

Evaluation of the acquisition of competences in the cardiovascular system in Medicine: self-perception, class attendance and academic performance.

Evaluación de la adquisición de competencias en sistema cardiovascular en Medicina: autopercepción, asistencia a clase y rendimiento académico.

Jose Ignacio Larrubia Valle ^{1,2,a}, Cristian Peláez Berdún ^{1,3,a}, Jorge Rodríguez Capitán ^{1,3,4}, Francisco Javier Pavón Morón ^{3,4}, Miguel Romero Cuevas ^{3,4}, Manuel F. Jiménez-Navarro ^{1,3,4}

1 Faculty of Medicine, University of Malaga. 2 Cardiology and Cardiovascular Surgery Clinical Management Unit, Hospital Regional Universitario de Málaga. 3 Heart Clinical Management Unit, Virgen de la Victoria University Hospital, Málaga Biomedical Research Institute - IBIMA, Málaga. 4 CIBER-CV (Cardiovascular Diseases), Carlos III Health Institute, Madrid.

^a Both authors contributed equally to the development of the work.

* Correspondence: joseignaciolv@gmail.com

Received: 11/22/2022; Accepted: 1/16/2023; Posted: 1/23/2023

Abstract: The acquisition of skills is essential in areas as clinically relevant as cardiovascular pathology. This study aims to assess the acquisition by medical students of the main competencies regarding the cardiovascular system, as well as their self-perception and the relationship with attendance and academic performance. To achieve this objective, the data obtained through the electronic completion by 142 students of the fourth, fifth and sixth year of the Degree in Medicine of the University of Malaga of a self-made questionnaire (0-15 points) with questions of multiple choice based on clinical situations and a self-assessment on competencies. Analyzing the results, the competencies considered to be acquired by a greater and lesser number of students were, respectively, the management of cardiovascular risk factors (100%) and cardiopulmonary auscultation (38.3%). Better results were obtained in students who attended class (11.28 ± 1.84 vs 9.54 ± 2.45 ; $p < 0.01$). In addition, it was shown that self-perception of correct learning (odds ratio [OR]=1.26, 95% confidence interval [95%CI]=1.07-1.50), class attendance (OR=3.55; IC95%=1.64-7.7) and the mean grade of the file (OR=2.6; IC95%=1.46-4.63) are predictive variables of high grades in the questionnaire (≥ 11 points). This allows us to infer that class attendance seems fundamental in learning. In addition, self-perception could be used as a tool to guide teaching. On the other hand, an insufficient development of eminently practical skills is suggested, as well as the importance of interrelating knowledge, since a better general academic performance during the degree is also reflected in the specialty studied in this work.

Keywords: Degree in Medicine; clinical competencies; questionnaire; self appraisal; attendance

Resumen: La adquisición de competencias resulta fundamental en ámbitos tan relevantes clínicamente como la patología cardiovascular. Este estudio pretende valorar la adquisición por parte de estudiantes de Medicina de las principales competencias respecto al sistema cardiovascular, así como su autopercepción y la relación con la asistencia presencial y el rendimiento académico. Para lograr este objetivo, se analizaron los datos obtenidos mediante la cumplimentación telemática por parte de 142 estudiantes de cuarto, quinto y sexto curso del Grado en Medicina de la Universidad de Málaga de un cuestionario de elaboración propia (0-15 puntos) con preguntas de elección múltiple basadas en situaciones clínicas y una autoevaluación sobre competencias. Analizando los resultados, las competencias consideradas como adquiridas por un mayor y menor número de estudiantes fueron, respectivamente, el manejo de los factores de riesgo cardiovascular (100%) y la auscultación cardiopulmonar (38,3%). Se obtuvieron mejores

resultados en estudiantes que asistieron a clase ($11,28 \pm 1,84$ vs $9,54 \pm 2,45$; $p < 0,01$). Además, se demostró que la autopercepción de un correcto aprendizaje (odds ratio [OR]=1,26, intervalo de confianza al 95% [IC95%]=1,07-1,50), la asistencia a clase (OR=3,55; IC95%=1,64-7,7) y la nota media del expediente (OR=2,6; IC95%=1,46-4,63) son variables predictoras de calificaciones altas en el cuestionario (≥ 11 puntos). Esto nos permite inferir que la asistencia a clase se antoja fundamental en el aprendizaje. Además, la autopercepción podría utilizarse como herramienta para guiar la docencia. Por otro lado, se sugiere un insuficiente desarrollo de las competencias eminentemente prácticas, así como la importancia de interrelacionar conocimientos, pues un mejor rendimiento académico general durante el grado se refleja también en la especialidad estudiada en este trabajo.

Palabras clave: Grado en Medicina; competencias clínicas; cuestionario; autoevaluación; asistencia

1. Introduction

Education in general and, more specifically, in the health sciences, has undergone an evolution in recent decades from teaching and evaluating mainly theoretical concepts to comprehensive and practical training, in which it is no longer enough to know these data, but its correct interpretation and application is also necessary. This is reflected in important changes in education at a European level such as the Bologna process, which entails the transition to an education oriented towards results or professional skills (1).

With regard to the graduate in Medicine, due to its own medical ethics, the acquisition of these skills is even more important, which must also include the management of the main and most frequent pathologies, research and continuous learning (2). As a consequence, medical education in the 21st century is undergoing an evolution towards competency-based training, whose objective is to train professionals based on the requirements of the social and health systems and, for this, requires that all actions of a formative nature start from a holistic approach and promote learning based on problems or situations (3). This is especially important in areas of great clinical relevance such as cardiovascular disease, which continues to be the leading cause of death in the world (4).

Regarding this learning, regular class attendance has classically played a fundamental role, since it has been considered that the elaboration of knowledge requires mutual interaction, both between the students and with the teaching staff, which is a key element in learning. promote shared understanding and debate (1). The latter has a long history and has been proposed as a tool to improve the development of skills in health sciences students (5).

Another instrument that could be useful in teaching is the perception by students of their own acquisition of these competencies, a fundamental capacity both for training and for the future performance of the profession, which could be used in addition to the evaluation of this learning.

With all this, the main objective of this work is to assess the acquisition of the main competencies related to the cardiovascular system by Medicine students, studying their relationship with variables such as regular class attendance and academic performance. In the same way, it is intended to analyze the self-perception of learning by the latter and its relationship with the true assimilation of competences.

2. Methods

Participants

The target population of this study was constituted by the group of students of the Degree in Medicine of the University of Malaga (Spain). Participation was voluntary and the main requirement for inclusion in the study was to have passed the course "Circulatory and respiratory system diseases" or to be studying it, as long as the students had received the full course on cardiology before completing the questionnaire. The students who met this requirement were invited to complete a questionnaire and a survey through the online learning tool Virtual Campus of the University of Malaga (<https://campusvirtual.cv.uma.es/>). Finally, the sample was made up of 142 participants.

Preparation of the questionnaire on competencies

Given the absence of validated tools in the bibliography, it was decided to develop an own questionnaire that would serve to adequately assess the acquired skills. For this, the main competences to be assessed were firstly identified, based mainly on those that any student who has taken the subject "Circulatory and respiratory system diseases" must know and know how to do according to the "White Book of the Bachelor's Degree in Medicine" (6). Taking these competencies as a reference, different clinical situations were elaborated about the main syndromes of cardiovascular pathology, on which multiple-choice questions were formulated (some accompanied by multimedia material). These types of questions have proven to be reliable and convenient for assessing the acquisition of skills in diseases of the cardiovascular system, especially if they are based on clinical contexts (7). With these premises, a competency questionnaire was prepared that would be completed by the participants and that can be read in the Annex. In this same document there is a survey prepared by the author, prior to the questionnaire, which includes, in addition to demographic variables and academic data, a self-assessment on the acquisition of skills. With respect to this, the participants had to indicate whether or not they considered that they had acquired the various competencies about which they were asked, grouping these into different sets based on their main characteristics: preparation of a good clinical history, knowledge and management of the main cardiovascular risk factors, elaboration of a good diagnostic judgment, cardiopulmonary auscultation, electrocardiogram interpretation, interpretation of other diagnostic tools and management and treatment of the main clinical syndromes.

Statistic analysis

To assess the acquisition of skills, the score obtained in the questionnaire (maximum score=15) was considered a result or dependent variable, expressing the results, as well as the rest of the quantitative variables, as mean \pm standard deviation (SD), while the variables qualitative have been expressed as percentages. The JASP computer program was used to perform the statistical analysis. The results were compared using the Student's t test. The association between variables was also assessed through correlation analysis, using the Pearson coefficient (r), as well as the strength of association with the Odds Ratio (or probability ratio) obtained in a binary logistic regression model to differentiate a high (≥ 11) and low (<11) qualification in the acquisition of competencies in cardiovascular pathology.

Ethical implications

This study complies with the ethical principles stipulated in the 1964 World Medical Association (WMA) Declaration of Helsinki and amended at the 64th WMA General Assembly in 2013 (Fortaleza, Brazil). All participants were informed that participation was

voluntary and the data would be anonymized and treated confidentially, in accordance with Regulation (EU) 2016/679 and the Organic Law on Data Protection 3/2018.

3. Results

Both the demographic characteristics and the results obtained in the questionnaire are found in Table 1.

Table 1. Demographic characteristics and questionnaire results.

Course		2018/19	2019/20	In progress	Total
Number of participants N (%)		42 (29.6%)	29 (20.4%)	71 (50.0%)	142
Sex No. (%)	Women	31 (73.8%)	22 (75.9%)	54 (76.1%)	107 (75.4%)
	Male	11 (26.2%)	7 (24.1%)	17 (23.9%)	35 (24.7%)
Age (years)	Mean \pm SD	23.3 \pm 0.7	22.7 \pm 1.8	23.9 \pm 5.7	23.5 \pm 4.2
	Median (IR)	23 (23-24)	22 (22-23)	22 (21-23)	23 (21-23)
Regular class attendance N (%)		24 (57.1%)	20 (69%)	54 (76.1%)	98 (69%)
Average grade (0-10)	Mean \pm SD	7.7 \pm 0.6	7.8 \pm 0.6	7.6 \pm 0.7	7.7 \pm 0.6
	Median (IR)	7.8 (7.2-8.3)	7.9 (7.3-8.3)	7.5 (7-8.2)	7.6 (7.1-8.2)
Questionnaire result (0-15)	Mean \pm SD	10.2 \pm 2.1	10.2 \pm 2.2	11.4 \pm 2.0	10.8 \pm 2.2
	Median (IR)	10.7 (8.9-11.7)	10 (8.9-11.8)	11.9 (10-12.8)	11.2 (9.5-12.4)

Abbreviations: SD = standard deviation; IR = interquartile range

Figure 1 shows how the self-perception of the acquisition of each of the competencies considered was, indicating the percentage of students who reported having acquired or not the same. Regarding the global form of self-perception of learning competencies, an average score of 7.49 ± 0.21 points out of 10 was obtained, with only 20.6% being the percentage of students who indicated having acquired all the skills. evaluated competencies. When its association with the questionnaire score was studied, a weak but statistically significant positive correlation ($r=+0.23$; $p<0.01$) was obtained between both variables. In addition, the transformation of the questionnaire score into a dichotomous variable with high (≥ 11) and low (<11) acquisition of competencies in the cardiovascular system allowed us to perform a logistic regression model with an OR=1.26 (95%CI= 1.07-1.50), demonstrating that self-perception was a good independent variable that predicted the degree of acquisition of skills assessed by the questionnaire.

Class attendance and competition results

The analysis of the students' class attendance showed that there were significantly higher competency scores obtained in the questionnaire ($p < 0.01$) in students who attended class regularly compared to those who did not (11.28 ± 1.84 and 9.54 ± 2.45), as can be seen in Figure 2. Based on the logistic model to determine the degree of skills acquired, it was shown that regular class attendance by students was a predictor variable of a high acquisition of skills with an $OR = 3.55$ (95% $CI = 1.64-7.70$).

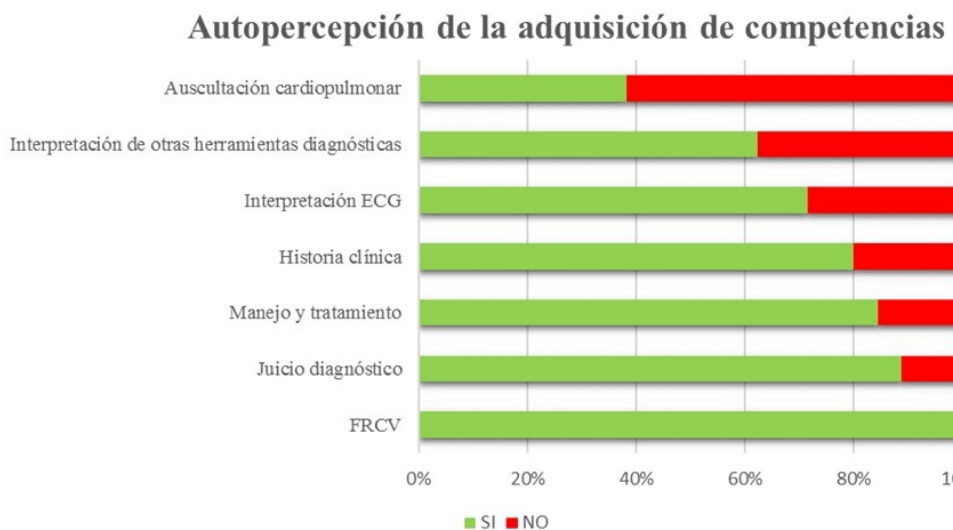


Figure 1. Percentage of students that consider or not competence acquisition.

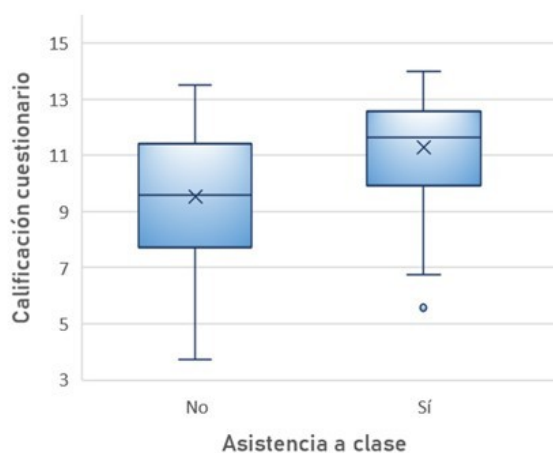


Figure 2. Grade obtained in questionnaire (0-15) depending on the attendance to class. (No/Yes).

Academic performance and competition results

Finally, the results of the questionnaire in relation to academic performance, based on the average grade of the file, were analyzed. The analysis revealed a positive and significant correlation ($r = +0.37$; $p < 0.01$) between the variables. Once again, the mean grade

of the record was identified in the regression model as a variable capable of predicting a high score in the acquisition of cardiocirculatory skills with an OR=2.6 (95%CI=1.46-4.63). .

4. Discussion

The analysis of these results reveals that those competencies in cardiovascular pathology that are predominantly theoretical, such as the management of cardiovascular risk factors, are considered correctly acquired by a much higher number of students than those whose development is eminently practical, such as cardiopulmonary auscultation, considered as acquired by less than half of the participants. This shows that, despite the advances in teaching and its didactic resources, efforts continue to be concentrated on learning theoretical knowledge to the detriment of the development of practical skills, which is still deficient. This idea was already presented in a study in the field of surgery in Mexico (8). In it, this same conclusion was reached, since it showed that there were numerous practical skills that were not acquired by the graduates, while most of the theoretical knowledge was correctly assimilated. It should be noted that in the Mexican study, 70.6% of the students considered the competence of electrocardiogram interpretation as acquired, a figure very similar to that of this work (71.6%), which could demonstrate the global trend of these results. .

With regard to the Faculty of Medicine of Malaga, from whose students these data have been obtained, changes have recently been made to the Teaching Plan for the subject "Circulatory and respiratory system diseases" (12 ECTS) leaving the corresponding part configured. to the circulatory system (6 ECTS), which is the one that concerns us in this study, as follows: 33 hours of master classes, 20 hours of learning based on cooperative work problems and 10 hours of practical seminars that focus on transversal concepts of the subject as practical cases, comprehensive approach to the patient, echocardiography, interpretation of electrocardiograms, hemodynamics and surgical aspects, among others. In addition to this, students have 40 hours of care practices in hospital complexes, 5 hours of skills and competencies seminars (physical examination, cardiopulmonary auscultation, arterial pulse interpretation, etc...) and 5 hours of clinical reasoning seminars.

Taking into account the self-perception of competences in a global way, this variable proved to be adequate to predict a greater acquisition of competences on the cardiovascular system, so it could be a useful tool to assess this learning and guide teaching in the Degree in Medicine. In another investigation, in his case regarding Dentistry, this issue has already been explored and it was shown that learning directed by the needs of the students led to greater satisfaction and acquisition of skills on their part (9). Although it is true that self-perception data is self-reported and, therefore, subjective, given its good correlation with objective results, we believe that it could be a fairly faithful reflection of reality; however, given the selection bias of the participants (volunteers and therefore involved in the subject), the average general self-perception of this study is probably higher than the real one.

On the other hand, another of the relevant facts that have been verified in this study is the importance of regular class attendance, this variable being a good predictor for obtaining high grades in the competency questionnaire. This reinforces the idea that learning is a collaborative process in which interaction with students and teachers favors the acquisition of knowledge. In fact, these results are in line with the findings of another study carried out on medical students whose objective was to study the relationship between class attendance and grades in a subsequent exam, in this case referring to the subject of Physiology (10). In this article, it was concluded that students who regularly

attended class, both repeaters and non-repeaters, obtained better grades in the three partial exams that were taken.

Lastly, another noteworthy finding was the positive and significant correlation observed between the average grade of the file and the qualification of the questionnaire on the acquisition of competences, which can be explained by the fact that the different areas of the medical field are widely interrelated and share common competencies. Therefore, the students with a better academic performance could have been better integrating the knowledge acquired, which would have also allowed them to have a better performance in this evaluation. Thus, it becomes clear that medical training can only be understood globally.

Limitations

This research has presented some limitations in its development. In the first place, it has been carried out exclusively locally, in different courses of the Degree and, in addition, the sample size is limited (approximately 40% of the target population of this study), so the sample has some restricted characteristics that may affect the extrapolation of the results to the general population. In addition, it has not been possible to use a validated questionnaire on cardiovascular system competencies and one of its own has been prepared, the completion of which is self-reporting and subjective, so that its results may not fully adjust to reality. Finally, it is necessary to indicate that, considering the sample size, a Gaussian distribution of the variables has been assumed.

5. Conclusions

The following conclusions have been drawn from the results of this study, therefore, taking into account its limitations, indicated previously, they may not be extrapolated to the general population, but they may serve as hypotheses for future research:

- Self-perception has shown to be useful in predicting the acquisition of competencies, so it could be used as a tool to guide teaching.
- A scarce development of those competences whose scope is mainly practical is suggested.
- Regular class attendance has proven to be essential in learning skills, correlating with higher grades.
- A better overall academic performance is associated with a greater acquisition of competencies, thus indicating the importance of interrelating knowledge, since a greater general performance during the degree is also reflected in the specialty studied in this work.

Supplementary material: Annex 1. Questionnaire - Contains the questionnaire that was completed by the study participants

Funding: There has been no direct funding for this work.

Acknowledgments: This research is part of the Final Degree Project of the first authors (JILV-CPB) at the Faculty of Medicine of the University of Malaga. The main research group belongs to the CIBER-CV "Cardiovascular Diseases" (CB16 / 11/00360) of the Carlos III Health Institute, in turn financed by the Spanish Ministry of Health, co-founded by the European Regional Development Fund (FEDER).). It has been carried out in collaboration with the Chair of Advanced Therapies in Cardiovascular Pathology of the University of Malaga (CIF Q-2918001-E), the Nicolás Monardes program of the Andalusian Health Service, Health and Families Council (C1-0049-2019) and the Miguel Servet II program of the Carlos III Health Institute (CPH19/00022).

Declaration of conflict of interest: The authors declare that they have no conflict of interest. The funders had no role in study design, data collection, analysis, or interpretation; in the writing of the manuscript or in the decision to publish the results.

Author Contributions : JILV and CPB equally contributed to the development of the study and the writing of the article. MFJN provided the original idea, drew up the work plan and has guided its development. The rest of the authors have helped with the collection and analysis of data, as well as with the review of the article.

References

1. Palés J. The Bologna process, beyond structural changes: A vision from Medical Education in Spain. REDU [Internet]. 2012 [Cited Mar 16, 2021]; 10 (1 Spec No): 35-53. Available at <https://doi.org/10.4995/redu.2012.6092>
2. Martínez Altarriba MC. Competition evaluation. What is it and why do it? SEMERGEN [Internet]. 2003 [Cited Mar 16, 2021]; 29(11):591-598. Available at [https://doi.org/10.1016/S1138-3593\(03\)74255-5](https://doi.org/10.1016/S1138-3593(03)74255-5)
3. Morán-Barrios J. The evaluation of performance or competencies in clinical practice. 1st Part: principles and methods, advantages and disadvantages. Educ Med [Internet]. 2016 [Cited Mar 20, 2021]; 17(4): 130-9. Available at <http://doi.org/10.1016/j.edumed.2016.07.001>
4. GBD 2017 Causes of Death Collaborators. Global, regional, and national age-sex-specific mortality for 282 causes of death in 195 countries and territories, 1980-2017: a systematic analysis for the Global Burden of Disease Study 2017. Lancet [Internet]. 2018 [Cited 20 Mar 2021]; 392(10159):1736-88. [https://doi.org/10.1016/s0140-6736\(18\)32203-7](https://doi.org/10.1016/s0140-6736(18)32203-7)
5. Arrue M, Zarandona J. The debate in the university classroom: building alternatives to develop competencies in health sciences students. Educ Med [Internet]. 2019 [Cited 20 Mar 2021]. <https://doi.org/10.1016/j.edumed.2019.10.016>
6. National Agency for Quality Assessment and Accreditation (ANECA). White Book of the degree in medicine [Internet]. Madrid: ANECA; 2005 [Cited Mar 25, 2021]. Available at http://www.aneca.es/var/media/150312/libroblanco_medicina_def.pdf
7. Palés J. Objective assessment instruments. Educ Med [Internet]. 2012 [Cited 3 Apr 2021]; 15 (suppl 1): S3-S6. Available at: http://www.educmed.net/pdf/revista/15S01/2512058_AAVV_mdp_EDU.pdf
8. Villegas-Álvarez F, Polaco-Castillo AJ, González-Zamora JF, García-Pineda, AM, Madrid-Zavala MR. Medical-surgical skills. Self-perception in physicians recently graduated from the undergraduate degree. Cir Cir [Internet]. 2007 [Cited 20 Apr 2021];75(1):43-47. <https://www.redalyc.org/articulo.oa?id=66275109>
9. Muñoz F, Matus O, Pérez C, Fasce E. Blended learning and predisposition to self-directed learning in a dental specialization program. Educ Med [Internet]. 2020 [Cited 22 Apr 2021]; 21(4):230-236. <https://doi.org/10.1016/j.edumed.2018.08.006>
10. Demir EA, Tutuk O, Dogan H, Egeli D, Tumer C. Lecture attendance improves success in medical physiology. Adv Physiol Educ [Internet]. 2017 [Cited 22 Apr 2021]; 41(4): 599-603. <https://doi.org/10.1152/advan.00119.2017>



© 2023 University of Murcia. Submitted for open access publication under the terms and conditions of the Creative Commons Attribution-NonCommercial-No Derivatives 4.0 Spain (CC BY-NC-ND) license (<http://creativecommons.org/licenses/by-nc-nd/4.0/4.0/>).