

Knowledge of nicotine dependence and treatment in clinical practice improved after an e-learning course among medical students

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Abstract

Objective. Tobacco smoking is the leading cause of preventable death in developed countries and smokers should be encouraged to quit. Physicians are instrumental in this, but recent reports suggest inadequate training in medical school. We aimed to assess the knowledge of nicotine dependence and its treatment among Italian medical students.

Study design. Prospective observational study.

Methods. We developed an online course consisting of 11 *Didactic Modules* (6 for *Tobacco Dependence I, TDI*, and 5 for *TDII*) on nicotine dependence and treatment. The course was administered to 4th and 5th year medical students in Italy in Academic Years 2016-17 (Course A) and 2017-18 (Course B). A validated questionnaire was used before and after each part in order to measure knowledge of smoking epidemiology, health effects and benefits of giving up smoking (“Score 1”, *TDI*), and effectiveness of cessation treatments (“Score 2”, *TDII*).

Results. 324 students took both *TDI* and *TDII* and completed all questionnaires (Course A, n = 245; Course B, n = 79). 55 students were current smokers (17%). A significant increase in score 1 and 2 was observed at the end of both *TDI* (pre-course 47.2±13.1, post-course 66.0±12.3, p < 0.0001) and *TDII* (pre-course 55.6±11.5, post-course 68.1±10.9, p < 0.0001). The prevalence of students wishing for a smoke-free medical school significantly increased between the beginning of *TDI* (74.4%, 241/324) and the end of *TDII* (88%, 285/324; p < 0.0001).

Conclusions. This e-learning course has proven to be an effective tool in teaching students on nicotine dependence and treatment. *Clin Ter* 2019; 170(4):e252-257 doi: 10.7417/CT.2019.2143

Key words: e-learning, smoking cessation, cigarette smoking, medical education

Introduction

Smoking continues to be a public health problem in Italy, with 22% of the population reporting current smoking status in 2019¹. The prevalence is higher among men (28.0%) compared to women (16.5%) and, importantly, the

rate of decline has been relatively unchanged since 2007. Smoking cessation is also relatively rare, as few make serious attempts to quit smoking. However, as proven in the United States^{3,4} and Japan⁵, data from Italy suggest that the earlier a smoker quits, the more life is gained (7 years versus 5 years for cessation at ages 30 versus 60) and gains are greater for heavier (9 years) versus light (4 years) smokers².

Physicians have an important role to play in helping smokers quit. Solid evidence supports the association between physician-delivered advice and a serious attempt to quit and cessation⁶. In fact, the Clinical Practice Guideline in the United States recommends that physicians ask all smokers about tobacco use, advise smokers to quit, assess for readiness to quit smoking, assist in a cessation attempt, and arrange for follow-up⁶. These behaviors can increase the odds of cessation at 6 months by 30%⁶.

Research suggests that physicians in Italy are not counseling smokers to quit, or assisting them in a cessation attempt, on a regular basis. One reason could be due to the fact that smoking is more common among physicians in Italy compared to other countries, with rates ranging from 9% to 14%⁷⁻¹⁰. However, the exact prevalence of physician-delivered counseling is unknown. Only 25% of smokers who completed the Italian Adult Tobacco Survey reported being advised to quit smoking by a physician in the past year, and smokers with less education, heavier smokers, and those interested in quitting were more likely to receive advice¹¹. In contrast, results from a survey of cardiac units in Italy suggests that smokers consistently receive advice to quit smoking; however, less than half of these units are equipped to provide counseling or prescribe pharmacotherapy¹². Results from surveys of oncologists and cardiologists suggest that 50% regularly advise smokers to quit^{7,9}, which is much higher than smoker-reported counseling⁹.

Even at a 50% rate, this is still lower than the recommendation to advise all smokers to quit⁶. Studies suggest that attitudes and knowledge could partially explain the low rates of counseling. In one study, less than 60% of Italian cardiologists acknowledged the addictive behavior of smoking⁷

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and in another, general knowledge of nicotine dependence and its treatment was poor¹⁰. Nobile et al.⁸ reported that less than one third of Italian primary care providers were aware of the importance of pharmacotherapy for treating nicotine dependence and less than 60% believed that physicians play an important role in helping smokers quit.

Italian physicians recognize their lacking training in how to treat nicotine dependence^{7,10}, consistently with the information on medical school curricula. Armstrong and colleagues¹³ reported that Italian students had a generally lower level of training in nicotine dependence and engaged in brief counseling less often than the American students. In a larger survey of medical students specializing in public health from 24 schools in Italy, less than 20% received formal training in nicotine dependence treatment¹⁴.

Our own work with Italian medical students suggests that knowledge of nicotine dependence and its treatment is generally low¹⁵, but not as low as knowledge among other university students¹⁶. We also demonstrated that it is possible to increase knowledge with just one structured lesson during the fourth-year course on pharmacology¹⁶. Students who attended the lecture scored significantly better on tests of the epidemiology of smoking and treatment of nicotine dependence one year after the lecture. We have extended this one lesson to a full online course for medical students at one medical school in Italy (Sapienza, University of Rome). The objective of this paper is to report our preliminary findings of the effectiveness of this online course at increasing knowledge of the harmful effects of tobacco, tobacco dependence, and treatments for dependence.

Methods

Course Development

The e-learning, fully online English language course, was developed for advanced medical students (4th and 5th years of school). The *Rx for Change* curriculum served as the foundation of the course. This curriculum was developed at the University of California at San Francisco and is available for educational purposes (<http://rxforchange.ucsf.edu/about.php>). The course consisted of a total of 11 didactic modules. The first part of the course, *Tobacco Dependence I (TDI)* consists of 6 modules: history of tobacco, epidemiology of smoking in Italy, toxicology of nicotine, nicotine dependence (ND), craving and withdrawal, and other tobacco exposures. The second part of the course, *TDII*, is composed of 5 modules: clinical practice guidelines, the pharmacological therapies for smoking cessation and the role of the doctor in helping smokers quit.

Procedures

Students were introduced to the course when they were enrolled in “Pharmacology and Toxicology” at “Sapienza” medical school. Because the Pharmacology and Toxicology course is offered to 4th and 5th year medical students in Italy (part 1 and part 2), the course was available to the 4th and

5th year “Sapienza” medical students: i) between November 2016 and February 2017 as the first application of both courses (*TDI* and *TDII*) (Course A), and ii) between May 2017 and February 2018, as the second year of application of both courses (Course B).

As a first step, students watched a video of Michael Fiore, author of Clinical Practice Guideline on tobacco dependence⁶, explaining why this topic is important for doctors. Students then had to complete a pre-questionnaire prior to watching the *TDI* modules. After the modules, students completed the post-questionnaire and then moved on to *TDII*. There were four questionnaires total (2 pre and 2 post each *TD* course) aimed at assessing knowledge related to: epidemiology of tobacco use, health effects associated with smoking and benefits of smoking cessation, how to diagnose ND, the therapies to treat ND, and how doctors can deliver the 5 A’s to help patients quitting smoking.

Measures

Two knowledge scores were created following our previous work¹⁵ with medical students. We measured knowledge of smoking epidemiology, health effects and benefits of quitting smoking (“Score 1”, *TDI*), and effectiveness of cessation treatments (“Score 2”, *TDII*). *Score 1* was computed using 14 items of the *TDI* questionnaire, assigning a value of 0 – 2 to each answer (range 0 – 28). A value of 2 implied the student answered correctly or in an acceptable range (depending on the question), a value of 1 implied it was not far from the correct answer, and a value of 0 implied a totally incorrect answer. The items included questions of: i) epidemiology of tobacco use, ii) health effects associated with smoking, and iii) benefits of cessation. A score of at least 60% was chosen as a cut-off to represent a sufficient level of knowledge. *Score 2* was computed using 9 questions (14 items) of *TDII* questionnaire, using the same mechanism for assigning values as in the Score 1 system, to assess students by their knowledge of: i) clinical guidelines on smoking cessation, ii) how to diagnose ND, iii) the therapies to treat ND and iv) effectiveness of smoking cessation methods^{15,16}. For both Scores 1 and 2, means and SDs were computed for each group of students, and by gender and current smoking status. Missing data were counted as incorrect answers.

Approval of the study was obtained from the Ethics Committee of the Teaching Hospital “Azienda Ospedaliero-Universitaria Policlinico Umberto I” – “Sapienza” University of Rome and, owing to the nature of data collected (anonymous, noninvasive, or sensitive) by the Dean of Medical School.

Statistical Analysis

Questionnaire data were analyzed using the statistical software R (version 3.3.3). Paired t-tests were used to assess changes in scores between pre- and post-course results for both Score 1 and Score 2. Changes in scores by gender and smoking behavior were assessed via the Welch two-sample t-test. Changes in categorical variables were measured via the Pearson’s chi-square test.

Results

Course A

Between December 2016 and February 2017, 296 students engaged in the e-learning course and completed at least one of the four questionnaires. Among these 296 students, 42 refused to disclose information about their smoking behavior and 47 were current smokers (18.8%).

245 (140 females, 105 males) students completed all 4 questionnaires. Among them, 42 were current smokers (17.1%) (Table 1). Paired t-test showed significantly improved scores for both *TDI* (before course: 46.0±13.2, after course: 60.5±13.0, $p<0.0001$) and *TDII* (before course: 56.6±11.2, after course: 67.9±10.7, $p<0.0001$) (Fig. 1). No significant differences were observed by gender or smoking behavior (Tables 2 and 3).

Most students wished for a completely smoke-free medical school, with a significant increase after the end of both courses (before *TDI*: 70.6%, (173/245) after *TDII*: 87.3% (214/245) $P<0.0001$). At the end of the course, only two students had quit smoking.

Course B

Between May 2017 and February 2018, 153 students completed the e-learning course and at least one of the four questionnaires. Among these 153 students, 31 were current smokers (20.3%) and no students refused to disclose information in these regards.

79 students (46 females, 33 males) took all 4 questionnaires; among them, 13 were current smokers (16.5%) (Table 1). Paired t-test showed significantly improved scores for both *TDI* (before course: 51.0±12.7, after course: 83.1±10.3; $p<0.0001$) and *TDII* (before course: 52.6±12.3%, after course: 68.8±11.4%; $p<0.0001$) (Figure 1). Similar to Course A, no significant differences were observed in regards to students' scores for all parts when addressing gender differences (Table 2) or smoking behavior (Table 3).

Before the start of the course, 86.1% (68/79) of students wanted their medical school to be completely smoke-free; at the end of both courses, this percentage had increased to 89.9% (71/79), although the change did not reach statistical significance ($p=0.466$). At the end of the course, the number of current smokers had decreased from 13 to 11.

Table 1. Participant demographics, smoking behavior, characteristics and intention to quit among "Sapienza" University of Rome medical students.

| | Total 2016-17 & 2017-18 | Course A 2016-17 | Course B 2017-18 |
|---|--|-----------------------------|-----------------------------|
| Participants | 324 | 245 | 79 |
| Mean age yrs (range) | 25.7±2.8 (22-41) | 25.7±2.8 (22-41) | 25.6±2.9 (22-36) |
| Females | 186 (57.4) | 140 (57.1) | 46 (58.2) |
| Smoking behavior | | | |
| Never smokers | 207 (63.9) | 158 (64.5) | 49 (62.0) |
| Current smokers | 55 (17.0) | 42 (17.1) | 13 (16.5) |
| Former smokers | 62 (19.1) | 45 (18.4) | 17 (21.5) |
| Mean age at onset of smoking among ever smokers: yrs (range) | 17.3±2.5 (12-27) | 17.4±2.7 (12-27) | 17.1± 1.9 (14-22) |
| Mean age of smoking cessation among former smokers: yrs (range) | 23.5±4.4 (16-38) | 23.3± 4.3 (16-38) | 24.2±4.6 (19-36) |
| Characteristics of current smokers | | | |
| Fagerström score (range) | 1.9±2.2 (0-8) | 1.9±2.2 (0-8) | 1.9±2.1 (0-6) |
| Tried to stop smoking during University | 40 (72.7) | 33 (78.6) | 7 (53.8) |
| Tried in the last year to stop smoking and succeeded for 1 day or longer | 40 (72.7) | 33 (78.6) | 7 (53.8) |
| "Would you like to give up smoking altogether?" (% yes) | 40 (72.7) | 32 (76.2) | 8 (61.5) |
| Which of the following statements best describes your current intentions in regards to smoking? | | | |
| "I want to quit." | 21 (38.2) | 17 (40.5) | 4 (30.8) |
| "I will continue to smoke for now." | 12 (21.8) | 8 (19.0) | 4 (30.8) |
| "I will stop in the next 6 months" | 15 (27.3) | 12 (28.6) | 3 (23.0) |
| "I will stop in the next 30 days" | 7 (12.7) | 5 (11.9) | 2 (15.4) |

Data expressed as means ± SD or n (%)

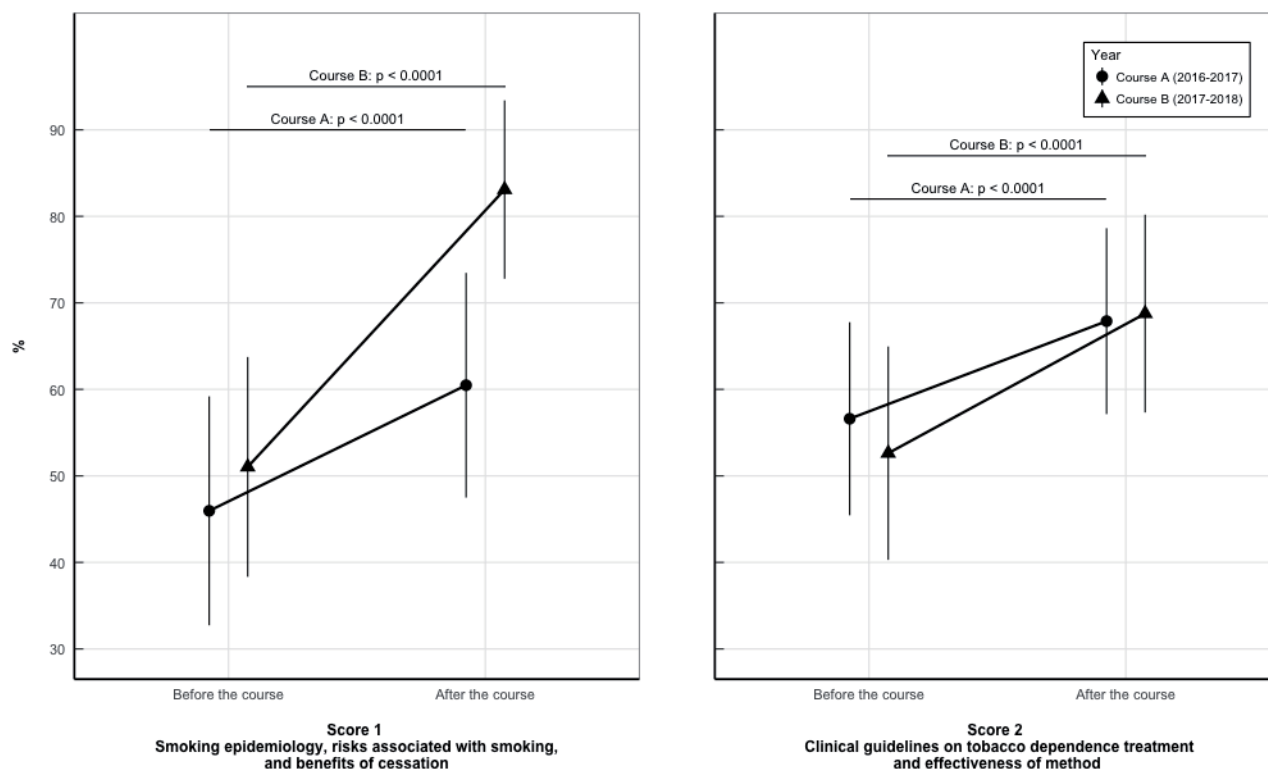


Fig. 1. Results from an e-learning course designed to train medical students on how to treat nicotine dependence in clinical practice.

Table 2. Scores 1 and 2 (mean±SD) by gender before and after each e-learning course.

| Course | Scores | | Females | Males | p |
|----------|--------|---------------|-----------|-----------|------|
| Course A | TDI | before course | 46.6±12.6 | 45.1±14.1 | 0.39 |
| | | after course | 61.0±12.7 | 59.8±13.4 | 0.46 |
| | TDII | before course | 55.5±10.7 | 58.1±11.6 | 0.07 |
| | | after course | 66.8±10.2 | 69.3±11.4 | 0.08 |
| Course B | TDI | before course | 52.9±13.1 | 48.5±11.8 | 0.12 |
| | | after course | 83.5±10.7 | 82.6±9.9 | 0.70 |
| | TDII | before course | 51.2±11.5 | 54.5±13.3 | 0.25 |
| | | after course | 68.6±12.4 | 68.9±10.0 | 0.90 |

Course A: n = 245 (females 140, males 105); course B: n = 79 (females 46, males 33).

Table 3. Scores (mean±SD) by smoking behavior before and after each e-learning course.

| Course | Scores | | Non-smokers | Smokers | p |
|----------|--------|---------------|-------------|------------|------|
| Course A | TDI | before course | 46.1±12.9 | 45.3±14.7 | 0.75 |
| | | after course | 60.5±13.0 | 60.5±12.9 | 0.99 |
| | TDII | before course | 56.7±11.5 | 56.2±9.5 | 0.78 |
| | | after course | 67.7±11.0 | 68.8±9.2 | 0.50 |
| Course B | TDI | before course | 50.2±12.5 | 55.5± 13.5 | 0.21 |
| | | after course | 84.0±9.7 | 78.6±12.3 | 0.15 |
| | TDII | before course | 52.7±12.6 | 52.2±11.3 | 0.89 |
| | | after course | 69.4±11.0 | 65.4±13.5 | 0.32 |

Course A: n = 245 (non-smokers 203, smokers 42); course B: n = 79 (non-smokers 66, smokers 13).

Comparison between years

Courses A and B were taken by two separate groups of students of the medical schools of “Sapienza” University of Rome. There were no significant differences in regards to age and gender distributions (respectively $t_{(130,1)}=0.456$, $p=0.649$ and $\chi^2_{(1, n=324)}=0.002$, $p=0.969$). No significant difference was observed concerning smoking behavior by gender for both courses (Course A: $\chi^2_{(1, n=245)}=1.877$, $p=0.171$; course B, $\chi^2_{(1, n=79)}=0.070$, $p=0.791$). Most smokers were considering quitting, with no significant difference between Course A (76.2%, 32/42) and Course B (61.5%, 8/13) [$\chi^2_{(1, n=55)}=1.0745$, $p=0.299$]. No statistically significant difference was observed concerning the prevalence of smokers willing to continue smoking between Course A (19%, 8/42) and Course B (30.8%, 4/13) [$\chi^2_{(1, n=55)}=0.799$, $p=0.371$].

Significant differences were found by year for both *TDI* and *TDII* questionnaires and are represented in Figure 1. For *TDI*, compared to students taking the course in 2016-17, those who took the course between 2017 and 2018 had significantly better results for both the pre-course questionnaire (Course A: 46.0 ± 13.2 , Course B, 51.0 ± 12.7 ; $p=0.003$) and the post-course questionnaire (Course A, 60.5 ± 13.0 , Course B, 83.1 ± 10.3 ; $p<0.0001$); on the contrary, for *TDII* students in 2017-18 performed significantly worse in the pre-course questionnaire (Course A, 56.6 ± 11.2 , Course B 52.6 ± 12.3 ; $p=0.01$), but there was no significant difference in the post-course questionnaire (Course A, 67.9 ± 10.7 , Course B 68.8 ± 11.4 ; $p=0.5$).

Total of all students

A grand total of 324 students took both *TDI* and *TDII* and completed all four questionnaires. A significant increase in score 1 and 2 was observed at the end of both *TD* (score 1: pre-course 47.2 ± 13.1 , post-course 66.0 ± 12.3 , $p<0.0001$; score 2: pre-course 55.6 ± 11.5 , post-course 68.1 ± 10.9 , $p<0.0001$). The prevalence of students who would like a smoke-free Medical School significantly increased between the beginning of *TDI* and the end of *TDII* (beginning of *TDI*: 74.4%, 241/324; end of *TDII*: 88%, 285/324; $p<0.0001$).

The total prevalence of smoking was 17.0% (55/324), with no significant gender difference. The mean Fagerström score for the smokers was 1.9 ± 2.2 . Most smokers (72.7%, 40/55) were considering quitting; 21.8% of current smokers reported no intention to quit. Only 23.6% (13/55) reported receiving advice to quit smoking from their GP in the last year.

Discussion

E-learning courses have proven to be effective tools in teaching. Compared to our previous research on traditional lectures^{15,16}, the e-learning modules have shown far better results in regards to both Score 1 and 2. In fact our previous studies revealed that Italian medical students attending a single lecture on nicotine dependence slightly improved knowledge about this topic, and this effect was significant but moderate (as mean values for Score 1 before the course

was 48.9 and after the course was 55.0 and Score 2 was 48.1 before and 55.4 after the course¹⁶); after the present e-learning courses Scores 1 and 2 improved significantly in Courses A and B, reaching values higher than 60.0% in both courses.

The finding that an e-learning course significantly improved the knowledge about tobacco-related issues is of considerable interest. As an adjunct method of teaching, e-learning might allow teachers to enrich the *core curriculum* of their courses while at the same time reducing the need for classroom lectures. E-learning is a viable solution for medical education¹⁷, as students are more likely to study at their own pace and without fixed schedules; however, best results are obtained when an objective measurement of their effort is obtained following course completion. In Course A, students received several reminders concerning deadlines, whereas in Course B teachers did not send messages to students enrolled: we suppose that this might have influenced participation rate among students (Course A: 245 students, Course B: 79 students).

Tobacco smoking is the leading cause of preventable death in the world¹⁸ and every smoker should be encouraged to give up smoking. Physicians should advise and educate patients about smoking dangers: however, the opportunity to provide this advice is frequently missed, often because of inadequate training in the medical school. Reports on medical education in Europe have shown insufficient undergraduate training in regards to nicotine dependence and its treatment^{15,16,19,20}. There are several well-designed educational interventions for medical students; however, these programs are rarely part of the curricula, as they require commitment of resources and teacher time. While individual factors might influence smoking cessation²¹, the guidance for an expert clinician is clearly recommended in order to improve the outcome. There is a need for straightforward and relatively simple but yet effective tobacco curricula.

Limitations of the study

This study has several limitations. There is a significant risk of selection bias. It is possible that students who were either smokers themselves, or interested in the strategies for treating ND, were more likely to participate in the course. It is also possible that the students may not be representative of all Italian medical students or that they misreported their smoking status because they felt it would be inappropriate for future physicians to smoke.

There is a significant difference in regards to *TDI* post-course scores between Course A and Course B, whereas all other scores show non-significant differences. As this is one of the first e-learning courses for the School of Medicine at “Sapienza,” it is possible that this result is a consequence of inadequate training on online courses; however, this might also suggest that several students took the post-course questionnaire without studying, therefore obtaining less-than-average scores. This is also mirrored by a greater spread in scores, as shown by the difference in standard deviations between Course A and Course B.

Conclusions

In conclusion our data show that an e-learning course on ND for medical school students can: i) increase the students' knowledge about tobacco dependence, smoking related pathologies, and clinical practice guidelines for smoking cessation, ii) make students understand the role of the physician in promoting cessation and iii) prepare medical students to deal with patients who smoke. All these could reduce the tobacco use and the related mortality in the 21st century. Medical students need adequate preparation, but these topics are rarely approached in traditional curricula despite their importance. An e-learning course created *ad hoc* for students of the "Sapienza" University of Rome provided good results in terms of knowledge of smoking epidemiology, health effects and benefits of giving up smoking, and effectiveness of cessation treatments.

Declaration of Interests

The authors declare that they have no conflicts of interest.

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