Visualizing Empathy: Understanding Patient-Doctor Interactions through Eye-Tracking Technology

Yuyi Park, Hyungsin Kim, Hakkyun Kim

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Yuyi Park[1] MS; Hyungsin Kim[2*] PhD; Hakkyun Kim[3*] PhD

[1]Seoul National University Seoul KR
[2]Kookmin University Seoul KR
[3]Sungkyunkwan University Seoul KR
[*]these authors contributed equally

Corresponding Author:
Hyungsin Kim PhD
Kookmin University
77, Jeongneung-ro, Seongbuk-gu
Seoul
KR

Abstract

Background: Communication between patients and doctors in healthcare settings is fundamental for positive patient health outcomes. Nonetheless, researchers have paid scant attention to the significance of clinical empathy as a practical skill in these interactions.

Objective: This study aims to comprehend clinical empathy during doctor–patient encounters by examining doctors' and patients' verbal and nonverbal behaviors. Using eye-tracking techniques, we focus on the relationship between traditionally assessed clinical empathy and a doctor's gaze behavior.

Methods: We employed mixed methods to understand clinical encounters by a comparison of three quantitative measures—eye tracking data, K-JSE-HP scores, and CARE scores, and with qualitative interviews with patients regarding their encounters.

Results: Perceived empathy from physicians was notably higher when doctors maintained eye contact during consultations, as indicated by gaze patterns focusing on patients' faces. Furthermore, an analysis of Areas of Interest (AOI) revealed distinct patterns in interactions with new versus returning patients. Post-consultation interviews suggested that task- and social-oriented empathy are critical in aligning with patients' expectations of empathetic communication.

Conclusions: This proof-of-concept study advocates for a multidimensional approach to clinical empathy, revealing that a combination of verbal and nonverbal behaviors significantly bolsters perceived empathy from healthcare providers. This evolved paradigm of empathy underscores profound consequences for the pedagogy of medical education and the caliber of healthcare delivery.

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Keywords: clinical empathy; eye tracking; medical communication; nonverbal behavior; doctor–patient encounters

Introduction

Communication between patients and doctors is crucial in medical services as the first entry point in the healthcare system [1]. In particular, health communication is gaining more attention as the new paradigm of global health is shifting to patient-centered care [2]. Doctor–patient communication in healthcare settings is essential for establishing a trusting relationship and is a fundamental aspect in improving diagnostic accuracy and effective clinical care [1]. In addition, research shows that doctors' empathy abilities, utilized in the process, enhance the quality of healthcare and patients' health outcomes [3].

Clinical empathy is a concept that encompasses several competencies of healthcare professionals: the ability to understand a patient's inner experiences and perspectives, the capacity to respond appropriately to the patient's emotions, and the skills to communicate effectively [4-6]. Like ordinary communication, health communication involves the appropriate use of verbal and nonverbal communication skills [7]. Research estimates that 80% of communication is nonverbal, with the nonverbal communication of healthcare professionals being crucial in influencing patients' well-being and overall care experience [8,9]. Also, nonverbal components may be more critical than verbal communication, especially when clinicians make clinical decisions involving multicultural patients [10].

Despite a gradual increase in research on health communication or clinical empathy, relatively few studies have analyzed the nonverbal communication aspects of actual medical consultations. A review of previous studies revealed that most studies fragmentedly investigated self-reported perceptions or attitudes of clinical empathy by patients [11,12], doctors [13,14], or students [15,16]. These survey-based studies (particularly those solely reliant on self-report questionnaires) are susceptible to reporting or social desirability biases and have limitations in interpreting the genuine characteristics of empathic interactions [17]. Therefore, in this study, we explore gaze behaviors as a key nonverbal component of social interaction in the context of clinical empathy. This study utilized an eye-tracking device with a doctor during medical consultations to understand the eye movement characteristics of empathy.

Methods

Design

This study employs an explorative research design to investigate the utilization of eye-tracking glasses in doctor–patient encounters. We also integrated mixed methods to collect the data to understand patient and doctor interactions. Moreover, we collected qualitative data from patients at the end of the experiment through interviews. Ultimately, we triangulated the data because we wanted to cross-verify and validate the findings from the eye tracking technology with traditionally measured empathy assessments such as the Jefferson Scale of Empathy–Health Profession (JSE-HP) and the Consultation and Relational Empathy (CARE) survey. Before the experiment, we obtained approval from the Kookmin University Institutional Review Board (KMU-202111-HR-289).

Setting

We conducted our experiment at a doctor's office practicing Traditional Korean Medicine in Incheon, South Korea, from December 2021 to February 2022. We used eye-tracking technology throughout the experiment; however, we only considered individual patients' medical consultation sessions for analysis. The starting and ending points of the consultation were the initial greeting and the closing

exchange between the patient and the doctor.

Participants

We recruited 7 participants for the study, including a female doctor in her mid-thirties specializing in Traditional Korean Medicine and operating her clinic. The patient group comprised one male and five females, spanning diverse age ranges from their 20s to 60s. All participants provided written consent before attending the medical consultations, and we offered a nominal monetary compensation to acknowledge their participation in the research. The study excluded individuals taking neuropsychiatric medications, doctors wearing glasses, and psychiatrists. These exclusions align with our research objective, aiming for a comprehensive understanding of clinical empathy within general medical interactions.

Materials

First, we used the Tobii Pro Glasses 2.0 for tracking eye movement. This wireless wearable eye-tracking technology records a subject's pupil position with infrared cameras and maps the subject's visual attention. It weighs 45 grams, so a subject can freely move while wearing the glasses. Second, we analyzed all the recorded videos using the Tobii Pro Lab Analyzer Program. Third, we used two standardized instruments to measure clinical empathy: the Korean version of the Jefferson Scale of Empathy-Health Professional (K-JSE-HP) for doctors and the Consultation and Relational Empathy Measure (CARE) for patients. Lastly, we developed a semi-structured interview questionnaire to gain insights into patients' perceived empathy with the doctor.

Procedures

The experiment comprised three procedures: a pre-medical consultation, a medical consultation, and a post-medical consultation. After completing a consent form, the doctor took the K-JSE-HP assessment to evaluate her clinical empathy capabilities in the initial phase. Subsequently, she prepared for the experiment by putting on the Tobi eye-tracking glasses. During the medical consultation phase, the doctor engaged individually with six patients while wearing the eye-tracking goggles. In the post-medical consultation phase, she documented medical notes on paper.

Concerning the patients, each participant completed a consent form during the pre-medical consultation. They then received the medical consultations; following the consultations, we assessed their perceived clinical empathy using the CARE evaluation. Lastly, we conducted 15-minute semi-structured interviews with each patient to explore the aspects related to clinical empathy.

Results

Doctor's Self-reported Empathy

The physician scored 94 out of a maximum of 126 points on the K-JSE-HP. This self-reported scale comprises 18 questions, with each rated on a 7-point Likert scale. Unlike the original JSE-HP scale, the Korean edition omitted two questions for enhanced internal consistency. The Cronbach's alpha coefficient for the Korean JSE-HP was 0.88 [18]. The Korean edition of the JSE-HP assesses clinical empathy across three subscales: 10 items on perspective-taking, 6 on compassionate care, and 2 on standing in the patient's shoes. Higher scores indicate greater proficiency in clinical empathy [4,18]. The score (94 points) is similar to the previous finding reported in Park et al.'s [19] study, which assessed empathy among Korean doctors (male doctors: 92.4, female doctors: 95.8).

Patients Perceived Empathy for a Doctor

The average score for the K-CARE tool, designed for patients to evaluate their doctors' empathy, was 47.8 out of a possible 50 points. Generally, a score above 43 points implies a high level of empathy in doctors [20]. Since this doctor's score was almost perfect (with a maximum of 50 points), the doctor's empathy ability was very high. The K-CARE instrument comprises 10 validated and reliable items rated on a 5-point Likert scale. A higher total score indicates increased perceptions of clinical empathy by patients. The reliability of the K-CARE tool was robust, with a Cronbach's alpha coefficient of 0.94 [11]. Table 1 provides an overview of the demographic characteristics of each participant in the study, including their respective K-CARE scores. Additionally, we queried participants about their status as new or follow-up patients.

Table 1. General characteristics and empathy ratings of the patient participants.

Subject ID	Type of visit	Age (years)	Gender	Chief complaint	CARE score (Korean edition)
1	Follow-up	21	Female	Gastrointestinal discomfort	50 (50)
2	Follow-up	21	Female	Lumbar and leg pain	48 (50)
3	First-time	63	Female	Lumbar, right knee, and leg discomfort	39 (50)
4	Follow-up	45	Female	Neck and shoulder pain	50 (50)
5	First-time	38	Female	Head, neck, arm, shoulder, and hand pain	50 (50)
6	Follow-up	20	Male	Neck, shoulder, and lumbar pain	50 (50)

Area of Interest (AOI) during the Medical Consultation

To understand where a doctor paid special attention during the medical consultation, we defined four areas of interest (AOI). AOI includes (1) the patient's face, (2) the patient's body, (3) the patient's chart and the doctor's office environment, and (4) educational materials for the patient. We quantified the doctor's gaze time for each area as a percentage of the total time spent, as shown in Table 2.

Table 2. Doctor's eye tracking data of AOI (Area of Interest).

Subject ID	Type of visit	Length of medical consultation, sec (%)	AOI, sec (%)			
			Face	Body	Chart and environment	Education material
1	Follow-up	243.7 (100)	124.2 (51.0)	2.2 (0.9)	46.7 (19.2)	0.0 (0.0)
2	Follow-up	148.9 (100)	53.9 (36.2)	2.9 (2.0)	17.6 (11.8)	0.0 (0.0)
3	First-time	565.3 (100)	181.6 (32.1)	42.1 (7.4)	37.3 (6.6)	61.2 (10.8)
4	Follow-up	157.3 (100)	29.3 (18.6)	28.6 (18.2)	6.6 (4.2)	29.4 (18.7)
5	First-time	271.5 (100)	66.7 (24.6)	17.9 (6.6)	22.3 (8.2)	48.1 (17.7)
6	Follow-up	254.8 (100)	60.6 (23.8)	24.1 (9.5)	16.1 (6.3)	22.5 (8.8)

The analysis revealed the highest gaze time toward the patient's face across all patients. Specifically, for the two first-time patients, the doctor dedicated most of the time to observing the patient's face, followed by patient education/explanatory materials on specific diseases, the patient's chart and environment, and finally, the patient's body. As for the remaining four follow-up patients, the doctor spent most of the time looking at the patient's face, similar to the first-time patients. In contrast with the first-time patients, the doctor's attention to the follow-up patients after looking at the patient's face was toward the patient's chart and environment, the patient's body, and finally, patient education/explanatory materials.

We examined the distribution of AOI as a percentage of the total medical consultation duration, comparing the first-time and follow-up patients (Figure 1). In the patients' physical domain, we observed no significant difference between the two groups (first-time patients: 7%, follow-up patients: 7.6%). However, we found a notable disparity in patient education/explanatory materials, with a more than twofold difference: 14.3% for first-time patients, compared to 6.9% for follow-up patients. Conversely, for the patient's chart and clinic room environment (7.4% for first-time patients; 10.4% for follow-up patients) and the patient's face (28.3% for first-time patients; 32.4% for follow-up patients), the percentage was higher for follow-up patients. This finding suggests that the doctor spent comparable amounts of time physically examining patients between the first-time and returning patients. However, there were distinctions in the proportion of eye contact during counseling, patient education, and documentation.

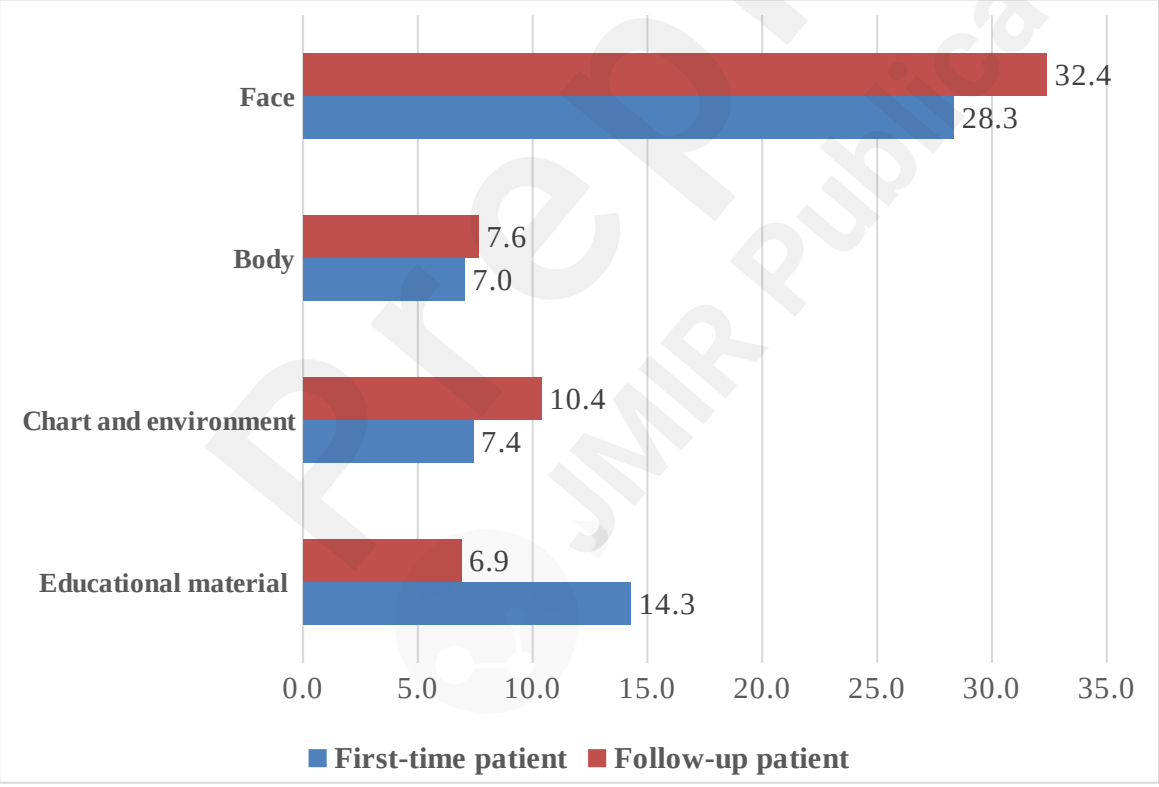

Figure 1. AOI ratios for first-time and follow-up patients.

Heatmap during the Medical Consultation

We used the doctor's eye gaze (fixation) data to create a heat map. Since we created one image for each patient, we had 6 heat maps (see Figure 2). These maps illustrate the distribution of the doctor's gaze fixation position toward the patient. Warmer colors generally indicate higher attention, while cooler colors represent lower attention. Our data show red for high gaze intensity, yellow for

moderate gaze intensity, and green for low gaze intensity. During the medical consultations, most of the doctor's gaze distribution was a long ellipse centered on the patient's mouth (participant Nos. 1, 2, 3, 5, and 6). Remarkably, the doctor's gaze concentrated on Participant 4's mouth and neck, indicating the primary area of pain complaint.

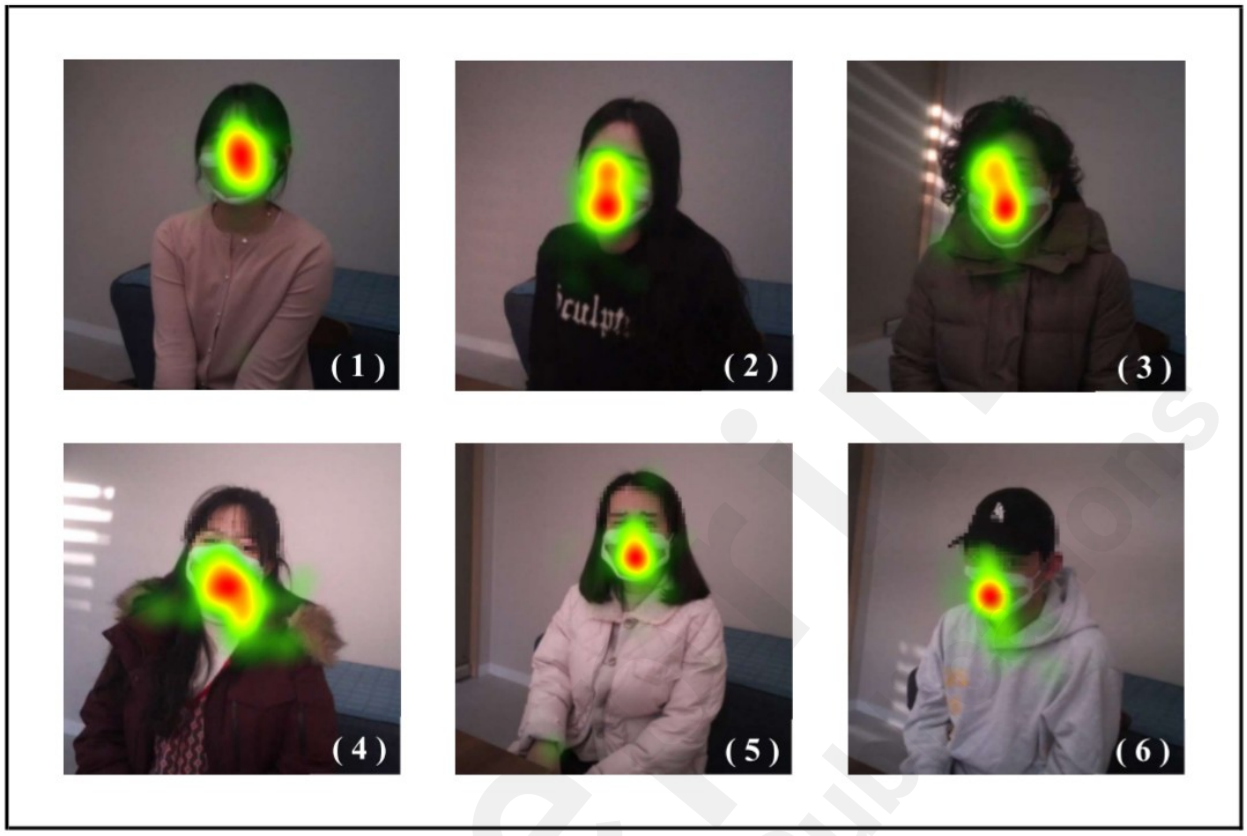

Figure 2. Heat maps of the patients' images.

Post-Medical Consultation Interview

Our analysis of the interview data focused on identifying the verbal and nonverbal behaviors of physicians that may enhance patients' perceptions of empathy during medical consultations. As detailed in Table 3, we discerned 12 distinct themes, organized into 4 subcategories, and further consolidated into 2 overarching categories. These categories represent the patients' perceptions of physicians' clinical empathy, distinguishing between task- and socially oriented behaviors.

Table 3. Factors associated with patients' perceptions of clinical empathy.

Category	Subcategory	Theme
Task-oriented clinical empathy	Presence of task-oriented clinical empathy	Attentively listening
		Offering sincere or active care
		Supplying in-depth explanations
	Lack of task-oriented clinical empathy	Carelessly listening
		Delivering low-quality care
		Inadequate verbal communication
Socially oriented clinical empathy	Presence of socially oriented clinical empathy	Concerning the patient's well-being
		Displaying a kind and polite demeanor
		Providing reassurance
		Understanding the patient's perspective or

Category	Subcategory	Theme
		emotion
	Lack of socially oriented clinical empathy	Inappropriate nonverbal communication
		Impolite manners

First, the task-oriented dimension encompassed clinical empathy rooted in essential or functional medical tasks within the healthcare environment. When patients perceived the presence of task-oriented clinical empathy, doctors exhibited dedication to attentively listening to their patients, demonstrated a sincere commitment to addressing holistic patient needs beyond the completion of medical tasks, and fostered an empathetic environment by delivering thorough, in-depth explanations tailored to the patient's comprehension level. Conversely, the lack of task-oriented clinical empathy became apparent in patients' perceptions when doctors engaged in inattentive listening, delivered care that fell short of the patients' expectations, and demonstrated insufficient verbal communication during the patient-physician interactions. For example, the participants mentioned the following:

- "I believe that when doctors actively listen to patients and truly understand them, it is a way to demonstrate empathy." [Participant 2]
- "I felt a sense of clinical empathy from my doctor when she understood the severity of my pain and took proactive measures in my treatment." [Participant 3]
- During the medical consultation, I discussed my pain with the doctor, but it felt like he wasn't really listening. He spoke as if he already knew everything. I realized that he just wanted to wrap up the consultation, so I couldn't feel any empathy." [Participant 4]

Second, the socially oriented aspect extended beyond the obligatory medical tasks conducted by the doctors in the healthcare setting, encompassing expressions of care and concern for patients and providing comfort. Interviewees expressed perceptions of socially oriented clinical empathy when the doctors considered broader aspects of the patient's health and life beyond the immediate medical issue, when the interaction respected the patient, when the doctors conveyed positive attitudes and words of encouragement regarding their patient's recovery, and when the doctors actively sought to comprehend the patient's perspective and feelings about their situation. In contrast, in interactions lacking socially oriented clinical empathy, the doctors exhibited inappropriate nonverbal communication or unkind and rude behavior toward the patients. For example, patients said the following:

- "Doctors' friendly attitude and commitment to patient care are crucial in clinical empathy." [Participant 1]
- "When my doctor noticed that I had to go to work even though I was sick, he showed concern for me and offered encouraging words about my recovery; it made me feel that he empathized with my situation." [Participant 5]
- I shared my new symptoms with my doctor. However, I didn't perceive any moments of empathy because the doctor solely focused on the computer monitor and prescribed medication without asking any questions." [Participant 6]

Discussion

In this study, we collected eye-tracking data from doctors during actual medical consultations. We analyzed the data alongside the doctors' self-reported empathy scores and the empathy scores assigned to the doctors by their patients. From these data, we derived three interesting implications.

First, the analysis showed that the doctors demonstrating higher levels of clinical empathy tended to focus their gaze more on the facial areas of the patients during the consultations. This finding aligns with the outcomes of various prior studies [21–23]. Scholars have identified the additional gaze frequency or time that doctors spend observing patients' faces as a crucial element in enhancing patient satisfaction and the overall quality of interactions between doctors and patients [23–26].

Second, our observations regarding facial interactions highlight a distinct emphasis on the patients' mouths. The heatmap analysis indicated that the doctors demonstrating higher levels of clinical empathy showed a vertically elongated oval pattern of gazes centered around the mouth. This pattern suggests visual behavior, underscoring the importance of focusing on the patient's story. We interpret the preference for looking more at the patient's mouth than eyes as an effort to understand the patient's narrative. This approach, often referred to as lip leading or speech reading, is not exclusively for individuals with hearing impairments but is also a natural communication strategy in general [27]. Studies have previously demonstrated that speech perception improves when combining auditory input with visual speech reading instead of relying solely on auditory cues [28].

Additionally, the high scores that doctors received—4.83 out of 5—on the third item of the CARE tool, which queries whether "the doctor listened attentively to me," suggests that the doctors paid significant attention to reading their patients' lips to enhance their active listening skills. The interview data further reinforced that patients value empathetic behavior, particularly "active listening," as a critical component of clinical empathy. Nonetheless, we need further research to delve deeper into the nuances of doctors' listening behaviors and attitudes.

Last, regarding the cultural characteristics of East Asia, it is important to consider these as a contextual backdrop to the observed behaviors. For instance, scholars acknowledge "eye contact" as a key component in social cognitive processes across different cultures [29]. For example, while Western cultures often perceive avoiding eye contact negatively, it is not necessarily viewed negatively in Eastern cultures. Research conducted by Senju et al. has identified differences in the duration of gaze fixation on the eyes and mouth based on cultural background [30]. In East Asian cultures, nonverbal communication and the subtleties of empathetic engagement may differ significantly from Western norms, potentially affecting how medical professionals engage with patients. Understanding these cultural dimensions is crucial in interpreting the implications of gaze patterns and empathetic listening in clinical settings. Further exploring these cultural specifics could provide deeper insights into observed visual attention behaviors and their impact on doctor–patient interactions.

Conclusions

This proof-of-concept study demonstrates the potential to enhance our understanding of clinical empathy beyond traditional reliance on self-reported data. By integrating triangulated data sources, including quantitative eye-tracking, the Jefferson Scale of Empathy–Health Professions (JSE-HP), the Consultation and Relational Empathy (CARE) measure, and qualitative patient feedback on perceptions of clinical empathy, we underscore the multifaceted nature of clinical empathy, which encompasses task- and socially oriented dimensions. Our findings suggest that future research on clinical empathy, whether theoretical or practical (e.g., empathy development training for doctors), should address these complex characteristics. Consequently, this study advocates for a dual-focused approach in the education and training of medical practitioners, emphasizing the importance of developing both aspects of empathy.

Abbreviations

CARE: Consultation and Relational Empathy
JSE-HP: Jefferson Scale of Empathy-Health Professionals

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