

Resilience and Empathy in Health Science Students

Resiliencia y empatía en estudiantes de ciencias de la salud

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ABSTRACT

Introduction: To determine whether resilience dimensions are able to predict empathy dimensions based on individual resilience scores in a sample of health sciences students. **Methods:** The sample consisted of 1,093 students from the Faculty of Health Sciences of El Salvador. Descriptive statistics were estimated to characterize the sample and the prediction of the dimensions of resilience on those of empathy was estimated using structural equations. **Results:** It was found that the Engineering and Adaptive dimensions of resilience negatively predict the Adoption of Perspective and Compassionate Care dimensions of empathy, while the ecological dimension positively predicted the Adoption of Perspective and Compassionate Care dimensions of empathy. **Conclusion:** Individual resilience is a variable that can influence empathy and predict empathic behaviour in students from different careers or study programmes belonging to a Faculty of Health Sciences. These findings provide empirical evidence supporting the concept that empathy can be defined as a dependent variable regarding individual resilience. It is necessary to introduce training in resilience and empathy in a coordinated manner in the teaching-learning process in health sciences students.

Keywords: Resilience, empathy, statistical prediction, structural equations, training.

RESUMEN

Introducción: Determinar si las dimensiones de la resiliencia son capaces de predecir las dimensiones de la empatía a partir de las puntuaciones de resiliencia individual en una muestra de estudiantes de ciencias de la salud. **Métodos:** La muestra estuvo compuesta por 1093 estudiantes de la Facultad de Ciencias de la Salud de El Salvador. Se calcularon estadísticas descriptivas para caracterizar la muestra y se estimó la predicción de las dimensiones de resiliencia sobre las de empatía mediante ecuaciones estructurales. **Resultados:** Se encontró que las dimensiones de resiliencia ingenieril y adaptativa predicen negativamente las dimensiones de empatía de adopción de perspectiva y cuidado compasivo, mientras que la dimensión ecológica predijo positivamente las dimensiones de empatía de adopción de perspectiva y cuidado compasivo. **Conclusión:** La resiliencia individual es una variable que puede influir en la empatía y predecir el comportamiento empático en estudiantes de diferentes carreras o programas de estudio pertenecientes a una Facultad de Ciencias de la Salud. Estos hallazgos proporcionan evidencia empírica que respalda el concepto de que la empatía puede definirse como una variable dependiente de la resiliencia individual. Es necesario incorporar la formación en resiliencia y empatía de forma coordinada en el proceso de enseñanza-aprendizaje de los estudiantes de ciencias de la salud.

Palabras Clave: Resiliencia, empatía, Predicción estadística, ecuaciones estructurales, entrenamiento.

INTRODUCTION

There are several definitions and theories that attempt to explain resilience (Bonanno, 2021; Tang *et al.*, 2022). However, all these theories agree that resilience is complex and determined by different variables or traits that can interact with each other. Ontogenic factors can negatively impact a person, altering their psychological well-being and can be associated with low levels of resilience. But there are also factors or characteristics of a resilient person that can decrease or nullify negative situations in the ontological process, such as positive affect, self-esteem, optimism, or self-efficacy, among others (Teh *et al.*, 2023).

If there is exposure to a risk (and despite this exposure), an appropriate response to the presence of that risk will involve the presence of psychosocial well-being despite the threat it faces (Yule *et al.*, 2019). However, a problematic situation that seems to have no solution can lead to dysfunctional adaptation and psychological distress (Yule *et al.*, 2019). People with higher resilience will adapt and face risks and negative experiences due to their ability to build a positive response even under the influence of negative circumstances that may surround them. Therefore, they acquire the ability to use personal, family, relational, and existential resources properly to face suffering and psychic vulnerability (Dulin *et al.*, 2018).

However, the conceptualization of resilience varies depending on the research area and the theoretical-empirical structure used. This situation hinders reaching a common definition of the concept and making comparisons (Moya & Goenechea, 2022), also making its measurement difficult (Sisto *et al.*, 2019). Thus, the operationalization of resilience is complex since there is no theory that unifies the different approaches to this concept, coexisting two approaches that have greater acceptance, the buffering hypothesis and the trait approach (Johnson *et al.*, 2011; Khalil *et al.*, 2022). The buffering approach measures resilience on a binary scale, and the trait approach considers the ability to recover and the attitude towards negative events (Maltby *et al.*, 2015). The trait approach is built from the combination of systems theory and ecology, generating three subsystems that attempt to explain resilience: engineering resilience, ecological resilience, and adaptive resilience. The first allows restoring balance when a person is subjected to a disturbance (Hoffman & Hancock, 2017). The second allows a person to absorb or resist a disturbance before the adjustment process of the system mechanisms to overcome it and maintain in terms of function, purpose, structure, or identity (Maltby *et al.*, 2015; Timpane-Padgham *et al.*, 2017), and the third is the ability of an ecosystem to manage and adapt to change (Maltby *et al.*, 2015; Palacio *et al.*, 2020).

Empathy in Health Students and Professionals

The empathy of health professionals can be considered an attribute that gives the ability to understand the thoughts and feelings of sick individuals, providing these professionals with the opportunity to respond emotionally appropriately (Adam *et al.*, 2022). Consequently, the structure of the empathy construct can be stipulated by a cognitive and an emotional component. The cognitive component enables the professional to understand the patient's experiences and expectations regarding their health situation (Ulloque *et al.*, 2019). The emotional component allows understanding and feeling the patient's pain (Tehranineshat *et al.*, 2019). Therefore, it is important to consider empathy as a complex system of components that interact dynamically (Altuna, 2018; Díaz-Narváez *et al.*, 2017a; Wilczek-Rużyczka, 2023). An imbalance in this system necessarily results in a decrease in empathic capacity (Díaz-Narváez *et al.*, 2018), and in the worst cases, if one of its components (especially the emotional) fails, the situation can lead to severe psychopathy (Blair, 2018; Kerr-Gaffney *et al.*, 2019).

The development of empathy involves the intervention of two evolutionary processes: phylogeny and ontogeny (Decety & Svetlova, 2012; Díaz-Narváez *et al.*, 2017b). The first is the product of biological evolution and is related to quantitative and qualitative changes in the brain over time. In the phylogenetic process, the development of the brain's limbic complex occurs, responsible for learning and memory processes but also emotions (Díaz-Narváez *et al.*, 2017b). This limbic system is regulated by the frontal lobe and its cognitive

abilities (Barrera-Gil *et al.*, 2018). Ontogeny consists of all the factors that can influence a person throughout their life, even before birth (Calzadilla-Núñez *et al.*, 2017). Of course, there is a dynamic relationship between the processes generated by phylogeny and ontogeny, and therefore, human development (and that of the brain) must be explained through a process of continuity where these evolutionary factors interact simultaneously but with different intensities on an individual or a group.

The most widely used instrument to measure empathy with patients in Latin America is the Jefferson Scale of Empathy for Health Professions (JSE-HP) and its version for Health Sciences students (JSE-HPS) (Hojat *et al.*, 2002b). This scale measures the cognitive component that has two dimensions: Perspective-Taking (PT) and “Walking in the Patient’s Shoes” (WIPS), and the emotional component expressed in the dimension Compassionate Care (CC). The study of empathy in Latin America has revealed some characteristics, such as the variability in empathic distribution between genders and between means over academic years in undergraduate students (Díaz-Narváez *et al.*, 2020, 2021, 2022; Santander-Díaz *et al.*, 2021). This variability has shown that empathic decline (Hojat *et al.*, 2020) is not the only form of empathy behavior, and this concept can be confined to a particular case of the distribution of mean scores between academic years in undergraduate students, at least in Latin America (Díaz-Narváez *et al.*, 2018, 2020, 2021).

Resilience and Empathy

Resilience and empathy, along with other factors, have been studied to explain various behaviours in health professionals and students (Chaukos *et al.*, 2017; Elam & Taku, 2022; Foster *et al.*, 2018; Rafaqat *et al.*, 2022; Sturzu *et al.*, 2019; Velayudhan, 2021). In this regard, a positive effect of resilience and self-efficacy on compassion fatigue in nurses was observed (Zhang *et al.*, 2022). This implies that resilience influences the affective component of empathy. Compassion fatigue is one of the factors that explains the empathic erosion process, and the mentioned study provides evidence that resilience was related to raising the compassion threshold of nurses. It has also been observed that resilience acts as a mediator between empathy and work engagement (Cao & Chen, 2020).

In this context, it has been noted that health science students are exposed to various risk factors that can cause a decrease in empathy towards patients (Carvajal *et al.*, 2019). These factors include stress (Haykal *et al.*, 2022; Nitschke & Bartz, 2023), depression (Haykal *et al.*, 2022; Rajput *et al.*, 2020), burnout (MacAulay *et al.*, 2023), personal well-being (Paloniemi *et al.*, 2021), academic performance, and anxiety (Ahmad *et al.*, 2022; Wells *et al.*, 2023), among other factors. The raised issues allow inferring that resilience could be an important modulator of empathy. If this modulation is positive, the effect would be the elimination or attenuation of the negative consequence on the cognitive and

emotional components of empathy (Carvajal *et al.*, 2019; Ulloque *et al.*, 2023), and as a final consequence, the reduction of the risk of generating empathic erosion in health science students in general (Díaz-Narváez *et al.*, 2018, 2020). The findings provide empirical evidence for the theoretical assumption that considers resilience as a predictor of empathy (Findyartini *et al.*, 2021; Halimi *et al.*, 2023; Morice-Ramat *et al.*, 2018; Ord *et al.*, 2020; Razaqat *et al.*, 2022; Stern *et al.*, 2023; Waddimba *et al.*, 2021; Wu *et al.*, 2022). However, it is not entirely proven that resilience is a modulator or a predictor of empathy, and more evidence is needed for such an effect.

Additionally, it is necessary to consider the proven existence of variability in the distribution of empathy in health science students in Latin America (Díaz-Narváez *et al.*, 2021, 2022). The situations raised earlier might suggest that the main question in this context is related to the association between resilience and empathy in a specific population of students. Although it is not always clear the dependent or independent role that each variable plays in relation to the other. In this regard, studies on resilience as a predictor of empathy and its dimensions in health science students have been relatively scarce, especially in Latin America. Moreover, studies of this kind in Latin America must be conducted with special care due to the significant variability in the distribution of empathy among students within the same specialty and between different specialties, within and between countries in this continent (Díaz-Narváez *et al.*, 2021).

Based on the above background, it is possible to hypothesize that the dimensions of resilience are potentially capable of predicting the dimensions of empathy. In this context, the objective of this study is to associate resilience and empathy, seeking to predict the dimensions of empathy based on the dimensions of resilience in a sample of students from various specialties at a Faculty of Health Sciences.

METHODS

Design: This study is characterized as being cross-sectional with a quantitative approach, with the method of non-probabilistic sampling by convenience, composed of 1,093 students from the Faculty of Health Sciences at the University Autónoma de Santa Ana, El Salvador.

Participants: A non-probabilistic, intentional sample was selected, comprising 1093 students from the Faculty of Health Sciences at the University Autónoma de Santa Ana, El Salvador. This sample represents 80.6% of the total population of the Faculty (N=1356), covering all years of each academic program included in the sampling.

Sample characteristics: The sample was collected in November 2022 and consisted of students from Medicine (n=430), Dental Surgery (Dentistry) (n=212), Physiotherapy (n=157), Clinical Laboratory (n=116), Nutrition (n=109), and Nursing (n=69). It consisted

of 72.5% females ($n = 792$) and 27.5% males ($n = 301$), with ages ranging from 17 to 39 years ($M = 21.62$, $SD = 3.17$).

Instruments

Individual Resilience: EEA Trait Resilience Scale (Maltby *et al.*, 2015). This scale evaluates three facets of resilience: engineering, ecological, and adaptive resilience. It consists of a 12-item Likert-type format, with five response levels per item, ranging from “Strongly disagree” (1) to “Strongly agree”. The EEA Trait Resilience Scale has demonstrated satisfactory internal and test-retest reliability. Additionally, it exhibits a cross-culturally stable factor structure, convergent and construct validity concerning associations with personality, and a positive contribution to clinical and non-clinical psychological health states (Maltby *et al.*, 2015, 2016).

Empathy: Jefferson Scale of Empathy for Health Professionals (JSE-HPS) (Hojat *et al.*, 2002b)

This scale comprises 20 items that measure empathy levels with patients in health science students of any specialization. Items are rated on a 7-point response scale, ranging from 1 (strongly disagree) to 7 (strongly agree). The scale gauges three dimensions: Compassionate Care (CC, items 1, 7, 8, 11, 12, 14, 18, 19), Perspective-Taking (PA, items 2, 4, 5, 9, 10, 13, 15, 16, 17, 20), and “Walking in the Patient’s Shoes” (WIPS, items 3 and 6). The scale has demonstrated adequate internal consistency ($\alpha = 0.78-0.92$) and appropriate correlations with other psychological variables (Hojat *et al.*, 2002).

Procedure

The instruments were administered in a group setting, using a pen-and-paper format, during the students’ regular class hours. Data collection was carried out by faculty members from the Faculty of Health Sciences who were not involved in this research and had received the necessary training to correctly administer the instruments, address students’ queries, and ensure the proper reception of responses. All students signed an informed consent before completing the instruments, ensuring their autonomy, voluntariness, and confidentiality of information.

The study adhered to the ethical principles of the Declaration of Helsinki (2013). The research project, along with the informed consent, received approval from the Institutional Ethics Committee of the Andrés Bello University (Chile, File: 020-2022). All sociodemographic and personal data, as well as responses from the administered instruments, are treated as confidential.

Data Analysis

The data underwent descriptive studies, and the following statistics were calculated: maximum and minimum values, means, standard deviation, skewness, and kurtosis. Subsequently, the unidimensional normality of the data was assessed using the Kolmogorov-Smirnov test (K-S) ($n > 50$). The internal reliability of the data was calculated in each of the dimensions of resilience and empathy using McDonald's omega (McDonald., 1999) and Cronbach's alpha (Cronbach., 1951) coefficients. Instruments with missing data and outliers were eliminated and not considered for the previously characterized sample.

For data analysis, a Structural Equation Model (SEM) was employed. The fundamental objective is to confirm the proposed relationships based on the theory applied to the studied system (Escobedo *et al.*, 2016; Hair *et al.*, 2006). The robust Multiple Linear Regression (MLR) estimator was used, and the model's fit was evaluated using the Comparative Fit Index (CFI) (> 0.95), Tucker-Lewis Index (TLI) (> 0.95), Root Mean Squared Error of Approximation (RMSEA) (< 0.08), and Standardized Root Mean Square Residual (SRMR) (< 0.08) (Kline, 2016; Schumacker & Lomax, 2015).

Regarding measurement models, a Confirmatory Factor Analysis (CFA) will be conducted using the robust MLR estimator, considering the same fit indicators as those used in the SEM model. For statistical analysis, the RStudio environment (RStudio Team, 2018) for R (R Core Team, 2019) was used. Specifically, the "lavaan" package (Rosseel, 2012) performed the SEM. The significance of the model was performed for a $p < .05$.

RESULTS

Table 1 displays the outcomes of the estimation of descriptive statistics for both variables under investigation: Empathy (E) and its dimensions - Compassionate Care (CC), Perspective-Taking (PT), and "Walking in the Patient's Shoes" (WIPS) - and Resilience (R) and its dimensions: Engineering (EN), Ecological (EC), and Adaptive (AD). It is noted that the Perspective-Taking dimension of Empathy is the only one with severe deviations from symmetry and kurtosis. The results of the Kolmogorov-Smirnov test were significant ($p < 0.005$) for both Resilience and Empathy and for the dimensions of each of these constructs.

Table 1:
Descriptive Statistics for Resilience, Empathy, and their Dimensions (n=1093)

Variables	<i>Mín.</i>	<i>Máx.</i>	<i>M</i>	<i>DE</i>	<i>Asim</i>	<i>Cur</i>
IN	4	20	12.88	3.82	-.19	-.46
EC	4	20	16.11	2.77	-.65	.38
AD	4	20	13.63	3.54	-.37	-.09

Variables	<i>Min.</i>	<i>Máx.</i>	<i>M</i>	<i>DE</i>	<i>Asim</i>	<i>Cur</i>
Resilience	12	60	42.62	7.54	-.25	.32
CC	9	56	38.71	8.93	-.55	.05
PA	15	70	59.52	8.30	-1.30	2.83
WIPS	2	14	7.66	3.06	.16	-.58
Empathy	45	140	105.89	14.60	-.39	.21

Note: *M*= media, *DE*= Standar Deviation, *Asim*=skewness, *Cur*= Kurtosis.

Measurement Models

In this study, the resilience scale showed strong evidence in favor of validity based on internal structure ($\chi^2 = 252.16$; $df = 50$; $p < .001$; $RMSEA = .066$ [90% CI .058 – .074]; $CFI = .95$; $TLI = .93$; $SRMR = .047$). Furthermore, it demonstrated adequate reliability levels in all its dimensions: Engineering ($\omega = .81$, $\alpha = .86$), Ecological ($\omega = .75$, $\alpha = .74$), and Adaptive ($\omega = .74$, $\alpha = .74$). On the other hand, the factorial structure of the scale has shown evidence of being strictly invariant by participants' gender across the sequence of proposed invariance models: metric invariance ($\Delta CFI = .000$; $\Delta RMSEA = -.003$), scalar invariance ($\Delta CFI = -.014$; $\Delta RMSEA = .005$), and strict invariance ($\Delta CFI = .000$; $\Delta RMSEA = -.003$). All these results indicate that both measurement models (empathy and resilience) are adequately represented and are suitable for the structural model.

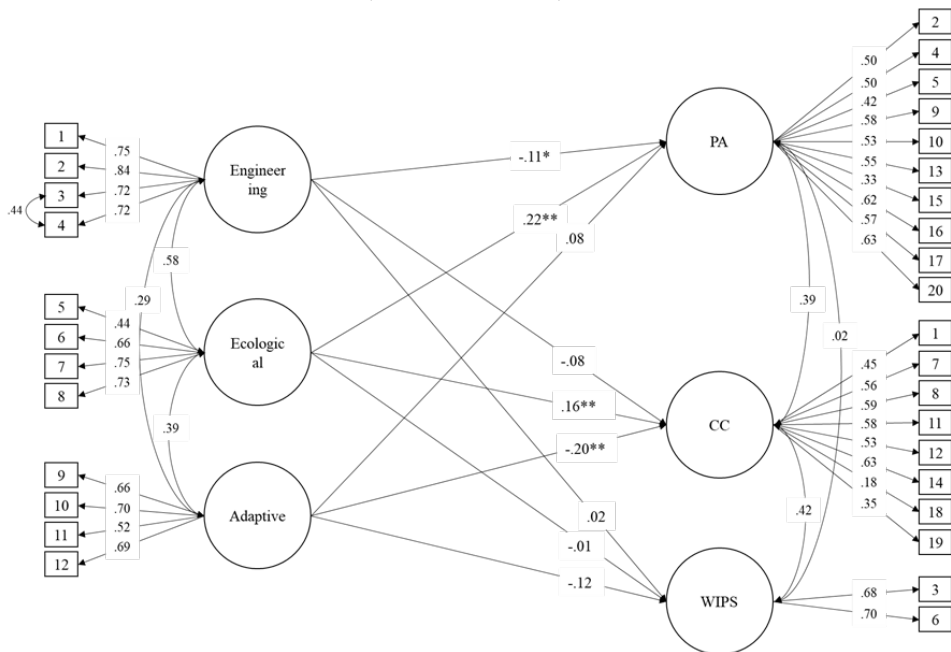
Similarly, the empathy scale presents adequate fit indices to the data ($\chi^2 = 444.16$; $df = 167$; $p < .001$; $RMSEA = .041$ [90% CI .036 – .046]; $CFI = .92$; $TLI = .91$; $SRMR = .038$), demonstrating that the instrument has validity based on the internal structure. It also showed adequate reliability levels in all its dimensions: Perspective-Taking ($\omega = .78$, $\alpha = .78$), Compassionate Care ($\omega = .71$, $\alpha = .70$), and “Walking in the Patient’s Shoes” ($\omega = .65$, $\alpha = .65$). On the other hand, the factorial structure of the scale has shown evidence of being strictly invariant by participants' gender across the sequence of proposed invariance models: metric invariance ($\Delta CFI = -.004$; $\Delta RMSEA = .000$), scalar invariance ($\Delta CFI = -.002$; $\Delta RMSEA = .000$), and strict invariance ($\Delta CFI = -.007$; $\Delta RMSEA = .000$).

Explanatory Model

In this study, it was evidenced that the structural model presents adequate fit indices ($\chi^2 = 1024$; $df = 448$; $p < .001$; $RMSEA = .035$ [90% CI .032 – .038]; $CFI = .93$; $TLI = .92$; $SRMR = .037$). As depicted in Figure 1, the Engineering dimension significantly and negatively predicts Perspective-Taking ($-.11$; $p < .05$). However, this resilience dimension did not predict the other components of empathy. Regarding the Ecological dimension, Figure 1 shows that it significantly and positively predicts the components of Perspective-Taking

(.22; $p < .01$) and Compassionate Care (.16; $p < .01$). However, it did not predict the component of “Walking in the Patient’s Shoes.” Finally, it is observed in Figure 1 that the Adaptive dimension significantly and negatively predicts the components of Compassionate Care (-.20; $p < .01$) and “Walking in the Patient’s Shoes” (-.12; $p < .05$). On the other hand, this resilience dimension did not predict the Perspective-Taking component.

“Figure 1.
Explanatory model of Resilience (and its dimensions) in relation to Empathy
(and its dimensions).”



DISCUSSION

The objective of this study is to associate resilience and empathy, seeking to predict the dimensions of empathy based on the dimensions of resilience in a sample of students from various specialties at a Faculty of Health Sciences.

The ecological dimension of resilience positively predicted two dimensions of empathy: Perspective adoption and Compassionate Care. The ecological component of resilience is generally characterized by a student’s ability to absorb or resist perturbation before employing primary mechanisms and maintaining a state of equilibrium in relation to the function, purpose, structure, or identity of his or her psychological state. Therefore, the traits

associated with this component allow the student's psychological system to persist, enabling the balance necessary to adopt the patient's perspective and understand the subjectivity of his or her thoughts while maintaining the principle of objectivity. The positive association found between ecological resilience and the perspective taking component of empathy can be understood in the sense that the traits contained in this resilience (ability to be robust, self-confidence, trust in one's own abilities, stoic attitude, resourcefulness, and determination) achieved through key domains in life can be associated with the development of executive functions in a complex process. In this sense, cognitive development is additively systemic throughout the ontogenetic process: selectivity and control of cognitive processes, greater ability to create mental schemes, greater mental flexibility, greater use and complexity of memory learning strategies, and better organization and planning of cognitive processes and behavioral activity; based on a constant development of the attitude towards analyzing things in increasingly abstract ways, as well as on the use of more complex psycholinguistic elements (Ganesan & Steinbeis, 2022; Shibaoka *et al.*, 2023), and the development of these cognitive aspects, in turn, favors the specific cognitive aspects of the perspective-taking component of empathy. Indeed, Decety and Jackson (2004) stated that cognitive flexibility is required to adopt the perspectives of others, and ecological resilience traits could positively influence in some way the ability to develop the cognitive flexibility necessary to positively develop the perspective-taking dimension in empathy. Certainly, this inference needs to be the subject of future research that can determine the "intersection zones" between ecological resilience traits, ontogenetic cognitive development of executive functions, and the ability to develop the patient's perspective, which is ultimately the intellectual understanding of his or her condition.

The findings of this study show that the Engineering dimension of resilience negatively predicts the Perspective adoption component of empathy. This result shows a failure in the development of traits associated with the ability to regain a state of equilibrium. That is, the student was able to resist the disturbance; however, the traits associated with the ability to return to the initial state (engineering resilience) would be deficient and their consequence is to prevent the student's ability to intellectually understand the other's condition from being expressed. It also obstructs the possibility of sharing the patient's emotional state.

In this sense, the mean of the engineering dimension in the students examined was 12.58, which would imply (in general) a certain diminished capacity to recover and return to the normal state after having difficult experiences or to return to the previous state after negative experiences. To arrive at this possible inference we must remember that the maximum value of this dimension is 20. On the other hand, the means of the dimensions PA = 59.52 and CC = 38.71 have a relatively large gap with respect to the maximum values 70 and 56 respectively, which shows two findings. The first is the existence of a gap between the empirical value of the mean of the engineering dimension with respect to its

maximum value and also gaps between the mean values of the PA and CC dimensions with respect to their maximum values. The second is that resilience seems to act indirectly with respect to empathy. Indeed, when a resilience dimension negatively predicts a dimension of empathy, it must be interpreted as meaning that the specific traits associated with the resilience dimension inhibit the expression of the empathy dimension affected by such a negative prediction. Whereas, when the prediction is positive, the corresponding resilience dimension allows the development of the potential empathy of empathy. Therefore, resilience does not “increase” or “decrease” empathy, but rather prevents or allows, to one degree or another, empathic expression, regardless of the degree of development it has. These results show the need for training in resilience and empathy in the students examined. These results could not be compared with studies that attempt to predict empathy from resilience because they did not assess prediction from the dimensions of the constructs.

The negative correlation cannot be interpreted as meaning that the traits of this dimension produce a reduction in the capacity for perspective taking per se but rather the temporary inability to adopt the perspective until the student can return to his or her previous state. In other words, there would be a temporary decrease in the perceptual capacity to obtain a representation of the patient’s vision based on his real situation, or in the cognitive capacity to represent the patient’s thoughts, or in the affectivity to infer his emotional states, or, finally, in a combination of these diminished ways of adopting the patient’s perspective.

The adaptive dimension of resilience negatively predicted the Compassionate Care dimension, resulting in a reduction in the student’s ability to provide compassionate care to the patient. This result aligns with the observation in the engineering component and manifests that students do not possess sufficiently developed traits such as the ability to adapt well, adjust, be flexible, innovate, modify, and respond well to disturbances, all of which contribute to reducing the compassionate threshold and, possibly, avoiding empathic contagion and its consequence: empathic erosion. The potential consequences of this finding could be explained by the potential presence of some degree of empathic fatigue and, consequently, empathic erosion in students, with the negative impact this has on the student-patient relationship. However, it is also possible to suggest that this finding could be explained by a conscious process of adapting to the conditions of observing pain and a good response to this disturbance, mainly using cognitive empathy to find the necessary “mechanism” to maintain an objective perspective and make informed decisions, based on the recognition that emotional empathy is also necessary to establish an effective connection with patients. Therefore, what has been described may imply the ability to “apply” both cognitive and emotional empathy in different situations and be aware of when it is appropriate to “use” each of them with greater “intensity” in relation to the other to create an adequate empathic balance that allows regulating the effect of the patient’s pain

on the student's empathic effectiveness and ensure proper patient care. This alternative can explain successful coping based on the idea that adaptive resilience produces an increase in the compassionate threshold, and this process possibly allows the student to adapt positively to disturbances through emotional regulation mechanisms, without this regulation decreasing their compassionate capacity (Díaz-Narváez *et al.*, 2017a). In this case, resilience would contribute to finding a balance without affecting their capacity to feel compassion. Certainly, a response to this inference should be studied in future research.

Although not the objective of this study, the findings allow suggesting, first, that the positive and negative correlations found, although statistically significant, have very low values. This means that resilience can explain a small part of the empathic behavior of the examined students, but there are other unstudied factors that contribute to modulating empathy. These results support the hypothesis of some Latin American authors (Barrera-Gil *et al.*, 2018; Dávila-Pontón *et al.*, 2020; Díaz-Narváez *et al.*, 2017a, 2017b, 2020, 2021, 2022; Santander-Díaz *et al.*, 2021) that empathy could be the result of the action of various exogenous and endogenous factors that act all at once or at different stages of life (especially in childhood and adolescence) and ultimately determine the empathic behavior of individuals. Second, it raises the question that the study of empathy in health science students should not be the sole focus of attention by educators in higher education, and these specialists should not only take relevant actions to raise the empathy levels of their students but also pedagogically care about the possible factors that modulate empathy.

The complexity of the empathy concept remains a subject of theoretical contradictions (Davis *et al.*, 1987; Eisenberg & Fabes, 1990; Eisenberg *et al.*, 1991; Ferriz *et al.*, 2018; Machado & Calvetti, 2019). In this context, clinical empathy is proposed to have both cognitive and emotional components (Hojat *et al.*, 2002). However, in this definition, the cognitive component predominates when it comes to patient care (Hojat *et al.*, 2020, Hojat *et al.*, 2023). Nevertheless, other authors (Díaz-Narváez *et al.*, 2022, Wilczek-Rużyczka, 2023) suggest that empathy, being a system, entails a dynamic relationship among its components. Consequently, as empathy, as a system, requires the involvement of all its dimensions contained in its components, the empathy system weakens if one of its dimensions weakens in the process of intersubjectivity with the patient. The same applies to individual resilience (Alzugaray *et al.*, 2018; Windle *et al.*, 2011). Consequently, studying how resilience can modulate empathic behavior is akin to studying how one complex system modulates another complex system. This type of study is complicated by the fact that it involves understanding how the first system modulates the second based on determining how specifically each dimension of resilience modulates each dimension of empathy and, consequently, integrating these results correctly or generating the correct questions that may arise from these results.

The confirmation that the measurement models of resilience and empathy are met is a necessary first step to ensure that the relationships between variables and their dimensions have methodological support (Dávila Pontón *et al.*, 2023; Estrada-Méndez *et al.*, 2023). Moreover, verifying invariance across genders opens the opportunity to methodologically study the behavior of resilience and empathy between both genders and observe if the relationships found in this work behave similarly or differently in each of them.

It is known that students in health sciences are exposed to exogenous disturbances that hinder their academic and clinical performance. Some of these factors include stress, anxiety, depression, academic pressure, workload, financial problems, the year of study, exams, grades, and patient care (Fonseca-Molina *et al.*, 2018a; Fonseca-Molina *et al.*, 2018b). The ideal response of the student should be to positively confront them (Atkinson *et al.*, 2009). In this regard, measures of resilience can be associated with different traits that allow successful coping with disturbing exogenous factors (Alzugaray *et al.*, 2020; Gariépy *et al.*, 2016).

Finally, in the future, it is necessary to further investigate the role played by certain demographic variables such as age and gender, which have been associated with resilience but without conclusive evidence (Lee *et al.*, 2013). Recent studies suggest that women may be less resilient (Afshari *et al.*, 2021; Singh *et al.*, 2019) and that resilience increases with age (Afshari *et al.*, 2021; Staneva *et al.*, 2022).

Limitations

The main limitation of this study is that the results of the found associations cannot be a priori generalized to all health sciences students in El Salvador and Latin America due to the lack of representativeness of the sample and the significant variability in empathy and its dimensions existing in Latin America.

CONCLUSIONS

Individual resilience is a variable that can influence empathy and predict empathic behavior in students from different careers or study programs belonging to a Faculty of Health Sciences. These findings constitute empirical evidence supporting the conception that it is possible to define empathy as a dependent variable and resilience as an independent variable. However, based on the low values of the significant correlations found, the existence of several factors that modulate empathy is inferred. The main conclusion is that the findings show the need for training in resilience and empathy in the students examined.

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Disclosure Statement

No potential conflict of interest was reported by the author(s).

Data Availability Statement

Study data are available from the corresponding author, VD-N, upon request.

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