or coronary heart disease experience shorter delays (Allmark et al., 2011; Wechkunanukul et al., 2017).

The potential importance of symptom clusters in help-seeking for ACS is also supported by two widely used theoretical models in the study of patient delay. The General Model of Total Patient Delay (Andersen et al., 1995; Scott and Walter, 2010) is a model specific to the help-seeking process that starts with the detection of somatic information (e.g., unexplained symptoms) and divides patient decision delay into two stages. The first stage, called appraisal delay, describes the time a person takes to evaluate the new somatic information and decide whether it suggests a disease might be present. The second stage, called illness delay, describes the time elapsed from deciding a disease might be present to deciding to seek help. According to this model, the type and nature of symptoms experienced would have a strong influence on the length of appraisal delay, whereas knowledge about the disease

would influence illness delay (Scott and Walter, 2010).

The Common Sense Model of Self-Regulation (Baxter and Allmark, 2013; Hagger and Orbell, 2022; Leventhal et al., 2016) posits that unexplained symptoms are interpreted as threat signals that evoke specific cognitive representations of the illness. Information regarding illnesses is stored in memory as "illness prototypes" that are formed and updated through knowledge (social and cultural) and experience (personal and vicarious). A mismatch between the symptom experience and the disease prototype can lead individuals to activate inappropriate coping responses or wait to take any action until something changes. This suggests that symptom clusters that have a lower match with what people consider a symptom presentation indicative of ACS may result in longer PDD.

Empirical evidence supporting the mechanisms proposed by both models comes from studies showing that longer delays are experienced by patients who report symptom incongruence (Abed et al., 2015) or symptoms without clear chest involvement (Allmark et al., 2011), patients who recognize fewer symptoms of ACS (Wechkunanukul et al., 2017), and patients who do not initially attribute their symptoms to a cardiac cause (Arrebola-Moreno et al., 2020), in other words, patients who were less likely to have experienced a "match" between the experienced symptoms and their illness prototype.

The goals of this research were to investigate anticipated PDD in the general population in response to naturalistic scenarios representing common symptom clusters and describe how it varies as a function of diverse socio-demographic and medical history variables in the Spanish Cardiobarometer Study. Our primary aim was to investigate how different symptom clusters influence help-seeking intentions, anticipated PDD, and symptom attributions. Based on the previous literature reviewed above, we hypothesized that people would be more likely to seek help for symptom clusters with a clear intense chest involvement. Secondary aims included investigating how diverse socio-demographic characteristics (including sex, age, and socio-economic status) and medical history variables (including the presence of cardiovascular history and risk factors) influence help-seeking intentions, anticipated PDD, and symptom attributions in response to different symptom clusters.

2. Method

The study methodology was pre-registered before data collection on [AsPredicted.org](https://aspredicted.org/#68635) (#68635, <https://aspredicted.org/fr7ju.pdf>).

We conducted a survey of the non-institutionalized general population of adults 55 years old or older residing in Spain. The survey was designed to be representative of the reference Spanish population based on sex, age, and place of residence distribution. The minimum age restriction was applied to achieve a sample at relatively higher risk of developing ACS. The survey consisted of computer-assisted telephone interviews based on a structured questionnaire with a duration of about 25 min. Data collection was commissioned to a specialized market research company (Demometrika). Three main data sources were used to contact potential participants including the Spanish National Telecommunications Market Commission database, the IBERINFO database, and a database based on random mobile number generation. These databases meet the criteria of the Data Protection law, contain more than 9 million landline and mobile phone numbers, and are regularly updated.

The survey used stratified random sampling and stratification based on sex, age group, and residence. The distribution of the sample by sex and age was designed proportional to the resident population of Spain aged 55 and over. The selection of households was carried out in a strictly random manner with probability proportional to residence unit size. The selection of the last unit (person to be interviewed) was based on a random selection of households with people aged 55 and over, with only one person interviewed per household. Data collection took place during 3 weeks in June 2021 and was conducted by trained interviewers, who were previously familiarized with the study protocol.

Standard data quality control was performed, including software checks, interview supervision, and examination of pilot data.

Participants were invited to participate in a survey about “seeking medical help”. In total, 1002 interviews were conducted. The response rate was 42.4% considering all contacted households, and 60.4% considering only households with individuals over 55 and discounting the households that were generally not interested in participating in surveys. The sample size was based on the funding available. Assuming a 95% confidence level and a population of 15,740,719 individuals aged 55 years and older residing in Spain in 2021 according to the National Institute of Statistics (<https://www.ine.es/>), the obtained sample size allows estimations with a 3.1% margin of error.

2.1. Scenario design

To create naturalistic scenarios that capture a variety of experiences and realistic manifestations of ACS, we conducted a comprehensive literature review of studies that reported symptom clustering in patients with ACS. We developed four scenarios drawing from 11 empirical studies that encompassed over 7000 patients (53% male, 63 years old on average) (Araújo et al., 2018; DeVon et al., 2010; Kim et al., 2018; Lindgren et al., 2008; McKee et al., 2018; McSweeney et al., 2010; Riegel et al., 2010; Rosenfeld et al., 2015; Ryan et al., 2007, 2019; Ryan and Zerwic, 2004), three systematic reviews with or without meta-analysis (Bruyninckx et al., 2008; DeVon et al., 2017; van Oosterhout et al., 2020), and one narrative review (DeVon et al., 2016). The scenarios were designed to approximate the experience of at least more than half of patients who suffer ACS, according to the literature. The characteristics and full text of the four scenarios are shown in Fig. 1. The scenarios were reviewed for fidelity by practicing cardiology professionals, including an interventional cardiologist with more than 35 years of experience and a cardiac nurse with more than 15 years of experience, and by two research psychologists who had listened to more than 200 ACS patients narrate their symptom experience in interviews.

The four scenarios were presented in a randomized order and for each scenario participants answered the questions described below. For all questions, interviewers recorded when the person answered “I don’t know” or did not respond, although these were not presented as answer options for participants.

2.2. Dependent measures

Help-seeking intentions. Participants were asked if they would seek help (yes or no) in each scenario.

Anticipated prehospital decision delay (PDD). Those who said they would seek help, were further asked how long they would wait to seek help, asking them to indicate the time in minutes, hours, days or weeks.

Type of help. Those who said they would seek help were asked what kind of help they would seek and their free text answers were coded into one of 12 categories by interviewers: 1) call emergency services (061, 112), 2) go to the hospital or emergencies, 3) go to a local health center, 4) call or request an appointment with the general practitioner (GP), 5) call or request an appointment with another doctor, 6) call a local healthcare center, 7) use the telemedicine button, 8) call a family member, 9) call a co-worker, 10) call a neighbor or go out on the street, 11) would not know what to do, and 12) other, whereby the action was recorded in short text.

Symptom attribution. Participants were asked if they thought they had a medical problem in each scenario (yes or no) and if they said yes, they were asked to identify the type of problem or disease. Answers were recorded in short free text (generally 1 to 4 words) and were classified into one of 7 categories by two independent coders (DP and DG) following a pre-established coding scheme (see Table S1). The first coder (DP) reviewed the open-ended answers and established the coding scheme and rules. The seven categories included 1) heart attack-related (interpretations that specifically mentioned terms related to a heart attack or cardiac arrest), 2) tension-related (interpretations mentioning tension or arterial blood pressure), 3) other cardiovascular (other diverse or non-specific cardiovascular interpretations not included in the first category such as cardiac, heart, or cardiovascular problems, stroke, arrhythmias ...), 4) respiratory (interpretations referring to lung or respiratory issues, covid, or asthma), 5) psychological or external explanations (references to stress, anxiety, fatigue, or other psychological or external factors), 6) others (remaining responses that do not fit in any category), and 7) does not know. The second coder independently applied the coding scheme to all responses and concordance between the two coders was checked. Conflicts were minimal (occurring on between 1% and 4% of responses, depending on scenario) and were resolved by the first coder.

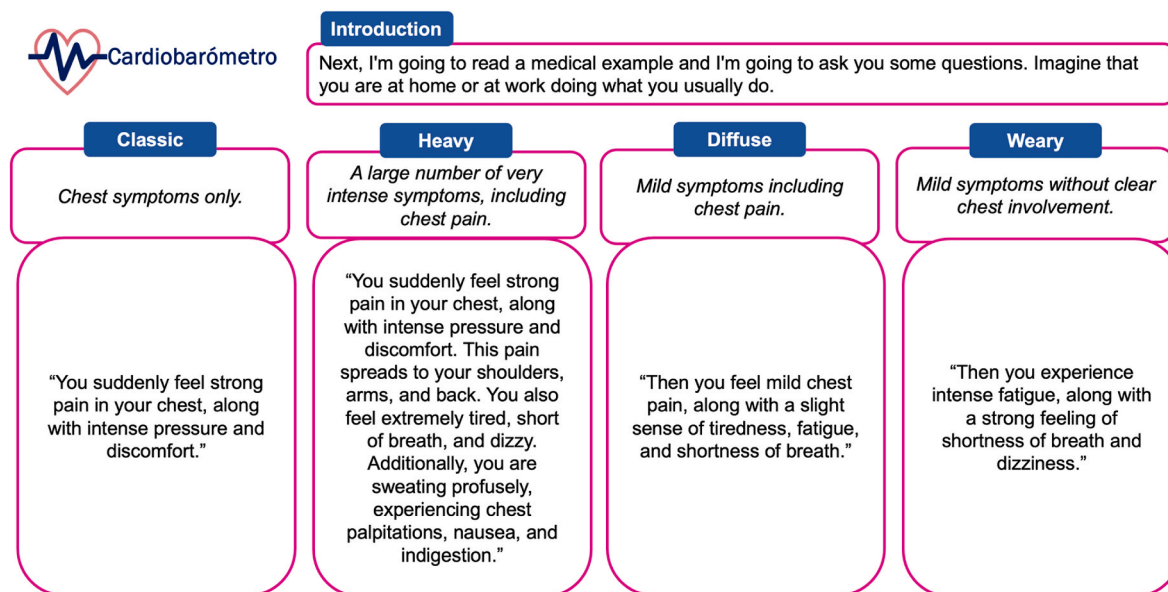


Fig. 1. Full description of the symptom cluster scenarios. Note: The scenario names are broadly based on clinical descriptions in previous studies on symptom clusters and are used for the purpose of ease of reference. They may be subject to different interpretations and are not meant to be shown to participants.

2.3. Socio-demographic variables

Participants were classified in terms of sex (male, female, or other based on self-identification), age (55–64, 65–74, and 75 and more), civil status (single, married or with partner, separated or divorced, widowed, and other), residence (rural vs. city or metropolitan), and living alone (yes vs. no). Socio-economic status (SES) was determined based on questions about occupation and education and was classified into “high”, “middle”, and “low” based on criteria developed by the Spanish Society of Epidemiology (Domingo-Salvany et al., 2013). The “high” SES group comprised social classes I (Directors and managers of establishments of 10 or more employees and professionals traditionally associated with university degrees) and II (Directors and managers of establishments of less than 10 workers, professionals traditionally associated with university diplomas and other technical support professionals. Sportsmen and artists), the “middle” social classes III (Intermediate occupations) and IV (self-employed workers), and the “low” social classes V (Supervisors and workers in qualified technical occupations), VI (Qualified workers from the primary sector and other semi-skilled workers), and VII (Unskilled workers).

2.4. Medical history variables

Participants were asked if they had ever been told by a doctor that they had any of the following conditions (yes versus no): a) myocardial infarction, angina pectoris, coronary heart disease, heart failure or stroke, which were used to define a combined dichotomous variable to identify whether they had a personal history of cardiovascular disease, and b) diabetes, hypertension, hypercholesterolemia (presented to participants as “high cholesterol levels”), overweight, depression, anxiety, and stress, which were coded as independent dichotomous variables. We also collected self-reported height in cm and weight in kg, from which we calculated their Body Mass Index (BMI) as kg/m^2 , and classified it as underweight, normal weight, overweight, and obese using common World Health Organization (WHO) cut-offs (*A Healthy Lifestyle—WHO A healthy lifestyle—WHO recommendations, 2010*).

Tobacco smoking and alcohol consumption were measured with questions used in the periodic National Health Survey of Spain (Spanish Ministry of Health, National Statistical Institute of Spain, 2018), from which participants were classified as “never smokers”, “ex-smokers” or “current smokers”, and drinking alcohol “never or rarely”, “a few times a week”, or “daily or almost daily”, respectively.

2.5. Data availability and ethics

The final version of the questionnaire and the raw data are included as supplementary material on the Open Science Framework (<https://osf.io/kcjt8/>). The study contained additional information (symptom knowledge, risk factor recognition, and psychological questionnaires) that will be reported elsewhere.

This research was approved by the Ethical committee of the University of Granada (No. 20140240001160) and oral informed consent was obtained by participants before proceeding with the interview.

2.6. Statistical analyses

Analyses were conducted in IBM SPSS version 28 after applying sampling weights. We had pre-registered exclusion of participants from the analyses if they did not answer three or more of the help-seeking intention questions, but no participants met this criterion.

For analyses, participants were classified as seeking help if they answered “yes” to the help-seeking question and as not seeking help if they answered “no” or “I do not know” (*help-seeking* variable). “I do not know” answers were very rare: 0.8% in the classic, 0.4% in the heavy, 1.2% in the diffuse, and 2.5% in the weary scenario, respectively, and were hence grouped with the “no” category. Participants were classified

into a “no decision delay” group if they said they would seek help within 30 min of symptom onset and into a “decision delay” group if they said otherwise (i.e., would wait longer than 30 min or would not seek help) (*PDD variable*). This 30-min cut-off was based on the distribution of responses and was reasonable given median decision delay reported in Spanish samples of ACS survivors (ranging between 30 and 60 min) (Arrebola-Moreno et al., 2020; Garrido et al., 2020). Using a liberal criterion, participants were classified as having correct intuitions about the problem if they mentioned that it was heart-attack-related or cardiovascular in nature (categories 1 or 3); the rest of categories were considered as incorrect (*symptom attribution* variable).

For our main analysis, we described the distribution of responses in each scenario on the help-seeking, prehospital decision delay, and problem correct variables. To compare responses between scenarios, we conducted a repeated-measures logistic regression model (GENLIN command) using the classic scenario as a reference and calculating odds ratios (OR) with 95% confidence intervals (CI). We conducted this analysis unadjusted and adjusted for all demographic and medical history variables and compared the results.

We then analyzed the responses to each scenario separately using multiple logistic regression models (GENLIN command) including all demographic and medical history variables. To also adjust for the effect of scenario order parsimoniously (there were 24 possible scenario orders), we considered whether the first scenario participants received contained the landmark symptom of ACS strong chest pain (classic or heavy) vs. not (weary or diffuse). The robust (Huber-White) estimator was used in all models and 95% CIs were calculated for parameter estimates. In the multivariable analyses we had to exclude 29 participants who could not be assigned to a socio-economic status group due to never having worked because in some models the presence of this small group resulted in convergence problems.

3. Results

The demographic characteristics of the weighted sample are displayed in Table 1. Females comprised 53.5% of the study sample. The majority of participants had low socio-economic status (49%), were married (70.7%), and lived in rural areas (52.6%); 22.2% reported being overweight or obese, 16.7% were current smokers, 50.4% drank alcohol daily or almost daily, and 19.7% had previous cardiovascular history.

3.1. Differences between scenarios

To address our primary aim of investigating how different symptom clusters influence help-seeking intentions, PDD, and symptom attributions, we conducted repeated measures logistic regressions with scenario as the repeated factor, using the classic scenario as reference. This approach allowed us to test our hypothesis that participants will be more likely to seek help for scenarios with clear intense chest involvement (classic and heavy) compared to scenarios without clear intense chest involvement (weary and diffuse). We conducted the analysis with and without adjusting for socio-demographic and medical history variables. The results are reported in Table S2 and were very similar with and without additional variable adjustment. Below we report ORs from the unadjusted analyses.

Help-seeking. Almost all participants stated that they would seek help in the heavy scenario (99%), whereas less than two-thirds would seek help in the diffuse scenario (62%) (see Fig. 2). Using the classic scenario as reference (92% help-seeking), participants reported help-seeking much more frequently in the heavy scenario (OR = 6.37, 95% CI [3.73,10.88], and less frequently in the weary (OR = 0.37, [0.29, 0.47] and diffuse ones (OR = 0.14, [0.11, 0.18]). These results were in line with our hypothesis that participants would be more likely to seek help in the scenarios with clear intense chest involvement (classic and heavy).

Calling emergency services was the most frequent type of help to be

Table 1
Characteristics of the study sample. Demographic description of the weighted study sample (N = 979; unweighted N = 1002).

Variable	Category	N	Percentage
Sex	Male	455	46.5
	Female	524	53.5
	Other	0	0.0
Age	55–64	404	41.3
	65–74	300	30.7
	75 and more	275	28.1
Socio-economic status	High	281	28.8
	Middle	189	19.3
	Low	479	49.0
	Never worked	29	2.9
Civil status	Single	53	5.4
	Married or with partner	692	70.7
	Separated or divorced	68	6.9
	Widowed	147	15.0
	Other	4	0.4
Residence	Does not answer	15	1.5
	Rural	461	52.6
	City or metropolitan	515	47.1
Lives alone	Does not answer	3	0.3
	Yes	207	21.2
	No	764	78.1
Body mass index (kg/m ²)	Does not answer	8	0.8
	Underweight	149	15.2
	Normal weight	588	60.1
	Overweight	175	17.9
	Obesity	42	4.3
Tobacco smoking	Missing	24	2.4
	Never smoker	439	44.8
	Ex-smoker	376	38.5
Alcohol consumption	Current smoker	163	16.7
	Daily or almost daily	493	50.4
	A few times a week	252	25.8
Medical history	Never or rarely	233	23.8
	Cardiovascular history ^a	193	19.7
	Diabetes history ^a	189	19.3
	Arterial hypertension history ^a	432	44.2
	High cholesterol levels history ^a	395	40.4
	Depression history ^a	219	22.4
Anxiety history ^a	252	25.8	
Stress history ^a	240	24.6	

^a Reported percentage corresponds to “Yes” and remaining percentage corresponds to “No”.

sought in all scenarios, ranging from 57.3% in the heavy, 43.5% in the classic, 35.5% in the weary, to 22.9% in the diffuse scenario (Table 2). Going to the hospital or emergency room was the second most frequent option, followed by going to the local healthcare center.

Prehospital decision delay. In the classic scenario, 22% of participants showed PDD (not seeking help within 30 min, see Fig. 2). Delay was less common in the heavy scenario (11%, OR = 0.45, [0.37, 0.54]) and more common in the weary (34%, OR = 1.79, [1.59, 2.08]) and diffuse (55%, OR = 4.37, [3.71, 5.15]) scenarios.

Symptom attribution. Fifty-five percent of participants had a correct intuition that symptoms could be cardiovascular in nature in the classic scenario (Fig. 2). Compared to the classic scenario, participants were more likely to attribute the problem to cardiovascular causes in the heavy scenario (70%, OR = 1.93, [1.65, 2.26]) but were much less likely to do so in the diffuse (27%, OR = 0.30, [0.26, 0.36]) and the weary (23%, OR = 0.24, [0.21, 0.29]) scenarios. The proportion of participants attributing symptoms to psychological or external explanations was low, but was more common in the diffuse and weary scenarios (see Fig. S1). The weary scenario (that does not include chest pain) also received the highest percentage of tension-related and respiratory problem attributions.

3.2. Socio-demographic and medical determinants

Next, to address our goal of investigating how socio-demographic

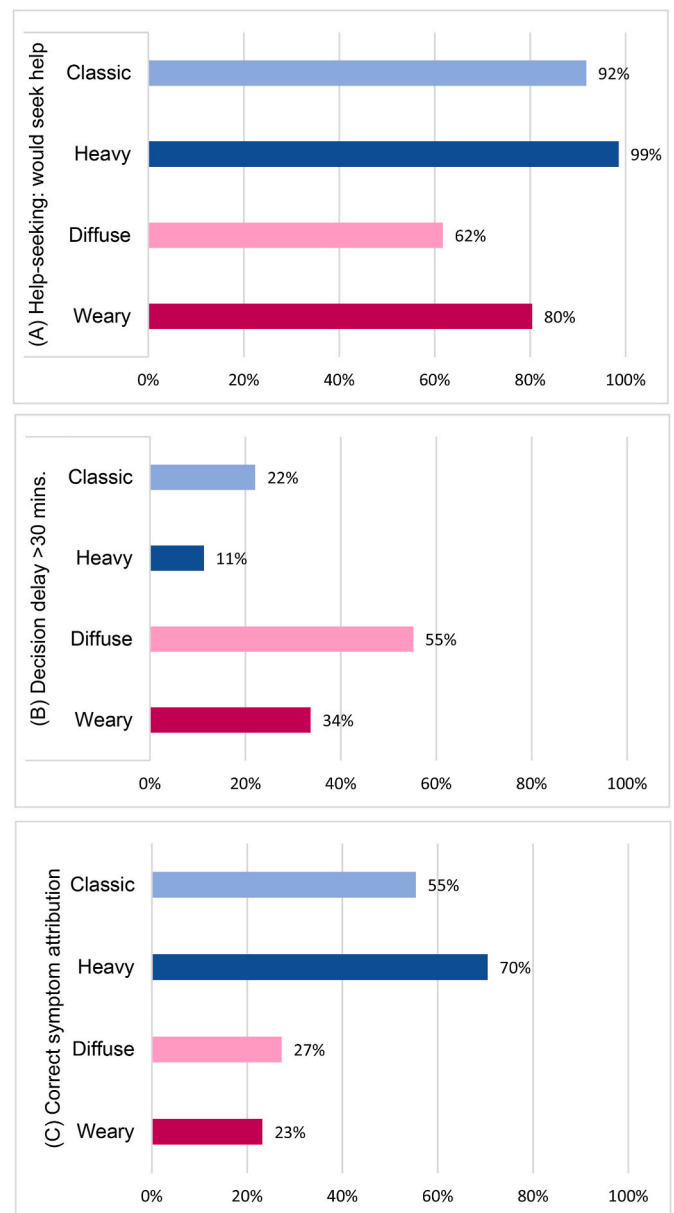


Fig. 2. Help-seeking, decision delay, and symptom attribution according to symptom cluster scenario. Percentage of participants who declare that they would seek-help (panel A), that they would delay help-seeking 30 min or more (panel B), and attribute symptoms to a cardiovascular cause (panel C) according to scenario.

characteristics and medical history variables influence responses to the different symptom clusters, we conducted multiple logistic regressions on help-seeking intentions, anticipated PDD, and symptom attributions in each scenario. Fig. 3 displays the descriptive results as a function of age, sex, and SES. Detailed results from the logistic regression analyses are reported in Tables S3–5 and Fig. S2, respectively.

3.2.1. “Classic” ACS scenario

Help-seeking. Help-seeking in the classic scenario was less frequent among females than males, OR = 0.48, [0.27, 0.85] and among the youngest (55–64 yo) compared to the oldest age group (75+ yo), OR = 0.46, [0.23, 0.93].

Prehospital decision delay. Females were more likely to delay help-seeking than males, OR = 1.56, [1.07, 2.28], whereas people with cardiovascular history were less likely to delay, OR = 0.63, [0.41, 0.98].

Table 2
Type of help sought by respondents. Percentage of respondents according to the type of help they would seek.

Type of help participants would seek	Scenario			
	Classic	Heavy	Diffuse	Weary
Would not seek help	8.2	1.4	38.3	19.6
Call emergency services (061, 112)	43.5	57.3	22.9	35.5
Go to the hospital or emergencies	22.9	21.9	12.4	17.2
Go to a local health center	11.2	7.4	12.4	12.5
Call or request an appointment with the general practitioner (GP)	2.7	2.2	4.3	3.4
Call or request an appointment with another doctor	0.3	0.1	0.3	0.2
Call a local health center	5.4	3.6	4.8	5.5
Use the telemedicine button	2.5	2.6	1.7	2.5
Call a family member	2.0	2.3	2.3	2.1
Call a co-worker	0.4	0.1	0.2	0.1
Call a neighbor or go out on the street	0.8	0.9	0.3	0.8
Look for information on the internet	0.0	0.0	0.0	0.1
Would not know what to do	0.1	0.3	0.1	0.5

Symptom attribution. People with lower SES were less likely to attribute symptoms to a cardiovascular cause compared to people with high SES (OR = 0.57, [0.42, 0.79]).

3.2.2. “Heavy” ACS scenario

Help-seeking. Help-seeking in the heavy scenario was less frequent among the oldest age group compared to the youngest (OR = 0.16, [0.03, 0.75]) and among people who were overweight or obese compared to normal-range weight (OR = 0.32, [0.11, 0.94]).

Prehospital decision delay. The oldest age group was more likely to delay help-seeking than the younger 65–74 yo group (OR = 2.8, 1.59–4.99). People with overweight or obesity (OR = 1.71, [1.05, 2.78])

and people with history of depression (OR = 1.84, [1.08, 3.14]) were also more likely to delay than people without such conditions.

Symptom attribution. Females (OR = 1.60, [1.11, 2.30]), younger participants (OR = 1.72, [1.15, 2.56] for 55–64yo vs. 75+ yo), participants with high SES (OR = 1.98, [1.38, 2.86] vs. low SES), married participants (OR = 1.89, [1.30, 2.73]), participants with cardiovascular history (OR = 1.54, [1.04, 2.29]), and participants with history of stress (OR = 1.58, [1.03, 2.21]) were more likely to attribute symptoms to a cardiovascular cause.

3.2.3. “Diffuse” ACS scenario

Help-seeking. Help-seeking was less common among women (OR = 0.67, [0.48, 0.92]), younger participants (OR = 0.31, [0.20, 0.46] for 55–64 yo vs. 75+ yo), and participants with high SES (OR = 0.49, [0.35, 0.69] vs. low SES). In contrast, participants with history of hypertension were more likely to seek help (OR = 1.38, [1.02, 1.85]), as were participants who were first presented with a scenario containing strong chest pain (OR = 1.36, [1.03, 1.79]).

Prehospital decision delay. Younger individuals (OR = 2.52, [1.73, 3.69] for 75+yo vs. 55–64 yo) and participants with high SES (OR = 1.57, [1.03, 2.39]) were more likely to delay help-seeking.

Symptom attribution. Older individuals (OR = 1.60, [1.05, 2.44] for 75+ vs 55–64 yo) and participants who were presented first with a scenario not containing strong chest pain (OR = 2.36, [1.75, 3.20]) were more likely to attribute symptoms to a cardiovascular cause.

3.2.4. “Weary” ACS scenario

Help-seeking. Help-seeking was less common among women (OR = 0.66, [0.44, 0.98]), younger participants (OR = 0.48, [0.30, 0.79] for 55–64 yo vs. 75+ yo), and participants with high SES (OR = 0.63, [0.43, 0.92] vs. low SES). In contrast, participants with diabetes (OR = 1.83,

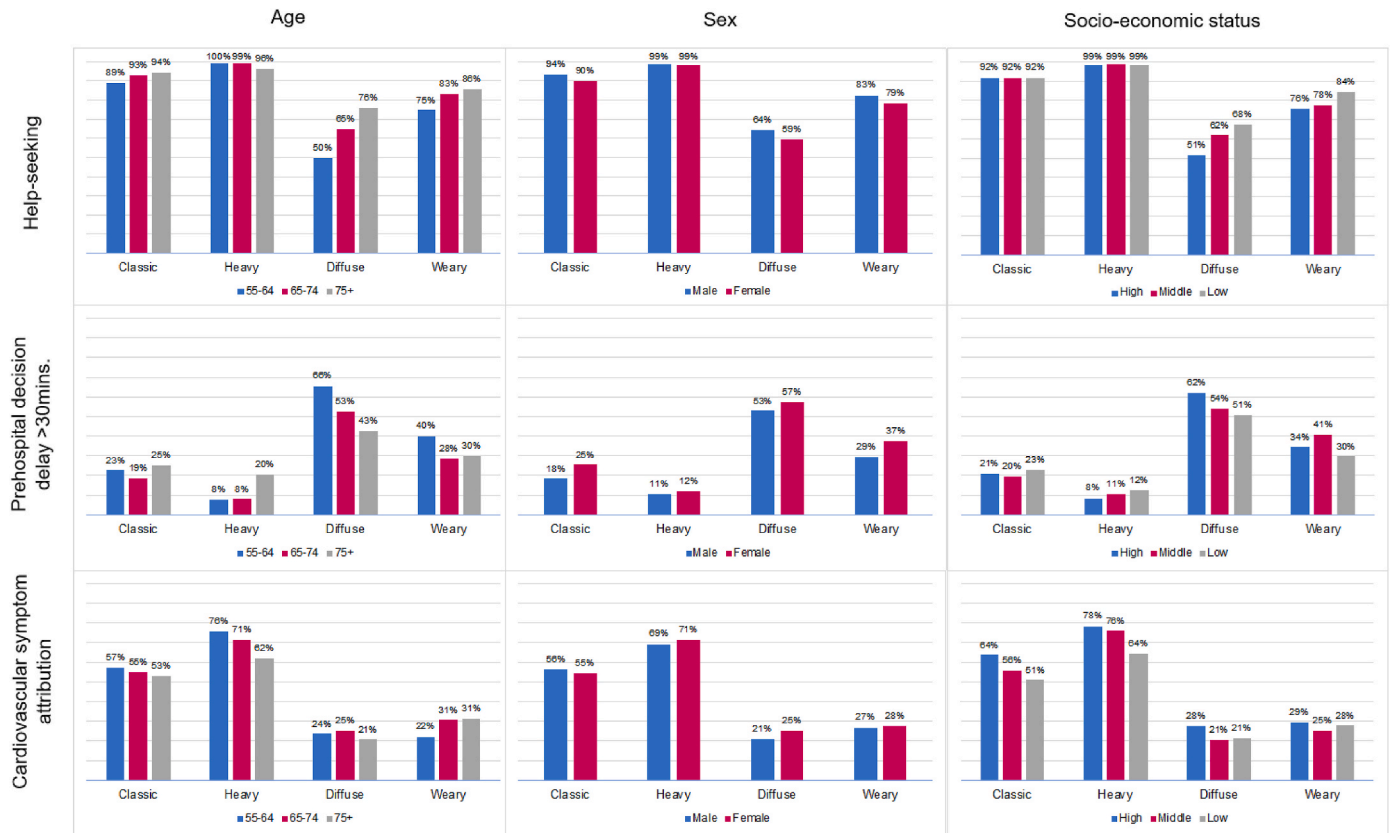


Fig. 3. Socio-demographic differences in help-seeking, prehospital decision delay, and symptom attribution. Percentage of respondents who would seek help, who would delay help-seeking 30 min or more, and who attribute the problem to cardiovascular causes according to age group, sex, and socio-economic status.

[1.08, 3.10]) and high cholesterol history (OR = 1.47, [1.03, 2.08]) were more likely to seek help.

Prehospital decision delay. Females (OR = 1.61, [1.15, 2.26]), younger individuals (OR = 1.71, [2.40, 1.22] for 55–64 vs. 75+ yo), people living alone (OR = 1.57, [1.03, 2.39]), people who consume alcohol a few times a week (OR = 1.49, [1.03, 2.15]), and people with a history of depression (OR = 1.51, [1.03, 2.34]) were more likely to delay help-seeking.

Symptom attribution. Females (OR = 1.63, [1.13, 2.35]), people with high SES (OR = 1.49, [1.03, 2.17]), people living in city or metropolitan area vs. rural (OR = 1.42, [1.03, 1.96]), people not living alone (OR = 1.70, [1.03, 2.79]), people with cardiovascular history (OR = 1.66, [1.14, 2.44]), and people who were presented first with a scenario not containing strong chest pain (OR = 1.65, [1.20, 2.24]) were more likely to attribute symptoms to a cardiovascular cause.

4. Discussion

To investigate anticipated PDD in the general population, we developed four naturalistic scenarios representing common symptom clusters experienced by ACS patients. Our findings show that people appraise the diverse manifestations of ACS in fundamentally different ways, evidenced by large differences in anticipated help-seeking and symptom attribution as a function of symptom clusters. Responses varied as a function of sex, age, socio-economic position, and medical history, largely in line with findings from studies with patients who experienced ACS. This agreement demonstrates that studying anticipated PDD and symptom recognition in response to symptom clusters in the general population may be a valid methodology that can produce useful results complementing those from studies of ACS survivors (Arrebola-Moreno et al., 2020). This methodology can be used in the future to help reveal potential barriers to help-seeking and capture effects of population interventions.

Symptoms of ACS occur in clusters that vary among persons but are relatively homogenous across geographical regions and cultures (DeVon et al., 2017). Experts have recommended that the public and clinicians should be educated about symptom cluster presentations rather than relying on chest pain alone (Jurgens et al., 2022; Kim et al., 2018; Ryan et al., 2007). To our knowledge, this is the first study that has investigated people's help-seeking intentions and symptom attributions to diverse symptom clusters. The results highlight how participants' intended behavior differs by cluster, and how these differences are not homogeneous by sex, age, sociodemographic characteristics or medical history. Anticipated PDD was most frequent in the diffuse scenario, followed by the weary, classic, and heavy scenarios. Taking recommended action in case of ACS (i.e., to call emergency services) was also least frequent in the diffuse, followed by the weary, classic, and heavy scenarios.

Overall, the diffuse cluster (mild symptoms including chest pain) was the most difficult to recognize in terms of importance. Previous research has found that this cluster is more common among older patients and is associated with higher mortality compared to other symptom presentations (Riegel et al., 2010; Rodgers et al., 2019). The weary scenario was the only one that did not include chest pain and was the scenario that was least frequently attributed to cardiovascular causes (23%), especially among younger individuals. Symptom presentation without clear chest pain involvement is characteristic for about 1 in 5 patients (McKee et al., 2018) and is associated with longer prehospital delays (Allmark et al., 2011). In both the diffuse and weary scenarios, women and younger individuals were less likely to intend to seek help, suggesting that they may be at higher risk of negative outcomes if they experience such symptom clusters (Maas, 2019; Mehta et al., 2019; Woodward, 2019).

Symptom experience as described in the heavy scenario (a large number of intense symptoms) is somewhat more frequent among younger patients and women (DeVon et al., 2017; Riegel et al., 2010).

The heavy scenario was the only one for which women were equally likely to seek timely help as men and for which help-seeking was almost ubiquitous, especially among younger age groups. It was also the scenario with most frequent cardiovascular attributions, although men, older individuals, people from lower SES groups, and people without previous cardiovascular history were less likely to recognize it. Hence, it is perhaps the heavy symptom presentation that most closely matches people's preconception or "prototype" about experiencing ACS. Timely help-seeking in the classic chest-focused presentation was less likely among women, younger patients, and those without previous cardiovascular history. Both the heavy and classic scenarios described a more sudden as opposed to gradual onset of symptoms, which has been associated with shorter prehospital delays in ACS patients (Mirzaei et al., 2020; O'Donnell et al., 2014).

The current results are in line with a substantial body of research showing gender inequalities in prehospital delays, treatment, and outcomes of ACS (Haider et al., 2020; Mateo-Rodríguez et al., 2022; Vogel et al., 2021). Women were less likely to seek help and/or more likely to delay help-seeking beyond 30 min in three out of the four scenarios (with and without chest pain), despite being more likely than men to recognize their cardiovascular nature. Research shows that despite increasing awareness of gender disparities, women continue to experience longer patient and system delays, receive less aggressive invasive treatment and pharmacotherapies, and experience higher mortality post-ACS (Haider et al., 2020; Mateo-Rodríguez et al., 2022; Nguyen et al., 2010; Tamargo et al., 2017). The most common ACS symptom in both men and women is chest pain, although women are less likely to present it (van Oosterhout et al., 2020). A study from the US found that about 1 in 2 women believes that men and women have different ACS symptoms but the symptoms women associate with ACS often do not reflect how women's experience is described in the literature (Blakeman et al., 2023).

Few previous studies have described barriers to women's help-seeking that go beyond symptom interpretation (Lefler and Bondy, 2004). A recent study showed that having received an educational intervention about ACS increased knowledge and decreased delay in help-seeking for a hypothetical chest pain among men but not among women (Wang et al., 2023). A survey in six European countries (including Spain) showed that women were less likely than men to consider heart disease as one of the most important health problems, to have discussed risk factors with their doctors, and to have been screened for cardiovascular risk (Daponte-Codina et al., 2022), showing important inequalities in cardiovascular prevention efforts (Gámez et al., 2016). Further studies using the anticipated PDD methodology could help shed some light on the observed gender disparities.

Having previous cardiovascular history or classical risk factors (e.g., diabetes, hypercholesterolemia, hypertension) was associated with more timely help-seeking and higher rates of cardiovascular symptom attributions. This greater ACS awareness may be due to learning from previous experiences, having received information from healthcare providers, or having had one's cardiovascular risk assessed. Previous studies with ACS patients have shown that those with previous history of coronary heart disease have shorter prehospital delays (Allmark et al., 2011; Wechkunanukul et al., 2017) however, findings regarding the role of other cardiovascular risk factors are inconsistent (Allmark et al., 2011; Moser et al., 2006). In the current study, participants with overweight or obesity were more likely to delay help-seeking in the heavy scenario, whereas those with previous history of depression were more likely to delay in the heavy and weary scenarios. The latter is consistent with research showing that ACS patients who reported being depressed in the weeks prior to their ACS had longer prehospital delays (Bunde and Martin, 2006).

There was heterogeneity in the association between SES and the different study outcomes. One consistent finding was that people with lower SES were less likely to attribute the symptoms to cardiovascular causes. However, they were less likely to delay help-seeking in the

diffuse and weary scenarios compared to people with high SES, a result that stands in contrast to findings showing that patients from lower SES background experience longer delays in practice (Moser et al., 2006; Wechkunakul et al., 2017). A very similar discrepancy between results from general population surveys and patient studies has been found for help-seeking for cancer symptoms and has been attributed to different barriers experienced by the different SES groups when it comes to actual help-seeking (Petrova and Sánchez, 2021). The Common Sense Model of Self-Regulation (Hagger and Orbell, 2022) may offer one possible explanation for the heterogeneous SES effects. It is possible that people with high SES may be more knowledgeable about diseases in general, thereby activating multiple illness representations and prototypes to which to compare the described symptoms. This could make them more likely to consider alternative benign or non-urgent explanations for the more ambiguous symptoms in the diffuse and weary scenarios, making them less likely to intend to seek help. In contrast, SES had no significant effects on help-seeking in the scenarios with clear intense chest pain (heavy and classic), the most widely recognized symptom of ACS. Further studies are needed to understand how SES influences actual and anticipated help-seeking for ACS.

Limitations of the study include potential selection biases related to survey non-response. For instance, 53% of the 203 interviews that started but could not be completed were conducted in persons ≥ 75 years old, who found the total length of the interview too demanding. We also did not survey population groups younger than 55 years old. The order in which the scenarios were presented had some significant effects, mostly on symptom attribution, and hence must be controlled for in analyses.

The four scenarios do not represent all possible manifestations of ACS, do not include all symptoms characteristic of the disease (e.g., indigestion), and do not reflect all circumstances of the symptom experience that could be important for help-seeking (e.g., symptom duration, gradual onset, life circumstances...). This was the first study to test such a scenario-based methodology and the scenarios have not been validated by experts external to our research team. For the purposes of the current study, we sought only a small number of scenarios that were succinct, and could hence be successfully administered to older adults in telephone interviews. Future studies should extend these scenarios to include additional combinations of symptoms and other aspects such as symptom duration, persistence (continuous vs. on and off), symptom onset (gradual or sudden), or life-circumstances that can influence help-seeking.

Another limitation is that anticipated help-seeking only reflects what individuals think they would do in a hypothetical situation that lacks further context. People's reactions to the actual experience of ACS may be very different and strongly dependent on the specific symptoms, their appraisal, and the moment and context in which symptoms occur. To illustrate, in the current study, a large proportion of participants said that they would call emergency services or go to the hospital, whereas only a negligible proportion said that they would call another layperson. In fact, studies on patients who actually experienced an ACS show the opposite pattern. Less than 10% of patients call emergency services as a first response, with the most common action being consulting another layperson (Allmark et al., 2011). Previous studies in Spanish patients also show that the majority tend to be at home with their family when symptoms start (Garrido et al., 2020; Petrova et al., 2017), so consulting another person would be a natural first action for many. However, the scenarios used in the current study did not specify whether the person was alone or in the company of others and hence participants could have made a variety of assumptions. These discrepancies illustrate the inherent differences between the retrospective and anticipated approaches to the study of ACS response that should be taken into account when interpreting the results and addressed in future studies.

Nevertheless, we think the proposed survey methodology is useful to help understand determinants of PDD. Responses to the four scenarios would usually take about 5–7 min to administer. This methodology can

be used to study barriers to help-seeking that go beyond symptom recognition such as psychological traits, coping strategies, competing priorities (work and family obligations), or perceived risk. To illustrate, previous studies suggest that people who perceive that they are at low risk of experiencing ACS (e.g., due to being young or having a healthy lifestyle) may be more likely to delay help-seeking when experiencing symptoms (Darawad et al., 2016; Lefler and Bondy, 2004). The cluster scenario methodology can help identify how and to what extent perceived risk plays a role in the appraisal of different symptom clusters. The scenario methodology can also be used to study the effects of information campaigns or interventions in the general population. These first results from the Spanish Cardiobarometer study show that the diverse manifestations of ACS generate fundamentally different appraisals that vary as a function of sex, age, socio-economic position, and medical history, largely in line with findings from studies with patients who experienced ACS. The findings reinforce previous recommendations that the public and clinicians should be educated about symptom cluster presentations rather than chest pain alone and that health education in this area should take into account the prevalence of these clusters in each population group and people's perception of them (Kim et al., 2018; Ryan et al., 2007).

Funding

The Spanish Cardiobarometer study was funded by project PSI2014-51842-R (Spanish Ministry of Economy and Competitiveness). DP was supported by a Juan de la Cierva Fellowship Grant JC2019-039691-I funded by MICIU/AEI/10.13039/501100011033 and a Miguel Servet Fellowship (CP23/00024) from the Health Institute Carlos III.

CRedit authorship contribution statement

Dafina Petrova: Writing – original draft, Visualization, Validation, Software, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation. **Dunia Garrido:** Writing – original draft, Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation. **Andrés Catena:** Writing – review & editing, Supervision, Methodology, Funding acquisition, Conceptualization. **José Antonio Ramírez-Hernández:** Writing – review & editing, Resources, Methodology, Investigation, Funding acquisition, Conceptualization. **Mitti Blakoe:** Writing – review & editing, Investigation, Formal analysis. **Nicolás Francisco Fernández-Martínez:** Writing – review & editing, Methodology, Formal analysis, Data curation. **Beatriz Pérez-Gómez:** Writing – review & editing, Resources, Investigation, Formal analysis. **María José Sánchez:** Writing – review & editing, Supervision, Resources, Project administration, Methodology, Funding acquisition, Conceptualization. **Rocio Garcia-Retamero:** Writing – review & editing, Writing – original draft, Supervision, Resources, Project administration, Methodology, Funding acquisition, Conceptualization.

Data availability

The study materials and raw data are shared on the Open Science Framework (<https://osf.io/kcjt8/>).

Acknowledgement

Funding Open Access Charges: Universidad de Granada/CBUA.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.socscimed.2024.117263>.

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