

Tools for assessing professional identity in health professions education: A scoping review

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Abstract

Due to the complexity and multidimensional nature of professional identity assessment in health professions education, it is essential to establish appropriate criteria. Therefore, we conducted a scoping review to explore the current knowledge in this process and map the directions for future research. The present review was based on the five-step framework of Arksey and O'Malley. Eligible articles were examined using descriptive analysis of studies on the characteristics and psychometrics of the tools for professional identity assessment and their underlying theories. After an extensive search, 9,924 studies were identified, 162 of which were selected for full-text review, and finally, 17 articles qualified for inclusion in the study. For the most part, the target group consisted of studies on nursing and medical students. In 14 of the included studies, tools and psychometric properties were mentioned.

Most professional identity assessment tools were designed or developed based on identity theories, particularly the social identity theory and Kagan's constructive-developmental theory, which were used more often than others. This scoping review will help researchers to choose or develop reliable and valid tools under clear conceptual and theoretical frameworks to assess the formation and development of professional identity in health professions education.

Keywords: Professional identity; Health professions education; Scoping review.

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Introduction

Training efficient graduates to meet the health needs of the 21st century will not be possible without growth and improvement in all aspects of professional development. Available evidence suggests that modern university graduates do not possess the necessary professional skills to succeed in their future workplace (1 - 3). Therefore, understanding how professional identity is formed and planning the principles accordingly in universities will play a crucial role in the development of individual identity in health professionals, from undergraduate years through their professional lives (4, 5).

For centuries acquiring professional identity has been considered a fundamental element of the mission of medical education. In the past, it was referred to by words such as "character" or having appropriate "characteristics" (4, 6). A physician's professional identity represents his/her interpretation of what being a good doctor means and how he or she should behave (7, 8). Professional identity is a complex structure of meanings in which a person links his/her motivation and capabilities with acceptable job roles (8, 9).

Rather than merely achieving the qualifications required by a profession and concentrating on actions that need to be performed, professional identity formation focuses on strengthening the ability to think, act and feel like a professional. It is further defined as a continuous and self-directed process with the goal of developing the growth of "thoughts, actions and feelings in an individual" during which the essential characteristics, values and norms are internalized (10-14). Professional identity formation will allow students to develop the capacity to cope with the growing complex problems in healthcare environments (15, 16). An internalized, self-defined professional identity will help students perform effectively in rapidly evolving settings (17).

The importance of professional identity formation increased with the 2010 report of the Carnegie Foundation for the Advancement of Teaching (11, 18). This foundation considered professional identity formation to be the main goal of medical education (10, 19 - 22). Also, the Carnegie Foundation attributed great importance to facilitating this process in learners by faculty

members and planning for its promotion and growth during the educational period (10).

Subsequently, specialists such as Cruess et al., Jarvis-Selinger et al., Holden et al. and Kalet et al. expressed support for professional identity formation in each medical student in the course of undergraduate medical education and residency, and considered it to be the primary goal of medical education (4, 11, 23 - 25). They also emphasized the necessity for change in training strategies and assessments to attain this goal (4, 10, 11, 23 - 26). Apart from the emphasis on professional identity and its formation in medical students (11, 24, 27), it has been discussed as an essential issue in other areas of medical sciences, such as pharmacy (28 - 31), nursing (32 - 35) and dentistry (36).

Although professional identity development is the main goal of health professions education, experimental data on the assessment of how it forms and develops are limited due to the complexity of the process and its multi-dimensional nature (37). While several qualitative studies have been conducted through open-ended interviews to assess professional identity (12), identifying valid and reliable tools in which the complexities of the mentioned process are considered can provide ways to better research and understand the formation and development of

professional identity. Such tools would not only assess professional identity formation on a larger scale for educational or research purposes but could facilitate a comparison of the identity formation process across various paradigms and nationalities (38, 39). Assessing the literature did not show any review studies aimed at identifying reliable and valid tools to assess the formation and development of professional identity in health professions education. The current scoping review aims to create a cumulative map of related literature for identifying and selecting a reliable and valid tool based on appropriate theory and to help determine the knowledge gaps in assessing the formation and development of professional identity in health professions education.

Methods

This scoping review was performed based on the five-step Arksey and O'Malley framework (40) which included: 1) identifying the research question, 2) identifying relevant studies, 3) study selection, 4) charting the data, and 5) collating, summarizing, and reporting the results. The review is reported in concordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) (Appendix 1) (41).

Research Question

Our scoping review focused on answering the following research question: What theory-driven psychometric tools have been developed to assess professional identity formation and development in health professions education?

Relevant Studies

Selecting Databases

A systematic search was performed to identify evidence related to the research question in electronic databases like PubMed, Eric, ProQuest and Scopus. The conducted searches in the above databases and retrospective and prospective investigations were performed as ancestry searching (in the list of references to included studies) and forward tracing (in the citations of included studies) in the Google Scholar search engine up to September 21, 2022.

Search Strategy

A three-person task force was formed for systematic analysis. The researchers came together

at all stages of the study to discuss any challenges or uncertainties related to the selection of studies and to revise their search strategy if needed. At first, the search strategy was written broadly so that studies related to the research question could be selected and included in the review by considering the inclusion and exclusion criteria. Initially, we searched for the terms "professional identity", "professional identity formation", and "professional identity development". Since all the terms contained the phrase "professional identity", the search strategy only used this phrase along with inclusion and exclusion criteria applicable to the database.

Inclusion and Exclusion Criteria

Considering the limitations, the study period was extended from the beginning to September 21, 2022. The inclusion and exclusion criteria are shown in Table 1.

Table 1. Study eligibility criteria

Criteria	Study
Inclusion Criteria	Published in English
	Focusing on health professions education
	Quantitative or qualitative Methods
	Original articles, review articles, dissertations
	Containing tools for assessing professional identity/professional identity development/professional identity formation
Exclusion criteria	Publication date before September 21, 2022
	Non-English articles
	Focusing on populations outside the health professions education
	Not assessing professional identity
	Containing assessment tools other than those mentioned in the inclusion criteria above
	Articles without full text following contact of the corresponding author
	Books, conference papers, conference abstracts

Study selection

In the first stage, databases were evaluated based on the search strategy, and the retrieved articles were entered into EndNote software. Then, the papers were examined to remove duplicate records. Two authors (ZST and MKM) studied all topics and abstracts of the retrieved articles and extracted the relevant ones using the study inclusion and exclusion criteria. Two authors independently reviewed the text entries. Whenever there was a

dispute over reaching a consensus, the third author's opinion (HA) was considered. Then, the retrospective and prospective search was performed in the form of ancestry searching (in the list of references to included studies) and forward tracing (in the citations of included studies) in Google Scholar. The authors of the relevant studies were also contacted for any additional information or full-text versions of their works when needed (Fig. 1).

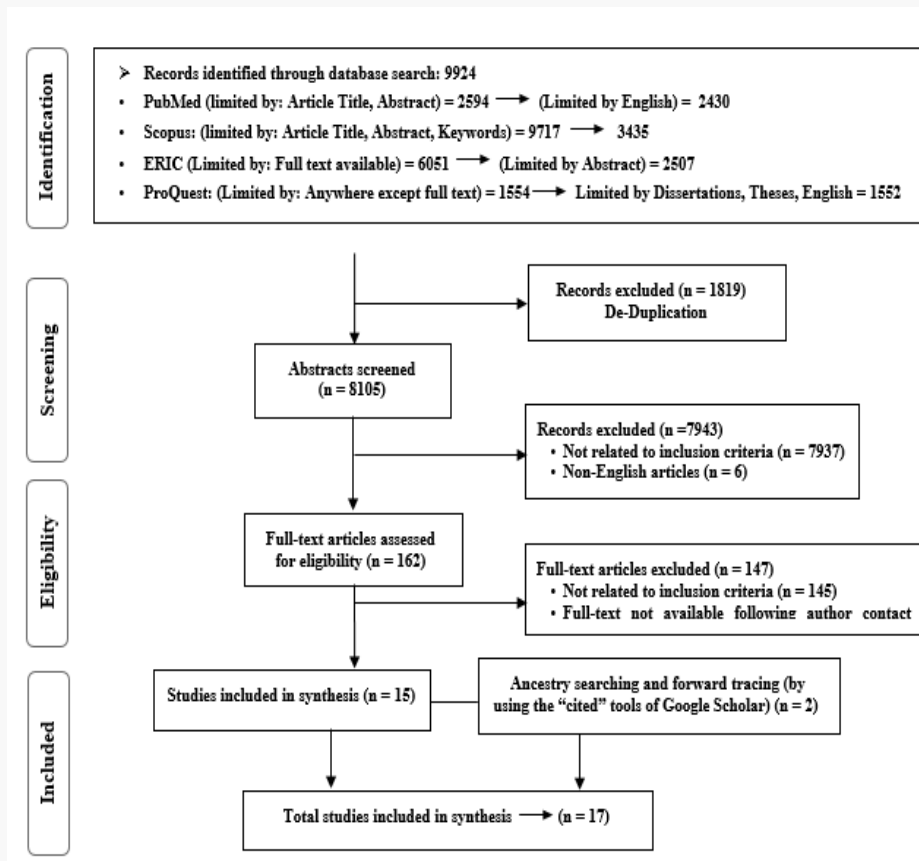


Fig. 1. PRISMA flow diagram adapted from Moher et al. (42)

Charting the data

We adopted a descriptive-analytical approach that applied a common analytical framework (i.e., a set of questions) to all the included articles. A preliminary data extraction form was created in an Excel spreadsheet to draw data from all studies, and then interpretations and reviews were performed repeatedly. To answer our research question, we applied the following analytical questions to our data/literature set:

- 1) What tools have been developed to assess the formation and development of professional identity in health professions education so far?
- 2) Are the tools developed to assess the formation and development of professional identity for health professions education reliable and valid?
- 3) Do the tools developed to assess professional identity formation and development for health professions education have the required theoretical basis?

The authors discussed the data that needed to be extracted from the included studies to answer the above questions. Based on Figure 1, we first selected a broad search strategy. This helped to

minimize the loss of relevant articles as much as possible. Then, we applied entry and exit criteria based on the research questions, identifying 17 relevant articles. The quality of the studies was not evaluated with respect to the scoping review methodology.

Collating, summarizing, and reporting the results

The selected articles were analyzed descriptively to identify recurring patterns. The data were collated, summarized quantitatively, and input to an Excel spreadsheet, including demographic data (such as author, publication year and location, and journal name) and methodology data (for instance, research design or data collection). Then, descriptive analyses were conducted on the specifications and psychometric characteristics of the tools and their underlying theories. In the preliminary sources and texts search, 9924 studies were identified. After removing the redundant studies and studies that did not conform to the inclusion criteria (Table 1), the texts of 162 articles were selected to be thoroughly examined (Fig. 1). The full-text articles were assessed by ZST and MKM. The level of agreement was 97% (157/162).

Results

Mapping the results

Fifteen articles met the eligibility criteria following a full-text review (Fig. 1). Next, the second phase of the search was performed in Google Scholar by ancestry searching and forward tracing. After finding two more new studies, 17 were selected based on the inclusion and exclusion criteria. A flowchart of the search and selection process, reported in line with PRISMA guidelines, is provided in Fig. 1 (41).

Study characteristics

In the relevant studies, eight target groups were related to nursing, and five were related to medicine. One target group examined pharmacy students, and three studies examined the professional identity of specialists in health professions education.

Table 2 shows demographic and methodology data for the included studies (author, year and location of publication, journal name, and type of tools used in the study, for instance, research design and data collection). Table 3 presents the results of descriptive analyses on the specifications and psychometric characteristics of the tools, and Table 4 shows the underlying theories of the tools.

The years of publication extended from 1986 to 2022, and most of the included studies were from England (5 studies) and Japan (4 studies). The methodology of the included studies was comprised of six mixed methods (quantitative and qualitative), ten quantitative studies, and one review study (Table 2).

Table 2. Demographic and methodology data of the articles included in this scoping review on health professions education tools for assessing professional identity

No.	Authors	Year	Journal Name	Country	Research Design	Data Collection
1	Brown et al. (43)	1986	Journal of Occupational Psychology	UK	Quantitative and Qualitative	Questionnaire
2	Cowin, L. (44)	2001	Western Journal of Nursing Research	Australia	Quantitative and Qualitative	Scale
3	Madill, A. (45)	2005	Social Science & Medicine	UK	Quantitative and Qualitative	Repertory grids
4	Adams K. et al. (46)	2006	Learning in Health and Social Care	UK	Quantitative	Scale
5	Crossley J. & Vivekananda-Schmidt P. (47)	2009	Medical Teacher	UK	Quantitative	Scale
6	Hao Y. F. (48)	2014	Master Thesis	China	Quantitative and Qualitative	Scale
7	Goltz H.H. & Smith M.L. (49)	2014	Health Promotion Practice	USA	Review	Questionnaire (open)
8	Ellis R. et al. (50)	2015	Journal of Nursing & Care	UK	Quantitative and Qualitative	Scale

9	Tan, Ch. P. (51)	2015	Studies in Higher Education	Netherlands	Quantitative	Instrument
10	Kalet A. et al. (12)	2016	Medical Teacher	USA	Quantitative and Qualitative	Questionnaire (open)
11	Mylrea M.F. et al. (28)	2017	Currents in Pharmacy Teaching and Learning	Australia	Quantitative	Questionnaire
12	Moola S. (34)	2017	Global Journal of Health Science	KSA	Quantitative	Scale
13	Kanefuji A. & Nakatani H. (52)	2017	Health	Japan	Quantitative	Questionnaire
14	Miyoshi M. et al. (33)	2019	Yonago Acta Medica	Japan	Quantitative	Questionnaire
15	Tagawa M. (39)	2019	BMC Med. Educ.	Japan	Quantitative	Questionnaire
16	Tagawa M. (53)	2020	BMC Med. Educ.	Japan	Quantitative	Questionnaire
17	Li R. & Lou J. (54)	2022	Healthcare	Taiwan	Quantitative (Cross-Sectional Survey)	Scale

Study findings

Analytical descriptive¹ studies about the specifications and psychometric characteristics of the tool

The included studies either developed tools for the first time (14 studies) or utilized tools extended for other purposes (3 studies) to assess the formation and development of professional identity in health professions education. The term "extended for other purposes" means that initially, the tool was developed for another purpose, for instance, to be self-administered (33), or for a target group other than health professions students and professionals (46). Additionally, a tool like PIE had previously

been developed but was completed by Kalet et al. in 2016 and took on the name Professional Identity Essay. In Table 3, the column "used/developed tool" offers details of the 17 included studies, two did not address the psychometric properties of the instrument (Table 3). Of the remaining studies, 13 utilized various validity methods for the psychometrics. All studies used construct validity, especially factor analysis, and 7 used the content validity method. Moreover, in 13 of the included studies, various reliability methods were applied to the psychometric tools, and in about 85% of them, internal consistency, especially Cronbach's Alpha, was employed.

¹ The "analytical descriptive" approach is used to organize and present the results in a structured manner. It typically involves a comprehensive description of the existing literature, providing a detailed overview of the range of

evidence and research on the topic without synthesizing the results into a single outcome (as is common in systematic reviews).

Table 3. The specifications and psychometric characteristics of the tools and assessed concepts

Authors	Target Group	Tool	Used/Developed Tool	Psychometric Properties	Main Results of the Psychometric Analysis*	Assessed Concept
Brown et.al. 1986 (43)	Nurses	Professional Identity Questionnaire (PIQ)	Developed**	<p><i>Reported by Toben D. et al. for medical students (2021) (38)</i></p> <p>Validity:</p> <ul style="list-style-type: none"> • Inter-Item Content Validity Index (I-CVI) • Construct validity (Exploratory Factor Analysis) • Concurrent validity (Self-Regulation Scale/SRQ-A) <p>Reliability:</p> <ul style="list-style-type: none"> • Internal consistency (Cronbach's Alpha) • Stability (Pearson's Correlation Test) 	<ul style="list-style-type: none"> • Exploratory Factor Analysis contained 10 items for the two-factor dimensions • Cronbach's Alpha value of 0.82 • Negative to positive spectrum of Pearson's correlations corresponding to increasingly internal qualities of motivation 	<p>PI***</p> <ul style="list-style-type: none"> • PIQ is a tool to measure group professional identification. • Two-factor dimensions reflected the measure of attached and detached attitudes toward the medical profession.
Cowin, L. 2001 (44)	Nursing students	Nurse Self Concept Questionnaire (NSCQ)	Developed	<p>Validity:</p> <ul style="list-style-type: none"> • Content validity (expert panel) • Construct validity (Exploratory and Confirmatory Factor Analysis) <p>Reliability:</p> <ul style="list-style-type: none"> • Internal consistency (Cronbach's Alpha) • Intra-item correlations 	<ul style="list-style-type: none"> • Exploratory Factor Analysis: The final version contained 36 items in six-factor dimensions • Cronbach's Alpha value from 0.88 to 0.96 	<p>PI</p> <ul style="list-style-type: none"> • NSCQ is a tool to measure self-concept. • Six-factor dimensions included caring, communication, staff relationships, leadership, nursing skills, knowledge and nursing ability. • Self-concept in light of professional identity
Madill, A. 2005 (45)	Medical students	Repertory Grids	Developed	<p>Validity:</p> <ul style="list-style-type: none"> • Construct validity (Principle Components Analysis/PCA) <p>Reliability:</p> <p>Internal consistency (Spearman-Brown Test and McQuitty's Elementary Linkage Analysis)</p>	<ul style="list-style-type: none"> • PCA suggests three common themes concerning identity change • To examine the relation between roles at different points in time, two non-parametric correlation analyses (Spearman's rho) 	<p>PID****</p> <ul style="list-style-type: none"> • Three themes included dedication, competence and responsibility. • These Repertory Grids (two) explore identity change in medical students over their first year of medical training, particularly in connection with

					<p>were conducted on the scores obtained for the five roles in the identity grids</p> <ul style="list-style-type: none"> The resulting two correlation matrices were then explored using McQuitty's Elementary Linkage Analysis. 	<p>their experience of human dissection.</p>
<p>Adams K. et al. 2006 (46)</p>	<p>Health and social care students</p>	<p>Macleod Clark Professional Identity Scale MCPIS</p>	<p>Used (Created by Macleod J. et al.) (2005) (55)</p>	<p>Validity:</p> <ul style="list-style-type: none"> Construct validity (Exploratory Factor Analysis) <p>Reliability:</p> <ul style="list-style-type: none"> Internal consistency (Cronbach's Alpha) 	<ul style="list-style-type: none"> Exploratory Factor Analysis: The final version contained 25 items in three-factor dimensions Cronbach's Alpha value of 0.79 	<p>PI</p> <ul style="list-style-type: none"> Three-factor dimensions included Professional Identity Scale, Team Scale, and Cognitive Flexibility Scale. Investigating the level of professional identity when students commence their university education, the differences in the level of professional identity between students from a range of professions, and the factors that may affect the initial levels of professional identification
<p>Crossley J. & Vivekananda-Schmidt P. 2009 (47)</p>	<p>Medical students</p>	<p>Professional Self-Identity Questionnaire (PSIQ)</p>	<p>Developed</p>	<p>Validity:</p> <ul style="list-style-type: none"> Content validity Construct validity (Spearman's Correlation Co-Efficient) Construct validity (Exploratory Factor Analysis) <p>Reliability:</p> <ul style="list-style-type: none"> Internal consistency (Cronbach's Alpha) 	<ul style="list-style-type: none"> Spearman's Correlation Coefficient 0.05 - 0.22 Exploratory Factor Analysis: The final version contained 9 items in three-factor dimensions Cronbach's Alpha value of 0.93 	<p>PID</p> <ul style="list-style-type: none"> Creating a tool to monitor the development of professional self-identity across different health and social care professions (professional self-identity is a 'state of mind' that refers to identifying oneself as a member of a professional group) Three-factor dimensions included interpersonal tasks, generic attributes

Hao Y. F. 2014 (48)	Nursing students	Professional Identity Scale for Nursing Students (PISNS)	Developed	<p>Validity:</p> <ul style="list-style-type: none"> • Content validity • Construct validity (Exploratory Factor Analysis) <p>Reliability:</p> <ul style="list-style-type: none"> • Internal consistency (Cronbach's Alpha, Coefficient Alpha, and Split-Half Spearman-Brown) 	<ul style="list-style-type: none"> • Exploratory Factor Analysis: The final version contained 17 items in five-factor dimensions • Cronbach's Alpha value of 0.83 • Split-half reliability was 0.84 	<p>and profession-specific elements.</p> <p>PID</p> <ul style="list-style-type: none"> • Five-factor dimensions included professional self-image, the benefit of retention and turnover risk, social comparison and self-reflection, independence of career choice, and social modeling. • PISNS could be used to evaluate the developing level of professional identity in nursing students and assess the effectiveness of corresponding interventions and strategies.
Goltz H.H. & Smith M.L. 2014 (49)	Health education and health promotion specialists	Tool for Explaining the Concept of Professional Identity	Developed	Not reported	–	<p>PI</p> <p>The purpose of this tool is to explain the concept of professional identity.</p>
Ellis R. et al. 2015 (50)	Nurses and Nursing students	ISA/Ipseus Tool (Instrument to Measure Professional Identity and Values in Nursing) <i>Ipseus is a powerful psychological software tool</i>	Developed	<p>Validity:</p> <ul style="list-style-type: none"> • Face validity • Construct validity 	<ul style="list-style-type: none"> • Face validity: The process described has produced constructs reflecting values drawn from the literature and expert judgments. The constructs thus have high face validity • Construct validity contained 21 constructs/values and two-factor dimensions 	<p>PI</p> <ul style="list-style-type: none"> • The instrument has been developed as an in-depth measure of professional identity and values in nursing. • Two-factor dimensions included structural pressure (sp) and emotional significance (s).
Tan, Ch. P. 2015 (51)	Students in a wide range of professions (social and healthcare)	Professional Identity Five Factor Scale (PIFFS)	Developed	<p>Validity:</p> <ul style="list-style-type: none"> • Content validity • Construct validity (Confirmatory Factor Analysis) <p>Reliability:</p> <ul style="list-style-type: none"> • Coefficient H Test 	<ul style="list-style-type: none"> • Confirmatory Factor Analysis contained 27 items for the five-factor dimensions • Scores from reliability analysis using coefficient H were within the range of 0.65 to 0.85. 	<p>PID</p> <ul style="list-style-type: none"> • Five-factor dimensions included knowledge about professional practices development, professionals being perceived and followed as role models, students gaining experience in the profession, acquiring a

Kalet A. et al. 2016 (12)	Medical students	Professional Identity Essay (PIE), the Defining Issues Test (DIT2) and Students' reflections	Used (Created by Monson, V. E. et al.) (2008) (56)	Reliability: <ul style="list-style-type: none"> • Inter-rater reliability • Intra-rater reliability 	<ul style="list-style-type: none"> • Inter-rater ICC 0.83, 95% CI [0.57 - 0.96], • Intra-rater ICC 0.85, 95% CI [0.50 - 0.93] 	<p>preference for a particular profession and developing professional self-efficacy.</p> <ul style="list-style-type: none"> • This scale measures professional identity development. PIF**** • Assessing the feasibility and utility of measuring baseline professional identity formation (PIF) • Developmental theory is based on professional identity formation, and moral reasoning measures are related.
Mylrea M.F. et al. 2017 (28)	Pharmacy students	Pharmacy Motivation Scale (Pharm-S)	Developed	Validity: <ul style="list-style-type: none"> • Convergent validity • Face validity (Confirmed readability and comprehension) • Content validity • Construct validity (Exploratory Factor Analysis) Reliability: <ul style="list-style-type: none"> • Internal consistency (Cronbach's Alpha and Spearman-Brown Test) • Test-retest correlation 	<ul style="list-style-type: none"> • A positive correlation emerged between the two variables, $r = 0.65$, $n = 327$, $p < 0.01$, (2-tailed) • Face validation confirmed readability and comprehension • Exploratory Factor Analysis: The final version contained 14 items in six-factor dimensions • Cronbach's Alpha values from 0.66 to 0.80 • Mean test-retest correlation of 0.82 	<p>PID</p> <ul style="list-style-type: none"> • Six-factor dimensions included intrinsic, integrated, identified, introjected, external and amotivated. • Determining motivation regulators in undergraduate students and exploring a possible link to professional identity development
Moola S. 2017 (34)	Nursing students	Nurses' Professional Identity Scale (NPIS)	Developed	Validity: <ul style="list-style-type: none"> • Content validity • Construct validity (Exploratory Factor Analysis) Reliability: <ul style="list-style-type: none"> • Internal consistency 	<ul style="list-style-type: none"> • Exploratory Factor Analysis: The final version contained 45 items in five-factor dimensions • Cronbach's Alpha value of 0.91 	<p>PI</p> <ul style="list-style-type: none"> • Measuring professional identity • Five-factor dimensions included self-presentation, self-image, self-esteem,

				(Cronbach's Alpha)	self-categorization and self-concept.
				Validity:	
				<ul style="list-style-type: none"> • Construct validity (Exploratory Factor Analysis and Confirmatory Factor Analysis) • Divergent validity with Spearman's correlation coefficient (Self-Esteem Scale) 	<ul style="list-style-type: none"> • Exploratory Factor Analysis: The final version contained 12 items in three-factor dimensions • The correlation coefficient between self-esteem scores and professional identity total scores was $\rho = 0.384$ • Cronbach's Alpha value of 0.87
Kanefuji A. & Nakatani H. 2017 (52)	Nurses	Professional Identity Structure	Developed	Reliability:	PI
				<ul style="list-style-type: none"> • Internal consistency (Cronbach's Alpha) • Construct validity (Difference between novice and expert students with the Kruskal-Wallis Test) 	<ul style="list-style-type: none"> • Investigating the structures of professional identity • Three-factor dimensions included the intention to develop professionally, confidence in one's own abilities, and occupational affinity.
			Used		
Miyoshi M. et al. 2019 (33)	Nursing and clinical laboratory students	Professional Identity Scale of Nurses	(Created by Hatano K. & Onodera T.) (1993) (57) (Japanese language)	Not reported	PIF
					Investigating the effects of observing a cadaver dissection on professional identity
				Validity:	PIF
				<ul style="list-style-type: none"> • Construct validity (Exploratory Factor Analysis) 	<ul style="list-style-type: none"> • Instrument to evaluate the degree of personal maturation and professional development in terms of socialization
				Reliability:	
				<ul style="list-style-type: none"> • Internal consistency (Cronbach's Alpha) 	<ul style="list-style-type: none"> • Evaluating PIF that can be applied to a large group of medical trainees • Five-factor dimensions including self-control as a professional, awareness of being a medical doctor, reflections as a medical doctor, execution of social responsibility, and external and
Tagawa M. 2019 (39)	Medical students, residents and experienced medical doctors (instructors)	Developing Scale (DS)	Developed		
				<ul style="list-style-type: none"> • Exploratory Factor Analysis: The final version contained 15 items in five-factor dimensions • Cronbach's Alpha value of 0.72 	

					internal self-harmonization
Tagawa M. 2020 (53)	Medical students, residents and experienced medical doctors (instructors)	Stage-Specific Attribute Scales (SASs)	Developed	<p>Validity:</p> <ul style="list-style-type: none"> Construct validity (Difference between novice and expert respondents) <p>Reliability:</p> <ul style="list-style-type: none"> Internal consistency (Cronbach's Alpha) 	<ul style="list-style-type: none"> Construct validity contained 27 items in four stages (Students had the highest mean score in stage 2, and instructors had the highest mean score in stage 4 and higher stage scales) Cronbach's Alpha value from 0.53 to 0.66
Li R. & Lou J. 2022 (54)	Nursing students	Professional Identity (PI) Scale	Developed	<p>Validity:</p> <ul style="list-style-type: none"> Content validity Construct validity (Confirmatory Factor Analysis) <p>Reliability:</p> <p>Internal consistency (Cronbach's Alpha)</p>	<ul style="list-style-type: none"> Confirmatory Factor Analysis of 12 items in three-factor dimensions Cronbach's Alpha value from 0.72 to 0.79 for the three subscales and 0.88 for the entire scale

* Only some of the main results of the included studies appear in this column. To check complete details, please refer to the cited study.

** The PIQ was developed by Brown et al. to measure the extent of an individual's social identity with a certain group. The PIQ has been used to assess the degree to which nurses working in various hospitals in South England identify with their specialized vocational groups. Finally, Toben D. et al. 2021 investigated the validity and reliability of the Professional Identity Questionnaire (PIQ) tools to measure professional identity among medical students.

*** Professional Identity

**** professional Identity Development

***** Professional Identity Formation

Analytical descriptive studies about the underlying theories of the tools

in studies where identity theories were used more often than others.

Of the 17 included studies, 4 (about 23.53%) were not based on a specific theory or theory-driven (Table 4). A wide range of theories were identified

Table 4. Analytical descriptive studies about the underlying theories of tools

Theory Domain	Theory Subdomain	Author, Year	Definition
Sociological theory	Symbolic Interactionism Theory (Horton Cooley, 1902 & Herbert Mead, 1934)	Hao Y. F., 2014	Symbolic interactionism is a micro-level theoretical framework and sociological perspective that deals with how society is created and maintained through repeated individual interactions. In other words, it provides a framework for a better understanding of how individuals interact with each other to develop symbolic worlds and how these worlds create individual behaviors (58).
Constructivist psychological theories	Personal Construct Theory (George Kelly, 1955)	Madill, A., 2005 Ellis R. et al., 2015	In the constructivist psychological theory, people form unique ideas (i.e., their concepts) about how the universe works and then use them to interpret their information and experiences. In other words, this theory attributes differences between individuals to different ways of interpreting the events of the world around them (59).
	Psychosocial Development Theory (Erik Erikson, 1950s)	Hao Y. F., 2014 Ellis R. et al., 2015	In the psychosocial development theory, Erikson suggests that there are eight stages in the psychosocial development of each individual, extending from infancy to adulthood, during which a person acquires his/her identity. At each stage, a person enters a socio-psychological crisis that can positively or negatively impact the development of his/her identity. In Erickson's view, such crises are socio-psychological because they consider the individual's emotional needs to be in conflict with the needs of society (60).
Motivation theories	Self-Determination Theory (SDT) (Ryan and Deci, 1980s)	Mylrea, M.F., 2017	The self-determination theory is a macro theory about human motivation and personality that relates to the natural growth tendencies and psychological needs of individuals (61). This theory, which describes a chain of motivation regulators, has been proposed as a convenient framework for studying students' motivation. According to this theory, individuals can determine their destiny when their needs for competence, connection, and independence are met (28).
	Intrinsic/Extrinsic Motivation Theory (Deci and Ryan, 1985)	Goltz, H.H., 2014	Motivation theories are defined as initiating, directing, and maintaining goal-driven behavior. They are essentially about what drives people to act to achieve a goal or satisfy a need or expectation (62). These theories explain what causes an individual to turn toward a particular goal or outcome. Motivation theories are numerous and vary (internally or externally) based on the specific needs that a person is trying to meet. Maslow's motivation theory is one of the most recognized and influential motivational theories (63).
Social psychology theories	Cognitive Dissonance Theory (Festinger, 1957)	Ellis R. et al., 2015	The cognitive dissonance theory shows that we have an internal incentive to keep all our attitudes and behaviors harmonious and avoid dissonance. This theory is known as the principle of cognitive compatibility. Disharmony between attitudes or behaviors causes cognitive dissonance or psychological discomfort in an individual, and to reduce it and restore equilibrium, changes occur in one of the attitudes, beliefs, or behaviors. Therefore, people in a state of cognitive dissonance will take measures to reduce their levels of inconsistency (64, 65).
	Realistic Conflict Theory (Campbell, 1965)	Brown et al., 1986	Realistic conflict theory deals with intergroup conflicts and how group members perceive and behave toward each other. When competition for limited resources, apparent social conflict can arise among groups. The theory also explains how feelings of prejudice and discrimination toward the enemy group accompany intergroup hostility and reinforce intra-group solidarity. Hostility can arise from a war over political power or lifestyle (66, 67).

Tools for assessing professional identity in health professions education: A scoping review

Social learning theories	Social Learning Theory (Albert Bandura, 1977)	Goltz, H.H., 2014 Li R. & Lou J., 2022	The social learning theory proposed by Albert Bandura in 1977 stresses the importance of observing, patterning, and copying other people's behaviors, attitudes, and emotional reactions. This theory contemplates how environmental and cognitive factors affect learning and human behaviors (68).
	Social Network Theory (Wilson, 1975)	Goltz, H.H., 2014	The social network theory is a study of how individuals, organizations, or groups interact within their networks. This theory will be easier to understand when you examine every single component, starting from the most prominent element (networks) and working your way down to the smallest element (individuals) (69).
	Social Identity Theory (Henri Tajfel, 1970)	Adams, K., 2006 Goltz, H.H., 2014 Moola, S., 2017 Brown et al. 1986	According to the social identity theory, individuals acquire a part of their identity - their social identity - from the groups to which they belong (e.g., identity as "student", "woman", "left-handed", etc.) (70). This interactive social-psychological theory addresses the role of self-concept and related cognitive processes and social beliefs in group activities and intergroup relations. The social identity theory aims to identify and predict conditions in which people think of themselves as individuals or members of a group (71).
Identity theories	Self-Concept Theory (Carl Rogers, 1951)	Cowin, L., 2001	Self-concept is a type of identity theory with various definitions. The core definition of self-concept, according to Rosenberg (1979), is: "the totality of an individual's thoughts and feelings having reference to himself [or herself] as an object" (72). Self-concept is the mental image that individuals form about themselves (73). Simply put, it refers to how we think about ourselves and how we should think, behave, and play various roles in our lives. Self-concept is a multidimensional feature. For example, people have various roles, such as mothers, teachers, students, democrats, and intellectuals. Each of these roles influences self-concept. "Real self-concept" is based on one's perceptual reality, and "ideal self-concept" is a point of reference compared with the real self. The difference between the two leads to a motivational force that drives the individual up. Both real and ideal self-concepts have social dimensions (74).
	Constructive-Developmental Theory (Kegan, 1982)	Kalet, A., 2016 Tagawa, M., 2019 Tagawa, M., 2020	Constructive-developmental theories are based on the works of Piaget, Kohlberg, and Maslow (75 - 77) and state that context is essential in making meanings (78). Meaning-making in people is influenced by external and internal factors, including the individual's physical environment, personal actions, behaviors and feelings, and interactions with others. By presenting a model based on the constructive-developmental theory, Kegan describes the movement process between the various stages of identity formation (77, 79). He (1982) believes that identity development takes place in five distinct stages and three dimensions: cognitive (the nature of knowledge), intrapersonal (individual goals, values, and self-belief), and interpersonal (the well-known beliefs, values, and goals of others) (77, 79). Individuals move from the self-centered concept of an identity that only considers the self to the formation of a professional and moral identity that conforms to the expectations, norms, and criteria of a profession (putting the interests of others before one's own and sacrificing one's ambitions to serve the society) (80).

Discussion

The results of this study identified reliable and valid tools such as SASs, PI scale, PIE, and NPIS that correspond to the proper theories for assessing and measuring the formation and development of professional identity in health professions education. Out of the 17 studies included in the present scoping review, 14 utilized dependable and accurate methods to evaluate the formation and development of professional identity. Furthermore, 13 tools were developed based on specific underlying theories. All of the studies used construct validity, especially factor analysis, and in 7, the content validity method was applied. When evaluating identity formation, researchers have predominantly employed three strategies more than others: standard inventories or repertory grids, structured or semi-structured interviews, and reflective writings (15). Some studies have offered a variety of scales or questionnaires for assessing identity formation (39, 53). Several qualitative studies have used open-ended interviews and reflective writings that emphasize different influential aspects of the issue. Considering that the present review aims to identify and review the tools developed for assessing the formation and development of professional identity in health

professions education, such studies were not included in our research due to the lack of tool development (81).

This study included only tools such as standard inventories or repertory grids (45), scales, and questionnaires (28, 33, 34, 43, 44, 46, 47, 50 - 52, 54). Psychometrics of these instruments were conducted either in this review or in future studies for the same target group or another one. Madill et al. used tools such as repertory grids based on George Kelly's Personal Construct Theory and thereby investigated identity changes in medical students during their first year of university, especially concerning their cadaver dissection experience (45). In 2019 and 2020, Tagawa et al. developed scales and questionnaires to assess the formation and development of professional identity, including a Developing Scale (DS) and a quantitative questionnaire of 27 items based on Kagan's theory (39, 53). Some studies have used open essay tools to assess professional identity and its formation or development using reflective writing. Among all these studies, those aiming at developing and using the open essay tools were included in our review (12, 15, 25, 49). The questionnaire may consist of closed- or open-

answer questions. Since open essays are questionnaires with open-answer questions, they are considered qualitative tools. One such tool was devised by Bebeau et al., who proposed the Professional Identity Essay (PIE) to assess the formation and development of professional identity in dental students based on Kegan's constructive-developmental theory (15). He stated that PIE is a potential source of information about identity development and formation for college admission. Kalet et al. adapted and used PIE to measure professional identity formation in medical students in their 2016 and 2018 studies (12, 25).

Some of the included studies did not adopt a measure of the same concepts for PIF/PI and had different perceptions. For instance, in 2001, Cowin et al. considered self-concept measurement as a way to assess professional identity and used the expression "self-concept in light of professional identity" (44). Moreover, in 2009, Crossley et al. stated that professional self-identity (which means identifying oneself as a member of an experienced group) and its development are essential factors in acquiring one's professional identity (47). Some studies deal with the correlation between professional identity formation and moral reasoning measures (12), or examine motivation regulators and link them to professional identity

development (28). Most of the included studies, however, measure the same concepts for PIF/PI and have the same perceptions regarding the assessment of professional identity or its formation and development (34). These studies have proposed terms such as "measure the developing level of professional identity" (48), "measure the professional identity change" (45), and "measure of professional identity and values" (50) in their goals. In checking the validity and reliability of the included studies, the exploratory or confirmatory factor analysis showed that different dimensions and factors, in other words, various components, were identified and measured. Professional self-image (48) and self-concept (44) are two factors that have been considered in the evaluation of professional identity in one or more studies. Therefore, having a self-image as a doctor or nurse and reflecting on it will affect the development and formation of a person's professional identity. Furthermore, many factors, such as self-presentation, self-esteem, self-categorization (34), confidence in one's abilities, occupational affinity, and intention to develop professionally (52), can help to evaluate the growth of professional identity in a person.

In most of the included studies, the items related to each dimension or identified component reported

high internal consistency or Cronbach's alpha. As regards the investigated target groups, it can be stated that some studies focused on the formation or development of professional identity among students in a wide range of health professions (51, 53), while others evaluated only identity in students of a specific field (12, 28, 34, 44, 45, 47, 48, 52).

Despite the considerable amount of emphasis on the procedural nature of professional identity development, some of the identified assessment methods are based on observable behavior (39). Relying on visible behaviors alone, however, will impede recognition of the essential aspects of professional identity (19). On the other hand, some studies suggest that by measuring the visible behaviors and revealing specific characteristics of professional identity, a snapshot of the mentioned path and process can be obtained (38, 39, 82).

Considering the emphasis of studies on forming and developing professional identity and its continuous nature, most tools provide mere snapshots of the process and fail to assess the multi-dimensional aspects of professional identity over time. In addition, no widely used tool has been identified for the development and shaping of the professional identity of students and healthcare professionals in general.

It is incorrect to assume that professional identity formation in students is a smooth, predictable, and linear way. The pathways of development for every student are different from others and completely dependent on the context (12).

Some experts in linear models consider the formation and development of adult professional identity very simple, but medical specialists believe it is a complex cultural and social phenomenon. According to the latter, professional identity formation is a multi-dimensional, evolving, and lifelong process that continues through one's professional life rather than a procedure with a final destination (1, 12, 24, 27, 83-86).

The research work carried out between 2019 and 2020 by Tagawa et al. are studies that have investigated the non-linear nature of professional identity formation and development and tried to quantify the complexity and the processes based on professional identity formation. Tagawa et al. devised a development scale using a quantitative questionnaire with multi-step scales (39, 53), which they believed could be a valuable indicator for examining medical students' progress and the development of their professional identity, as well as the process of their admission to the professional community (39). Moreover, a quantitative

questionnaire with multi-stage scales can facilitate the measuring and assessing process based on professional identity formation (39, 53). This study and studies in 2016 and 2018 by Kalet et al. reported different individual patterns in general and addressed the non-linear nature of professional identity development (12, 25). These studies were based on Kegan's constructive-developmental theory, which belongs to a class of theories that describe the process of movement between the various stages of identity development (77, 79), and can therefore be a comprehensive basis for forming professional identity.

Kalet et al. also proposed that in the process of professional understanding and formation and development of professional identity, we should move beyond the "shallow" interpretations obtained by checklists of values, personality characteristics or behaviors (12).

Experts have mentioned self-reporting tools as some of the most essential instruments for assessing professional identity formation in their studies. (19, 23, 82). However, due to the complexity of the process of professional identity formation and its multidimensional nature, assessing and measuring it will require more comprehensive self-reporting tools and multidimensional assessment strategies. Such tools

would evaluate the impact of experience on forming a person's professional identity and provide a clear conceptual framework, as well as the possibility of analysing the continuous and non-linear process of professional identity formation. Valid and reliable tools offer several advantages: 1) they are applicable on a wide scale and have a non-linear nature and multi-stage, 2) they consider the limitations of intercultural studies (since professional development is influenced by the culture and context of any society), and 3) they facilitate assessment and identity development methods in health professions education in different paradigms and among various national and ethnic communities (38, 39). This is one knowledge gap in the field that future studies should strive to fill. Notably, there is no widely used tool for assessing the formation and development of professional identity that could be recommended for health professions students and professionals.

The results of this review will contribute to future research and promote informed decisions for the selection or development of reliable and valid tools based on a clear conceptual and theoretical framework; such tools will serve as a means to assess professional identity not only among students but also among specialists in various fields

of health sciences. Also, the diversity of identity and growth theories underlying these tools makes it possible to bring the theories together better to explain the formation and development of professional identity.

Furthermore, due to the developmental nature of professional identity, some of these tools can be used in admission tests and entrance exams to evaluate students' initial understanding of the field and to measure their moral virtue before entering the programs, especially programs such as general medicine (39, 53). It is also possible to evaluate the professional identity formed in students during and at the end of the training period. Finally, based on the results obtained, it is possible to design and implement effective strategies and interventions in health profession education programs to accurately and fundamentally develop individuals' professional identities.

One strength of this review is that we designed the study selection and search strategy in databases comprehensively and extensively so that nearly all the studies corresponding to the research question could be examined. Also, since we recognized reliable and valid tools by adopting specific theories as the basis of the study, especially identity development theories, our findings can provide a valuable basis for future studies. In terms of

limitations, it can be noted that deleting non-English articles may have resulted in language bias. Finally, the quality of the included studies was not evaluated, although this was acceptable in a scoping review (87).

Conclusion

In summary, this scoping review can help to identify the available assessment tools for professional identity formation and development and to evaluate the tools based on their psychometric properties (validity and reliability), types of formats (repertory grids, scale, and questionnaire), underlying theory and targeted group. Most assessment tools have been developed in specific disciplines, including nursing, medicine, and pharmacy. Among the studies that deal with the non-linear nature of professional identity formation and development and try to quantify the complexity and processes based on professional identity formation, one can refer to Tagawa and Kalet studies. These studies consider the constructive-developmental theory of Kegan as the basis of research. Constructive-developmental theories offer a description of the process of movement between the various stages of identity formation and can be considered as comprehensive theories on the subject of professional identity formation.

This study will assist assessors and teachers in health professions education in selecting the most appropriate and validated tools to evaluate professional identity formation and development.

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Conflict of Interests

The authors declare that they have no competing interests.

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