

DEVELOPMENT, VALIDATION, AND RELIABILITY OF AN INSTRUMENT FOR ASSESSING KNOWLEDGE OF COMPREHENSIVE CARE

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Highlights: (1) A novel ACCIS instrument developed for diagnostic use regarding comprehensive care in health professions education. (2) Instrument validated through e-Delphi with panelists from across Brazil and a content validity index equal to 1.0. (3) Internal consistency and factor structure confirm that the instrument accurately measures what it is intended to assess. (4) The instrument fills a curricular gap and can guide pedagogical decisions in health programs.

PRE-PROOF

(as accepted)

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ABSTRACT

Objective: To develop and validate an instrument to assess knowledge of comprehensive health care in undergraduate Health Sciences programs. **Methods:** A methodological study with a qualitative-quantitative approach, conducted in three stages: construction of the instrument, content validation using an expert consensus technique, and reliability assessment. The expert panel comprised 21 participants in the first round and 14 in the second, with diverse backgrounds in the health sciences and from different regions of Brazil. Reliability and factor structure were assessed through internal consistency analysis and exploratory factor analysis, with a pilot test administered to 130 undergraduate medical students at a public higher education institution, excluding interns. **Results:** The final instrument contains 16 items organized into two components: students' perception of comprehensive care in undergraduate education (4 items) and knowledge of comprehensive health care (12 items). The overall content validity index reached 1.0 in the second round, and the overall Cronbach's alpha coefficient was 0.865, indicating good internal consistency. The factor analysis confirmed a unidimensional structure for the knowledge component, with satisfactory fit indices and factor loadings between 0.43 and 0.81 for all items. **Conclusion:** The instrument developed showed robust evidence of content validity and reliability, constituting a useful tool for diagnosing training in comprehensive care in undergraduate health programs, with the potential to inform pedagogical decisions and multicenter studies.

Keywords: Comprehensive Health Care; Health Education; Higher Education Policy

INTRODUCTION

Comprehensive care in health is a fundamental principle of the Brazilian Unified Health System (Sistema Único de Saúde, SUS). In the Brazilian context, the principle of comprehensive care refers to a holistic and broad approach to health, going beyond the treatment of diseases and considering the physical, psychological, social, and cultural dimensions of individuals¹. The concept is aligned with the idea that health care should be provided in a complete manner, considering the specific needs and characteristics of each person. It is a broad and complex concept that involves aspects related to individual and collective health, as well as cultural and social issues². There are different interpretations of

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what it means to offer comprehensive health care, which may generate disagreements among health professionals and hinder coordination among the different areas of the health system^{2,3}.

Other points may also be attributed to the limitations related to comprehensive care, such as structural and financial causes, which often prevent the provision of a complete set of health actions and services². The lack of access to essential services may compromise the guarantee of comprehensive care⁴. Thus, the pursuit of the realization of comprehensive care in the SUS must take into account not only conceptual difficulties but also a set of gaps, seeking solutions that make it possible to offer comprehensive, high-quality health care to the entire population^{2,5}.

In this sense, training for comprehensive care is an essential process to enable health professionals to provide health care that considers the biopsychosocial dimensions of the individual. This implies a paradigm shift in education, which should be oriented toward a more humanized and person-centered approach^{2,4}. In addition, training for comprehensive care should address aspects related to health promotion, disease prevention, and rehabilitation^{5,6}.

Another point that should be considered relevant is interdisciplinarity and multiprofessional practice. Offering comprehensive health care requires the participation of a team and coordination among different levels of health care. It is noted that training for comprehensive care should be oriented toward the construction of shared knowledge that values the exchange of experiences and the collective construction of knowledge in health. This can be achieved through active teaching methodologies provided for in the Pedagogical Course Projects, such as problem-based learning and team-based learning, which aim to stimulate critical reflection and problem solving from a perspective of comprehensive care^{2,7}.

Pedagogical Course Projects (PPC) can be remodeled to achieve this objective. The PPC is considered a fundamental tool for ensuring quality education that encompasses the competencies, skills, and content necessary for professional practice, and it should be constantly evaluated and updated so as to ensure that the program is in line with the needs of society. Thus, the PPC is an important instrument for guiding the training of health professionals capable of offering comprehensive and humanized care to the population⁸⁻¹².

In this way, the National Curriculum Guidelines (Diretrizes Curriculares Nacionais, DCN) for health programs are documents that guide the training of health professionals in Brazil,

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establishing the competencies necessary for quality, comprehensive education. The DCN were created with the aim of guiding more humanized, person-centered training, capable of meeting the needs of the population and of health services. They establish specific guidelines for each health area, such as Nursing, Pharmacy, Medicine, and Dentistry, guiding the structuring of curricula and the organization of educational processes. In addition, the DCN emphasize the importance of interdisciplinarity, primary health care, and coordination among the different levels of health care, seeking to promote comprehensive care in the training of health professionals. The DCN are, therefore, an essential tool for training professionals who will work directly in building a fairer, more equitable, and more efficient health system, capable of meeting the needs of the Brazilian population^{2,13-16}.

Thus, given the problem of the need for training directed toward comprehensive care, the proposal arises to develop and validate an instrument that enables the assessment of the teaching of comprehensive care in human health undergraduate programs, in order to identify their potentialities and limitations. It is worth remembering that questionnaires are fundamental tools in research, as they allow researchers to collect data in a structured and objective manner and can be used to collect information about opinions, behaviors, demographic characteristics, and other aspects relevant to the research in question¹⁷.

METHODS

This is a methodological study on the process of developing and validating an instrument to assess knowledge of comprehensive health care. The complete investigation and construction took place in 2023, including the questionnaire development stage. The study was developed in three stages: development/construction, validation, and reliability assessment of the instrument.

The study was conducted in accordance with the guidelines of the Declaration of Helsinki and the provisions of the Brazilian National Health Council. It was approved by the Research Ethics Committee for Research Involving Human Subjects of the Federal University of Goiás (Universidade Federal de Goiás) under Opinion No. 5.243.541.

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Stage 1 – Construction of the instrument

The initial instrument was developed considering the documentary analysis of the DCN of six Bachelor's programs in the field of Human Health Sciences from a previously published study, which aimed to analyze the perspective of comprehensive health care at a Higher Education Institution (HEI)¹⁸. This was complemented by a systematic review that surveyed articles on comprehensive care in health professions education². It also drew on the regulatory framework of the SUS and related literature^{1,19-22}.

The initial instrument included a total of 16 questions, each supported by at least two references. These were divided into two major components: (I) Characterization and perception of comprehensive care, with 4 items; (II) Knowledge of comprehensive care, with 12 items. For the panelists' judgments, a four-point Likert scale was established as the response option: strongly agree; agree; disagree; and strongly disagree²³⁻²⁵.

The items were presented in a structure in which each statement/question was placed in a row and the evaluative dimension in columns. For each of the criteria, in addition to the scale-based judgment, panelists were given the option of making suggestions that could help improve the item^{24,26}. The following questions were posed to the panelists:

- Is the statement/question clearly worded?
- Is the item relevant to the content of the study?
- Do the response options presented meet the objectives of the question?

Stage 2: Selection of panelists for the content validation process (e-Delphi)

This stage assessed the content validity of the instrument using the e-Delphi method in two rounds. The deadline set for participants to return the material was 30 days, counted from the date the invitation was sent. As a strategy to obtain a larger number of responses, reminders about the approaching deadline were sent every ten days. For the subsequent round, the deadlines were reduced by half^{26,27}.

Panelists were selected by inviting those identified on the Lattes Platform (a platform for the deposit of curricula vitae of Brazilian academics and researchers). The filters applied in the search were:

- Search by subject: Collective health;

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- Databases: Doctorate holders and other researchers – Brazilian nationality;
- Field of activity: Health sciences – all areas;
- Nature of activity: Teaching – Brazil – all regions;

To obtain a sample of panelists, faculty members from across the country were selected, with the aim of including at least seven professionals²⁸.

- From the search conducted on the Lattes Platform, 101 potential panelists were selected and invited, online, to join the panel through an invitation letter containing the link to access the research instrument on the *Google Forms* platform. The invitation explained the objectives of the research and requested the faculty member's participation. The faculty member's confirmation as a member of the expert panel occurred through their consent, expressed in the Informed Consent Form (Termo de Consentimento Livre e Esclarecido, TCLE), presented in the first section of the form on the *Google Forms* platform.

Stage 3: Statistical Analysis for the Assessment of Validity and Reliability

Content validity aims to judge how well each element or item of a measurement instrument reflects the dimension or construct it is intended to measure, in order to verify whether the items of the instrument actually represent, adequately, the characteristic or concept to be assessed^{29,30}. In contrast, reliability refers to the ability of the instrument to produce consistent and stable results over time or in different situations. In simpler terms, a tool is considered reliable when, applied repeatedly under similar circumstances, it provides consistent and reproducible results³¹.

In this sense, Cronbach's alpha coefficient was calculated to assess the reliability attribute of the questionnaire. The analysis of the results was performed using SPSS® version 26 (*Statistical Package for Social Science for Windows*). In addition, aiming for greater robustness of the internal validity of the construct, an Exploratory Factor Analysis (EFA) was conducted to evaluate the factor structure of knowledge of comprehensive care³¹. The analysis was implemented using a polychoric correlation matrix and the *Robust Diagonally Weighted Least Squares* (RDWLS) extraction method³². The decision on the number of factors to be

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retained was made using the Parallel Analysis technique with random permutation of the observed data³³, and the rotation used was *Robust Promin*³⁴.

To conduct the EFA, a pilot test was carried out. A total of 130 questionnaires were administered to a sample that reflected the characteristics of the study population: undergraduate medical students at a public University Center, excluding the internship (n = 375). The sample size was determined by simple sample calculation (estimate-based), yielding 129 – 95% confidence level and 7% margin of error^{35,36}.

In addition, the panelists' responses were also analyzed using the Content Validity Index (CVI), which is the method intended for evaluating the content of the instrument's items through the proportion of panelists who agree on the aspects fundamental to the instrument. In this sense, the CVI is used to assess the relevance and adequacy of the questionnaire items for the construct in question, based on the experts' responses. The combined use of e-Delphi and the CVI made it possible to obtain information from experts remotely, quickly, and efficiently, while ensuring the validity of the questionnaire items, thereby increasing the reliability of the results obtained in the research^{37,38}.

The CVI was calculated by the sum of the responses considered “appropriate” divided by the total number of responses. CVI values above 0.80 were considered indicative of good content validity³⁸.

RESULTS

The initial version of the research instrument was evaluated by 21 panelists, and the second round included 14 of them. The description of the expert panel is presented in Chart 1. The Content Verification Indices, as well as the items submitted to the first round of the e-Delphi, can be viewed in Table 1.

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Chart 1 – Panel of experts who actually participated in the study

Panelist	Field of Training	Highest Academic Degree	Teaching experience (in years)	Profile of the institution where they work or have worked
Panelist 1	Pharmacy	Master's	two	Public and private
Panelist 2*	Pharmacy	Master's	two	Public and private
Panelist 3*	Medicine	Doctorate	three	Public
Panelist 4	Psychology	Doctorate	one	Public and private
Panelist 5*	Nutrition	Doctorate	three or more	Public
Panelist 6*	Medicine	Doctorate	three or more	Public
Panelist 7*	Medicine	Doctorate	three or more	Public and private
Panelist 8*	Social Comm.	Doctorate	three or more	Public and private
Panelist 9	Nutrition	Doctorate	three or more	Public
Panelist 10*	Nursing	Doctorate	three or more	Public and private
Panelist 11*	Pharmacy	Doctorate	three or more	Public and private
Panelist 12*	Nutrition	Doctorate	three or more	Public and private
Panelist 13*	Nursing	Master's	three or more	Private
Panelist 14	Dentistry	Doctorate	three or more	Private
Panelist 15*	Nursing	Master's	three or more	Private
Panelist 16*	Nursing	Doctorate	three or more	Public and private
Panelist 17*	Pharmacy	master's	one	Private
Panelist 18	Medicine	master's	three or more	Private
Panelist 19	Pharmacy	Master's	three or more	Public and private
Panelist 20	Medicine	master's	three or more	Public
Panelist 21*	Nutrition	Master's	three or more	Public and private

* Panelists who participated in both rounds

Source: Authors

Cronbach's alpha is a statistical measure widely used to assess the internal consistency of a measurement instrument, such as a questionnaire or scale. This measure calculates the average correlation among the items of the instrument, indicating the degree of homogeneity of the responses³⁹. Cronbach's alpha coefficient ranges from 0 to 1, with values closer to 1 indicating greater internal consistency. To interpret the result, the following criteria were considered: values below 0.6 indicated weak consistency, values between 0.6 and 0.7 indicated fair consistency, values between 0.7 and 0.8 indicated good consistency, values between 0.8 and 0.9 indicated very good consistency, and values above 0.9 indicated excellent consistency. Items with a Cronbach's alpha value equal to or greater than 0.7 were considered to have acceptable internal consistency for the constructs³¹– Table 1. The items considered to have

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weak consistency were rewritten according to the panelists' opinions and sent to the second round of evaluation.

The items considered for rewriting and submission to the second round of evaluation met at least one of the following criteria: (a) Cronbach's alpha coefficient lower than 0.70, indicating weak or fair internal consistency; (b) Content Validity Index (CVI) lower than 0.80 in any of the evaluated domains (clarity, relevance, or breadth of the responses), below the threshold considered satisfactory for content validity; or (c) a qualitative suggestion for reformulation by at least one of the panelists, regardless of the quantitative score obtained.

Table 1 – Description of the validity and reliability of the instrument in the first round.

Item	Clarity % (n)	Relevance % (n)	Breadth % (n)	Alpha coeff. *	ICC 95%
<i>COMPONENT: Characterization and perception of comprehensive care</i>					
What is your undergraduate program?				0.640	0.265-0.843
Strongly disagree	-	-	-		
disagree	-	-	-		
agree	4.8 (1)	4.8 (1)	19.1 (4)		
strongly agree	95.2 (20)	95.2 (20)	80.9 (17)		
CVI	1	1	1		
**In which year of your undergraduate program are you currently enrolled				0.311	-0.425-0.699
strongly disagree	-	-	-		
disagree	4.8 (1)	-	-		
agree	9.5 (2)	-	4.8 (1)		
strongly agree	85.7 (18)	100 (21)	95.2 (20)		
CVI	0.95	1	1		
**Do you remember having studied "COMPREHENSIVE CARE" in any course?				0.492	0.051-0.778
strongly disagree	-	-	-		
disagree	9.6 (2)	4.8 (1)	-		
agree	33.3 (7)	9.5 (2)	19.1 (4)		
strongly agree	57.1 (12)	85.7 (18)	80.9 (17)		
CVI	1	0.95	0.95		
**Do you remember having studied "COMPREHENSIVE CARE," its concepts and applications, in any EXCLUSIVELY THEORETICAL course?				0.571	0.112-0.812
strongly disagree	-	-	-		
disagree	4.8 (1)	4.8 (1)	-		
agree	23.8 (5)	4.8 (1)	28.9 (5)		
strongly agree	71.4 (15)	90.4 (19)	71.1 (16)		
CVI	1	0.95	0.95		
<i>COMPONENT: Knowledge of comprehensive care</i>					
During your education, you can understand that the State must provide comprehensive care, with priority given to preventive activities, without detriment to care services.				0.658	0.293-0.850
strongly disagree	-	-	-		
disagree	4.8 (1)	-	4.8 (1)		
agree	4.8 (1)	-	4.8 (1)		
strongly agree	19.0 (4)	100 (21)	90.4 (19)		
CVI	1	0.95	0.95		

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**Comprehensive care is one of the pillars of the Brazilian Public Health System. However, there are several interpretations and perspectives regarding the concept of comprehensive care.				0.238	0.576-0.667
strongly disagree	-	-	-		
disagree	4.8 (1)	-	-		
agree	-	4.8 (1)	9.6 (2)		
strongly agree	95.2 (20)	95.2 (20)	90.4 (19)		
CVI	0.95	1	1		
The concept of comprehensive care has been expanded to include other dimensions, assuming care directed not only to the individual but also to the family and community (social inclusion).				1	-
strongly disagree	-	-	-		
disagree	4.8 (1)	-	-		
agree	4.8 (1)	-	-		
strongly agree	90.4 (19)	100 (21)	100 (21)		
CVI	0.95	1	1		
So-called “comprehensive” care cannot be limited to curative care or preventive care in isolation. These must be combined with current economic, social, political, and cultural transformations.				0.624	0.222-0.836
strongly disagree	-	-	-		
disagree	14.3 (3)	-	9.5 (2)		
agree	9.5 (2)	-	-		
strongly agree	76.2 (16)	100 (21)	90.5 (19)		
CVI	0.89	1	0.9		
Within the perspective of comprehensive care, we should not think of primary and secondary networks as synonyms of better or worse, but rather in terms of the technologies necessary and appropriate to meet a given user demand or a situation perceived by the health team.				0.721	0.422-0.878
strongly disagree	4.8 (1)	-	-		
disagree	9.5 (2)	9.5 (2)	9.5 (2)		
agree	33.3 (7)	33.3 (7)	42.9 (9)		
strongly agree	52.4 (11)	57.2 (12)	47.6 (10)		
CVI	0.9	1	0.9		
Comprehensive care is a concept that allows subjects to be identified as totalities, even if these are not attainable in their fullness.				0.895	0.782-0.954
strongly disagree	9.5 (2)	-	4.8 (1)		
disagree	4.8 (1)	4.8 (1)	-		
agree	14.3 (3)	9.5 (2)	9.5 (2)		
strongly agree	71.4 (15)	85.7 (18)	85.7 (18)		
CVI	0.9	0.95	1		
Within the scope of the SUS, we can assume that comprehensive care goes beyond the hierarchical and regionalized organizational structure of health care.				0.897	0.787-0.955
strongly disagree	-	-	-		
disagree	-	-	-		
agree	9.5 (2)	4.8 (1)	4.8 (1)		
strongly agree	90.5 (19)	95.2 (20)	95.2 (20)		
CVI	1	1	1		
It is expected that, in comprehensive health care, educational work should be carried out with the population and, finally, that it should be accepted that there is uncertainty in the definition of professional roles, where there is an alternation of knowledge and practices of each constituted core of the health professions.				0.922	0.839-0.966
strongly disagree	-	-	-		
disagree	-	-	-		
agree	23.8 (5)	14.3 (3)	14.3 (3)		
strongly agree	76.2 (16)	85.7 (18)	85.7 (18)		
CVI	1	1	1		
The discussion on comprehensive care permeates professional education and permanent education, which should encourage teamwork so as to foster dialogue among professionals.				1	-
strongly disagree	-	-	-		
disagree	-	-	-		
agree	-	-	-		

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strongly agree	100 (21)	100 (21)	100 (21)		
CVI	1	1	1		
The notion of comprehensive care as a principle should guide one to listen, understand, and, on that basis, respond to the demands and needs of people, groups, and communities.					
strongly disagree	-	-	-	0.798	0.583-0.912
disagree	4.8 (1)	-	4.8 (1)		
agree	23.8 (5)	33.3 (7)	19.0 (4)		
strongly agree	71.4 (15)	66.7 (14)	76.2 (16)		
CVI	0.95	0.95	0.95		
Based on the principle of comprehensive care and of acting in health, services should offer health promotion actions, prevention of risk factors, care for harms, and rehabilitation according to the dynamics of the health-disease process, and these should be articulated and integrated across all organizational spaces of the health system.					
strongly disagree	-	-	-	1	-
disagree	-	-	-		
agree	9.5 (2)	-	-		
strongly agree	90.5 (19)	100 (21)	100 (21)		
CVI	0.95	1	0.95		
In the Principles and Guidelines of the Unified Health System (SUS), comprehensive care is defined as the articulated and continuous set of preventive and curative, individual and collective actions and services required for each case at all levels of complexity of the system. Thus, we can state that the SUS user must have access to all health technologies for the reduction of harm and suffering and for prolonging life.					
strongly disagree	-	-	-	0.675	0.328-0.858
disagree	4.8 (1)	-	4.8 (1)		
agree	19.0 (4)	14.3 (3)	14.3 (3)		
strongly agree	76.2 (16)	85.7 (18)	80.9 (17)		
CVI	1	1	1		

Legend: ICC: Interclass correlation index Source: produced by the author

CVI: content verification index

* Cronbach's alpha coefficient

**Questions selected for the second round

Source: Authors

Table 2 summarizes the items evaluated and the overall reliability data of the instrument. When interpreting Cronbach's alpha in relation to "overall reliability," the following is generally considered: a Cronbach's alpha above 0.70 is often considered acceptable. Values above 0.80 are generally desired to ensure good internal consistency³¹.

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Table 2 – Cronbach’s alpha coefficient in the reliability of the instrument

COMPONENT ANALYZED	QUESTIONS	ITEMS EVALUATED	RELIABILITY*	
			ROUND 1	ROUND 2
Characterization and Perception of students regarding comprehensive care in undergraduate education	4	12	0.721	0.846
Knowledge of comprehensive health care	12	36	0.842	0.843
Overall	16	48	0.868	0.865

* Cronbach’s alpha

Source: Authors

Questions 2, 3, and 4 of component (I): Characterization and perception of comprehensive care, as well as question 2 of component (II) – item 6 of the instrument: Knowledge of comprehensive care, were revised to read as follows, respectively:

- In which period of your undergraduate program do you consider yourself to be? (consider the one in which you take the most courses).
- In any practical and/or theoretical course you have taken, was the topic of comprehensive care addressed?
- If the answer to the previous item was yes, in which course(s) was the topic “comprehensive care” addressed?
- Judge the statement: The concept of comprehensive care is broad and allows for interpretations ranging from the holistic conception of the individual to the organization of health actions (health promotion, protection, and recovery).

Exploratory Factor Analysis (EFA)

Regarding validity, the magnitude of factor loadings is a fundamental aspect of factor analysis, as it provides insights into the strength of the relationship between the items of a test or scale and the underlying factors one is trying to measure. In general, the magnitude of the factor loading indicates how strongly an item is associated with the factor in question. Higher loadings suggest a stronger relationship, whereas lower loadings indicate a weaker one. There is no strict universal threshold for what constitutes an “important” or “sufficiently high” factor loading. Furthermore, the interpretation of the factor loading often depends on the specific

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context of the research and the field of study. However, recent research considers loadings above 0.4 or 0.5 as indicative of a substantial association⁴⁰.

Chart 2 presents the descriptive analysis of the variables in the Pilot Test. It is worth noting that the instrument applied generated an overall score ranging from 12 to 60 points, with each item scored from 1 to 5 points.

Chart 2 – General description of the pilot test

Item/ variable	Mean	Confidence interval (95%)	Variance
Item 1	4.669	4.51 – 4.83	0.483
Item 2	4.531	4.38 – 4.68	0.449
Item 3	4.685	4.57 – 4.80	0.262
Item 4	4.685	4.56 – 4.81	0.293
Item 5	4.546	4.39 – 4.71	0.509
Item 6	4.400	4.25 – 4.55	0.455
Item 7	3.669	3.42 – 3.92	1.206
Item 8	3.954	3.73 – 4.18	0.982
Item 9	4.600	4.48 – 4.72	0.286
Item 10	4.623	4.51 – 4.74	0.266
Item 11	4.569	4.43 – 4.71	0.368
Item 12	4.462	4.24 – 4.69	0.987

Legend: Item 1 = What is your undergraduate program?; Item 2 = In which period of your undergraduate program do you consider yourself to be?; Item 3 = In any practical and/or theoretical course you have taken, was the topic of comprehensive care addressed?; Item 4 = If the answer to the previous item was yes, in which course(s) was the topic of comprehensive care addressed?; Item 5 = During your education, you can understand that the State must provide comprehensive care, with priority given to preventive activities, without detriment to care services; Item 6 = Comprehensive care is one of the pillars of the Brazilian Public Health System; Item 7 = The concept of comprehensive care has been expanded to include other dimensions; Item 8 = So-called comprehensive care cannot be limited to curative care or preventive care in isolation; Item 9 = Within the perspective of comprehensive care, we should not think of primary and secondary networks as synonyms of better or worse; Item 10 = Comprehensive care is a concept that allows subjects to be identified as totalities; Item 11 = Within the scope of the SUS, we can assume that comprehensive care goes beyond the organizational structure; Item 12 = In the Principles and Guidelines of the SUS, comprehensive care is defined as the articulated and continuous set of actions and services. Items 1 to 4 make up Component I (Characterization and Perception of Comprehensive Care); items 5 to 16 make up Component II (Knowledge of Comprehensive Health Care).

Source: Authors

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For the component “Knowledge of comprehensive care,” the parallel analysis suggested a single factor as the most representative for the dataset. The factor loadings of the items and the 95% Bias-Corrected and Accelerated (BCa) bootstrap confidence intervals for loading values can be seen in Table 3. This statistical technique is used to calculate confidence intervals around estimated values, specifically for loading values in the context of factor analysis or factor structure. The term “bias-corrected” indicates that the technique addresses possible distortions (bias) in the estimation, and “accelerated” refers to a correction for skewness in the distribution of the estimated values⁴⁰.

Table 3 – Factor structure of Knowledge of comprehensive care

ITEMS	FACTOR LOADING	BCA	MSA
Item 1	0.434	0.183 – 0.608	0.78022
Item 2	0.635	0.390 – 0.786	0.72972
Item 3	0.648	0.398 – 0.816	0.78120
Item 4	0.800	0.657 – 0.904	0.34895
Item 5	0.640	0.434 – 0.785	0.80056
Item 6	0.631	0.413 – 0.782	0.76109
Item 7	0.452	0.285 – 0.607	0.76028
Item 8	0.516	0.311 – 0.671	0.81025
Item 9	0.791	0.572 – 0.882	0.76779
Item 10	0.812	0.648 – 0.913	0.71216
Item 11	0.677	0.498 – 0.807	0.78260
Item 12	0.452	0.285 – 0.607	0.83064

Legend: BCa Confidence Interval: 95% bias-corrected and accelerated (BCa) bootstrap confidence intervals for loading values.

MSA - Measure Of Sampling Adequacy: measure of sampling adequacy.

Source: Authors

The Measure of Sampling Adequacy (MSA) assesses the extent to which each item shares variance with the other items in the set, indicating its adequacy for factor analysis. MSA values below 0.50 suggest that the item, taken in isolation, does not measure the same latent domain as the other items and, therefore, may be considered for removal; however, such a decision must jointly take into account the psychometric evidence and the theoretical judgment about the relevance of the construct represented by the item⁴¹.

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DISCUSSION

The findings of this study demonstrate that it is possible to develop and validate, with methodological rigor, an instrument for assessing knowledge of comprehensive health care in undergraduate education. The convergence among the evidence of content validity, the internal consistency, and the adequacy of the factor structure indicates that the instrument measures the proposed construct coherently and accurately, addressing a gap identified in the literature on the assessment of comprehensive care in health programs^{2,42}.

The results of the e-Delphi validation process revealed high content validity indices for the great majority of the items already in the first round, with an overall CVI above 0.80 in clarity, relevance, and breadth. This pattern is consistent with studies validating instruments in the health field that adopt e-Delphi as the method, in which the diversity of the experts' backgrounds tends to broaden the representativeness of the content assessed, reducing disciplinary biases and favoring the logical validity of the instrument^{38,42}.

The overall Cronbach's alpha coefficient of 0.865 in the second round places the instrument in the very good internal consistency range, according to the criteria widely adopted in the psychometric literature³¹. The marked improvement in Component I between rounds (from 0.721 to 0.846) indicates that the qualitative revision of the items based on the panelists' suggestions was effective in increasing the homogeneity of the constructs assessed. The marked improvement in Component I between rounds (from 0.721 to 0.846) indicates that the qualitative revision of the items based on the panelists' suggestions was effective in increasing the homogeneity of the constructs assessed^{31,37}.

The exploratory factor analysis confirmed a unidimensional structure for Component II, with factor loadings ranging from 0.434 to 0.812, all above the 0.40 threshold frequently adopted as indicative of a substantial association^{35,41}. Although Item 4 showed a Measure of Sampling Adequacy value of 0.349 (below the recommended threshold of 0.50), it was decided to retain it for both theoretical and psychometric reasons. From a theoretical standpoint, this item represents a core construct of comprehensive care: the articulation between the holistic conception of the individual and the organization of health actions along the axes of promotion, protection, and recovery, with a CVI = 1.0 in both rounds of the panel. From a psychometric standpoint, the item showed a factor loading of 0.800 (95% CI: 0.657–0.904), expressing a

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robust association with the latent factor, in line with international guidelines for the construction of assessment instruments^{17,29}.

The additional fit indices reinforce the adequacy of the factor structure: a Comparative Fit Index of 0.927 (95% bootstrap CI: 0.920–0.968) and a Tucker-Lewis Index of 0.922 (95% bootstrap CI: 0.902–0.960), both within acceptable limits for single-factor models³⁵. The quality of the factor score estimates also exceeded the thresholds recommended for use in individual assessments: Factor Determinacy Index of 0.953, marginal reliability of the scores of 0.908, sensitivity ratio of 3.137, and expected percentage of true differences of 92.9%^{40,41}.

As with any initial development and validation study, this work has limitations inherent to its methodological nature. The pilot test sample was composed of students from a single public institution, which is expected at this stage and does not compromise the evidence obtained, but indicates that the results should be interpreted in the context of the sample studied. Additionally, in scales whose statements align with widely recognized values in the health field, respondents may tend to agree with the statements regardless of their knowledge (an effect that cannot be controlled in this case). These aspects point to natural directions for future research, which should broaden the sample to include other programs, institutional profiles, and regions of the country.

CONCLUSION

The instrument developed in this study demonstrated satisfactory evidence of content validity, internal consistency, and adequacy of the factor structure for assessing knowledge of comprehensive health care in training, addressing the gap identified in the literature regarding the absence of specific tools for this purpose. The validation process by expert consensus in two rounds ensured content representativeness, and the reliability analyses confirmed that the instrument coherently measures what it is intended to assess.

Its use is recommended in diagnostic and exploratory research on students' perception and knowledge of comprehensive care, with attention to the institutional context of the sample at this stage of validation. Future studies in different programs, regions, and teaching modalities may broaden the evidence and consolidate the instrument as a tool for curricular monitoring in the health field.

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