

ORIGINAL ARTICLE

An instrument calibrated by Item Response Theory to assess knowledge about head and neck cancer

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Abstract

Introduction: Head and neck tumors are in the 9^o place among the most frequent cancers in the world, being the incidence of 700,000 new cases per year. To suspect and to diagnose early the cancer implies to know well the subject. The questionnaire is a good instrument for measuring knowledge. **Objective:** To provide an item bank, calibrated by the Item Response Theory (IRT), to evaluate the “knowledge about head and neck cancer”, in any respondent, in order to benefit the studies on this construct, in the area of health education. **Methods:** To evaluate the “knowledge about head and neck cancer”, we started with a scale already calibrated by the IRT, with 24 items for schoolchildren (n = 2,006). A further 29 items of equal difficulty were created (n = 994 schoolchildren). Then, 60 new items, of equal construct and greater difficulty (n = 883 dentistry professionals) were incorporated into this scale. **Results:** The analysis of 2,847 responses resulted in a bank with 113 items on head and neck cancer calibrated by IRT and arranged on a skill scale. **Conclusion:** From this collection of items, different questionnaires can be set up according to the skill level of the respondent. The results of the evaluations, in single or distinct moments, can be compared since the items are on the same scale of ability.

Keywords: head and neck neoplasms; mouth neoplasms; questionnaires; knowledge; adolescents; dental surgeons; Item Response Theory (IRT).

Introduction

The head and neck tumors are in 9^o place among the most frequent cancers in the world, being the incidence of 700,000 new cases per year and more prevalent in developing countries¹.


They comprise the following anatomical regions: lip and mouth; pharynx (oropharynx, nasopharynx and hypopharynx); larynx; maxillary sinuses; nasal cavity and ethmoid sinuses; salivary glands and thyroid glands², with the most common cancer being squamous cell carcinoma – SCC³⁻⁶.

When neoplasm is detected early (early diagnosis), the prognosis is good, the treatment and rehabilitation of the patient becomes less complex, the patient’s quality of life improves, and patient survival increases. Morbidity

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This work, during its construction, was partially presented at the Scientific Meeting of the 58th Annual Meeting of the Brazilian Region of the International Society of Biometrics and the 15th Symposium on Statistics Applied to Agronomic Experimentation, Campina Grande, PB, from 22 to 26 July 2013; in the IV Meeting of Collective Health and Bioethics and VI Workshop of Post-Graduation in Preventive and Social Dentistry. FOA - Unesp - Araçatuba, 13-15 August 2013, and at the XXVII International Biometric Conference, on 11 July 2014, in Florence - Italy.

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and mortality rates decrease, as does the risk of mutilation; however, 70% to 80% of head and neck tumors are discovered at an advanced stage of the disease¹, even when located in a region of easy visual access, such as mouth cancer.

In Brazil, the estimate for each year of the biennium 2018-2019 is 11,200 new cases of oral cancer in men and 3,500 in women, being, respectively, the 5th and 12th most frequent among all cancers⁷.

In order for the doctor, dental surgeon and other health professionals to diagnose a cancer, in addition to understanding the subject, they must admit the possibility of this disease¹. Measuring the knowledge of these professionals contributes to the strengthening of policies to combat cancer⁸⁻¹³.

The measurement of a latent trait, a characteristic not directly observable, is done indirectly, through the application of a questionnaire, a tool that allows to evaluate this ability. However, the process of creating this instrument is so complex and time-consuming that some studies even advocate exporting questionnaires to other cultures¹⁴⁻¹⁷.

Two theories are used to measure a latent trait for a given construct: the Classical Test Theory (CTT) and the Item Response Theory (IRT)¹⁸.

In Classical Theory of Tests the measure of a respondent's latent trait is expressed by the total result: how many items the respondent hit in the test. In this theory, what is important is the test as a whole.

In Item Response Theory it is the item that signals the measure of the latent trait of the respondent: why the respondent hit or missed each individual item. In IRT, the important thing is the item itself.

One of the great advantages of IRT in relation to CTT is to allow the achievement of a scale where the items and individuals are positioned and interpreted in the context of the study. For this, it uses models, such as the three-parameter One-Dimensional Logistic Model, proposed by Bock & Zimowski¹⁹, in which the first parameter shows the discrimination index of the item; the second, the difficulty index of the item, which is measured on the same scale as the respondent's latent trace, and the third parameter, the probability of correct response by chance^{18,20,21}.

The evaluation of a certain construct requires the prior construction of a bank of items, a process that requires exhaustive scientific research, but constitutes the great richness of those who work with tests¹⁸.

Up to now, the "knowledge about head and neck cancer" is a construct that is little focused on databases, as an object of measurement.

Thus, the objective of this study is to provide an item bank, calibrated by IRT, to evaluate the "knowledge about head and neck cancer", in order to benefit the studies about this construct in the area of health education.

Methods

In this research, 113 items were created to evaluate the "knowledge about head and neck cancer" using a sample consisting of 2,847 respondents, of which 883 were dental surgeons and the others, students of the 3rd year of high school.

All the students of the 3rd year of high school in the public schools of Araçatuba, SP who were present on the day of the application of the questionnaire, totaling 2,006 students, were included in the sample. The local Office of Education, after previous clarification on the purpose of this research, consented to the participation of the students.

As for dental surgeons, the sample consisted of volunteers who agreed to participate in the research, having signed the Free and Informed Consent Term (FICT), required by the Research Ethics Committee (REC).

This research was carried out in three steps:

Step 1: Starting from an existing questionnaire, composed of 24 items, to evaluate the construct “knowledge about head and neck cancer” in 1,012 students in the 3rd year of high school. In order to position, calibrate and validate these items through IRT, a scale was created. Therefore, these 24 initial items, with fixed parameters, constitute the reference group of this research²².

Step 2: In this research, 32 new items were created to evaluate the same construct “knowledge about head and neck cancer”, aimed at the same population: middle school students (n = 994). Then, these 32 items were incorporated into that initial scale, being also positioned in it²³.

During the incorporation process, three items had to be eliminated because they were well above the respondents’ ability. We obtained, at this stage of the research, a scale, now with 53 items, with level equivalent to the 3rd year of High School.

Step 3: Subsequently, 68 new specific items on “head and neck cancer” were developed for dentistry professionals, with 95 students from the last years of the graduation and 746 dental surgeons, totaling 841 respondents.

These 68 items were incorporated into the 53 previous items, these being of lower level of knowledge than those. When there is incorporation of new items, of a higher level than the existing ones, the scale is enriched, improved, because the construct is the same^{14,24}.

Of the total items created (121), eight could not be calibrated, because (also) they were well above the respondents’ ability. This research, therefore, generated an instrument composed of 113 items validated and calibrated by TRI, arranged, therefore, in that scale of proficiency, or scale of abilities²³.

This research was approved by the CEP of FOA - Unesp - CAAE Protocol no. 05556112.4.0000.5420 - Brazil Platform and follows the IRT model for several groups, in this case three groups, proposed by Bock & Zimowski¹⁹, which assumes that the greater the respondent’s proficiency, the greater his likelihood of success: a cumulative latent trait.

For the IRT analysis, the data were processed by the software Bilog-Mg for Windows, version 3.11.10.

Results

This research generated a bank with 113 items (Figures 1-4) to evaluate the “knowledge about head and neck cancer” in any respondent (or group of respondents).

- | | | | |
|---|--|--|--|
| <p>1) Do you know if mouth cancer exists?
a- <input checked="" type="checkbox"/> yes
b- <input type="checkbox"/> no</p> | <p>11) Do you think that there is a safe amount for the use of cigarette?
a- <input type="checkbox"/> yes
b- <input checked="" type="checkbox"/> no</p> | <p>a- <input checked="" type="checkbox"/> yes
b- <input type="checkbox"/> no</p> | <p>28) In the classification of malignant tumors, the letter T followed by a number, means:
a- <input checked="" type="checkbox"/> the size of a tumor
b- <input type="checkbox"/> the lifetime of a tumor
c- <input type="checkbox"/> the temperature of a tumor
d- <input type="checkbox"/> the strain of adjacent muscles</p> |
| <p>2) Mouth cancer:
a- <input type="checkbox"/> is not a disease
b- <input checked="" type="checkbox"/> is a disease, but it is not transmitted from one person to another
c- <input type="checkbox"/> is a disease and can be transmitted from one person to another</p> | <p>12) How many chemical substances are there in a cigarette?
a- <input type="checkbox"/> none
b- <input type="checkbox"/> 15
c- <input type="checkbox"/> 300
d- <input type="checkbox"/> 1500
e- <input checked="" type="checkbox"/> over 4000</p> | <p>20) What do you need to do your mouth self-examination?
a- <input type="checkbox"/> a dentist's tool
b- <input checked="" type="checkbox"/> only a mirror and a well-lit place
c- <input type="checkbox"/> someone to help</p> | <p>29) Is cancer contagious?
a- <input type="checkbox"/> yes
b- <input checked="" type="checkbox"/> no</p> |
| <p>3) Cancer is due to:
a- <input checked="" type="checkbox"/> abnormal growth of the cells
b- <input type="checkbox"/> death of the cells
c- <input type="checkbox"/> growth of the cells
d- <input type="checkbox"/> attack of antibodies against foreign bodies
e- <input type="checkbox"/> penetration of virus in the cells</p> | <p>13) What kind of skin do you think most influences the onset of cancer of the lip and face?
a- <input checked="" type="checkbox"/> very pale skin
b- <input type="checkbox"/> fair skin
c- <input type="checkbox"/> dark skin
d- <input type="checkbox"/> any of the above</p> | <p>21) If you noticed any alteration in your mouth for more than fifteen days, what would you do?
a- <input type="checkbox"/> I wouldn't worry about it
b- <input type="checkbox"/> I would apply some medication myself
c- <input type="checkbox"/> I would wait for a while for it to disappear
d- <input type="checkbox"/> I would go to a healer
e- <input checked="" type="checkbox"/> I would look for a doctor or dentist</p> | <p>30) Most of mouth cancers look like:
a- <input type="checkbox"/> a lump
b- <input type="checkbox"/> a white patch
c- <input checked="" type="checkbox"/> an unhealed wound
d- <input type="checkbox"/> a red patch
e- <input type="checkbox"/> a sore spot in the mouth</p> |
| <p>4) At first, mouth cancer:
a- <input type="checkbox"/> hurts a lot
b- <input checked="" type="checkbox"/> does not hurt</p> | <p>14) Do you think that your food can help prevent mouth cancer?
a- <input checked="" type="checkbox"/> yes
b- <input type="checkbox"/> no</p> | <p>22) What must be done to prevent mouth cancer? We must:
a- <input type="checkbox"/> have a healthy diet
b- <input type="checkbox"/> not smoke
c- <input type="checkbox"/> not drink
d- <input type="checkbox"/> protecting yourself against the sun
e- <input checked="" type="checkbox"/> follow all the procedures above
f- <input type="checkbox"/> none of the above</p> | <p>31) Must patients treated for cancer have medical follow-up? Why?
a- <input type="checkbox"/> Yes, every patient must have follow-up
b- <input checked="" type="checkbox"/> Yes, they tend to have a second tumor
c- <input type="checkbox"/> No, these patients don't need follow-up</p> |
| <p>5) In your opinion, which of the symptoms below, have to do with mouth cancer?
a- <input type="checkbox"/> difficulty in speaking
b- <input type="checkbox"/> difficulty in chewing
c- <input type="checkbox"/> difficulty in swallowing
d- <input type="checkbox"/> rapid weight loss
e- <input checked="" type="checkbox"/> all mentioned above
f- <input type="checkbox"/> none of the above</p> | <p>15) What kinds of food can help prevent mouth cancer?
a- <input type="checkbox"/> none
b- <input checked="" type="checkbox"/> fruits and vegetables
c- <input type="checkbox"/> red meat
d- <input type="checkbox"/> bread and pasta
e- <input type="checkbox"/> fat</p> | <p>23) For you, mouth cancer:
a- <input type="checkbox"/> has no cure, I will always suffer
b- <input checked="" type="checkbox"/> can be cured but must be attentive and make up
c- <input type="checkbox"/> can be cured and I can forget about this problem forever</p> | <p>32) After mouth cancer surgery, patients must be cared by:
a- <input type="checkbox"/> a physiotherapist
b- <input type="checkbox"/> a speech therapist
c- <input type="checkbox"/> a psychologist
d- <input checked="" type="checkbox"/> all of the above
e- <input type="checkbox"/> the medical treatment is enough</p> |
| <p>6) For you, which of the following types of cancer occur more often in your country?
a- <input type="checkbox"/> of the lip
b- <input checked="" type="checkbox"/> of the skin
c- <input type="checkbox"/> of the neck
d- <input type="checkbox"/> of the lung</p> | <p>16) For you, oral cancer occurs with greater frequency:
a- <input checked="" type="checkbox"/> in men
b- <input type="checkbox"/> in women</p> | <p>24) Have you heard of any of the methods used for the treatment of cancer?
a- <input type="checkbox"/> yes, surgery
b- <input type="checkbox"/> yes, radiotherapy
c- <input type="checkbox"/> yes, chemotherapy
d- <input checked="" type="checkbox"/> yes, all of the above
e- <input type="checkbox"/> psychiatry
f- <input type="checkbox"/> none of the above</p> | <p>33) Carcinogenicity:
a- <input type="checkbox"/> might result from multiple causes
b- <input type="checkbox"/> starts with DNA damages
c- <input type="checkbox"/> has only one cause
d- <input type="checkbox"/> none of the above
e- <input checked="" type="checkbox"/> only a and b are correct</p> |
| <p>7) What is the main risk factor for mouth cancer?
a- <input type="checkbox"/> drinking
b- <input type="checkbox"/> solar exposure
c- <input checked="" type="checkbox"/> smoking
d- <input type="checkbox"/> virus</p> | <p>17) What is the incidence of mouth cancer in Brazil?
a- <input checked="" type="checkbox"/> 11 out of a hundred thousand inhabitants among men and 4 out of a hundred thousand inhabitants among women.
b- <input type="checkbox"/> 4 out of a hundred thousand inhabitants among men and 11 out of a hundred thousand inhabitants among women.
c- <input type="checkbox"/> 700 out of a hundred thousand inhabitants among men and 300 out of a hundred thousand inhabitants among women.
d- <input type="checkbox"/> a- 300 out of a hundred thousand inhabitants among men and 700 out of a hundred thousand inhabitants among women</p> | <p>25) Is radiotherapy an important tool to fight malignant tumors?
a- <input checked="" type="checkbox"/> yes
b- <input type="checkbox"/> no</p> | <p>34) The risk factor for a disease is a condition that:
a- <input type="checkbox"/> is associated with a disease, but it's not its triggering factor
b- <input checked="" type="checkbox"/> is associated with a disease and it is its triggering factor
c- <input type="checkbox"/> although it's not associated with a disease, it acts as a triggering factor</p> |
| <p>8) Among the risk factors, which is the association that increases the chances of having mouth cancer considerably?
a- <input type="checkbox"/> there is no dangerous association
b- <input type="checkbox"/> solar exposure and alcohol
c- <input type="checkbox"/> exposição solar e álcool
d- <input checked="" type="checkbox"/> smoking and alcohol
e- <input type="checkbox"/> virus and smoking
f- <input type="checkbox"/> alcohol and virus</p> | <p>18) In what age group are most of the cases of mouth cancer diagnosed?
a- <input type="checkbox"/> below 20 years old
b- <input type="checkbox"/> between 20 and 30 years old
c- <input type="checkbox"/> between 30 and 40 years old
d- <input checked="" type="checkbox"/> between 40 and 60 years old
e- <input type="checkbox"/> over 60 years old</p> | <p>26) Which animal is associated with the word cancer?
a- <input type="checkbox"/> scorpion
b- <input type="checkbox"/> fox
c- <input type="checkbox"/> ant
d- <input checked="" type="checkbox"/> crab</p> | <p>35) The statement: “Cancer is the second most common death cause, coming after heart disease”, is:
a- <input checked="" type="checkbox"/> true
b- <input type="checkbox"/> false</p> |
| <p>9) Do you think that smoking is harmful to your health?
a- <input checked="" type="checkbox"/> yes
b- <input type="checkbox"/> no</p> | <p>19) Do you know what self-examination of the mouth is?</p> | <p>27) Who is the person who can, precociously detect the possibility of oral cancer?
a- <input type="checkbox"/> the doctor
b- <input type="checkbox"/> the dentist
c- <input type="checkbox"/> the person himself/herself
d- <input checked="" type="checkbox"/> all of the above
e- <input type="checkbox"/> we can't detect it precociously</p> | <p>36) For you:
a- <input type="checkbox"/> every tumor is malignant
b- <input type="checkbox"/> every tumor is benign
c- <input checked="" type="checkbox"/> there are benign and malignant tumors
d- <input type="checkbox"/> there is no benign tumor</p> |
| <p>10) Do you think that smoking near other people can be harmful to them?
a- <input checked="" type="checkbox"/> yes
b- <input type="checkbox"/> no</p> | | | |

Figure 1. Presentation of items number 1 to 36.

On the other hand, in this research we do not intend to present the result referring to the volunteers who composed the sample: high school students and dental surgeons^{6,13,25-28}, but use the diversity of their answers, in the calibration process, for the positioning of the items in the “knowledge about head and neck cancer” scale^{20,29,30}.

- 37) They are early signs of mouth cancer:
a- aphthas (mouth ulcers)
b- sore
c- unhealed lesions
d- fistulas
e- granulomas
- 38) In oncology, which are the letters for the classification of malignant tumors?
a- CBM
b- CN L
c- TNM
d- TDM
- 39) Identify the items which are related to cancer:
a- radiation
b- genetics
c- nutrition
d- all of the above
e- none of the above
- 40) Early detection of oral cancer:
a- doesn't interfere in long-term patient survival
b- can afford patients an extended survival time
c- it is impossible to be done
- 41) Chemotherapy:
a- is a local treatment which makes use of medication to destroy tumor cells
b- is a systemic treatment (related to the whole body) which affects tumor cells as well as normal cells.
c- is a local treatment which never affects normal cells.
- 42) Radiotherapy:
a- is a local treatment in which ionizing radiation is used in malignant tumor region.
b- is a systemic treatment (related to the whole body) in which ionizing radiation is used to destroy a tumor or prevent its cells from growing.
c- is a local treatment which affects mainly normal tissues adjacent to the tumor.
- 43) Is the damage caused by sunlight or any artificial sources cumulative over the years?
a- Yes, it increases the risk of skin cancer
b- No, it only affects the skin color, reverting over the years
c- Yes, yet it doesn't cause harmful consequences to your health
- 44) Do you think you are able to notice mouth cancer?
a- no
b- I try to be vigilant to any suspicion
c- I don't worry about it
- 45) The delay in mouth cancer detection occurs when:
a- the patient fails to care about initial lesions
b- the professional performs thorough clinical exams
c- the patient isn't careless about the first signs
d- the professional who checks your mouth isn't prepared to identify any signs and symptoms of cancer
e- the patients as well as the professionals isn't prepared to identify any signs and symptoms of cancer
- 46) Factors which can contribute to cancer formation:
a- physical
b- chemical
c- viral
d- all of the above
e- none of the above
- 47) It is part of cancer and other illnesses prevention:
a- to eat healthy food
b- to avoid stress
c- to smoke
d- to drink
e- to have plenty of sun exposure
f- to often eat fried food, condiments and canned food
g- alternatives a and b
h- alternatives b and e
i- none of the above
- 48) Is cancer a genetic alteration of a cell?
a- yes
b- no
c- sometimes
- 49) When oral cancer is detected, the clinical appearance is:
a- a red patch
b- a white patch
c- an ulcer
d- all of the above
- 50) The most suitable treatment for oral cancer at an early stage is:
a- radiotherapy
b- chemotherapy
c- surgery
- 51) Are all types of cancer hereditary?
a- yes
b- no
c- only 5 to 10 %
- 52) Does oral cancer heal after the use of mouthwash or ointment?
a- yes
b- no
- 53) As for biopsy, it is correct to say that:
a- it is the removal of a piece of tissue or all the tumor to be examined by a pathologist
b- it is the procedure that confirms the specific type of tumor
c- it is an unnecessary procedure for cancer treatment
d- alternatives a and b
e- alternatives a and c
f- alternatives b and c
g- none of the alternatives
- 54) Excision is:
a- partial removal of the lesion
b- total removal of the lesion
c- marsupialization
d- an expectant treatment
- 55) Clinically, oral cancers:
a- always looks the same
b- has different morphologies
- 56) Check the correct sequence to the definitive clinical diagnosis:
a- biopsy, clinical diagnosis, physical examination
b- biopsy, clinical diagnosis, physical examination
c- physical examination, biopsy, clinical diagnosis, differential examination
d- physical examination, biopsy, clinical diagnosis, differential examination, differential diagnosis
e- there is no sequence to follow as clinical diagnosis is not a process
- 57) The extra-oral physical examination on the patient:
a- should be not included in the protocol of a dental surgeon
b- should be done when something gets the dental surgeon's or the patient's attention
c- should be done in all situations
d- none of the above
- 58) What's the difference between benign and malignant tumor?
a- there is no difference
b- the malignant tumor always penetrates the underlying tissues
c- the malignant tumor grows quickly
- 59) Carcinoma in situ:
a- is related to squamous cell carcinoma
b- is related to the papillomaviruses
c- is related to ameloblastoma
d- is the squamous cell carcinoma
e- is one that is contained within the epithelial layer
- 60) Biopsy in tumors of the upper aero digestive tract, should be taken:
a- in the necrotic area of the tumor
b- in no necrotic area of the tumor
c- in any area of the tumor
- 61) It is not a radiotherapy side effect:
a- mucositis
b- trismus
c- xerostomia
d- osteoradionecrosis
e- sialorrhoea
f- none of the above
- 62) Aspect of “sunshine” in bony tissue in image exams are characteristics of:
a- Ewing sarcoma
b- Osteosarcoma
c- Chondrosarcoma
- 63) In cancer, pain is a symptom that:
a- is manifested in more advanced disease
b- does not manifest even in advanced disease and infiltrated nerve ending
c- none of the above
- 64) The patient profile that is more likely to have oral cancer:
a- white women between 30 and 40 years old
b- white men between 40 and 60 years old
c- brown men between 40 and 60 years old
d- white women between 40 and 60 years old
e- black men and women over 40 years old
- 65) Patients under treatment for head and neck cancer who do not adapt to laryngeal voice, can communicate by:
a- written
b- gestures
c- articulate speech - articulation without sound
d- all of the above
e- none of the above
- 66) Linking ultraviolet radiation to skin cancer, check the correct alternative:
a- the intensity of the ultraviolet radiation is constant the whole day
b- ultraviolet radiation is more intense in higher altitudes
c- the sunlight directly on your skin or reflected on the sand, water or snow doesn't interfere in ultraviolet radiation intensity
- 67) The distant metastasis of mouth carcinoma takes place mostly in the following organs:
a- lungs
b- bones
c- liver
d- none of the above

Figure 2. Presentation of items number 37 to 67.

It is a (0,1) scale, in which zero(0) represents the mean and one(1) the standard deviation of the ability of the reference group: the first group of students of the 3rd year of high school.

- 68)The thickness of a tumor consists of:
a-the horizontal measurement of a tumor
b-the vertical measurement of a tumor
c-none of the above
- 69)The regional dissemination of the oropharynx SCC is made by:
a-contiguity
b-contiguity
c-lymphatic route
d-through the bloodstream
e-none of the above
- 70)A gene can also be changed by the interaction of physical and genetic factors:
a-right
b-wrong
- 71)Radioterapy does not have anti-inflammatory action:
a-right
b-wrong
- 72)About squamous cell carcinoma:
a-is the most common cancer of the head and neck, including tumors of the mucosa of the upper gastrointestinal tract
b-is the most common cancer of the head and neck, excluding tumors of the upper gastrointestinal tract mucosa
c-is not the most common within the head and neck area
- 73)Initial tumors of the greater salivary glands are characterized by:
a-skin involvement
b-involvement of mucosa and underlying tissue
c-ulcerated nodules
d-non-ulcerated nodules, solitary and painless
e-none of the above
- 74)The diagnosis of leukoplakia by clinical examination:
a-is essential
b-is nonessential
c-may be occasional
- 75)Erythroplasia shows these characteristics
a-very painful red patches
b-red color which stands out from normal mucose
c-neither of the above
- 76)Check the two tumors of vascular origin:
a-Kaposi sarcoma, angular cheilitis
b-pyogenic granuloma, hemangioma
c-hemangioma, Kaposi sarcoma
d-pyogenic granuloma, tonsillitis
e-tonsillitis, angular cheilitis
f-none of the above
- 77)A gene can also be changed by the interaction of chemical and immunological factors:
a-right
b-wrong
- 78)After lower lip, oral cancer is more frequent on:
a-soft and hard palate
b-tongue and soft palate
c-hard palate and floor of the mouth
d-floor of the mouth and tongue
- 79)In cases of suspected thyroid tumor:
a-should be performed fine needle
b-should be avoided because the puncture false negatives are frequently
c-must be avoided because the puncture has been described implantation of carcinoma in needle path, even small-caliber
d-none of the above
- 80)Biopsy is:
a-a simple supplementary exam
b-a complex supplementary exam
c-not a supplementary exam
- 81)Check the malignant neoplasm below:
a-adenoma
b-ameloblastoma
c-carcinoma
d-odontoma
e-oncocytoma
- 82)The local spread of carcinomas of the UADT-upper aero digestive tract - can be:
a-lymphatic, so treatment should be based on the loco regional approach
b-lymphatic, so the treatment should not be based on loco regional approach
c-carcinomas of the upper aerodigestive tract shows no lymphatic dissemination
- 83)It is common malignant tumors of the nasopharynx presenting cervical lymphadenopathy:
a-never have cervical lymphadenopathy
b-as the patient's complaint
c-have no cervical lymphadenopathy
- 84)About verrucous carcinoma:
a-has a better prognosis than undifferentiated squamous cell carcinoma, depending on the clinical staging
b-has a worse prognosis than squamous cell carcinoma grade I, II and III, regardless of the clinical stage
c-has prognostic equal to grades I, II and III squamous cell carcinoma, independent of clinical staging
- 85)The diagnosis hypothesis of an oral lesion is:
a-anamnesis
b-physical examination
c-the certainty of diagnosis
d-the most likely diagnosis
- 86)Malignant tumors of the parotid gland, in more advanced stages, may show:
a-facial nerve paralysis and painful symptoms
b-paralysis of the hypoglossal nerve and painful symptoms
c-trismus
d-non-ulcerated nodules
- 87)In the initial phase, ulcers of oral cancer are clinically very significant.
a-yes
b-no
- 88)The lowest incidences of malignant tumors in the mouth, are:
a-spinocellular carcinoma, sarcomas, melanomas
b-squamous cell carcinoma, spinocellular carcinoma, sarcomas
c-melanomas, sarcomas, malignant tumors of the salivary glands
d-sarcomas, squamous cell carcinoma, malignant tumors of the salivary glands
e-epidermoid carcinoma, spinocellular carcinoma, carcinoma of scamous cells
f-none of the above
- 89)Dysplasia is a change diagnosed, especially:
a-clinically
b-histologically
- 90)Oropharyngeal neoplasm give metastasis, distance, usually in the following body:
a-spleen
b-liver
c-lung
d-bone
e-intestine
f-stomach
- 91)What's the influence of time for the diagnosis and the beginning of the treatment over the survival of the patient with cancer?
a-early diagnosis, delayed treatment, longer survival
b-early diagnosis, delayed treatment, lower survival
c-early diagnosis and prompt treatment do not affect survival time
d-late diagnosis and prompt treatment do not affect in survival time
e-early diagnosis and prompt treatment, longer survival
f-there is no relation with the survival time of the patient
- 92)The jaw may be partially resected (marginal mandibulectomy), in case of minimal invasion.
a-yes
b-no
- 93- In eritroleucoplasics injury, the most significant area is:
a-the white area
b-a red area
c-all of the above
- 94)The returns in segment of patient with cancer of the mouth, should be performed:
a-month by month in the first year and 2 in 2 months from the second to fourth year
b-3 in 3 months for the first year and 2 in 2 months from the second to fourth year
c-2 in 2 months in the first year and 6 in 6 months from the third to sixth year
d-none of the above
- 95)Which treatment should be administered given if there is cancer diagnosis and the patient is in final stage?
a-surgery
b-radiotherapy
c-chemotherapy
d-support treatment
e-there is no treatment
- 96)Exfoliative cytology is a procedure that can not be used in the diagnosis of suspected oral lesions.
a-right
b-wrong
- 97)In patients under treatment in head and neck cancer the oral communication with laryngeal voice comprises:
a-use of the laryngeal vibrator
b-esophageal voice
c-traqueoesophageal voice
d-pharyngeal voice
e-oral speech - articulation sounds with mouth
f-all of the above
g-none of the above
- 98)The regional drainage of CEC can be taken by lymphatic chain:
a-submandibular
b-submental
c-jugulocarotideia
d-all of the above
e-none of the above
- 99)Clinically, oral cancers have similar growth and are all treated the same way.
a-right
b-wrong

Figure 3. Presentation of items number 68 to 99.

- 100)As cancer in tongue lesions features high rate of hidden cervical metastasis, surgical treatment will depend on:
a-to be associated with supraomohyoid cervical dissection
b-not to be associated with supraomohyoid cervical dissection
c-the clinical stage
- 101)The surgical treatment of oral cancer should include:
a-simple resection without border
b-excision of the lesion with a margin of safety
- 102)Squamous cell carcinoma originates in the tissue:
a- connective
b-nervous
c-muscle
d-epithelial
e-venous
- 103)Check the correct alternative about oral cancer:
a-it is not always an open wound
b-it is always an open wound
c-its main characteristic is the hardening of the high area
d-it is characterized by the power of infiltration
e-the lesion is not bounded
- 104)In malignant neoplasm of base of tongue:
a-the pain is very common
b-pain is uncommon
c-the presence of pain will depend on the clinical stage
- 105)A gene can also be changed by the interaction of infectious and genetic factors:
a-right
b-wrong
- 106)Check the malignant neoplasm below:
a-pyogenic granuloma
b-inflammatory fibrous hyperplasia
c-squamous cell carcinoma
d-hemangiomas
e-fibroma
- 107)When a cell is exposed to carcinogens, the levels of the protein p53 tend to:
a-decrease
b-increase
c-does not alter
- 108)Leucoplakia shows these characteristics:
a-red patches which contrast with the normal mucosa color
b-red patches which get unnoticed with the normal mucosa color
c-neither of the above
- 109)Actinic cheilitis is caused by:
a-excess of vitamin B
b-long exposure of sunlight
c-prostheses with reduced vertical dimension
d-all of the above
e-none of the above
- 110)About osteogenic sarcoma:
a-is a rare tumor composed of benign epithelial structure
b-is a rare neoplasm composed of malignant epithelial structure
c-is a rare neoplasm composed of benign mesenchymal structure
d-is a rare neoplasm, composed of malignant mesenchymal structure
- 111)The result of a biopsy does not mean:
a-it is 100% correct
b-it has the possibility of false positive or negative
c-it has the possibility of true positive or negative
- 112)Radiotherapy alone may be recommended as palliative to patients considered inoperable.
a-yes
b-no
- 113)When a primary tumor of the nasopharynx is not detected, the diagnosis is usually made:
a-by cervical metastasis, which is never bilateral
b-by cervical metastasis, unilateral or bilateral
c-by the absence of cervical metastasis

Figure 4. Presentation of items number 100 to 113.

The mean of the difficulty parameters of the items of the 3rd year of high school is 0.18 (average performance, close to zero level), and standard deviation 1.48, while the items directed to health professionals have mean 2.74 and standard deviation 1.21. This shows that the items vary greatly across the scale, making possible to place the respondents, on the same scale, with different items.

The items of this research were positioned between levels -3 and 6. (Figure 5).

The disposition of this bank of items can be better visualized in the scale of abilities of Table 1. This scale is fundamental for the choice of questions of greater or less complexity, according to the ability of the respondent.

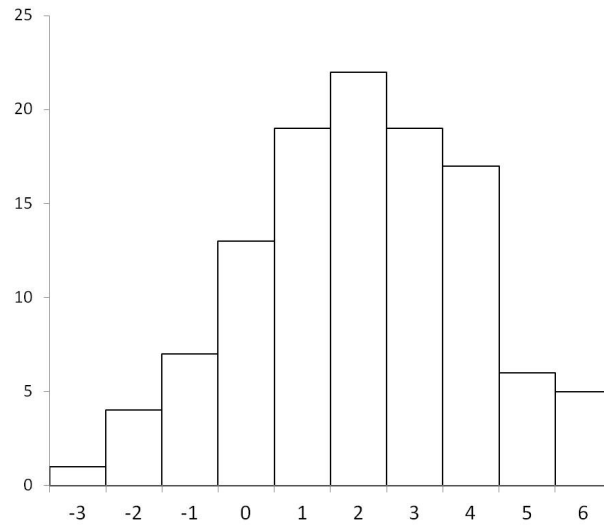


Figure 5. Distribution of the 113 items on the “head and neck cancer” construct in the skills scale. Araçatuba, SP - 2015.

Table 1. Classification of the 113 items of the “head and neck cancer” construct, according to the level of difficulty. Araçatuba, SP - 2015.

level	items																					
-3	1																					
-2	10	9	11	25																		
-1	23	21	36	29	14	4	35															
0	43	52	15	6	22	55	7	16	26	91	37	48	12									
1	40	47	39	20	13	34	81	46	31	2	58	41	44	53	28	99	54	74	5			
2	106	24	42	101	65	8	85	57	108	32	63	95	3	70	51	33	30	19	78	89	56	80
3	77	49	27	62	105	64	59	75	45	96	76	60	86	17	18	104	103	69	92			
4	102	72	113	67	111	82	61	110	107	73	90	100	66	112	83	50	109					
5	98	71	97	38	87	84																
6	88	94	93	68	79																	

Discussion

The construction of an item bank requires laborious scientific research and time-consuming, thus besides the creation of the items for a particular psychological process, it is necessary to demonstrate its psychometric quality, which is the calibration, and also to validate the items. To validate means to establish the legitimate adequacy between what is to be measured and its physical representation, which is the behavior, the item. Validity is, therefore, what gives the item the characteristic of good item¹⁸.

In the social sciences, the measurement process is complex, because a psychological, subjective, intangible variable is not directly observable, like most physical variables^{14,18}.

An instrument can only be considered valid if it is capable of adequately capture one pre-specified underlying concept^{21,30}.

The questionnaire is a good instrument for measuring knowledge, and can be calibrated by IRT, a type of measure that starts from a secondary, observable reality, which is the behavior, the response, the item; to end up at a hypothetical, unobservable reality, which is the latent trait^{14,28}.

In the calibration process, the TRI positions the items in a same metric, which is the scale of the latent trace. With the items calibrated we obtain the measure of the latent trait for each one of the respondents in the same metric^{18,20,24}.

The criterion of positioning of the item on a certain level of the scale is based on probability^{17,20}. However, this probability is not 100%, but around 65% and, at the same time, the respondent's domain on the previous level must be below of 50%. So the person who is positioned on a level has a high probability of dominate the items on that level and the items from previous levels (because the model is cumulative), but should not dominate items from posterior levels.

As in a language proficiency test, the skill scale generated in this research is a proficiency scale for the "head and neck cancer" construct. In this way, the person who is positioned at **level -3**, the 1st in Table 1, is able to correctly answer only item 1: "Do you know if there is cancer of the mouth?" This is the item that requires the lowest level of ability, among all others created in this research; while the person who is positioned at **level -2** should know how to respond if radiotherapy is important to fight malignant tumors (item 25), if the act of smoking only affects the smoker (item 9), or also near him (item 10); if there are safe doses for the use of cigarettes (item 11); and also to the previous level item, which, in this case, is item 1. The person who is at **level 3**, will be able to respond to specific items, such as definition of carcinoma in situ, (item 59), exfoliative cytology (item 96), alteration of genes (items 77 and 105), among others, but will not be able to respond much more specific items, such as **level 5**: regional drainage of CPB (item 98), alaringeal voice (item 97), whereas the individual positioned at **level 6**, which requires a greater degree of ability of the respondent, will not only have the ability to respond correctly to the malignant tumors that present the smallest incidences in the mouth(item 88), but also to all items of the scale, once that all other items are prior to this level.

It can be seen, therefore, by the scale of abilities of this research, that at levels below zero, and especially close to zero, there really is a predominance of people with ability to respond to items related to risk factors for cancer mouth, going to level 1, from which, the questions already address cancerous lesions, treatment methods for head and neck cancer, among other concepts, which gradually become more specific.

This means that, although this metric was built based on a 3rd year high school population, and another population with dental professionals, the great majority of the items that make up it can be applied to anyone with these levels (medium or higher), since this generated skill scale, if correctly interpreted, can level any respondent; because in TRI, an item measures certain knowledge, regardless of who is responding to it^{20,24,29}. Items that measure specific knowledge discussed only in higher education should not be presented to high school respondents. For instance, item 61: Is sialorrhea a side effect of radiation therapy?

Since IRT focuses on the item rather than on the test as a whole, from the valid items database, produced and made available in this research, different questionnaires (tests) can be built, for different skill levels: “tailor-made tests”, with the great advantage of being able to compare the results of these assessments. In addition, since a warehouse (bank) of items is in continuous formation, this bank of items can be expanded by IRT to evaluate this same construct^{15,20,21}.

Conclusion

This work presents a bank of items to evaluate “knowledge about head and neck cancer”.

Although a construct can not be exhausted in its semantic fullness, this bank of items can be very useful, since from it, different questionnaires can be elaborated, for different moments, as it is the case of the initial and final evaluations of educational programs, as well as allowing for different tests for the same moment, since the items, because they are all on the same scale of ability, have an isonomic character.

References

1. A.C.Camargo Cancer Center [Internet]. Levantamento aponta sinal de alerta para diagnóstico tardio de câncer de Cabeça e Pescoço. São Paulo: A.C.Camargo Cancer Center; 2017 [cited 2018 Fev 14]. Available from: <https://www.accamargo.org.br/noticias/levantamento-aponta-sinal-de-alerta-para-diagnostico-tardio-de-cancer-de-cabeca-e-pescoco>
2. Instituto Oncoguia [Internet]. Câncer de cabeça e pescoço tem alta incidência. São Paulo: Oncoguia; 2017 [cited 2019 Fev 17]. Available from: <http://www.oncoguia.org.br/conteudo/cancer-de-cabeca-e-pescoco-tem-alta-incidencia/11012/7/>
3. Moyses RA, Michaluart P Jr. Alterações genéticas e moleculares no câncer de cabeça e pescoço. In: Parise O, Kowalski LP, Lehn C. Câncer de cabeça e pescoço. 1a ed. São Paulo: Âmbito Editores; 2008. p. 11-5.
4. Vigneswaran N, Williams MD. Epidemiologic trends in head and neck cancer and aids in diagnosis. *Oral Maxillofac Surg Clin North Am.* 2014;26(2):123-41. <http://dx.doi.org/10.1016/j.coms.2014.01.001>. PMID:24794262.

5. Panarese I, Aquino G, Ronchi A, Longo F, Montella M, Cozzolino I, Rocuzzo G, Colella G, Caraglia M, Franco R. Oral and Oropharyngeal squamous cell carcinoma: prognostic and predictive parameters in the etiopathogenetic route. *Expert Rev Anticancer Ther.* 2019;19(2):105-19. <http://dx.doi.org/10.1080/14737140.2019.1561288>. PMID:30582397.
6. Frola MI, Barrios R. Knowledge and attitudes about oral cancer among dental students after bologna plan implementation. *J Cancer Educ.* 2017;32(3):634-9. <http://dx.doi.org/10.1007/s13187-016-0990-9>. PMID:26864438.
7. Brasil. Ministério da Saúde. Instituto Nacional de Câncer José Alencar Gomes da Silva. Coordenação de Prevenção e Vigilância. Estimativa 2018: incidência de câncer no Brasil. Rio de Janeiro: INCA; 2017.
8. Chen X, Hay JL, Waters EA, Kiviniemi MT, Biddle C, Schofield E, Li Y, Kaphingst K, Orom H. Health literacy and use and trust in health information. *J Health Commun.* 2018;23(8):724-34. <http://dx.doi.org/10.1080/10810730.2018.1511658>. PMID:30160641.
9. van der Waal I. Knowledge about oral leukoplakia for use at different levels of expertise, including patients. *Oral Dis.* 2018;24(1-2):174-8. <http://dx.doi.org/10.1111/odi.12695>. PMID:29480645.
10. Patino D, McQuistan MR, Qian F, Hernandez M, Weber-Gasparoni K, Macek MD. Oral health knowledge levels of Hispanics in Iowa. *J Am Dent Assoc.* 2018;149(12):1038-48. <http://dx.doi.org/10.1016/j.adaj.2018.07.023>. PMID:30322589.
11. Stephenson MC, Gurenlian JR, Bowen DM. Perceptions of oral cancer screenings as compared to other cancer screenings: a pilot study. *J Dent Hyg.* 2017;91(3):37-46. PMID:29118070.
12. Azhar N, Doss JG. Health-Seeking behaviour and delayed presentation of oral cancer patients in a developing country: a qualitative study based on the self-regulatory model. *Asian Pac J Cancer Prev.* 2018;19(10):2935-41. PMID:30362327.
13. Osazuwa-Peters N, Tutlam NT. Knowledge and risk perception of oral cavity and oropharyngeal cancer among non-medical university students. *J Otolaryngol Head Neck Surg.* 2016;45(1):5. <http://dx.doi.org/10.1186/s40463-016-0120-z>. PMID:26818939.
14. Tezza R, Bornia AC, Andrade DF, Barbeta PA. Modelo multidimensional para mensurar qualidade em website de e-commerce utilizando a teoria da resposta ao item. *Gest Prod.* 2018;25(4):916-34. <http://dx.doi.org/10.1590/0104-530x1875-18>.
15. Gomes DE, Santos JLG, Borges JWP, Alves MP, Andrade DF, Erdmann AL. Teoria da resposta ao item nas pesquisas em saúde pública. *Ver enferm UFPE on line.* 2018;12(6):1800-12.
16. Navabi N, Hashemipour MA, Roughani A. Validation of a Persian short-form version of a standardised questionnaire assessing oral cancer knowledge, practice and attitudes among dentists. *Clinical & basic research. Sultan Qaboos Univ Med J.* 2017;17(1):80-7. <http://dx.doi.org/10.18295/squmj.2016.17.01.014>. PMID:28417033.
17. Souza Santos TS, Julian C, Andrade DF, Villar BS, Piccinelli R, González-Gross M, Gottrand F, Androutsos O, Kersting M, Michels N, Huybrechts I, Widhalm K, Molnár D, Marcos A, Castillo-Garzón MJ, Moreno LA. Measuring nutritional knowledge using Item Response Theory and its validity in European adolescents. *Public Health Nutr.* 2019;22(3):419-30. <http://dx.doi.org/10.1017/S1368980018003269>. PMID:30501683.

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18. Pasquali L. *Psicometria: teoria dos testes na psicologia e na educação*. Petrópolis: Vozes; 2017.
19. Bock RD, Zimowski MF. Multiple group IRT. In: Van Der Linder WJ, Hambleton RK. *Handbook of modern item response theory*. New York: Springer-Verlag; 1977. p. 433-48.
20. Santos KD, Fischer FM, Andrade DF, Barbetta PA, Alves Cardoso MR, Gouveia Vilela RA. Shift work and sex are variants across Karolinska Sleep Questionnaire and the application of linking analysis as a step forward using Item Response Theory. *Chronobiol Int*. 2019;36(1):42-56. <http://dx.doi.org/10.1080/07420528.2018.1515773>. PMID:30403888.
21. Menegon LDS, Vincenzi SL, Andrade DF, Barbetta PA, Merino EAD, Vink P. Design and validation of an aircraft seat comfort scale using item response theory. *Appl Ergon*. 2017;62:216-26. <http://dx.doi.org/10.1016/j.apergo.2017.03.005>. PMID:28411732.
22. Rodrigues MAB. *Elaboração, padronização e aplicação de questionário para avaliação de conhecimento sobre câncer bucal validado pela teoria de resposta ao item [dissertação]*. Araçatuba: Universidade Estadual Paulista; 2011.
23. Borghi WMMC. *Criação de um banco de itens para avaliar o conhecimento sobre câncer de cabeça e pescoço. [tese]*. Araçatuba: Universidade Estadual Paulista; 2014.
24. Silveira PM, Borgatto AF, Andrade DF, Both J, Nascimento JV. Criação de uma escala para o perfil do estilo de vida dos docentes de educação física. *Rev Educ Fis UEM*. 2015;26(4):519-27. <http://dx.doi.org/10.4025/reveducfis.v26i4.24996>.
25. Jafer M, Crutzen R, Jafer A, van den Borne B. What do dental college clinicians know about oral cancer and its risk factors? An assessment among final year students, interns and faculty members in Saudi Arabia. *J Clin Exp Dent*. 2018;10(9):e908-13. PMID:30386524.
26. Grafton-Clarke C, Chen KW, Wilcock J. Diagnosis and referral delays in primary care for oral squamous cell cancer: a systematic review. *Br J Gen Pract*. 2019;69(679):e112-26. <http://dx.doi.org/10.3399/bjgp18X700205>. PMID:30455220.
27. Farthing PM, Speight PM. Educational aspects of oral cancer. *Br Dent J*. 2018;225(9):875-8. <http://dx.doi.org/10.1038/sj.bdj.2018.925>. PMID:30412570.
28. Kogi S, Silva J, Mikasa Y, Lee C, Ishikawa-Nagai S, Yang Q, Kihara H, Abe R, Yamada H. Knowledge and practice of oral cancer screening in teaching faculty-comparison of specialty and year of clinical experience. *J Cancer Educ*. 2018 PMID:29354870.
29. Kim S, Kolen MJ. *Multiple Group IRT Fixed-Parameter Estimation for Maintaining an Established Ability Scale*. Iowa City: Center for Advanced Studies in Measurement and Assessment, University of Iowa; 2016. (CASMA Research Report; 49).
30. Feyh M H, Bornia A C, Echegaray FA, Andrade DF. Comportamento de consumo sustentável: mensuração com o uso da teoria da resposta ao item. *Gestão.org*. 2016;14(Esp):16-29.