Professional Identity Formation in MEDical Students: a scoping review (PIF-MEDS)

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Abstract

Objectives:

Professional identity formation (PIF) in trainee doctors is the process where one's personal identity is merged with the values, norms and characteristics of a physician. The result is an individual that still retains his own personal identity, yet thinks, acts and feels like a physician. Where in the past PIF was a mere by-product there now appears to be a shift towards making professional identity formation a primary objective of medical education.

In this scoping review we aim to map out the different factors that influence PIF in medical students. Ultimately, we want to aid faculty and curriculum designers in reworking their education program, taking on a more active role in promoting PIF.

Methods:

A scoping review was conducted in accordance with the PRISMA scoping review guide and checklist, using the PubMed, Embase and Web of Science databases.

The data was charted, analysed, and filtered through a process of iteration. 17 Subthemes were identified.

Results:

A total of 2901 unique articles were identified, screened, and assessed for eligibility.

A total of 171 sources were deemed relevant of which 46 did not have a full text available for retrieval. A total of 125 records were included in this scoping review. Articles were charted and grouped according to 17 subthemes based on their main focus.

Conclusion:

Research on PIF has obtained much attention in the past decade. Faculty and curriculum designers adjust their curriculum and education programmes, with the goal to focus on more patient centred care, student wellbeing and their professional identity formation.

In our scoping review an effort was made to map out the different influences on PIF and assist educators and faculty in this process.

Our digging through articles surfaced a topic called "the hidden curriculum", something we were not aware of during our own time as a medical student and trainee.

Conversely, educators and faculty should take care not to be too involved and controlling in the process of PIF; a thin line to be walked. Further research is needed to determine in what ways the curriculum can be adapted. Remediation in cases of lapse in PIF is also lacking research.

We propose to give students a roadmap throughout their curriculum, giving purpose and background to the multitude of reflections and professionalism courses, giving them a handle on their PIF.

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Introduction

Rationale

The concept of professional identity was first established in the 1970's with a limited number of publications. More recently, in the late 2000's, there was a revival of the subject. Since then, there have been ample publications regarding professional identity formation (PIF) and professionalism, in no small part as a response to declining mental health and an increase in unprofessional behaviour in physicians and healthcare personnel.

Professional identity in physicians can be seen as the result of merging one's personal identity with the values, norms and characteristics of a physician, resulting in an individual that still retains his own personal identity, yet behaves and feels like a physician. This process is called PIF and occurs largely during medical education.

While the formation of a professional identity was previously more of a by-product of medical education, there now appears to be a shift towards making PIF a primary objective of said medical education. To assist students in forming this professional identity, we need to fully understand this process and the multitude of factors influencing it.

Objectives

In this scoping review we aim to map out the different factors that influence PIF in medical students, giving an overview of the current literature regarding this subject, so that the areas where literature is lacking can be identified.
Ultimately, we want to aid faculty and curriculum designers in reworking their education program, taking on a more active role in promoting PIF.

Methods

Originally, we set out to create a systematic review regarding the subject of PIF in medicine students. However, as we progressed our search for information and data acquisition, we found that the subjective nature of the subject, as well as the heterogeneity of our data, did not lend itself for a systematic review. After extensive consultation with Nele Pauwels, the information specialist associated with the research support centre of the UGent faculty of medicine, in addition to our (co-)promotors, we decided that a scoping review would be better suited for this subject.

Protocol and registration

For this scoping review, we have used the PRISMA scoping review guide and checklist to provide us with a general structure and protocol [1, 2].

Eligibility criteria

The eligibility criteria we have used can be found in table 1. The subject of PIF has first been established during the 1970's with a limited number of publications. Starting from the late 2000's, however, there has been a newfound interest in the subject. As such, most of the publications regarding this subject are relatively new and we have not imposed an age limit to the sources of evidence.
Additionally, PIF should be the main focus of the evidence source, with medicine students being the population. This includes undergraduates, post-graduates, pre-graduates, clerkships, internships and

fellowships. Non-physician healthcare students are excluded, as well as physicians that have graduated and are no longer enrolled in any form of formal education.

	INCLUSION CRITERIA	EXCLUSION CRITERIA
POPULATION	MED SCHOOL STUDENTS	GRADUATED PHYSICIANS NO LONGER ENROLLED IN ANY EDUCATIONAL PROGRAM, NON-PHYSICIAN HEALTHCARE STUDENTS
SUBJECT	PIF IS MAJOR FOCUS	
AGE	ANY	
LANGUAGE	ENGLISH OR DUTCH	ANY OTHER LANGUAGES
STUDY DESIGN		CASE REPORT OR CASE STUDY

Table 1: inclusion and exclusion criteria

Information sources

An initial search, using a preliminary syntax, was carried out in the Cochrane Library, PubMed, Embase, PsycNet and Web of Science (WoS) to identify the databases with the highest number of relevant articles. The syntaxes used for these initial searches can be found in appendix A. The Cochrane Library and PsycNet database only yielded 12 and 26 results respectively and were therefore not used in our full search strategy. Embase, WoS and PubMed yielded 1594, 1224 and 1163 results respectively using the preliminary syntax and were thus identified as the most promising databases or libraries.

Search

A more extensive syntax was produced for each of the databases, with no imposed limits. The syntax used for our Embase search strategy can be found below:

> (professional OR 'professional s' OR (professional AND ('s'/exp OR s)) OR 'professionalism'/exp OR professionalism OR professionality OR professionalize OR professionalized OR professionalizing OR professionally OR professionals) AND (identities OR 'identity'/exp OR identity) AND ('medical student'/exp OR 'medical student' OR (medical AND ('student'/exp OR student)) OR 'med school student'/exp OR 'med school student' OR (med AND ('school'/exp OR school) AND ('student'/exp OR student)) OR 'med student'/exp OR 'med student' OR (med AND ('student'/exp OR student)) OR 'medical school student'/exp OR 'medical school student' OR (medical AND ('school'/exp OR school) AND ('student'/exp OR student)) OR 'medical students'/exp OR 'medical students' OR (medical AND ('students'/exp OR students)) OR 'student, medical'/exp OR 'student, medical' OR (('student,'/exp OR student,) AND medical) OR 'students, medical'/exp OR 'students, medical' OR (('students,'/exp OR students,) AND medical))

This search string yielded 2150 results. The syntaxes used in WoS and PubMed can be found in appendix B, which produced 1534 and 1088 results respectively, with a combined total of 4772 results. The last search was performed on the 28th of November 2022.

Selection of sources of evidence

The sources of evidence obtained were imported into the Rayyan research tool for further processing. Removal of duplicates was performed by the two reviewers, Callant Jonas and Wim De Kimpe, after which 2901 unique evidence sources were withheld.
Subsequently, the two reviewers evaluated the titles, abstracts and full text (if necessary) of the

same 2901 sources of evidence, blinded, for relevance using the Rayyan tool.
Afterwards, blinding was lifted and any disagreements on in- or exclusion of these sources were resolved through discussion and consensus by both reviewers.

Data charting process

The two reviewers developed a data-charting form to resolve the variables that needed to be extracted. The data was subsequently charted by the two reviewers and, through a process of iteration, was updated continuously.

Data items

The variables that were included in the data chart were as follows: Author, title, year of publication, objective/aim of the study or article, insights gained and population size if applicable. The Data chart can be seen in appendix C/data chart below.

Synthesis of results

Through discussion and consensus with our promotor and co-promotor, the subject of PIF was analysed and a number of subthemes were identified. Note that the topic of professional identity formation is particularly broad and faintly delineated. Accordingly, there is a varying degree of overlap between the subtopics. An overview of these subtopics can be seen in table 2. The 125 evidence sources were analysed and categorised into these subthemes. Note that the universal subtheme was used to encompass all sources that deal with PIF in a broad and overarching way and thus cannot be categorised into subthemes.

SUBTHEME	
ARTS	INTERNATIONAL ELECTIVES & CULTURAL DIFFERENCES
COMMUNITY-BASED EDUCATION	NARRATIVE MEDICINE
COVID	REFLECTION
CRITICAL EVENTS	ROLE MODELS & MENTORS
DISSECTIONS	SIMULATION
DIVERSITY	SOCIALISATION
(EARLY) PATIENT CONTACT	TRAINING & WORK BASED LEARNING
EXPLICIT LEARNING	UNIVERSAL
HIDDEN CURRICULUM	

Table 2: overview of subtopics

Results

Selection of sources of evidence

A total of 171 sources were deemed relevant. Of these 171 sources of evidence, 46 did not have a full text available for retrieval. A total of 125 records were included in this scoping review. An overview of the selection and processing of the evidence sources can be found in figure 1 below.

Characteristics of sources of evidence

The different subthemes of PIF can be seen in Table 2 above. For a more detailed explanation of the various subthemes, we refer to the synthesis below.

A comprehensive data chart, including the characteristics of each evidence source, can be found in Appendix C/data chart.

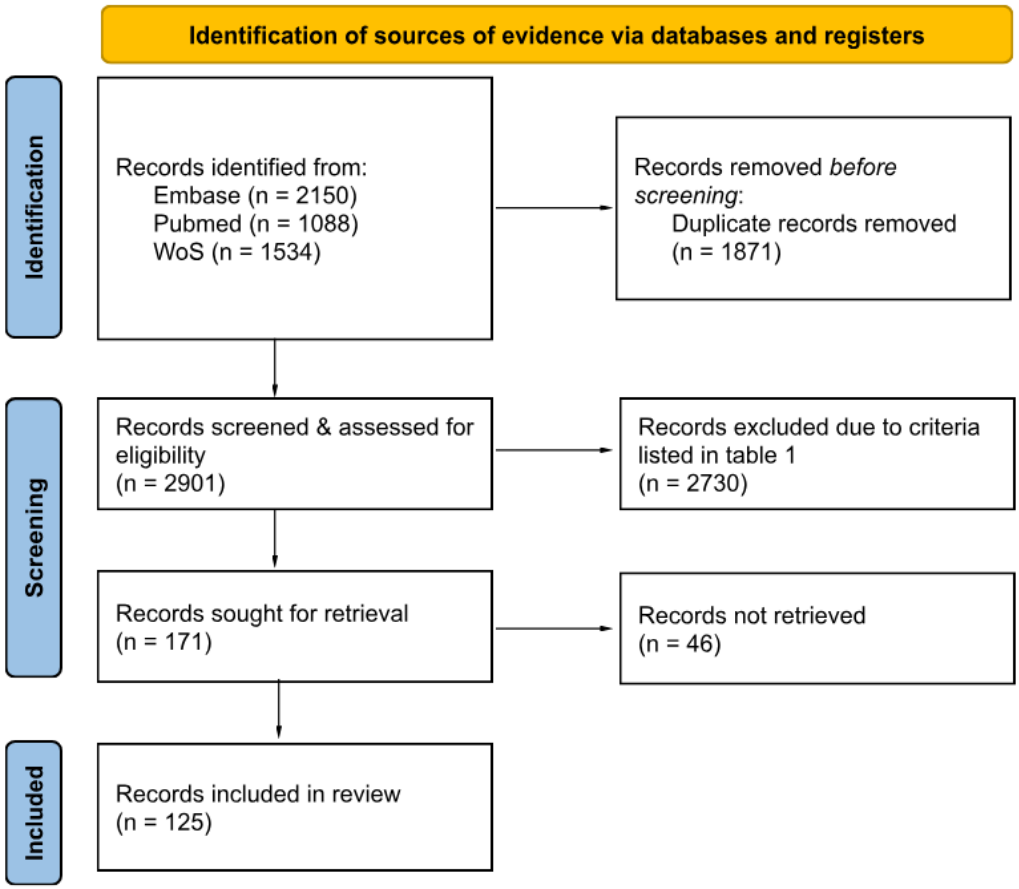


Figure 1: Overview of the selection and processing of evidence sources. Adapted from [2].

Results of individual sources of evidence

An overview of the individual evidence sources, along with their relevant outcomes, can be seen in Appendix C/Data chart.

Synthesis of results

Arts

Aluri et al. have performed a qualitative analysis of written reflections of 10 students, made after a course focussed on visual arts. They found that the arts-based curriculum, as well the reflection writing, did indeed encourage PIF formation. Aluri et al. state the following: "These themes addressed core components of PIF: introspection, emotional awareness, self-assessment and contemplation of role transitions." They further state that such a course promotes vulnerability and care-seeking behaviour and that the educators involved in these programs should be trained to respond in an appropriate way [3].

Michael J. Green has performed a thematic analysis of 58 student-produced comics, as well as a pre- and post-program assessment, and found that the students enrolled in the comic-creating course do believe that this creative process can indeed promote PIF [4].

In a course that utilised mask making and written narratives from students, Joseph et al. have selected four masks and narratives that provide the most insight into the students' PIF. They suggest

that the process of mask making, accompanied by narratives, can provide educators with the means to identify students that experience a conflict between the different aspects of their own identity, or identity dissonance, and can aid said educators in providing appropriate interventions to combat this identity dissonance [5]. Shapiro et al., using a near-identical study design, identified 12 usable masks and their accompanying narratives. A similar overarching theme was described [6]. Stephens et al., applying a similar setup to a larger population of several hundred students, identified role strain, burnout, isolation and identity dissonance as the most prevalent themes among the students [7]. Stephens et al. later applied this setup to a smaller population, but with an iterative, yearly mask making exercise. Five students completed the process, with the previously mentioned themes again emerging [8]. Next, M. Stephens analysed the mask making of 5 medical students, after they were asked to make a mask on a yearly basis, totalling 5 masks per student. Additionally, they were instructed to review and evaluate their iterative mask making process. Imposter syndrome was identified as the most common, recurring theme by the researcher, as well as by the students [9].

H. Korkmaz and Y. Senol have focussed on the use of metaphors in first year medical students and asked the 148 participants of their study to produce a physician related metaphor. This yielded 71 eligible results, which could be divided into six themes. Students either see the physician as a figure of kindness, a superior figure, a symbol of prestige, a health care provider, a cooperative leader or a knowledge provider. These insights can help educators identify the personal beliefs and values of students, as well as how they perceive their role as a medical student or future physician. Alternatively, the metaphors chosen by the students can make them aware of how their own role perceptions and initiate a change in their professional identity [10].

In a study evaluating the effects of mask making, poetry and comics, Shapiro et al. enrolled 94 medical students into one of these art making groups. They found that the mask making was perceived as more relaxing and fun, conveying more positive emotions, while the literary arts were perceived to stimulate reflection about their professional lives as well as critical events. Identity dissonance was identified as an overarching theme. Furthermore, Shapiro et al. found that students that were allowed to choose an art form had enjoyed the course significantly more than students that were not allowed to choose [11].

Community-based education

Ahmad et al. have evaluated the effects of community-based education (CBE) on 21 medical students and found that a CBE does indeed aid PIF. An evolution in soft skills, personal values and professional skills, as well as a further development of the students' research skills, were noted as positive effects of the CBE [12].

Beck et al. found similar results during an evaluation of nine medical students' experience doing voluntary work at a camp for children with special needs. They found that participation in the program did indeed promote PIF through improving awareness and communication skills, as well as increasing the students' confidence [13]

COVID-19

Ali et al. have analysed reflections of 26 volunteering medical students during the COVID-19 pandemic and noted that the experience did prove to be beneficial to PIF. They state the following: "Major areas of development included communication, teamwork, compassion and altruism, which are not easily developed through the formal curriculum." However, some students also admitted difficulty coping with the extraordinary situation [14]. During a large cross-sectional survey involving 244 040 medical students in China, Yu et al. discovered a similar positive impact on the professional identity of medical students. Nevertheless, when the medical students' parents were active healthcare workers as well, this appeared to exert a negative influence on PIF in the students [15].

Yang et al. have focussed more on the effects of the global pandemic on career choice and PIF with a survey of 6 226 Chinese medical students. They have established that for the gross majority, PIF and career attitude was not affected or even increased. However, a smaller percentage of students did suffer from a sense of career uncertainty and reduced PIF. This was especially the case in students that did not have a supportive social network, suffered from anxiety, showed symptoms of depression or were in a higher grade. Furthermore, post-COVID outbreak surveys showed that 37.0% of the medical students experience symptoms of depression, while 24.9% suffered from anxiety [16]. Lai et al. have performed a similar study exploring PIF in 635 medical students during the pandemic, finding markedly higher levels of PIF, mediated through a more profound understanding of medicine. However, PIF was found to decrease with grades, with the authors contributing this to high amounts of pressure and a long education cycle [17]. Additionally, a similar study by Luman et al. found that the pandemic did disrupt medical education. Twenty students reported that the interruption of hands-on experiences and courses were challenging. They did not, however, find a statistical significant increase or decrease in PIF [18].

Alternatively, the COVID-19 pandemic has necessitated a transition of on-site or live courses to an online format. The effect of this forced transition was studied by Darici et al., comparing examination results of 1326 medical students. They noted that online-only courses were accompanied with a decrease in PIF, as well as increased stress levels in students and a reduced amount of knowledge retention [19].

Moula et al. studied the effects of the pandemic on 155 medicine students, finding that there was indeed an increase in PIF, with the students developing various coping strategies and creative outlets for their emotions, as well as them becoming more aware of their own role, needs and priorities. However, there was also an increase in mental health challenges. They suggest that educators should implement adequate support systems to help students deal with these types of uncontrollable stressors [20].

Critical events

Ackerman et al. reviewed the reflections of 41 interns on critical events and found that there are six major themes to be found: connections, life balance, managing expectations, facilitating teamwork, confidence and emotional responses. Negatively experienced critical events were evenly distributed among these themes, while critical events that were experienced as positive were generally within the themes of confidence and connections. The researchers state that a critical incident can be either promoting or inhibiting of PIF, regardless of whether it was positive or negative, and that this is largely contributed to the intern's degree of awareness of their own insights. They propose that educators should implement more tools and exercises to allow medical students to deal with these incidents purposefully [21]. Similarly, Ribeiro et al. set out to identify the nature and impact of moral dilemmas in medical school, analysing the interviews of 13 students and found 4 themes: conflicting moral values, conflict between current and desired attitudes, conflicting ethical principles and external limiting of moral action. They state that moral dilemmas are highly impactful experiences that could be beneficial to PIF if educators can find meaningful ways to guide students during these events [22]. Using an analogue study setup, Peterson et al. analysed 173 student reflections of their struggles or dilemmas. The process of identifying these challenges and finding solutions to them is an important part of PIF, while not doing so increases risk of burnout. Educators and mentors can help students in this process through reflection and discussion [23]. Similar findings were found by Ratanawongsa et al., who interviewed 28 students regarding their experiences with dying patients and end-of-life care, finding that the strong emotions associated with death, as well as the identification of, and finding solutions to, these challenges have a positive impact on PIF, depending on the personnel's enthusiasm and skills in teaching and empathy [24]. A study by Fredholm et al.,

including authentic experiences of 15 students, found likewise results, further underpinning the importance of authentic experiences and faculty and personnel interaction during these events [25].

White coat ceremonies (WCCs) are a prime example of a significant critical event in medical school, as they are used to signify the start of the transformation from student to physician. Bidwell et al. analysed 43 surveys after such a WCC, concluding that 79% of the students see the event as critical for PIF [26]. In a similar fashion, Sorrell & Ibrahim analysed the impact of wearing professional attire on PIF in 21 students and found that wearing scrubs does appear to promote PIF, which can be further enhanced through discussions with educators and mentors [27].

Bhat et al. applied the threshold concepts (TC) theory to the critical events of 17 medical students, stating that the critical events can be seen as a sort of threshold which the students need to overcome in order to further advance their professional identity. These concepts can be used to guide the students more effectively, since different students can struggle with different TCs. As such, the researchers propose that the TCs be incorporated into assessments of students [28].

In an analysis of the shameful experiences of 16 students, Whelan et al. found that all students had experienced these events to varying degrees. These shame experiences were mostly brought on by clinician behaviour and triggered highly detrimental emotions in the students, such as anger, loss of motivation and anxiety. There were no shameful experiences associated with a positive effect on PIF. They propose to make educators and clinicians more aware of the effects of shame, since clinicians are found to have limited awareness of the impact of shame on medicine students [29].

The critical incident technique (CIT) is a method to identify the outcomes of a critical incident, depending on the context of said incident. Y. L. Lin implemented a short course using CIT as a teaching tool to foster PIF. This course was completed by 30 students, with 77% of them evaluating CIT as an effective teaching strategy to promote PIF [30].

Dissections

Madill & Latchford explore identity change in medical students over their first year of medical training, particularly in relation to their experience of human dissection. Repertory grids were filled in by 4 first year students in medical training in a large university in the north of England at 2 specific moments before and after the dissection exercise in the first year. Analysis suggests a process of enculturation as a medical student. The main theme to emerge from the data on the students' experience of human dissection was 'involvement' [31].

In an op-ed article, Pawlina expresses his belief that basic sciences, including anatomy should play a bigger role in teaching professionalism and in developing the PIF and that this process should commence as early as possible [32].

Shojaei et al. suggest that, despite being one of the fundamental pillars of medical knowledge, anatomy has been pulled back as a simple course in the preclinical period. This while it could be tool for early transition into responsible and resilient professional physicians. Based on analysis of semi-structured interviews with 24 participants selected from year 1 to senior interns and 12 faculty from 9 Iranian Universities of Medical Sciences, they constructed a three-step educational model called the blacksmith approach [33].

Diversity

In a scoping review and metasynthesis performed by Volpe et al., they established that while it is evident that one's background plays a role in PIF, the literature on this subject is lacking. Only a limited number of studies analysed the role of race, socio-economic status, gender, age and sexual

preferences. The studies that do look further into the issue seem to agree that students not fitting into the white male majority have more difficulties developing their professional identity [34].

Frost & Regehr wrote an article in which they present a critical review of medical education literature on the discourses of diversity and standardization, demonstrating the tension between them. Medical education suggests that there is only one way to be a competent physician, yet there is a large diversity among medical students. They propose that educators and faculty recognise and use this tension to help students develop their professional identities [35].

(Early) patient contact

Barr et al. explored the impact of patient encounters in 67 medicine students, finding that patient contact changes the focus of the curriculum from diagnosis and problem-solving to patient centred practice. The most effective way to influence education an emphasise patient centredness is to implement longitudinal patient contact early on in the curriculum [36]. A statement that is shared by L. Brandt, since early patient encounters are greatly beneficial to communication skills [37]. Schei et al., evaluating the impact of early patient contact on PIF in 28 students, note that while early patient contact can serve as a trigger for PIF, it can also trigger emotional responses with negative affect and lead to uncertainty in the students, advocating the need for adequate support from faculty staff [38].

Longitudinal integrated clerkships (LIC) are a form of curriculum where the students follow a patient over time, across different disciplines and with repeated contact with the patient. Konkin & Suddards evaluated the impact of such a LIC on PIF in 25 students and found that they do indeed promote PIF. They state the following: "students are learning to care: to advocate, to empathize, to attend to needs, however small; in other words they are learning to be receptive and responsible." LIC give students the opportunity to develop a relationship with patients in a supportive environment [39]. In an analysis of 56 student essays, Roper et al. note that early patient contact is identified by the students as the most influential to PIF, providing opportunities to engage in authentic learning experiences and practice empathic communication with patients [40]. Trying to identify the most influential factors impacting PIF, O'Doherty et al. interviewed 9 students and also found similar results, further cementing the importance of early patient contact and LIC [41]. Studying the effects of early patient contact on PIF, Orsmond et al. reviewed the reflections of 10 students and found comparable results [42]. Likewise, A. Vågan researched the effects of early communication skills training on PIF in 10 students. Conversely, while Vågan does agree that the course stimulates PIF, the effect seems to be limited by the uncertainty and insufficient medical knowledge of the students this early in the curriculum [43].

Schrewe et al. analysed 20 case presentations and 14 sign-over rounds from students in a paediatric ward. They found that patients in a paediatric ward are mostly conceptualised as principally biomedical entities and a key resource for education. They underline the tensions of an education that wants to promote patient centredness with the reality of patients not being seen as a person, but rather as a disease or educational commodity, and propose a re-conceptualisation of patients to help promote PIF [44].

Explicit learning

In a review evaluating how different medical schools teach professionalism formally, Byszewski et al. note that there is a shift towards more informal methods of PIF promotion, for example through role models, clerkships and clinical experience. There are, however, still formal methods in place that use essays, reflections and teaching modules regarding professionalism, often using the CanMEDS roles. A total of 14 medical schools responded [45].

Buck et al. have tried to map the effects of a course giving explicit training in PIF on 200 students through feedback and reflection. They found that this voluntary course, named the Physicians Healer Track (PHT), helped develop confidence, coping mechanisms and personal growth in students, there was also an increase in humanistic skills and PIF [46]. A similar curriculum design was evaluated by Lawrence et al., reviewing the surveys of 92 enrolled students. They note that 57.6% of the students experienced a positive effect on empathy towards other students and 50% experienced a positive effect on empathy towards patients. Mental health markers were reportedly increased in 25 to 30% of students, and the majority of students reported an increase in their PIF [47].

Volpe et al. investigated the effect of a medical humanities curriculum on PIF in 22 students, with similar results, being an increase in PIF [48]. Studying the effects of a formal curriculum paired with shadowing experiences, Merlo et al. found comparable results in 135 students [49].

Bhatia-Lin et al. designed a 2-hour professionalism module, prompting 181 first-year students to reflect about one aspect of their personal identity that they would like to protect during their education. They found that the module triggers students to think about their professional identity and supports them during their PIF [50].

Chandran et al. present an integrated evidence-based approach to enhance PIF among trainees and faculty at Renaissance School of Medicine at Stony Brook University [51].

Also at the Faculty of Medicine at Universitas Indonesia, in a study, a formal course with multi-modal activities is installed that has high potential in supporting PIF and professional development among undergraduate pre-clinical medical students, as well as remediating their lapses in professionalism. Challenges to implementing the course with a larger cohort have been considered, and studies documenting the long-term impact of this model are required [52].

Hidden curriculum

D. Blouin used the surveys of 13 residents to identify the extracurricular influences impacting PIF. They identified interpersonal relationships with peers or faculty as an important factor influencing PIF. While these interactions outside of curriculum have a mostly positive impact on PIF, Blouin found that there can be a negative influence on PIF as well. Especially when professional boundaries are challenged and there is a resulting lapse in feedback and teaching from faculty members [53]. A similar study was performed by Park & Hong, interviewing 20 medical school students about how their professional identity evolved over time and what role the hidden curriculum plays. They confirmed that these students had to go through a conflict of their individual and professional values, merging them into a new identity. The most important factors identified by the students were role models, as well as patient contact, confirming that the hidden curriculum during clinical experiences plays an important role in PIF [54].

Brown et al. tried to determine which factors of the hidden curriculum play a role in medical student development, using interviews from 39 students and 14 faculty members. They found that positive experiences in the clinical environment can promote PIF through acting as a hidden curriculum, yet negative experiences, if reflected upon properly, also have the possibility to promote PIF to some extent. Of course, there is a limit to this positive effect, as the mistreatment of students is well established as detrimental to PIF. They suggest that further faculty training should make them aware of the role they play as a role model, as well as help students negate any lasting negative impacts of negative experiences.
Additionally, the researchers found that efforts from faculty to establish professional attributes and a concept of professionalism in a top-down manner are experienced by students as restrictive to their own personal identity. Furthermore, organisational culture and institutional agenda results in a

negative impact on PIF, as this is seen by the students as hierarchical and a way to control the students. Transparency regarding this hidden curriculum through clear communication from faculty, as well as taking into account feedback from students, could be critical in preventing these feelings of aversion and limit the negative effects on PIF [55]. These findings confirm what Chuang et al. discovered in an earlier study, where they reflected on the hidden curriculum and its impact on PIF through reviewing the relevant literature. They affirm the following principles to help faculty and educators improve the hidden curriculum: "professional behaviour can be altered. The hidden curriculum should be addressed regularly throughout medical school, but particularly during orientation and transitions. Self-reflection, structured or unstructured, influences personal and professional growth and the hidden curriculum. Role modelling is the primary way an individual affects the hidden curriculum. Any effort to maximize the positive impact of the hidden curriculum is valuable; however, ideally change should be implemented and supported at the institutional level [56]." This was also the conclusion of Hafferty et al., analysing PIF in physician trainees from a military standpoint [57].

A model of the hidden curriculum, including the factors that influence it and how it can be managed, was proposed by Yazdani et al. The different factors influencing PIF are identified as environmental factors, human factors, as well as the formal curriculum. In order to manage the hidden curriculum, they propose to control these factors, as well as the learners or students themselves. An overview of their model can be seen in their article [58].

International electives & cultural differences

Hayashi et al. have evaluated the long-term impact of international electives on 23 students, concluding that cross-cultural work done during these electives does indeed promote PIF [59]. Similarly, Sawatsky et al. collected reflections from 377 students that participated in international electives and explored how this led to transformative learning and impacted their PIF. Their discoveries were twofold, they state the following: "Five components of transformative learning were identified: a disorienting experience; an emotional response; critical reflection; perspective change; and a commitment to future action. Additionally, three domains relating to professional identity were identified: making a difference; the doctor–patient relationship; and medicine in its purest form." They confirm that international electives do trigger PIF, as well as provide meaningful experiences for medical students [60].

Conversely, Helmich et al. researched the differences in how Dutch and Taiwanese students reflect on their experiences, evaluating the impact of cultural difference on PIF. 22 Students were sampled and their reflections compared. The researchers found a marked difference in how the students perceive physicians and patient autonomy, leading to different professional identities due to these cultural differences [61]. Similarly, Gilligan et al. compared how 167 Australian and 188 German students perceived ideal doctors, themselves, as well as real doctors. They found that while there was no difference in the perception of the ideal, there was a difference in the perception of the real doctor as well as their own image [62]. These studies confirm a reflection Helmich et al. made earlier, where they elaborated on the impact of cross-cultural experiences on PIF, stating that norms and values differ from culture to culture and lead to the development of context-specific professional identity [63].

Narrative medicine

Storytelling is one of the oldest and most common forms of communication. As such, narrative medicine is based on the principle that people are inherently storytellers and hopes to promote interpersonal relationships between patients, physicians and students. The process helps doctors and students identify, explain and act on other people's problems through storytelling, triggering reflection and leading to an increase in soft skills and PIF [64-68]

Huang et al found from data analysis of semi-structured interviews with 30 Taiwanese 3 (interrelated) mechanisms that can explain PIF from narrative reflection: self-exploration (you write about yourself), reflection (you turn the clinical situation into a story) and awareness of professional identity : "humanistic medicine is like a small garden in your heart, and this unpleasant situation or another, the bad attitude or a difficult family are like the storms trying to smash your garden. And humanistic medicine is like, like the sun, or something else. It reminds you that you still have to … you still have to keep some basics in the medical field, which is your original intention. You are responsible to these people."
Further they found that narrative medicine resulted in empathy, communication and doctor-patient relationship, all attributes of humanistic medicine [64].

Khoo et al recognized the limitations of explicit teaching of professionalism. They studied an online forum, named Letters to Residents, where faculty members could periodically share personal reflective narratives via email. Residents reported that narratives, if written by authors who were recognized as role models, triggered the processes of reflection and socialization; were more effective in provoking reflection if they resonated with residents' experiences; inspired them to follow how their role models reflected on and coped with challenges; and influenced the culture of the workplace, impacting the residents' daily experiences and leading to socialization and development of their professional identity [65].

Miller et al. dived into transcripts of focus group discussions amongst 130 participants on completion of an intensive half-semester of narrative medicine seminars. The readers were "deeply moved and surprised by the results of this study. The students' spontaneous conversation, complex and challenging yet generous and gentle to each other, demonstrated their ability to enter discourse with those with whom they might disagree, to appreciate other points of view, and to not feel personally threatened by other opinions—all qualities that students specifically commented on in reference to their NM seminars."
Students recognized the clinical salience of what they had undergone in their seminar, it made them listen better, discover more and report in a more nuanced way what patients tell them. Among others, they also learn to feel more affiliation with colleagues and patients, experience personal growth, made the more attentive, made them stronger representatives and find even more pleasure in being a doctor, all important aspects in PIF [66].

Reflection

Clandinin et al. have developed a pedagogical strategy by engaging family medicine and internal medicine residents in writing so-called parallel charts of their experiences and subsequently engaging them in small-group shared inquiry into the charts. Their paper draws on the transcripts of the discussions of 1 specific student and her reflections on how to become a "good doctor". It shows that professional identity is shaped over time, over multiple landscapes, and is always in the making [67].

Cunningham et al describe a similar reflective writing portfolio at a Columbian university, to provide a safe, purposeful, exploratory reflective space in which students may grow and share. To enhance the longitudinal scope and to augment the benefits of reflective writing within this portfolio, they designed an end-of-semester meta-reflection assignment called the Signature Reflection. In those, 2 main themes were identified: recognition, that is heightened awareness of their own attributes and empathy, and "grappling" or in other words: different aspects of change and uncertainty. The students' writing of their Signature Reflection allows their perceptions of who they are and who they are becoming to surface and be captured in permanent form [68].

Wong & Trolope-Kumar did an exhaustive reading of 604 reflections from 65 students to retrieve influencing themes of PIF. Many of the themes mentioned in this review, such as role models, explicit curriculum and patient encounters also appear from these readings, meaning that reflective writings provide a window on the dynamic, discursive and iterative nature of PIF [69].

Similarly, Hatem & Halpin describe the "becoming a physician" curriculum at the university of Massachusetts and students' essays on "becoming the doctor that I want to become". During this writing exercise they reflect on experiences during their principal clinical year that make them feel like doctors. Authors suggest that PIF can be looked at as a developmental process arrived at through reflection, that will move learners from the expectation of changing their behaviours to changing their very identity [70].

According to Kumagai et al., the reflective space requires three qualities: safety and confidentiality, an intentional designation of a time apart from the distractions of daily life for reflection and dialogue, and an awareness of the transitional nature—the liminality—of a critically important period of professional identity development. In this open space of reflection and dialogue, one's identity as a humanistic physician takes form [71].

In their paper "Professional Identity Formation in Medical Education for Humanistic, Resilient Physicians. Pedagogic Strategies for Bridging Theory to Practice", Wald et al. present three pedagogic innovations contributing to the PIF process within undergraduate and graduate medical education (GME) at their institutions: (1) interactive reflective writing, (2) synergistic teaching modules about mindful clinical practice and resilient responses to difficult interactions and (3) strategies for effective use of a professional development e-portfolio and faculty development of reflective coaching. Research on effectiveness of these innovations is at its infancy [72].
In a separate Commentary paper, the main author offers background reading on key elements in PIF, including guided reflection, use of personal narratives, integral role of relationships and role modelling, and community of practice. They are viewed through various lenses of PIF theory and pedagogy [73].

Vaizer et al. used analysis of written reflections to explore if community embedded discussions with local community members reshape the social imaginary of medicine among students and contribute positively to their professional identity. This explorative, qualitative study involved 35 first-year medical students who volunteered to attend a 2-hour forum at a local church to ask community members about their experiences with doctors and healthcare systems [74].

Tan et al. carried out a systematic scoping review on the use of medical student portfolios (MSPs). They found a variability in the employ of MSPs as a result of a failure to recognize its different roles and uses. Additional roles are proposed, promising a holistic, authentic and longitudinal perspective of the medical student's development and maturing PIF [75].

In a critical literature review on PIF educational interventions, Mount et al. found that reflective writing and the use of narrative reflections were the dominant modes of student activity in PIF interventions, supporting the dominant individualist approach to PIF. Less commonly PIF was understood as a socialization process or as an active process with both individually and socially focused influences. An unintended consequence of this individualist orientation is that cultural problems embedded in the profession can become burdens for individual physicians to personally bear [76].

Owens et al. developed and evaluated a tool for PIF among preclinical medical students, via reflective writings about their clinical shadowing experiences. Reliable use of this tool currently requires a team approach that could be improved by machine learning [77].

Niemi described the quality of professional self-reflection and identity formation during the preclinical training on the basis of two qualitative materials--learning logs and identity status interviews. Four types of learning log reports on the early patient contact course could be identified: 'committed reflection', 'emotional exploration', 'objective reporting' and 'diffuse reporting'. At the end of the preclinical training, the identity status of several students could still be characterized as diffuse or giving rise to only very tentative professional considerations [78].

In a Commentary paper, Sharpless et al. present a chorus of individual student voices from along the medical education trajectory. Medical students (years 1–4) and a first-year resident in paediatrics respond to a variety of questions based on prevalent PIF themes extracted from the literature to reflect on their personal experiences of PIF. Aim of this work is to vividly illustrate the diverse and personal forces at play in individual students' PIF processes in a qualitative way and to encourage future pedagogic efforts supporting healthy, integrated PIF in medical education [79].

Jarvis-Selinger et al. analysed discussions with 12 medical students and found that guided reflections helped the students generate awareness of their current identity, as well as their future self. Furthermore, the moments that seem to generate these feelings are not always critical events, but often more unremarkable and mundane [80].

Role models & Mentors

Aslam et al. conducted a qualitative exploratory study (15 telephonic semi-structured interviews) on fifth year medical students of three medical colleges of Lahore, Pakistan, to investigate the determining elements that make a teacher a role model, so that role modelling can be used as an effective educational tool. A first theme highlighted attributes of negative role models which include humiliation of students and juniors, poor teaching and communication skills, lack of empathy for patients and unethical relationship with pharmaceutical industry. The second theme focused on the components of positive role modelling like formal workplace attire, candid approach in teaching, strategic dealing with students, empathetic attitude towards patients and prioritising fair treatments. The study findings suggest that medical students pay attention to both positive and negative attributes of their teachers and their influence on promoting professionalism and character development. It is suggested that both teachers and administrators should understand the significance of role models and advocate excellence in role modelling [81].

Bettin states that for mentorship to be truly successful in terms of mentee PIF, the mentors must be willing to set aside their own aspirations and mentor future generations of physicians and surgeons for the greater good of the medical community and future patients.
Not all physicians may be natural-born mentors. As the competitiveness for medical school and residency positions continues to skyrocket, mentors in the field have the distinct position to help guide students to their realities and callings [82].

Boudreau et al. present a mixed mode study of the 'physician apprenticeship' program at McGill university's faculty of medicine. Physician Apprenticeship activities promoted and sustained medical professionalization in the participants. Salient features of successful apprenticeship learning were access to authentic clinical experiences as well as the provision of a safe learning environment and guided critical reflection. The latter two ingredients appear to be mutually reinforcing and contributed to the creation of meaningful student–teacher relationships. Teachers exhibited several qualities that align with a parental role. Students became increasingly aware of having entered the

kinship of physicians. Teachers experienced a renewal and validation of their commitment to the ideals of medicine [83].

Kline et al studied the Health Mentors Program, a longitudinal preclinical elective in which patients, or their caregivers, act as mentors and educate students about their lived experience of a chronic condition or disability. They found that, given the right educational platform, patients can facilitate PIF by providing a safe space to explore and commit to professional values that society expects of physicians [84].

In a study amongst faculty members, acting as mentors, and medical students, Kusner et al found that students' expectations evolve throughout the course of longitudinal mentorship. Experienced mentors are aware of the importance of discussing aspects of their personal lives, a quality valued by the majority of students [85].

In a scoping review, Toh et al. mapped current understanding of the 'mentoring umbrella', this is the combined use of mentoring with supervision, coaching, tutoring, instruction, and teaching, providing definitions of each element of the mentoring umbrella, touching on how they impact PIF, and what are its enablers and barriers [86].

Mat Nor et al carried out a qualitative study on what mentoring programmes need to meet first-year medical students' expectations at a university in Malaysia. Four themes and seven categories were identified. One of the more striking themes was the need for students to understand the purpose of a class, hence also of mentoring in the curriculum. Medical students considered a curriculum map, which provided an overview of the programme's academic requirements, to be an anti-stress tool [87].

Parsons et al. describe a comprehensive, longitudinal clinical coaching program for medical students designed to support learners' PIF and effectively promote their emerging competence. An important theme mentioned is a coach-mentee relationship built on trust [88].

In an attempt to identify lapses in professionalism witnessed by medical students during their four-year medical doctor curriculum, Hendelman & Byszewski emphasize in their study the importance of role modelling and the need for faculty development to improve the learning environment [89].

Simulation

Jowsey et al. present an Auckland based interprofessional simulation training course called "Urgent and Immediate Patient Care Week". Their research found that the use of interdisciplinary simulation exercises can play a developmental role in PIF, simulation can give students stress, staff-led debrief is essential in the success [90].

Simulated patients (SPs) can contribute to students' developing identities as doctors. This was found by McLean et al. when they researched PIF through the special lens offered by SPs through which to view students' emerging identities as future doctors [91].

Feldman et al state that simulation experiences can be used as a trigger for self-reflection to assist in medical student professional identity development as early as the first weeks of medical school [92].

Tien et al. performed a mixed-methods study to explore the relationship between simulation, PIF, and patient ownership among third-year medical students in between their clerkship rotation blocks. When medical students felt like a physician, they took ownership of their patients. When they took ownership of their patients, they felt like a physician. By introducing simulation activities

earlier in medical education, students will have opportunities to develop patient ownership and professional identity earlier, allowing for a fuller, more mature development process [93].

Socialization

Cruess et al. have challenged themselves to make a schematic representation of this process. This schematic can be found in their article. They also make some suggestions for improving PIF in education. They express the following: "Personalized curricular approaches contextualizing students' clinical and other experiences through guided, individualized feedback on their reflections can facilitate the professional identity formation process. Identifying and encouraging reflection on the impact of the factors beyond the formal curriculum may contribute to professional identity formation by deepening students' understanding of who they are and who they wish to be." Furthermore, they suggest reworking of admissions criteria with PIF in mind, aiming to select students that already have some of the values of a good physician [94].

In an effort to find out how different relationships and social interactions contribute to PIF, Adema et al examined the social interactions of 9 students. They found that the students categorized relationships with peers, patients and doctors as meaningful experiences. Discussions with peers and doctors and imagining themselves as future physicians triggered a more profound understanding of the values and virtues of becoming a physician. Furthermore, students that were actively being included and respected as future doctors experienced a stimulation of their PIF [95]. An earlier, yet similar study by Weaver et al., including 13 medical students, found that there were two main contributors to PIF: professional inclusivity and social exclusivity. The former meaning that they were treated as future medical professionals by faculty, peers and patients and the latter signifying that they were separate from other, non-medical students, which helped them form a sense of peer unity, as well as a shared professional identity [96].

In a rather unusual study, Shikama et al. studied the early socialization with non-healthcare personnel in a clinical setting in 259 students. They found that this early socialization triggered PIF in students through a deeper understanding of what it means to be a doctor. They note that non-healthcare personnel have a niche role in the socialization process, or even as role models for medical students [97].

While peer assisted learning (PAL) is already well established as a teaching method, Burgess & Nestel analysed the impact of a PAL curriculum on PIF in medical students, finding that the socialization process with peers aids in PIF [98].

Training & work based learning

From analysis of focus group discussions with 92 GP residents from 4 general practitioner training institutes in the Netherlands, Barnhoorn et al investigated PIF throughout the full length of the GP training. They found that all PIF happens on the workplace, by doing the work of a GP. Many of the already mentioned themes were mentioned (reflection, role models, socialization, …). Self-confidence grows in an evolution from "doing" to "becoming". Negotiation of personal and professional roles led to thinking of "what kind of doctor GP residents want to become [99].

Similarly, Bearman et al interviewed 30 interns and 6 intern supervisors from different medical schools in Australia, with comparable findings: PIF happens on the important balance between support from colleagues and development through taking independent responsibility. It is important to see internship as a necessary phase in the natural progression of a much longer career path [100].

Workplace experience can also influence PIF earlier in the curriculum in so-called entrusted professional activities (EPA), as studied by Bremer et al interviews with 21 undergraduate students

in Nijmegen. An EPA-based curriculum does stimulate PIF in the complex context of working and learning by supporting participation in the workplace and by encouraging feedback-seeking behaviour. Striking the right balance between participation, feedback-seeking behaviour and choosing learning activities is essential [101].

Though continuity is lauded as the cornerstone of longitudinal integrated clerkships (LICs), continuity should be seen as facilitating the development of important relationships within diverse communities of practice, which leads medical students to construct professional identities as responsible, compassionate advocates for underserved populations [102].

Work-based learning (WBL) is complementary to on-campus skills training. The WBL sites gave the students rich opportunities to position themselves, act independently, and behave as professionals seriously striving for mastery. On the on-campus sites, the students behaved less seriously, and were conscious of their rights to try out things, get support, and have fun [103].

Work based learning in the form of "stage" makes newly graduated doctors to take responsibility. Successful transition requires a supported period of identity reconciliation during which responsibility may feel burdensome. During this, there is a fine line between too much and too little responsibility [104].

That longitudinal integrated clerkship (LIC) may be particularly supportive of PIF is suggested by the fact that even after several years, graduates recalled their principal clinical year as a meaningful and transformative experience. Graduates describe 4 core processes in their PIF during LCs: deliberate encouragement to integrate pre-professional and professional identities; support for learner autonomy in discovering meaningful roles and responsibilities; learning through caring relationships with patients, peers, teachers, and community; and a curriculum and an institutional culture that make values explicit [105].

At Utrecht University Medical Center, final year of medical school is designed to ease the transition from student to practitioner. Trainees are no longer regarded as regular clerks but work in a unique position as "semi-physicians," performing similar tasks as a junior resident during extended rotations, fostering PIF. As a semi-physician, students were very aware of being a practitioner, experienced more continuity in patient care and felt increased clinical responsibility. They felt they could make a significant contribution to patient care and in that experienced a sense of pride and purpose. Finally, the trainees became integrated into daily social routines [106]. These results were in line with findings from Teo et al., stating the following: "Postings are envisaged as Communities of Practice influencing self-concepts of personhood and identity and shaping how medical students see their roles and responsibilities as future physicians." They advocate for all clerkship and residency programs to provide adequate support for students facing clinical, ethical and moral trials [107]

An important driver of PIF during residency is autonomy in relationship to making decisions and responsibility for patient care [108].

In a study of Santivasi et al, residents reframed their definition of a "good doctor" during residency because of navigating tensions between their preconceived ideals of medicine and the realities of medical practice. Sensitivity to this process can provide educators with opportunities to facilitate residents' intentional reflection on professional identity and recognize and mitigate negative influences on PIF [109].

Universal

Afshar et al. synthesized a meta static structural model for professional identity, based on the results of previous research and 9 conceptual models found in literature, with the explicit presentation of the dimensions, constructs, and sub-constructs of the concept of professional identity [110].

The experience of medical school has unique stressors, challenges, individual motivations, and societal expectations that for most medical students converge at a critical time of young adult development. In a literature review, Cohen et al. analysed how medical educations impacts the students' personal development, as well as their core identity. They identify that the excessive workload, confrontation with death and suffering and high expectations can lead to a number of negative effects, including detrimental coping strategies and loss of core values, negatively impacting PIF. The authors urge faculty and educators to help students find meaningful and healthy coping strategies, as well as guidance by adequate role models and mentors [111].

Burford et al. analysed questionnaires of 166 first year and 101 second year students with regards to how they identify themselves. They found that these students identify themselves more as a doctor than as a student but note a slight decrease over time as the curriculum advances. [112].

One way to evaluate students' PIF was suggested by Brennan-Wydra et al. They propose analysing students' feedback on courses, using them as a marker for their PIF in addition to improving the educational program [113].

In 2014, Cruess et al. suggested that medical educations alter its objectives from teaching knowledge and professionalism to fostering PIF in individuals. For this to happen, we must understand the complex nature of PIF, with many different factors influencing this process. The formation of professional identity is not a linear process but rather happens as a result of key events or interactions. This can be accompanied by significant stress or anxiety, depending on the experience and the personal identity of the student. Through this process, the students go from "pretending to be a doctor" to "being a doctor". The researchers propose some modifications of education to assist medical students in their PIF [114]. This is in line with earlier findings by Holden et al., as well as Kavas et al. and L. V. Monrouxe, further cementing the complexity of the subject [115-117]. A scoping review by Sarraf-Yazdi et al. produced some additional information on the different influences on PIF, elaborating that insufficient support from faculty can turn factors that usually promote PIF into barriers [118].

Further work by Holden et al. divided the PIF process into 6 domains comprising 30 subdomains, spread over 3 developmental stages. They also propose activities, objectives and assessment methods to help students and faculty guide their PIF. A schematic overview of this framework can be found in their respective article [119]. A different model was proposed by Vivekanada-Schmidt et al., following interviews of 17 medical students. They suggest that professional identity is the culmination of the learners' self-perception and the perception of their professional role. This is influenced through 3 mechanisms: Practicing their professional role, being acknowledged as future professionals and being allowed to participate in their professional roles [120]. Reimer et al. suggest another model into PIF, which shows an evolution of how students see the professional image of a physician over the years [121]. Alternatively, Lewin et al. propose using Kegan's model of adult development to help educators support the students' PIF [122].

An analysis of the prospect of individualised remediation, performed by Hayashi et al. and involving 22 students, showed that there is still much room for improvement. Faculty should focus on integrative interaction methods and mentoring, while adapting to the individual students' context [123]. Maitra et al. share this view, proposing individualised coaching and role-modelling to help

students form their professional identity. This could be especially useful in combination with guided patient encounters [124].

Houseknecht et al. performed a longitudinal analysis of professional identity and wellbeing in 110 medical students and found an increase in imposter syndrome, as well as a decrease in wellbeing and perceived professional identity over 3 years. They also experienced a significant drop in response rate over these 3 years. The researchers emphasize that there should be an increased focus on student wellbeing and PIF, even though the clinical years are the most stressful and busy, a result that Kavas et al. also described in earlier research with 59 medical students [116, 125]. A. MacLeod tried to examine how professional identities are formed through observation of courses, as well as interviews with students, and found that there are two competing discourses: competence versus caring. This can be a cause for significant stress and identity dissonance [126].

Additional findings by Stubbing et al. show that first year medical students experience significant tension due to the preconceptions on becoming a doctor conflicting with feelings of being unable to help or having insufficient knowledge. They propose that adopting a learner identity is an essential stepping stone for PIF and advocate for making students aware of this process [127].

Discussion

Summary of evidence

As we can see, there is a plethora of evidence and information available with regards to PIF and professionalism. The different factors that play a part in PIF are, however, not sharply delineated, with a varying degree of overlap between the different subthemes. Even within the subthemes themselves it is often difficult to evaluate the impact on PIF.
From all of the above it can be understood that PIF is a complex process. Many educational interventions try to steer this process. However, given these complexities, it is difficult to propose effective interventions without a deep and comprehensive understanding of this process. In our search we found several attempts in creating a model or a theoretical background [58, 77, 94, 110, 119-122].

This ambiguity is especially true for the subtheme of arts, where there is plenty of room for interpretation of the results by the researchers. We think this is, in large part, due to the subjective nature of art itself. All the evidence agrees, however, that arts-based programs or courses can be used in varying forms and degrees to promote PIF, either focussing on literary or visual arts-based methods. This is mostly achieved through encouraging teamwork and communication, as well as providing a safe space to show vulnerability and expressing thoughts and emotions [3-11].

Community-based education, or CBE, refers to a program in which the faculty and a community come together to offer medical students the opportunity to learn and experience patient care in specific, local communities, which cannot be recreated in a typical classroom or hospital setting. While the evidence found for this subtheme was rather limited, CBE appears to promote PIF through the development of soft skills, as well as raising awareness with regards to the socio-economic problems the different communities face and the varying ways that physicians can provide help [12, 13].

The COVID-19 pandemic had a profound effect on the healthcare system in countries all over the world. Since medical students are closely involved in this system, it should come as no surprise that the pandemic lead to major changes in the education of medical students, an upsurge in volunteering students and an increase in stressful situations [14-20]. These changes in the

curriculum led to a decrease in student mental health and a decreased PIF, with researchers urging educators and institutes to implement the necessary support systems for students during crisis [14, 16, 18-20]. Still, despite the disastrous consequences for the world, the pandemic and the accompanying stress did provide some opportunities for medicine students as well. The possibility for students to provide help in a clinical setting often led to an increase in PIF and the development of coping strategies [14-17, 20].

Critical events or incidents are moments in a medical students' education or life that are challenging and memorable and thus have the power to influence PIF in these students. Prime examples of such moments are the WCC or wearing professional attire [26, 27]. The incidents themselves can be a positive or negative experience for the student, yet depending on the experience, the students' capacity to reflect, their own insights and support from faculty, the impact on PIF can be either positive or negative, regardless of how it was experienced by the students initially [21, 22, 25, 28]. Here, the key seems to be support from faculty, where mentors and educators can support students, aid them in reflecting upon the events and help them find a solution to moral or ethical dilemmas [21-24]. Students that are not supported or even shamed by faculty or personnel experience a negative impact on PIF [29]. Bhat et al., as well as Lin suggest implementing additional techniques into the curriculum to help students with these events and assess their progress on PIF [28, 30]. Perhaps the most striking example of critical events in the students' life are the dissection classes, with researchers noting an accompanying increase in PIF [31-33]. An important aspect of the laboratory is that it requires students to break taboos surrounding the desecration of human remains and forces them to behave in an appropriate, respectful way.

Since PIF can be seen as the result of successfully resolving conflicting personal and professional ideals and values, it is a logical assumption that a student's background plays an important role in how the students develop their professional identity. Additionally, the medical community has historically consisted of a white male majority, with a recent shift towards a majority of female students, as well as more diversity among student backgrounds. Authors propose that educators and faculty are made aware of the possible tension and conflict that this can create, and the hinderance that this can pose to PIF [34, 35].

Being engaged with patients allows for students to put their theoretical knowledge into practice, come into contact with other healthcare personnel and give them a glimpse of how it feels to be a practitioner. Contact with patients allows students to develop a connection, giving rise to a multitude of emotions. As such, patient contact as an authentic experience could be a powerful tool to foster PIF, especially if it is integrated longitudinally into the curriculum [36, 37, 39-42]. Nevertheless, educators should take care to implement early patient contact in a meaningful way and not too early in the curriculum, as this can lead to uncertainty in students [38, 43]. Furthermore, strategies must be implemented to help foster patient centred care, as in reality patients are often looked at as (collection of) diseases, symptoms or educational commodities [44].

Many schools and educators have implemented a course giving specific training on professionalism and PIF in an effort to help students during the process of forming their professional identity. This can be seen as explicit learning, since the students are made aware that they are being educated with regards to their PIF. A number of researchers have analysed the effects of such a curriculum on the PIF of students and found a marked increase in personal growth and PIF [45-52]. While some researchers note a shift from explicit learning to the informal or hidden curriculum, this is still a powerful tool to help promote PIF [45]. We, the authors, were also enrolled in a curriculum teaching professionalism at the University of Ghent. We feel, however, that at the time, we were not made sufficiently aware of the purpose of the curriculum, making it appear less organised and useful, which led to less engagement from the students.

While the explicit or formal curriculum can be seen as the deliberate learning that has happened with regards to PIF, the hidden or informal curriculum encompasses all the opportunities that are not deliberate, often subconscious, yet can still impact PIF. This can either happen in the workplace or during education, but also during extracurricular activities. These experiences during the hidden curriculum can either be positive or negative, yet depending on the support mechanisms in place from faculty and educators, as well as the personal growth and reflection capabilities of the students, even negative experiences can exert a positive influence on PIF [53-57]. This is in line with the results we described with regards to critical events. Findings like this further cement the important role of faculty, educators, role models and mentors in aiding the students in this process. Furthermore, researchers propose making the students more aware of the hidden curriculum and its effect, motivating the students to reflect independently on their experiences and making this hidden curriculum a bit more explicit [53-57]. On the other hand, several researchers also found a detrimental effect on PIF if faculty and educators try to force their own concept of professionalism and professional attributes in a top-down fashion. Additionally, organisational culture and the institutional agenda are experienced by students as controlling and leads to aversion from the educational program, further limiting PIF and possibly leading to lapses in professionalism [55, 56]. This is in line with our own experiences during our education, as we have felt or seen these effects ourselves or with fellow students. As such, there is a delicate balance regarding the hidden curriculum, where too much interference from faculty can lead to an opposite effect of what was aimed for. Clear communication from faculty and educators appears to be key to reducing this effect.

Different cultures have contrasting views of how the ideal doctor should act or behave and what values of ethics to adhere to. It is therefore a logical consequence that the process of PIF in students evolves in a dissimilar way. During international electives, students are submerged in these unfamiliar cultures. This can trigger emotions and reflection, causing students to view professionalism from a fresh point of view and trigger their PIF [59-63].

Storytelling is one of the oldest and most common forms of communication. As such, narrative medicine is based on the principle that people are inherently storytellers and hopes to promote interpersonal relationships between patients, physicians and students. The process helps doctors and students identify, explain and act on other people's problems through storytelling, triggering reflection and leading to an increase in soft skills and PIF [64-68]

Reflection and reflective writing have been used as a tool for some time in portfolios to try and trigger PIF in medical students. Research has confirmed that students that reflect on their experiences helps them view things from a novel point of view, eliciting emotions and fostering PIF [69-80]. However, for reflection to be meaningful and qualitative, there needs to be a safe space, confidentiality, as well as a designated time for it, not disturbed by the distractions of daily life [71]. Additionally, faculty and teachers need to be educated on how to handle these reflections and guide the students in this process [72, 73, 79, 80].

Since PIF is essentially the acquisition of a physician's identity, comprising its values and ethics, it is little wonder that role models and mentors play a large part in this process. Indeed, researchers find that adequate role models and mentors are tremendously beneficial for PIF in students [81-89]. Conversely, it was noted that unprofessional role models and mentors have the ability to negatively impact PIF [81, 82, 85, 89]. While one study suggests using patients as mentors in a longitudinal course, it is evident that not all physicians are suitable to be a role model or mentor [84]. Faculty should implement a selection procedure for these positions, with a teaching program making the mentors and role models aware of the influence they have over the students. Another key

component of role models and mentors alike is trust. Classes or discussions with the former should feel like a safe space for the students, with room for the students to reflect, but also for the role models and mentors to elaborate on their own experiences and how they manage them [81-89].

Simulation exercises are a tool usually implemented by educators to help students develop their (soft) skills and promote PIF, often early on in the curriculum. Research shows this to be true indeed, especially when combining simulation with debriefing and reflection exercises [90-93].

During the medicine curriculum, the student comes into contact with patients, their family, peers, physicians and non-physician healthcare personnel. This interaction or socialisation process is an integral part of the hidden curriculum and helps students form their professional identity [94-98]. One way to enhance socialisation, and thus PIF, is PAL [98]. The logical next step for educators is to make peers, physicians and non-physicians aware of the role they play in the PIF of each other.

It is clear that PIF is an extremely complex process involving a multitude of influences from different people and interactions, with students evolving over the years from "wanting to be a doctor" to "pretending to be a doctor" to "being a doctor" [110-127]. While this seems like a logical path of progression, it appears that there is an important intermediate step between these two: the learner identity. Students should first adopt the learner identity in order to expand their knowledge, before being able to use this knowledge in a clinical setting, since multiple researchers have noted that being exposed to patients too early and with insufficient knowledge can lead to identity dissonance and feelings of uncertainty [127].

Several researchers, however, note a decrease in PIF and mental wellbeing and an increase in imposter phenomena as the curriculum continues, attributing this decrease to an excessive workload, high expectations and a continuing confrontation with death and suffering [111, 112, 116, 118, 125]. Since students come from a different background and have varying personal identities, there appears to be a sensible next step: an individualised curriculum. Every student is different and should respond differently to the experiences and influences of the curriculum. The result is that students often have varying degrees of PIF, with some researchers suggest measuring this in students [113]. While it is obvious that educators should implement adequate measures and support systems for students, lapses in professionalism or PIF do occur in students. Literature on these lapses and their remediation is limited, but an individualised remediation course or program should be implemented here as well, since not every coping strategy is equally effective for every student [116, 123-125].

Limitations

The scoping review was carried out in accordance with the PRISMA guidelines for scoping reviews [1]. We deviated from these guidelines only with regards to funding, as we did not include the funding of every article. Since there is no incentive for the pharmaceutical industry, policy makers or curriculum designers and faculty to influence the results of the study, we think this does not make a significant difference overall.

Furthermore, we can see in the data chart (appendix C) that most of the evidence sources have a rather small study population, often comprised of only one university, limiting the statistical power of any analyses made and making the study more susceptible to bias.

Conclusions

Research with regards to PIF has come a long way in recent years. With the ongoing destigmatization of mental health the time seems ripe for faculty and curriculum designers to adjust their curriculum and education programmes, with the goal to focus on more patient centred care, student wellbeing and their PIF.
In our scoping review an effort was made to map out the different influences on PIF and assist educators and faculty in this process. While we now have a more complete view on the different factors that influence PIF, there are still some areas that are less clear.

One such area is the hidden curriculum as a whole. During our own education, we were not aware of the hidden curriculum, the purpose of the multitude of reflections or the purpose of the professionalism course, making it all seem rather unnecessary and out of place. We suggest informing students about this, making them aware of the goals of all the different exercises and courses. As mentioned earlier, efforts to control PIF or to define the ideal physician and its values are often met by aversion from students, or seen as efforts to control the students, something we have experienced first-hand. While literature is rather limited on this subject, and it is not easily delineated, educators and faculty should take care not to be too involved and controlling. Indeed, this is a thin line to be walked, and more research into this area could prove beneficial for faculty and curriculum designers. Ultimately, clear communication from faculty to the students seems to be key. The threshold concepts seem like a useful tool for this, yet it is not adapted for an individualised curriculum. Further research is needed here to determine in what ways the curriculum can be adapted.

Another area that is lacking research is with regards to remediation. While a number of different researchers propose individualised remediation courses to help students that experience a lapse in PIF, we have encountered very little evidence sources that evaluate the impact of a remediation strategy. More research is necessary to determine which type of remediation is more successful in helping students, while also making efforts to offer an individualised program.

All in all, we propose giving the students a roadmap to guide them through the curriculum, offering them the agency to individualise their own program, acknowledging the difficulties and struggles of being a medicine student and make them explicitly aware of the different factors influencing PIF. Normalise feelings of imposter syndrome, yet make sure that the students are aware of any support programs that are implemented and provide individualised remediation strategies for when things go wrong.

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Appendix

Appendix A: syntaxes used during initial search

Cochrane

#1: "Professional identity"
#2: pedagog* OR educat* OR "medical school" OR undergrad* OR "medical student*"
#3: medicine OR medical
#4: #1 AND #2 AND #3 (Word variations have been searched)

Embase

('professional identity'/exp OR 'professional identity') AND (pedagog* OR educat* OR 'medical school'/exp OR 'medical school' OR undergrad* OR 'medical student*') AND ('medicine'/exp OR medicine OR medical)

PsycNet

Any Field: "Professional identity" AND (Any Field: pedagog* OR Any Field: educat* OR Any Field: "medical school" OR Any Field: undergrad* OR Any Field: "medical student*") AND (Any Field: medicine OR Any Field: medical)

Web of Science

All fields: "professional identity" AND (pedagog* OR educat* OR "medical school" OR undergrad* OR "medical student*") AND (medicine OR medical)

Pubmed

All fields: "professional identity" AND (pedagog* OR educat* OR "medical school" OR undergrad* OR "medical student*") AND (medicine OR medical)

Appendix B: syntaxes used during definitive search

WoS

((professional OR professional s OR professionalism OR professionalism OR professionalized OR professionalized OR professionalizing OR professionally OR professionals) AND (identities OR identity)) AND (medical student OR med school student OR med student OR medical school student OR medical students OR student, medical OR students, medical)

Pubmed

((professional OR professional s OR professionalism OR professionality OR professionalize OR professionalized OR professionalizing OR professionally OR professionals) AND (identities OR identity)) AND (medical student OR med school student OR med student OR medical school student OR medical students OR student, medical OR students, medical)

Which is automatically expanded to the following:

("professional"[All Fields] OR "professional s"[All Fields] OR "professionalism"[MeSH Terms] OR "professionalism"[All Fields] OR "professionality"[All Fields] OR "professionalization"[All Fields] OR "professionalize"[All Fields] OR "professionalized"[All Fields] OR "professionalizing"[All Fields] OR "professionally"[All Fields] OR "professionals"[All Fields] OR (("professional"[All Fields] OR "professional s"[All Fields] OR "professionalism"[MeSH Terms] OR "professionalism"[All Fields] OR

"professionality"[All Fields] OR "professionalization"[All Fields] OR "professionalize"[All Fields] OR "professionalized"[All Fields] OR "professionalizing"[All Fields] OR "professionally"[All Fields] OR "professionals"[All Fields]) AND "s"[All Fields]) OR ("professional"[All Fields] OR "professional s"[All Fields] OR "professionalism"[MeSH Terms] OR "professionalism"[All Fields] OR "professionality"[All Fields] OR "professionalization"[All Fields] OR "professionalize"[All Fields] OR "professionalized"[All Fields] OR "professionalizing"[All Fields] OR "professionally"[All Fields] OR "professionals"[All Fields]) OR ("professional"[All Fields] OR "professional s"[All Fields] OR "professionalism"[MeSH Terms] OR "professionalism"[All Fields] OR "professionality"[All Fields] OR "professionalization"[All Fields] OR "professionalize"[All Fields] OR "professionalized"[All Fields] OR "professionalizing"[All Fields] OR "professionally"[All Fields] OR "professionals"[All Fields]) OR ("professional"[All Fields] OR "professional s"[All Fields] OR "professionalism"[MeSH Terms] OR "professionalism"[All Fields] OR "professionality"[All Fields] OR "professionalization"[All Fields] OR "professionalize"[All Fields] OR "professionalized"[All Fields] OR "professionalizing"[All Fields] OR "professionally"[All Fields] OR "professionals"[All Fields]) OR ("professional"[All Fields] OR "professional s"[All Fields] OR "professionalism"[MeSH Terms] OR "professionalism"[All Fields] OR "professionality"[All Fields] OR "professionalization"[All Fields] OR "professionalize"[All Fields] OR "professionalized"[All Fields] OR "professionalizing"[All Fields] OR "professionally"[All Fields] OR "professionals"[All Fields]) OR ("professional"[All Fields] OR "professional s"[All Fields] OR "professionalism"[MeSH Terms] OR "professionalism"[All Fields] OR "professionality"[All Fields] OR "professionalization"[All Fields] OR "professionalize"[All Fields] OR "professionalized"[All Fields] OR "professionalizing"[All Fields] OR "professionally"[All Fields] OR "professionals"[All Fields])) AND ("identities"[All Fields] OR "identity"[All Fields] OR ("identities"[All Fields] OR "identity"[All Fields])) AND ("students, medical"[MeSH Terms] OR ("students"[All Fields] AND "medical"[All Fields]) OR "medical students"[All Fields] OR ("medical"[All Fields] AND "student"[All Fields]) OR "medical student"[All Fields] OR (("mediterr conf control automation"[Journal] OR "mediastinum"[Journal] OR "med n y"[Journal] OR "med"[All Fields]) AND ("educational status"[MeSH Terms] OR ("educational"[All Fields] AND "status"[All Fields]) OR "educational status"[All Fields] OR "schooling"[All Fields] OR "education"[MeSH Terms] OR "education"[All Fields] OR "school s"[All Fields] OR "schooled"[All Fields] OR "schools"[MeSH Terms] OR "schools"[All Fields] OR "school"[All Fields]) AND ("student s"[All Fields] OR "students"[MeSH Terms] OR "students"[All Fields] OR "student"[All Fields] OR "students s"[All Fields])) OR (("mediterr conf control automation"[Journal] OR "mediastinum"[Journal] OR "med n y"[Journal] OR "med"[All Fields]) AND ("student s"[All Fields] OR "students"[MeSH Terms] OR "students"[All Fields] OR "student"[All Fields] OR "students s"[All Fields])) OR (("schools, medical"[MeSH Terms] OR ("schools"[All Fields] AND "medical"[All Fields]) OR "medical schools"[All Fields] OR ("medical"[All Fields] AND "school"[All Fields]) OR "medical school"[All Fields]) AND ("student s"[All Fields] OR "students"[MeSH Terms] OR "students"[All Fields] OR "student"[All Fields] OR "students s"[All Fields])) OR ("students, medical"[MeSH Terms] OR ("students"[All Fields] AND "medical"[All Fields]) OR "medical students"[All Fields] OR ("medical"[All Fields] AND "students"[All Fields])) OR ("students, medical"[MeSH Terms] OR ("students"[All Fields] AND "medical"[All Fields]) OR "medical students"[All Fields] OR ("student"[All Fields] AND "medical"[All Fields]) OR "student medical"[All Fields]) OR ("students, medical"[MeSH Terms] OR ("students"[All Fields] AND "medical"[All Fields]) OR "medical students"[All Fields] OR ("students"[All Fields] AND "medical"[All Fields]) OR "students medical"[All Fields]))

Translations

professional: "professional"[All Fields] OR "professional's"[All Fields] OR "professionalism"[MeSH Terms] OR "professionalism"[All Fields] OR "professionality"[All Fields] OR "professionalization"[All Fields] OR "professionalize"[All Fields] OR "professionalized"[All Fields] OR "professionalizing"[All Fields] OR "professionally"[All Fields] OR "professionals"[All Fields]
professional: "professional"[All Fields] OR "professional's"[All Fields] OR "professionalism"[MeSH Terms] OR "professionalism"[All Fields] OR "professionality"[All Fields] OR "professionalization"[All Fields] OR "professionalize"[All Fields] OR "professionalized"[All Fields] OR "professionalizing"[All Fields] OR "professionally"[All Fields] OR "professionals"[All Fields]
professionalism: "professional"[All Fields] OR "professional's"[All Fields] OR "professionalism"[MeSH Terms] OR "professionalism"[All Fields] OR "professionality"[All Fields] OR "professionalization"[All Fields] OR "professionalize"[All Fields] OR "professionalized"[All Fields] OR "professionalizing"[All Fields] OR "professionally"[All Fields] OR "professionals"[All Fields]
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professionalize: "professional"[All Fields] OR "professional's"[All Fields] OR "professionalism"[MeSH Terms] OR "professionalism"[All Fields] OR "professionality"[All Fields] OR "professionalization"[All Fields] OR "professionalize"[All Fields] OR "professionalized"[All Fields] OR "professionalizing"[All Fields] OR "professionally"[All Fields] OR "professionals"[All Fields]
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identities: "identities"[All Fields] OR "identity"[All Fields]
identity: "identities"[All Fields] OR "identity"[All Fields]
medical student: "students, medical"[MeSH Terms] OR ("students"[All Fields] AND "medical"[All Fields]) OR "medical students"[All Fields] OR ("medical"[All Fields] AND "student"[All Fields]) OR "medical student"[All Fields]
med: "Mediterr Conf Control Automation"[Journal:__jid101599293] OR "Mediastinum"[Journal:__jid101731833] OR "Med (N Y)"[Journal:__jid101769215] OR "med"[All Fields]
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med: "Mediterr Conf Control Automation"[Journal:__jid101599293] OR "Mediastinum"[Journal:__jid101731833] OR "Med (N Y)"[Journal:__jid101769215] OR "med"[All Fields]
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students, medical: "students, medical"[MeSH Terms] OR ("students"[All Fields] AND "medical"[All Fields]) OR "medical students"[All Fields] OR ("students"[All Fields] AND "medical"[All Fields]) OR "students, medical"[All Fields]

Appendix C: Data Chart

	Author	Title	Year	Objective/Aim	Insights	Population size
	Arts					
1	Aluri et al.	The role of arts-based curricula in professional identity formation: results of a qualitative analysis of learner's written reflections	2023	Impact of arts-based curricula and written reflections on PIF	Students are pushed to think about key components of PIF. An arts-based program can promote vulnerability and care-seeking in medicine students	10
2	Green	Comics and medicine: peering into the process of professional identity formation	2015	Impact of comic-creation on PIF	Students enrolled in a comic-creating course find that the creative process can promote PIF	58
3	Joseph et al.	Unmasking identity dissonance: exploring medical students' professional identity formation through mask making	2017	Impact of mask making and narrative reflections on PIF	Mask making and narratives can help educators identify students with identity dissonance and provide them with interventions	4
4	Korkmaz & Senol	Exploring first grade medical students' professional identity using metaphors: implications for medical curricula	2014	Impact of physician related metaphors on PIF	The use of physician related metaphors can help educators and students identify the beliefs and values of the students	71
5	Shapiro et al.	Medical Students' Creation of Original Poetry, Comics, and Masks to Explore Professional Identity Formation	2021	Impact of arts-based curricula and written reflections on PIF	Mask making was perceived as more relaxing and fun, while conveying more positive emotions. Poetry and comics were perceived to stimulate reflection. An overarching theme of identity dissonance was recognised	94
6	Shapiro et al.	Medical Students' Efforts to Integrate and/or Reclaim Authentic Identity: Insights from a Mask-Making Exercise	2018	Impact of mask making and narrative reflections on PIF	An overarching theme of identity dissonance was identified	12
7	Stephens	Taking Off the Mask: Impostorism and Medical Education	2022	Impact of iterative mask making and narrative reflecions on PIF	Imposter syndrom was the most common theme identified	5
8	Stephens et al.	Examining Professional Identity Formation Through the Ancient Art of Mask-Making	2019	Impact of mask making and narrative reflections on PIF	Role strain, burnout, isolation and identity dissonance were the most prevalent themes identified	'Several hundred'
9	Stephens et al.	Organizing Chaos: Iterative Professional Identity Formation Through the Lens of Mask Making	2020	Impact of iterative mask making and narrative reflecions on PIF	Role strain, burnout, isolation and identity dissonance were the most prevalent themes identified	5
	Community based education					
10	Ahmad et al.	Nurturing professional identity through a community based	2018	Explore the effects of CBE on PIF.	CBE promotes PIF through the development of professional skills, soft skills and personal values.	21

		education program: medical students experience				
11	Beck et al.	Professional Identity Development Through Service Learning	2015	Evaluate the effects of medical students volunteering at a camp for children with medical conditions.	CBE promotes PIF through improving awareness, communication skills and confidence	9
	COVID					
12	Ali et al.	Exploring medical students' perceptions of the challenges and benefits of volunteering in the intensive care unit during the COVID-19 pandemic: A qualitative study	2021	Evaluate the impact of volunteering during the COVID-19 pandemic on PIF	Coping difficulties were noted, but overall beneficial impact on PIF	26
13	Yu et al.	Professional Identity of 0.24 Million Medical Students in China Before and During the COVID-19 Pandemic: Three Waves of National Cross-Sectional Studies	2022	Evaluate the impact of COVID-19 on PIF	Overall beneficial impact on PIF, unless the students' parents were active healthcare workers	244040
14	Yang et al.	The Professional Identity and Career Attitude of Chinese Medical Students During the COVID-19 Pandemic: A Cross-Sectional Survey in China	2022	Evaluate the impact of COVID-19 on PIF and carreer choice	Overall beneficial impact on PIF, but negative impact on students with signs of depression or anxiety, or weak social support systems.	6226
15	Darici et al.	"Fun slipping into the doctor's role" - The relationship between sonoanatomy teaching and professional identity formation before and during the Covid-19 pandemic	2022	Impact of transition to online-only courses on PIF	Online-only courses decrease PIF, increase stress and reduce knowledge retention	1326
16	Lai et al.	Current Status of Chinese Medical Students' Professional Identity After COVID-19 and the Factors That Influence It	2022	Evaluate the impact of COVID-19 on PIF	Beneficial impact on PIF, decrease in PIF with grades	635
17	Luman et al.	"Am I even a med-student anymore?" A Mixed-Methods Study of the Impact of the Initial Disruptions Caused by the COVID-19 Pandemic on Medical Student Professional Identity Formation	2022	Evaluate the impact that the onset of the COVID-19 pandemic had on medical students' PIF.	Disruption of hands-on courses and experiences was challenging, but no statistical significant impact on PIF	20
18	Moula et al.	The impact of Covid-19 on professional identity formation: an international qualitative study of medical students' reflective	2022	Impact of COVID-19 on PIF	the pandemic increased PIF but led to more mental health challenges. Adequate support systems should be implemented.	155

		entries in a Global Creative Competition				
	Critical events					
19	Ackerman et al.	Critical events in the lives of interns	2009	To evaluate the most critical events in the lives of interns.	Critical events can have a positive or negative effect on PIF, depending on the degree of awareness the student has of his own insights	41
20	Bhat et al.	What trainees grapple with: a study of threshold concepts on the medicine ward	2018	Investigate the impact of critical events on PIF using threshold concepts	Threshold concepts can be used to guide students more effectively through critical events	17
21	Whelan et al.	Shame in medical clerkship: "You just feel like dirt under someone's shoe"	2021	How do shameful experiences impact PIF	Shame has a distinct negative impact on PIF	16
22	Fredholm et al.	Authenticity made visible in medical students' experiences of feeling like a doctor	2019	The impact of authentic situations on PIF	Authentic situations are necessary to feel like a doctor and have a positive impact on PIF	15
23	Lee Bidwell et al.	White Coat Ceremony as a Professional Identity Formation Activity in a United States Family Medicine Residency Program	2016	The impact of white coat ceremonies on PIF	79% of students see the event as critical to PIF	43
24	Lin	Fostering students' professional identity using critical incident technique	2012	Impact of critical incident technique teaching method on PIF	77% of students evaluated CIT as an effective teaching strategy to promote PIF	30
25	Ribeiro et al.	'I found myself a despicable being!': Medical students face disturbing moral dilemmas	2021	Identify the impact and nature of moral dilemmas in medical students	Moral dilemmas are highly impactful and can be beneficial to PIF if educators can guide students in a meaningful way	13
26	Sorrell & Ibrahim	First year medical students' perceptions of the impact of wearing scrubs on professional identity: A narrative analysis in the United Arab Emirates	2020	The impact of wearing professional attire on PIF	Wearing scrubs does influence PIF and can be further enhanced through discussion with educators and mentors.	21
27	Peterson et al.	Understanding the Struggles to Be a Medical Provider: View Through Medical Student Essays	2018	The impact of struggles the students face on PIF	Identifying challenges and finding solutions to them is important for PIF and not doing so increases risk of burnout.	173
28	Ratanawongsa et al.	Third-year medical students' experiences with dying patients during the internal medicine clerkship: A qualitative study of the informal curriculum	2005	The impact of death or dying patients on PIF	End-of-life care gives students the opportunity to promote PIF, but can be impacted by the surrounding medical personnel's enthusiasm, teaching and empathy.	28
	Dissecties					

29	Madill & Latchford	Identity change and the human dissection experience over the first year of medical training	2005	explore identity change in medical students over their first year of medical training, particularly in relation to their experience of human dissection, and in so doing increase understanding of the transition from lay-person to doctor-in-training	The main theme to emerge from our data on the students' experience of human dissection was 'involvement'	4
30	Pawlina	Not "How Should I Learn?" or "How Should I Act?" but, "Who Shall I Become?": A Précis on the Roots of Early Professional Identity Formation in the Anatomy Course	2019	Explore current literature on PIF and dissections	basic sciences should play a bigger role in teaching professionalism and in developing the PIF and that this process should commence as early as possible	/
31	Shojaei et al.	The blacksmith approach: a strategy for teaching and learning in the medical anatomy course (a qualitative study)	2022	to identify the themes that explain the strategy for teaching and learning and foster meaningful learning and professional identity in medical anatomy courses among medical students in Iran. Also, we aimed to develop a conceptual framework to explain this strategy development based on the experience of both students and faculty members	A conceptual 3step model emerged from the data analysis with the main theme called the blacksmith approach	24
32	Volpe et al.	Is research on professional identity formation biased? Early insights from a scoping review and metasynthesis	2019	Gain insights into PIF literature	Literature studying the impact of one's background on PIF is severely underrepresented.	57 studies on medicine students
33	Frost & Regehr	I am a doctor: Negotiating the discourses of standardization and diversity in professional identity construction	2013	To review literature on the discourses of diversity and standardisation and study the impact on PIF	in constructing appropriate professional identities, medical students today are affected by the competing discourses of diversity and standardization	/
	(Early) patient contact					
34	Barr et al.	Developing a patient focussed professional identity: an exploratory investigation of medical students' encounters with patient partnership in learning	2015	The impact of early patient contact on PIF	Early patient contact changes the focus to patient centredness if implemented early on in the curriculum.	67
35	Brandt	Personal professional identity formation through interprofessional learning and early patient encounter during preclinical years	2017	The impact of early patient contact on PIF	Early patient contact is greatly beneficial to communication skills and PIF	1
36	Konkin & Suddards	Creating stories to live by: Caring and professional identity formation in a longitudinal integrated clerkship	2012	The impact of LIC on PIF	Patient contact through a LIC does promote PIF and focusses on patient care.	25
37	O'Doherty et al.	Medical students and clinical placements - a qualitative study of	2021	Identify the most significant factors influencing PIF	Early patient contact, LIC and role models were most influential.	9

		the continuum of professional identity formation				
38	Roper et al.	The challenge of authenticity for medical students	2016	Identify the most significant factors influencing PIF	Early patient contact were most influential.	56
39	Schei et al.	Stretching the Comfort Zone: Using Early Clinical Contact to Influence Professional Identity Formation in Medical Students	2019	The impact of early patient contact on PIF	Early patient contact can trigger PIF, but adequate support from faculty is necessary.	28
40	Orsmond et al.	It's how we practice that matters: professional identity formation and legitimate peripheral participation in medical students: a qualitative study	2022	The impact of early patient contact on PIF	Early patient contact is beneficial to PIF.	10
41	Schrewe et al.	The Big D(eal): professional identity through discursive constructions of 'patient'	2017	Authors used critical discourse analysis (CDA) to examine the language students used to construct the patient role and develop a relevant professional identity	Patients in a pediatric ward are mostly conceptualised as principally biomedical, a key resource for clinical education and largely spoken for and about. This could influence who the students, that adopt this discourse, are becoming	20+14
	Explicit learning					
42	Buck et al.	The physician healer track: educating the hearts and the minds of future physicians	2021	Evaluate the impact of an explicit training course on PIF	The course increases PIF and humanistic skills, as well as personal growth	200
43	Byszewski et al.	Socialization to professionalism in medical schools: a Canadian experience	2015	Compare how professionalism is formally adressed in curricula	There is a gradual shift towards informal teaching. Formal methods are still in place through essays, reflections and teaching modules.	14 medical schools
44	Lawrence et al.	Requiring the Healer's Art Curriculum to Promote Professional Identity Formation Among Medical Students	2020	Evaluate the impact of an explicit training course on PIF	The course increases PIF, mental health and empathy in the majority of students	92
45	Volpe et al.	Does Pre-clerkship Medical Humanities Curriculum Support Professional Identity Formation? Early Insights from a Qualitative Study	2019	Evaluate the impact of an explicit training course on PIF	The course increases PIF	22
46	Vågan	Medical students' perceptions of identity in communication skills training: A qualitative study	2009	Evaluate the impact of an early explicit training course on PIF	The course increases PIF but this effect is limited by the uncertainty and lacking medical knowledge of students	10
47	Merlo et al.	MPRO: A Professionalism Curriculum to Enhance the Professional Identity Formation of University Premedical Students	2021	Evaluate the impact of an explicit training course, paired with shadowing experiences, on PIF	The course increases PIF	135

48	Bhatia-Lin et al.	What Will You Protect? Redefining Professionalism Through the Lens of Diverse Personal Identities	2021	to foster empathy for others' personal experiences, demonstrate how personal identity and professionalism can conflict, and prime students to support each other through these conflicts as they become professional physicians		/
49	Chandran et al.	Developing "a Way of Being": Deliberate Approaches to Professional Identity Formation in Medical Education	2019	discuss how at Renaissance School of Medicine at Stony Brook University we have integrated evidence-based approaches to enhance professional identity formation among our trainees and faculty		/
50	Findyarti Sudarsono	Remediating lapses in professionalism among undergraduate pre-clinical medical students in an Asian Institution: a multimodal approach	2018	to explore the students' perceptions of their personal identity formation and professional development following completion of the course	multimodal activities have high potential in supporting personal identity formation and professional development among undergraduate pre-clinical medical students, as well as remediating their lapses in professionalism.	/
	Hidden curriculum					
51	Blouin	Impact of interpersonal relations on learning and development of professional identity: A study of residents' perceptions	2018	Identify extracurricular impacts on PIF	Interpersonal relations with faculty members and peers outside of curriculum impacts PIF in a mostly positive way, but this can negative if there is a lapse in teaching or feedback provision.	13
52	Brown et al.	Exploring the Hidden Curriculum's Impact on Medical Students: Professionalism, Identity Formation and the Need for Transparency	2020	Explore the impact of the hidden curriculum on PIF and professionalism	The hidden curriculum impacts PIF in a mostly positive way, but efforts from faculty to impart a concept of professionalism can be seen as restrictive or controlling by students.	39 students and 14 faculty members
53	Chuang et al.	To the point: Reviews in medical educationtaking control of the hidden curriculum	2010	Discuss the role of the hidden curriculum on PIF	During the clinical experiences the hidden curriculum is most influential. The following 5 key principles should guide educators as they evaluate and shape the hidden curriculum: (1) professional behavior can be altered. (2) The hidden curriculum should be addressed regularly throughout medical school, but particularly during orientation and transitions. (3) Self-reflection, structured or unstructured, influences personal and professional growth and the hidden curriculum. (4) Role modeling is the primary way an individual affects the hidden curriculum. (5) Any effort to maximize the positive impact of the hidden curriculum is valuable; however, ideally change should be implemented and supported at the institutional level.	/
54	Yazdani et al.	A comprehensive model of hidden curriculum management in medical education	2019	to design a hidden curriculum management model	/	/
55	Hafferty et al.	Alternative Framings, Countervailing Visions: Locating the "P" in Professional Identity Formation	2016	Discuss the role of the hidden curriculum on PIF	The hidden curriculum must be designed to produce a group professional identity, yet retains a measure of individual identity.	/

56	Park & Hong	"Not yet a doctor": medical student learning experiences and development of professional identity	2022	How do informal learning experiences influence PIF	Informal learning experiences promote PIF	20
57	Hayashi et al.	Long-term contribution of international electives for medical students to professional identity formation: a qualitative study	2020	Evaluate the impact of international electives on PIF	international electives promote PIF	23
58	Sawatsky et al.	Transformative Learning and Professional Identity Formation During International Health Electives: A Qualitative Study Using Grounded Theory	2018	The impact of international electives on PIF and transormative learning.	international electives promote PIF and provide meaningful experiences that trigger transformative learning	377
59	Helmich et al.	Emotional Learning and Identity Development in Medicine: A Cross-Cultural Qualitative Study Comparing Taiwanese and Dutch Medical Undergraduates	2017	Evaluate the impact of different culture on PIF	Culturally different perceptions of the physician role lead to different professional identities	22
60	Helmich et al.	Becoming a Doctor in Different Cultures: Toward a Cross-Cultural Approach to Supporting Professional Identity Formation in Medicine	2017	How do cross-cultural experiences impact PIF	Different cultures lead to different professional identities	/
61	Gilligan et al.	Medical identity; perspectives of students from two countries	2020	Analyse how different cultures impact the perception of ideal doctors, real doctors and self-image	Ideal doctor perception was the same, but there was a difference in self-image and the perception of real doctors.	167 Australian and 188 German students
	Narrative medicine					
62	Huang et al.	How does narrative medicine impact medical trainees' learning of professionalism? A qualitative study	2021	to explore how NM impacts medical trainees' learning of professionalism during a clerkship in a Taiwanese clinical setting	self-exploration, reflection, and awareness of professional identity are mechanisms that impact professionalism learning , empathy, communication, doctor-patient relationship and understanding patients were identified as the result	30
63	Khoo & Wong	When Faculty Tell Tales: How Faculty Members' Reflective Narratives Impact Residents' Professional Identity Formation	2022	to explore if it is possible that faculty members' reflective narratives, if appropriately shared with trainees, can facilitate the processes of reflection and socialization and help shift the training paradigm toward supporting professional identity formation	Residents reported that narratives, if written by authors who were recognized as role models, triggered the processes of reflection and socialization; were more effective in provoking reflection if they resonated with residents' experiences; inspired them to follow how their role models reflected on and coped with challenges; and influenced the culture of the workplace, impacting the residents' daily experiences and leading to socialization and development of their professional identity.	40

64	Miller et al.	Sounding narrative medicine: Studying students' professional identity development at Columbia university College of physicians and surgeons	2014	To learn what medical students derive from training in humanities, social sciences, and the arts in a narrative medicine curriculum and to explore narrative medicine's framework as it relates to students' professional development	Narrative medicine can contribute to PIF.	130
	Reflection					
65	Clandinin et al.	Narrative reflective practice in medical education for residents: composing shifting identities	2011	Show the ways the pedagogical strategy of narrative reflection attends to the development of physician identity	professional identity is shaped over time, over multiple landscapes, and is always in the making	1
66	Cunningham et al.	Looking Back to Move Forward: First-Year Medical Students' Meta-Reflections on Their Narrative Portfolio Writings	2018	learn what students themselves would see when given the opportunity to look back on their own writings, learn whether their words might shed light on the learning outcomes of the portfolio, and if so, how, and finally, understand if students used the portfolio to explore professional identity construction, and if so, how	the Signature Reflection may have surfaced a recognition of a disquiet or angst within themselves that lay previously unnoticed or unexamined either by themselves or their mentors.	60
67	Wong & Trollope-Kumar	Reflections: an inquiry into medical students' professional identity formation	2014	Understand the major influencers of PIF from reflections made by medical students	Reflective writings provide a window on the dynamic, discursive and iterative nature of PIF	65
68	Hatem & Halpin	Becoming Doctors: Examining Student Narratives to Understand the Process of Professional Identity Formation Within a Learning Community	2019	Understand the major influencers of PIF from reflections made by medical students	Reflective writings of students give insight in drivers in PIF	86
69	Kumagai & Naidu	Reflection, Dialogue, and the Possibilities of Space	2015	understand the nature of this educational space in terms of its purpose, uses, dynamics, and limitations, and the underlying components that allow reflection and transformation to occur	the reflective space requires three qualities: safety and confidentiality, an intentional designation of a time apart from the distractions of daily life for reflection and dialogue, and an awareness of the transitional nature—the liminality—of a critically important period of professional identity development. In this open space of reflection and dialogue, one's identity as a humanistic physician takes form	NA
70	Wald et al.	Professional Identity Formation in Medical Education for Humanistic, Resilient Physicians: Pedagogic Strategies for Bridging Theory to Practice	2015	Present 3 pedagogical innovations in medical education	Ideally, such pedagogic innovations can make a significant contribution toward enhancing quality of care and caring with resilience for the being, relating, and doing of a humanistic health care professional	NA
71	Wald	Professional identity (trans)formation in medical education: reflection, relationship, resilience	2015	To provide an overview of foundational principles and key drivers of PIF	A nice overview commentary paper on many key elements in PIF	NA

72	Vaizer et al.	What does it mean to be a physician? Exploring social imaginaries of first-year medical students	2020	To explore if community embedded discussions with local community members reshape the social imaginary of medicine among students and contribute positively to their professional identity	Patient expectations were discordant to some aspects of the medical imaginary of medical students. The experience and subsequent reflections may be salient to contributing to each student's professional identity	35
73	Tan et al.	Medical Student Portfolios: A Systematic Scoping Review	2022	a Systematic Scoping Review on medical student portfolios	The use of MSPs, when placed in a consistent framework ,promises a holistic, authentic and longitudinal perspective of PIF	96
74	Mount et al.	A Critical Review of Professional Identity Formation Interventions in Medical Education	2022	a critical review of the recent literature on PIF interventions in medical education to explore the conceptualizations of and theoretical approaches to PIF that underlie them	Reflective writing and similar narrative-based activities were the most common interventions	43
75	Owens et al.	Clinical shadowing experience PIF rubric	2022	develop and evaluate a tool for documenting professional identity formation (PIF) among preclinical medical students, via reflective writings (RWs) about their clinical shadowing experiences	The clinical shadowing experience PIF rubric is a theory-informed analytic tool that demonstrates feasibility of measuring PIF in preclinical medical students' RWs.	29
76	Niemi	Medical students' professional identity: Self-reflection during the preclinical years	1997	ik zou deze eruit laten wegens te oud, resultaten zijn echt gedateerd en voegen niets toe	At the end of the preclinical training, the identity status of several students could still be characterized as diffuse or giving rise to only very tentative professional considerations	90
77	Sharpless et al.	The becoming: students' reflections on the process of professional identity formation in medical education	2015	help inform medical educators' efforts to support students' active PIF processes	The presented 'chorus' of student voices and their reflection on specific questions on key topics related to PIF gives some qualitative insight in the process of PIF	
78	Jarvis-Selinger et al.	Understanding Professional Identity Formation in Early Clerkship: A Novel Framework	2019	How do students examine and negotiate their emerging professional identities	Guided reflections promotes PIF.	12
	Role Models & mentors					
79	Aslam et al.	Medical Students' Perspective about Attributes of Role Models - The Other Side of Story	2021	To investigates the determining elements that make a teacher a role model, so that role modelling can be used as an effective educational tool	medical students pay attention to both positive and negative attributes of their teachers and their influence on promoting professionalism and character development	15
80	Bettin	The Role of Mentoring in the Professional Identity Formation of Medical Students	2021	An overview on influencers of PIF, with specific focus on mentoring	For mentorship to be truly successful in terms of mentee PIF, the mentors must be willing to set aside their own aspirations and mentor future generations of physicians and surgeons for the greater good of the medical community and future patients.	
81	Boudreau et al.	Affirming professional identities through an apprenticeship: Insights from a four-year longitudinal case study	2014	o understand the apprenticeship learning process, particularly its contribution to professional identity formation	Teachers exhibited several qualities that align with a parental role.	27

82	Kline et al.	Professional Identity Formation: A Role for Patients as Mentors	2020	to examine the long-term outcomes of interaction with a patient mentor in the preclinical period to understand the role that patients could play in PIF	Patient mentors can help medical students begin to construct their professional identity during the preclinical period by supporting exploration of and commitment to the professional values that society expects of physicians	18
83	Kusner et al.	Aligning Student-Faculty Mentorship Expectations and Needs to Promote Professional Identity Formation in Undergraduate Medical Education	2022	to better understand how medical students' mentorship needs may change throughout the course of their undergraduate medical education and assess faculty alignment with student expectations	students value mentors discussing aspects of their personal life; experienced mentors are more aware of this expectation	415
84	Toh et al.	The role of mentoring, supervision, coaching, teaching and instruction on professional identity formation: a systematic scoping review	2022	To map current understanding of the 'mentoring umbrella', the comined use of mentoring with with supervision, coaching, tutoring, instruction, and teaching	Understanding the mentoring umbrella is key to addressing difficulties faced and ensuring holistic and timely support in mentoring	207
85	Mat Nor et al.	Characteristics of mentoring programmes in the early phase of medical training at the Universiti Sains, Malaysia	2017	To explore the need for mentoring programmes for first-year medical students at the Universiti Sains, Malaysia	mentoring is essential to medical students in developing their identity and professional maturity. The effectiveness of the mentoring programme is supported by several factors. Students find a curriculum map to be an anti-stress tool	9
86	Parsons et al.	You can have both: Coaching to promote clinical competency and professional identity formation	2021	To describe a comprehensive, longitudinal clinical coaching program for medical students designed to support learners' professional identify formation and effectively promote their emerging competence	an affective coach-mentee relationship is one that is built on trust	
87	Hendelman & Byszewski	Formation of medical student professional identity: categorizing lapses of professionalism, and the learning environment	2014	To identify lapses in professionalism witnessed by medical students during their four year MD curriculum, and to categorize, from the students' perspective, who was responsible and the settings in which these occurred	Results from this study emphasize the importance of role modeling and the need for faculty development, to improve the learning environment	255
	Simulation					
88	Jowsey et al.	Performativity, identity formation and professionalism: Ethnographic research to explore student experiences of clinical simulation training	2020	to identify whether we were missing any important aspects of the student experience of UIPCW in relation to learning outcomes around preparedness and skill acquisition, professional identity and practice	The use of interdisciplinary simulation exercices can play a developmental role in PIF, simulation can give students stress, staff-led defrief is essential in the success	115
89	McLean et al.	Simulated patients' perspectives of and perceived role in medical students' professional identity development	2015	To explore the views of simulated patients on students' emerging professional identities at one Australian medical school	SPs can contribute to students' developing identities as doctors	14
90	Feldman et al.	The Role for Simulation in Professional Identity Formation in Medical Students	2022	To investigate student professional identity experiences related to participation in a clinical simulation during the first week of medical school	Simulation experiences can be used as a trigger for self-reflection to assist in medical student professional identity development as early as the first weeks of medical school	183

91	Tien et al.	Simulation as a Tool to Promote Professional Identity Formation and Patient Ownership in Medical Students	2019	to explore the relationship between simulation, PIF, and patient ownership among third-year medical students	When medical students felt like a physician, they took ownership of their patients. When they took ownership of their patients, they felt like a physician.	
	Socialisation					
92	Adema et al.	Social Interactions of Clerks: The Role of Engagement, Imagination, and Alignment as Sources for Professional Identity Formation	2019	The impact of social relations on PIF	Students that were actively invited to participate and had the opportunity to imagine themselves as future physicians during discussions experienced more PIF.	9
93	Burgess & Nestel	Facilitating the development of professional identity through peer assisted learning in medical education	2014	Analyse the impact of peer assisted learning on PIF	peer assisted learning increases PIF	/
94	Cruess et al.	A schematic representation of the professional identity formation and socialization of medical students and residents: a guide for medical educators	2015	Make a schematic representation of the socialisation process.	Personalized curricular approaches and reworked admissions criteria should be made with PIF in mind.	/
95	Weaver et al.	'Part of the team': professional identity and social exclusivity in medical students	2011	The impact of social relations on PIF	Social exclusivity and professional inclusivity triggers PIF	13
96	Shikama et al.	The use of text mining to detect key shifts in Japanese first-year medical student professional identity formation through early exposure to non-healthcare hospital staff	2021	The impact of socialisation with non-healthcare personnel in a clinical setting.	early socialisation with non-healthcare personnel triggered a deeper understanding of what it means to be a doctor, promoting PIF.	259
	Training & work based learning					
97	Barnhoorn et al.	General practice residents' perspectives on their professional identity formation: a qualitative study	2022	to investigate the process of PIF during the full length of General Practice (GP) training and which factors residents perceive as influential.	It all happens in the workplace	92
98	Bearman et al.	Participation and progression: new medical graduates entering professional practice	2011	to explore experiences and developing professional identities during internship	the important balance between support from colleagues and development through taking independent responsibility; and the strength of the view of internship as part of a 'natural progression', an inevitable evolution through the stages of medical training.	30+6
99	Bremer et al.	How an EPA-based curriculum supports professional identity formation	2022	to explore the effects of an EPA (entrustable professional activities)-based curriculum on the PIF of medical students in undergraduate curricula	An EPA-based curriculum does stimulate PIF in the undergraduate curriculum	21

100	Brown et al.	Medical Student Identity Construction Within Longitudinal Integrated Clerkships: An International, Longitudinal Qualitative Study	2022	To explore medical student professional identity construction through time within longitudinal integrated clerkships (LICs) internationally	Continuity is the cornerstone of LICs, as it facilitates development of important relationships within diverse communities of practice, which leads medical students to construct professional identities as responsible, compassionate advocates for underserved populations	33
101	Christensen et al.	Positioning health professional identity: on-campus training and work-based learning	2017	to characterize the activities and positions of students and supervisors at workplaces and on-campus skills training sites across the higher health professional educations	Work-based learning (WBL) is complementary to on-campus skills training.	12
102	Yardley et al.	What do we do, doctor?' Transitions of identity and responsibility: a narrative analysis	2020	to explore realities of transition through anticipatory, lived and reflective stages	successful transition requires a supported period of identity reconciliation during which responsibility may feel burdensome	32
103	Gaufberg et al.	In Pursuit of Educational Integrity: Professional Identity Formation in the Harvard Medical School Cambridge Integrated Clerkship	2017	Investigated core processes in PIF during longitudinal clerkships	longitudinal integrated clerkship may be particularly supportive of professional identity formation	12
104	van den Broek et al.	Social Identification with the Medical Profession in the Transition from Student to Practitioner	2020	explores professional identity formation during a final year of medical school designed to ease the transition from student to practitioner	being a semi-physician as transition contributed tot PIF	21
105	Sawatsky et al.	Autonomy and professional identity formation in residency training: A qualitative study	2020	o further theorise the relationships between the individual and contextual aspects of PIF through exploring the associations amongst autonomy, making decisions and responsibility for patients during residency training	Residents discussed three main themes: autonomy; making decisions, and responsibility for patient care.	23
106	Santivasi et al.	Reframing professional identity through navigating tensions during residency: A qualitative study	2022	to explore how residents navigate tensions during residency training and how that navigation affects resident PIF	Multiple tensions during residency between ideals and reality influence PIF	23
107	Teo et al.	Assessing professional identity formation (PIF) amongst medical students in Oncology and Palliative Medicine postings: a SEBA guided scoping review	2022	scoping review on PIF in oncology and palliative medicine postings	Postings influence PIF and all clerkship or residency programs should provide adequate support for students facing clinical, ethical and moral trials	88
	Universal					
108	Afshar et al.	Professional identity of medical students: Proposing a Meta Static Structural Model	2021	to synthesize a static structural model for professional identity	a comprehensive structural static model derived from 9 conceptual models in the field of socialisation and professional identiy	
109	Burford et al.	First and second year medical students identify and self-stereotype more as doctors than as students: a questionnaire study	2017	To investigate if PIF happens already in the beginning of medical school	medical students identify as doctors from as early as their first few weeks at university	160

110	Cohen et al.	Identity transformation in medical students	2009	To review the literature on the impact of medical school on personal development and consolidation of core identity	Paper goes into factors that can negatively impact PIF and well-being	/
111	Cruess et al.	Reframing medical education to support professional identity formation	2014	Assess how education should go from teaching professionalism to fostering PIF	Some propositions on how to alter education to further assist students in their PIF.	/
112	Hayashi et al.	Ambivalent professional identity of early remedial medical students from Generation Z: a qualitative study	2022	Analyse the prospect of individualised remediation strategies	Faculty should focus on integrative interaction methods and mentoring, while adapting the process to the learner's individual context.	22
113	Holden et al.	Professional identity formation in medical education: the convergence of multiple domains	2012	Review the essential components of PIF	The authors review the essential elements of PIF and propose strategies to influence it.	/
114	Holden et al.	Professional identity formation: creating a longitudinal framework through TIME (Transformation in Medical Education)	2015	To create a framework for PIF	A longitudinal framework for PIF was proposed.	/
115	Houseknecht et al.	A Longitudinal Assessment of Professional Identity, Wellness, Imposter Phenomenon, and Calling to Medicine Among Medical Students	2019	perform a longitudinal assessment of professional identity, wellness, imposter phenomenon and calling.	A marked decrease in response rate, professional identity and wellness, as well as an increase in imposter syndrome were found.	110
116	Kavas et al.	Turkish students' perceptions of professionalism at the beginning and at the end of medical education: a cross-sectional qualitative study	2015	Map students' perceptions of professionalism longitudinally	The hidden curriculum plays an important role in the decrease of professionalism along the years.	59
117	Vivekananda-Schmidt et al.	A model of professional self-identity formation in student doctors and dentists: a mixed method study	2015	Develop a model for PIF	The authors propose a model for PIF	17
118	Lewin et al.	Minding the Form That Transforms: Using Kegan's Model of Adult Development to Understand Personal and Professional Identity Formation in Medicine	2019	Understanding PIF through Kegan's model of adult development	Application of Kegan's model can aid educators and students in their PIF.	/
119	MacLeod	Caring, competence and professional identities in medical education	2011	Evaluate the different discourses that impact PIF	Caring and competence are two conflicting discourses impacting PIF	/
120	Monrouxe	Identity, identification and medical education: Why should we care?	2010	Give an overview of the core underlying processes of PIF	Educations should shift towards promoting PIF in students	/
121	Reimer et al.	Pre-clerkship medical students' perceptions of medical professionalism	2019	Compare first & second year medical students' perceptions of professionalism.	The perception of professionalism evolves over time.	/

122	Sarraf-Yazdi et al.	A Scoping Review of Professional Identity Formation in Undergraduate Medical Education	2021	collect relevant literature and ways how faculty support PIF	Factors that enable PIF can be barriers for PIF if there is unsufficient support from faculty	76 articles
123	Stubbing et al.	Authoring the identity of learner before doctor in the figured world of medical school	2018	to understand how identity tensions are managed and experienced in early medical school	First year students undergo significant tensions. Helping them adopt a learner identity instead of a doctor identity may help.	23
124	Maitra et al.	Balancing Forces: Medical Students' Reflections on Professionalism Challenges and Professional Identity Formation	2021	How do students experience professionalism	Students view professionalism as a balance of forces. Role-modelling, individualised coaching and guided patient encounters could be used to promote PIF.	100
125	Brennan-Wydra et al.	Reviewing the reviewer: Medical student course feedback as a marker of professional identity formation	2020	To explore the usefulness of comments by students in evaluation of first year courses and instructors as markers of students' professional identity formation	student evaluation of teaching are an important tool in the medical curriculum and represent one way to assess the professional growth of students	389