

*Doctoral Thesis / Tesis Doctoral*

# **Factores psicológicos en la enfermedad coronaria: estudio de la toma de decisiones y comportamiento de salud**



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# ***RESUMEN***



**Antecedentes:** La enfermedad coronaria (EC) es la principal causa de muerte en Europa, causando unas 1.739.000 muertes al año, representando 20% de todas las muertes. Tiene varias presentaciones clínicas, entre cuales las más frecuentes son los síndromes coronarios agudos (SCA) y las anginas. El pronóstico de los pacientes con EC ha mejorado mucho en las últimas décadas gracias a las terapias farmacológicas e intervenciones médicas. Sin embargo, la toma de decisiones y el comportamiento de los pacientes también influyen en su pronóstico y por lo tanto pueden ser objetivo de intervención. En concreto, tanto el comportamiento durante el evento coronario (p.ej., la decisión de buscar atención médica cuando comiencen los síntomas o *demora prehospitalaria*) como el comportamiento tras el evento (p.ej., la decisión de adoptar un estilo de vida más saludable o *comportamiento de salud*) pueden influir en el pronóstico, estado psicológico y calidad de vida de los pacientes. En esta tesis nos centramos en investigar sobre los factores psicológicos que influyen en la toma de decisiones y el comportamiento de los pacientes con EC, en concreto la demora prehospitalaria y los comportamientos de salud.

**Objetivos:** El objetivo general de esta tesis fue identificar los factores psicológicos relacionados con la toma de decisiones, el estado psicológico y el comportamiento de salud de los pacientes con EC durante y después del evento coronario. Los objetivos específicos fueron identificar factores psicológicos relacionados con a) la demora prehospitalaria durante el evento coronario, b) el estado psicológico tras el evento coronario, y c) el comportamiento de salud en el periodo de recuperación y prevención secundaria.

**Métodos y resultados:** Realizamos tres estudios con diferentes metodologías.

El **Estudio 1** fue una revisión de la literatura con el objetivo de investigar la relación de nueve factores psicológicos y cognitivos con la demora prehospitalaria. El protocolo se registró previamente y se realizó una búsqueda y revisión sistemática siguiendo las pautas de PRISMA. Se realizaron búsquedas en las siguientes bases de datos para artículos cuantitativos publicados entre 1997 y 2019: Medline (PubMed), Web of Science, Scopus, Psych Info, PAIS y Open Gray. El riesgo de sesgo de los estudios seleccionados se evaluó con la Herramienta de evaluación de calidad de NIH. Se realizó una “best evidence synthesis” para resumir los hallazgos de los estudios incluidos. Se identificaron 57 estudios de 23 países que cumplieron con los criterios de inclusión. Los estudios utilizaron definiciones muy diversas de la demora prehospitalaria. Los resultados mostraron que había evidencia de que los pacientes que atribuyeron sus



síntomas a un evento coronario, percibieron los síntomas como graves o sintieron ansiedad en respuesta a los síntomas reportaron una demora prehospitalaria más corta, con tamaños de efecto que indican diferencias clínicamente importantes (una reducción de la demora de 1.5-2 horas). Al contrario, no hubo evidencia de una relación entre la demora prehospitalaria y el conocimiento de los síntomas, la preocupación por molestar a otros, el miedo o la vergüenza de pedir ayuda.

El **Estudio 2** fue un estudio transversal de 102 pacientes consecutivos sobrevivientes de SCA, clínicamente estables e ingresados en la unidad de cardiología del Hospital Universitario Virgen de la Nieves en Granada. Los pacientes completaron un cuestionario que midió la demora prehospitalaria, la angustia psicológica y varios factores psicosociales relacionados con la salud cardiovascular: personalidad tipo D, resiliencia, apoyo social y pensamientos durante el evento coronarios. Se realizaron análisis de mediación y regresión lineal múltiple. Los resultados revelaron que la personalidad tipo D y las preocupaciones sobre las graves consecuencias de retrasar la búsqueda de ayuda se relacionaron con una mayor demora prehospitalaria y con más angustia psicológica después del SCA. Por el contrario, la resiliencia se relacionó con una menor angustia psicológica. El apoyo social y las preocupaciones sociales sobre la búsqueda de ayuda no se relacionaron con las variables de resultado.

El **Estudio 3** fue un estudio transversal de 419 pacientes recién diagnosticados con enfermedad coronaria (infarto de miocardio o angina) que participaron en la Encuesta Nacional de Salud en España (2017). Se investigó la relación de la salud mental y el apoyo social con los comportamientos de salud de los pacientes (dieta, actividad física, consumo de alcohol y tabaquismo). Se calculó el número de comportamientos no saludables reportados por cada paciente de acuerdo con las Directrices europeas sobre prevención de enfermedades cardiovasculares. Se puso de manifiesto que solo el 1% de los pacientes no informó ningún comportamiento no saludable, el 11% informó uno, el 40% dos, el 35% tres y el 13% cuatro o más comportamientos no saludables. En una regresión múltiple ajustada para factores de riesgo demográficos y cardiovasculares tradicionales, una peor salud mental se relacionó con más probabilidades de conductas no saludables acumuladas. Esta relación fue más importante en los pacientes con obesidad. La falta de apoyo social se asoció con más comportamientos no saludables, pero esta relación no fue significativa en el modelo de regresión múltiple.

**Discusión:** Los resultados de esta tesis nos brindan un conocimiento más amplio sobre los factores psicológicos que puedan influir en la toma de decisiones, estado psicológico

y comportamiento de salud, y por lo tanto en el pronóstico a largo plazo de los pacientes con EC. Buscar atención médica inmediatamente después del comienzo de los síntomas de un SCA es una decisión fundamental para mejorar la supervivencia y calidad de vida de los pacientes. Los resultados de esta tesis apuntan a tres tipos de factores psicológicos que podrían reducir la demora prehospitalaria debida a la toma de decisiones de los pacientes: a) la interpretación y percepción de los síntomas como graves, importantes y relacionados con causas cardíacas, b) los pensamientos durante el evento coronario enfocados en las consecuencias graves y negativas de la demora y c) los rasgos de personalidad que podrían influir en estas percepciones y pensamientos. Los resultados también demuestran la importancia del estado psicológico del paciente, ya que por un lado la demora prehospitalaria más larga se relaciona con más angustia psicológica en el periodo inmediato tras el evento coronario y por otro lado una salud mental peor se asocia con un comportamiento menos saludable en el periodo de recuperación y prevención secundaria. La resiliencia psicológica y capacidad de afrontar las dificultades podría proteger la salud mental de los pacientes y ayudar a reducir los hábitos no saludables a largo plazo. Los resultados de esta tesis proporcionan información valiosa para futuras investigaciones e intervenciones dirigidas a reducir la demora prehospitalaria o mejorar la adherencia a recomendaciones para prevención secundaria en pacientes con EC.



# **INTRODUCCIÓN**



Las enfermedades cardiovasculares son la principal causa de muerte en Europa, con más de 4 millones de muertes cada año (WHO, World Health Statistics. 2015). A nivel mundial, en 2015 representaron el 31% de todas las muertes (WHO, World Health Statistics. 2015). En España, las enfermedades cardiovasculares siguen siendo la primera causa de defunción, según el último informe publicado por el Instituto Nacional de Estadística (INE) (Defunciones según causa de Muerte, INE, 2017).

Dentro de las enfermedades cardiovasculares, **la enfermedad coronaria (EC)** es la principal causa de muerte en Europa, causando unas 1.739.000 muertes al año, representando 20% de todas las muertes (Wilkins, et al., 2017). La EC se debe, en la mayor parte de los casos, a la presencia de lesiones ateroscleróticas en las arterias, estas placas pueden causar un mayor o menor grado de obstrucción de la luz arterial y resultar en varias presentaciones clínicas, que pueden clasificarse como síndromes coronarios agudos (SCA) o síndromes coronarios crónicos (CCS) (Knuuti, et al. 2019).

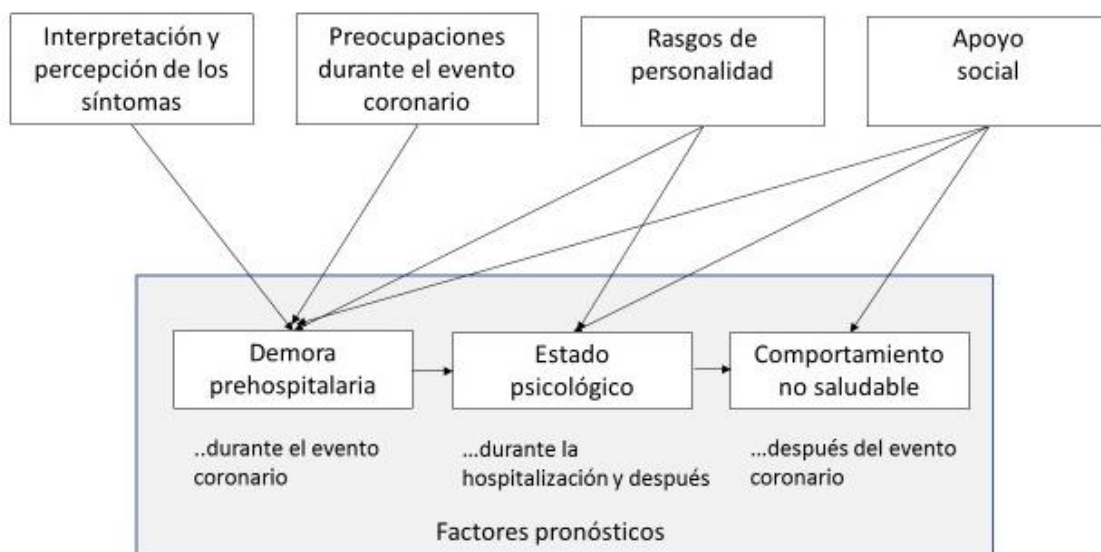
Dentro de la EC, el SCA tiene la mayor prevalencia en los países europeos (Townsend et al, 2016). El SCA engloba un espectro de condiciones compatibles con isquemia miocárdica aguda debido a la reducción abrupta de flujo sanguíneo coronario, lo cual causa la necrosis de las células del miocardio, pudiendo provocar la muerte del paciente (Amsterdam, et al., 2014). En concreto, el SCA se produce por la rotura y/o erosión de una placa aterosclerótica que determina la formación de un trombo intracoronario, provocando así la aparición de angina inestable (AI), infarto agudo de miocardio (IAM) o muerte súbita (Velasco, Cosín, Maroto, Muñiza, Casasnovasa, Plaza, & Abadala, 2000). Generalmente se manifiesta con dolor en el pecho, dolor en uno o ambos brazos, dificultad para respirar y otros síntomas y se conoce entre la población general como “ataque cardíaco”.

**El SCC** es un término más amplio que incluye pacientes con sospecha de EC y síntomas de angina de pecho estable o inestable, o con aparición de insuficiencia cardíaca (IC) o pacientes sintomáticos o asintomáticos después de 1 año del SCA (Knuuti, et al. 2019).

Hay varios factores que influyen en el pronóstico de los pacientes con EC. De hecho, la EC puede prevenirse y controlarse a través de ajustes en el estilo de vida, terapias farmacológicas y no farmacológicas que incluirían los procedimientos de

revascularización quirúrgicos y percutáneos (Knuuti, et al. 2019). En concreto, el pronóstico de los pacientes con EC ha mejorado mucho en las últimas décadas gracias a las terapias farmacológicas y a los procedimientos intervencionistas. Sin embargo, la toma de decisiones, el estado psicológico y el comportamiento de los pacientes también podrían influir en su pronóstico y por lo tanto pueden ser objetivo de intervención para mejorar los resultados a largo plazo. En esta tesis nos vamos a centrar **los siguientes tres factores pronósticos modificables en los que el paciente tiene un papel importante (véase Figura 1):**

Figura 1. Modelo conceptual de los factores pronósticos investigados en la tesis.



### Proceso de toma de decisiones. Demora prehospitalaria

Se ha demostrado que la *demora prehospitalaria*, que es el tiempo que transcurre entre el comienzo de los síntomas y el momento en que el paciente recibe tratamiento, tiene un papel pronóstico fundamental para el paciente, ya que el éxito de las terapias médicas aplicadas ante un SCA, depende en gran parte del tiempo, siendo más eficaz si se administra dentro de las primeras horas después del comienzo de los síntomas (Bulluck, et al., 2016). En este sentido, la mortalidad por SCA y las complicaciones derivadas del mismo podrían verse reducidas hasta un 50% si se administra tratamiento dentro de la primera hora desde que se producen los primeros síntomas (Moser, et al., 2006).

Sin embargo, la investigación muestra que la gran mayoría de los pacientes no reciben tratamiento dentro del período de tiempo recomendado (una o dos horas) y este retraso se debe principalmente a demoras en la toma de decisiones: los pacientes esperan

mucho tiempo para buscar atención médica después de que los síntomas han comenzado (Wechkunanukul, Grantham, & Clark, 2017). En este sentido, una reciente revisión mundial de estudios mostró que los tiempos medios para buscar tratamiento oscilaron entre 1,6 y 12,9 horas y siempre fueron mayores que los plazos recomendados en los estudios disponibles (Wechkunanukul, et al., 2017). Por lo tanto, la *demora prehospitalaria*, en concreto la demora en tomar la decisión de buscar atención médica, producirá mayores o menores tasas de supervivencia y de recuperación posterior (Bulluck, et al., 2016).

### Estado psicológico tras el evento coronario

Además de la demora prehospitalaria, hay otros factores que predicen el pronóstico posterior del paciente tras un SCA. El *estado psicológico* tras el evento coronario, como es el desarrollo de ansiedad y / o depresión durante la hospitalización y en meses después del evento coronario, se asocia con una mayor probabilidad de empeoramiento pronóstico y mortalidad (Kurdyak, Gnam, Goering, Chong & Alter, 2008; Kurdyak, Chong, Gnam, Goering & Alter, 2011; Watkins et al., 2013). Un metaanálisis encontró que los riesgos de eventos coronario recurrentes y mortalidad cardiaca al año siguiente por SCA fueron entre 2.0 y 2.6 más altos en pacientes con depresión post-SCA en comparación a pacientes sin depresión (van Melle, et al., 2004).

El estado psicológico tras el evento coronario es un factor importante, ya que muchos de los pacientes se ven muy afectados psicológicamente. En esta línea, la prevalencia de la ansiedad y depresión tras un evento coronario ha sido analizada en un reciente estudio en el que las tasas de depresión y de ansiedad fueron medidas durante un año después del evento coronario. Las tasas de ansiedad fueron de 28 y 27% en convalecencia temprana y tardía (12 meses tras el evento coronario) mientras que las tasas de depresión fueron de 17 y 15% respectivamente. Estas cifras sugieren que, en los 12 meses posteriores a un evento coronario, las tasas de prevalencia aumentan 2 veces para la ansiedad y 2.5 veces para la depresión (Murphy, 2020). Estas tasas de ansiedad y depresión son en gran medida consistentes con las observadas después de otros eventos traumáticos como accidente cerebrovascular (Broomfield, Quinn, Abdul-Rahim, Walters, & Evans, 2014) y diagnóstico de cáncer (Linden, et al., 2012).

### Comportamientos de salud tras el evento coronario



Otro factor pronóstico en el que nos hemos centrado es el *comportamiento de salud* del paciente tras sufrir el evento coronario por su importante influencia en la prevención de futuros eventos coronarios. La prevención de futuros eventos coronarios y complicaciones en pacientes ya diagnosticados con EC es un enfoque importante porque estos pacientes tienen hasta 5 o 6 veces mayor probabilidad de sufrir futuros eventos cardiovasculares (Piepoli, et al., 2016). En concreto, los pacientes diagnosticados con EC deben seguir ciertas recomendaciones de estilo de vida que pueden reducir su riesgo cardiovascular. En particular, un estilo de vida saludable: como realizar actividad física de intensidad moderada, llevar una dieta saludable, mantener un peso saludable, no fumar y no beber grandes cantidades de alcohol (Piepoli, et al., 2016), se ha demostrado que podría ayudar a prevenir y controlar la hipertensión, el colesterol alto, la obesidad o la diabetes, todo lo cual aumenta significativamente el riesgo de EC (Piepoli, et al., 2016). Sin embargo, la investigación reciente realizada en 24 países europeos muestra que, aunque muchos pacientes intentan seguir las recomendaciones sobre el estilo de vida, el cumplimiento no es satisfactorio y los objetivos con frecuencia no se alcanzan (Kotseva, et al., 2018). Además de investigar factores pronósticos relacionados con el comportamiento del paciente, en esta tesis **nos centramos en identificar los factores psicológicos** que podrían influir en estos. Muchos estudios se han centrado en factores sociodemográficos y clínicos que caracterizan los pacientes con alto riesgo de eventos coronarios repetidos. Sin embargo, la investigación de los factores psicológicos puede ser especialmente útil porque puede **revelar los mecanismos y las causas del riesgo elevado**. Además, muchos factores psicológicos son **accionables**, es decir pueden abordarse en campañas e intervenciones destinadas a reducir el riesgo cardiovascular de los pacientes.

La evidencia científica previa ha demostrado o sugerido varios factores psicológicos de importancia para los factores pronósticos descritos anteriormente. Estos pueden ser factores inmediatos al evento coronario que tienen que ver con la interpretación y percepción de los síntomas o los pensamientos y preocupaciones durante la toma de decisiones o factores como rasgos de personalidad o la disponibilidad de apoyo social que influyan de manera indirecta (véase la Figura 1).

### Factores psicológicos relacionados con la demora prehospitalaria.

La investigación ha identificado varios determinantes de la demora prehospitalaria, aunque la mayoría de los estudios se han centrado en factores sociodemográficos, clínicos y sociales / situacionales. En cuanto a los factores psicológicos o cognitivos, se

ha explorado cómo éstos afectan a la demora prehospitalaria en pacientes con síntomas de SCA (Khraim, & Carey, 2009).

En esta línea, varios estudios han encontrado que los pacientes que interpretan correctamente sus síntomas como posibles eventos coronarios comparado con los que no lo hicieron correctamente, esperan aproximadamente una hora menos antes de buscar atención médica (Albarqouni, et al., 2016, Maeso-Madronero, Bergbauer, Mensing, Murza, Athanasiou, & Lange, 2000; McKinley, et al., 2004). Otro factor de interés son las preocupaciones y pensamientos de los pacientes durante el evento coronario. En particular, preocupaciones relacionadas con las graves consecuencias de retrasar la búsqueda de ayuda en caso de que sea necesaria (es decir, en caso de que uno está experimentando un ataque cardíaco) y preocupaciones sociales relacionadas con las consecuencias de buscar atención médica en el caso de una falsa alarma (es decir, en caso de que uno no esté sufriendo un ataque cardíaco). Sin embargo, los resultados de la investigación sobre preocupaciones durante el evento coronario tienden a ser mixtos, ya que hay estudios que sugieren que la ansiedad, la gravedad percibida de los síntomas, la vergüenza o la preocupación por molestar a otros podrían afectar a la demora prehospitalaria, pero los resultados no siempre han sido consistentes (Moser et al., 2006; Wechkunanukul, Grantham, & Clark, 2017; Dracup, & Moser, 1997). El conocimiento de los síntomas del SCA también se ha asociado ocasionalmente con la demora prehospitalaria (Maeso-Madronero, Bergbauer, Mensing, Murza, Athanasiou, & Lange, 2000; Khraim, & Carey, 2009; Mackay, Ratner, Nguyen, Percy, Galdas, & Grunau, 2014). Hay otros factores psicológicos, que también podrían relacionarse con la demora prehospitalaria pero han sido poco investigados, como son: la personalidad tipo D, la resiliencia, y el apoyo social.

La personalidad tipo D se refiere a la combinación de afecto negativo e inhibición social (o la tendencia de experimentar emociones negativas fuertes con frecuencia, pero no hablar de estas emociones con otras personas) y se ha asociado con peor pronóstico en pacientes con enfermedades cardiovasculares (Denollet, 2005; Grande, Romppel, & Barth, 2012cambios). Dada la tendencia de las personas con personalidad tipo D a no hablar con otros sobre sus emociones, el peor pronóstico de los pacientes con personalidad tipo D, podría explicarse por una demora prehospitalaria más prolongada.

La resiliencia, definida como la capacidad de hacer frente a circunstancias adversas, prosperar frente a la adversidad y encontrar una connotación positiva en situaciones negativas, es otro rasgo psicológico que se ha relacionado con los resultados de salud (Ryff et al., 2012; Tusaie & Dyer, 2004). La investigación sobre el papel de la resiliencia en el SCA es en general limitada, pero un estudio realizado por Arrebola-Moreno y sus colegas mostró que la resiliencia estaba relacionada con una menor respuesta inflamatoria y menos daño al miocardio (Arrebola-Moreno, García-Retamero, Catena, Marfil- Álvarez, Melgares-Moreno, & Ramírez-Hernández, 2014). Por otro lado, la resiliencia podría ser un factor protector de la demora prehospitalaria, ya que se asocia con un comportamiento de salud más proactivo (Ma et al., 2013; Rosenberg et al., 2014).

Respecto al apoyo social, definido como la creencia que uno es "atendido y amado, estimado y miembro de una red de obligaciones mutuas" (Cobb, 1976), como efecto protector, se ha demostrado que, las personas que tienen apoyo social, respecto a las que no lo tienen, tienen menor riesgo de desarrollar enfermedad cardiovascular y un menor riesgo de morir cuando la desarrollan (Barth, Schneider & von Kanel, 2010; Lett, Blumenthal, Babyak, Strauman, Robins, & Sherwood, 2005). Las personas que tienen apoyo social pueden ser más propensas a recibir consejos para buscar atención médica de inmediato. Por ejemplo, estar con un compañero o un compañero de trabajo cuando comienzan los síntomas puede reducir el retraso, mientras que estar solo o vivir solo se ha asociado con retrasos más largos (Moser et al., 2006), lo que sugiere que las personas con apoyo social podrían tener una demora prehospitalaria menor.

En esta tesis los factores psicológicos investigados en relación con la demora prehospitalaria fueron los diversos factores relacionados con la interpretación y percepción de los síntomas, las preocupaciones durante el evento coronario, la personalidad tipo D, la resiliencia, y el apoyo social.

### Factores psicológicos relacionados con el estado psicológico del paciente

Los factores psicológicos investigados en esta tesis en relación con el estado psicológico del paciente tras el evento coronario, han sido ciertos rasgos mencionados en el apartado anterior y el apoyo social del paciente, todos ellos factores de riesgo o protectores de la salud cardiovascular y que pueden revelar cómo las personas lidian con un evento coronario (Rozanski, 2014).

Dichos factores psicológicos son: la personalidad tipo D, la resiliencia, y el apoyo social. Por una parte, parece que la personalidad tipo D, se ha identificado como un factor de vulnerabilidad para la depresión y la ansiedad (Kupper & Denollet, 2018), lo que sugiere que los pacientes con personalidad tipo D pueden ser más propensos a informar angustia psicológica después del evento coronario.

Por otro lado, la resiliencia se ha asociado con mejor salud mental, como es en pacientes renales, ya que se ha relacionado con un mejor manejo de la enfermedad. En el caso de los padres de niños con cáncer, los que mostraron una mayor resiliencia reportaron menor nivel de angustia, más apoyo social y una mejor capacidad para compartir preocupaciones relacionadas con la salud, siendo en general la resiliencia descrita como factor protector en la adaptación al cáncer y se ha relacionado con menos angustia emocional (Ma, et al., 2013; Rosenberg, et al., 2014; Rowland & Baker, 2005). Esto sugiere que los pacientes con mejor resiliencia podrían estar más protegidos frente a problemas psicológicos después del evento coronario.

Respecto al apoyo social, hay varios mecanismos que pueden explicar su efecto protector frente a eventos coronarios (Barth, Schneider & von Kanel, 2010) y uno de ellos podría ser menos angustia psicológica después del evento coronario. Por ejemplo, se ha observado que los altos niveles de apoyo social amortiguan el impacto de la depresión en la mortalidad tras un evento coronario (Frasure-Smith, Lesperance, Gravel, Masson, Juneau, Talajic, & Bourassa, 2000).

### Factores psicológicos investigados relacionados con el comportamiento de salud tras el evento coronario

Los factores psicológicos investigados en esta tesis en relación con el comportamiento de salud del paciente en el periodo de recuperación han sido el apoyo social y la salud mental.

El bajo apoyo social se ha asociado con un mayor riesgo de mortalidad cardíaca (Barth, Schneider & von Kanel, 2010; Valtorta, Kanaan, Gilbody, Ronzi, & Hanratty, 2016) y una mayor exposición a factores de riesgo conductuales en poblaciones sanas (Debnam, Holt, Clark, Roth, & Southward, 2012; Hwang, Hong, & Rankin, 2015). Los problemas

de salud mental como la depresión son especialmente propensos a desarrollarse después de un evento cardíaco y se han asociado con un aumento de dos veces en el riesgo de resultados cardiovasculares negativos (por ejemplo, mortalidad) (van Melle et al., 2004). Los síntomas depresivos también se han relacionado con una menor adherencia a comportamientos de salud que reducen el riesgo cardiovascular (Cohen, Edmondson, & Kronish, 2015; Kronish, Rieckmann, Halm, Shimbo, Vorchheimer, Haas, & Davidson, 2006) y una menor adherencia a la medicación (Grenard, et al, 2011). Tanto la falta de apoyo social de amigos y familiares como la depresión se han asociado con una menor probabilidad de retomar y completar los programas rehabilitación cardiovascular (Murray, Craigs, Hill, Honey, & House, 2012). Esto sugiere que ambos factores podrían relacionarse con más prevalencia de comportamientos no saludables en el periodo de recuperación tras un evento coronario.

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***JUSTIFICACIÓN,  
HIPÓTESIS Y  
OBJETIVOS***



**a) Hipótesis y justificación**

Teniendo en cuenta que, la enfermedad coronaria es la principal causa de muerte en Europa, y que su pronóstico puede mejorarse no solo a través de terapias farmacológicas o médicas, sino a través de cambios en el comportamiento de los pacientes, estimamos de gran relevancia la investigación sobre los factores psicológicos que influyen en la de toma de decisiones durante el evento coronario, el estado psicológico del paciente después del evento coronario y los comportamientos de salud en el periodo de recuperación.

La hipótesis general de esta tesis es que los factores psicológicos podrían relacionarse con la demora prehospitalaria, el estado psicológico del paciente tras el evento coronario y los comportamientos de salud en el periodo de recuperación, y por lo tanto tener relevancia para el pronóstico de los pacientes.

**b) Objetivo general y específicos**

*Objetivo general:* Identificar los factores psicológicos que podrían tener un papel importante en el pronóstico de los pacientes con EC a través de su relación con la toma de decisiones, el estado psicológico y el comportamiento de salud de los pacientes.

*Objetivos específicos:*

- 1) Investigar la relación entre varios factores relacionados con la interpretación y percepción de los síntomas y las preocupaciones durante el evento coronario con la demora prehospitalaria (Estudios 1 y 2).
- 2) Investigar la relación entre la personalidad tipo D, la resiliencia, y el apoyo social con la demora prehospitalaria (Estudio 2) y el estado psicológico tras el evento coronario (Estudio 2).
- 3) Investigar la relación entre el apoyo social y la salud mental con el comportamiento de salud en el periodo de recuperación (Estudio 3).



***MEMORIA DE  
ARTÍCULOS***





***Artículo 1: Psychological and cognitive factors related to prehospital delay in acute coronary syndrome: A systematic review.***

El contenido de este artículo está publicado como: Arrebola-Moreno, M., Petrova, D., García-Retamero, R.; Rivera-López, R.; Jordan Martínez, L., Arrebola, J.P.; Ramírez-Hernández, J.A.; & Catena, A. (2020). Psychological and cognitive factors related to prehospital delay in acute coronary syndrome: A systematic review. *International Journal of Nursing Studies*. doi: 10.1016/j.ijnurstu.2020.103613. Posición: Q1, Decil 1, FI JCR 2018: 3.57 (1/120 en la categoría Nursing).



**Psychological and cognitive factors related to prehospital delay in acute coronary syndrome: A systematic review**

**Abstract**

**Background.** In acute coronary syndrome the time elapsed between the start of symptoms and the moment in which the patient receives treatment is an important determinant of survival and subsequent recovery. However, many patients do not receive treatment as quickly as recommended, mostly due to substantial prehospital delays such as waiting to seek medical attention after symptoms have started.

**Objective.** To conduct a systematic review with meta-analysis of the relationship between nine frequently investigated psychological and cognitive factors and prehospital delay.

**Design.** A protocol was preregistered in PROSPERO [CRD42018094198] and a systematic review was conducted following PRISMA guidelines.

**Data sources.** The following databases were searched for quantitative articles published between 1997 and 2019: Medline (PubMed), Web of Science, Scopus, Psych Info, PAIS, and Open Grey.

**Review methods.** Study risk of bias was assessed with the NIH Quality Assessment Tool for Observational, Cohort, and Cross-Sectional Studies. A best evidence synthesis was performed to summarize the findings of the included studies.

**Results.** Forty-eight articles, reporting on 57 studies from 23 countries met the inclusion criteria. Studies used very diverse definitions of prehospital delay and analytical practices, which precluded meta-analysis. The best evidence synthesis indicated that there was evidence that patients who attributed their symptoms to a cardiac event (n=37), perceived symptoms as serious (n=24), or felt anxiety in response to symptoms (n=15) reported shorter prehospital delay, with effect sizes indicating important clinical differences (e.g., 1.5-2 hours shorter prehospital delay). In contrast, there was limited evidence for a relationship between prehospital delay and knowledge of symptoms (n=18), concern for troubling others (n=18), fear (n=17), or embarrassment in asking for help (n=14).

**Conclusions.** The current review shows that symptom attribution to cardiac events and some degree of perceived threat are fundamental to speed up help-seeking. In contrast, addressing social concerns and barriers in seeking medical attention (embarrassment or concern for troubling others) may not be as important as initially thought. The current review also shows that the use of very diverse methodological practices strongly limits the integration of evidence into meaningful recommendations. We conclude that there is urgent need for common guidelines for prehospital delay study design and reporting.

### **Introducción**

Acute coronary syndrome is the greatest single cause of mortality and loss of disability-adjusted life years (DALYs) worldwide, accounting for roughly 7 million deaths and 129 million DALYs annually (Naghavi, et al., 2017; Vedanthan, Seligman, & Fuster, 2014). Acute coronary syndromes are often caused by the abrupt occlusion of a coronary artery, and are treated with thrombolytic therapy or percutaneous coronary intervention to restore blood flow. When the occlusion of a coronary artery lasts more than 20-30 minutes, myocardial necrosis begins to occur, with serious consequences for the patient's health. However, mortality and the associated complications can be substantially reduced if treatment is administered soon after symptom onset (e.g., within one or two hours) (Moser, et al., 2006; Ibanez, et al., 2018). Therefore, the time elapsed between the start of the symptoms and the moment the patient receives treatment is an important determinant of survival and subsequent recovery (Moser et al., 2006). Research shows that the large majority of patients do not receive treatment within the "golden time window" (one or two hours) and this delay is mostly due to patients waiting to seek medical attention after the symptoms have started (Wechkunanukul, Grantham, & Clark, 2017). To illustrate, a recent worldwide review of studies showed that mean times to seeking medical care ranged from 1.6 to 12.9 hours and they were always greater than the recommended timeframes in the available studies (Wechkunanukul, et al., 2017).

Research has identified several determinants of prehospital delay. The majority of studies have focused on socio-demographic, clinical, and social/situational factors. For instance, socio-demographic characteristics related to longer prehospital delays include female gender, older age, lower educational level, lower socioeconomic status, and belonging to a minority ethnic group (Moser, et al., 2006; Wechkunanukul et al., 2017; Khraim, & Carey, 2009). Clinical factors that characterize patients with longer delays include history of myocardial infarction, angina, or other chronic diseases such as diabetes daytime (Moser, et al., 2006; Wechkunanukul et al., 2017). Finally, social/situational factors related to longer delays include living alone or being alone at symptom onset, not calling an ambulance, consulting with a physician, and suffering the cardiac episode during daytime (Moser, et al., 2006; Wechkunanukul et al., 2017). In contrast, the presence or advice of family members or co-workers seems to help decrease delays, although results are mixed (Moser, et al., 2006; Wechkunanukul et al., 2017; Khraim, & Carey, 2009).

Research has also explored how psychological or cognitive factors affect prehospital delay in patients with symptoms of acute coronary syndrome (Dracup, &

Moser, 1997). This research can be especially useful because it may reveal the psychological mechanisms that drive delays. In addition, many psychological and cognitive factors are actionable and can be addressed in campaigns and interventions aiming to reduce prehospital delay. For instance, several studies have found that patients who interpret their symptoms as potential cardiac events—as opposed to stemming from anxiety, musculoskeletal pain, or other less serious conditions—wait about an hour less before seeking medical attention (Abed, Khalil, & Moser, 2015; McKee, Mooney, O'Donnell, O'Brien, Biddle, & Moser, 2013; McKinley, Dracup, Moser, Ball, Yamasaki, Kim, & Barnett, 2004).. In contrast, worrying about troubling others by asking for help could double the odds of hospital arrival later than one hour after symptom onset (Dracup, & Moser; 1997)., and even later than two hours (Bray et al., 2015). Such large differences in the time taken to receive medical attention can have strong effects on patient outcomes because each half an hour of delay in administering treatment could reduce patients' life-expectancy by a year (Rawles, 1997) and delays in general increase the risk of recurrent cardiac events or death (Cullen, et al., 2016; De Luca, Suryapranata, Ottervanger, Antman, 2004).

However, results from research on psychological and cognitive factors tend to be mixed. For instance, studies suggest that anxiety, perceived seriousness of symptoms, embarrassment or concern for troubling others might affect prehospital delay, yet results have not always been consistent (Moser, et al., 2006; Wechkunanukul et al., 2017; Khraim, & Carey, 2009). Knowledge of the symptoms of acute coronary syndrome has also been only occasionally associated with prehospital delay (McKee, et al., 2013; Albarqouni, Smenes, Meinertz, Schunkert, Fang, Ronel, & Ladwig, 2016; Maeso-Madronero, 2000). In addition, extensive and costly information campaigns and interventions that aimed to reduce prehospital delay by focusing on some of these factors were only occasionally effective (Farquharson, et al., 2018; Mooney, McKee, Fealy, O'Brien, O'Donnell, & Moser, 2012; Mooney, McKee, Fealy, O'Brien, O'Donnell, & Moser, 2014). The majority of these interventions employed mass media campaigns emphasizing the symptoms of acute coronary syndrome and the importance of rapid action, but their effectiveness was limited and it was not clear what factors differentiated effective and ineffective interventions (Farquharson, et al., 2018; Mooney, et al., 2012). Finally, almost all these interventions have put a lot of emphasis on knowledge of acute coronary syndrome warning signs, benefits of treatment, and instructions about what to do, but only a small number of them directly addressed potential perceived psychological barriers to seeking help (Farquharson, et al., 2018; Mooney, et al., 2012; Mooney, et al., 2014)—an aspect that might affect their effectiveness.

Campaigns and interventions will be more effective when they properly address the main reasons for prehospital delay in the target population, which so far seem to be unclear. A systematic review of the existing literature would shed light on this issue as it would help integrate the existing knowledge. Such a review can also help develop an integrated theoretical model of the factors influencing prehospital delay and help design successful, theoretically-driven interventions. In this paper, we aimed to conduct a systematic review with meta-analysis of the relationship between several frequently investigated psychological and cognitive factors and prehospital delay.

### **Method**

When designing the study, we followed PRISMA guidelines for conducting and reporting systematic reviews (Moher, Liberati, Tetzlaff, Altman, & PRISMA Group., 2010).. All data, detailed results, and PRISMA and MOOSE checklists are available on the Open Science Framework (OSF): doi: 10.17605/OSF.IO/4MB3D. As per protocol, we searched the following databases: Medline (PubMed), Web of Science, Scopus, and Psych Info, and considered articles published between 1997 (date of publication of the modified Response to Symptoms Questionnaire—the first instrument to systematically measure psychological and cognitive factors in relation to prehospital delay; (Dracup, & Moser, 1997) and March 2019. In addition, we searched two databases that contain grey literature: PAIS and Open Grey. The search terms used are provided in the registration protocol in PROSPERO [CRD42018094198]. The bibliographic search was conducted by a researcher with methodological training in systematic reviews.

### **Selection of psychological and cognitive factors that might affect prehospital delay**

The selection of the variables was based on factors categorized as psychological and/or cognitive in previous related reviews of broad scope (Moser, et al., 2006; Khraim, & Carey, 2009). To identify existing narrative reviews, systematic reviews, or other similar articles that could guide us in the selection process, we conducted a preliminary exploratory study of the literature in PubMed and PsychInfo. We identified three reviews (Moser, et al., 2006; Wechkunanukul, et al., 2017; Khraim, & Carey, 2009), and we searched for additional articles not included in the reference list of the reviews, which resulted in 14 additional articles. From these, we aimed to identify factors that were frequently measured in previous studies. Because we aimed to conduct meta-analyses, we restricted the search to those psychological or cognitive factors where there was indication that a meta-analytic synthesis would be meaningful (i.e., availability of multiple studies and indications for relatively homogenous measures). The final list of factors

contained variables measured by the frequently used (modified) Response to Symptoms Questionnaire (Dracup, & Moser, 1997), whereas other psychological factors such as personality traits were discarded for potential lack of accumulated evidence.

The psychological and cognitive factors selected for the review were the following: a) objective knowledge of the symptoms of acute coronary syndrome (patients' correct recognition of the symptoms in a test-like questionnaire: e.g., "Is chest pain a symptom of a heart attack?"); b) subjective knowledge of the symptoms of acute coronary syndrome (patients' self-reported knowledge of the symptoms before the cardiac event, e.g., "Did you know the symptoms of a heart attack?"); c) attribution of the symptoms to a cardiac vs. another event; d) anxiety in response to symptoms; e) perceived seriousness of the symptoms; f) concern/worry for troubling others; g) fear in response to symptoms; h) fear from the potential consequences of the symptoms or disease; i) embarrassment/shame in asking for help.

### **Inclusion criteria**

We included quantitative studies with adult participants that measured prehospital delay and reported its relationship with any of the psychological/cognitive factors listed above. We did not select studies based on the exact definition of the prehospital delay interval but instead we followed previous work (Mackay, Ratner, Nguyen, Percy, Galdas, & Grunau, 2014)., and recorded and analyzed the definition used in each study. During the process of review, we came across studies that reported several prehospital delay intervals. In these cases, we decided to extract the decision delay interval if available (time elapsed from symptom onset to the decision to seek medical attention) or the interval closest to it, because it is the interval that should be most influenced by psychological/cognitive and not external (e.g., transportation) factors.

There were no restrictions regarding the specific study design or language in which the paper was written. Cross-sectional, longitudinal, and experimental/intervention research was considered as long as the relationships of interest were reported. We considered for inclusion both studies with patients who retrospectively reported on their prehospital delay and studies with healthy populations who reported hypothetical prehospital delay in a hypothetical scenario (e.g., participants had to think about how they would feel and react). Abstracts in languages not spoken by the research team were screened using [translate.google.com](https://translate.google.com).

### **Exclusion criteria**

We excluded reviews, qualitative studies, editorials, opinion articles, conference



proceedings or similar publications not reporting data from original empirical studies.

#### Article selection

The citations were managed in the software Refworks ([www.refworks.com](http://www.refworks.com)). After removing duplicates, the titles of all publications identified in the search were screened by one author who discarded publications when the title clearly suggested that the article would not meet inclusion criteria (e.g., a publication on an unrelated topic or a systematic review). Subsequently, the abstracts of the remaining publications were independently screened by two reviewers who resolved disagreements through discussion or revision of the full text. Two reviewers independently reviewed the full texts of the selected abstracts. After an initial sample of articles was identified for inclusion, their reference lists were thoroughly reviewed to identify additional articles of relevance. The review procedure was repeated with the studies identified from the reference lists.

#### Data extraction

One researcher extracted the data from the selected studies using a predefined data sheet according to the review preregistration protocol in PROSPERO and another author thoroughly checked it. Disagreements were resolved through discussion. Information was extracted about study and publication characteristics and regarding the relationships of interest (see Table 1 and OSF: [doi: 10.17605/OSF.IO/4MB3D](https://doi.org/10.17605/OSF.IO/4MB3D)). Regarding the relationships of interest, we recorded the definitions and scales/items used to measure the variables, the statistical result reported (and its effect size when available), whether it was reported as significant, and whether the statistical results were extracted from simple or adjusted (for covariates) analyses. Whenever necessary we contacted authors to request additional information.

#### Study risk of bias

The risk of bias for each study was assessed with the NIH Quality Assessment Tool for Observational, Cohort, and Cross-Sectional Studies (National Institutes of Health, 2015). We chose this tool because of its suitability for cross-sectional studies, which we expected to form the majority of the study sample. In addition, four items were added to the NIH tool to evaluate the quality of the prehospital delay measurement, following similar procedures to research on early cancer diagnosis (Weller et al., 2012). These items were: a) Whether prehospital delay was clearly defined and measured according to the definition stated by the authors; b) Whether the time elapsed between the diagnosis of acute coronary syndrome and participation in the study/interview was reported, and if yes, if it was reasonable according to our expert judgment (e.g., a reasonable time would be two weeks or fewer after the cardiac event (i.e., when memory is fresh) vs. one year or more after the cardiac event); c) Whether patient-reported data

on prehospital delay was cross-checked with other sources (e.g., hospital records, family members, etc.); d) Whether data analysis was described in full, including how and why data are categorized, how missing and incomplete data were managed, and how outliers at both ends of the spectrum were accounted for.

The highest possible score in the quality assessment was 18 (14 NIH items + 4 prehospital delay items). We defined cut-offs regarding what was considered low, medium, and high risk based on our judgment regarding the relative and not absolute risk of bias of the studies. In particular, we considered a wide range of scores as low risk because all studies meeting the inclusion criteria were cross-sectional and thus no study received more than 14 points. In contrast, we considered a conservative threshold regarding what is considered high risk because all studies were of low evidence level. Thus, we considered a score of 12 (highest quartile) or more as low risk of bias, a score of 10 or 11 (2<sup>nd</sup> and 3<sup>rd</sup> quartiles) as medium risk, and a score of 9 or less (lowest quartile) as high risk. Two reviewers evaluated the studies independently and the disagreements were resolved by discussion with a third reviewer.

#### Analysis

We aimed to conduct a meta-analysis of the relationships of interest. However, despite the relatively high homogeneity of the measures used across studies and the large number of studies available, the very diverse analytical and reporting practices of authors precluded any meaningful quantitative synthesis (see more details in the results section). Even considering studies separately as a function of whether prehospital delay was dichotomized for analysis or not, authors reported very diverse statistics that could not be meaningfully combined (e.g., differences in means, in log-transformed means, in medians, in geometric means, standardized beta coefficients, unstandardized B coefficients, ORs, etc.) and often no sufficient detail regarding transformations was provided.

Instead, we conducted a qualitative “best evidence synthesis” (Slavin, 1995). This method is recommended for cases where meta-analysis is not meaningful and constitutes a critical qualitative summary of the available evidence, taking into account strict inclusion criteria, the methodological quality of the evidence, and the effect sizes. Following recent applications of the method (Slavin, 1995; van Deutekom, Chinapaw, Jansma, Vrijkotte, & Gemke, 2017; de Vries, Meulendijks, Driessen, van Dooren, Tjin, & van de Kerkhof, 2018; Asker, Brooke; Walden, Tranaeus, Johansson, Skillgate, & Holm, 2018), we adapted the best evidence synthesis procedure to the current research and developed a procedure for evidence evaluation described in Table 1. The evidence for each relationship of interest was classified as strong, moderate, limited, conflicting, or no

evidence based on criteria specified in Table 1. In case of moderate or strong evidence, the clinical significance of the effects was determined from the effects sizes and/or the practical significance of the documented differences (e.g., median difference in minutes of prehospital delay).

In addition, we conducted sensitivity analysis exploring how conclusions would change if we considered whether the effects were obtained from simple (unadjusted) analyses or from analyses adjusted for important covariates (e.g., demographics, other psychological factors). This is important to consider because some of the effects of interest may be mediated by other more proximal predictors and thus could be significant in unadjusted but not in adjusted analyses.

Finally, we also explored how the results vary according to the definition of prehospital delay and the continent where the study was conducted. We considered whether authors measured prehospital decision delay (i.e., the time elapsed from symptom onset to the decision to seek medical attention, the interval most likely to be influenced by psychological or cognitive factors) or another definition of prehospital delay (e.g., the time elapsed from symptom onset to arrival at the hospital, to first medical contact, or to first treatment). The grouping by continent was done based on cultural and socio-economic similarity and the available number of studies. The three groups created were: Asia/Africa (there was only one study from Africa, in particular Egypt), America/Australia, and Europe.

**Table 1. Best evidence synthesis procedure.**

Study inclusion criteria: <ul style="list-style-type: none"><li>• Studies that measure the relationships of interest as per study protocol.</li></ul>
Best evidence synthesis exclusion criteria: <ul style="list-style-type: none"><li>• Studies with high risk of bias: <math>\leq 9</math> points on the methodological quality assessment (per pre-registered protocol).</li><li>• Studies with very small sample sizes (<math>&lt; 73</math>) able to detect only effect sizes <math>&gt; R^2 = .10</math>, based on analyses with G*power, assuming <math>\alpha = .05</math>, power = .80 (post hoc).</li></ul>
Best evidence synthesis conclusion criteria: <ul style="list-style-type: none"><li>• Strong evidence: Consistent evidence provided by 70% or more of the low risk studies, provided that a sufficient number of studies is available.</li></ul>

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- Moderate evidence: Consistent evidence provided by 60% or more of the medium and low risk studies, provided that a sufficient number of studies is available.
- Limited evidence: Consistent evidence provided by less than 60% of the medium and low risk studies available, or a very small number of studies available.
- Conflicting evidence: Inconsistent findings in multiple studies.
- No evidence: No studies of low or medium risk were located.

#### Clinical significance:

- In case of moderate or strong evidence: Description (e.g., median difference in minutes of prehospital delay) and categorization (low, medium, strong) of effect sizes whenever possible for the low risk studies with positive findings.

## **Results**

Figure 1 shows a flow diagram of the selection process and Table 2 presents the basic characteristics of the included studies. In some of the included publications, the relationships of interest were examined only by separating the total study sample in several groups (e.g., based on demographics such as country or gender of the participants) and the relationships of interest were not reported in the whole sample. This was the case for five publications that separated the total study sample based on gender, one based on race, and one based on country. To be able to summarize the evidence in accordance with the pre-planned procedure, and to increase homogeneity of the results keeping up with the common one-country-per-study pattern, we have considered each sub-sample as a separate study (a result that is indicated in the first column of Table 2).

A total of 48 publications were eligible according to the criteria. After considering samples separated by country, gender, or race as different studies, these 48 publications resulted in 57 studies from 23 different countries. All studies were cross-sectional studies with patients in which prehospital delay and the psychological/cognitive factors were measured retrospectively after the cardiac event had taken place. No longitudinal, experimental, or cross-sectional studies with healthy samples fulfilled the inclusion criteria. The studies included 17,501 participants overall; 46 studies (81%) included patients with both STEMI (i.e., ST-elevation myocardial infarction) and non-STEMI; 10 studies (17%) included patients with STEMI only; and 1 study (2%) included patients with chest pain regardless of final diagnosis. Seventeen studies (30%) were conducted in countries in America or Australia, 21 (37%) in Asia/Africa, and 19 (33%) in Europe. The

countries most often represented were USA (9 studies), Jordan (5 studies), UK (5 studies), South Korea (4 studies), and Sweden (4 studies). Regarding methodological quality, 6 studies (11%) received high risk of bias rating, 28 (49%) medium, and 23 (40%) low.

In all the studies, the starting point for the prehospital delay interval was defined as the moment of symptom onset. In most studies the end point of the prehospital delay interval was arrival at the hospital as estimated by the patient,  $n=24$  (42%), or the decision to seek medical attention  $n=19$  (33%). The remaining studies,  $n=14$  (25%), used other very diverse definitions included in Table 2. In 51% ( $n=29$ ) of the studies the measure of prehospital delay was dichotomized for analysis (delay vs. no delay group). Among the most frequent cut-offs used to define delay were 60 min ( $n=10$ , 34%) or 120 min. ( $n=10$ , 34%). The rest of studies ( $n=28$ , 49%) analyzed prehospital delay as a continuous variable, and the majority ( $n=22$ , 78%) employed some transformation to eliminate the typical positive skew of the variable.

#### Best evidence synthesis

Table 3 provides a summary of the best evidence synthesis results and Table 4 displays the results as a function of type of analysis, prehospital delay definition, and continent. Despite a large number of available studies, we found limited evidence for a relationship between prehospital delay and symptoms knowledge, concern for troubling others, and being embarrassed to seek help. Two available studies suggest that fear in response to symptoms is related to shorter prehospital delay. However, the evidence was judged as limited due to the small number of studies. Evidence regarding the relationship between fear in response to the potential consequences of the disease and prehospital delay was limited and conflicting (see Table 3).

In contrast, we found strong evidence that patients who attribute their symptoms to a cardiac event have shorter prehospital delay (70% of low risk studies finding a significant relationship). Effect sizes from the low risk studies suggest an important clinical difference (e.g., a difference of two hours in prehospital delay between those who attribute symptoms correctly vs. incorrectly, and halved odds of delay in studies using a cut-off for prehospital delay, see Table 3 for details). However, 32% of good-quality (medium and low risk) studies did not demonstrate a significant relationship so true effect sizes are likely smaller. Overall, 15 studies investigated decision delay and 22 studies used other definitions of prehospital delay (see Table 4). A similar number of studies was conducted in America/Australia (13 studies), Asia/Africa (11 studies), and Europe (13 studies), and the percentage showing significant results was similar.

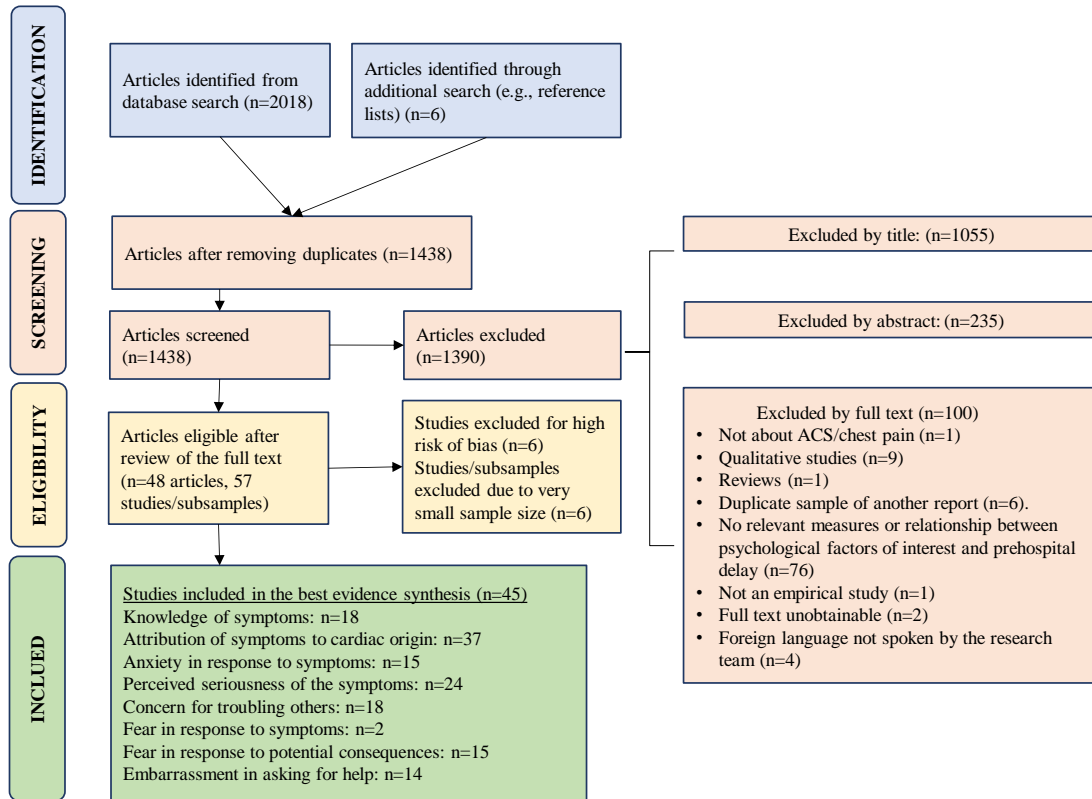
In addition, we found evidence that patients who were more anxious when

symptoms started had shorter prehospital delay, again with effect sizes of clinical importance, (e.g., a difference of about 2 hours in prehospital delay between those who report anxiety vs. no anxiety, and halved odds of delay in studies using a cut-off for prehospital delay, see Table 3 for details). However, 40% of good-quality (medium and low risk) studies did not demonstrate a significant relationship, so the strength of the evidence was judged as borderline moderate, and true effect sizes are very likely smaller. Overall, 5 studies investigated decision delay and 10 studies used other definitions of prehospital delay (see Table 4). A similar number of studies was conducted in Asia/Africa (5 studies), America/Australia (6 studies), and Europe (4 studies). The proportion reporting significant results was lowest for Asia/Africa (Table 4).

Finally, there was moderate evidence that patients who perceived their symptoms as serious had shorter prehospital delay, with effect sizes of clinical importance similar to those of the other factors, (e.g., a difference of about 2 hours in prehospital delay between those who perceive symptoms as serious vs not, and halved odds of delay in studies using a cut-off for prehospital delay, see Table 3 for details). In this case, 25% of good-quality (medium and low risk) studies did not report a significant relationship, so the evidence was judged as moderate and true effect sizes are likely smaller. Overall, 8 studies investigated decision delay and 16 studies used other definitions of prehospital delay (see Table 4). The majority of studies investigating the relationship between symptom attribution and prehospital delay were conducted in America/Australia (11 studies), with fewer studies from Asia/Africa (7 studies) and Europe (6 studies). The proportion reporting significant results was lowest for Asia/Africa (Table 4).

The sensitivity analysis showed that the majority of results were based on unadjusted analysis but the analysis did not show further differences in the significance of the effects as a function of covariate adjustment (Table 4). There were no other notable differences in the results as a function of prehospital delay definition or continent (Table 4).

Figure 1. Flow diagram of the search process.



**Table 2. Basic characteristics of the included studies.**

Note: KO= knowledge of symptoms-objective measure, KS= knowledge of symptoms-subjective measure, A=Attribution of symptoms to a cardiac event, ANX=anxiety in response to symptoms, PS=Perceives seriousness of symptoms, W=Worry about disturbing others, FS=Fear of symptoms, FC= Fear of consequences, E=Embarrassed to seek help. \* In bold, those that reached statistical significance according to the original study authors (p<.05). STEMI=ST-elevation myocardial infarction. Both=both STEMI and non-STEMI. In the article by Ottesen et al. (2004) decision delay was available for a much smaller sample, so time to arrival at the hospital was extracted instead

First author	Pub year	Country	Study design	Patients diagnosis	Sample size	% females	Average age	Definition of prehospital delay	Was delay dichotomized?	Cutoff in minutes	Psychological/cognitive measures	NIH+additional items	Methodological quality	TOTAL quality score
Dracupet al. (1997)	1997	Australia	Cross-sectional	both	317	Not specified	63	to arrival at the hospital	yes	120	A, PS, W, FC, E	(9+4) Low risk	13	
Dracupet al. (1997)	1997	USA	Cross-sectional	STEMI	277	28	58	to arrival at the hospital	yes	60	KS, A, PS, W, FC, E	(8+4) Low risk	12	
McKinley et al. (2000)	2000	Australia	Cross-sectional	both	147	34	62	to arrival at the hospital	no		KS, A, PS, W, FC, E	(7+4) Medium risk	11	
O'Carroll et al. (2001)	2001	UK	Cross-sectional	both	72	31	63	to arrival at the hospital	yes	240	A	(7+4) Medium risk	11	
Carney et al. (2002)	2002	UK	Cross-sectional	both	62	11%	57	to the decision to seek medical attention	yes	60	A	(7+3) Medium risk	10	
Kentschn et al. (2002)	2002	Germany	Cross-sectional	STEMI	739	30	65	to the decision to seek medical attention	yes	60	A, ANX, PS, W, FS	(9+2) Medium risk	11	
Johansson et al. (2004)	2004	Sweden	Cross-sectional	both	381	43	62	to the decision to seek medical attention	yes	60	A, PS	(9+2) Medium risk	11	



McKinley et al. (2004)	2004	USA	Cross-sectiona	both	191	50	61	to arrival at the hospital	no	KO, A, ANX, PS, W, FC, E	(8+4) Low risk	12
McKinley et al. (2004)	2004	South Korea	Cross-sectiona	both	127	23	60	to arrival at the hospital	no	KO, A, ANX, PS, W, FC, E	(8+4) Low risk	12
McKinley et al. (2004)	2004	Japan	Cross-sectiona	both	136	20	61	to arrival at the hospital	no	KO, A, ANX, PS, W, FC, E	(8+4) Low risk	12
McKinley et al. (2004)	2004	UK	Cross-sectiona	both	141	23	61	to arrival at the hospital	no	KO, A, ANX, PS, W, FC, E	(8+4) Low risk	12
Ottesen et al. (2004)	2004	Denmark	Cross-sectiona	both	240	31	68	time from symptom onset to hospital presentation	no	A	(8+49) Low risk	12
Walsh et al. (2004)	2004	Ireland	Cross-sectiona	both	61	28	62	to arrival at the hospital (doctor's estimate)	no	ANX	(8+4) Low risk	12
Wu, et al. (2004)	2004	China	Cross-sectiona	both	102	23,5	62	to the decision to seek medical attention	no	A	(8+2) Medium risk	10
Al-Hassan, & Omran (2005)	2005	Jordan	Cross-sectiona	both	79	31	52	to the decision to seek medical attention	yes	A	(9+2) Medium risk	11

Fukuoka et al. (2005)	2005	Japan	Cross-sectional	both	145	13	62	to arrival at the hospital	no	180	KS, A, ANX, PS, W, FC, E	(9+4) Low risk	13
Morgan (2005)	2005	USA	Cross-sectional	both	98	37	63	to the decision to seek medical attention	no		ANX, PS	(9+3) Low risk	12
Moser et al. (2005)	2005	USA	Cross-sectional	both	194	49	60	to arrival at the hospital	no		KO, A, ANX, PS, W, FC, E	(7+4) Medium risk	11
Quinn (2005)	2005	USA	Cross-sectional	both	100	41	64	to the decision to seek medical attention	no		A	(9+4) Low risk	13
Taylor et al. (2005)	2005	Australia	Cross-sectional	diverse diagnoses (chest pain)	150	40	52	to the decision to seek medical attention	yes	180	KS, A, PS, W, FC, E	(10+4) Low risk	14
Noureddine et al. (2005)	2006	Lebanon	Cross-sectional	both	204	28	62	to arrival at the hospital	no		KO, A, PS, W, FC	(9+3) Low risk	12
Khan et al. (2007)	2007	Pakistan	Cross-sectional	both	720	22	54	to arrival at the hospital	yes	360	KO	(7+3) Medium risk	10
Lovlien et al. (2007) (Female sample)	2007	Norway	Cross-sectional	both	149	100	61	to the decision to seek medical attention	yes	60	A	(9+2) Medium risk	11

Lovlien et al. (2007) (Male sample)	200 7	Norway	Cross-sectional	both	384	0%	59	to the decision to seek medical attention	yes	60	A	(9+2) Medium risk	11
McSweeney et al. (2007) (Female sample)	200 7	USA	Cross-sectional	both	509	100	63	to receiving treatment	yes	120	A	(8+2) Medium risk	10
McSweeney et al. (2007) (Male sample)	200 7	USA	Cross-sectional	both	500	100	67	to receiving treatment	yes	120	A	(8+2) Medium risk	10
Perkins-Porras et al. (2008)	200 8	UK	Cross-sectional	both	177	22	60	to arrival at the hospital	yes	130	A	(9+4) Low risk	13
Khraim et al. (2009) (Female sample)	200 9	Jordan	Cross-sectional	both	24	100	about 55	to the decision to seek medical attention	no		KS, A, ANX, PS, W, E	(10+3) Low risk	13
Khraim (et al. (2009) (Male sample)	200 9	Jordan	Cross-sectional	both	110	0	about 55	to the decision to seek medical attention	no		KS, A, ANX, PS, W, E	(10+3) Low risk	13
Perkins-Porras et al. (2009)	200 9	UK	Cross-sectional	both	228	22	59	to the decision to seek medical attention	yes	60	A	(8+2) Medium risk	10
Zegrean et al. (2009)	200 9	USA and Canada	Cross-sectional	both	135	28	60	to the decision to seek medical attention	no		PS	(7+3) Medium risk	10

Herlitz et al. (2010)	Sweden	2010	Cross-sectional	both	1879	25	about 65	to the decision to seek medical attention	yes	60	A, ANX, FS	(9+4) Low risk	13
Lesneski (2010)	USA	2010	Cross-sectional	both	105	31	64	to arrival at the hospital	no		KS, A, ANX, PS, W, FC, E	(10+4) Low risk	14
Gouveia et al. (2011)	Brasil	2011	Cross-sectional	STEMI	115	31	the majority above 60	to admission at the hospital	yes	720	A	(5+2) High risk	7
Damasceno et al. (2012)	Brasil	2012	Cross-sectional	both	100	29	59	to the decision to seek medical attention	no		A, PS	(8+2) Medium risk	10
Hwan & Jeong (2012)	South Korea	2012	Cross-sectional	both	165	43	74	to arrival at the hospital	yes	360	A	(7+3) Medium risk	10
Kirchberger et al. (2012)	Germany	2012	Cross-sectional	both	2243	25	61	to first examination by a physician	yes	120	A	(8+3) Medium risk	11
Momeni et al. (2012)	Iran	2012	Cross-sectional	STEMI	162	35	60	to arrival at the hospital	yes	120	A, ANX, PS	(7+3) Medium risk	10
Gao & Zhang (2013)	China	2013	Cross-sectional	both	119	28	64	to initiation of treatment	yes	360	KS, A	(5+1) High risk	6
McKee et al. (2013)	Ireland	2013	Cross-sectional	both	1894	28	63	to arrival at the hospital	no		KO, A	(10+3) Low risk	13

Author (Year)	Year	Country	Study Design	MI Type	n	n (MI)	n (Control)	Outcome	Sample Size	Variables	Risk Level	Score
Vidotto et al. (2013)	2013	Italy	Cross-sectional	both	929	0	18	about 60, NR	no	A	(8+2) Medium risk	10
Al-Hassan (2014)	2014	Oman	Cross-sectional	both	112	18	59	to arrival at the hospital	yes	A, FC	(8+2) Medium risk	10
Abed et al. (2015)	2015	Jordan	Cross-sectional	both	299	20	55	to arrival at the hospital	no	A, ANX, PS	(8+4) Low risk	12
Allana et al. (2015) (Female sample)	2015	Pakistan	Cross-sectional	both	116	100	56	"prehospital delay" undefined	no	KS, A, ANX, PS, W, FS	(8+1) High risk	9
Allana et al. (2015) (Male sample)	2015	Pakistan	Cross-sectional	both	133	0	56	"prehospital delay" undefined	no	KS, A, ANX, PS, W, FS	(8+1) High risk	9
Bray et al. (2015)	2015	Australia	Cross-sectional	both	199	32	62	to arrival at the hospital	yes	A, ANX, PS, W, FC, E	(9+3) Low risk	12
Ghazawy et al. (2015)	2015	Egypt	Cross-sectional	both	207	25	58	to arrival at the hospital	yes	A	(7+2) High risk	9
Albarqouni et al. (2016)	2016	Germany	Cross-sectional	STE MI	486	25	62	to first ECG in the clinic	no	KO	(8+2) Medium risk	10
Darawad et al. (2016)	2016	Jordan	Cross-sectional	both	160	53	53	to arrival at the hospital	no	KO	(9+1) Medium risk	10
Kim et al. (2017) (Female sample)	2017	South Korea	Cross-sectional	STE MI	64	100	71	to arrival at the hospital	yes	KS	(7+4) Medium risk	11
Kim et al. (2017) (Male sample)	2017	South Korea	Cross-sectional	STE MI	286	0	59	to arrival at the hospital	yes	KS	(7+4) Medium risk	11

Petrova et al. (2017)	2017	Spain	Cross-sectional	both	102	16	58	to the decision to seek medical attention	yes	60	KO, A, ANX, PS, W, FC, E	(10+4) Low risk	14
Mesas et al. (2018)	2018	Brazil	Cross-sectional	STEM I	50	36	59	first medical contact	yes	60	PS	(8+3) Medium risk	11
Sederholm Lawesson et al. (2018) (Female sample)	2018	Swede n	Cross-sectional	STEM I	109	100	70	to first medical contact	no		PS, W	(7+4) Medium risk	11
Sederholm Lawesson et al. (2018) (Male sample)	2018	Swede n	Cross-sectional	STEM I	340	0	65	to first medical contact	no		PS, W	(7+4) Medium risk	11
Venkatesan et al. (2015)	2015	India	Cross-sectional	both	93	14	>65% above 50	time from symptom onset to arrival at the hospital	yes	120	K, PS	(6+2) High risk	8

**Table 3. Summary of results: Number and percentage of significant studies and conclusions.**

Note: Conclusions are based on the criteria in Table 1. Study risk refers to the results of the methodological quality assessment. Effect size are from low risk studies reporting significant effects. F.=female sample. M.=male sample

	Study selection			Study synthesis				Effect sizes	
	Number of studies excluded	Studies included	Studies reporting a significant relationship	Conclusion	Effect sizes				
	High risk of bias	Low sample size	Number	Sample size: mean, median (min, max)	Total	Low risk only	Direction of relationship		
Knowledge of the symptoms (objective)	1 Venkatesan, 2018 <sup>66</sup>	0	5	672, 486 (102, 1894)	2/5 (40%)	0	Better knowledge, shorter prehospital delay.	Limited evidence	-
Knowledge of the symptoms (subjective)	3 Allana, 2015 <sup>61</sup> (F.) Allana, 2015 <sup>61</sup> (M.) Gao, 2013 <sup>56</sup>	2 Khraim, 2009 <sup>48</sup> Kim, 2017 <sup>64</sup>	13	170, 147 (105, 286)	4/13 (31%)	4/10 (40%)	Better knowledge, shorter prehospital delay	Limited evidence	-
Knowledge of the symptoms (objective OR subjective)	4 Allana, 2015 <sup>61</sup> (F.) Allana, 2015 <sup>60</sup> (M.) Gao, 2013 <sup>57</sup> Venkatesan, 2018 <sup>67</sup>	2 Khraim, 2009 <sup>48</sup> Kim, 2017 <sup>64</sup>	18	309, 150 (102, 1894)	6/18 (33%)	4/11 (36%)	Better knowledge, shorter prehospital delay.	Limited evidence	-
Attribution of symptoms to cardiac event	6 Allana, 2015 <sup>61</sup> (F.) Allana, 2015 <sup>61</sup> (M.) Gao, 2013 <sup>55</sup> Ghazawy, 2015 <sup>62</sup> Gouveia, 2011 <sup>53</sup> Venkatesan, 2018 <sup>66</sup>	3 Khraim, 2009 <sup>48</sup> Carney, 2002 <sup>33</sup> O'Carroll, 2001 <sup>31</sup>	37	378, 177 (79, 2243)	25/37 (68%)	14/20 (70%)	Attributed to a cardiac event, shorter prehospital delay.	Strong evidence	Mean standardized beta coefficient .33 (based on 4 studies); a median difference of 2 hours (7 studies); mean OR for delay of .45 (3 studies).

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Anxiety in response to symptoms	2 Allana, 2015 <sup>61</sup> (F.) Allana, 2015 <sup>61</sup> (M.)	2 Khraim, 2009 <sup>48</sup> Walsh, 2004 <sup>36</sup>	15	308, 145 (98, 1879)	9/15 (60%)	7/13 (54%)	Stronger anxiety, shorter prehospital delay.	Moderate evidence	Standardized beta coefficient of .29 (1 study); a median difference of 1.85h (2 studies); mean OR for delay .53 (2 studies); F value of 3.57 (1 study); Spearman rho of .23 (1 study).
Perceived seriousness of the symptoms	3 Allana, 2015 <sup>61</sup> (F.) Allana, 2015 <sup>61</sup> (M.) Venkatesan, 2018 <sup>68</sup>	2 Khraim, 2009 <sup>48</sup> Mesas, 2018 <sup>66</sup>	24	204, 147 (98, 739)	18/24 (75%)	9/15 (60%)	More perceived seriousness, shorter prehospital delay.	Moderate evidence	Standardized beta coefficient of .39 (2 studies); a median difference of 2.1h (4 studies); mean OR for delay .56 (3 studies); mean correlation .27 (2 studies).
Concern for troubling others	2 Allana, 2015 <sup>61</sup> (F.) Allana, 2015 <sup>61</sup> (M.)	1 Khraim, 2009 <sup>48</sup>	18	207, 147 (102, 739)	9/18 (50%)	6/13 (46%)	More concerned for troubling others, longer prehospital delay.	Limited evidence	-
Fear in response to symptoms	2 Allana, 2015 <sup>61</sup> (F.) Allana, 2015 <sup>61</sup> (M.)	0	2	NA, NA (739, 1897)	2/2 (100%)	1/1 (100%)	More fear, shorter prehospital delay.	Limited evidence (small number of studies)	-
Fear in response to potential consequences	0	0	15	170, 147 (102, 317)	3/15 (20%)	2/12 (17%)	One study: more fear, shorter prehospital delay. Three studies: more fear, longer prehospital delay.	Limited and conflicted evidence	-
Embarrassment in asking for help	0	1 Khraim, 2009 <sup>48</sup>	14	167, 145 (102, 317)	5/14 (36%)	4/12 (33%)	More embarrassment/shame, longer prehospital delay.	Limited evidence	-



Table 4. Sensitivity analyses: Number and percentage of significant results according to study characteristics

		Significant results according to:						
		Analysis:		Prehospital delay definition:		Continent:		
	Number of studies included	Unadjusted	Adjusted	Decision delay	Other	Americas/Australia	Asia/Africa	Europe
Knowledge of the symptoms (objective)	5	1/1 (100%)	1/4 (25%)	0/1 (0%)	2/4 (50%)	0	1/2 (50%)	1/3 (33%)
Knowledge of the symptoms (subjective)	13	3/10 (30%)	1/3 (33%)	2/4 (50%)	3/11 (27%)	1/6 (17%)	3/6 (50%)	0/1 (0%)
Knowledge of the symptoms (objective OR subjective)	18	4/11 (36%)	2/7 (29%)	1/3 (33%)	5/15 (33%)	1/6 (17%)	4/8 (50%)	1/4 (25%)
Attribution of symptoms to cardiac event	37	9/16 (56%)	16/21 (76%)	8/15 (53%)	17/22 (77%)	9/13 (69%)	7/11 (64%)	9/13 (69%)
Anxiety in response to symptoms	15	9/13 (69%)	0/2 (0%)	4/5 (80%)	5/10 (50%)	4/5 (80%)	2/6 (33%)	3/4 (75%)
Perceived seriousness of the symptoms	24	9/13 (69%)	9/11 (82%)	7/8 (88%)	11/16 (69%)	9/11 (82%)	4/7 (57%)	5/6 (83%)
Concern for troubling others	18	3/11 (27%)	6/7 (86%)	3/4 (75%)	6/14 (43%)	4/8 (50%)	2/5 (40%)	3/5 (60%)
Fear in response to symptoms	2	1/1 (100%)	1/1 (100%)	2/2 (100%)	0	0	0	2/2 (100%)
Fear in response to potential consequences	15	3/14 (21%)	0/1 (0%)	0/2 (0%)	3/13 (23%)	2/8 (25%)	1/5 (20%)	0/2 (0%)
Embarrassment in asking for help	14	4/12 (33%)	1/2 (50%)	2/3 (66%)	3/11 (27%)	3/8 (38%)	2/4 (50%)	0/2 (0%)

## **Discussion**

Summary of findings. This is the first systematic review focused on the relationship between psychological and cognitive factors and prehospital delay in the context of acute coronary syndrome. This review builds on previous reviews of from 10 or more years ago (Moser, et al., 2006; Khraim, & Carey, 2009) and offers updated evidence based on a systematic pre-registered protocol to examine the relationships between nine factors and prehospital delay. Prehospital delay is associated with higher risk of mortality and health complications (Moser, et al., 2006; Cullen, et al., 2016; De Luca et al., 2004). Multiple studies from around the world have identified several demographic, clinical, and situational predictors of longer prehospital delay, such as female gender, older age, or history of chronic disease (Moser, et al., 2006; Wechkunanukul et al., 2017; Khraim, & Carey, 2009). However, the psychological or cognitive determinants of prehospital delay are crucial and add to this body of research because they can shed light on the mechanisms behind long delays that can be addressed in interventions and campaigns aiming to reduce prehospital delay. Unfortunately, with a few exceptions, the interventions conducted so far have had little success overall and it is not clear what differentiates successful from unsuccessful interventions (Farquharson et al, 2018; Mooney, et al., 2012). This review aimed to shed light on what psychological or cognitive factors may be worth addressing in intervention design or further research aiming to reduce prehospital delay.

We found strong evidence that patients who attributed their symptoms to a cardiac event reported shorter prehospital delay. We also found moderate evidence that those patients who perceived symptoms as serious and felt anxiety reported shorter prehospital delay. The effect sizes reported speak of clinically significant differences in prehospital delay that could have a strong effect on treatment success and patient outcomes (e.g., a median difference of up to 1.5-2h hours between patients who correctly attribute symptoms to a cardiac event vs. those who do not).

In contrast, we found no support for the relationships between prehospital delay and knowledge of symptoms, concern for troubling others, fear of the potential consequences, or embarrassment in seeking help. These factors have been suggested as potential barriers or facilitators to timely help-seeking in previous narrative reviews (Moser, et al., 2006; Khraim, & Carey, 2009). However, a systematic examination of the recent evidence taking into account study quality shows that these factors do not consistently show significant relationships with prehospital delay. In addition, fear of the potential consequences showed conflictive evidence. The contradictory findings are in

line with the previously documented ambivalent role of fear in help-seeking behavior: it can act as a motivator for action and decrease time to help-seeking but it can also delay help-seeking due to denial or not wanting to face the consequences (Dubayova et al; 2010).

Implications for intervention design. The current results do not suggest addressing perceived social barriers to help-seeking as a promising strategy, because concerns for troubling others and feeling embarrassed to seek help have not shown consistent relationships with prehospital delay. Instead, the results show that those patients who attribute the experienced symptoms to a cardiac event, recognize that they are serious, and have an adequate emotional response to a threatening situation (i.e., anxiety) are those who delay less. Hence, results suggest that interventions should focus on helping patients recognize cardiac symptoms and raising awareness of the serious consequences of acute coronary syndrome. However, virtually all previous interventions provided education about symptoms but only a limited number of those were successful (Farquharson et al., 2018; Mooney, et al., 2012). In addition, education about the serious consequences of acute coronary syndrome instead of the benefit of timely treatment could easily backfire by generating fear and inadequate coping strategies instead of timely action. Thus, we suggest that symptom attribution to a cardiac event and the perception of some level of threat (i.e., seriousness, anxiety) are the most important facilitators of timely help-seeking identified to date.

Finally, the importance of the attribution of symptoms to a cardiac event stands at odds with the results showing that symptom knowledge was largely unrelated to prehospital delay. On one hand, this suggests that knowing the symptoms of acute coronary syndrome may not guarantee correct attribution of symptoms when one is experiencing them. This could be because other factors mediate the relationship between knowledge and attribution (e.g., perceived risk: if patients do not perceive they are at risk of a heart condition, they may fail to attribute their symptoms to a cardiac event). On the other hand, it is important to keep in mind that all studies in this review were retrospective and the variables were reported only after the cardiac event had occurred. It is likely that patients learn about their condition during hospitalization or at least learn from their experience, thus retrospective studies are not adequate to examine the relationship between knowledge of symptoms and prehospital delay (e.g., due to memory biases). In the next section we give methodological recommendations regarding how this and other shortcomings in the study of prehospital delay could be overcome.

Methodological recommendations. This review confirms previous findings that the study of factors related to prehospital delay lacks a “consistent operational definition

of prehospital delay duration, rendering comparisons and conclusions tenuous” (Mackay, et al, 2014). The studies used diverse definitions of prehospital delay and the majority of them did not measure the different intervals within the total delay period (e.g., decision delay, health system delay). Exact definitions of what is considered as “symptom onset” were also rare. In order to better understand the causes for delays and make reliable comparisons across studies and populations (e.g., based on age or gender), it is vital that definitions and measurements in the literature are standardized (e.g., a standard cut-off of 60 minutes). In addition, in our opinion the decision delay interval offers the most sensitive and logical measure when it comes to studying the influence of psychological or cognitive factors, because patient decision making is unlikely to influence health system delays. A standardized definition and measurement would also help make valid comparisons across studies to identify how age, gender, or culture may influence the role of different psychological factors.

All studies meeting the inclusion criteria in this review were cross-sectional studies with patients who had recently experienced a cardiac event. Whereas these studies are certainly useful to study determinants of prehospital delay, they have major shortcomings that limit their validity. For instance, mild cognitive impairment and hence memory biases may be an issue (Saczynski, et al., 2017), in addition to the fact that only survivors are included. This leaves out the most vulnerable population (i.e., those who may have waited too long and did not survive) and hence some important barriers to help-seeking may never come to light using this methodology. We believe that the study of prehospital delay in acute coronary syndrome could borrow insight from the study of early diagnosis in cancer, where recent advances have been made using hypothetical studies with healthy populations (etrova, Okan, Salamanca-Fernández, Domínguez-López, Sánchez, & Rodríguez-Barranco, 2019; Donnelly, Quaife, Forbes, Boylan, Tishelman, & Gavin, 2007).. In this methodology, healthy persons are recruited and report how long they would wait to seek medical attention if they were experiencing certain symptoms, and this waiting time is investigated in relation to a number of psychological factors or perceived barriers. For instance, using such a methodology the relationship between symptom knowledge and prehospital delay could be investigated producing useful results. Another methodology that has been previously proposed includes the use of surrogates (e.g., family members) to represent the experiences of non-surviving patients (Khraim, & Carey, 2009) but that is also rarely used. Although practically more difficult, prospective studies may also be feasible with populations at high risk of acute coronary syndrome, where psychological factors are measured at

baseline and prehospital delay is assessed after a cardiac event occurs.

Limitations and future directions. The heterogeneity of reporting practices prevented us from conducting meta-analyses and exploring potentially important moderators of the relationships of interest (e.g., definition of prehospital delay, gender composition of the sample, age, country or health system characteristics, measurement properties, etc.). To overcome this limitation, we adapted an evidence synthesis procedure for which we needed to make a number of decisions regarding evidence quality. We conducted sensitivity analyses to explore the impact of these decisions; nevertheless, the used methodology relied on statistical significance, which can produce spurious results especially when studies are underpowered. We have made all data and results (including effect sizes where available) accessible to researchers who wish to consult specific information: OSF doi: 10.17605/OSF.IO/4MB3D.

The sample of studies was highly international. Given the multitude of cultural and economic differences between the 23 countries represented, it would be interesting to explore cross-cultural differences in the influence of the different psychological factors on prehospital delay. Unfortunately, the current analytical approach was limited: a meta-regression analysis would have been better suited and more sensitive to detect cross-cultural differences. Nevertheless, the current results do suggest that anxiety in response to symptoms and perceived symptom seriousness could be less reliable predictors of delay in patients from Asian/African countries (there was overall a smaller proportion of studies reporting significant relationships in this group). Culture, and in particular the independent vs. interdependent self-construal could explain these findings. A more independent self-construal with a focus on individualism and autonomy is characteristic of Northern American and European countries, whereas a more interdependent self-construal with a focus on group goals is characteristic of Asian and African countries. Fukuoka and colleagues (Fukuoka, et al., 2005) found that patients with more interdependent self-construal had longer prehospital delay times. One reason proposed by the authors to explain these differences was that individuals with more interdependent self-construal may be more likely to stay in their social roles and continue with their work or family obligations after symptoms have started. Such a tendency would explain why anxiety and perceived seriousness of symptoms may be less reliable predictors of prehospital delay in countries where a more interdependent self-construal is predominant. Future studies should investigate how culture shapes decision making during a cardiac event and how intervention strategies should take into account such cultural influences.

A limitation was that in several publications the effects of interest were reported

separately for men and women, whereas in the majority of publications this was not the case. Gender comparisons were not among the goals of the current review but they would be essential to address in future research given the general differences in prehospital delay between men and women, and their potential causes. In particular, a review of 42 studies showed that women consistently had longer prehospital delays and that, unfortunately, these differences did not decrease over time (Nguyen, Saczynski, Gore, & Goldberg, 2010). However, there are several differences in the factors related to prehospital delay between men and women. Perhaps the most often explored reason for this gender gap has been symptom presentation: women often report different or more “atypical” symptoms, although findings have been mixed (Chen, Woods, & Puntillo, 2005). In addition, whereas in men longer prehospital delays were related to low education, symptom onset at home, not asking for help, having early musculoskeletal pain, or lack of consistency between expected and experienced symptoms, in women longer prehospital delay were related to older age, being single, having a history of MI, being alone during symptom onset, and not wanting to trouble anyone (Nguyen et al, 2010). Age is another factor consistently related to prehospital delay with older persons reporting longer prehospital delays; however, few studies have investigated the reasons behind these differences (Nguyen et al, 2010). In the current review, the study samples were relatively homogeneous in terms of age and only a few studies reported the relationships of interest as a function of gender; for this reason we could not reliably investigate if gender or age influenced the relationships studied. Given that women and older patients consistently report longer prehospital delays, it would be important to do more research on the possible psychological, cognitive, and social reasons for these differences.

All studies that met the inclusion criteria were cross-sectional and no studies of higher evidence category (e.g., longitudinal) or alternative designs (e.g., surveys with healthy populations measuring hypothetical prehospital decision delays) reported the relationships of interest. Thus, it is not possible to make any causal inferences. Although all studies were of the same evidence category (cross-sectional), we found that an independent evaluation of the methodological quality of the study and its report were essential. In particular, several publications were of low quality (due mostly to lack of detail). Finally, this review examined a pre-defined list of frequently investigated psychological and cognitive factors and did not cover all such factors or barriers of potential relevance, thus it is not an exhaustive examination of all psychological factors in relation to prehospital delay. Future research should continue to explore psychological

determinants beyond those included in this review (e.g., individual differences in personality and cognitive traits (Petrova, et al., 2019)).

Conclusion. This review was based on evidence from 23 countries, including both high and low income countries. We conclude that prehospital delay is consistently related to attribution of symptoms to a cardiac event, perceiving symptoms as serious, and feeling anxiety in response to symptoms. In contrast, prehospital delay was not consistently related to knowledge of symptoms, concern for troubling others, fear of the potential consequences, or embarrassment in seeking help. Despite the high homogeneity in the measures used, the variety of analytical and reporting practices prevented meta-analysis. Given the inconclusive and inconsistent findings of interventions aiming to reduce prehospital delay (Farquharson et al, 2018; Mooney, et al., 2012), there is urgent need for a higher quality, methodologically-consistent research on psychological factors and barriers influencing prehospital delay. This could be achieved by agreeing on common guidelines for study design, procedure, and reporting (see an example on delays in cancer diagnosis (Weller et al., 2012)), that guide the choice of definition of prehospital delay and the analysis and reporting of results, among others. Such guidelines can help produce higher quality studies that would be informative for intervention design and theory advancement in the field of prehospital delay.

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## ***Artículo 2: Prehospital decision delay and psychological distress in ACS patients.***

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**Psychosocial markers of pre-hospital decision delay and psychological distress  
in acute coronary syndrome patients.**

**Abstract**

**Objectives:** Both prehospital decision delay – the time patients wait before seeking medical attention after symptoms have started – and high psychological distress after the cardiac episode predict poor prognosis of acute coronary syndromes (ACS) patients. We aimed to identify psychosocial markers of these prognostic factors.

**Design:** A cross-sectional study of 102 consecutive, clinically stable ACS survivors.

**Methods:** Participants completed a questionnaire measuring prehospital decision delay, psychological distress, and several known psychosocial factors related to cardiovascular health: Type-D personality, resilience, social support, and concerns during the cardiac event. Multiple linear regression and mediation analyses were conducted.

**Results:** Type-D personality and fewer concerns about the serious consequences of delaying help-seeking were related to more psychological distress post-ACS, and these relationships were mediated by longer prehospital decision delay. In contrast, resilience was related to lower psychological distress. Social support and social concerns about help-seeking were not related to the outcome variables.

**Conclusions.** Type-D personality may be a risk factor for more delayed help-seeking for an ACS and higher psychological distress after the cardiac event. Resilience, in contrast, emerged as a potential protective factor of patients' mental health after the cardiac event. Prehospital decision delay was related to thinking about serious consequences (e.g., complications, protecting one's family) but not about social concerns (e.g., wasting other people's time) during the cardiac episode.

### Introduction

Acute coronary syndrome (ACS) is among the main causes of mortality, morbidity, and health costs worldwide (Sanchis-Gomar, Perez-Quilis, Leischik, & Lucia, 2016; Vedanthan, Seligman, & Fuster, 2014). Mortality from ACS and its complications could be reduced dramatically if treatment is administered as soon as possible after the first symptoms occur (Moser et al., 2006). However, the majority of patients do not receive treatment within the “golden time window” (one or two hours), due mostly to patients’ delay in seeking medical attention for symptoms (Wechkunanukul, Grantham, & Clark, 2017). Therefore, the time it takes for the patient to realize the seriousness of the problem and seek medical attention - called *prehospital decision delay* - can determine survival and subsequent recovery (Moser et al., 2006). Longer delays have been shown to predict worse patient outcomes one year after the cardiac event, including death or recurrent myocardial infarction (Cullen et al., 2016; De Luca, Suryapranata, Ottervanger, & Antman, 2004) and each half an hour of delay reduces patients’ life-expectancy by about one year (Rawles, 1997).

Prehospital decision delay is not the only factor related to the cardiac episode that predicts subsequent prognosis. ACS is a significant life event for patients and their families and has important sequels beyond hospitalization. For instance, the development of anxiety and/or depression during hospitalization for ACS and in the months after the cardiac event is associated with an increased likelihood of worse prognosis and mortality (Kurdyak, Gnam, Goering, Chong, & Alter, 2008; Kurdyak, Chong, Gnam, Goering, & Alter, 2011; Watkins et al., 2013). A meta-analysis found that the risks of recurrent cardiac events and cardiac mortality in the year following ACS were between 2.0 and 2.6 higher in patients with post-ACS depression compared to patients without depression (van Melle et al., 2004).

In sum, how patients cope with ACS both during and directly after the cardiac event can influence their prognosis. It is also possible that prehospital decision delay and psychological distress such as the presence of anxiety and/or depression symptoms post-ACS are related. For instance, longer prehospital decision delay can contribute to a more severe disease and more complications (Moser et al., 2006) or a more stressful experience, which can in turn result in more experienced psychological distress in the days after the cardiac event. Identifying patients who are at risk of dangerous delay or high psychological distress after the cardiac event can help target interventions aimed to reduce negative consequences. To help address this issue, the **objective of this study** was to identify psychosocial markers of prehospital decision delay and psychological distress (i.e., symptoms of anxiety and depression during hospitalization) in patients with ACS. In particular, we investigated the role of type-D personality, resilience, perceived

social support, and self-reported concerns during the cardiac event. We chose these psychosocial factors because they have been identified as risk or protective factors of cardiovascular health and because they can reveal how individuals cope with a stressful event such as a heart attack (Rozanski, 2014).

**Type-D personality.** Type-D personality is the stable tendency to experience high negative affectivity (e.g., strong negative emotions), coupled with high social inhibition (e.g., reluctance to express these emotions) (Denollet, 2005). Type-D personality may be an independent predictor of adverse cardiac events (Martens, Mols, Burg, & Denollet, 2010; although results have been mixed, Grande, Romppel, & Barth, 2012) and has been associated with greater tissue damage to the myocardium among patients with recurrent cardiovascular disease (Garcia-Retamero, Petrova, Arrebola-Moreno, Catena, & Ramirez-Hernandez, 2016). One of the proposed mechanisms through which type-D personality affects cardiac prognosis is through unhealthy behaviour. Type-D personality has been associated with a less healthy diet, smoking, being overweight, not exercising or not adhering to medical treatment (Mommersteeg, Kupper, & Denollet, 2010; Sveinsdottir et al., 2013; Williams, Abbott, & Kerr, 2016). For instance, a large study conducted in the general population of Iceland (n=4753) revealed that individuals with type-D personality reported less frequent exercise, a larger body-mass index, wider waist circumference, and higher prevalence of smoking and hypertension. In another study in the UK, individuals with type-D personality reported fewer health-beneficial behaviours (e.g., getting enough sleep, eating and exercising sensibly) (Williams et al., 2013). In addition, these behaviours partially explained the relationship of type-D personality with more physical symptoms and lower health-related quality of life. In the current research, we propose that longer prehospital decision delay could be another behavioural mechanism explaining the worse prognosis of type-D compared to non type-D patients. For instance, the reluctance of type-D patients to share feelings and worries with other people may prevent them from telling others about their symptoms and seeking medical attention. In addition, type-D personality has been identified as a vulnerability factor for depression and anxiety (Kupper & Denollet, 2018), suggesting that patients with type-D personality may be more likely to report psychological distress post-ACS.

**Resilience.** Resilience, defined as the ability to cope with adverse circumstances, thrive in the face of adversity, and find a positive connotation in negative situations, is another psychological trait that has been related to health outcomes (Ryff et al., 2012; Tusaie & Dyer, 2004). Research on the role of resilience in ACS is overall limited, but one study conducted by Arrebola-Moreno and colleagues showed that

resilience was related to lower inflammatory response and less damage to the myocardium (Arrebola-Moreno, Garcia-Retamero, Catena, Marfil-Álvarez, Melgares-Moreno, Ramírez-Hernández, 2014). Evidence from other diseases shows that higher resilience is associated with more proactive health-behaviour and lower distress (Ma et al., 2013; Rosenberg et al., 2014; Rowland & Baker, 2005). For instance, in patients with chronic kidney disease resilience has been related to better disease management (Ma et al., 2013). In parents of children with cancer, higher resilience was associated with lower distress, more social support, and a better ability to share health-related concerns (Rosenberg et al., 2014). In cancer patients, resilience has been described as a protective attribute in the adaptation to cancer (Rowland, & Baker, 2005) and has been related to less emotional distress (Min et al., 2013). This evidence suggests that higher resilience could also be related to shorter delay and lower psychological distress post-ACS. In particular, individuals higher on resilience might be more proactive regarding their health and might share with others that they are experiencing symptoms and thus receive assistance. Individuals higher on resilience might also be more resistant to psychological distress after acute stressors (e.g., a cardiac event).

**Social support.** Social support is another factor that predicts cardiovascular prognosis. Compared to people who lack social support, people who have social support have a lower risk of developing cardiovascular disease and a lower risk of dying when they develop it (Barth, Schneider, & von Kanel, 2010; Lett et al., 2005). For instance, the availability of emotional support, social integration, and interpersonal social relations have all been related to a smaller progression of coronary artery disease among women diagnosed with acute myocardial infarction or unstable angina (Wang, Mittleman, & Orth-Gomer, 2005). Importantly, these were independent of traditional clinical and lifestyle risk factors (Wang et al., 2005). Several mechanisms have been proposed to explain the protective effect of social support on cardiovascular health, one of which is health-related behaviour. For example, a study using a large representative sample of the Spanish population showed that people who perceive that they have sufficient social support are twice as likely to be screened for cardiovascular risk (Petrova, Garcia-Retamero, & Catena, 2015). Social support may also help reduce prehospital decision delay, because people who have good supportive networks may be more likely to receive advice to immediately seek medical attention. For example, being with a companion or a co-worker when symptoms start might reduce delay, whereas being alone or living alone has been associated with longer delays (Moser et al., 2006). Besides delaying less, patients with more social support may also report lower psychological distress post-ACS—a result that would be in line with previous research showing a protective function of social support in this context (Barth et al., 2010). In particular, a study of 887 patients with

myocardial infarction showed that, among those patients who developed depression after their cardiac event, higher levels of social support predicted significant improvements in depression symptoms during the following year (Frasure-Smith et al., 2000). In addition, high levels of social support buffered the impact of depression on subsequent mortality (Frasure-Smith et al., 2000).

**Concerns during the cardiac event.** Besides personality and psychosocial factors, we also examined how patients' immediate concerns and thoughts during the cardiac event are related to prehospital decision delay. In particular, we focused on two types of concerns based on their importance suggested in previous literature (Moser et al., 2006): a) concerns related to the serious consequences of delaying help-seeking in case it is needed (i.e., in case one is actually experiencing a heart attack) and b) social concerns related to the consequences of seeking medical attention in the case of a false alarm (i.e., in case one is not suffering a heart attack). For example, fear about what could happen (Bray et al., 2015), experiencing serious symptoms (Fang et al., 2016), or attributing symptoms to a serious condition (Abed, Khalil, & Moser, 2015) have been linked to a shorter delay. In particular, patients who attribute their symptoms to a cardiac cause as opposed to temporal anxiety, musculoskeletal pain, or other less serious symptoms, wait on average one hour less before seeking medical attention for their symptoms (Abed et al., 2015; McKee et al., 2013; McKinley et al., 2004). In contrast, social and other-oriented concerns such as feeling embarrassed to seek help or worrying about wasting other people's time have been linked to longer delays (Khraim, Scherer, Dorn, & Carey, 2009; McKinley et al., 2004). For instance, worrying about troubling others by asking for help was found to double the odds of later arrival (i.e., later than one hour after symptom onset) at the hospital (Dracup & Moser, 1997). This suggests that people who consider the serious consequences of delay assuming that their condition is serious would delay less, whereas people who focus on the social consequences of help-seeking for a non-serious condition would delay more.

In sum, the goal of this research was to investigate the relationships between type-D personality, resilience, perceived social support, and self-reported concerns during the cardiac event with a) prehospital decision delay and b) psychological distress. Following previous research, we hypothesized that longer prehospital decision delays and more psychological distress post-ACS would be related to type-D (vs. not type-D) personality, lower trait resilience, lower social support, fewer concerns related to the serious consequences of delaying help-seeking, and more social concerns regarding seeking medical attention. In addition, we also investigated the relationship between prehospital decision delay and psychological distress post-ACS. We expected that



longer prehospital decision delays would be related to more psychological distress post-ACS. This could be because, on one hand, longer delays can contribute to a more serious heart condition, more invasive or complicated treatments, serious complications, disability, or longer recovery period (Moser et al., 2006), which could all increase the risk of psychological sequelae such as high levels of mental distress or the development of depression after the cardiac event. If prehospital decision delay is related to psychological distress, then it follows that the psychosocial factors related to prehospital decision delay may have an indirect impact on psychological distress post-ACS via prehospital delay. Thus, as an additional aim we tested whether any effects of the psychosocial variables on psychological distress were mediated by prehospital decision delay.

### **Method**

After approval of the Hospital Ethics Committee we conducted a retrospective survey study. Participants were ACS patients admitted to the Cardiology Service of the [hospital name masked for review] who agreed to participate. The inclusion criteria were: (a) having high cardiac markers (i. e., troponin I) and symptoms or ECG abnormalities suggestive of ischemia, and (b) being fluent in Spanish. The exclusion criteria were having an inflammatory disease or neurological problems that prevent participation in the study. Patients were selected based on these criteria by a qualified cardiologist who extracted information about the final diagnosis. A researcher informed clinically stable and eligible patients about the study and informed consent was obtained. Data was collected during hospitalization. To minimize the exclusion of participants due to fatigue, illiteracy, or other reading difficulties the researcher offered assistance to all patients and gave detailed instructions.

Participants completed a survey that consisted of two parts on average 5 days (95% CI 4.49 to 6.34) after the cardiac event. The first part contained an assessment of decision delay, an adapted version of the Modified Response to Symptoms Questionnaire (Dracup & Moser, 1997), and other measures, the results of which are reported elsewhere (Petrova et al., 2017). The second part focused on the influence of psychological traits on decision delay and contained the measures described here. For the purpose of the current analysis, post-hoc sensitivity analysis with G\*power (gpower.hhu.de) assuming  $\alpha=.05$ ,  $\text{power}=.80$ , and 7 predictors (5 psychosocial and 2 demographic variables) indicated that with the obtained sample size ( $N=102$ ) an effect size of  $f^2=.08$  ( $R^2=.075$ ) could be detected.

### **Measures**

**Prehospital decision delay.** This was operationalized as the time from symptom onset to the decision to seek medical attention. Participants were asked to

indicate at what time their symptoms started (e.g., at what time they started having symptoms and feeling unwell,  $T_1$ ) and at what time they decided to seek medical attention (e.g., decided to call an ambulance or go to the hospital,  $T_2$ ). The log of the number of minutes elapsed between  $T_1$  and  $T_2$  was calculated.<sup>1</sup> This retrospective measure was validated against patients' troponin levels on arrival at the hospital (see Petrova et al. (2017)). Troponin is a protein that is released when the heart muscle has been damaged and its levels are continuously monitored when ACS is suspected. The high time sensitivity and known progression curve of troponin make it a useful additional objective measure of delay in receiving medical attention. As expected, patients reporting longer decision delay had higher troponin levels on hospital admission, validating the self-reported measure (see Petrova et al. (2017)).

**Psychological distress.** Patients completed the Hospital Anxiety and Depression Scale (HADS) (Zigmond & Snaith, 1983). The scale consists of 14 questions that measure the levels of anxiety and depression experienced by the patient during the previous week (e. g., "Worrying thoughts go through my mind", 3= a large part of the time, 2= a lot of the time, 1= occasionally, but not very often, 0= only occasionally). Because we were interested in measuring general psychological distress and not in screening for specific disorders, we did not calculate separate scores for anxiety and depression but instead used the sum of all items (Cronbach's  $\alpha = 0.84^2$ ), where a higher score indicates greater psychological distress (see Crawford, Henry, Crombie, & Taylor, 2001).

**Type-D Personality.** This was measured with a validated Spanish version of the DS14 questionnaire (Denollet, 2005; Montero, Rueda, & Bermúdez, 2012). The questionnaire consists of 14 items that measure the two components of the Type-D personality: negative affectivity (NA, 7 items, Cronbach's  $\alpha = 0.65$ , for example, "I am often in a bad mood") and social inhibition (SI, 7 items, Cronbach's  $\alpha = 0.74$  for example,

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<sup>1</sup> We also considered the common approach of grouping/categorizing this variable. However, in order to be able to conduct the mediation analysis described further in the manuscript we used the continuous score.

<sup>2</sup> All Chronbach  $\alpha$  refer to the current sample.

“I frequently talk to strangers”—reversed) on scales from 0 (false) to 4 (true). A score was obtained by multiplying the scores of both components (Denollet, Pedersen, Vrints, & Conraads, 2013) and by using the traditional cut-off approach categorizing patients into type-D (both NA and SI >10) and non type-D (Emons, Meijer, & Denollet, 2007). The pattern of results across both approaches was similar. For the sake of brevity, we report the results with the product of the two dimensions, which has the potential to be a more sensitive measure.

**Resilience.** This was measured with an instrument consisting of 25 Likert type items on a scale from 1 (disagree) to 7 (agree) (Wagnild & Young, 1993). The instrument measures participants’ self-esteem, flexibility, and ability to cope with conflicts. The Spanish version was used that was previously validated in ACS patients (current sample Cronbach’s  $\alpha = .86$ ) (Arrebola-Moreno, et al., 2014).

**Social Support.** This was measured with the Spanish version of the ENRICH Instrument (Vaglio et al., 2004; Wiesmaierova et al., 2019). Six items assess perceived emotional and instrumental support (for example, having someone who listens, gives advice or helps with everyday tasks) on scales ranging from 1 (never) to 5 (always). The last item is a dichotomous question (whether the patient is married or living with a partner; 0 = no, 1 = yes). The final score is a sum of all items and ranges from 6 to 31, where higher scores indicate more perceived social support. The scale showed good internal consistency (Cronbach’s  $\alpha = .82$ ).

**Concerns questionnaire.** This questionnaire was developed for this research based on Signal Detection Theory (Egan, 1975) and previous literature on factors affecting decision delay (Moser et al., 2006). Using 14 Likert-scale items from 1 (not at all) to 7 (very much), it assesses retrospectively patients’ thoughts and concerns during the cardiac episode related to a) the serious consequences of delaying help-seeking in the case of a hit (i.e., if the patient is experiencing a heart attack/serious condition, 6 items, *serious consequences factor*) and b) the social consequences of help-seeking in the case of a false alarm (i.e., if the patient is not suffering a serious condition, 8 items, *social concerns factor*). Participants were asked to recall the time between the start of symptoms and the moment they decided to seek medical attention and indicate the importance and the extent to which they thought about each of 14 concerns (see Appendix). Two variables were derived from this questionnaire: “serious consequences” (Cronbach’s  $\alpha = .82$ ) and “social concerns” (Cronbach’s  $\alpha = .72$ ). Factor analysis, psychometric characteristics, and an English translation of the items is displayed in the Appendix (Table S1).

### **Data Analyses**

Pearson correlations were conducted to test for associations between the two outcome variables (i.e., prehospital decision delay and psychological distress) and the five predictor variables (i.e., type-D personality, resilience, serious consequences, social concerns, and social support). To determine the unique influence of each predictor, we conducted multiple regressions. Age and sex were entered as covariates. Finally, to test whether any potential relationships between the psychosocial factors and psychological distress were mediated by prehospital decision delay we conducted mediation analyses following Hayes (2013).

### **Results**

Of the 188 patients that were invited, 11% (n=20) declined to participate; 168 agreed to participate, and 69% (116) returned a completed survey and had a full medical record. One patient was excluded due to death during hospitalization and 8 were excluded because the final diagnosis at discharge was determined not to be ACS. Five more patients were excluded because they were unable to recall decision times and other details of the cardiac episode (e.g., the patient had a cardiac arrest followed by memory loss). Thus final sample size was 102 (84.3% male, mean age= 57.99, range from 32 to 74). Invited patients who did not enter the final study sample were more likely to be female (30% vs. 16%),  $Ch^2(1)=5.69$ ,  $p=.017$ , and somewhat more likely to be older,  $t(186)=1.73$ ,  $p=.085$ ,  $M=60$  ( $SD=9.68$ ) vs.  $M=58$  ( $SD=9.17$ ).

Descriptive statistics for all study variables are presented in Table 1 and the Appendix (Concerns questionnaire). From the whole sample, 24.5% (n= 25) reported prehospital decision delay less or equal to 30 minutes; 15.7% (n=16) reported delay between 30 and 60 minutes; the remaining 59.8% (n=61) reported delay longer than 60 minutes. The majority of patients showed low or moderate levels of psychological distress, with 31 (30%) of patients showing clinically significant scores potentially indicative of an underlying condition ( $\geq 16$ ) (Crawford et al., 2001). Social support and resilience were negatively skewed, with the majority of patients showing high social support and resilience. Type-D personality scores were positively skewed, with only 25% of patients classified as having type-D personality using the cut-off approach (both NA and SI  $>10$ ). The majority of patients reported concerns regarding the serious consequences of delaying help-seeking in case of a serious condition and fewer patients reported social concerns in case of a false alarm (see Table S1). Bivariate Pearson correlations between the continuous prehospital delay score and the rest of the variables are presented in Table 2.

For our main analyses we conducted two multiple linear regression analyses with

prehospital decision delay and psychological distress as outcome variables. The rest of the variables (i.e., social support, resilience, type D Personality, serious consequences, gender, and age) were included as potential predictors. Social concerns were not included in these analyses because this factor was not related to any of the outcomes (Table 2). Because the questionnaire measuring psychological distress referred mostly to the days after the cardiac event (i.e., the survey was completed on average 5 days after the event), in the regression on psychological distress we also included prehospital decision delay as a predictor. The results of these two regression analyses are presented in Table 3, including standardized regression coefficients ( $\beta$ s) and the change in  $R^2$  for each predictor.

**Prehospital decision delay.** The model accounted for 13% of the total variance in prehospital decision delay,  $F(6,91) = 2.238, p < .05$ . Type-D personality ( $R^2=5.4\%$ ) and lower scores on serious consequences (i.e., fewer concerns) ( $R^2=6.5\%$ ) were related to longer prehospital decision delay. The other predictors were not significant ( $p > .05$ ).

**Psychological distress.** The model accounted for 34% of the total variance in psychological distress,  $F(7,90) = 6.502, p < .001$ . Prehospital decision delay, resilience, type-D personality, and gender accounted for 3.4%, 3.4%, 5.7%, and 4.1% respectively of the variability, whereby longer prehospital decision delay, lower resilience, type-D personality, and female gender were related to higher levels of psychological distress post-ACS. The other predictors were not significant ( $p > .05$ ).

**Mediation analyses.** Prehospital decision delay was related to psychological distress in the multiple regression analysis, suggesting that it could be a potential mediator of the relationship between the psychological traits and psychological distress post-ACS (see Figure 1). To test this possibility, we estimated indirect effects of prehospital decision delay for all candidate predictors using the PROCESS SPSS macro (Hayes, 2013). We consulted 95% confidence intervals of the indirect effects based on 5000 bias-corrected bootstrap samples. Results showed that there were significant indirect effects of a) type-D personality and b) serious consequences on psychological distress via prehospital decision delay (95% confidence intervals excluding 0, see Table 3).

Besides the planned regression analyses reported above, we conducted a post-hoc analysis driven by some unexpected results. In particular, although type-D personality did not correlate significantly with prehospital decision delay, it did become significant in the multiple regression model, indicating the possibility of a suppression effect (Thompson & Levine, 1997). Results showed that type-D personality only became significant after the inclusion of serious consequences in the model, suggesting that there could be an interaction between the two variables. We tested this possibility in a

model including the two variables and their interaction, and the interaction was significant,  $B=.002$  ( $SE=.001$ ),  $p=.015$ ,  $R^2=5.6\%$ . To understand this result further, we divided patients into two groups based on the presence of type-D personality (using the cut-off approach). Among patients without type-D personality (75% of the sample), more concerns about the consequences of delaying medical attention in case of a serious condition were related to shorter prehospital decision delay,  $r=-.315$ ,  $p=.006$ . However, among patients with type-D personality (25%), this relationship was not present,  $r=.046$ ,  $p=.826$ .

**Table 1. Descriptive statistics for all variables in the sample (n = 102).**

	Mean	Median	Min	Max	Possible scale range	SD	Missing data
Prehospital decision delay (min)	84.07	30	0	2880	NA	315.06	0 (0%)
Psychological distress (HADS instrument)	12.11	11	1	35	0-42	7.42	2 (1.96%)
Social support	26.98	29	10	30	6-31	4.73	3 (2.94%)
Resilience	138.69	141	83	175	25-175	19.13	3 (2.94%)
Type-D Personality	106.26	80	0	420	0-784	91.82	3 (2.94%)
Social concerns factor score	-.12	.20	-2.17	.65	NA	.44	0 (0%)
Serious consequences factor score	-.09	.39	-2.01	.44	NA	.62	0 (0%)

Table 2. Pearson correlations between prehospital decision delay, psychological distress (HADS instrument), and psychosocial factors

	1	2	3	4	5	6	7
1. Prehospital decision delay (log)	-						
2. Psychological distress (HADS instrument)	.17	-					
3. Social support	.08	-.22*	-				
4. Resilience	.12	-.28*	.09	-			
5. Type D Personality	.14	.41*	-.23*	-.27*	-		
6. Social concerns	-.06	.19	-.15	-.18	.11	-	
7. Serious consequences	-.31*	.21*	.04	-.06	.07	.15	-

\*  $p < .05$ ;



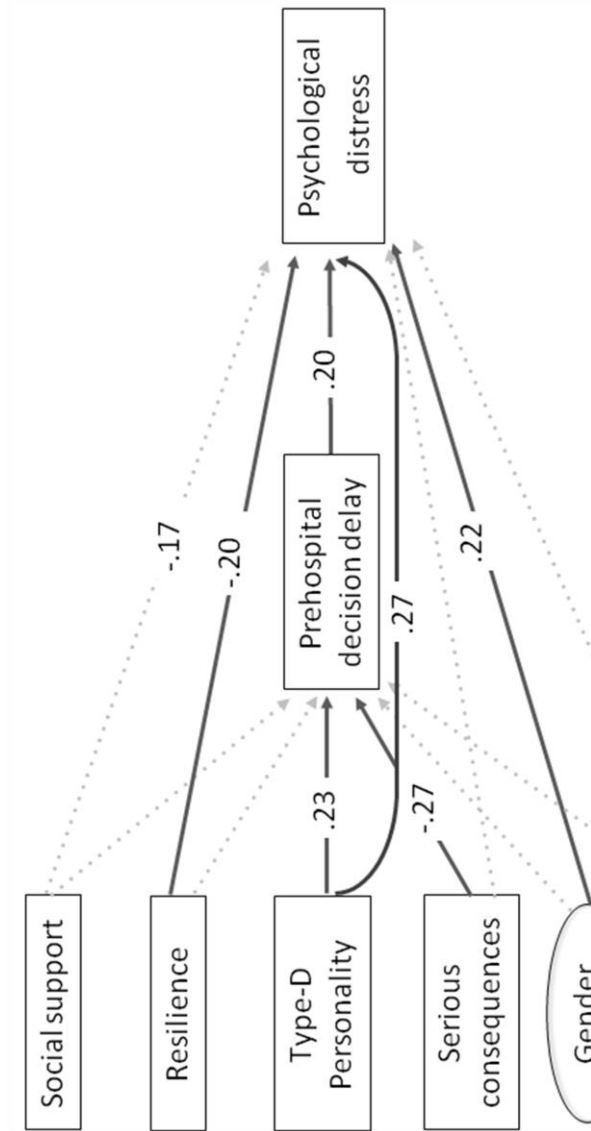
**Table 3. Linear regression analyses to determine the influence of each predictor on prehospital decision delay and psychological distress.**

	Dependent variable												
	Prehospital decision delay (log)					Psychological distress (HADS)					Indirect Effects		
	B	SE	$\beta$	p	R <sup>2</sup>	B	SE	$\beta$	p	R <sup>2</sup>	Coeff	95% LLCI	95% ULCI
Prehospital decision delay (log)	-	-	-	-	-	1.39	.65	.20	.036	.03	-	-	-
Social support	.03	.02	.13	.221	.03	-.24	.15	-.14	.125	.02	.022	-.006	.109
Resilience	.01	.01	.19	.080	.03	-.08	.04	-.20	.037	.03	.009	-.002	.039
Type D Personality	.00	.00	.23	.028	.05	.02	.01	.27	.005	.06	.001	.001	.007
Serious consequences	-.29	.11	-.27	.011	.07	1.13	.72	.15	.122	.02	-.317	-.973	-.022
Gender	.25	.30	.09	.408	.06	4.51	1.88	.22	.018	.04	.042	-.825	1.181
Age	.01	.01	.05	.624	.05	-.10	.08	-.12	.206	.01	.014	-.009	.065

LLCI/ULCI=Lower/Upper level confidence interval. Coeff=indirect effect coefficient.

Figure 1. Results from the mediation analyses.

Note: Only significant paths are displayed ( $p < .05$ ). Coefficients are standardized  $\beta$ . Gender was coded as 1=female, 0=male.



## **Appendix**

### **A: Concerns questionnaire**

To investigate whether the questionnaire conformed to a two-component structure, we performed a factor analysis with Varimax rotation allowing the extraction of two factors. The items formed two factors as intended (see Table S1): *Social concerns* about consequences in case of not suffering ACS (false alarm) (Cronbach's alpha = .82, 8 items, e.g., "If I seek medical attention and it turns out to be nothing serious, I would waste my time and the time of others for nothing") and *concerns about the serious consequences* of delay in case of suffering ACS (hit) (Cronbach's alpha = .72, 6 items, e.g., "Delaying medical attention could cause me serious complications"). We saved participants' scores on each factor (using the regression approach) and used them as measures of each component.

Table S1. Factor loadings of the items of the Concerns questionnaire.

*Please, think of the time between the moments when you started experiencing symptoms and the moment you decided to seek medical attention (e.g., call emergency, go to the hospital).*

Item	Mean (SD)	Factor loadings	
		Social concerns	Serious consequences
<b><i>During this time, how important did the following seem to you? (1 – not at all to 7 – very )</i></b>			
1. Protecting my life and my health	5.54 (2.12)	-.041	<b>.450</b>
2. Avoiding medical complications	4.22 (2.49)	.136	<b>.464</b>
3. Sparing my family any suffering	5.40 (2.31)	.305	<b>.406</b>
4. Not being embarrassed	1.69 (1.67)	<b>.395</b>	.145
5. Not wasting my time and the time of others with unimportant things	2.46 (2.16)	<b>.587</b>	-.061
6. Not worrying my family with unimportant things	3.52 (2.61)	<b>.608</b>	.082
7. Not wasting social security resources unnecessarily*	2.41 (2.25)	<b>.519</b>	.164
<b><i>During this time, to what extent did you consider each of the following? (1 – I did not think about this to 7 – I thought a lot about this)</i></b>			
8. Delaying getting medical help could cost me my life	3.70 (2.61)	-.051	<b>.830</b>
9. Delaying getting medical help could cause me serious health complications	4.00 (2.62)	-.079	<b>.937</b>
10. Delaying getting medical help could cause suffering for my family	4.26 (2.69)	.213	<b>.722</b>
11. If I seek medical attention and it turns out to be nothing serious, I would be embarrassed or ashamed	1.56 (1.51)	<b>.674</b>	.032
12. If I seek medical attention and it turns out to be nothing serious, I would waste my time and time of others for nothing	2.06 (1.99)	<b>.725</b>	-.074
13. If I seek medical attention and it turns out to be nothing serious, I would worry my family for nothing	2.63 (2.35)	<b>.705</b>	-.049
14. If I seek medical attention and it turns out to be nothing serious, I would waste social security resources	1.53 (1.46)	<b>.568</b>	.077
% of variance explained		22.18	19.61

\*Spain offers universal health coverage through its social security syste

## **Discussion**

To the best of our knowledge, this is the first study investigating the relationship between multiple psychosocial factors that might affect cardiovascular risk, prehospital decision delay, and psychological distress in ACS survivors. The results reveal that some patients may be at higher risk due to how they cope with the cardiac event, reflected by their decision making about help-seeking and their psychological state after the ACS. Importantly, this research shows that personality traits and cognitive factors may serve as markers of this increased risk.

Patients who waited longer to seek medical attention reported more psychological distress following the cardiac event than patients who did not wait as long. In addition, this decision delay mediated the relationship of type-D personality and concerns about the potential serious consequences of delaying with psychological distress post-ACS. Longer delays can result in higher psychological distress in the days post-ACS and a higher risk of developing depression because they can lead to a more serious medical condition, complications, disability, or longer recovery period. This is the first study to our knowledge to test and document such a relationship.

According to the theory behind the influence of Type-D personality on cardiovascular risk, type-D patients are at higher risk because of their vulnerability to chronic distress, expressed as the combination between high negative affectivity and high social inhibition (Denollet, 2005). This increased vulnerability has been investigated in relation to biological mechanisms including higher cardiovascular stress reactivity, decreased heart rate variability, dysfunctional hypothalamic-pituitary-adrenal axis, and inflammation (Denollet, Schiffer, & Spek, 2010 for a brief review). However, evidence has accumulated showing that also behavioural mechanisms such as unhealthy behaviours (Mommersteeg et al., 2010; Sveinsdottir et al., 2013; Williams et al., 2016), poor medication adherence (Williams, O'Connor, Grubb, & O'Carroll, 2011), and inadequate consultation behaviour (Pelle, Schiffer, Smith, Widdershoven, & Denollet, 2010) can contribute to the higher vulnerability of type-D patients. The current study showed that patients with type-D personality reported longer prehospital decision delays and more psychological distress after the cardiac event, suggesting that these are additional mechanisms that can explain their increased risk of poor prognosis and impaired self-reported physical and mental health status revealed in prospective studies (Grande, Romppel, & Barth, 2012; Versteeg, Spek, Pedersen, & Denollet, 2012).

In contrast to patients without type-D personality, in patients with type-D personality potential concerns about the consequences of delay were not related to

prehospital decision delay. In other words, concerns such as avoiding complications or sparing suffering to one's family may not have sped up help-seeking of type-D patients. This result suggests a maladaptive coping strategy that could also explain the increased risk of poor prognosis in these patients as it could have delayed help-seeking. This result is also in line with previous research showing that people with type-D personality are more likely to use avoidant coping strategies such as resignation (e.g., trying to not pay attention to one's problems) or withdrawal (e.g., withdrawing from other people when things get difficult; Polman, Borkoles, & Nicholls, 2010). The use of such strategies, together with this group's natural tendency to feel but not share negative emotions may be responsible for their more delayed help-seeking and their worse mental state after the ACS. However, we should keep in mind that the questionnaire about concerns during the cardiac event is retrospective in nature and may not reflect patients' concerns very accurately due to memory biases or post-hoc reinterpretation of events.

Previous research had already established that type-D patients are at higher risk of depression (Kupper & Denollet, 2018). The current study shows that longer prehospital decision delays are one potential mechanism that increases risk of depression in this group. In particular, as mentioned above longer delays in the administration of treatment can lead to more severe disease, more complications, and a need for more adjustment for patients who survive the cardiac episode (Moser et al., 2006). Researchers are already examining ways to intervene in patients with type-D personality to decrease these risks. For instance, stepwise psychotherapy has been shown to be (somewhat) beneficial for depressed type-D patients in comparison to information sessions (Herrmann-Lingen et al., 2016).

Higher levels of resilience were related to lower psychological distress post-ACS—a result that is also consistent with previous studies demonstrating the protective effect of this personality trait on mental health (Toukhsati et al., 2017). Suffering an ACS can be a traumatic experience for patients because of the fear and pain experienced during the episode and because of the life-long sequelae such as the need to take various medications, change harmful habits, and adopt new healthier habits. The current study shows that trait resilience may be a marker for the cognitive resources needed to cope with the physical and psychological stress inherent to the ACS. For instance, patients low in resilience may have at their disposal fewer (or less effective) coping skills to help them during the period of adjustment immediately post-ACS, which may involve coming to terms with new physical limitations and the need to make important life changes. In a study with coronary heart disease patients, those who were higher in resilience achieved better physical and mental outcomes in response to an 8-week

rehabilitation program (Chan, Lai, & Wong, 2006). The accumulating evidence suggests that instruments measuring resilience may help identify vulnerable patients prone to high psychological distress and in special need of assistance during the post-ACS adjustment period. Future studies should explore this possibility.

The Concerns questionnaire revealed that having thought about the potentially serious consequences of delaying help-seeking in the case of a serious condition (e.g., dying, causing suffering to one's family) was the strongest predictor of prehospital decision delay, explaining 7% of the variance in this variable. In contrast to our expectations, social concerns about help-seeking for a fleeting or non-serious condition were not related to prehospital decision delay. This stands at odds with previous research showing that patients who were concerned about troubling others, felt embarrassed, or did not want to waste other people's time report longer prehospital delays (Moser et al., 2006). However, there are multiple plausible explanations of this discrepancy, including a difference in measurement or cultural differences. The literature on prehospital delay is highly international and results regarding the relationship between delay and decision making concerns such as those measured in the current research are often mixed (Wechkunanukul et al., 2017). In addition, there is no unified theory of how and under what condition the diverse psychosocial and cognitive factors studied influence prehospital decision delay. However, research from Mediterranean countries is scarce and this study, which is to the best of our knowledge the first study conducted in Spain relating prehospital decision delay to various psychosocial factors, adds valuable cross-cultural evidence.

More perceived social support was related to lower psychological distress post-ACS. However, in multiple regression controlling for other factors, it was no longer a significant predictor, suggesting that the effect of social support was explained by the other predictors. In particular, higher social support was negatively correlated with type-D personality and positively correlated with resilience. Previous research had already shown that type-D personality is associated with lower social support in a healthy population (Williams et al., 2008). The current study confirms the generalizability of this relationship to patients with ACS; however, there was no relationship between social support and prehospital decision delay and the relationship between social support and psychological distress was not robust. Finally, perceptions of social support were measured after the cardiac event and could have been strongly influenced by the perceived availability of support in the days immediately after the cardiac event. Thus, they might not fully reflect the support available to patients outside of their current context, which could explain the lack of relationship between social support and prehospital decision delay. It would be of interest for future studies to use other types of

social support measures less prone to situational influences (e.g., structural, Wills & Ainette, 2012) or to test the effect of this factor using a prospective design.

A strength of the current study is that the measure of delay was validated against biological parameters (troponin). Limitations include memory biases and selection biases that are typical for this type of retrospective studies. In addition, the sample only includes survivors. It is possible that concerns about help-seeking in case of a false alarm (embarrassment, worry about wasting time) are predictive of delay but this relationship is not detected among these patients. Unfortunately, prospective studies on prehospital decision delay are exceptionally rare due to various constraints, thus retrospective studies despite their limitations remain among the most useful methods to study prehospital decision delay. Women and older patients were subsampled and the size of the sample was small, thus a replication of the current research is encouraged. Finally, our mediation analyses assumed that prehospital decision delay contributed to psychological distress measured post-ACS and not the other way round, which is consistent with the timeline of measurement (i.e., psychological distress was measured about 5 days after the cardiac event and the questionnaire inquired about state of mind in the past 7 days). However, it is possible that high psychological distress was present in some patients before the cardiac event (Glassman, Bigger, Gaffney, Shapiro, , & Swenson, 2006). Thus, the current study only shows a relationship between the two that should be investigated in future studies.

Most interventions aimed at reducing prehospital decision delay and its sequelae have focused on improving the recognition of symptoms in the population or raising awareness about successful treatment (Mooney et al., 2012). This research suggests that interventions and campaigns should emphasize not only the availability of successful treatment, but also address the potentially serious consequences of delaying care. Finally, the investigation of psychosocial factors in relation to prehospital decision delay and post-ACS psychological distress could reveal psychological mechanisms that increase the cardiovascular risk and help generate primary and secondary prevention strategies.

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**Artículo 2:** *Prehospital decision delay and psychological distress in ACS patients.*

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**Artículo 2:** *Prehospital decision delay and psychological distress in ACS patients.*

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***Artículo 3: Who does what the cardiologist recommends? Psychosocial markers of unhealthy behavior in coronary disease patients.***

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**Who does what the cardiologist recommends?**

**Psychosocial markers of unhealthy behavior in coronary disease patients**

**Abstract**

Patients diagnosed with coronary heart disease should follow lifestyle recommendations that can reduce their cardiovascular risk (e.g., avoid smoking). However, some patients fail to follow these recommendations and engage in unhealthy behavior. With the aim to identify psychosocial factors that characterize patients at high risk of repeated cardiovascular events, we investigated the relationship between social support, mental health (coping, self-esteem, and perceived stress), and unhealthy behavior.

We conducted a cross-sectional study of 419 patients recently diagnosed with coronary heart disease (myocardial infarction or angina) who participated in the National Health Survey in Spain (2018). Unhealthy behaviors were defined according to the European Guidelines on cardiovascular disease prevention. Only 1% of patients reported no unhealthy behaviors, with 11% reporting one, 40% two, 35% three, and 13% four or more unhealthy behaviors. In multiple regression controlling for demographic and traditional risk factors, mental health was the only significant psychosocial factor, doubling the odds of accumulated unhealthy behaviors,  $OR(\text{high vs. low})=2.03$ , 95% CI [1.14, 3.64]. Mental health was especially strongly related to unhealthy behavior among patients with obesity,  $OR(\text{high vs. low})=3.50$ , 95% CI [1.49, 8.45].

The relationship between mental health and unhealthy behaviors suggests that a large proportion of patients may not adhere to lifestyle recommendations not because they purposefully choose to do so, but because they lack coping skills to maintain the recommended healthy behaviors. Low mental well-being may be especially detrimental for behavior change of patients with obesity.

### **Introduction**

Cardiovascular diseases (CVD) are the leading cause of death in Europe (Wilkins et al., 2017). Globally, in 2016 they accounted for 31% of all deaths worldwide (WHO, World Health Organization, Cardiovascular diseases (CVDs), 2017). CVDs are also the leading cause of death in Spain, with coronary heart diseases representing 105 deaths (154 in men and 69 in women) per 100,000 inhabitants, according to the latest data of the National Statistics Institute (2017) (National Statistics Institute of Spain., 2017).

The burden of coronary heart disease (CHD) can be dramatically reduced through prevention efforts targeting healthier lifestyle. In particular, healthy lifestyle could help prevent and control hypertension, high cholesterol, obesity, or diabetes, all of which significantly increase the risk of CHD (Piepoli, et al., 2016). The prevention of future cardiac events and complications in patients already diagnosed with CHD is an important policy focus because these patients are at 5-6 times higher risk of suffering cardiovascular events (Piepoli, et al., 2016). To reduce this risk, patients are advised to follow certain health recommendations such as to engage in moderate-intensity physical activity, to eat a healthy diet, maintain a healthy weight, not to smoke, and not to drink large amounts of alcohol (Piepoli, et al., 2016). However, research in 24 European countries shows that, although many patients try to follow the recommendations regarding lifestyle, compliance is not satisfactory and objectives are frequently not achieved (Kotseva, et al., 2016). Similarly, less than half of eligible patients in Europe benefit from cardiac rehabilitation programs (Bjarnason-Wehrens, et al., 2010). Engaging in behaviors that increase the risk of repeated cardiac events (e.g., smoking or drinking alcohol) or not engaging in highly recommended behaviors that could reduce this risk (e.g., exercising, eating a healthy diet) reflects what we refer to as a pattern of unhealthy behaviors. A patient who does not follow a larger number of recommendations exposes him- or herself to larger cardiovascular risk.

Past research has identified several demographic predictors of unhealthy behavior. For instance, several studies have suggested that men follow medical recommendations to a lesser extent than women (De Smedt, et al., 2016; Zhao, et al., 2017), whereas married patients follow recommendations to a larger extent than unmarried patients (Manfredini, et al, 2017).

Besides demographic factors, psychosocial factors can also influence the risk of subsequent cardiac events and are likely more proximal predictors of behavior that drive the effects of socio-demographic factors (Rosengren, et al. 2004; Rozanski, Blumenthal, Davidson, Saab, & Kubzansky, 2005). Some of the psychosocial factors that have been related to increased cardiovascular risk are: lack of social support (Barth, Schneider, & von Känel, 2010, low resilience (Arrebola-Moreno, Garcia-Retamero, Catena, Marfil-

Álvarez, Melgares-Moreno, & Ramírez-Hernández, 2014), stress (Rosengren, et al. 2004), depression (Gan, et al. 2014), anxiety (Roest, Martens, de Jonge, & Denollet, 2010), and type-D personality (Garcia-Retamero, Petrova, Arrebola Moreno, Catena, A., & Ramírez Hernández, 2016).). Part of the effect of psychosocial factors on cardiovascular risk could be driven by their influence on behavior. To illustrate, patients with low social support are less likely to engage in cardiovascular risk screening (Petrova, Garcia-Retamero, & Catena, 2015 and have more trouble with the maintenance of self-care behaviors to manage their disease (Graven, & Grant, 2014).

In the current research, we investigated the relationship of two psychosocial factors – social support and mental health – with unhealthy behaviors in CHD patients. Low social support has been associated with a higher risk of cardiac mortality (Barth, 2010; Valtorta, Kanaan, Gilbody, Ronzi, & Hanratty, 2016) and a greater exposure to behavioral risk factors in healthy populations (Debnam, Holt, Clark, Roth, & Southward, 2012; Hwang, Hong, Rankin, 2015). Mental health problems such as depression are especially likely to develop following a cardiac event and have been associated with a two-fold increase in the risk of negative cardiovascular outcomes (e.g., mortality) (van Melle, et al., 2004). Depressive symptoms have also been linked to lower adherence to risk-reducing health behaviors ((Cohen, Edmondson, & Kronish, 2015; Kronish, Rieckmann, Halm, Shimbo, Vorchheimer, Haas, Davidson, 2006) and lower medication adherence (Grenard, Munjas, Adams, Suttrop, Maglione, McGlynn, & Gellad, 2011). Both lack of social support from friends and family and depression have been associated with a lower likelihood of taking up and completing cardiovascular lifestyle behavior change programs (Murray, Craigs, Hill, Honey, & House, 2012).

Guidelines for rehabilitation and self-care of CHD patients place emphasis on addressing the full range of modifiable risk factors (Balady, et al., 2007). However, no study to our knowledge has examined the relationships of social support and mental health with the global unhealthy behavior profile of patients. Because social support has also been associated with depression in cardiac patients (Frasure-Smith, Lesperance, Gravel, Masson, Juneau, Talajic, Bourassa, 2000).), it is possible that its beneficial effects on health-related behavior are explained by mental health; thus, it will be important to investigate the independent relationships of these two factors with unhealthy behavior. In addition, most previous studies investigated these relationships in healthy populations (Debnam, 2012 ; Hwang, 2015) or focused specifically on the presence of clinical depression (Cohen et al, 2015). Using a broader measure of mental health can capture manifestations of different types of mental distress and provide indication as to what specific cognitive processes (e.g., problems with coping or self-esteem) could be

associated with unhealthy behavior.

To fill this gap, we investigated the relationships of social support and general mental health with unhealthy behaviors in a sample of CHD patients drawn from a representative sample of the Spanish population. In particular, we aimed to describe the type and number of unhealthy behaviors reported by these patients, and quantify the unique relationships of social support and mental health with the number of unhealthy behaviors. The identification of psychosocial markers of unhealthy behavior could help identify patients who need intervention to prevent new cardiovascular events. It could also reveal potential underlying mechanisms that hinder the successful reduction of cardiovascular risk among this vulnerable group and thus provide recommendations regarding intervention design.

### **Method**

We conducted a cross-sectional descriptive study using survey data from the latest National Health Survey (NHS), conducted in 2017-2018 by the Spanish Ministry of Health, Social Services and Equality, and the National Institute of Statistics of Spain. The survey covered the entire territory of Spain and multistage stratified random sampling was used to obtain a representative sample of the adult population (Spanish Ministry of Health, Social Services and Equality, National Statistical Institute of Spain, 2017). Data were collected through a personal computer-assisted interview by trained interviewers. The number of households selected was 37,500 and these were distributed in 2,500 census sections; the census sections were grouped into six strata, according to the size of the municipality to which they belonged and were selected with a probability proportional to this size. Fifteen households were randomly selected within each census section. From each household, one adult was selected at random to participate in the survey. The response rate was 95% and responses were gathered from 23,090 adults.

For the current research, we selected those respondents who: a) were 40 years old or older at the time of the survey because the prevalence of CHD increases after this age (Mozaffarian, et al., 2015) and b) reported that they were diagnosed with CHD (acute myocardial infarction or angina) in the last 12 months. A total of N=419 people met these criteria: 150 (36%) reporting myocardial infarction (MI) only, 235 (56%) reporting angina only, and 34 (8%) reporting both. No ethical approval was required for this research as it involved secondary data analysis. The data and code for the analyses are available on the Open Science Framework (doi: 10.17605/OSF.IO/3D9FA).

### **Measures**

**Number of unhealthy behaviors.** Participants answered various questions about their health-related behavior from which we extracted data regarding behaviors considered as modifiable behavioral risk factors for coronary heart disease based on the

guidelines of the European Society of Cardiology (ESC) (Piepoli, et al., 2016). For each participant, we recorded whether he/she reported behavior that did not comply with the guidelines of the ESC regarding physical activity, alcohol consumption, smoking, vegetable, fruit, fish, sugary drinks, and fast food consumption. We assigned participants a score of one for each behavior not in line with recommendations and summed up the total number of behaviors (0 to 8); occasional survey non-responses (e.g., “do not know”, <1%) were coded as not in line with recommendations. Regarding physical activity, patients were regarded as completing recommendations when they reported either (a) doing physical activity in their leisure time at least several times a week or (b) reported frequent physical activity during their principal daily activity (e.g., work) such as walking, carrying weight, moving frequently, or doing tasks that require great physical effort.<sup>3</sup> Regarding alcohol consumption, unhealthy behavior was defined as more than 20 gr/day of pure alcohol on average for men and 10 gr/day for women as per ESC recommendation. Alcohol consumption data were based on a variable derived from an extensive assessment incorporated in the survey in which participants were asked about their consumption of various alcoholic drinks and the mean consumption of pure alcohol in grams per week was derived. Regarding smoking, unhealthy behavior was defined as currently smoking (daily or not). Regarding diet, the following consumption was regarded as unhealthy behavior as per ESC guidelines: fewer than two servings of vegetables daily, fewer than two servings of fruit daily, fish consumption less than once/twice a week. ESC guidelines discourage the consumption of sugar-sweetened soft processed food rich in saturated fat, thus three or more times a week consumption of fast food (e.g., fried chicken, sandwiches, pizzas, hamburgers) and sugary drinks was regarded as unhealthy behavior. The questions about diet were based on multiple choice items (all available on the statistical portal of <http://www.msssi.gob.es>).

**General Health Questionnaire (GHQ-12).** To measure mental health, the validated Spanish version of this instrument was administered (Sánchez-López, & Dresch, 2008). The instrument is designed to screen for general non-psychotic psychiatric morbidity using questions measuring problems with coping, low self-esteem, and perceived stress (Sánchez-López, & Dresch, 2008). In particular, twelve questions assess participants’ mental health in the past two weeks compared to usually on scales

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<sup>3</sup> The ESC recommends that individuals accumulate at least 150 min/week of moderate intensity physical activity or 75 min/week of vigorous intensity physical activity; however, in the survey physical activity was assessed in such detail only in individuals younger than 70. Thus, we created a proxy criterion based on the available information.



from 0 to 3, where a higher score indicates worse mental health. We used the sum of the scores on all items (Cronbach's  $\alpha=0.93$ ) as a measure of mental health.

**Social support.** This was measured with the Spanish version of the Functional Social Support Questionnaire of Duke-UNC (Bellón Saameño, Delgado Sánchez, Luna del Castillo, & Lardelli Claret, 1996). This instrument includes 11 items measuring perceived emotional and instrumental support on scales from 1 "much less support than I want" to 5 "as much support as I want". The final score (Cronbach's  $\alpha = 0.93$ ) ranges between 11 and 55, where higher scores indicate higher perceived social support.

**Socio-demographic variables.** We recorded participants' age, gender, marital status (married, single, widowed, separated/divorced), and social class (based on the classification of Domingo-Salvany (Domingo-Salvany, Bacigalupe, Carrasco, Espelt, Ferrando, & Borrell, 2013); category descriptions are found in Table 1).

**Further CHD risk factors.** We recorded whether patients had at any point suffered diabetes, hypertension, high cholesterol, chronic anxiety, and depression. Patients' body-mass index (BMI) was calculated based on self-reported weight and height and obesity was defined as  $BMI > 30 \text{ kg/m}^2$ . Finally, we computed the total number of comorbidities reported, i.e., number of other diseases that the patient reported having suffered (e.g., cancer, asthma, rheumatism, osteoporosis, etc.) from a total of 24 possible diseases, as other diseases and their cumulative impact could also be related to participants' health-related behavior.

## **Analysis**

The dependent variable of interest was the number of unhealthy behaviors. The predictors of main interest were the psychosocial factors: mental health and social support. The rest of the variables were regarded as control variables. First, we used descriptive statistics to summarize the general characteristics of the sample and the most common unhealthy behaviors. Then we analyzed the relationship between the psychosocial factors and the unhealthy behaviors. We first conducted simple regressions with each psychosocial factor as predictor and unhealthy behaviors as dependent variable. We finally conducted a multiple regression analysis including the two psychosocial factors and the demographics and traditional risk factors. The rate of missing data was low and no imputation was performed.

In the case of categorical predictors of more than two categories (social class and marital status), the following categories were used as references in comparisons between the different levels: the lowest social class (VI) and being married. These categories have been previously associated with cardiovascular risk (a higher risk in the case of low social class and a protective effect in the case of being married (Manfredini,

et al., 2017; Valtorta et al., 2016)). The odds ratio (OR) was used as an estimator of the effect size and 95% confidence intervals were computed to determine the significance of the predictors (intervals excluding 1). The analyses were carried out using the packages *summarytools* and *MASS* (function *polr*) in *R*.

## Results

Table 1 shows descriptive statistics for the categorical variables and Table 2 shows descriptive statistics for the continuous measures for all patients and based on type of CHD (MI or angina). Only 1% of patients reported no unhealthy behaviors, with 11% reporting one, 40% two, 35% three, and 13% four or more unhealthy behaviors. Patients with MI reported more unhealthy behaviors compared to patients with angina,  $OR=1.48$ , 95% CI [1.04, 2.13]. Regarding the specific behaviors (see Table 1), the proportion of patients reporting behavior not consistent with recommendations was highest for vegetable consumption (89%) and physical activity (88%), followed by fruit consumption (43%), smoking (10%), fish (9%), and sugary drinks consumption (8%). Only a small proportion of patients did not adhere to recommendations regarding alcohol consumption (5%) and fast foods consumption (2%).

Because not many individuals reported either zero or four or more unhealthy behaviors, an ordinal variable “Categories of unhealthy behavior” was created (see Table 1) and regression analyses were conducted on this ordinal variable. In particular, we first conducted simple ordinal logistic regressions (*polr* in *R*). Higher social support was related to fewer unhealthy behaviors (albeit insignificantly),  $OR=.98$ , 95% CI [.96, 1.00]. Worse mental health was related to more unhealthy behaviors,  $OR=1.03$ , 95% CI [1.002, 1.06].

We then conducted multiple regression analysis, the results of which are shown in Table 3 and Fig 1. Mental health remained significant in the multiple regression model,  $OR=1.04$ , 95% CI [1.002, 1.08]. To further illustrate its effect, we divided the mental health variable into terciles and conducted the same multiple regression analysis. Both the middle,  $OR=1.72$ , 95% CI [1.06, 2.79] and the highest tercile,  $OR=2.03$ , 95% CI [1.14, 3.64] were related to more unhealthy behaviors compared to the lowest tercile.

Among the control variables, women,  $OR = 0.52$ , 95% CI [0.33, 0.83], younger patients,  $OR = 0.97$ , 95% CI [0.95, 0.99], and patients with obesity,  $OR = 0.64$ , 95% CI [0.41, 0.99] reported fewer unhealthy behaviors. We next checked for significant interactions between mental health and these variables. There were no significant interactions between mental health with gender or age and stratified analysis showed that there were no notable differences in the relationship between mental health and unhealthy behavior across these categories and as a function of type of disease (see

Table 4). However, there was a significant interaction, OR = 1.08, 95% CI [1.01, 1.16], between mental health and obesity, showing that mental health was more strongly related to unhealthy behavior among patients who suffer obesity vs. those who do not (see Fig 1 and Table 4). In particular, patients with obesity who reported good mental health (low GHQ-12 scores) were at lower risk of unhealthy behaviors compared to patients without obesity; however, for patients who reported mental health problems (high GHQ-12 scores) this tendency reversed and patients with obesity were at higher risk of unhealthy behavior compared to patients without obesity (Fig 1).

Table 1. Descriptive statistics (number of cases and percentage from total) for categorical variables used in the study.

Variable	Categories	All patients		Myocardial infarction		Angina	
		N	419	N	184	N	269
Gender	Man	233	56%	112	61%	144	54%
	Woman	186	44%	72	39%	125	46%
Social Classal	Category I: Directors and managers of establishments of 10 or more employees and professionals traditionally associated with university degrees.	27	6%	12	7%	18	7%
	Category 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.	15	4%	6	3%	10	4%
	Category III: Intermediate occupations and self-employed workers.	70	17%	29	16%	46	17%
	Category IV: Supervisors and workers in qualified technical occupations.	62	15%	32	17%	35	13%
	Category V: Qualified workers from the primary sector and other semi-skilled workers.	160	38%	66	36%	109	41%
	Category VI: Unskilled workers. Missing	65	16%	31	17%	39	14%
		20	5%	8	4%	12	4%

Civil Status	Single	41	10%	15	8%	29	11%
	Widowed	114	27%	45	24%	78	29%
	Separated/divorced	26	6%	13	7%	16	6%
	Married	238	57%	111	60%	146	54%
Diabetes	Yes	137	33%	55	30%	98	36%
	No	282	67%	129	70%	171	64%
Hypertension	Yes	284	68%	127	69%	183	68%
	No	135	32%	57	31%	86	32%
High cholesterol	Yes	246	59%	108	59%	158	59%
	No	173	41%	76	41%	111	41%
Depression	Yes	97	23%	37	20%	69	26%
	No	321	77%	146	79%	200	74%
	Missing	1	0%	1	1%	0	0%
Chronic anxiety	Yes	66	16%	26	14%	48	18%
	No	352	84%	157	85%	221	82%
	Missing	1	0%	1	1%	0	0%
Body-mass index (BMI)	Underweight (< 18,5 kg/m <sup>2</sup> )	6	1%	4	2%	2	1%
	Normal weight (18,5 kg/m <sup>2</sup> ≤ IMC < 25 kg/m <sup>2</sup> )	106	25%	50	27%	63	23%
	Overweight (25 kg/m <sup>2</sup> ≤ IMC < 30 kg/m <sup>2</sup> )	175	42%	72	39%	119	44%
	Obesity (≥30 kg/m <sup>2</sup> )	111	26%	44	24%	76	28%
	Missing	21	5%	14	8%	9	3%

	None	1	2	3	4	5	6	7
Unhealthy behaviors	None	1	1%	3	1%	1%	1%	1%
	1	21	11%	30	11%	45	11%	11%
	2	61	33%	113	42%	167	40%	42%
	3	70	38%	93	35%	148	35%	35%
	4	22	12%	25	9%	42	10%	9%
	5	7	4%	1	0%	7	2%	0%
	6	1	1%	4	1%	5	1%	1%
Categories of unhealthy behaviors	7	1	1%	0	0%	1	0%	0%
	Low: None or one	22	12%	33	12%	49	12%	12%
	Low-medium: Two	61	33%	113	42%	167	40%	42%
	Medium-high: three	70	38%	93	35%	148	35%	35%
Physical activity	High: four or more	31	17%	30	11%	55	13%	11%
	Active/within norm	24	13%	32	12%	51	12%	12%
Alcohol consumption	Inactive	160	87%	237	88%	368	88%	88%
	Within norm ( $\leq 20$ gr/d for men and $\leq 10$ gr/d for women)	175	95%	259	96%	400	95%	96%
	High	9	5%	10	4%	19	5%	4%
Smoking	Does not smoke	165	90%	244	91%	377	90%	91%
	Smokes	19	10%	25	9%	42	10%	9%
Vegetable consumption	Within norm	20	11%	29	11%	44	11%	11%
	Low (< two servings daily)	164	89%	240	89%	375	89%	89%

Fruit consumption	Within norm	239	57%	97	53%	157	58%
	Low (< two servings daily)	180	43%	87	47%	112	42%
Fish consumption	Within norm	383	91%	160	87%	250	93%
	Low (less than once/twice a week)	36	9%	24	13%	19	7%
Sugary drinks	Within norm	386	92%	163	89%	253	94%
	High (three or more times a week)	33	8%	21	11%	16	6%
Fast foods	Within norm	409	98%	179	97%	264	98%
	High (three or more times a week)	10	2%	5	3%	5	2%

**Table 2. Descriptive statistics (minimum, maximum, mean and standard deviation) for the continuous variables used in the study (N=419).**

	Minimum	Maximum	Median	Mean	Standard deviation	% Missing data
All patients (N=419)						
Age (years)	40	97	73	72.0	11.7	0%
Comorbidities (n°)	0	6	2	2.6	1.7	0%
Mental health	1	36	11	13.2	6.8	1%
Social Support (Duke-UNC)	11	55	49	47.1	8.4	6%
Myocardial infarction (N=184)						
Age (years)	43	95	73	70.7	11.8	0%
Comorbidities (n°)	0	6	2	2.5	1.7	0%
Mental health	1	36	12	13.7	7.1	0%
Social Support (Duke-UNC)	18	55	49	47.0	8.0	7%
Angina (N=269)						
Age (years)	40	97	74	72.6	11.5	0%
Comorbidities (n°)	0	6	2	2.6	1.7	0
Mental health	4	36	11	13.1	6.6	1%
Social Support (Duke-UNC)	11	55	49	47.0	8.8	8%



Table 3. Results from multiple ordinal logistic regression.

Predictor	B	SE	t-value	Odds ratio	95% Confidence Interval	
					Inferior	Superior
Gender [female vs. male]	-0.65	0.24	-2.72	<b>0.524</b>	<b>0.328</b>	<b>0.834</b>
Social class (medium vs. low)	-0.32	0.22	-1.41	0.728	0.468	1.129
Social class (high vs. low)	-0.14	0.34	-0.42	0.867	0.445	1.681
Civil status (separated/divorced/single vs. married)	-0.06	0.30	-0.20	0.944	0.528	1.686
Civil status (widowed vs. married)	0.43	0.28	1.54	1.544	0.890	2.686
Age	-0.03	0.01	-2.67	<b>0.973</b>	<b>0.954</b>	<b>0.993</b>
Diabetes (yes vs. no)	0.16	0.23	0.70	1.175	0.749	1.843
Hypertension (yes vs. no)	0.30	0.23	1.30	1.354	0.857	2.142
High cholesterol (yes vs. no)	-0.12	0.22	-0.57	0.883	0.575	1.355
Obesity (yes vs. no)	-0.45	0.23	-1.96	<b>0.641</b>	<b>0.410</b>	<b>0.997</b>
Chronic anxiety (yes vs. no)	-0.31	0.34	-0.91	0.734	0.376	1.424
Depression (yes vs. no)	-0.19	0.30	-0.65	0.825	0.458	1.479
Comorbidities	0.01	0.06	0.10	1.006	0.889	1.138
Mental health	0.04	0.02	2.05	<b>1.038</b>	<b>1.002</b>	<b>1.075</b>
Social support	-0.01	0.01	-1.04	0.986	0.960	1.013
Type of disease (MI vs. angina)	0.22	0.21	1.05	1.242	0.827	1.867

Note: Significant effects (95% confidence intervals for the odds ratio excluding 1) are marked in bold. B=unstandardized regression coefficient. SE=standard error of B. For social class, the original six categories were grouped into high (I and II), medium (III and IV), and low (V and VI) due to low cell counts in some of the categories. For civil status, the category "single" was grouped with "separated/divorced" due to low cell count.

**Table 4. Relationship between mental health scores and unhealthy behaviors from simple regression analyses as a function of type of CHD, gender, age group, and the presence of obesity.**

	N	Mental health (terciles)					
		Medium vs. Low			High vs. Low		
		OR	LLCI	ULCI	OR	LLCI	ULCI
Type of coronary heart disease							
MI	184	1.946	0.999	3.821	1.896	1.020	3.552
Angina	269	1.198	0.709	2.026	2.020	1.156	3.551
Gender							
Men	233	1.534	0.882	2.677	1.998	1.100	3.656
Women	186	1.766	0.895	3.514	2.022	1.034	3.995
Age							
40-59	75	2.613	0.904	7.779	2.359	0.893	6.415
60-80	220	1.486	0.825	2.687	1.522	0.830	2.798
81+	124	1.419	0.643	3.153	2.158	0.925	5.120
Obesity							
No obesity (BMI <30 kg/m <sup>2</sup> )	287	1.452	0.881	2.400	1.347	0.791	2.298
Obesity (BMI ≥30 kg/m <sup>2</sup> )	111	1.770	0.726	4.358	3.496	1.490	8.446

Comparisons are based on terciles of mental health

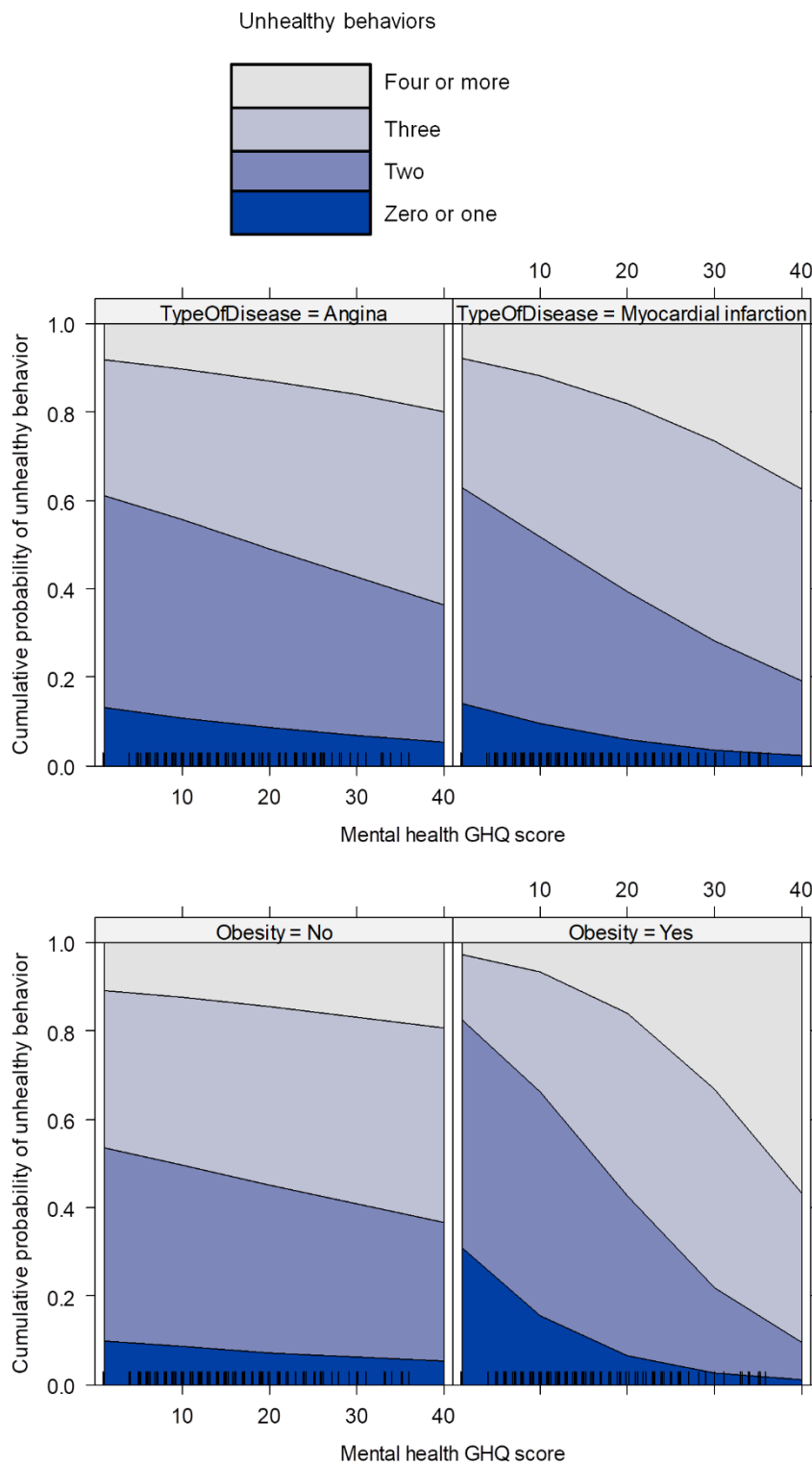


Fig 1. Relationship between mental health and the cumulative predicted probability of unhealthy behavior for each category derived from the multiple ordinal regression model, as a function of type of disease and the presence of obesity.

### **Discussion**

Consistent with previous studies, we observed that patients reporting more unhealthy behaviors tended to have lower levels of social support (Manfredini, et al., 2017). We also observed that patients who engaged in more unhealthy behaviors reported worse mental health. However, in multiple regression controlling for demographics and traditional risk factors, mental health emerged as the only significant psychosocial predictor of unhealthy behavior. This suggests that the beneficial effect of social support on reducing unhealthy behavior after a cardiac diagnosis observed in previous studies (Murray, et al., 2012) may be at least partly attributable to the protective effects of social support on mental health (Frasure-Smith, et al., 2000; Leifheit-Limson, et al., 2012).

We further found that mental health was more strongly related to unhealthy behaviors in patients suffering from obesity. In particular, at scores signifying good mental health, patients with obesity reported fewer unhealthy behaviors than patients without obesity. This finding may reflect these patients' higher motivation to reduce their high cardiovascular risk. However, at scores signifying the presence of mental health problems, patients with obesity reported more unhealthy behaviors compared to patients without obesity. This reversal shows that mental well-being may be especially important for behavior change in this highly vulnerable population. Unfortunately, European surveys show that about one in two patients with obesity report not having taken any action to lose weight after their coronary event (Kotseva et al., 2016).

The documented relationship between mental health and unhealthy behaviors has two important practical implications. On one hand, it suggests that a formal assessment with the GHQ-12 (Sánchez-López, & Dresch, 2008) or an informal assessment by a physician or a nurse using open-ended questions (Rozanski, et al, 2005), could successfully identify CHD patients who might have greater difficulty in carrying out the recommendations regarding lifestyle. On the other hand, these results also suggest that a substantial proportion of patients remain at high cardiovascular risk not because they decide to ignore the physicians' recommendations, but because they may lack the emotional capacity and coping skills to see these through. The GHQ-12 questionnaire is composed of items measuring problems with coping, low self-esteem, and perceived stress (Sánchez-López, & Dresch, 2008), suggesting that these issues could be contributing to unhealthy behavior patterns, especially among patients with obesity. This suggestion is in line with research on cardiac rehabilitation attendance showing that besides beliefs (e.g., the belief that the disease cannot be controlled or has

no severe consequences) (French, Cooper, & Weinman, 2006; Resurrección, et al, 2019), additional barriers such as physical (e.g., lack of transportation) and personal (e.g., embarrassment) barriers (Neubeck, Freedman, Clark, Briffa, Bauman, & Redfern, 2012) deter patients from participation in rehabilitation. Importantly, such external barriers could be potentially overcome with the appropriate coping skills. For instance, in patients with obesity lowering cardiovascular risk, and specifically weight loss, remains a challenge. The current results are in line with the importance of implementing behavioral weight loss (BWL) in cardiac rehabilitation programs (Ades, & Savage, 2017), as this approach addresses several psychological obstacles to weight loss by using positive reinforcement, self-monitoring, and goal setting, among others.

The current results also contribute to the findings of a recent study showing that Chinese CHD patients with lower self-esteem engaged in fewer health promoting behaviors; in particular, the relationship between self-esteem and behavior was partially mediated by confrontation coping, or the tendency to take direct action regarding stressors (Zou, Tian, Chen, Cheng, & Fan, 2017). In addition, patients with lower self-esteem showed higher levels of avoidance and resignation coping (i.e., avoiding stressors or not doing anything about them). In the context of the current study, these results support the idea that low self-esteem and the inability to cope with problems and stressors could be preventing coronary heart disease patients from following physicians' recommendations.

Previous research shows that interventions based on Self-Regulation Theory, involving components such as goal setting, self-monitoring, planning, and feedback can be successful at increasing adherence to lifestyle changes in programs for patients with CHD (Sniehotta, Scholz, & Schwarzer, 2006). For instance, in one study participants who formed action plans about when, where, and how they would exercise, and coping plans about how they would overcome anticipated barriers engaged in more physical exercise two months after discharge from cardiac rehabilitation (Sniehotta, Scholz, & Schwarzer, 2006). Making action and coping plans was also shown to reduce depressive symptoms a year after the intervention, and this effect was mediated by perceived goal attainment (Scholz, Knoll, Sniehotta, & Schwarzer, 2006). However, these positive effects were observed in patients attending cardiac rehabilitation programs. It remains for future research to establish to what extent such strategies can be helpful in more diverse samples of patients or as part of brief, practical interventions integrated into clinical practice (e.g., a brief session with a physician or a nurse during regular cardiac consultation). In addition, if indeed improved mental well-being mediates the effect of social support on health behavior and cardiovascular risk as suggested above, then incorporating social support in intervention design could increase intervention success.

Our results showed that less than 1% of the surveyed patients reported full compliance with lifestyle recommendations for patients diagnosed with CHD and almost half (48%) reported three or more unhealthy behaviors. These results are in accordance with research in the healthy Spanish population showing that less than 1% of individuals comply with lifestyle recommendations regarding cardiovascular health (nonsmoking, normal weight, physical activity at goal, and healthy diet) (Graciani, León-Muñoz, Guallar-Castillón, Rodríguez-Artalejo, & Banegas, 2013). The low vegetable consumption and low physical activity are also in accordance with results from the general Spanish population, as are the generally high adherence to fish consumption and avoidance of sugary drinks (Graciani, et al., 2013). A study in older Spanish adults ( $\geq 60$  years old) found that 43% were completely sedentary and 54% reported only occasional light physical activity mirroring the results found in the current study (Guallar-Castillón, et al., 2004). Comparing the results to those of other samples of CHD patients, the current sample had a lower prevalence of smoking (10%) and obesity (26%) compared to the average reported by patients from 24 European countries (16% and 38%, respectively) in the EUROASPIRE IV study ((Piepoli, et al., 2016).

Regarding socio-demographic factors, we found no differences in unhealthy behaviors as a function of marital status. These results are inconsistent with previous findings showing that married individuals have a better risk profile and better cardiovascular health (Manfredini, et al., 2017). However, we found differences between men and women, in accordance with previous results showing that men are less likely to follow advice regarding lifestyle changes (e.g., diet and smoking) (De Smedt, et al., 2016). Finally, we also found that older patients report fewer unhealthy behaviors.

A notable strength of the current study is the wide age range of the sample and the possibility to extrapolate the results to the general patient population. Limitations that need to be taken into account include the possibility of selection biases (e.g., not participating in the survey due to illness) and inaccurate knowledge of participants regarding the condition diagnosed. The specific clinical diagnoses of participants and their exact timing were not recorded.

Issues related to the measurement of the unhealthy behaviors or cardiovascular risk factors could have an impact on the results. In particular, for some behaviors (e.g., physical activity) the survey did not contain sufficient detail to evaluate adherence according to the specific European Guidelines and no information was available for some aspects part of a healthy diet according to the Guidelines (e.g., unsalted nuts or salt consumption). For other behaviors (e.g., fast food and sugary drinks consumption) there are no specific guidelines but a general recommendation against their consumption on

a regular basis, thus, we used our expert judgment to set the criterion for these variables. There was no detailed clinical information available regarding the traditional risk factors and no information about previous personal or family history of CHD. In addition, we could not control for patients' lifestyle before the diagnosis and did not examine medication adherence. The latter is an especially important part of secondary prevention efforts that could have even stronger effects than lifestyle factors (Piepoli, et al., 2016).

Given the correlational nature of this research, a bidirectional relationship is also possible, such that the inability of patients to adopt a healthier lifestyle could also be contributing to lower mental health. For instance, individuals who do not engage regularly in physical activity are more likely to suffer low moods and depression (Harvey, et al., 2017). Finally, we adopted a behavioral approach and gave equal weight to all unhealthy behaviors. Future studies should consider alternative risk scores, as some behaviors may be more harmful than others (e.g., smoking may increase risk to a larger extent than does lack of physical activity). In addition, it would be of interest for future research to investigate unhealthy behaviors and the documented relationships comparing patients with CHD to patients with other chronic diseases or a healthy population.

Finally, another psychosocial factor that could be of interest is adverse working conditions such as job strain and small decision latitude that have been related to the development of CHD (Theorell, Jood, Järvholm, Vingård, Perk, Östergren, & Hall, 2016). Unfortunately in the current sample the large majority of patients (67%) were retired and no information about their previous working conditions was available. It is possible that long-lasting unfavorable work conditions contribute to unhealthy behavior patterns and this way increase the risk of CHD. However, findings regarding the relationship between stressful work conditions and unhealthy behaviors appear to be inconclusive and more research on this issue is needed (Siegrist, & Röde, 2006).

#### Conclusions

Using recent data, the current study confirms that there is a need for individual or community-based interventions aiming to increase adherence to lifestyle recommendations among CHD patients. Low mental well-being (i.e., problems with coping, low self-esteem, and perceived stress) was associated with more unhealthy behaviors, with an effect size of clinical significance (i.e., doubling the odds of accumulated unhealthy behaviors). This relationship was even stronger in patients with obesity. These results suggest that a large proportion of patients may not adhere to lifestyle recommendations not because they purposefully choose to do so but because they have difficulty coping with the perceived barriers to introducing and maintaining the recommended healthy behaviors. This possibility should be investigated further using prospective research designs. These findings also speak to the potential utility of further

research on brief interventions that provide coping resources such as action and coping planning instructions to help patients adopt a healthier lifestyle.

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***DISCUSIÓN Y  
CONCLUSIONES  
GENERALES***





El objetivo principal de esta tesis ha sido investigar sobre los factores psicológicos que se relacionan con la toma de decisiones y el comportamiento de salud de los pacientes con enfermedad coronaria. Se ha investigado sobre tres momentos clave en la ruta sanitaria de los pacientes coronarios: la toma de decisiones durante el SCA medida a través de la demora prehospitalaria, los primeros días tras el evento coronario enfocándose en el estado psicológico, y el periodo de recuperación y prevención secundaria enfocándose en el comportamiento de salud.

Para ello, hemos investigado sobre toda la literatura existente hasta el momento relativa a la relación entre varios factores psicológicos y cognitivos frecuentemente investigados y la demora prehospitalaria, a través de la primera revisión sistemática a nivel mundial, según nuestro conocimiento. Por otro lado, en un estudio empírico hemos investigado las relaciones entre varios factores psicológicos relevantes según la investigación realizada hasta el momento como son: la personalidad tipo D, la resiliencia, el apoyo social percibido y las preocupaciones durante el evento coronario, con la demora prehospitalaria y el estado psicológico de los pacientes. Por último, en otro estudio empírico hemos investigado sobre el tipo y la cantidad de comportamientos no saludables informados por los pacientes en el periodo de recuperación, para describir las relaciones entre el apoyo social y salud mental con la cantidad de conductas no saludables y así identificar a los pacientes que necesitan intervención para prevenir nuevos eventos cardiovasculares.

Teniendo en cuenta que, la enfermedad coronaria es la principal causa de muerte en Europa (Wilkins, et al., 2017), y que su pronóstico puede mejorarse no solo a través de terapias farmacológicas o médicas, sino de cambios en el comportamiento de los pacientes (Knuuti, et al. 2019), estimamos de gran relevancia la investigación sobre los factores psicológicos que influyen en la de toma de decisiones durante el evento coronario, el estado psicológico del paciente después del evento coronario y los comportamientos de salud en el periodo de recuperación y rehabilitación.

La **hipótesis general** de esta tesis se ha visto probada a través de la investigación realizada, ya que hemos comprobado cómo varios factores psicológicos se relacionan con la toma de decisiones y el comportamiento de los pacientes coronarios, en concreto con la demora prehospitalaria, el estado psicológico del paciente tras el evento coronario y los comportamientos de salud en el periodo de recuperación.

En cuanto al primer objetivo específico, hemos investigado y encontrado relación entre varios factores relacionados con la interpretación y percepción de los síntomas y las preocupaciones durante el evento coronario con la demora prehospitalaria (Estudios 1 y 2). En concreto, hemos encontrado que varios factores psicológicos han demostrado ser muy relevantes en la búsqueda de ayuda, específicamente la atribución de los síntomas a eventos coronarios, la percepción de los síntomas como graves y la ansiedad. Sin embargo, según los resultados del Estudio 1, las preocupaciones y barreras sociales percibidas por algunos pacientes en la búsqueda de atención médica (vergüenza o preocupación por molestar a otros) parecen ser mucho menos importantes de lo que se pensaba (Moser et al., 2006 y Wechkunanukul, et al., 2017). Estos hallazgos se confirmaron en el Estudio 2, donde la demora prehospitalaria se relacionó con pensar en consecuencias graves (por ejemplo, complicaciones, proteger a la familia) pero no con preocupaciones sociales (por ejemplo, perder el tiempo de otras personas) durante el episodio coronario. El conocimiento de los síntomas, por su parte, tampoco evidenció una tendencia clara. A pesar de esto, y vistos los problemas metodológicos en la medición del conocimiento de los síntomas tras el evento coronario, concluimos que el conocimiento sí podría ser importante, dado que la atribución a los síntomas sí fue significativa y no podría haber una atribución correcta de los síntomas, sin un conocimiento de los mismos.

En cuanto a la investigación mundial de la demora prehospitalaria, hemos encontrado mucha diversidad en la metodología de análisis utilizada por los autores, lo cual ha limitado el poder realizar una síntesis cuantitativa. En esta línea, sería conveniente utilizar prácticas de análisis más homogéneas para permitir el meta-análisis de los resultados y con ello, un resumen cuantitativo de la evidencia científica que se va obteniendo. Sería conveniente la creación de una guideline para orientar sobre el reporte de los resultados, lo que disminuiría la heterogeneidad de las prácticas analíticas y así se podrá sintetizar la evidencia existente sobre esta temática.

Por otra parte, y en relación con el segundo objetivo específico, también investigamos y encontramos relaciones entre la personalidad tipo D, la resiliencia, y el apoyo social percibido con la demora prehospitalaria (Estudio 2) y el estado psicológico tras el evento coronario (Estudio 2). La personalidad tipo D y las preocupaciones por las consecuencias graves de la demora prehospitalaria se asociaron con la angustia psicológica a través de la demora prehospitalaria. La resiliencia, por otro lado, se asoció

directamente con la angustia psicológica, resultando un factor protector. Sin embargo, el apoyo social percibido no se relacionó ni con la demora prehospitalaria, ni con la angustia psicológica.

Respecto al **estado psicológico** del paciente tras el evento coronario, estos resultados sugieren que la forma en que los pacientes enfrentan psicológicamente al evento coronario puede influir indirectamente en su pronóstico. Específicamente, hemos encontrado que las personas con personalidad tipo D podrían tener más riesgo de demoras importantes en la búsqueda de ayuda y más probabilidad de experimentar angustia psicológica después de un SCA, lo que les expondría a un mayor riesgo de mal pronóstico (Grande, Romppel, & Barth, 2012). La resiliencia, en contraste, surgió como un posible factor protector de la salud mental de los pacientes después del evento coronario.

Por último, y respecto al tercer objetivo específico sobre la relación entre el apoyo social y la salud mental con el **comportamiento de salud** en el periodo de recuperación (Estudio 3), encontramos que, una peor salud mental se relacionó con mayor número de comportamientos no saludables y que esta relación fue más pronunciada en pacientes con obesidad en comparación con pacientes sin obesidad.

Con respecto al comportamiento de salud de los pacientes en el periodo de recuperación encontramos, acorde a estudios previos (Kosteva et al., 2016), que una gran proporción de pacientes no cumple con las recomendaciones de estilo de vida. La relación significativa que guarda la salud mental, medida a través de preguntas sobre el afrontamiento, autoestima y estrés percibido, con el comportamiento no saludable sugiere que muchos de los pacientes no guardan las recomendaciones porque carecen de habilidades de afrontamiento para mantener los comportamientos saludables recomendados y no porque lo hagan intencionadamente así.

El apoyo social, a pesar de su documentada importancia en estudios previos (Barth, Schneider & von Kanel, 2010; Lett, Blumenthal, Babyak, Strauman, Robins, & Sherwood, 2005; Moser et al., 2006), no demostró relación importante con ninguna de las variables de resultado consideradas en la tesis. Tanto en el Estudio 2, como en el Estudio 3, las correlaciones documentadas del apoyo social con el estado psicológico y comportamiento de salud dejaron de ser significativas en el análisis de regresiones múltiples, sugiriendo que el apoyo social pueda tener un efecto indirecto sobre estas

variables, mediado por otros factores. Esta posibilidad debería explorarse en estudios futuros.

Los resultados de esta tesis nos brindan un conocimiento más amplio sobre los factores psicológicos que puedan influir en la toma de decisiones, estado psicológico y comportamiento de salud, y por lo tanto en el pronóstico a largo plazo de los pacientes con EC. Buscar atención médica inmediatamente después del comienzo de los síntomas de un SCA es una decisión fundamental para mejorar la supervivencia y calidad de vida de los pacientes (Bulluck, Yellon, & Hausenloy, 2016; Moser, et al ., 2006).. Los resultados de esta tesis apuntan a tres tipos de factores psicológicos que podrían reducir la demora prehospitalaria debida a la toma de decisiones de los pacientes: a) la interpretación y percepción de los síntomas como graves, importantes y relacionados con causas cardiacas, b) los pensamientos durante el evento coronario enfocados en las consecuencias graves y negativas de la demora y c) los rasgos de personalidad que podrían influir en estas percepciones y pensamientos.

Los resultados también demuestran la importancia del estado psicológico del paciente, ya que por un lado la demora prehospitalaria más larga se relaciona con más angustia psicológica en el periodo inmediato tras el evento coronario y por otro lado una salud mental peor se asocia con un comportamiento menos saludable en el periodo de recuperación y prevención secundaria. La resiliencia psicológica y capacidad de afrontar las dificultades podría proteger la salud mental de los pacientes y ayudar a reducir los hábitos no saludables a largo plazo.

Esperamos que los resultados de esta tesis proporcionan información valiosa para futuras investigaciones e intervenciones dirigidas a reducir la demora prehospitalaria o mejorar la adherencia a recomendaciones para prevención secundaria en pacientes con EC.

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# ***CURRICULUM VITAE***



Nací en Granada, en 1986. Me licencié en psicología en el año 2009 por la Universidad de Granada. En 2010 realicé el Máster Universitario en Gerontología Social en la Universidad de Granada y el Máster en Sexología, Terapia sexual y Género en el Instituto de Sexología Al-Ándalus.

El 2011 comencé a trabajar como Psicóloga en Asociación para el empleo y la formación de personas con discapacidad, en la Fundación Once, desde 06/2011-04/2013.

En 2012 realicé el Máster en recursos Humanos por la UNED. En 2013 comencé a trabajar como funcionaria Psicóloga en la Delegación de Salud y Bienestar Social (Junta de Andalucía, Granada). En el año 2014 realicé el Máster Oficial en Neurociencia y Dolor por la Universidad de Granada.

En 2018 cursé el Máster Oficial Psicología General sanitaria por la Universidad Internacional de Valencia y en 2019 el Máster Oficial en Neuropsicología por la Universidad Oberta de Catalunya.

En 2017 comencé los estudios de doctorado, he realizado diversas formaciones relacionadas con la línea de investigación que seguí en mi tesis: aprendizaje, emoción y decisiones.

En 2018 empecé a formar parte del grupo de investigación Aprendizaje, Emoción y Decisiones de la Universidad de Granada. Soy miembro del Colegio Oficial de Psicólogos.

En 2018 participé en el Congreso Internacional de Psicología Clínica a través de la comunicación: "El estado anímico depresivo se asocia con mayor comportamiento de riesgo en pacientes con enfermedad coronaria", y en el Congreso Sociedad, Psicología y Salud, con la comunicación: Who does what the doctor says? Psychological factors and behavioral risk in coronary disease patients.

En el año 2018 y 2019 participé en las II y III Jornadas del Centro de Investigación, Mente y Cerebro (CIMYC) con las comunicaciones: "The role of psychological factors in cardiovascular disease" y "Determinantes psicosociales del retraso prehospitalario y los síntomas depresivos en pacientes con síndrome coronario agudo"

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