Reliability of a questionnaire designed to measure smoking intervention among secondary school students *

by

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Abstract

Objectives. *In the framework of the evaluation of a smoking prevention program for youngsters, a reliability study of the questionnaire was conducted. The questionnaire was designed to measure attitudes, self-efficacy, perceived social norms, social skills, short-term and long-term intentions to smoke, knowledge of smoking restrictions at school, communication with smokers and non-smokers and smoking behaviour of the respondents as well of their parents, siblings and friends.*

Methods. *A total of 753 students were eligible for a test-retest evaluation of the questionnaire with a 2-weeks interval. Out of these 753 pupils, 656 (87%) had duplicate questionnaires, reasons for drop-out mainly being absence and incorrect identification data result-*

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ing in problems of individual matching. Test-retest agreement of the data was statistically evaluated according to intra-class correlation coefficients (ICC) and kappa statistics.

Results. *The ICC coefficients for attitude, self-efficacy and communication with smokers and non-smokers were between 0.57 and 0.80. However, the mean score at the retest for self-efficacy and communication with smokers of the students as a group, showed a highly significant systematic increase compared to the first test. Highest kappa statistics (> 0.90) were found for smoking behaviour of the parents, while lowest values were observed for each of the 3 perceived social norms items (±0.50) and to a lesser extent for intention to smoke within the forthcoming month.*

Conclusions. *These results indicate that questions to assess smoking behaviour of youngsters and possible determinants in the framework of an evaluation study can have heterogeneous reliability values. Care should be taken in the interpretation of specified information related to items as perception of smoking prevalence rates, intention to smoke in the future and beliefs about own capabilities of quitting or no smoking in specific situations.*

Key-words

1. Introduction

Despite of a decreasing number of smoking adults in Belgium, an increasing number of adolescents adopts smoking (1, 2). Between 1990 and 1996 the proportion of 15-16 year old boys who reported to smoke daily increased from 14% to 28%. For girls the proportions were 12% and 20% respectively. The greatest increase in new smokers can be found among 12 and 14 year old adolescents. In 1996 16% of boys and 10% of girls aged 11-12 year reported that they had tried smoking at least once. Among 13-14 year old students the prevalence of experimentation was 40% and 38% respectively.

In 1990, the prevention program "No smoking-my freedom" was developed for that target group.

The main emphasis is on the student's ability to cope with the various social pressures to smoke. The program tries to prevent experimental smoking and regular smoking by:

— increasing knowledge of smoking consequences and prevalence rates,
— by reinforcing the non-smoking attitude,
— by developing skills for resisting social pressure, especially peer pressure and advertisements,
— by enhancing self-efficacy.

Students are encouraged to make a personal commitment not to smoke with their peers and parents.

The program was evaluated during the schoolyear 1995-1996. For our evaluation study we used a pre-post test control design. Results of the intervention group who received the program were compared with a control group. In the framework of this evaluation, a reliability study of the questionnaire was conducted. The reliability study is the subject of this article.

2. Reliability — reproducibility

Reliability is "a generic term that is used to indicate both internal consistency of a scale and reproducibility of scores" (3). We focus only on statistics that quantify test-retest reproducibility. When smoking behaviour and possible determinants are being followed in time by assessments, before and after an intervention program, the reproducibility of the instrument is important. Reproducibility refers to the variability of a measurement on the same subject under the same condition, the degree of stability in the course of time.

In case of a poor reproducibility, no valid estimates of smoking behaviour and its determinants can be expected. It is possible to interprete the results of a smoking intervention in a more accurate way.

For our reliability study an interval of 2 weeks was chosen to reduce the effect of changes in smoking habits and determinants. The period between the assessments had to be long enough to fade out the memory of the first questionnaire and as short as possible to reduce the effect of any changes in smoking habits.

The test retest reliability of the measurement instrument is very seldom evaluated in smoking prevention studies.

More attention has been paid to the validation of adolescents' reports of smoking (4). Reliability need to be distinguished from the validity of an instrument, which is the extent to which a method of measurement provides a true assessment of that which it purports to measure. Both aspects are important to enhance the accuracy of the data collected.

Researchers have validated students' self-reports by objective bio-chemical measures (carbon monoxide, thiocyanate, saliva and cotinine). The problem of biochemical validation with adolescents is to identify nondaily smokers. Sussman et al. (4) concludes that "a simple self-report measure of tobacco use and under conditions of anonymity will produce maximum reports of use". In our reliability study we applied the bogus pipeline procedure: students were told how smoking could be verified by a CO monitor.

3. Questionnaire

Outcomes were measured using a questionnaire which assess smoking behaviour and the constructs that are widely known to determine smoking onset: attitudes, personal self-efficacy expectations not to smoke or to stop, communication between smokers and non-smokers, perceived social norms (normative beliefs and motivations to comply), social skills (e.g. What would you do if a friend offers you a cigarette outside the school?), smoking behaviour of parents, siblings and friends, short-term and long-term intentions to smoke. These topics were representative of core elements in the prevention program aimed at preventing smoking in youngsters. Knowledge of smoking restrictions at school was also measured.

The instrument was pilot-tested. The relevance of questions, problems with response formats, question wording, amount of time needed to fill in the questionnaire and order of questions was studied during the pilot surveys. Approximately 270 students self-completed the questionnaire and discussed it. This process resulted in some questions being deleted and others being changed.

4. Methods

4.1. Study population

For the evaluation study a sample of 65 secondary schools was drawn randomly from the total of 1 015 schools in Flanders. Seven schools refused because of lack of time. These schools were enrolled in the reproducibility study.

A total of 753 2nd year students were eligible for a test-retest evaluation of the questionnaire with a 2-weeks interval. They filled in the questionnaire anonymously and in presence of one researcher and one or more teachers. 94% were high school students and 6% of them were vocational students. 61% were male and 39% of them were female. Age of the adolescents varied between 12 and 16 years, almost 77% was 13 years old.

656 students had duplicate questionnaires (87.7%). Reasons for drop-out mainly being absence on the day of testing (4.7%) and incorrect identification data (birth data and sexe) resulting in problems of individual matching (7.6%). The drop-out includes proportionally more youngsters with a risk profile. The percentage of smokers (who has smoked during the last month) in the group of analysis was 8.5%, the percentage of smokers in the drop-out group was 19.6%. The percentage of vocational students was also higher in the drop-out (15.2%) than in the group of analysis (6.1%).

4.2. Statistics

Several statistics are necessary to describe reproducibility. In this study test-retest agreement of the data was statistically evaluated according to intra-class correlation coefficients (ICC) and kappa statistics for ordinal data (3, 5).

These issues are well described by Deyo (3): "ICC assesses not only the strength of correlation, but also whether the slope and intercept vary from those expected with replicate measures. The values of the ICC vary from −1 to +1. If one measurement is systematically higher or lower than the other, the ICC is correspondingly reduced. If the ICC is high, it means that not much of the variability is due to variability in measurement on different occasions".

Kappa statistic (K) is usually used in nominal or existential scales. The statistic for measuring agreement with ordinal data is weighted Kappa (K_w). For our ordered categorical variables K_w was used with weights reflecting differences in the seriousness of disagreements (weights were assigned according to the number of categories separating the compared values. K_w values of >0.75 represent excellent agreement beyond chance; values of 0.40-0.75 represent fair to good agreement beyond chance and those <0.40 represent poor agreement.

The reproducibility was assessed for seperate items as well as for groups. For some questions with a group of items and quantitative answer possibilities, sumscores and the means of these scores were calculated.

The test-retest measures were combined with nonparametric tests for related samples. The McNemar test (for dichotomous variables) and the Wilcoxon signed rank test (for continuous variables) were used to measure systematic differences (lower or higher scores) between the two related measurement occasions.

5. Results

Smoking behaviour, smoking status of parents and friends,
social skills, knowledge of smoking restrictions at school
and intention to smoke next month and at age 18

This analysis yielded test-retest values ranging from 0.49 to 0.96 (see Table 1). Highest Kappa-statistics were found for smoking behaviour of own parents (0.94 and 0.96) and for one of the questions on social skills (0.75): what would you do if your friend offers you a cigarette at the schoolgate. The 3 questions on perceived social norms (estimation of % of regular smokers among peers and 16 years old pupils) showed the lowest test-retest reliability (0.49-0.53). Kappa values of ±0.60 were observed for the smoking status of the respondents as well of their best friend and girl-/boyfriend, for knowledge of smoking restrictions at school for pupils and for intention to smoke within the forthcoming month and at age 18.

Looking at the results of the test for symmetry, significant differences between the answers at the first and second test were found: a

significant shift toward reporting refusing a cigarette by more subjects on the second occasion ($p = 0.005$). Compared with the first test more subjects reported a higher percentage of daily smokers among peers ($p = 0.001$) and among 16 years old adolescents ($p = 0.04$). Finally more subjects reported being more uncertain about their intention not to smoke the next month ($p = 0.001$).

TABLE 1

Reliability values: Weighted Kappa values for categorical qualitative variables (N = 656)

	Test for symmetry $p =$	Weighted K		95% C.I.
Own smoking behaviour	0.35	0.66		0.56-0.76
Reactions on being				
asked to smoke by friend at schoolgate	**0.005**	*0.75*	*HIGHEST*	0.68-0.82
asked to smoke by friends at playground	0.16	0.72		0.65-0.78
asked to smoke by nephew and uncle	0.55	0.65		0.55-0.74
Smoking behaviour of				
– father	0.71	*0.94*	*HIGHEST*	0.92-0.96
– mother	0.71	*0.96*	*HIGHEST*	0.94-0.97
– best friend	0.78	0.69		0.64-0.75
– boy-/girlfriend	0.61	0.69		0.64-0.75
prevalence rates (estimation of)				
– % weekly smoking peers	0.07	*0.51*	*LOWEST*	0.47-0.56
– % daily smoking peers	**0.001**	*0.53*	*LOWEST*	0.48-0.57
– % daily smoking 16-year olds	0.04	*0.49*	*LOWEST*	0.44-0.54
knowledge of smoking rules at school				
– permission for teachers	0.15	0.70		0.66-0.75
– permission for students	0.16	0.57		0.49-0.65
Intention to smoke				
– next month	**0.001**	0.62		0.57-0.68
– at 18 years	0.054	0.66		0.62-0.71

Attitude, communication and self-efficacy

For the sum scores (calculated for group items with quantitative answers) ICC coefficients were between 0.57 and 0.80 (see Table 2). The highest coefficients were found for attitude, the lowest for the communication with non-smokers (only measured for smoking students).

Significant differences between the mean scores for the first and second test were found. The mean score at the retest for self-efficacy (perception of being able not to smoke in different situations) and

communication with smokers of the non-smoking students as a group showed a highly significant systematic decrease compared to the first test ($p<0.0001$). For the other component of self-efficacy expectations (component perceptions of difficulties not to smoke in different situations) a highly significant systematic increase was found ($p<0.0001$). This means that at the second test, students reported being more able and finding it less difficult not to smoke in different situations. Smaller differences were found for the non-smoking pupils: at the second test they reported communicating less frequently with their smoking peers about their smoking behaviour ($p \times 0.0003$) and being offered more frequently a cigarette and being urged to smoke ($p<0.007$).

TABLE 2

Reliability values: ICC coefficients for sum scores related to attitude, self-efficacy, communication with smokers and with non-smokers (N = 656)

	First test Mean (SD)	Second test		
		Mean (SD)	P_Δ*	ICC**
Attitudes	48.0 (11.7)	47.8 (12.7)	0.27	0.80
Able not to smoke	13.0 (5.7)	11.95 (5.7)	<0.0001	0.65
Difficulties not to smoke	19.8 (6.5)	20.9 (6.7)	<0.0001	0.69
Communication with non-smokers (only smokers)	15.4 (2.9)	15.4 (2.3)	0.66	0.57
Communication with smokers (only non-smokers)$_{1-5}$	11.8 (4.0)	11.4 (4.0)	0.0003	0.76
Communication with smokers (only non-smokers)$_{6-7}$	3.50 (1.77)	3.60 (1.81)	0.007	0.76

* Wilcoxon signed rank test. ** Intra Correlation Coefficient.

6. Conclusions and discussion

The reproducibility of the questionnaire designed to measure smoking intervention among secondary school students, showed considerable variance: some items scored very high, others rather low. The results indicate that questions to assess smoking behaviour of youngsters and possible determinants can have heterogeneous reliability results.

Comparing these results with other studies is difficult because the test retest reliability of the measuring instrument is very seldom evaluated in smoking prevention studies.

The questions with high reproducibility are : the smoking behaviour of own parents, the attitudes about sigarettes and possible consequences, personal reactions on the request of peers to smoke and specifically at the schoolgate, the communication of non-smoking students with smokers.

To a lesser degree but fair to good reproducibility scores were found for the own smoking behaviour and that of their best friend and girl-/boyfriend, the intention to smoke in the future, self-efficacy expectations not to smoke or to stop and the experienced difficulties to do so and the knowledge of smoking restrictions at school for teachers.

The lowest scores were found for the communication of smoking youngsters with non-smokers, the knowledge of smoking restrictions at school for pupils and the estimation of the number of smoking peers and 16 year old youngsters.

Our results indicate that the questionnaire is fairly to highly reproducible. However care should be taken in the interpretation of possible effects from the larger evaluation study. Results from the reliability study show that there were systematic differences between the first and second test, even without an intervention. At the second test the students reported being more able and finding it less difficult not to smoke in different situations. The non-smoking pupils reported communicating less frequently with their smoking peers about their smoking behaviour and reported being offered a sigarette and being urged to smoke more frequently in comparison with the first test. The students reported a higher percentage of daily smoking peers, were more uncertain about their intention not to smoke the next month and more students would resist to a sigarette offer at the schoolgate.

The lowest reliability scores could be attributable to the lack of knowledge on prevalence rates, unclearness of smoking rules at schools and the uncertainty about their intention to smoke in the future. As comparable to other studies, there is a tendency to overestimate smoking prevalence among their peers and prevention programs should paid more attention to social norms. Many school policies do not (clearly) address adolescent and adult smoking.

On the other hand, even with a short period of 2 weeks, due to the questionnaire students can communicate more frequently about "smoking" with their teacher(s), classmates or other peers.

Finally the results can indicate that there is little chance for changes in the smoking behaviour of adults (their parents), while their own smoking behaviour is less stable even within a period of 2 weeks. Research has shown that many youngsters try their first sigarette at this age, some of them get on experimenting while a small part becomes a regular smoker after a certain time. The greatest increase in new smokers can be found in that age group. The process from experimenting to regular smoking is taking time and is a dynamic and not a lineair process. Many adolescents tell having stopped smoking once or more times, while they are in fact experimenting and in many cases never smoked regularly. The questionnaire was developed to measure the effects of a smoking prevention program. Using a control group will correct for "normal" evolutions of the smoking behaviour of youngsters, not due to the influence of an intervention program. The pipeline procedure will be used for improving validity of self-reports.

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