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Wissenschaftlicher Brief/Scientific Letter

A combination of exhaled carbon monoxide (CO) measurement and the Fagerström Test for Nicotine Dependence (FTND) is recommended to complete information on smoking rates in population-based surveys

Regarding the article "Prävalenz des Tabakkonsums in der Schweiz der 1990er Jahre – Schätzung der Konsumtrends aufgrund zweier Methoden"[1] we wish to discuss possible developments in future studies, using objective measurement of tobacco consumption, and a definition of tobacco dependence based on a psychological test procedure.

Measuring smoking prevalence by self-administered questionnaires[2] leads to misclassification of smoking in one direction – underreporting of cigarette smoking (smokers falsely identifying themselves as non-smokers and/or underreport the amount of tobacco consumption e.g. by the parameter "number of cigarettes smoked per day").[3]

The wording of questions about smoking on questionnaires or other data-gathering instruments can affect response rates and the accuracy of response. One recent publication evaluated four questions about maternal smoking during pregnancy for use on birth certificates. Although pregnancy is a very specific situation, it was found out that sensitivity ranged from 47 to 87% and the smoking misclassification rate (percentage of reported non-smokers who actually where smokers) ranged from 2.2 to 10.5%.[4] Other studies found out that sensitivity of smoking questions ranged from 74 to 86%.[5,6]

Also tobacco control measures and the "anti-smoking climate" should have an influence on self-report in questionnaires. We have some doubts that comparisons of countries with a well developed anti-smoking climate (like the USA) with countries with low/no development in this respect (like Austria) are reliable, even if data are collected using the same, validated questionnaires.[7] However, we didn't find any study in this respect.

Effective planning and evaluation of public health programs and population-based research requires information not only on smoking prevalence but also which smokers quitted. If the heavy smokers remain in the population, disease rates will only slow down marginally.[8] The reduced prevalence rates won't provide the full magnitude of the problem and may be misused to argue that prevention programs works and political correctness is fulfilled.

We argue that smoking studies using self-administrated questionnaires should *at least* include the measurement of exhaled carbon monoxide (CO).[2] This type of examination was first used in 1997–1998 on medical students at the University of Vienna, avoided non-response bias, and implemented the CO measurement. This study could perhaps serve as an example.[9]

Carbon monoxide measurement is an easy useful and inexpensive method for obtaining objective data from smokers. A definite indication of active smoking is found at 11+ ppm CO; CO levels between 6 and 10 ppm may indicate light smoking, and definite non-smokers show up a lung breath CO reading between 0 and 5 ppm.[10]

There is a scientific discussion about the 11-ppm cut-off point; in one of our public health projects here in Austria (770 participants) the mean CO level was 22 ppm.

Evaluation of tobacco-dependence in the population seems also very useful. Highly dependent people experience a higher risk of contracting a tobacco related disease and at the same time find it more difficult to become non-smokers.[11] To demonstrate the need of a second instrument in addition to the measurement of CO to define the tobacco dependence we compared two diagnostic procedures, the CO measurement and the Fagerström

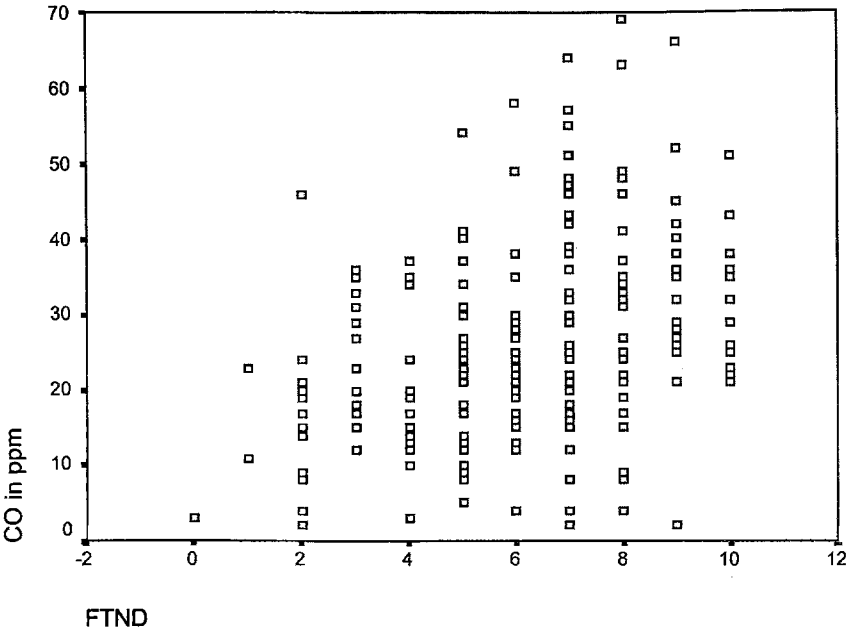

Figure 1. *Correlation of the FTND and measured carbon monoxide: r = 0.354, p < 0.001.*

Test for Nicotine Dependence (FTND):

Data originates from a counselling program of Vienna's Nicotine Institute.[12]

The FTND consists of six items and produces a score between 0 and 10. A low dependence is indicated by a score of 3–4, a score of 5–10 means a medium or high nicotine dependence. CO was measured with the Bedfont EC50-MICRO carbon monoxide monitor.

The sample consisted of 241 patients (men = 46%, women = 54%, mean age = 48) 54% of the participants were aged between 41 and 60, which is a typical age distribution for smoking cessation courses.

The mean FTND score was 6.12. (men = 6.06, women = 6.16). No significant age or gender differences were observed.

58.1% of the patients have shown a high/very high dependence regarding this questionnaire.

The mean carbon monoxide level was 26.19 ppm. (men = 26.48; women = 25.94).

The Pearson correlation of the FTND and the measured carbon monoxide was r = 0.354 ($p < 0.001$). (men = 0.364 ($p < 0.001$); women = 0.347 ($p < 0.001$)).

The relatively high means of FTND scores and CO values identify smokers attended the counseling program of Vienna's Nicotine Institute as heavy tobacco consumers.

The FTND and CO correlation coefficient of 0.35 is in the expected range. They obviously do not measure the same phenomenon. (Fagerström-private communication).

In conclusion, CO measures the actual exposure to harmful substances[13] and provides objective data. The FTND measures the dependence.

Thus, assessing the smoking prevalence by self-administered questionnaires only can therefore be misleading with respect to the *prevalence of addiction in the population.*

References

1 *Gmel G.* Prävalenz des Tabakkonsums in der Schweiz der 1990er Jahre – Schätzung der Konsumtrends aufgrund zweier Methoden. Soz Praventivmed 2000; *45*: 64–72.

2 *Groman E.* Evaluation of smoking prevalence: will there be an end to Self-Administered Questionnaires? Prev Med 2000; *30*: 346.

3 *Xiang H.* Evaluation of smoking Prevalence: is there an end to self-report in questionnaires of Smokers? Prev Med 2000; *30*: 347.

4 *Kharrazi M, Epstein D, Hopkins B,* et al. Evaluation of four maternal smoking questions. *Public Health Rep* 1999; 114: 60–70.

5 *Piper JM, Mitchel EF Jr, Snowden M,* et al. Validation of 1989 Tennessee birth certificates using maternal and newborn hospital records. Am J Epidemiol 1993; *137*: 758–68.

6 *Buescher PA.* Smoking in pregnancy in North Carolina: maternal characteristics and trends, 1988–1994. N C Med J 1997; *68*: 556–560.

7 *Sudam S, Bradburn NM.* Asking questions, a practical guide to questionnaire design. San Francisco: Jossey-Bass, 1988.

8 *Fagerstrom KO, Kunze M, Schoberberger R,* et al. Nicotine dependence versus smoking prevalence: comparisons among countries and categories of smokers. Tob Control 1996; *5*: 52–6.

9 *Groman E, Kunze U, Schmeiser-Rieder R, Schoberberger R.* Measurement of expired carbon monoxide among medical students to assess smoking behaviour. Soz Praventivmed 1998; *43*: 322–4.

10 *Groman E, Bernhard G, Blauensteiner D, Kunze U.* A harmful aid to stopping smoking. Lancet 1999; 353 (9151): 466–7.

11 *Kunze M.* Maximizing help for dissonant smokers. Addiction 2000; 95 (Supplement 1): 13–7.

12 *Groman E, Kunze U, Schmeiser-Rieder A, Schoberberger R.* Konzept, Aufgaben und Dienstleistun-

gen eines Instituts zur Diagnostik und Therapie der Tabak- und Nikotinabhängigkeit. Neuropsychiatrie 1999; *3*: 139–44.

13 *Groman E, Blauensteiner D, Kunze U, Schoberberger R.* Carbon monoxide in the expired air of smokers who smoke so-called "light" brands of cigarettes. *Tob Control* (in press).

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