

Article

# Assessment of knowledge regarding airways protection devices use: a questionnaire validation

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## Abstract

*Background:* Purpose of our research is the validation of a questionnaire to assess knowledge of personal protective equipment (PPE) use in airways protection.

*Methods:* The questionnaire is composed of 29 items and has been submitted twice to 23 subjects (14F, 9M) over a 2-3 days interval.

Cronbach alpha statistical test has been used to assess over time reproducibility and items homogeneity.

*Results:* Statistical analysis demonstrates significant reliability with a Cronbach Alpha value of 0.991, placing the questionnaire in the highest test's reliability range.

*Conclusions:* Results of our study demonstrate that our questionnaire is reliable in terms of internal consistency, both for degree of correlation between items and for over time reproducibility.

**Keywords:** Mask, questionnaire, validation, Italy.

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## Background

The Sars-Cov-2 pandemic has introduced to the public devices that were almost exclusively destined to specific workers' categories such as airway protection devices.

Several scientific studies have highlighted how the use of these devices can protect the population<sup>1-2</sup> from contagion, blocking the emission and/or protecting from droplets<sup>3</sup>, in addition to other preventive measures such as hand hygiene and environmental sanitation<sup>4</sup>.

General population suddenly had to deal daily with a technical device of which they knew little or nothing and which, if used incorrectly, may prove ineffective or furthermore dangerous.

Within the pandemic, in the light of the Italian regulatory framework for the protection of the health and safety of workers, each employer was faced with the need to provide its employees with these tools, in order to guarantee workers and customers health protection.

Given this situation specific training courses have emerged, aimed at both workers and general population, to provide necessary knowledge and skills for correct devices use<sup>5</sup>. In particular, some devices (specifically FFP2 respirator masks) require compulsory training as third category personal protection equipment (PPE)<sup>6</sup>.

Training courses are generally provided face-to-face, especially in their hands-on parts, however with the restriction of face-to-face training activities due to public health protection, it became necessary to find an alternative interactive solution.

Given our premises we decided to carry out a remote learning path, using an online method. To understand the efficiency of our tool, we need to evaluate adequately the knowledge regarding the subjects of the training, but after several researches we couldn't find a questionnaire able to respond to our needs.

That's why as first step we worked to create a questionnaire able to investigate both the knowledge and the behavior regarding the use of airways protection masks and to validate it to estimate his internal coherence and his reproducibility.

## Methods

The main purpose of our research was to generate a questionnaire able to evaluate theoretical and practical knowledge regarding the correct use of airways protection PPE.

A computer-assisted web interviewing (CAWI) questionnaire was prepared ad hoc (called "EX ANTE questionnaire") and self-administered.

Subsequently, a video course was delivered, and afterwards (2 days from video course administration) a second knowledge assessment was performed repeating the same questionnaire (called "EX POST questionnaire") in order to assess users' knowledge degree of modification.

## Creation of the ad hoc questionnaire

Users' knowledge evaluation phase was the most important and delicate point of our survey. Given the remote administration of the training (e-learning video course, with the possibility of contacting the researcher or trainer via email in case of doubts or necessities) we required a specific, easy to understand and simple to use tool.

For the above reason a multiple-choice CAWI questionnaire was chosen, which enables remote online data collection (link, a panel or a website)<sup>7</sup>.

Required characteristics of the questionnaire were:

- Clarity: multiple-choice not requiring presence and/or assistance of an operator during administration.
- Precision: multiple-choice closed answers reducing the possibility of interpretation by the reader, preserving the reliability of the collected data.
- Adaptability: answers (but also questions) may be easily modified and integrated based on the needs of the reader and/or user feedback.

It was also necessary to create an ad-hoc questionnaire which would investigate topic related learner knowledge and personal sphere learner aspects, identifying 3 macro-sections:

- Notional section was composed of 16 multiple choice questions, each providing 5 possible answers of which:

1 absolutely correct (to which 1 point was assigned)

3 incorrect, for which no score was assigned

1 "I don't know", for which no score was assigned.

The notional part includes questions related to the user's theoretical/practical knowledge of airways PPE; the given questions were the same as the ones asked during face-to-face courses.

Our choice of introducing the "I don't know" answer was weighted to prevent users not aware of one or more answers, from guessing by answering at random; this choice was also made to safeguard the truthfulness of the obtained data.

- Habits and behaviors section was composed of 6 questions investigating the user's habits and behaviors regarding airways PPE use. Multiple choices for which there is no correct or incorrect answer and no score is assigned; the possibility of answering "I don't know" was also not included.

- Socio-personal users' data section, included:

name, surname, age, gender, marital status, level of education and profession.

Once we identified the macro-categories we ordered the questions of each category according to a "from general to particular" criterion so as to provide a user friendly logic scheme.

At the beginning of the survey a brief explanation of the questionnaire purpose and general useful indications for compilation were also included.

Once our questionnaire was created, we identified as the most appropriate administration platform "Google Modules", due to intrinsic characteristics compatible with our research:

- Easy to use (no special knowledge of programming languages required)
- Free to use
- Widely customizable in terms of type of questions and answers
- It may be integrated with multimedia contents (images, videos, audio etc.)

- Allows to print the questionnaire respecting formatting and layout if a paper version is required
- Allows interface customization making the graphic appearance more pleasant
- Automatically generated a database with users answers, also tracing date and time of entered answers.

From the user's point of view is:

- Easy to use and intuitive
- Can be used easily on any device (PC, tablet or smartphone)
- Minimum OS power and connection speeds are necessary
- No registration required.

As mentioned above, the same questionnaire was administered before viewing the video course and two days after it, to investigate the level of knowledge change.

The users were informed about the steps composing their training, although the type and nature of EX-ANTE/EX-POST questions were not disclosed until their administration, to ensure the highest level of responses transparency.

Moreover, all questionnaire answer fields were mandatory to prevent "blank" answers, allowing for increased accuracy of the obtained results.

### **Validation and administration of the questionnaire**

Following questionnaires drafting we proceeded with pre-test validation analysis of it<sup>8</sup>. Pre-test validation was necessary to understand the level of reliability and reproducibility of the test, therefore the ability of the instrument to correctly measure the phenomenon and give the same result if administered over time. In other words, a verification of the stability and precision of the instrument<sup>9</sup>.

The purpose of the pre-test questionnaire validation was also to identify and correct possible interpretation errors, superfluous or repetitive questions, questions with a hazy meaning, answers that were difficult to understand, and thus we encouraged the interviewees to comment on the questions and answers, and also to provide suggestions, thus highlighting any critical tool issues.

After completion of the 23 pre-test questionnaires, we analyzed them for internal coherence, which expresses a measure of the relative weight of the variability associated with the items with respect to the variability associated with their sum<sup>10</sup>, identifying the value of Cronbach's Alpha; i.e. the average of the intercorrelations between all the items of the test, and the relationship of each test item to the total score.

The scale of values obtainable from the Cronbach Alpha analysis is divided into four levels defined by the ranges indicated below:

<.60 problematic

.60 - .70 just sufficient

.70 - .80 fair

> .90 excellent

The statistical analysis was carried out using SPSS 25.0 for Windows.

## Results

A statistical sample of 23 subjects was therefore chosen (control group) comparable in characteristics to the final research group, which was heterogeneous, composed of both men and women of different ages and without any specifically defined a-priori characteristics, to whom the first version of the questionnaire was sent.

The analysis of the items returned a Cronbach Alpha value of 0.991, which places the test in the highest range of the reference scale. In **Table 1** the statistical analysis of internal consistency of the questionnaire is reported.

Subsequently, having not received any feedback from the interviewees regarding suggestions for changes and/or corrections, we considered the tool reliable and ready to move on to the second and last step of the validation process, the verification of reproducibility.

We then submitted the same questionnaire to the same population sample at a distance of 2-3 days from the first survey.

**Table 1** - Statistical analysis of internal consistency of the questionnaire

	Scale mean when the item was deleted	Scale variance when the item was deleted	Correct Item-total Correlation	Cronbach's Alpha when the item was deleted
D1	15,90	1203,390	,948	,991
D2	15,52	1146,662	,975	,990
D3	15,24	1104,790	,987	,990
D4	15,81	1189,062	,957	,991
D5	15,14	1091,329	,988	,990
D6	15,33	1118,033	,987	,990
D7	15,71	1174,914	,963	,991
D8	15,90	1202,990	,952	,991
D9	15,81	1188,862	,959	,991
D10	15,24	1105,490	,983	,990
D11	15,90	1203,290	,949	,991
D12	15,90	1203,790	,944	,991
D13	15,14	1090,529	,992	,990
D14	15,52	1145,762	,981	,990
D15	14,95	1063,648	,995	,991
D16	15,52	1146,062	,979	,990

## Discussion

The main purpose of our research was to create a questionnaire able to investigate both the knowledge and the behavior regarding the use of airways protection masks and to validate its reliability and internal consistency, both for degree of correlation between items and for over time reproducibility.

After two subsequent questionnaire administrations (2-3 days interval; n. 23 subjects the results demonstrate:

- a Cronbach Alpha value of 0.991, which places the test in the highest range of the reference scale;
- no issues in terms of comprehension or need of modification suggested by the respondents.

During the second phase of the survey we have also received responses which were consistent with those obtained during the first phase.

We may conclude that our questionnaire demonstrates high internal coherence and adequate reproducibility.

Therefore the validation process can be considered successfully completed and our questionnaire can be administered to a research population.

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