

# Validation of a structured questionnaire to assess the perception and satisfaction of respiratory therapy students toward career prospects and learning resources

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**Background:** Respiratory therapy is an emerging profession that has existed in India since 1995. Respiratory therapy students will play a significant role in strengthening various aspects of healthcare in the future. There are no validated instruments to evaluate students' perceptions of their careers and satisfaction with the learning resources. The primary objective of the current study is to develop and validate a structured questionnaire (SQ) for respiratory therapy students in India, encompassing all the components of their career development and satisfaction.

**Methods:** Based on the literature review and content validity from respiratory therapy experts through multiple focused group discussions, a reliable SQ was generated with 40 items based on the Likert scale. After getting institutional ethics clearance and informed consent, the SQ was administered to 904 respiratory therapy students across the country. We performed principal component analysis (PCA), structural equation modeling, and confirmatory factor analysis (CFA) for the global fit. Cronbach's alpha was performed to estimate the internal consistency.

**Results:** The PCA generated a 4-factor model, and internal consistency for the total scale exceeded the standard criterion of >0.70. Satisfactory goodness of fit data were yielded from CFA. Average variances extracted were higher than the correlation coefficients of the factors, which show sufficient discriminant validity.

**Conclusion:** This study shows a clinically acceptable model, it fits and suggests the possibility of applying a SQ to a respiratory therapy student with relatively good construct validity and internal consistency, based on the results of CFA.

**Key Words:** *respiratory therapists; questionnaire; perception; career; validity*

## INTRODUCTION

Respiratory therapy is an emerging allied healthcare profession in India and is an integral part of the multidisciplinary team involved in the management of respiratory disorders through structured education and tailor-made exercises [1]. Respiratory Therapists (RT) have diverse roles and responsibilities in modern healthcare facilities, providing respiratory care to patients at various levels. They work in both acute and chronic care settings, employed as clinical application specialists in medical equipment companies, teaching faculty at universities and colleges, and as health care researchers. RT's specialized care is documented to reduce the overall duration of hospital stay, reduce recurrent hospital visits, and reduce morbidity [2, 3]. With the increase in the sophistication of medical care, and the increasing number of respiratory-related disorders such as Chronic Obstructive Pulmonary Disease, Severe Acute Respiratory Syndrome, Middle East Respiratory Syndrome, and COVID-19, there is greater demand and need for highly skilled RTs [4]. Appropriate respiratory care provided by a suitably qualified and skilled RT is documented to reduce the cost of care and improve patient-related outcomes with lower ICU and hospital stays [5].

The importance of evidence-based medicine in managing respiratory conditions is highly recommended and RTs are expected to be up to date in knowledge to deliver optimal care as part of the multidisciplinary team [6]. A well-structured respiratory therapy program, which acquires and maintains international recognition, accreditation, and standards, has a greater impact on fostering students' critical thinking and problem-solving skills [7]. In India, the respiratory care profession was established 25 years ago; however, its widespread implementation in hospitals is still ongoing [8]. Exploring respiratory therapy students' perceptions regarding their careers, satisfaction with the learning resources, and experience with the curriculum by using a standardized and validated tool is necessary for continuous quality improvement. One way to measure a student's perception of the quality of education is by using a standardized questionnaire. Questionnaires are popular research methods as it offers an efficient and inexpensive way to gather large amounts of data from a sizeable sample. However, there are no standardized and validated questionnaires available that can robustly measure the perceived quality of the overall learning experience of a respiratory therapy student. The objective of the current study is to develop and provide

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validity evidence for a structured questionnaire to assess the perception of respiratory therapy students in India regarding their future careers, prospects, and satisfaction with the available learning resources in their program.

## MATERIALS AND METHODS

The modified Zhou's Mixed Methods Model of Scale Development and Validation was used to construct structured questionnaire (SQ) [9]. We list these steps below.

### Item generation

A series of informal focus group meetings were conducted with RTs employed in clinical settings, academia, industries, and those who work outside the conventional RT job profiles (e.g., Clinical Application Specialists, Research Assistants, Hospital managers, Homecare service providers etc.). These discussions were audio-recorded and transcribed verbatim in a word document. Themes were produced through thematic analysis by qualitative experts at the institution, which eventually became the items of SQ, consisting of four primary domains: (i) perception, (ii) satisfaction, (iii) curriculum, and (iv) suggestions. A few questions were also added to obtain demographic and other relevant information.

### Content validation

Content validation was carried out by four internal and four external experts who are actively engaged in the respiratory care domain using the Lawshe method [10]. This method has been extensively used to establish and enumerate content validity in various fields including healthcare, education, and organizational development. It includes a panel of subject matter "experts" who score the items into one of three categories: "essential", "useful, but not essential", or "not necessary". Items deemed "essential" by a critical number of panel members are then contained within the final instrument, with items failing to achieve this critical level discarded. Lawshe suggested that based on "established psychophysical principles", a level of 50% agreement gives some assurance of content validity. The internal experts graduated from a respiratory therapy program and were then employed within the same institution, whereas external experts had graduated from respiratory therapy from other universities and were employed in different organizations. Acceptance for inclusion in the SQ is based on the agreement of at least five out of eight experts. Expert panel inputs and suggestions provided for important recensions and facilitated the construction of a more comprehensive SQ. The resulting SQ had 40 closed-ended questions ranging from 1 (strongly disagree) to 3 (strongly agree) on a Likert scale. Demographics and open-ended questions about facilitating factors, hindering factors, and suggestions were not counted as part of the tool [11].

### Participants and procedures

Institutional Ethics Clearance was obtained from the host institution before the participants were recruited (Ref: SUEC 2020/001 Dated 02.01.2020). The questionnaire was circulated through email and WhatsApp to all the participants. Students were informed that the purpose of the survey was to assess their perception regarding career prospects and satisfaction with the available learning resources. Informed consent was obtained from all the respondents.

### Statistics

Duplicate, impossible, and invalid data were reviewed before the primary analysis. A histogram was used to check for normality, and a box plot was used to check outliers for factor analysis. There were no outliers found, and the distribution was close to normal. First, the calibration sample was subjected to exploratory factor analysis (EFA), utilizing the principal component analysis to explore the factor structure in each of the four components [12]. The field specialists predetermined the individual factors and underlying components.

R statistical version 4.0.2 was used to evaluate the global goodness of fit model indices. The goodness-of-fit index (GFI), comparative fit index,

root mean square error of approximation (RMSEA), approximate GFIs, normed fit index (NFI), and standardized root mean square residuals (SRMR) are among these indices. The degree of variance and covariance are combined in the GFI to represent how well the model fits the sets of observed data.

Comparative fit index is used to compare the null model to the fits of the proposed model. The data are acceptable if the value is  $>0.90$ . The RMSEA describes how well the model quantitatively fits the observable data. A value  $<0.05$  is regarded to be a good fit. SRMR is defined as a closed fit, with values  $<0.05$  indicating a good fit and values between 0.05 and 0.08 indicating an appropriate fit. The NFI scale is 0–1, with higher values indicating better fit [13, 14]. CFAs were performed using the Lavaan package of R version 3.1.2 [15]. The internal consistency and reliability for SQ and subscales were measured by Cronbach's alpha.

Composite reliability (CR) was used as a measure of internal consistency of the factors, where values  $>0.70$  indicate good reliability. To compute convergent and discriminant validity we used the procedure proposed by Fornell and Larcker [16]. In this method, we obtained discriminant validity if the average variance extracted (AVE) is greater than the maximum shared squared variance (MSV). For convergent validity, the AVE should be  $\geq 0.50$  and lower than CR.

## RESULTS

Nine hundred and four students were included in the analysis after excluding 31 students as invalid cases and those not willing to participate in the survey. Most students ( $n = 446$ , 48%) were 20–22 years old, and over half of the respondents were female (60%) (Table 1). Both EFA and CFA were then performed to assess the tool's validity.

Exploratory factor analysis was conducted on the Likert scale items for each factor of the questionnaire. According to the predefined models, the perception factor contained 16 items (P1–P16), the satisfaction factor contained 13 items (S1–S13), the curriculum factor contained 6 items (C1–C6), and the suggestion factor contained 5 items (SU1–SU5). Normality assessment usually rejects if the skewness ratio is  $> \pm 1$  and (or) kurtosis is  $> \pm 2$  [17]. The items' distribution deviated from the normality of the abovementioned range removed from the model (Table 2).

The Kaiser-Meyer-Olkin (KMO) is a measure that provides an approach to comparing the zero-order correlations to the partial

**TABLE 1**  
**Subject demographics ( $n = 904$ )**

Demographic characteristics	<i>n</i> (%)
<b>Type of degree</b>	
Bachelor	856 (95)
Diploma	2 (0.2)
Master	46 (4.8)
<b>Current academic year</b>	
Internship	163 (17)
First year	218 (23)
Second year	280 (30)
Third year	243 (26)
<b>Age (years)</b>	
18–20	380 (41)
20–22	446 (48)
23–25	53 (5.7)
25–30	11 (1.2)
Above 30	3 (0.3)
Less than 18	11 (1.2)
<b>Gender</b>	
Female	554 (59)
Male	349 (37)
Other	1 (0.1)
<b>Marital status</b>	
Married	13 (1.4)
Prefer not to say	16 (1.7)
Unmarried	875 (94)

*Note: Percentages may not total 100 due to rounding.*

**TABLE 2**  
**Descriptive statistics for characteristics scale items (n = 904)**

Items	N	Minimum	Maximum	Mean	Standard deviation	Skewness	Kurtosis
P1	904	1	3	2.95	0.261	-5.381	30.852
P2	904	1	3	2.93	0.304	-4.658	22.571
P3	904	1	3	2.91	0.351	-3.990	16.079
P4	904	1	3	2.76	0.523	-2.117	3.563
P5	904	1	3	2.82	0.443	-2.402	5.197
P6	904	1	3	2.23	0.945	-0.478	-1.712
P7	904	1	3	2.47	0.848	-1.068	-0.755
P8	904	1	3	2.14	0.903	-0.285	-1.716
P9	904	1	3	2.59	0.759	-1.462	0.336
P10	904	1	3	2.08	0.933	-0.157	-1.834
P11	904	1	5	3.70	1.010	-0.374	-0.391
P12	904	1	5	3.89	0.965	-0.611	-0.231
P13	904	1	5	4.34	0.892	-1.271	0.985
P14	904	1	5	3.10	1.192	0.052	-0.863
P15	904	1	5	3.89	1.081	-0.724	-0.255
P16	904	1	5	4.24	0.988	-1.156	0.599
S1	904	1	5	3.81	1.076	-0.813	0.138
S2	904	1	5	3.85	1.038	-0.849	0.318
S3	904	1	5	4.12	0.859	-0.954	0.980
S4	904	1	5	3.93	1.004	-0.838	0.189
S5	904	1	5	3.98	0.932	-0.797	0.342
S6	904	1	5	4.10	0.954	-1.136	1.164
S7	904	1	5	3.99	0.949	-0.952	0.813
S8	904	1	5	4.02	0.977	-0.998	0.767
S9	904	1	5	4.11	0.930	-1.064	1.022
S10	904	1	5	4.01	0.918	-0.829	0.554
S11	904	1	5	4.01	0.956	-0.834	0.311
S12	904	1	5	4.07	0.947	-1.003	0.881
S13	904	1	5	3.94	1.049	-0.961	0.555
C1	904	1	5	3.75	0.958	-0.592	0.081
C2	904	1	5	3.89	0.846	-0.578	0.413
C3	904	1	5	4.15	0.788	-0.869	1.124
C4	904	1	5	4.00	0.854	-0.696	0.408
C5	904	1	5	3.73	0.991	-0.450	-0.226
C6	904	1	5	3.99	0.900	-0.663	0.052
SU1	904	1	5	4.25	0.807	-1.036	1.144
SU2	904	1	5	4.29	0.791	-0.957	0.697
SU3	904	1	5	3.50	1.140	-0.354	-0.653
SU4	904	1	5	3.37	1.168	-0.169	-0.886
SU5	904	1	5	3.73	1.047	-0.445	-0.376
<b>Kaiser-Meyer-Olkin Measure of Sampling Adequacy</b>							0.902
<b>Bartlett's Test of Sphericity</b>					Approximate $\chi^2$		4995.17
					Degree of freedom (df)		351
					Significance		0.0001

correlations between pairs of variables [18]. The KMO in the study model was 0.90; Kaiser (1974) stated that it is acceptable if the KMO is >0.50. The closer the KMO is to 1, the better the correlations between the pairs of variables explained by the other variables [19].

Results of the EFAs for perception showed that 12 items did not load (factor loading <0.30) on the factor well; P1-P9, P11, P12, and P16. The curriculum factor C5 and suggestion factors SU1 and SU6 were not loaded well; therefore, they were sequentially trimmed from the model. The modified model on perception comprised P10 and P13-P15, satisfaction comprised S1-S13, curriculum contained C1-C4 and C6, and suggestion factor contained SU2-SU5 and accounted for 43.7% of the total variance and was used to create a scree plot (Figure 1).

As seen in Table 3 the factor loadings for all the items ranged from 0.30 to 1.03, and the internal consistency was Cronbach  $\alpha = 0.85$ . Table 3 shows the loading of the 27 items on the four factors and the accounted cumulative variance with the entire sample (>64%).

Pearson's correlation coefficients were calculated to explore the inter-relationships between factors (Table 3). The measurement model fit using CFA is shown in Figure 2. The model fits the data adequately with

a good GFI (0.92), Tucker-Lewis Index (0.97), and RMSEA (0.06). The raw  $\chi^2$  is 198 and  $\chi^2/df$  is 4.9 with  $p < 0.01$  (Table 4).

The AVE of the constructs in the study was measured and compared to the inter-factor correlations [20]. Preliminary evidence of convergent validity was determined when the AVE of each construct was higher than its correlation with other constructs. In contrast, the discriminant validity of the competency scale was preliminarily determined by assessing the Maximum Shared Variance (MSV) and found to be lower than the AVE for all the constructs in the scale [21]. Convergent and discriminant validities results are available in Table 5.

## DISCUSSION

This research paper is the first attempt to develop and provide validity evidence for a SQ to understand the perception and satisfaction of respiratory therapy students regarding various aspects of their academic progression. These graduates are required to be highly competent and, to accomplish that, the curriculum of RT programs should include sound theoretical knowledge and be clinically relevant [22]. Respiratory therapy students in the United States ( $n = 87$ ) were surveyed to determine students' perceived self-efficacy, outcome expectations, barriers, and support to

FIGURE 1

Scree plot for the four-factor model of structured questionnaire.

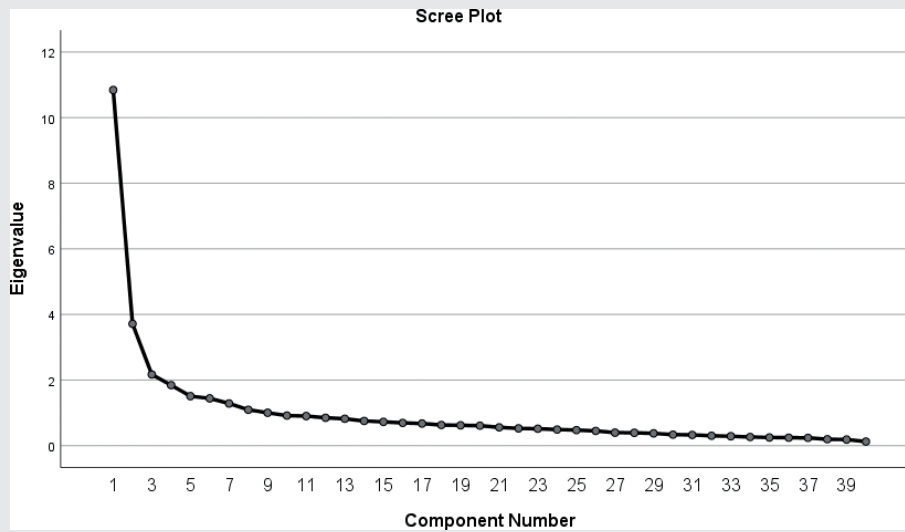


TABLE 3

Factor loadings and communalities

Factor	Items	Questionnaires	Factor loadings	Communalities
Perception	P10	News stories about the Respiratory Therapists' shortage	0.868	0.324
	P13	Not enough new graduates to fill the increasing number of jobs/demand	0.433	0.178
	P14	Work is physically and emotionally challenging	0.935	0.173
	P15	In India RTs are not recognized enough for their contributions	0.702	0.320
	P16	Other careers are more attractive so RTs change their profession.	0.526	0.344
Satisfaction	S1	In my knowledge and experience, the standard of my institute matches the international standards of respiratory therapy institutions	0.660	0.298
	S2	The physical facilities (e.g., classroom, furnishings, and computers) were appropriate	0.563	0.315
	S3	The situation of the educational environment (school/college/institution) and clinical training site environment is safe and secure	0.470	0.473
	S4	There are adequate and quality education tools in our program	0.987	0.519
	S5	Various courses are well coordinated to ensure equality among student	0.435	0.550
	S6	My faculty has excellent academic, practical, and professional experiences	0.498	0.666
	S7	The faculty members are keen enough on the completion of the course curriculum	0.498	0.544
	S8	Benefits gained by the students from the clinical/practical training sites are excellent	0.422	0.663
	S9	My faculty has excellent academic, practical, and professional experiences	0.489	0.667
	S10	The faculty members are keen enough on the completion of the course curriculum	0.443	0.591
	S11	Benefits gained by the students from the clinical/practical training sites are excellent	0.550	0.647
	S12	There is good interaction between students and teaching faculty during the classes	0.651	0.689
	S13	The teachers covered all the key points of the current syllabus	0.363	0.645
Curriculum	C1	The current method of teaching is satisfactory	0.918	0.616
	C2	The multiple modes of assessment help us, the students to excel	0.514	0.674
	C3	Small group discussion gives a better understanding of the subject	0.637	0.589
	C4	The viva voce examination is very effective	0.422	0.599
	C6	As respiratory therapy is a patient-oriented program, the teachers emphasize clinical skills rather than theory lectures	0.556	0.438
Suggestions	SU2	Career counseling help should be provided by the university	0.954	0.369
	SU3	The clinical teaching is inadequate	0.606	0.347
	SU4	There is no systematic training	0.477	0.293
	SU5	There is an urgent need for establishing a regulatory body	0.462	0.472

attend a Master of Science in Respiratory Care program; the primary goal was to graduate and gain employment as active and registered respiratory therapists, with only about 11.5% wanting to do a post-graduate degree in respiratory therapy [23]. This implies that the responding respiratory therapy students were only willing to learn the fundamentals of practice in their primary respiratory therapy program rather than attain post-graduate education. Additionally, in a developing country like India where the field

of respiratory therapy continues to evolve, the perception of the students enrolled in the respiratory therapy programs regarding their future career prospects gains even more significance, as it could have a direct impact on the involvement of students in the program.

The proposed SQ will be a useful tool to measure both the perception of respiratory therapy students towards their careers and their perception of the available learning resources to enhance their knowledge. The

FIGURE 2

Structural equation modeling results of the confirmatory factor analysis for the four-factor model.

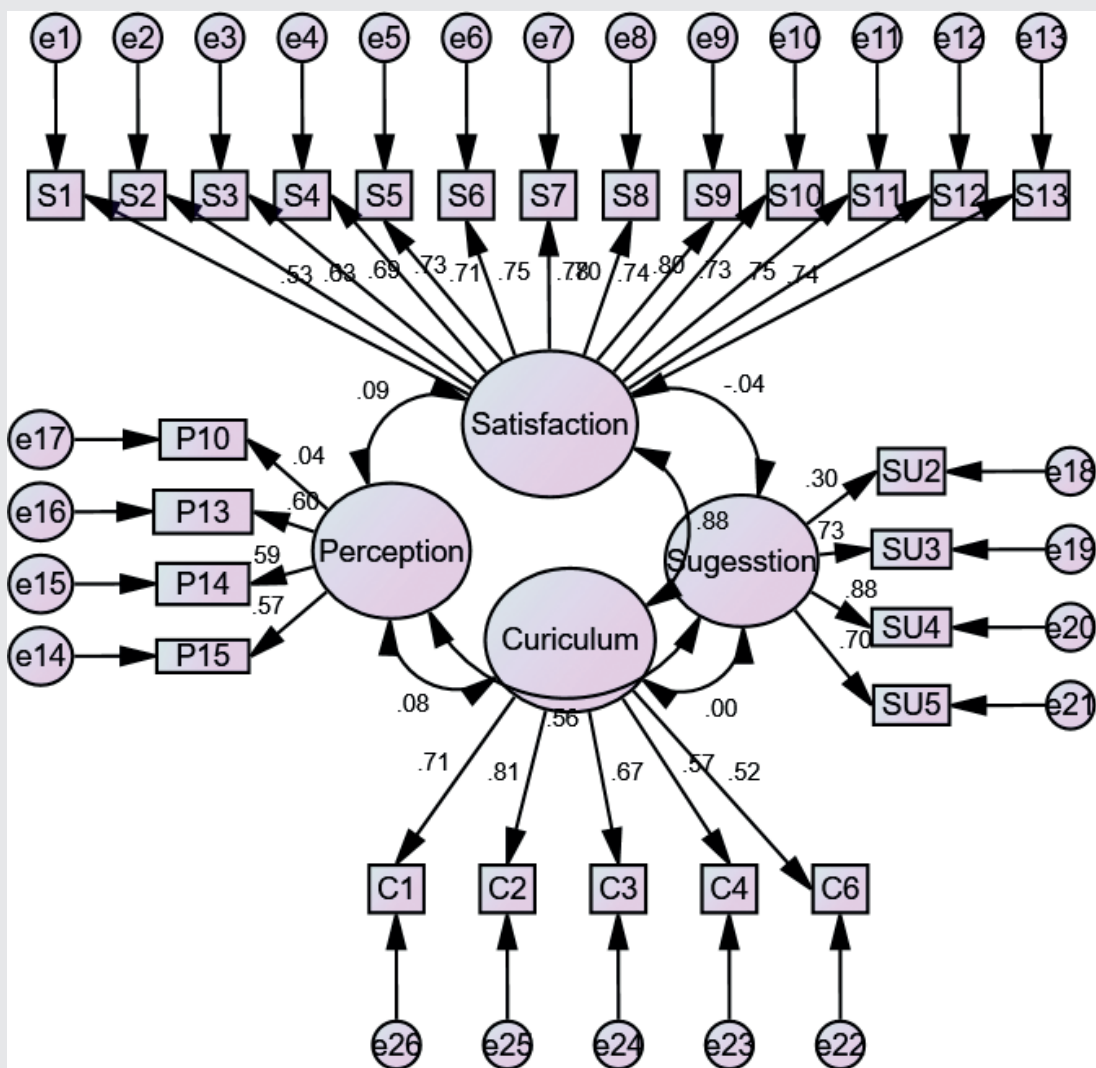


TABLE 4  
Confirmatory factor analysis process for scale

$\chi^2$	Root mean square error of approximation	Turker-Lewis Index	Comparative tit index	Goodness-of-fit index	$\chi^2/df$	p
198	0.06	0.97	0.94	0.92	4.9	0.01

four-factor model of the SQ was performed using structural equation modeling (SEM), by specifying relationships among the observed variables and the unobserved variables. The 27-item SQ would be a valid and reliable scale to measure respiratory therapy students’ future careers, perspectives, and satisfaction with learning resources. The four major domains of the SQ were perception, satisfaction, curriculum, and suggestions.

**Perception**

The “Work is physically, and emotionally challenging” item loaded the highest (0.93) in the domain. However, it is noteworthy that other items that loaded the most emphasized the inadequate recognition of RTs in the

TABLE 5  
Validity and reliability measures

Measure	Average variance extracted	Composite reliability	Maximum shared varianc
Perception	0.90	0.76	0.19
Satisfaction	0.84	0.79	0.24
Curriculum	0.86	0.68	0.32
Suggestions	0.82	0.72	0.22

country (0.702), with a shortage in the news stories on RTs (0.868). These two items gain increasing significance while considering the commonality from the respondents, who were from over 900 respiratory therapy students across the country, and inadequate recognition of the RTs has been well documented until the recent Coronavirus disease (COVID-19) outbreak [24, 25].

**Satisfaction**

The item that loaded the most in the factor of “satisfaction” was “there are adequate and quality education tools in our program” (0.98). Other

items that loaded the most also reflected the high level of satisfaction with the standard of teaching (0.66), physical facilities (0.563), good teacher–student interaction (0.651), and practical/clinical training provided (0.55).

### Curriculum

The item that loaded the most under the factor “curriculum” is the current method of teaching being satisfactory (0.918). Other items that loaded the highest highlighted the importance of small group discussions (0.637), patient-oriented clinical skills (0.556), and multiple modes of student assessment (0.514).

### Suggestions

The most loaded item of the factor is appropriate career counseling (0.954), which is essential and of greater importance in an emerging field like respiratory therapy. Other items included the need for further improvements in clinical teaching (0.606) and systematic training (0.477). The urgent need to establish a regulatory body was also one of the desirable loaded items (0.462).

A higher level of satisfaction was noted with the teaching methodologies, faculties, infrastructure, mode of assessment, and curriculum, which could be witnessed through the items loaded under the factors “satisfaction” and “curriculum”. However, one of the top priorities that were flagged to be significant was the inadequate recognition of the RTs despite a physically and emotionally challenging work environment [25, 26].

### Strengths and limitations

To the best of our knowledge, this is the first tool to evaluate the perception of RT students regarding their future career prospects and satisfaction with the available learning resources. The study’s major strength is the participation of students enrolled in respiratory therapy programs across the country, which would be an ideal representative sample of students from diverse multicultural and social backgrounds. One of the study’s limitations was that we were unable to compare the findings of the present study with previous research studies, as no such studies have been done using CFA and SEM to validate the SQ among respiratory therapy students.

### CONCLUSION

It is important to emphasize that the psychometric properties described in the 27-item structured questionnaire are reliable tools with acceptable model fits, good construct validity, and internal consistency. The CFA validated the construct and a positive aspect to underscore is that the statistical criteria were rigorously applied, and the fit indices are a useful guide. This SQ will allow the policymakers, educators, and researchers to evaluate and forge reflections on the importance, usefulness, and structure of the curriculum currently used to train RTs or in any allied healthcare domain. Moreover, this tool will serve as a survey reference for researchers wishing to effectively understand the students’ career perceptions and satisfaction with the learning resources.

### AUTHOR DISCLOSURES

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#### Availability of data and materials

The datasets generated and/or analyzed during the current study are not publicly available but are available from the corresponding author on reasonable request.

### Ethics declarations

This study was approved by the ethics committee of the Srinivas University, Mangalore, Karnataka-India (IRB number: SUEC 2020/001 Dated 02.01.2020). Participants provided informed consent electronically and anonymously. All study procedures were performed in accordance with the relevant institutional guidelines and regulations.

### Competing interests

The authors declare that they have no competing interests

### Funding

Not applicable

### Author contributions

JK conceptualized the theme and designed the questionnaire, project writing and ethical approval was done by JK and UKR, data collection was performed by JK with the support of MAA and PBM, data entry, curation and analysis were done by SKM and JK. JK wrote the original draft, UKR and MAA edited and reviewed. The entire project was supervised by UKR and MAA. All authors have read and agreed to the final version of the manuscript for publication.

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