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Searching for the erosion of empathy in medical undergraduate students: a longitudinal study.

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TITLE PAGE

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Authors:

- José Manuel Blanco Canseco^{a,b}. MD, PhD ORCID: 0000-0002-5534-5618i

^a School of Medicine. Universidad Francisco de Vitoria, Ctra. Pozuelo-Majadahonda (M-515) Km. 1.800, 28223, Pozuelo de Alarcón, Madrid, Spain.

^b Valle de la Oliva Healthcare Centre, Enrique Granados 2, 28222, Majadahonda, Madrid, Spain.

- Fernando Caballero Martínez^c. MD, PhD

^cDean School of Medicine. Universidad Francisco de Vitoria, Ctra. Pozuelo-Majadahonda (M-515) Km. 1.800, 28223, Pozuelo de Alarcón, Madrid, Spain.

- Santiago Álvarez Montero^c. MD, PhD ORCID: 0000-0002-8282-8877

^cVice-Dean School of Medicine. Universidad Francisco de Vitoria, Ctra. Pozuelo-Majadahonda (M-515) Km. 1.800, 28223, Pozuelo de Alarcón, Madrid, Spain.

- Mercedes Plans Tena^b. MD

^b Valle de la Oliva Healthcare Centre, Enrique Granados 2, 28222, Majadahonda, Madrid, Spain.

- Diana Monge Martín^c. MD, PhD ORCID: 0000-0002-3593-1820

1
2
3 Vice Dean School of Medicine. Universidad Francisco de Vitoria, Ctra. Pozuelo-
4 Majadahonda (M-515) Km. 1.800, 28223, Pozuelo de Alarcón, Madrid, Spain.
5
6
7

8 **CORRESPONDENCE:** Diana Monge Martín. Vice-dean School of Medicine.
9 Universidad Francisco de Vitoria, Ctra. Pozuelo-Majadahonda (M-515) Km. 1.800,
10 28223, Pozuelo de Alarcón, Madrid, Spain. Tel: (34) 678432636. Email:
11 d.monge@ufv.es
12
13
14
15
16
17
18
19
20
21
22
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For peer review only

ABSTRACT

Objective: To analyse the evolution of empathy throughout the degree programme of medicine in a Spanish school of medicine.

Design: Longitudinal, prospective five-year study, between October 2014 and June 2019.

Setting: Students from a Spanish university of Medicine.

Participants: Two voluntary cohorts of undergraduate medical students from two different school years were invited to participate (n=135 and 106 per school year). Finally, a total number of 174 students (102 (C1) and 72 (C2) students respectively) were monitored for five years. Each cohort was divided in two sub-cohorts of paired and unpaired students that were analysed to check possible social desirability bias.

Primary Outcome Measure: The Jefferson Scale of Empathy (JSE).

Results: The cohort of 102 students (C1) monitored between their first and fifth years of study (71.6% females) showed an improvement in JSE scores (global empathy) within paired females by 2.15 points (p=0.01) and in cognitive empathy by 2.39 points (p=0.01); in the unpaired female cohort the increase was of 2.32 points (cognitive empathy) (p=0.02). The cohort of 72 students (C2) monitored between their second to sixth years of study (70.8% females) displayed a cognitive empathy increase of 2.32 points (p=0.04) in the paired group of females. There were no decreased in male JSE scores.

Conclusions: The empathy of medical students at our school did not decline along grade years. In fact, it slightly improved in females, due to the cognitive dimension. This paper contributes to enlarge data from the Europe, where longitudinal studies are scarce. It supports the idea that there may be global geo-sociocultural differences; however, more studies comparing different school settings are needed.

Key words: empathy, medical students, medical training.

1
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3 **Key points:** We describe the evolution of empathy throughout the degree program in
4 medicine with the implementation of a person-centred medicine project teaching
5 approach. We observed that the empathy of medical students improved over time.
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10 11 12 13 **DECLARATIONS**

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16 **Funding:** The research was supported by University Francisco de Vitoria.

17
18 **Conflicts of interest/Competing interests:** Jose Manuel Blanco Canseco, Fernando
19 Caballero Martínez, Mercedes Plans Tena, Santiago Alvarez Montero and Diana Monge
20 Martín declare that they have no conflict of interest.
21
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24
25 **Ethics approval:** This study was performed in line with the principles of the Declaration
26 of Helsinki. Approval was granted by the Ethics Committee of University Francisco de
27 Vitoria, Madrid. Spain.
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32 **Consent to participate:** Informed consent was obtained from all individual participants
33 included in the study.
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37 **Consent for publication:** Not applicable.

38
39 **Availability of data and material:** The datasets generated during and/or analysed during
40 the current study are available from the corresponding author on reasonable request.
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44 **Code availability:** Not applicable.

45
46 **Authors' contributions:** All authors contributed to the study conception and design.
47 Material preparation, data collection and analysis were performed by Jose Manuel Blanco
48 Canseco, Diana Monge Martín and Fernando Caballero Martínez. Fernando Caballero
49 Martínez and Santiago Alvarez Montero led our person-centred medical curriculum.
50 Mercedes Plans Tena made substantial contributions to interpretation of data. The first
51 draft of the manuscript was written by Jose Manuel Blanco Canseco and Diana Monge
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3 Martín, and all authors commented on previous versions of the manuscript. All authors
4
5 read and approved the final manuscript.
6
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9

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24 Congreso Nacional de Educación Médica y V Congreso Hispano-Luso’, celebrated in
25 Salamanca in November of 2019.
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INTRODUCTION

Empathy is important for a clinical relationship and it is beneficial both for the patient and the healthcare professional. In patients, it has been associated with greater levels of satisfaction^{1,2,3}, greater participation in decision-making and caring for their health⁴, greater adherence to treatment^{1,5,6}, a better quality of life, lower levels of stress¹, and improved health results^{7,8}. Regarding the physician, empathy has been linked to better communication and relationships with the patient⁹, improved clinical skills^{9,10,11}, stronger capacity for inter-professional collaborative work¹², higher level of satisfaction and well-being^{13,14}, lower levels of professional burnout^{15,16,17}, less substance abuse or attempted suicide¹⁸, greater ethical awareness¹⁹ and a reduction in the number of official complaints^{20,21}. Moreover, different authors have reported that medical students with greater empathy have a higher level of well-being²² and experience less burnout²³. Students with greater empathy achieve higher practical work assessment scores from teachers or simulated patients^{24,25}.

Since Hojat et al.'s study in 2009,²⁷ several new studies have pointed out a decline in empathy evolution among schools^{27,28}. A systematic review of qualitative and quantitative studies (1990-2010) supported this observation which was mainly studied from longitudinal designs²⁹. A recent nationwide, multi-institutional, cross-sectional study from the United States comparing preclinical and clinical data found a decline in empathy scores³⁰.

In 2015, Roff warned about the possibility that empathy of medical students could not decline over time, at least, significantly. He conducted a literature review of cohorts of medical students monitored with the Student version of the Jefferson Physician Scale of Empathy (JPSE-S) in Japan, South Korea, China, Kuwait, India, Iran, UD, USA,

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3 Australia, Brazil, Colombia, the Dominican Republic, and Portugal³¹. A subsequent
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5 scoping review of English, Spanish, Portuguese and French literature (2009-2016)
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7 published in 2017 revealed that the predominant trend in cross-sectional studies was of a
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9 significantly higher or of similar empathy scores across years. Nevertheless, most
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11 longitudinal studies presented either mixed-results or empathy declines. They concluded
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13 that the literature does not offer clear conclusions relative to changes in student
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15 empathy³².

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20 In 2019, a meta-analysis was published to synthesize existing evidence examining how
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22 empathy changes during undergraduate medical education assessing whether different
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24 types of measures produce different results. Spatoula et al³³ discovered that studies
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26 showed contradictory results. For example, studies in the US found a significant reduction
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28 in empathy, but other countries, such as Portugal and Brazil did not show the same trend,
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30 maintaining the empathic disposition throughout medical school. The authors also stated
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32 that the JSPE report had higher effect sizes, considering that the decrease in empathy may
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34 depend on how empathy is measured³³.

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39 We do not know whether most data that comes from the USA is generalizable and whether
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41 empathy evolution could be a global problem or not. It has relevant practical academic
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43 consequences. We aimed to ascertain if empathy skills in Spain should be enhanced. More
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45 data from certain areas of the world, such as Europe, are needed since geo-sociocultural
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47 settings appear to exert an influence³⁴. More longitudinal data may provide a wider
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49 perspective about this topic and may help us to make educational decisions³³.

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54 In summary, although empathy is considered a basic skill for medical education and one
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56 would expect that medical students would become more empathetic as they progress
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58 through their career, results about its evolution are contradictory³³. There are Spanish
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3 studies that have validated versions of JSPE^{35,36,37}. However, these studies are cross-
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5 sectional and do not analyse the evolution of empathy throughout time in different student
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7 cohorts. Nevertheless, the JSPE seems to be a good resource to derive knowledge about
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9 empathy evolution in Spain.
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13 The objective of this study is to measure the evolution of medical students' levels of
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15 empathy at a Spanish University. We tracked two different cohorts to obtain a wider
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17 sample and checked the consistency of our outcomes by following up two different
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19 classes of undergraduates. We also compared the scale results within paired student
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21 cohorts to know if voluntary personal identification by means of a numerical code could
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23 introduce a social desirability bias.
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28 **METHODS**

31 **Design:**

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34 This was a longitudinal prospective cohort study.
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38 **Educational background:**

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41 Since its inception, our school has been part of the professional group known as The
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43 International Network for Person-Centered Medicine³⁸. One of its objectives is the
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45 maintenance and enhancement of levels of student empathy. Our person-centred
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47 curriculum has the following four-year educational pillars: a medical humanities pathway
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49 (one subject per year, from first to four years, coping with disciplines such as
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51 epistemology, anthropology, ethics, deontology and history of medicine), and a
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53 standardized-patient simulation program on clinical communication and relationship .
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3 During the first- year and the second-year, students take part in a program of early clinical
4 immersion. It consists of a clinical placement totalling four days at the health centre
5 (primary care) and four days in hospital during the first year. The second year, they attend
6 two days at a palliative care unit, three days in a psychiatric centre, and again, three days
7 in a health centre. It provides students direct experience of the real medical practice in
8 different contexts. Afterwards, they reflect on six principal areas: the patient- physician
9 relationship (professional attitudes and behaviour), communication, the participation of
10 patients and their families in care and decision-making, teamwork, healthcare
11 organization and teaching. The work concludes with their writing a report summarising
12 their reflections. During their clinical years, students approach different clinical simulated
13 scenarios and perform their internship with tasks pointed out and recorded within an
14 electronic portfolio.

31 **Measurement instrument:**

32 *The Jefferson Scale of Empathy:*

33
34 This study used the Jefferson Scale of Empathy, in its professional version (JSE-HP),
35 duly translated, adapted and validated for our environment³⁷. The JSE-HP can be used to
36 assess the empathy of medical students who have already had contact with real or
37 simulated patients (commonly from the third year)^{39,40}. In our case, we decided to use this
38 version because our students take part in the programme of early clinical immersion (see
39 above) which allows them to view themselves from the physician's perspective.

40
41 The JSE-HP has 20 items and is scored on a 7-point Likert Scale (1=totally disagree,
42 7=totally agree). The possible scores range from 20 to 140 points, so the highest scores
43 are associated with a greater degree of empathy. Although there is no time limit for the
44 assessment, it is usually answered in less than five minutes. After the factorial analysis⁴⁰,
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3 three dimensions are: Dimension 1: Patient perspective taking (cognitive aspects of
4 empathy) made up of 10 items; dimension 2: compassionate care (emotional aspects of
5 empathy) consisting of 8 items; dimension 3: standing in the patient's shoes containing 2
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10 items.

11 12 13 **Participants**

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16 The study took place between October 2014 and June 2019. Two cohorts, cohort 1 (C1)
17 and cohort 2 (C2) of students (Figure 1), respectively from the first and the second years
18 (academic year 2014-2015), were monitored for five years as they were the first cohorts
19 to follow all the person-centred curriculum as it is now. Each student received a call to
20 participate voluntarily, in the study. The degree of empathy within C1 was evaluated at
21 the start of the medical degree and at the end of the second, fourth and fifth years. The
22 C2 completed the JSE-HP at the start of the second year, and at the end of the third, fifth
23 and sixth years.
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36 **Statistical analysis**

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39 The quantitative variables are presented with their mean and standard deviation (SD). The
40 mean comparison of the JSE results in the paired student cohorts, when the variables
41 showed a non-gaussian distribution in the comparison groups, was made using the
42 Friedman non-parametric test. The mean comparison of the JSE results in unpaired
43 student cohorts was made using the Kruskal-Wallis non-parametric test.
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51 The SPSS 21.0 statistics program was used for statistical analysis, with a
52 significance level of $\alpha < 0.05$ in all the analyses.
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56 **Ethical approval**

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3 All the questionnaires were anonymous, by use of codes, with the aim of adhering to
4 international data protection laws, such as the current Spanish regulation (Organic Law
5 3/2018, of 5 December, regarding the Protection of Personal Data and guarantee of digital
6 rights, BOE 294 of 6/12/2018). When students voluntarily accept it, some data had a
7 numerical identification code to make possible analysis of paired student cohorts without
8 compromising anonymity. The study received the approval of the Ethics Committee of
9 the Francisco de Vitoria University. Participation was voluntary and independent of
10 students' academic results.
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23 RESULTS

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27 C1 initially had 135 students, and 102 of them (75,5% of this class) were monitored for
28 the five years, from their first year of career until their fifth year. It comprised 73 females
29 (71.6%) and 29 males (28.4%). The C2 students initially account for 106 participants and
30 72 (67,9% of this class) completed their monitoring from their second year until the end
31 of their sixth year. It comprised 51 females (70.8%) and 21 males (29.2%).
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40 Given that the personal identification by means of a code was voluntary, both cohorts
41 were subdivided into two sub-cohorts, one consisting of numerical code identified
42 students (paired) and another of unidentified students (unpaired). In C1, 49 students were
43 identified by code (48%): 35 females (71.4%) and 14 males (28.6%). Fifty-three students
44 remained unidentified (52%): 38 females (71.7%) and 15 males (28.3%). In the C2, 53
45 students were identified by numerical code (73.6%): 36 females (67.9%) and 17 males
46 (32.1%). Nineteen students remained unidentified (26.4%): 15 females (78.9%) and 4
47 males (21.1%).
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In the paired female C1 students, a statistically significant increase in global empathy (JSE-HP total) of 2.15 points (Cohen's d 0.26) was observed from their first to their fifth year ($p=0.01$). In the same way, the cognitive empathy (dimension 1 JSE-HP) increased 2.39 points (Cohen's d 0.35) when finishing the fifth year compared to the first ($p=0.01$). See Figure 2; Table 1.

Table 1. JSE-HP results in cohort C1 of medical students at the UFV monitored from the 1st to 5th years (paired and unpaired)

YEAR	2014/15 First	2015/16 Second	2017/18 Fourth	2018/19 Fifth	p
Paired females (n, %)	35 (71.4)	33 (70.2)	35 (71.4)	33 (70.2)	
Dim 1	61.4	64.48	60.14	63.79	0.01
Dim 2	48.74	50	48.37	49.33	0.45
Dim 3	12.77	12	11.63	11.94	0.25
JSE TOTAL	122.91	126.48	120.14	125.06	0.01
Paired males (n, %)	14 (28.6)	14 (29.8)	14 (28.6)	14 (29.8)	
Dim 1	64.29	61.86	61.36	61.71	0.75
Dim 2	48.43	48.64	48.43	47.36	0.78
Dim 3	12.36	11.14	11.21	11.57	0.44
JSE TOTAL	125.07	121.64	121	120.64	0.37
Unpaired females (n, %)	38 (71.7)	38 (71.7)	22 (66.7)	28 (71.8)	
Dim 1	62.82	63.34	59.86	65.14	0.02
Dim 2	49.29	49.89	49.14	50.46	0.61
Dim 3	12.03	12.11	11.55	11.39	0.77
JSE TOTAL	124.13	125.34	120.55	127	0.1
Unpaired males (n, %)	15 (28.3)	15 (28.3)	11 (33.3)	11 (28.2)	
Dim 1	60.07	60.2	57	60.73	0.79
Dim 2	47.33	48.47	45.18	49.55	0.3
Dim 3	12.53	11.73	12.18	11.36	0.31
JSE TOTAL	119.93	120.4	114.36	121.64	0.59

In the unpaired females of this cohort an improvement in cognitive empathy (dimension 1 JSE-HP) was also observed of 2.32 points (Cohen's d 0.48) ($p=0.02$). Differences found in empathy scores along time and between paired and nonpaired students were not statistically significant (Table 1).

In the paired C2, an increase in cognitive empathy (dimension 1 JSE-HP) was observed in females of 2.33 points (Cohen's d 0.44) ($p=0.04$). Again, there were no statistical

significative differences along time and between paired versus non-paired students (Figure 3; Table 2).

Table 2. JSE-HP results in cohort of medical students at the UFV monitored from the 2nd to 6th years (paired and unpaired)

YEAR	2014/15 Second	2015/16 Third	2017/18 Fifth	2018/19 Sixth	p
Paired females (n, %)	36 (67.9)	36 (67.9)	36 (67.9)	29 (64.4)	0.04
Dim 1	61.81	61.81	63.69	64.14	0.04
Dim 2	49.17	49.94	50.53	50.52	0.09
Dim 3	11.47	12.06	11.81	12.41	0.08
JSE TOTAL	122.44	123.81	126.03	127.07	0.12
Paired males (n, %)	17 (32.1)	17 (32.1)	17 (32.1)	16 (35.6)	
Dim 1	56.94	57.76	60.71	62.06	0.17
Dim 2	44.29	45.35	44.29	47.12	0.31
Dim 3	10	10.06	10.35	10.37	0.1
JSE TOTAL	111.24	113.18	115.35	119.56	0.1
Unpaired females (n, %)	15 (78.9)	15 (78.9)	24 (70.6)	28 (76.7)	
Dim 1	62.27	61.47	62.83	62.86	0.2
Dim 2	50	49.73	47.42	49.29	0.94
Dim 3	11.87	11.67	11.42	12.82	0.29
JSE TOTAL	124.13	122.87	121.67	124.96	0.69
Unpaired males (n, %)	4 (21.1)	4 (21.1)	10 (29.1)	10 (23.3)	
Dim 1	62.5	64.75	60.2	57.5	0.4
Dim 2	46	43	46.1	45.6	0.79
Dim 3	10.5	10	11.3	11.6	0.79
JSE TOTAL	119	117.75	117.6	114.7	0.66

As can be seen in Tables 1 and 2 and Figures 2 and 3, male cohorts showed levels of empathy that did not fall significantly among the preclinical (first and second years) and clinical years (third to sixth years).

DISCUSSION

The current study describes the curricular evolution of empathy in medical students at a university on European setting. The empathy of medical students at the Francisco de Vitoria University did not show a decline of scores on the JSE-HP at the end of their studies compared to their results when they started (preclinical and clinical courses,

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2
3 respectively). Moreover, it pointed out an increase of empathy evolution in females, as
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5 evidenced by a slight improvement of cognitive dimension.
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9 The JSE-HP measures self-perception of empathic attitudes but not empathic behaviour,
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11 though different studies have established a link between their results and those observed
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13 by the real^{41,42} or simulated patients⁴³. Otherwise, the cognitive empathy (dimension 1
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15 JSE-HP) seems to be the most likely influenced through suitable educational
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17 programmes⁴⁴, since emotional empathy appears to be more innate⁴⁴.
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21 The samples correspond to a single non-profit private university in Madrid and may not
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23 be representative of the rest of the Schools of Medicine in our environment. The cohorts
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25 of identified students behaved in the same way as those who did not wish to be identified,
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27 which is similar to the observations made by Hojat et al.²⁶. This fact is interesting as it
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29 seems to limit the social desirability bias which may accompany self-administered
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31 questionnaires.
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35 In Spain, there are no studies which analyse the degree of empathy of medical students
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37 over the long term. The current study provides a prospective monitoring of cohorts for
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39 five years. More longitudinal studies are required, as well as the effectiveness of the
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41 different programmes which aim to maintain and enhance it. Currently, we are carrying
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43 out an investigation which aims to analyse the degree of empathy in students across the
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45 eight medical faculties in Madrid (public and private) at three critical times in their
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47 training: at the start of the degree, at the end of the third year, and at the end of the sixth.
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49 The analysis of this data will provide more evidence regarding the evolution of empathy
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51 of Spanish medical students, discovering if differences exist in the empathy of students
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53 who take part in different curricular programmes, as well as establishing a proposal for
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55 cut-off values of low, medium and high levels of empathy in our environment.
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3 The broader question is what is taking place globally. This study adds some evidence
4 about the situation in Europe, where these kinds of studies are scarce, needed²⁹ and under
5 development⁴⁵. If we take into consideration west European quality studies selected in
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8 the Spatoula et al's meta-analysis³³, nine cross-sectional and only three longitudinal, we
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10 find that they gathered and analysed data (difference in means and 95% CI) from only
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12 two European countries: one university in Portugal (cross-sectional), 5 in another UK
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14 university (longitudinal). Also, they analysed 15 universities in the US, 10 universities in
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16 Asia and two universities in Africa.
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22 The cross-sectional study in a medical school in Portugal showed that the empathy
23 measures of senior year students were higher than the scores of those from the first year's
24 students.⁴⁶ A longitudinal study from the UK showed that neither men nor women showed
25 any change in cognitive empathy during the course. Women were more empathetic than
26 men and men's affective empathy declined slightly, whilst women's affective empathy
27 showed no change. Although statistically significant, the size was low. Neither men nor
28 women appear to become meaningfully less empathetic during their medical education⁴⁷.
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40 Our results complement these studies and it seems to support the idea that, at least in the
41 European setting, empathy does not diminish during the medical career. However, a
42 recent study from Switzerland showed that empathy remains stable in most medical
43 students but declines in some students. It suggests that some personality traits (openness)
44 as well as patient-oriented motives for studying medicine were associated with higher and
45 stable empathy⁴⁸.
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54 We cannot establish a cause-effect relationship as our study lacks a control group and all
55 the possible confusion bias factors which may be influencing the results have not been
56 isolated. However, it may help to acquire insight for asking questions and suggesting
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3 hypotheses. One question may be what sort of interventions are associated to better
4 empathy outcomes. A second one could be whether the effects of these interventions are
5 maintained in the long term, but actually little is known about it⁴⁹. Katahoka et al.⁵⁰
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7 observed an improvement in the empathy of first-year medical students in Japan after an
8 intervention was developed based on a communicative skills programme. They monitored
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10 this cohort of students and observed that the improvement in empathy did not last over
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12 time. They concluded that activities to improve empathy are necessary throughout the
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14 entire degree programme.
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22 This study stresses the question about what variables are associated with better or worse
23 outcomes. The empathy scores of UFV students are high compared to those reported in
24 other countries^{31,32} and in our environment³⁶, although these populations are not fully
25 comparable to ours. We may ask if it may be due to some of our four-year educational
26 pillars: a medical humanities pathway and a standardized-patient based program on
27 clinical communication and relationship.
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37 Empathy training interventions may be a possible factor among others. Intervention
38 length, scope of empathy measured, or the kind of tool used are important variables⁴⁹. For
39 instance, in two systematic reviews performed by the Best Evidence Medical Education
40 (BEME)⁵¹⁻⁵² the benefits of early clinical immersion at different levels is highlighted. On
41 the affective level, early clinical immersion promotes empathetic attitudes in students
42 towards the patients, reduces stress during clinical appointments, and enhances the
43 awareness of the students' own feelings and reactions. As we have described, our person-
44 centred curriculum has many kinds of interventions to promote empathy since first to last
45 year. The Carnegie Foundation⁵³ established the integration of theoretical knowledge into
46 clinical experience from the start of the degree among its most important lines of work.
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60 The General Medical Council of the United Kingdom⁵¹ prefers a vertical integration of

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3 different types of practical experience over time. This idea attempts to break down the
4 traditional division between preclinical and clinical courses (Flexner Academical Model).
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8 Another variable to be considered is the criteria for admission⁵⁴. At our school, 20% of
9 the admission score depends on the results of a personality, intelligence and
10 psychopathological test to which candidates are submitted. Therefore, there is a possible
11 selection bias towards students with a more humanistic and empathic profile. Stern,
12 Frohna and Gruppen⁵⁵ did not find a link between academic performance, used by the
13 medical faculties for student access, and students' future professional behaviour. They
14 believe, however, that certain humanistic personal qualities, such as empathy, could be
15 an influence. In this case, Hojat et al^{44,56,57} maintain that the personality and empathy
16 questionnaires as well as personal interviews could be a useful extra element to consider
17 in the selection process of the best students who wish to study at faculties of medicine.
18 This should undoubtedly be a variable to consider in future studies.
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35 A systematic review explored this question, but only a small number of possible
36 influential factors were investigated in each publication reviewed²⁹. In this review, gender
37 and age did not yield consistent results, but those students who selected patient-oriented
38 specialties had higher empathy scores. Some studies selected in this systematic review
39 found out that distress (for instance, burnout or a low sense of well-being) was associated
40 to a decrease of empathy. Hidden curriculum could play a role: mistreatment,
41 confrontation with clinical reality (illness, suffering, death), social support problems or
42 an excessive workload. It suggests that not only educational interventions may play a role
43 in empathy evolution, but other factors should be taken in mind in order to design future
44 studies.
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59 CONCLUSION

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3 The empathy of medical students at our school did not decline along grade years. In fact,
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5 it slightly improved in females, due to the cognitive dimension. Our institution makes a
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7 special effort in teaching empathy. This paper contributes to enlarge data from European
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9 area, where studies are scarce. It supports the idea that there may be global geo-
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11 sociocultural differences, however more studies comparing different school settings are
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13 needed to know what variables are associated with better results.
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18 **ARTICLE SUMMARY: STRENGTHS AND LIMITATIONS OF THIS STUDY**

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- 21 • This is a longitudinal study of two different cohorts we tracked yearly for 5 years.
 - 22 • We used a Spanish validated version of JSPE that is widely used for measuring
23 medical empathy.
 - 24 • We compared the results between paired and unpaired student cohorts to control
25 the social desirability bias.
 - 26 • Our students follow a person-centred medicine project In addition to their medical
27 technical training.
 - 28 • Our study includes only one University.
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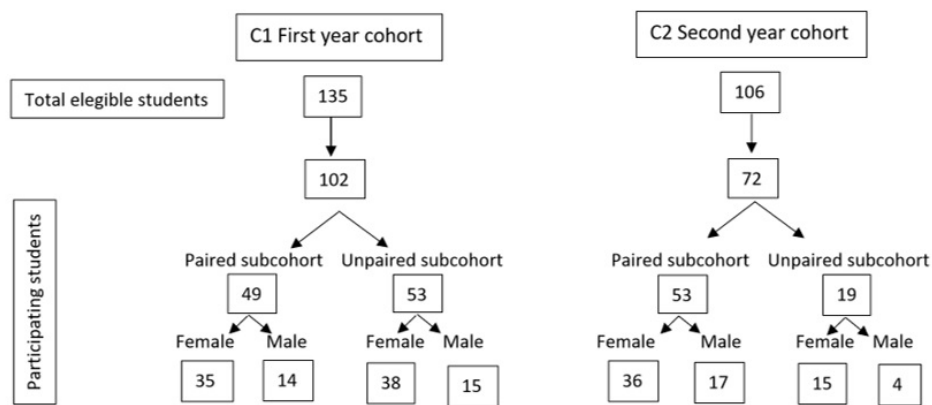
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Figure 1.

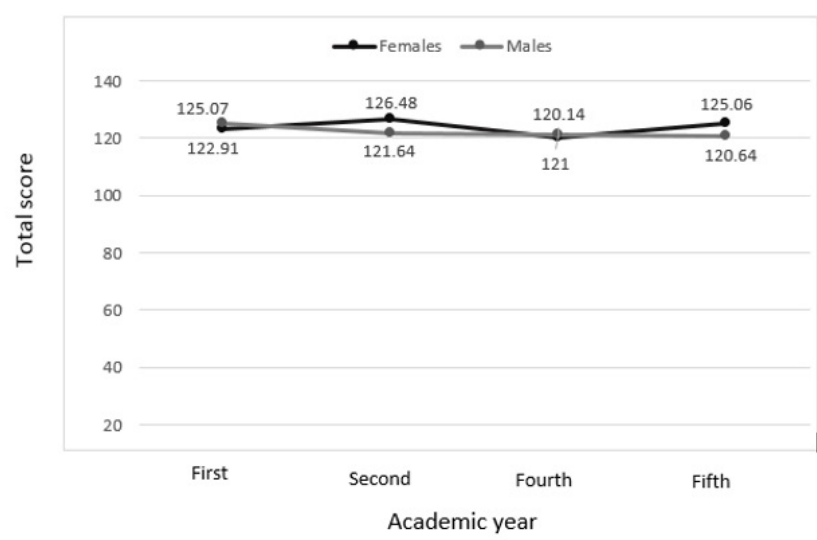


Cohorts description: sample size of C1 from first year and C2 from second year.

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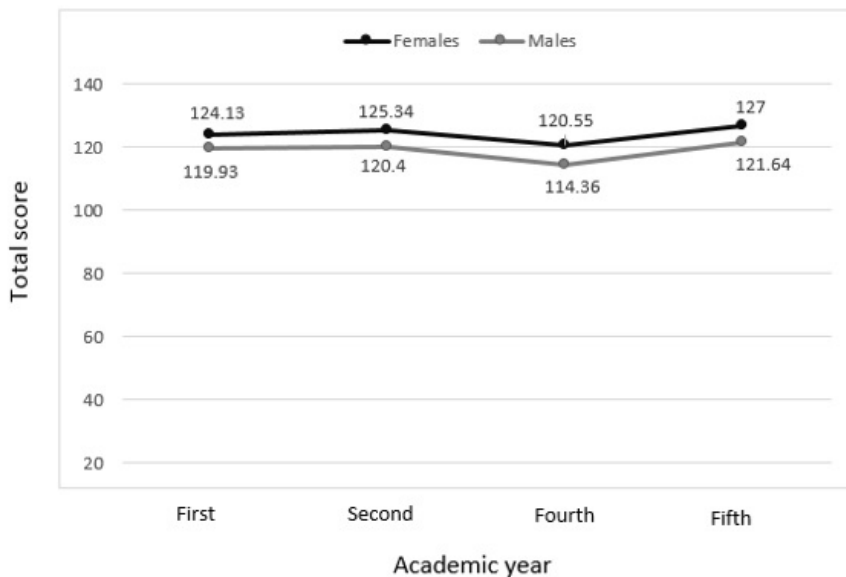
Fig 2. |



JSE-HP results in C1 paired cohort of 35 females and 14 males monitored for five years (Start of 1st year - end of 5th year).

197x129mm (96 x 96 DPI)

Fig 3.



JSE-HP results in C2 paired cohort of 36 females and 17 males monitored for five years (Start of 2nd year - end of 6th year).

173x129mm (96 x 96 DPI)

BMJ Open

Searching for the erosion of empathy in medical undergraduate students: a longitudinal study.

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TITLE PAGE

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Authors:

- Blanco, José Manuel^{a,b}. MD, PhD ORCID: 0000-0002-5534-56181

^a School of Medicine. Universidad Francisco de Vitoria, Ctra. Pozuelo-Majadahonda (M-515) Km. 1.800, 28223, Pozuelo de Alarcón, Madrid, Spain.

^b Valle de la Oliva Healthcare Centre, Enrique Granados 2, 28222, Majadahonda, Madrid, Spain.

- Caballero, Fernando^c. MD, PhD

^cDean School of Medicine. Universidad Francisco de Vitoria, Ctra. Pozuelo-Majadahonda (M-515) Km. 1.800, 28223, Pozuelo de Alarcón, Madrid, Spain.

- Álvarez, Santiago^c. MD, PhD ORCID: 0000-0002-8282-8877

^cVice-Dean School of Medicine. Universidad Francisco de Vitoria, Ctra. Pozuelo-Majadahonda (M-515) Km. 1.800, 28223, Pozuelo de Alarcón, Madrid, Spain.

- Plans, Mercedes^b. MD

^b Valle de la Oliva Healthcare Centre, Enrique Granados 2, 28222, Majadahonda, Madrid, Spain.

- Monge, Diana^c. MD, PhD ORCID: 0000-0002-3593-1820

1
2
3 Vice Dean School of Medicine. Universidad Francisco de Vitoria, Ctra. Pozuelo-
4
5 Majadahonda (M-515) Km. 1.800, 28223, Pozuelo de Alarcón, Madrid, Spain.
6
7

8 **CORRESPONDENCE:** Diana Monge Martín. Vice-dean School of Medicine.
9
10 Universidad Francisco de Vitoria, Ctra. Pozuelo-Majadahonda (M-515) Km. 1.800,
11
12 28223, Pozuelo de Alarcón, Madrid, Spain. Tel: (34) 678432636. Email:
13
14 d.monge@ufv.es
15
16
17
18
19
20
21
22
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For peer review only

ABSTRACT

Objective: To analyse the trajectory of empathy throughout the degree programme of medicine in a Spanish school of medicine.

Design: Longitudinal, prospective five-year study, between October 2014 and June 2019.

Setting: Students from a Spanish university of Medicine.

Participants: Two voluntary cohorts of undergraduate medical students from two different school years were invited to participate (n=135 (cohort 1, C1) and 106 (cohort 2, C2) per school year). Finally, a total number of 174 students (102 (C1, 71.6% females) and 72 (C2, 70.8% females) students respectively) were monitored for five years. Each cohort was divided in two sub-cohorts of paired and unpaired students that were analysed to check possible social desirability bias.

Primary Outcome Measure: The Jefferson Scale of Empathy (JSE).

Results: The cohort of 102 students (C1) monitored between their first and fifth years of study (71.6% females) showed an improvement among paired females of 2.15 points (p=0.01) in total JSE score and 2.39 points (p=0.01) in cognitive empathy; in the unpaired female cohort the increase was of 2.32 points (cognitive empathy) (p=0.02). The cohort of 72 students (C2) monitored between their second to sixth years of study (70.8% females) displayed a cognitive empathy increase of 2.32 points (p=0.04) in the paired group of females. There were no significant differences between paired and unpaired results for either cohort. There were no decreased in male JSE scores.

Conclusions: The empathy of medical students at our school did not decline along grade years. In fact, it improved slightly, particularly cognitive empathy, among females. This paper contributes to enlarge data from the Europe, where longitudinal studies are scarce. It supports the idea that there may be global geo-sociocultural differences; however, more studies comparing different school settings are needed.

ARTICLE SUMMARY: STRENGTHS AND LIMITATIONS OF THIS STUDY

- This is a longitudinal study of two different cohorts we tracked yearly for 5 years.
- We used a Spanish validated version of JSE that is the most widely used for measuring medical empathy.
- We compared the results between paired and unpaired student cohorts to control the social desirability bias.
- Our students follow a person-centred medicine project in addition to their medical technical training.
- Our study includes only one University.

Key words: empathy, medical students, medical training.

Key points: We describe the trajectory of empathy throughout the degree program in medicine with the implementation of a person-centred medicine project teaching approach. We observed that the empathy of medical students improved over time in females.

DECLARATIONS

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Conflicts of interest/Competing interests: Jose Manuel Blanco Canseco, Fernando Caballero Martínez, Mercedes Plans Tena, Santiago Alvarez Montero and Diana Monge Martín declare that they have no conflict of interest. Competing interest non declared.

Ethics approval: This study was performed in line with the principles of the Declaration of Helsinki. Approval was granted by the Ethics Committee of University Francisco de Vitoria, Madrid. Spain. Number/ID: 09/2017

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6 **Consent to participate:** Informed consent was obtained from all individual participants
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8 included in the study.
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10 **Consent for publication:** Not applicable.
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12 **Availability of data and material:** Data are available upon reasonable request.
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14 **Code availability:** Not applicable.
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17 **Authors' contributions:** All authors contributed to the study conception and design.
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19 Material preparation, data collection and analysis were performed by Jose Manuel Blanco
20
21 Canseco, Diana Monge Martín and Fernando Caballero Martínez. Fernando Caballero
22
23 Martínez and Santiago Alvarez Montero led our person-centred medical curriculum.
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25 Mercedes Plans Tena made substantial contributions to interpretation of data. The first
26
27 draft of the manuscript was written by Jose Manuel Blanco Canseco and Diana Monge
28
29 Martín, and all authors commented on previous versions of the manuscript. All authors
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31 read and approved the final manuscript.
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6 **Prior presentation:** The preliminary data of this work have been presented in the ‘XXIV
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8 Congreso Nacional de Educación Médica y V Congreso Hispano-Luso’, celebrated in
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10 Salamanca in November of 2019.
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For peer review only

INTRODUCTION

Empathy is important for a clinical relationship and it is beneficial both for the patient and the healthcare professional. In patients, it has been associated with greater levels of satisfaction[1,2,3] greater participation in decision-making and caring for their health[4], greater adherence to treatment[1,5,6] a better quality of life, lower levels of stress[1], and improved health results[7,8]. Regarding the physician, empathy has been linked to better communication and relationships with the patient[9], improved clinical skills[9,10,11] stronger capacity for inter-professional collaborative work[12], higher level of satisfaction and well-being [13,14], lower levels of professional burnout [15,16,17], less substance abuse or attempted suicide[18], greater ethical awareness[19] and a reduction in the number of official complaints[20,21]. Moreover, different authors have reported that medical students with greater empathy have a higher level of well-being[22] and experience less burnout[23]. Students with greater empathy achieve higher practical work assessment scores from teachers or simulated patients[24,25].

Since Hojat et al.'s study in 2009[26], several new studies have pointed out a decline in empathy trajectory among schools[27,28]. A systematic review of qualitative and quantitative studies (1990-2010) supported this observation which was mainly studied from longitudinal designs[29]. A recent nationwide, multi-institutional, cross-sectional study from the United States comparing preclinical and clinical data found a decline in empathy scores[30].

In 2015, Roff [31] warned about the possibility that empathy of medical students could not decline over time, at least, significantly. He conducted a literature review of cohorts of medical students monitored with the Student version of the Jefferson Scale of Empathy (JSE-S) in Japan, South Korea, China, Kuwait, India, Iran, UD, USA, Australia, Brazil,

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3 Colombia, the Dominican Republic, and Portugal[31]. A subsequent scoping review of
4 English, Spanish, Portuguese and French literature (2009-2016) published in 2017
5 revealed that the predominant trend in cross-sectional studies was of a significantly higher
6 or of similar empathy scores across years. Nevertheless, most longitudinal studies
7 presented either mixed-results or empathy declines. They concluded that the literature
8 does not offer clear conclusions relative to changes in student empathy[32].
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18 In 2019, a meta-analysis was published to synthesize existing evidence examining how
19 empathy changes during undergraduate medical education assessing whether different
20 types of measures produce different results. Spatoula et al[33] discovered that studies
21 showed contradictory results. For example, studies in the US found a significant reduction
22 in empathy, but other countries, such as Portugal and Brazil did not show the same trend,
23 maintaining the empathic disposition throughout medical school. The authors also stated
24 that the JSE report had higher effect sizes, considering that the decrease in empathy may
25 depend on how empathy is measured[33].
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37 We do not know whether most data that comes from the USA is generalizable and whether
38 empathy trajectory could be a global problem or not. It has relevant practical academic
39 consequences. We aimed to ascertain if empathy skills in Spain should be enhanced. More
40 data from certain areas of the world, such as Europe, are needed since geo-sociocultural
41 settings appear to exert an influence[34]. More longitudinal data may provide a wider
42 perspective about this topic and may help us to make educational decisions[33].
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52 In summary, although empathy is considered a basic skill for medical education and one
53 would expect that medical students would become more empathetic as they progress
54 through their career, results about its trajectory are contradictory[33]. There are Spanish
55 studies that have validated versions of JSE [35,36,37]. However, these studies are cross-
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3 sectional and do not analyse the trajectory of empathy throughout time in different student
4 cohorts. Nevertheless, the JSE seems to be a good resource to derive knowledge about
5 empathy trajectory in Spain.
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11 Another aspect to take into account is the social desirability bias described by
12 Edwards[38] when answering self-completed questionnaires. The authors of the JSE
13 recommend that the questionnaire should be anonymous and applied in non-penalizing
14 situations. Some studies[39,40] have controlled for this effect on JSE scores, not
15 observing substantial changes in them. Nevertheless, the risk of giving fake positive
16 answers and trying to present a socially acceptable image can always be present.
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26 The objective of this study is to measure the trajectory of medical students' levels of
27 empathy at a Spanish University. We tracked two different cohorts to obtain a wider
28 sample and checked the consistency of our outcomes by following up two different
29 classes of undergraduates. We also compared the scale results within paired student
30 cohorts to know if voluntary personal identification by means of a numerical code could
31 introduce a social desirability bias.
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40 **METHODS**

41 **Design:**

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47 This was a longitudinal prospective cohort study.
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50 **Educational background:**

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53 Since its inception, our school has been part of the professional group known as The
54 International Network for Person-Centered Medicine[41]. One of its objectives is the
55 maintenance and enhancement of levels of student empathy. Our person-centred
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3 curriculum has the following six-year educational pillars: a medical humanities pathway
4 (one subject per year, from first to four years, coping with disciplines such as
5 epistemology, anthropology, ethics, deontology and history of medicine), and a
6 standardized-patient simulation program on clinical communication and relationship .
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16 During the first- year and the second-year, students take part in a program of early clinical
17 immersion. It consists of a clinical placement totalling four days at the health centre
18 (primary care) and four days in hospital during the first year. The second year, they attend
19 two days at a palliative care unit, three days in a psychiatric centre, and again, three days
20 in a health centre. It provides students direct experience of the real medical practice in
21 different contexts. Afterwards, they reflect on six principal areas: the patient- physician
22 relationship (professional attitudes and behaviour), communication, the participation of
23 patients and their families in care and decision-making, teamwork, healthcare
24 organization and teaching. The work concludes with their writing a report summarising
25 their reflections. During their clinical years, from third to sixth year, students approach
26 different clinical simulated scenarios and perform their internship with tasks pointed out
27 and recorded within an electronic portfolio.
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45 **Measurement instrument:**

46 *The Jefferson Scale of Empathy (JSE):*

47 The most widely used measure of medical empathy is JSE. It is designed specifically to
48 measure self-perceived empathy in doctor-patient relationship, and it is more sensitive to
49 changes than others[42]. The IRI is a generic measure of empathy and, the JSE measures
50 empathy specifically for health care professionals. Both scales measure different but
51 related constructs[43].
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6 This study used the Jefferson Scale of Empathy, in its professional version (JSE-HP),
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8 duly translated, adapted and validated for our environment[37]. The JSE-HP can be
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10 used to assess the empathy of medical students who have already had contact with real
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12 or simulated patients (commonly from the third year)[44][45]. In our case, we decided
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14 to use this version because our students take part in the programme of early clinical
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16 immersion (see above) which allows them to view themselves from the physician's
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18 perspective.
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25 The JSE-HP has 20 items and is scored on a 7-point Likert Scale (1=totally disagree,
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27 7=totally agree). The possible scores range from 20 to 140 points, so the highest scores
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29 are associated with a greater degree of empathy. Although there is no time limit for the
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31 assessment, it is usually answered in less than five minutes. After the factorial
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33 analysis[45], three dimensions are: Dimension 1: Patient perspective taking (cognitive
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35 aspects of empathy) made up of 10 items; dimension 2: compassionate care (emotional
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37 aspects of empathy) consisting of 8 items; dimension 3: standing in the patient's shoes
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39 containing 2 items.
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45 **Setting and participants**

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48 The study took place between October 2014 and June 2019 in the school of Medicine of
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50 Francisco de Vitoria University (UFV). Two cohorts, cohort 1 (C1) and cohort 2 (C2) of
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52 students (Figure 1), respectively from the first and the second years (academic year 2014-
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54 2015), were monitored for five years as they were the first cohorts to follow all the person-
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56 centred curriculum as it is now. Each student received a call to participate voluntarily in
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58 the study, at the beginning of the class and fill in the paper questionnaire. The degree of
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3 empathy within C1 was evaluated at the start of the medical degree and at the end of the
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5 second, fourth and fifth years. The C2 completed the JSE-HP at the start of the second
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7 year, and at the end of the third, fifth and sixth years.
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11 To control the desirability bias, the two cohorts were subdivided into two sub-cohorts,
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13 one consisting of numerical code identified students (paired) and another of unidentified
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15 students (unpaired). So, the paired cohort could be tracked within subject longitudinally
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17 and compared.
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20 21 **Patient and public involvement**

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23 No patient involved.
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26 27 **Statistical analysis**

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29 The quantitative variables (JSE total, dimension 1, 2 and 3) are presented with their mean
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31 and standard deviation (SD). The qualitative variables (sex, code, cohort year) are
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33 presented with their frequency and percentage. The mean comparison of the JSE results
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35 in the paired student cohorts, when the variables showed a non-gaussian distribution in
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37 the comparison groups, was made using the Friedman non-parametric test. The mean
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39 comparison of the JSE results in unpaired student cohorts was made using the Kruskal-
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41 Wallis non-parametric test.
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46 The SPSS 21.0 statistics program was used for statistical analysis, with a
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48 significance level of $p < 0.05$ in all the analyses.
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51 52 **Ethical approval**

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54 All the questionnaires were anonymous, by use of codes, with the aim of adhering to
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56 international data protection laws, such as the current Spanish regulation (Organic Law
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58 3/2018, of 5 December, regarding the Protection of Personal Data and guarantee of digital
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rights, BOE 294 of 6/12/2018). When students voluntarily accept it, some data had a numerical identification code to make possible analysis of paired student cohorts without compromising anonymity. The study received the approval of the Ethics Committee of the Francisco de Vitoria University. Participation was voluntary and independent of students' academic results.

RESULTS

C1 initially had 135 students, and 102 of them (75.5% of this class) were voluntary monitored for the five years, from their first year of career until their fifth year. It comprised 73 females (71.6%) and 29 males (28.4%). The C2 students initially account for 106 participants and 72 (67.9% of this class) completed their voluntary monitoring from their second year until the end of their sixth year. It comprised 51 females (70.8%) and 21 males (29.2%).

Given that the personal identification by means of a code was voluntary, both cohorts were subdivided into two sub-cohorts, one consisting of numerical code identified students (paired) and another of unidentified students (unpaired). In C1, 49 students were identified by code (48%): 35 females (71.4%) and 14 males (28.6%). Fifty-three students remained unidentified (52%): 38 females (71.7%) and 15 males (28.3%). In the C2, 53 students were identified by numerical code (73.6%): 36 females (67.9%) and 17 males (32.1%). Nineteen students remained unidentified (26.4%): 15 females (78.9%) and 4 males (21.1%).

In the first clinical years (4th cohort year) we observe a slight drop in the total JSE score in both cohorts. However, scores at the end of follow-up recover to baseline levels. In cohort 2 they even improve slightly. See Figure 2 and 3.

In the paired female C1 students, a statistically significant increase in global empathy (JSE-HP total) of 2.15 points (Cohen's d 0.26) was observed from their first to their fifth year ($p=0.01$) (Figure 2). In the same way, the cognitive empathy (dimension 1 JSE-HP) increased 2.39 points (Cohen's d 0.35) when finishing the fifth year compared to the first ($p=0.01$). See Table 1.

Table 1. JSE-HP results in cohort C1 of medical students at the UFV monitored from the 1st to 5th years (paired and unpaired)

YEAR	2014/15 First (mean, SD)	2015/16 Second (mean, SD)	2017/18 Fourth (mean, SD)	2018/19 Fifth (mean, SD)	p
Paired females (n, %)	35 (71.4)	33 (70.2)	35 (71.4)	33 (70.2)	
Dim 1	61.40 (5.19)	64.48 (4.34)	60.14 (7.24)	63.79 (5.28)	0.01
Dim 2	48.74 (4.62)	50.00 (4.51)	48.37 (5.04)	49.33 (4.94)	0.45
Dim 3	12.77 (1.14)	12.00 (1.78)	11.63 (2.22)	11.94 (1.69)	0.25
JSE TOTAL	122.91 (8.29)	126.48 (7.19)	120.14 (9.85)	125.06 (8.40)	0.01
Paired males (n, %)	14 (28.6)	14 (29.8)	14 (28.6)	14 (29.8)	
Dim 1	64.29 (3.20)	61.86 (7.16)	61.36 (7.40)	61.71 (6.59)	0.75
Dim 2	48.43 (4.31)	48.64 (5.55)	48.43 (7.25)	47.36 (8.87)	0.78
Dim 3	12.36 (1.28)	11.14 (2.14)	11.21 (2.81)	11.57 (2.62)	0.44
JSE TOTAL	125.07 (6.89)	121.64 (12.00)	121.00 (14.57)	120.64 (16.78)	0.37
Unpaired females (n, %)	38 (71.7)	38 (71.7)	22 (66.7)	28 (71.8)	
Dim 1	62.82 (5.69)	63.34 (6.11)	59.86 (6.67)	65.14 (3.90)	0.02
Dim 2	49.29 (5.01)	49.89 (4.67)	49.14 (4.95)	50.46 (4.83)	0.61
Dim 3	12.03 (1.91)	12.11 (1.61)	11.55 (2.28)	11.39 (2.54)	0.77
JSE TOTAL	124.13 (10.70)	125.34 (10.24)	120.55 (11.37)	127.00 (8.58)	0.10
Unpaired males (n, %)	15 (28.3)	15 (28.3)	11 (33.3)	11 (28.2)	
Dim 1	60.07 (6.13)	60.20 (7.28)	57.00 (10.25)	60.73 (6.87)	0.79
Dim 2	47.33 (4.82)	48.47 (5.14)	45.18 (6.43)	49.55 (4.82)	0.30
Dim 3	12.53 (2.20)	11.73 (1.75)	12.18 (1.66)	11.36 (2.73)	0.31
JSE TOTAL	119.93 (10.43)	120.40 (12.03)	114.36 (16.10)	121.64 (11.59)	0.59

In the unpaired females of this cohort an improvement in cognitive empathy (dimension 1 JSE-HP) was also observed of 2.32 points (Cohen's d 0.48) ($p=0,02$). Differences found

in empathy scores along time and between paired and nonpaired students were not statistically significant (Table 1).

In the paired C2, an increase in cognitive empathy (dimension 1 JSE-HP) was observed in females of 2.33 points (Cohen's d 0.44) ($p=0,04$). Again, there were no statistical significant differences along time and between paired versus non-paired students (Table 2).

Table 2. JSE-HP results in cohort C2 of medical students at the UFV monitored from the 2nd to 6th years (paired and unpaired)

YEAR	2014/15 Second (mean, SD)	2015/16 Third (mean, SD)	2017/18 Fifth (mean, SD)	2018/19 Sixth (mean, SD)	p
Paired females (n, %)	36 (67.9)	36 (67.9)	36 (67.9)	29 (64.4)	
Dim 1	61.81 (6.32)	61.81 (5.98)	63.69 (4.90)	64.14 (4.02)	0.04
Dim 2	49.17 (5.27)	49.94 (4.34)	50.53 (4.00)	50.52 (4.59)	0.09
Dim 3	11.47 (2.22)	12.06 (2.32)	11.81 (1.95)	12.41 (2.06)	0.08
JSE TOTAL	122.44 (11.33)	123.81 (8.28)	126.03 (6.95)	127.07 (7.63)	0.12
Paired males (n, %)	17 (32.1)	17 (32.1)	17 (32.1)	16 (35.6)	
Dim 1	56.94 (7.10)	57.76 (8.19)	60.71 (8.59)	62.06 (5.01)	0.17
Dim 2	44.29 (4.90)	45.35 (5.95)	44.29 (9.34)	47.12 (4.91)	0.31
Dim 3	10.00 (2.50)	10.06 (2.19)	10.35 (3.08)	10.37 (2.06)	0.10
JSE TOTAL	111.24 (11.13)	113.18 (12.68)	115.35 (17.03)	119.56 (9.16)	0.10
Unpaired females (n, %)	15 (78.9)	15 (78.9)	24 (70.6)	28 (76.7)	
Dim 1	62.27 (4.33)	61.47 (3.52)	62.83 (7.14)	62.86 (7.07)	0.20
Dim 2	50.00 (3.29)	49.73 (4.57)	47.42 (8.68)	49.29 (4.17)	0.94
Dim 3	11.87 (1.96)	11.67 (1.95)	11.42 (3.22)	12.82 (1.02)	0.29
JSE TOTAL	124.13 (7.73)	122.87 (6.58)	121.67 (14.96)	124.96 (9.74)	0.69
Unpaired males (n, %)	4 (21.1)	4 (21.1)	10 (29.1)	10 (23.3)	
Dim 1	62.50 (5.32)	64.75 (3.95)	60.20 (7.57)	57.50 (8.06)	0.40
Dim 2	46.00 (4.00)	43.00 (16.67)	46.10 (7.53)	45.60 (5.38)	0.79
Dim 3	10.50 (1.91)	10.00 (3.91)	11.30 (2.00)	11.60 (0.84)	0.79
JSE TOTAL	119.00 (9.76)	117.75 (24.06)	117.60 (15.00)	114.70 (11.25)	0.66

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3 As can be seen in Tables 1 and 2 and Figures 2 and 3, male cohorts showed levels of
4 empathy that did not fall significantly among the preclinical (first and second years) and
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6 clinical years (third to sixth years).
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10 **DISCUSSION**

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14 The current study describes the curricular trajectory of empathy in medical students at a
15 university in a European setting. The empathy of medical students at the Francisco de
16 Vitoria University did not show a decline of scores on the JSE-HP at the end of their
17 studies compared to their results when they started (preclinical and clinical courses,
18 respectively). Moreover, it pointed out an increase of empathy trajectory in females, as
19 evidenced by a slight improvement of cognitive dimension.
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29 The JSE-HP measures self-perception of empathic attitudes but not empathic behaviour,
30 though different studies have established a link between their results and those observed
31 by the real[46,47] or simulated patients[48]. Otherwise, the cognitive empathy
32 (dimension 1 JSE-HP) seems to be the most likely influenced through suitable educational
33 programmes[49], since emotional empathy appears to be more innate[49].
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41 The samples correspond to a single non-profit private university in Madrid and may not
42 be representative of the rest of the Schools of Medicine in our environment. The cohorts
43 of identified students behaved in the same way as those who did not wish to be identified,
44 which is similar to the observations made by Hojat et al.[26]. This fact is interesting as it
45 seems to limit the social desirability bias which may accompany self-administered
46 questionnaires.
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56 In Spain, there are no studies which analyse the degree of empathy of medical students
57 over the long term. The current study is the first longitudinal work that provides a
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3 prospective monitoring of cohorts for five years. More longitudinal studies are required,
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5 as well as the effectiveness of the different programmes which aim to maintain and
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7 enhance it. Currently, we are carrying out an investigation which aims to analyse the
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9 degree of empathy in students across the eight medical faculties in Madrid (public and
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11 private) at three critical times in their training: at the start of the degree, at the end of the
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13 third year, and at the end of the sixth. The analysis of this data will provide more evidence
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15 regarding the trajectory of empathy of Spanish medical students, discovering if
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17 differences exist in the empathy of students who take part in different curricular
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19 programmes, as well as establishing a proposal for cut-off values of low, medium and
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21 high levels of empathy in our environment.
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27 The broader question is what is taking place globally. This study adds some evidence
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29 about the situation in Europe, where these kinds of studies are scarce, needed[29] and
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31 under development[50]. If we take into consideration west European quality studies
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33 selected in the Spatoula et al's meta-analysis[33], nine cross-sectional and only three
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35 longitudinal, we find that they gathered and analysed data (difference in means and 95%
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37 CI) from only two European countries: one university in Portugal (cross-sectional), 5 in
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39 another UK university (longitudinal). Also, they analysed 15 universities in the US, 10
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41 universities in Asia and two universities in Africa.
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47 The cross-sectional study in a medical school in Portugal showed that the empathy
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49 measures of senior year students were higher than the scores of those from the first year's
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51 students.[51] A longitudinal study from the UK showed that neither men nor women
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53 showed any change in cognitive empathy during the course. Women were more
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55 empathetic than men and men's affective empathy declined slightly, whilst women's
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57 affective empathy showed no change. Although statistically significant, the size was low.
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3 Neither men nor women appear to become meaningfully less empathetic during their
4 medical education[52].
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8 Our results complement these studies and it seems to support the idea that, at least in the
9 European setting, empathy does not diminish during the medical career. However, a
10 recent study from Switzerland showed that empathy remains stable in most medical
11 students but declines in some students. It suggests that some personality traits (openness)
12 as well as patient-oriented motives for studying medicine were associated with higher and
13 stable empathy[53].
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23 Besides, results from studies which use different instruments to analyse medical students'
24 empathy, as IRI and JSE, should be compared cautiously. Both scales measure different
25 but related constructs[43]. There might be appropriate to use both instruments or even
26 use other scales that measure empathy from real or simulated patients[46,47,48] in future
27 studies.
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34 There might be appropriate to use both instruments or even use other scales that measure
35 empathy from real or simulated patients
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41 We cannot establish a cause-effect relationship as our study lacks a control group and all
42 the possible confusion bias factors which may be influencing the results have not been
43 isolated. However, it may help to acquire insight for asking questions and suggesting
44 hypotheses. One question may be what sort of interventions are associated to better
45 empathy outcomes. A second one could be whether the effects of these interventions are
46 maintained in the long term, but actually little is known about it[54]. Katahoka et al.[55]
47 observed an improvement in the empathy of first-year medical students in Japan after an
48 intervention was developed based on a communicative skills programme. They monitored
49 this cohort of students and observed that the improvement in empathy did not last over
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3 time. They concluded that activities to improve empathy are necessary throughout the
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5 entire degree programme.
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9 This study stresses the question about what variables are associated with better or worse
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11 outcomes. The empathy scores of UFV students seems higher than those reported in other
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13 countries[31,32] and in our environment[36], although these populations are not fully
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15 comparable to ours and we haven't analysed this differences statistically . We may ask if
16
17 it may be due to some of our four-year educational pillars: a medical humanities pathway
18
19 and a standardized-patient based program on clinical communication and relationship.
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23 Empathy training interventions may be a possible factor among others. Intervention
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25 length, scope of empathy measured, or the kind of tool used are important variables[54].
26
27 For instance, in two systematic reviews performed by the Best Evidence Medical
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29 Education (BEME) [56,57] the benefits of early clinical immersion at different levels is
30
31 highlighted. On the affective level, early clinical immersion promotes empathetic
32
33 attitudes in students towards the patients, reduces stress during clinical appointments, and
34
35 enhances the awareness of the students' own feelings and reactions. As we have
36
37 described, our person-centred curriculum has many kinds of interventions to promote
38
39 empathy since first to last year. The Carnegie Foundation [58] established the integration
40
41 of theoretical knowledge into clinical experience from the start of the degree among its
42
43 most important lines of work. The General Medical Council of the United Kingdom[59]
44
45 prefers a vertical integration of different types of practical experience over time. This idea
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47 attempts to break down the traditional division between preclinical and clinical courses
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49 (Flexner Academical Model).
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56 Another variable to be considered is the criteria for admission [60]. At our school, 20%
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58 of the admission score depends on the results of a personality, intelligence and
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3 psychopathological test to which candidates are submitted. Therefore, there is a possible
4
5 selection bias towards students with a more humanistic and empathic profile. Stern,
6
7 Frohna and Gruppen[61] did not find a link between academic performance, used by the
8
9 medical faculties for student access, and students' future professional behaviour. They
10
11 believe, however, that certain humanistic personal qualities, such as empathy, could be
12
13 an influence. In this case, Hojat et al [40,49,62] maintain that the personality and empathy
14
15 questionnaires as well as personal interviews could be a useful extra element to consider
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17 in the selection process of the best students who wish to study at faculties of medicine.
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19 This should undoubtedly be a variable to consider in future studies.
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25 A systematic review explored this question, but only a small number of possible
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27 influential factors were investigated in each publication reviewed[29]. In this review,
28
29 gender and age did not yield consistent results, but those students who selected patient-
30
31 oriented specialties had higher empathy scores. Some studies selected in this systematic
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33 review found out that distress (for instance, burnout or a low sense of well-being) was
34
35 associated to a decrease of empathy. Hidden curriculum could play a role: mistreatment,
36
37 confrontation with clinical reality (illness, suffering, death), social support problems or
38
39 an excessive workload. It suggests that not only educational interventions may play a role
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41 in empathy trajectory, but other factors should be taken in mind in order to design future
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43 studies.
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49 **CONCLUSION**

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52 The empathy of medical students at our school did not decline along grade years. In fact,
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54 it slightly improved in females, due to the cognitive dimension. Our institution makes a
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56 special effort in teaching empathy. This paper contributes to enlarge data from European
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58 area, where studies are scarce. It supports the idea that there may be global geo-
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3 sociocultural differences, however more studies comparing different school settings are
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5 needed to know what variables are associated with better results.
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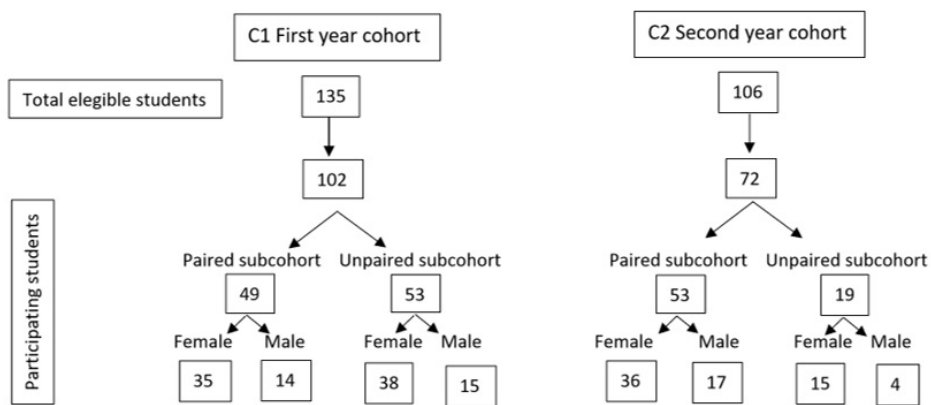
21 FIGURES LEGENDS:

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24 Figure 1. Cohorts description: sample size of C1 from first year and C2 from second year.
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27 Figure 2: JSE-HP results in C1 paired cohort of 35 females and 14 males monitored for
28 five years (Start of 1st academic year - end of 5th year).
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31 Figure 3: JSE-HP results in C2 paired cohort of 36 females and 17 males monitored for
32 five years (Start of 2nd academic year - end of 6th year).
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Figure 1.

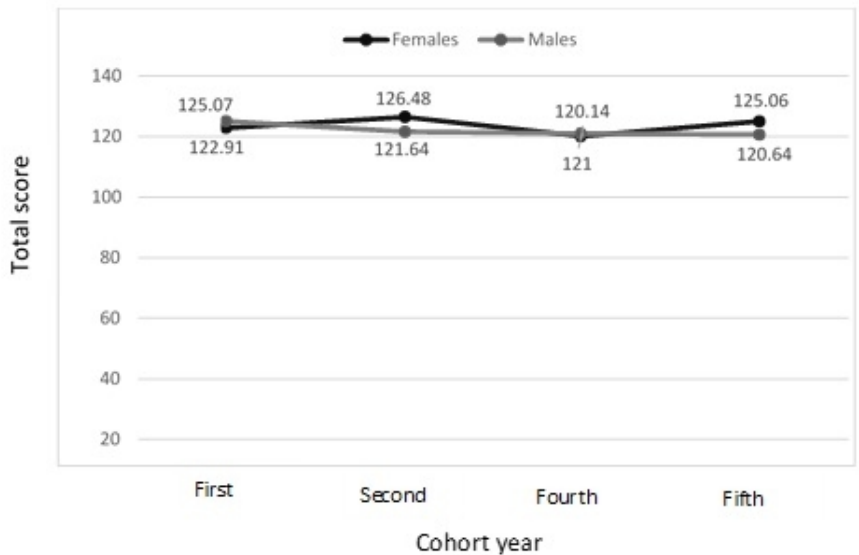


Cohorts description: sample size of C1 from first year and C2 from second year.

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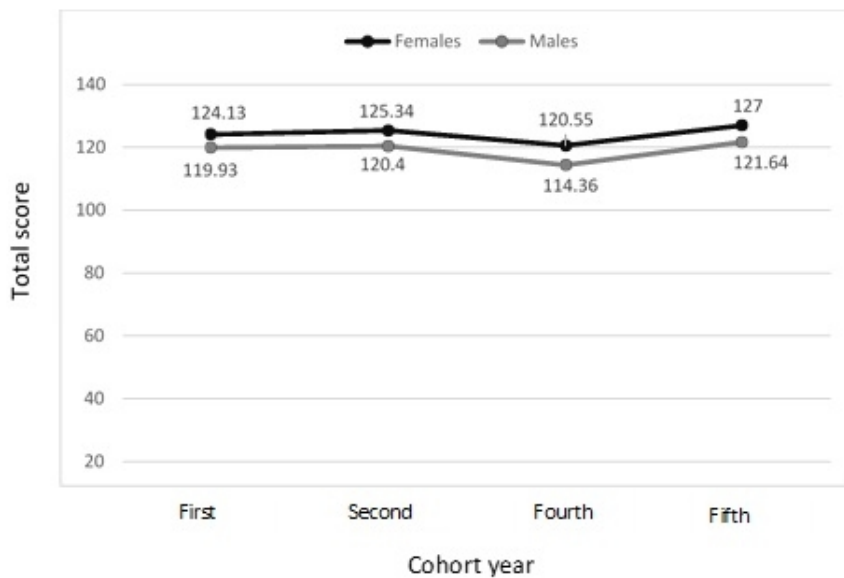
Fig 2:



JSE-HP results in C1 paired cohort of 35 females and 14 males monitored for five years (Start of 1st academic year - end of 5th year).

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Fig 3:



JSE-HP results in C2 paired cohort of 36 females and 17 males monitored for five years (Start of 2nd academic year - end of 6th year).

141x96mm (96 x 96 DPI)

STROBE Statement—checklist of items that should be included in reports of observational studies
BASED ON pages and lines of “Main document-marked copy”

	Item No	Recommendation	Pag/line
Title and abstract	1	(a) Indicate the study’s design with a commonly used term in the title or the abstract (b) Provide in the abstract an informative and balanced summary of what was done and what was found	Pag1 L2 and pag3 L30-31 Pag 3 L32-48
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	Pag 7 L113-166
Objectives	3	State specific objectives, including any prespecified hypotheses	Pag 9 L173-178
Methods			
Study design	4	Present key elements of study design early in the paper	Pag 9 L181 and 194-205
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	Pag 11 L230-239
Participants	6	(a) <i>Cohort study</i> —Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up <i>Case-control study</i> —Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls <i>Cross-sectional study</i> —Give the eligibility criteria, and the sources and methods of selection of participants (b) <i>Cohort study</i> —For matched studies, give matching criteria and number of exposed and unexposed <i>Case-control study</i> —For matched studies, give matching criteria and the number of controls per case	Pag 11 L208-214 -
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	Pag 10 L207-220
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	Pag 11 L221-228
Bias	9	Describe any efforts to address potential sources of bias	Pag 12 L240-243
Study size	10	Explain how the study size was arrived at	Pag 12 L235-239
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	Pag 12 L247-248
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	Pag 12 L 249-253

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2	(b) Describe any methods used to examine subgroups and	Pag 12 L 251-253
3	interactions	
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5	(c) Explain how missing data were addressed	-
6	(d) <i>Cohort study</i> —If applicable, explain how loss to follow-	-
7	up was addressed	
8	<i>Case-control study</i> —If applicable, explain how matching of	
9	cases and controls was addressed	
10	<i>Cross-sectional study</i> —If applicable, describe analytical	
11	methods taking account of sampling strategy	
12	<hr/>	
13	(e) Describe any sensitivity analyses	-
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Continued on next page

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Results

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	Pag 13 L269-274
		(b) Give reasons for non-participation at each stage	Pag 13 L269 and 272
		(c) Consider use of a flow diagram	Figure 1
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	Pag 13 L271-282
		(b) Indicate number of participants with missing data for each variable of interest	-
		(c) <i>Cohort study</i> —Summarise follow-up time (eg, average and total amount)	Pag 13 L269 and 272
Outcome data	15*	<i>Cohort study</i> —Report numbers of outcome events or summary measures over time	Pag 14 L285-292 Table 1 and 2
		<i>Case-control study</i> —Report numbers in each exposure category, or summary measures of exposure	-
		<i>Cross-sectional study</i> —Report numbers of outcome events or summary measures	-
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	Pag 14 L288-292 Table 1 and 2 Pag 15 L299-315
		(b) Report category boundaries when continuous variables were categorized	-
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	-
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	-

Discussion

Key results	18	Summarise key results with reference to study objectives	Pag 16 L317-322
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	Pag 16-17 L328-348 Pag 18 L378-388
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	Pag 17 L349-371
Generalisability	21	Discuss the generalisability (external validity) of the study results	Pag 17-20 L349-431

Other information

Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	Pag 4 L79
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Authors:

- Blanco, José Manuel^{a,b}. MD, PhD ORCID: 0000-0002-5534-56181

^a School of Medicine. Universidad Francisco de Vitoria, Ctra. Pozuelo-Majadahonda (M-515) Km. 1.800, 28223, Pozuelo de Alarcón, Madrid, Spain.

^b Valle de la Oliva Healthcare Centre, Enrique Granados 2, 28222, Majadahonda, Madrid, Spain.

- Caballero, Fernando^c. MD, PhD

^cDean School of Medicine. Universidad Francisco de Vitoria, Ctra. Pozuelo-Majadahonda (M-515) Km. 1.800, 28223, Pozuelo de Alarcón, Madrid, Spain.

- Álvarez, Santiago^c. MD, PhD ORCID: 0000-0002-8282-8877

^cVice-Dean School of Medicine. Universidad Francisco de Vitoria, Ctra. Pozuelo-Majadahonda (M-515) Km. 1.800, 28223, Pozuelo de Alarcón, Madrid, Spain.

- Plans, Mercedes^b. MD

^b Valle de la Oliva Healthcare Centre, Enrique Granados 2, 28222, Majadahonda, Madrid, Spain.

- Monge, Diana^c. MD, PhD ORCID: 0000-0002-3593-1820

1
2
3 Vice Dean School of Medicine. Universidad Francisco de Vitoria, Ctra. Pozuelo-
4
5 Majadahonda (M-515) Km. 1.800, 28223, Pozuelo de Alarcón, Madrid, Spain.
6
7

8 **CORRESPONDENCE:** Diana Monge Martín. Vice-dean School of Medicine.
9
10 Universidad Francisco de Vitoria, Ctra. Pozuelo-Majadahonda (M-515) Km. 1.800,
11
12 28223, Pozuelo de Alarcón, Madrid, Spain. Tel: (34) 678432636. Email:
13
14 d.monge@ufv.es
15
16
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ABSTRACT

Objective: To analyse the trajectory of empathy throughout the degree programme of medicine in a Spanish school of medicine.

Design: Longitudinal, prospective five-year study, between October 2014 and June 2019.

Setting: Students from a Spanish university of Medicine.

Participants: Two voluntary cohorts of undergraduate medical students from two different school years were invited to participate (n=135 (cohort 1, C1) and 106 (cohort 2, C2) per school year). Finally, a total number of 174 students (102 (C1, 71.6% females) and 72 (C2, 70.8% females) students respectively) were monitored for five years. Each cohort was divided in two sub-cohorts of paired and unpaired students that were analysed to check possible social desirability bias.

Primary Outcome Measure: The Jefferson Scale of Empathy (JSE).

Results: The cohort of 102 students (C1) monitored between their first and fifth years of study (71.6% females) showed an improvement among paired females of 2.15 points in total JSE score (p=0.01) and 2.39 points in cognitive empathy (p=0.01); in the unpaired female cohort the increase was of 2.32 points (cognitive empathy) (p=0.02). The cohort of 72 students (C2) monitored between their second to sixth years of study (70.8% females) displayed a cognitive empathy increase of 2.32 points (p=0.04) in the paired group of females. There were no significant differences between paired and unpaired results for either cohort. Empathy scores among males did not decrease.

Conclusions: The empathy of medical students at our school did not decline along grade years. In fact, it improved slightly, particularly cognitive empathy, among females. This paper contributes to enlarge data from the Europe, where longitudinal studies are scarce. It supports the idea that there may be global geo-sociocultural differences; however, more studies comparing different school settings are needed.

ARTICLE SUMMARY: STRENGTHS AND LIMITATIONS OF THIS STUDY

- This is a longitudinal study of two different cohorts we tracked yearly for 5 years.
- We used a Spanish validated version of JSE that is the most widely used for measuring medical empathy.
- We compared the results between paired and unpaired student cohorts to control the social desirability bias.
- Our students follow a person-centred medicine project in addition to their medical technical training.
- Our study includes only one University.

Key words: empathy, medical students, medical training.

Key points: We describe the trajectory of empathy throughout the degree program in medicine with the implementation of a person-centred medicine project teaching approach. We observed that the empathy of medical students improved over time in females.

DECLARATIONS

Funding: No funding received.

Conflicts of interest/Competing interests: Jose Manuel Blanco Canseco, Fernando Caballero Martínez, Mercedes Plans Tena, Santiago Alvarez Montero and Diana Monge Martín declare that they have no conflict of interest. Competing interest non declared.

Ethics approval: This study was performed in line with the principles of the Declaration of Helsinki. Approval was granted by the Ethics Committee of University Francisco de Vitoria, Madrid. Spain. Number/ID: 09/2017

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6 **Consent to participate:** Informed consent was obtained from all individual participants
7 included in the study.
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10 **Consent for publication:** Not applicable.
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12 **Availability of data and material:** Data are available upon reasonable request.
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14 **Code availability:** Not applicable.
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16
17 **Authors' contributions:** All authors contributed to the study conception and design.
18 Material preparation, data collection and analysis were performed by Jose Manuel Blanco
19 Canseco, Diana Monge Martín and Fernando Caballero Martínez. Fernando Caballero
20 Martínez and Santiago Alvarez Montero led our person-centred medical curriculum.
21 Mercedes Plans Tena made substantial contributions to interpretation of data. The first
22 draft of the manuscript was written by Jose Manuel Blanco Canseco and Diana Monge
23 Martín, and all authors commented on previous versions of the manuscript. All authors
24 read and approved the final manuscript.
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7
8 Congreso Nacional de Educación Médica y V Congreso Hispano-Luso’, celebrated in
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10 Salamanca in November of 2019.
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INTRODUCTION

Empathy is important for a clinical relationship and it is beneficial both for the patient and the healthcare professional. In patients, it has been associated with greater levels of satisfaction[1,2,3] greater participation in decision-making and caring for their health[4], greater adherence to treatment[1,5,6] a better quality of life, lower levels of stress[1], and improved health results[7,8]. Regarding the physician, empathy has been linked to better communication and relationships with the patient[9], improved clinical skills[9,10,11] stronger capacity for inter-professional collaborative work[12], higher level of satisfaction and well-being [13,14], lower levels of professional burnout [15,16,17], less substance abuse or attempted suicide[18], greater ethical awareness[19] and a reduction in the number of official complaints[20,21]. Moreover, different authors have reported that medical students with greater empathy have a higher level of well-being[22] and experience less burnout[23]. Students with greater empathy achieve higher practical work assessment scores from teachers or simulated patients[24,25].

Since Hojat et al.'s study in 2009[26], several new studies have pointed out a decline in empathy trajectory among schools[27,28]. A systematic review of qualitative and quantitative studies (1990-2010) supported this observation which was mainly studied from longitudinal designs[29]. A recent nationwide, multi-institutional, cross-sectional study from the United States comparing preclinical and clinical data found a decline in empathy scores[30].

In 2015, Roff[31] warned about the possibility that empathy of medical students could not decline over time, at least, significantly. She conducted a literature review of cohorts of medical students monitored with the Student version of the Jefferson Scale of Empathy (JSE-S) in Japan, South Korea, China, Kuwait, India, Iran, UD, USA, Australia, Brazil,

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3 Colombia, the Dominican Republic, and Portugal[31]. A subsequent scoping review of
4 English, Spanish, Portuguese and French literature (2009-2016) published in 2017
5 revealed that the predominant trend in cross-sectional studies was of a significantly higher
6 or of similar empathy scores across years. Nevertheless, most longitudinal studies
7 presented either mixed-results or empathy declines. The authors of this study that the
8 literature does not offer clear conclusions relative to changes in student empathy[32].
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12 In 2019, a meta-analysis was published to synthesize existing evidence examining how
13 empathy changes during undergraduate medical education assessing whether different
14 types of measures produce different results. Spatoula et al[33] discovered that studies
15 showed contradictory results. For example, studies in the US found a significant reduction
16 in empathy, but other countries, such as Portugal and Brazil did not show the same trend,
17 maintaining the empathic disposition throughout medical school. The authors also stated
18 that the JSE report had higher effect sizes, considering that the decrease in empathy may
19 depend on how empathy is measured[33].
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37 We do not know whether most data that comes from the USA is generalizable and whether
38 empathy trajectory could be a global problem or not. It has relevant practical academic
39 consequences. We aimed to ascertain if empathy skills in Spain should be enhanced. More
40 data from certain areas of the world, such as Europe, are needed since geo-sociocultural
41 settings appear to exert an influence[34]. More longitudinal data may provide a wider
42 perspective about this topic and may help us to make educational decisions[33].
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51 In summary, although empathy is considered a basic skill for medical education and one
52 would expect that medical students would become more empathetic as they progress
53 through their career, results about its trajectory are contradictory[33]. There are Spanish
54 studies that have validated versions of JSE [35,36,37]. However, these studies are cross-
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3 sectional and do not analyse the trajectory of empathy throughout time in different student
4 cohorts. Nevertheless, the JSE seems to be a good resource to derive knowledge about
5 empathy trajectory in Spain.
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11 Another aspect to take into account is the social desirability bias described by
12 Edwards[38] when answering self-completed questionnaires. The authors of the JSE
13 recommend that the questionnaire should be anonymous and applied in non-penalizing
14 situations. Some studies[39,40] have controlled for this effect on JSE scores, not
15 observing substantial changes in them. Nevertheless, the risk of giving fake positive
16 answers and trying to present a socially acceptable image can always be present.
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26 The objective of this study is to measure the trajectory of medical students' levels of
27 empathy at a Spanish University. We tracked two different cohorts to obtain a wider
28 sample and checked the consistency of our outcomes by following up two different
29 classes of undergraduates. We also compared the scale results within paired student
30 cohorts to know if voluntary personal identification by means of a numerical code could
31 introduce a social desirability bias.
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40 **METHODS**

41 **Design:**

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44 This was a longitudinal prospective cohort study.
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50 **Educational background:**

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53 Since its inception, our school has been part of the professional group known as The
54 International Network for Person-Centered Medicine[41]. One of its objectives is the
55 maintenance and enhancement of levels of student empathy. Our person-centred
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3 curriculum has the following six-year educational pillars: a medical humanities pathway
4 (one subject per year, from first to four years, coping with disciplines such as
5 epistemology, anthropology, ethics, deontology and history of medicine), and a
6 standardized-patient simulation program on clinical communication and relationship .
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16 During the first- year and the second-year, students take part in a program of early clinical
17 immersion. It consists of a clinical placement totalling four days at the health centre
18 (primary care) and four days in hospital during the first year. The second year, they attend
19 two days at a palliative care unit, three days in a psychiatric centre, and again, three days
20 in a health centre. It provides students direct experience of the real medical practice in
21 different contexts. Afterwards, they reflect on six principal areas: the patient- physician
22 relationship (professional attitudes and behaviour), communication, the participation of
23 patients and their families in care and decision-making, teamwork, healthcare
24 organization and teaching. The work concludes with their writing a report summarising
25 their reflections. During their clinical years, from third to sixth year, students approach
26 different clinical simulated scenarios and perform their internship with tasks pointed out
27 and recorded within an electronic portfolio.
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45 **Measurement instrument:**

46 *The Jefferson Scale of Empathy (JSE):*

47 The most widely used measure of medical empathy is JSE. It is designed specifically to
48 measure self-perceived empathy in doctor-patient relationship, and it is more sensitive to
49 changes than others[42]. The IRI is a generic measure of empathy and, the JSE measures
50 empathy specifically for health care professionals. Both scales measure different but
51 related constructs[43].
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6 This study used the Jefferson Scale of Empathy, in its professional version (JSE-HP),
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8 duly translated, adapted and validated for our environment[37]. The JSE-HP can be
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10 used to assess the empathy of medical students who have already had contact with real
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12 or simulated patients (commonly from the third year)[44][45]. In our case, we decided
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14 to use this version because our students take part in the programme of early clinical
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16 immersion (see above) which allows them to view themselves from the physician's
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18 perspective.
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25 The JSE-HP has 20 items and is scored on a 7-point Likert Scale (1=totally disagree,
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27 7=totally agree). The possible scores range from 20 to 140 points, so the highest scores
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29 are associated with a greater degree of empathy. Although there is no time limit for the
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31 assessment, it is usually answered in less than five minutes. After the factorial
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33 analysis[45], three dimensions are: Dimension 1: Patient perspective taking (cognitive
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35 aspects of empathy) made up of 10 items; dimension 2: compassionate care (emotional
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37 aspects of empathy) consisting of 8 items; dimension 3: standing in the patient's shoes
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39 containing 2 items.
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45 **Setting and participants**

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47 The study took place between October 2014 and June 2019 in the school of Medicine of
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49 Francisco de Vitoria University (UFV). Two cohorts, cohort 1 (C1) and cohort 2 (C2) of
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51 students (Figure 1), respectively from the first and the second years (academic year 2014-
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53 2015), were monitored for five years as they were the first cohorts to follow all the person-
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55 centred curriculum as it is now. Each student received a call to participate voluntarily in
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57 the study, at the beginning of the class and fill in the paper questionnaire. It was
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3 administered in a classroom setting. The degree of empathy within C1 was evaluated at
4 the start of the medical degree and at the end of the second, fourth and fifth years. The
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6 C2 completed the JSE-HP at the start of the second year, and at the end of the third, fifth
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8 and sixth years.
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13 To control the desirability bias, the two cohorts were subdivided into two sub-cohorts,
14 one consisting of numerical code identified students (paired) and another of unidentified
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16 students (unpaired). So, the paired cohort could be tracked within subject longitudinally
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18 and compared.
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22 23 **Patient and public involvement**

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25 No patient involved.
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28 29 **Statistical analysis**

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32 The quantitative variables (JSE total, dimension 1, 2 and 3) are presented with their mean
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34 and standard deviation (SD). The qualitative variables (sex, code, cohort year) are
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36 presented with their frequency and percentage. The mean comparison of the JSE results
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38 in the paired student cohorts, when the variables showed a non-gaussian distribution in
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40 the comparison groups, was made using the Friedman non-parametric test. The mean
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42 comparison of the JSE results in unpaired student cohorts was made using the Kruskal-
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44 Wallis non-parametric test.
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48 The SPSS 21.0 statistics program was used for statistical analysis, with a
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50 significance level of $p < 0.05$ in all the analyses.
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53 54 **Ethical approval**

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57 All the questionnaires were anonymous, by use of codes, with the aim of adhering to
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59 international data protection laws, such as the current Spanish regulation (Organic Law
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3 3/2018, of 5 December, regarding the Protection of Personal Data and guarantee of digital
4 rights, BOE 294 of 6/12/2018). When students voluntarily accept it, some data had a
5 numerical identification code to make possible analysis of paired student cohorts without
6 compromising anonymity. The study received the approval of the Ethics Committee of
7 the Francisco de Vitoria University. Participation was voluntary and independent of
8 students' academic results.
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19 **RESULTS**

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22 C1 initially had 135 students, and 102 of them (75.5% of this class) were voluntary
23 monitored for the five years, from their first year of career until their fifth year. It
24 comprised 73 females (71.6%) and 29 males (28.4%). The C2 students initially account
25 for 106 participants and 72 (67.9% of this class) completed their voluntary monitoring
26 from their second year until the end of their sixth year. It comprised 51 females (70.8%)
27 and 21 males (29.2%).
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37 Given that the personal identification by means of a code was voluntary, both cohorts
38 were subdivided into two sub-cohorts, one consisting of numerical code identified
39 students (paired) and another of unidentified students (unpaired). In C1, 49 students were
40 identified by code (48%): 35 females (71.4%) and 14 males (28.6%). Fifty-three students
41 remained unidentified (52%): 38 females (71.7%) and 15 males (28.3%). In the C2, 53
42 students were identified by numerical code (73.6%): 36 females (67.9%) and 17 males
43 (32.1%). Nineteen students remained unidentified (26.4%): 15 females (78.9%) and 4
44 males (21.1%).
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In the first clinical years (4th cohort year) we observe a slight drop in the total JSE score in both cohorts. However, scores at the end of follow-up recover to baseline levels. In cohort 2 they even improve slightly. See Figure 2 and 3.

In the paired female C1 students, a statistically significant increase in global empathy (JSE-HP total) of 2.15 points (Cohen's d 0.26) was observed from their first to their fifth year ($p=0.01$) (Figure 2). In the same way, the cognitive empathy (dimension 1 JSE-HP) increased 2.39 points (Cohen's d 0.35) when finishing the fifth year compared to the first ($p=0.01$). See Table 1.

Table 1. JSE-HP results in cohort C1 of medical students at the UFV monitored from the 1st to 5th years (paired and unpaired)

YEAR	2014/15 First (mean, SD)	2015/16 Second (mean, SD)	2017/18 Fourth (mean, SD)	2018/19 Fifth (mean, SD)	p
Paired females (n, %)	35 (71.4)	33 (70.2)	35 (71.4)	33 (70.2)	
Dim 1	61.40 (5.19)	64.48 (4.34)	60.14 (7.24)	63.79 (5.28)	0.01
Dim 2	48.74 (4.62)	50.00 (4.51)	48.37 (5.04)	49.33 (4.94)	0.45
Dim 3	12.77 (1.14)	12.00 (1.78)	11.63 (2.22)	11.94 (1.69)	0.25
JSE TOTAL	122.91 (8.29)	126.48 (7.19)	120.14 (9.85)	125.06 (8.40)	0.01
Paired males (n, %)	14 (28.6)	14 (29.8)	14 (28.6)	14 (29.8)	
Dim 1	64.29 (3.20)	61.86 (7.16)	61.36 (7.40)	61.71 (6.59)	0.75
Dim 2	48.43 (4.31)	48.64 (5.55)	48.43 (7.25)	47.36 (8.87)	0.78
Dim 3	12.36 (1.28)	11.14 (2.14)	11.21 (2.81)	11.57 (2.62)	0.44
JSE TOTAL	125.07 (6.89)	121.64 (12.00)	121.00 (14.57)	120.64 (16.78)	0.37
Unpaired females (n, %)	38 (71.7)	38 (71.7)	22 (66.7)	28 (71.8)	
Dim 1	62.82 (5.69)	63.34 (6.11)	59.86 (6.67)	65.14 (3.90)	0.02
Dim 2	49.29 (5.01)	49.89 (4.67)	49.14 (4.95)	50.46 (4.83)	0.61
Dim 3	12.03 (1.91)	12.11 (1.61)	11.55 (2.28)	11.39 (2.54)	0.77
JSE TOTAL	124.13 (10.70)	125.34 (10.24)	120.55 (11.37)	127.00 (8.58)	0.10
Unpaired males (n, %)	15 (28.3)	15 (28.3)	11 (33.3)	11 (28.2)	
Dim 1	60.07 (6.13)	60.20 (7.28)	57.00 (10.25)	60.73 (6.87)	0.79
Dim 2	47.33 (4.82)	48.47 (5.14)	45.18 (6.43)	49.55 (4.82)	0.30
Dim 3	12.53 (2.20)	11.73 (1.75)	12.18 (1.66)	11.36 (2.73)	0.31
JSE TOTAL	119.93 (10.43)	120.40 (12.03)	114.36 (16.10)	121.64 (11.59)	0.59

In the unpaired females of this cohort an improvement in cognitive empathy (dimension 1 JSE-HP) was also observed of 2.32 points (Cohen's d 0.48) ($p=0,02$). Differences found in empathy scores along time and between paired and nonpaired students were not statistically significant (Table 1).

In the paired C2, an increase in cognitive empathy (dimension 1 JSE-HP) was observed in females of 2.33 points (Cohen's d 0.44) ($p=0,04$). Again, there were no statistical significant differences along time and between paired versus non-paired students (Table 2).

Table 2. JSE-HP results in cohort C2 of medical students at the UFV monitored from the 2nd to 6th years (paired and unpaired)

YEAR	2014/15 Second (mean, SD)	2015/16 Third (mean, SD)	2017/18 Fifth (mean, SD)	2018/19 Sixth (mean, SD)	p
Paired females (n, %)	36 (67.9)	36 (67.9)	36 (67.9)	29 (64.4)	
Dim 1	61.81 (6.32)	61.81 (5.98)	63.69 (4.90)	64.14 (4.02)	0.04
Dim 2	49.17 (5.27)	49.94 (4.34)	50.53 (4.00)	50.52 (4.59)	0.09
Dim 3	11.47 (2.22)	12.06 (2.32)	11.81 (1.95)	12.41 (2.06)	0.08
JSE TOTAL	122.44 (11.33)	123.81 (8.28)	126.03 (6.95)	127.07 (7.63)	0.12
Paired males (n, %)	17 (32.1)	17 (32.1)	17 (32.1)	16 (35.6)	
Dim 1	56.94 (7.10)	57.76 (8.19)	60.71 (8.59)	62.06 (5.01)	0.17
Dim 2	44.29 (4.90)	45.35 (5.95)	44.29 (9.34)	47.12 (4.91)	0.31
Dim 3	10.00 (2.50)	10.06 (2.19)	10.35 (3.08)	10.37 (2.06)	0.10
JSE TOTAL	111.24 (11.13)	113.18 (12.68)	115.35 (17.03)	119.56 (9.16)	0.10
Unpaired females (n, %)	15 (78.9)	15 (78.9)	24 (70.6)	28 (76.7)	
Dim 1	62.27 (4.33)	61.47 (3.52)	62.83 (7.14)	62.86 (7.07)	0.20
Dim 2	50.00 (3.29)	49.73 (4.57)	47.42 (8.68)	49.29 (4.17)	0.94
Dim 3	11.87 (1.96)	11.67 (1.95)	11.42 (3.22)	12.82 (1.02)	0.29
JSE TOTAL	124.13 (7.73)	122.87 (6.58)	121.67 (14.96)	124.96 (9.74)	0.69
Unpaired males (n, %)	4 (21.1)	4 (21.1)	10 (29.1)	10 (23.3)	
Dim 1	62.50 (5.32)	64.75 (3.95)	60.20 (7.57)	57.50 (8.06)	0.40
Dim 2	46.00 (4.00)	43.00 (16.67)	46.10 (7.53)	45.60 (5.38)	0.79
Dim 3	10.50 (1.91)	10.00 (3.91)	11.30 (2.00)	11.60 (0.84)	0.79

JSE TOTAL	119.00 (9.76)	117.75 (24.06)	117.60 (15.00)	114.70 (11.25)	0.66
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As can be seen in Tables 1 and 2 and Figures 2 and 3, male cohorts showed levels of empathy that did not fall significantly among the preclinical (first and second years) and clinical years (third to sixth years).

DISCUSSION

The current study describes the curricular trajectory of empathy in medical students at a university in a European setting. The empathy of medical students at the Francisco de Vitoria University did not show a decline of scores on the JSE-HP at the end of their studies compared to their results when they started (preclinical and clinical courses, respectively). Moreover, it pointed out an increase of empathy trajectory in females, as evidenced by a slight improvement of cognitive dimension.

The JSE-HP measures self-perception of empathic attitudes but not empathic behaviour, though different studies have established a link between their results and those observed by the real[46,47] or simulated patients[48]. Otherwise, the cognitive empathy (dimension 1 JSE-HP) seems to be the most likely influenced through suitable educational programmes[49], since emotional empathy appears to be more innate[49].

The samples correspond to a single non-profit private university in Madrid and may not be representative of the rest of the Schools of Medicine in our environment. The cohorts of identified students behaved in the same way as those who did not wish to be identified, which is similar to the observations made by Hojat et al.[26]. This fact is interesting as it seems to limit the social desirability bias which may accompany self-administered questionnaires.

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3 In Spain, there are no studies which analyse the degree of empathy of medical students
4 over the long term. The current study is the first longitudinal work that provides a
5 prospective monitoring of cohorts for five years. More longitudinal studies are required,
6 as well as the effectiveness of the different programmes which aim to maintain and
7 enhance it. Currently, we are carrying out an investigation which aims to analyse the
8 degree of empathy in students across the eight medical faculties in Madrid (public and
9 private) at three critical times in their training: at the start of the degree, at the end of the
10 third year, and at the end of the sixth. The analysis of this data will provide more evidence
11 regarding the trajectory of empathy of Spanish medical students, discovering if
12 differences exist in the empathy of students who take part in different curricular
13 programmes, as well as establishing a proposal for cut-off values of low, medium and
14 high levels of empathy in our environment.
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31 The broader question is what is taking place globally. This study adds some evidence
32 about the situation in Europe, where these kinds of studies are scarce, needed[29] and
33 under development[50]. If we take into consideration west European quality studies
34 selected in the Spatoula et al's meta-analysis[33], nine cross-sectional and only three
35 longitudinal, we find that they gathered and analysed data (difference in means and 95%
36 CI) from only two European countries: one university in Portugal (cross-sectional), 5 in
37 another UK university (longitudinal). Also, they analysed 15 universities in the US, 10
38 universities in Asia and two universities in Africa.
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51 The cross-sectional study in a medical school in Portugal showed that the empathy
52 measures of senior year students were higher than the scores of those from the first year's
53 students.[51] A longitudinal study from the UK showed that neither men nor women
54 showed any change in cognitive empathy during the course. Women were more
55 empathetic than men and men's affective empathy declined slightly, whilst women's
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3 affective empathy showed no change. Although statistically significant, the size was low.
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5 Neither men nor women appear to become meaningfully less empathetic during their
6
7 medical education[52].
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11 Our results complement these studies and it seems to support the idea that, at least in the
12
13 European setting, empathy does not diminish during the medical career. However, a
14
15 recent study from Switzerland showed that empathy remains stable in most medical
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17 students but declines in some students. It suggests that some personality traits (openness)
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19 as well as patient-oriented motives for studying medicine were associated with higher and
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21 stable empathy[53].
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25 Besides, results from studies which use different instruments to analyse medical students'
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27 empathy, as IRI and JSE, should be compared cautiously. Both scales measure different
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29 but related constructs[43]. There might be appropriate to use both instruments or even
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31 use other scales that measure empathy from real or simulated patients[46,47,48] in future
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33 studies.
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38 There might be appropriate to use both instruments or even use other scales that measure
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40 empathy from real or simulated patients
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44 We cannot establish a cause-effect relationship as our study lacks a control group and all
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46 the possible confusion bias factors which may be influencing the results have not been
47
48 isolated. However, it may help to acquire insight for asking questions and suggesting
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50 hypotheses. One question may be what sort of interventions are associated to better
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52 empathy outcomes. A second one could be whether the effects of these interventions are
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54 maintained in the long term, but actually little is known about it[54]. Katahoka et al.[55]
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56 observed an improvement in the empathy of first-year medical students in Japan after an
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58 intervention was developed based on a communicative skills programme. They monitored
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3 this cohort of students and observed that the improvement in empathy did not last over
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5 time. They concluded that activities to improve empathy are necessary throughout the
6
7 entire degree programme.
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11 This study stresses the question about what variables are associated with better or worse
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13 outcomes. The empathy scores of UFV students seems higher than those reported in other
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15 countries[31,32] and in our environment[36], although these populations are not fully
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17 comparable to ours and we haven't analysed this differences statistically . We may ask if
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19 it may be due to some of our four-year educational pillars: a medical humanities pathway
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21 and a standardized-patient based program on clinical communication and relationship.
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25 Empathy training interventions may be a possible factor among others. Intervention
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27 length, scope of empathy measured, or the kind of tool used are important variables[54].
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29 For instance, in two systematic reviews performed by the Best Evidence Medical
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31 Education (BEME) [56,57] the benefits of early clinical immersion at different levels is
32
33 highlighted. On the affective level, early clinical immersion promotes empathetic
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35 attitudes in students towards the patients, reduces stress during clinical appointments, and
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37 enhances the awareness of the students' own feelings and reactions. As we have
38
39 described, our person-centred curriculum has many kinds of interventions to promote
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41 empathy since first to last year. The Carnegie Foundation [58] established the integration
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43 of theoretical knowledge into clinical experience from the start of the degree among its
44
45 most important lines of work. The General Medical Council of the United Kingdom[59]
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47 prefers a vertical integration of different types of practical experience over time. This idea
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49 attempts to break down the traditional division between preclinical and clinical courses
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51 (Flexner Academical Model).
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3 Another variable to be considered is the criteria for admission [60]. At our school, 20%
4 of the admission score depends on the results of a personality, intelligence and
5 psychopathological test to which candidates are submitted. Therefore, there is a possible
6 selection bias towards students with a more humanistic and empathic profile. Stern,
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8 Frohna and Gruppen[61] did not find a link between academic performance, used by the
9
10 medical faculties for student access, and students' future professional behaviour. They
11
12 believe, however, that certain humanistic personal qualities, such as empathy, could be
13
14 an influence. In this case, Hojat et al [40,49,62] maintain that the personality and empathy
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16 questionnaires as well as personal interviews could be a useful extra element to consider
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18 in the selection process of the best students who wish to study at faculties of medicine.
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20 This should undoubtedly be a variable to consider in future studies.
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29 A systematic review explored this question, but only a small number of possible
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31 influential factors were investigated in each publication reviewed[29]. In this review,
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33 gender and age did not yield consistent results, but those students who selected patient-
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35 oriented specialties had higher empathy scores. Some studies selected in this systematic
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37 review found out that distress (for instance, burnout or a low sense of well-being) was
38
39 associated to a decrease of empathy. Hidden curriculum could play a role: mistreatment,
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41 confrontation with clinical reality (illness, suffering, death), social support problems or
42
43 an excessive workload. It suggests that not only educational interventions may play a role
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45 in empathy trajectory, but other factors should be taken in mind in order to design future
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47 studies.
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53 **CONCLUSION**

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56 The empathy of medical students at our school did not decline along grade years. In fact,
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58 it slightly improved in females, due to the cognitive dimension. Our institution makes a
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3 special effort in teaching empathy. This paper contributes to enlarge data from European
4 area, where studies are scarce. It supports the idea that there may be global geo-
5 sociocultural differences, however more studies comparing different school settings are
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10 needed to know what variables are associated with better results.
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For peer review only

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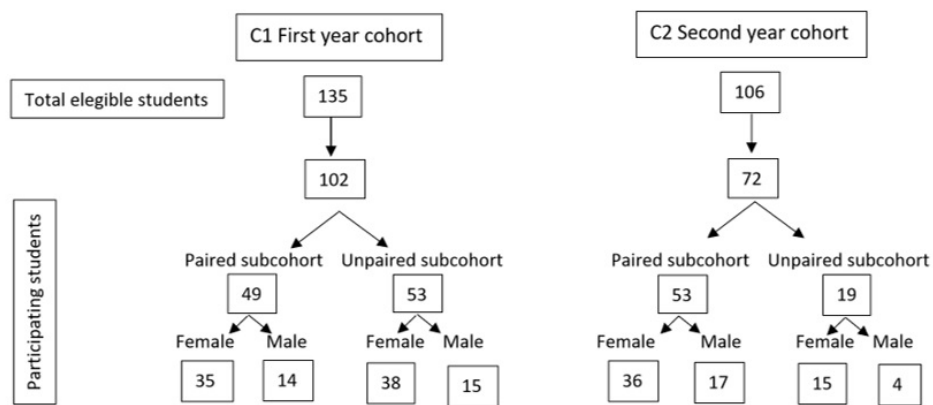
21 FIGURES LEGENDS:

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24 Figure 1. Cohorts description: sample size of C1 from first year and C2 from second year.
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27 Figure 2: JSE-HP results in C1 paired cohort of 35 females and 14 males monitored for
28 five years (Start of 1st academic year - end of 5th year).
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31 Figure 3: JSE-HP results in C2 paired cohort of 36 females and 17 males monitored for
32 five years (Start of 2nd academic year - end of 6th year).
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Figure 1.

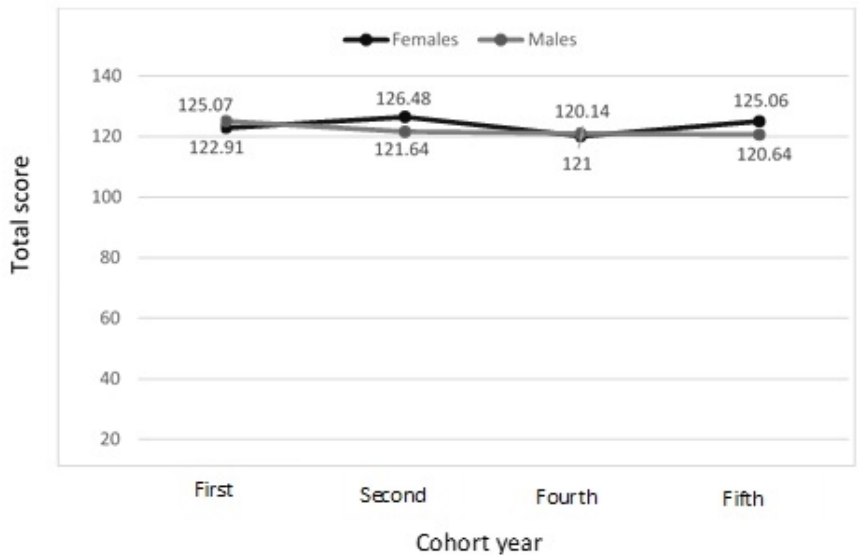


Cohorts description: sample size of C1 from first year and C2 from second year.

229x121mm (96 x 96 DPI)

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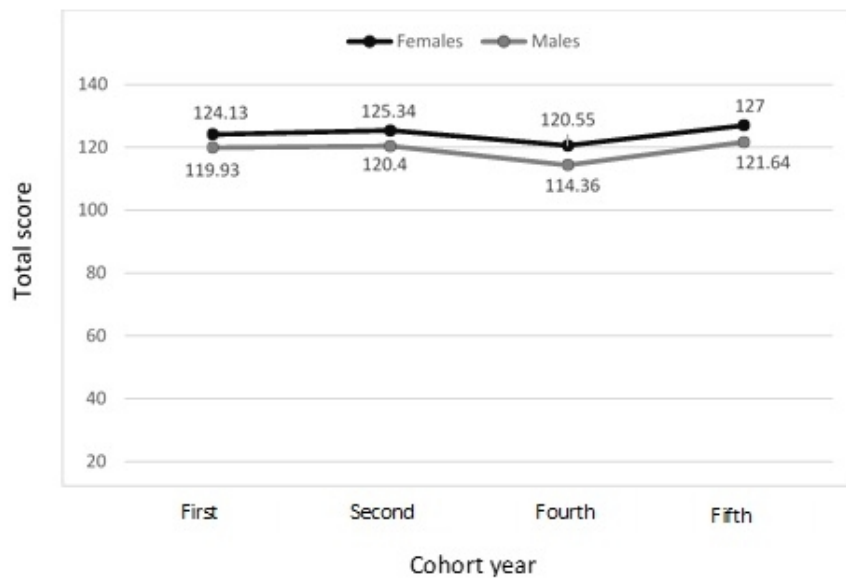
Fig 2:



JSE-HP results in C1 paired cohort of 35 females and 14 males monitored for five years (Start of 1st academic year - end of 5th year).

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Fig 3:



JSE-HP results in C2 paired cohort of 36 females and 17 males monitored for five years (Start of 2nd academic year - end of 6th year).

141x96mm (96 x 96 DPI)

STROBE Statement—checklist of items that should be included in reports of observational studies
BASED ON pages and lines of “Main document-marked copy”

	Item No	Recommendation	Pag/line
Title and abstract	1	(a) Indicate the study’s design with a commonly used term in the title or the abstract (b) Provide in the abstract an informative and balanced summary of what was done and what was found	Pag1 L2 and pag3 L30-31 Pag 3 L32-48
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	Pag 7 L113-166
Objectives	3	State specific objectives, including any prespecified hypotheses	Pag 9 L173-178
Methods			
Study design	4	Present key elements of study design early in the paper	Pag 9 L181 and 194-205
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	Pag 11 L230-239
Participants	6	(a) <i>Cohort study</i> —Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up <i>Case-control study</i> —Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls <i>Cross-sectional study</i> —Give the eligibility criteria, and the sources and methods of selection of participants (b) <i>Cohort study</i> —For matched studies, give matching criteria and number of exposed and unexposed <i>Case-control study</i> —For matched studies, give matching criteria and the number of controls per case	Pag 11 L208-214 -
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	Pag 10 L207-220
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	Pag 11 L221-228
Bias	9	Describe any efforts to address potential sources of bias	Pag 12 L240-243
Study size	10	Explain how the study size was arrived at	Pag 12 L235-239
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	Pag 12 L247-248
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	Pag 12 L 249-253

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2	(b) Describe any methods used to examine subgroups and	Pag 12 L 251-253
3	interactions	
4	<hr/>	
5	(c) Explain how missing data were addressed	-
6	(d) <i>Cohort study</i> —If applicable, explain how loss to follow-	-
7	up was addressed	
8	<i>Case-control study</i> —If applicable, explain how matching of	
9	cases and controls was addressed	
10	<i>Cross-sectional study</i> —If applicable, describe analytical	
11	methods taking account of sampling strategy	
12	<hr/>	
13	(e) Describe any sensitivity analyses	-
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Continued on next page

For peer review only

Results

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	Pag 13 L269-274
		(b) Give reasons for non-participation at each stage	Pag 13 L269 and 272
		(c) Consider use of a flow diagram	Figure 1
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	Pag 13 L271-282
		(b) Indicate number of participants with missing data for each variable of interest	-
		(c) <i>Cohort study</i> —Summarise follow-up time (eg, average and total amount)	Pag 13 L269 and 272
Outcome data	15*	<i>Cohort study</i> —Report numbers of outcome events or summary measures over time	Pag 14 L285-292 Table 1 and 2
		<i>Case-control study</i> —Report numbers in each exposure category, or summary measures of exposure	-
		<i>Cross-sectional study</i> —Report numbers of outcome events or summary measures	-
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	Pag 14 L288-292 Table 1 and 2 Pag 15 L299-315
		(b) Report category boundaries when continuous variables were categorized	-
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	-
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	-

Discussion

Key results	18	Summarise key results with reference to study objectives	Pag 16 L317-322
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	Pag 16-17 L328-348 Pag 18 L378-388
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	Pag 17 L349-371
Generalisability	21	Discuss the generalisability (external validity) of the study results	Pag 17-20 L349-431

Other information

Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	Pag 4 L79
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*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at www.strobe-statement.org.