Research article

Clin Ter 2021; 172 (5):427-434. doi: 10.7417/CT.2021.2353

E-learning course improves knowledge in tobacco dependence, electronic nicotine delivery systems and heat-not-burn products in Medical School students

M.S. Milella[1,2], A. Sansone[3], S. Basili[4], G. Battaglia[1,5], G. La Torre[6], A.K. Ferketich[7], M.C. Grassi[1]

[1]Department of Physiology and Pharmacology "V. Erspamer", "Sapienza" University of Rome, Rome, Italy; [2]Poison Control Center Unit, Department of Emergency, Anaesthesia and Critical Care, Policlinico Umberto I Hospital-Sapienza, University of Rome, Rome, Italy; [3]Chair of Endocrinology and Medical Sexology (ENDOSEX), Department of Systems Medicine, University of Rome Tor Vergata, Rome, Italy; [4]Department of Translational and Precision Medicine, "Sapienza" University of Rome, Policlinico Umberto I, Rome, Italy; [5]I.R.C.C.S. Neuromed, Pozzilli (IS), Italy; [6] Department of Public Health and Infectious Diseases, Sapienza University of Rome, Italy; [7]Division of Epidemiology, The Ohio State University College of Public Health, Columbus, OH 43210 USA, Ohio, USA

Abstract

Background. Adequate training in tobacco, nicotine dependence and treatment is lacking in Medical School education. With the rise in popularity of electronic alternatives to cigarettes, future physicians should also be provided with the more recent scientific evidence on these products during their undergraduate studies. We introduced an e-learning course for Medical School students and assessed its effectiveness of increasing knowledge on these topics.

Methods. We developed 16 didactic modules divided in 3 courses: tobacco dependence (*TDI*), treating tobacco dependence (*TDII*) and electronic products and tobacco control (*TDIII*). The course was offered to 4th, 5th, and 6th year Medical School students in Italy. To assess learning outcomes, we examined the pre- to post- changes in knowledge scores associated with each course. Paired and independent samples t-tests were performed overall, and among smokers and non-smokers separately.

Results. A total of 1318 students completed at least one of the courses; 21% were self-reported smokers. A significant increase in knowledge was observed at the end of *TDI* (pre-course: 52.1±15.9, post-course: 79.9±13.5, p<0.001), *TDII* (pre-course: 52.5±13.0, post-course: 66.5±12.0, p<0.001) and *TDIII* (pre-course: 52.2±15.3, post-course: 76.1±17.7, p<0.001). Smokers showed significantly lower improvements compared to non-smokers.

Conclusions. The e-learning course was effective in increasing knowledge about tobacco dependence, treatments, and electronic nicotine products in advanced medical students. Given the fundamental role for healthcare practitioners in encouraging and assisting people in quitting smoking, e-learning may be a useful tool in providing up-to-date and standardized training in the area during Medical School. ***Clin Ter 2021; 172 (5):e427-434. doi: 10.7417/CT.2021.2353***

Key words: *cigarette smoking, e-cigarettes, e-learning, heat-not-burn products, medical education, smoking cessation*

Introduction

Smoking is the largest avoidable health risk in Europe, causing premature death and reduced quality of life (1). In Italy, smoking continues to be prevalent, as approximately 22% of the population smokes (2,3), with rates only marginally declining over the last decade (4). Although the health benefits of smoking cessation are well documented (5-8), healthcare professionals often overlook the promotion of cessation in their medical practice (9-11). In one study, only 60% of Italian general practitioners believed that physicians play a key role in helping smokers quit (12). This represents a missed opportunity, as physician advice and assistance in a quit attempt can increase the odds of cessation at 6 months by 30% (13). Evidence-based guidelines in the United States recommend counseling smokers at each visit (14), or at least once a year in the UK (15). A recent survey among smokers in Italy, though, showed that only 1 out of 4 had received advice to quit in the preceding year (16).

A possible explanation is that nicotine dependence (ND) and ND treatment options are largely omitted from the Italian medical education (17,18), resulting in a low level of general knowledge of these topics among medical students (19) and physicians (20,21). In addition, the prevalence of smoking among Italian physicians is similar if not higher than in the general population (13%-34%) (12,22,23), which could result in an underestimation of smoking-related morbidity (24) and affect whether they advise patients to quit (25,26). Incorporating ND and treatment options into Medical School education should be considered of primary importance. In this regard we showed that a single educational intervention during the 4th year of Medical School was effective at significantly improving knowledge one year later (27).

E-learning is an effective tool to increase knowledge and skills in both undergraduate and graduate medical courses (28,29) comparable, if not superior, to traditional learning in

Correspondence: Prof. M. Caterina Grassi, Department of Physiology and Pharmacology "V. Erspamer", "Sapienza" University of Rome, School of Medicine, Piazzale Aldo Moro 5 - 00185 Rome, Italy. Tel. and Fax: +39.06.4450618, Mob: +39.335.6188151
E-mail: caterina.grassi@uniroma1.it

ISSN 1972-6007

terms of acquired competences (30). It is also well accepted by students (31). Indeed, e-learning modules can be a very useful medium to provide up-to-date education in areas that are not part of the standard curriculum but are topics of new and emerging scientific research that is important for future physicians. Other advantages are that they can be delivered in an easy and standardized way. Importantly, in the context of the COVID-19 pandemic, the educational system is projected to move towards a blended learning model in which e-learning is progressively implemented (32).

With the present study we aimed to extend our preliminary findings (33) of the effectiveness of an online course in increasing knowledge in tobacco, ND and treatment options among advanced undergraduate medical students. Given the expanding market of electronic alternatives for the delivery of nicotine (e.g., vaping devices, heat-not-burn tobacco products) and the related health concerns (34,35) we included specific learning modules about these products.

Methods

Course Development

We designed an e-learning, fully online English language course for medical students (4th, 5th and 6th year of school) based on The R*x for Change* developed at the University of California at San Francisco and available for educational purposes (http://rxforchange.ucsf.edu/about.phphttp://rxforchange.ucsf.edu/about.php). The course was structured in 16 didactic modules. Each module consisted of 15-20 slides and was about 40 minutes in length.

The first part of the course, "*Tobacco Dependence"* (*TDI*) included 6 modules: history of tobacco, epidemiology of smoking in Italy, toxicology of nicotine, ND, craving and withdrawal, and other tobacco products and exposures.

The second part of the course, "*Treating Tobacco Dependence"* (*TDII),* included 5 modules: clinical practice guidelines, the main pharmacological therapies for smoking cessation (Varenicline, Bupropion, Nicotine replacement therapy) and the role of physicians in helping smokers quit.

The third part of the course, *"Electronic Products and Tobacco Control"* (*TDIII)*, included 5 modules: overview of electronic cigarettes (e-cigs), health effects of e-cigs, epidemiology of e-cigs use, heated tobacco products – IQOS, and Tobacco Control Policy.

The first application of courses *TDI* and *TDII* dated November 2016 (33). *TDIII* was introduced during October 2019.

Procedures

Students were introduced to the e-learning course while attending the "Pharmacology and Toxicology" courses at Sapienza University of Rome, Italy, during the 4th, 5th and 6th year of Medical School. Enrolment in the e-learning course was optional. Once logged in, students responded to a set of demographic items and questions about alcohol use and smoking behavior. For alcohol consumption, we asked participants to provide an estimate of the weekly consumption of alcohol units, on a scale from 0 (no alcohol use) to more than 21 units per week. As a guideline, the caption for this question clarified how to interpret alcohol units, 1 Unit of Alcohol being the quantity of alcohol found in a small beer (330 ml), in a glass of wine, or in a single serving of any spirit (36).

At the beginning of the e-learning course, students watched a video by Michael Fiore, author of Clinical Practice Guideline on tobacco dependence (13), explaining the importance of the topic for physicians. Students then completed a pre-course questionnaire before viewing the *TDI* modules. At the end, students completed the post-course questionnaire and then moved on to *TDII* and to *TDIII.* There were six questionnaires total (3 pre- and 3 post- each *TD* course) to evaluate knowledge of the content in the related modules.

Measures

Two knowledge scores for *TDI* and *TDII* were calculated based on our previous work (19,27,33). A third knowledge score for *TDIII* was created and validated on a group of postgraduate medical doctors in Pharmacology and Medical Toxicology.

The first two scores assessed knowledge in 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. *Score 1* was based on questions about: i) epidemiology of tobacco use, ii) health effects associated with smoking, and iii) benefits of cessation. A score of 60% was chosen as a cut-off to represent a sufficient level of knowledge. *Score 2* was computed using 9 questions (14 items), using the same mechanism for assigning values as in the *Score 1* system, to assess 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.

Score 3 was computed using 14 items of the *TDIII* questionnaire on topics: i) JUUL and nicotine salts and compounds contained in JUUL aerosol, ii) e-liquids, iii) e cigs and respiratory health and e-cigs cardiovascular disease iv) PROMIS-E questionnaire and ND (37), v) prevalence of e-cigs use in Italy and validity of e-cigs use in smoking cessation, vi) e-cigs and cigarette smoking initiation in adolescents, vi) IQOS and inflammatory response, vii) Italian law for graphic warning labels on cigarettes viii) the Global Youth Tobacco Survey, ix) The Tobacco Control Scale (38).

Missing data were counted as incorrect answers.

The Ethics Committee of the Teaching Hospital "Azienda Ospedaliero-Universitaria Policlinico Umberto I" – "Sapienza" University of Rome granted approval for the study. Owing to the nature of data collected (anonymous, non-invasive, or sensitive) was also approved by the dean of Medical School.

Statistical Analysis

The statistical software IBM SPSS Statistics (version 25) was used to analyse the data. Differences between pre- and post-course scores were analysed with t-tests for paired samples and differences between groups with independent samples t-test. One-way ANOVA was used to test differences in means across three or more groups. Changes in categorical variables were measured using the Pearson's chi-square test. Pearson coefficient r was calculated for the correlation analysis. A linear regression was fit to identify independent factors associated with knowledge improvement in each score. The independent variables introduced in the regression analysis were age, gender, course year and smoking status (non-smoker, current smoker). Data were examined for violation of the assumptions of normality, linearity and homoscedasticity. Standardized residual plots and normal probability plots showed that these assumptions were adequately met. Regression coefficients B were calculated and reported.

Results

Descriptive characteristics

Between October 2019 and July 2020, a total of 1318 medical students, 42% of the total students (n=3154) attending at Sapienza University of Rome in their 4th, 5th and 6th year of Medical School, engaged in the e-learning courses on *TD* (Tab. 1). Among the students who reported on their smoking behavior, 72.2% have tried cigarettes in their lifetime and 247 (21.0%) were current smokers. A smaller proportion of students have tried electronic products, 21.6% for e-cigs (mostly with nicotine) and 16.4% for IQOS. Current smokers were more likely to have smokers among family members ($\chi^2_{(1,953)}$=22.96, p<0.001). Nearly all students (83.9%) said they would prefer a smoke-free faculty environment (Tab. 2).

Among smokers, 56.3% were female. ND, measured by the Fagerström test, was generally low, with no gender differences (p=0.116). The Fagerström score was, however, increased with year of school (ANOVA: $F_{(3,245)=}$2.82, p=0.04), and was significantly correlated with age (p=0.01). The majority of tobacco users reported using traditional cigarettes only (72.7%) but nearly 1 in 5 reported using IQOS, alone or in combination with cigarettes. About 70% of smokers reported at least one recent quit attempt. Among those who tried to quit, nearly half used e-cigs or IQOS. Former smokers, however, were equally likely to have used these products compared to current smokers. Only one-quarter of smokers reported receiving advice to quit smoking by a health professional in the last year.

Analysis of TDI, TDII and TDIII scores

Results from paired two-sample tests indicated that students significantly improved knowledge scores from pre-course to post-course (*TDI*, t(896)=-44.26, *TDII,* t(643)=-26.14 and *TDIII,* t(751)=-33.80; all p<0.001) as represented in Figure 1. There were no significant differences between the three pre-course scores. Significant differences were instead observed by gender and smoking status. In particular, males had higher pre-course scores in *TDI* (t(895)=1.98, p=0.049) while females scored better in both pre- and post-course *TDIII* (t(750)=3.70, p=0.001 and t(750)=2.86, p=0.006) (Tab. 3). Compared to smokers, non-smokers performed significantly better in *TDII* pre- and post-course tests (t(642)=2.85, p=0.004 and t(642)=5.37, p=0.001) and *TDIII* post-course test (t(607)=3.41, p=0.001) (Tab. 3). In addition, non-smokers displayed significantly higher mean improvement in all three scores compared to smokers (t(895)=2.06, p=0.040, t(642)=1.94, p=0.050 and t(607)=2.28 p=0.023 respectively). Among smokers, students who currently use e-cigs or IQOS, or that have tried these products in the past, did not perform better on any of the questionnaires.

The overall regression model fit for improvement in *Score 1* was R^2=0.027 ($F_{(4,892)}$=6.226, p<0.001), with gender and course year significant predictors (Tab. 4). The same regression model for improvement in *Score 2* and *Score 3* was not significant (R^2=0.007, p=0.309 and R^2=0.009, p=0.237 respectively), although smoking status was a significant predictor for both.

Table 1. Demographics characteristics and lifestyle habits among "Sapienza" University of Rome medical students attending the e-learning course in year 2019-2020 (n tot = 1318)

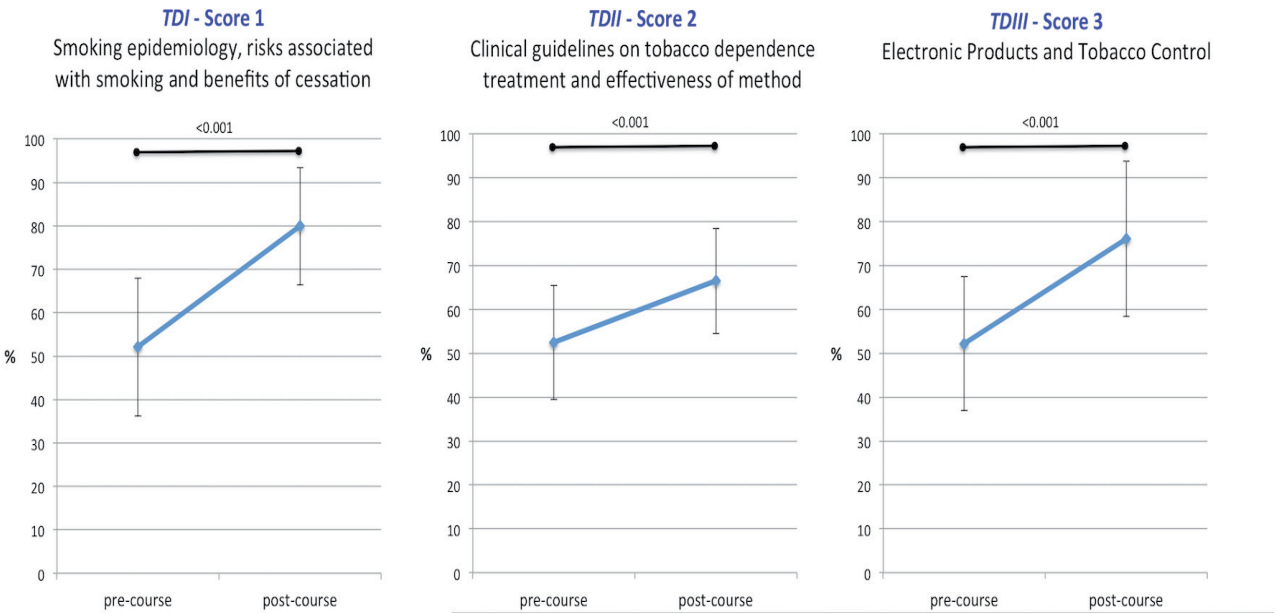
	n tot ± SD or n (%)
Course year:	
4th	386 (29.3)
5th	600 (45.5)
≥6th	332 (25.2)
Mean age yrs (range)	24.8 ± 3.1 (21-53)
Females	820 (62.2)
Coffee espresso/day (n=1285°):	
0	206 (16.0)
1-2	737 (57.4)
3-4	323 (25.1)
>4	19 (1.5)
Mean alcohol units/week°° (n=1285):	
0	324 (25.2)
1-2	683 (53.2)
3-4	166 (12.9)
>4	112 (8.7)
Physical Activities hours /week n=908):	
0	134 (14.8)
<2	260 (28.6)
2-4	279 (30.7)
>4	235 (25.9)
Currently living (n=953):	
alone	57 (6.0)
with cohabitants or room mates	452 (47.4)
with family of origin	444 (46.6)

°In brackets numbers of subjects providing data for each variable
°° 1 Unit of Alcohol = a small beer (33 cl), a glass of wine, or a single serving of any spirit

Table 2. Smoking behavior, characteristics of smokers and intention to quit among "Sapienza" University of Rome medical students attending the e-learning course in year 2019-2020 (n tot = 1318)

	n tot ± SD or n (%)
Smoking behavior:	
Ever smoked a cigarette (n=1175°)	848 (72.2)
Current smokers (n=1175)	247 (21.0)
Former smokers (n=945)	160 (16.9)
Mean age at onset of smoking among ever smokers: yrs (range) (n=466)	17.3 ± 2.4 (12-28)
Mean age of smoking cessation among former smokers: yrs (range) (n=257)	22.1 ± 3.2 (13-36)
Family smokers (n=953)	428 (44.9)
Living with smokers (n=953)	412 (43.2)
Ever tried e-cigs (n=956): no	791 (82.7)
yes, with nicotine	79 (8.3)
yes, without nicotine	19 (2.0)
yes, with and without nicotine	67 (7.0)
Ever tried IQOS (n=956)	125 (13.1)
I would like a Faculty smoke free (n=958)	804 (83.9)
Characteristics of smokers:	
Females (n=247)	139 (56.3)
Fagerström score (range) (n=246)	1.7 ± 2.0 (0-9)
What do you currently smoke (n=150): cigarettes	109 (72.7)
e-cigs with nicotine	7 (4.7)
e-cigs and cigarettes	6 (4.0)
IQOS	23 (15.3)
IQOS and cigarette	5 (3.3)
Intention to quit (n=223): for now I want to continue smoking	43 (19.3)
I want to quit but not ready now	99 (44.4)
I am seriously considering quitting in next 6 months	63 (28.3)
I am in a program and will try to stop in next 30 days	18 (8.0)
Relapsed after quitting (n=284)	120 (42.3)
Tried to stop smoking during University (n=176)	121 (68.7)
Tried in the last year to stop smoking and succeeded for 1 day or longer (n=176)	122 (69.3)
In the past 12 months a medical doctor advised you to quit smoking (n=162)	42 (25.9)

°In brackets numbers of subjects providing data for each variable



TDI (n=897): pre-course 52.1±15.9, post-course 79.9±13.5
TDII (n=644): pre-course 52.5±13.0, post-course 66.5±12.0
TDIII (n=752): pre-course 52.2±15.3, post-course 76.1±17.7
Significant paired samples t-test p values are shown

Fig. 1. Questionnaire Scores (mean ± SD) pre- and post- each e-learning course on TD to assess knowledge among the medical students (total n=1318)

Table 3. Questionnaire scores (mean ± SD) by gender and by smoking behavior pre- and post- each e-learning course

E-learning course		n	Questionnaire scores		p*	n	Questionnaire scores		p*
			Female	Male			Non-smokers	Smokers	
TDI	pre-course	F=561 M=336	51.3 ± 15.5	53.5 ± 16.4	0.048	NS=733 S=164	51.7 ± 16.2	54.2 ± 14.0	0.061
	post-course		80.6 ± 12.0	78.7 ± 15.5	0.060		80.0 ± 13.3	79.3 ± 14.3	0.513
TDII	pre-course	F=388 M=256	52.5 ± 13.1	52.6 ± 12.8	0.916	NS=500 S=144	53.3 ± 13.1	49.8 ± 12.1	0.004
	post-course		66.2 ± 12.1	66.8 ± 11.9	0.560		67.8 ± 11.6	61.8 ± 12.1	0.001
TDIII	pre-course	F=456 M=296	53.9 ± 15.0	49.7 ± 15.3	0.001	NS=449 S=160	52.6 ± 15.5	51.2 ± 15.0	0.317
	post-course		77.6 ± 16.2	73.8 ± 19.7	0.006		77.3 ± 17.2	71.8 ± 18.4	0.001

F = Female; M = Male; NS = Non-smokers; S = Smokers
* Independent samples t-test

Discussion

Our e-learning course significantly increased knowledge of ND and treatment options among undergraduate medical students. Students also showed significant improvement in knowledge of the emerging science on e-cigs and heat-not-burn products. The low pre-course scores suggest that medical students have limited knowledge of the topics covered, consistent with previous reports (19,27,33). This confirms the lack of sufficient undergraduate training during Medical School, as the online course was offered to advanced students already enrolled in the 4th year or higher.

The introduction of the new e-learning modules of *TDIII* revealed that student's knowledge on the epidemiology and risks of e-cigs and heat-not-burn products like JUUL and IQOS is very limited. This is not surprising, as medical students receive little education in electronic alternatives to cigarettes (39,40). Healthcare practitioners only have a basic, and non-academic, knowledge on the topic (41,42). Such products are often promoted as smoking cessation devices (43) that are less harmful than conventional cigarettes; however, they are better associated with harm reduction (44,45), rather than complete avoidance of harm, and there is accumulating evidence that they may cause cardiovascular damage and lung inflammation (46). Being mistakenly perceived as safe, these devices could also act as a "gateway" to traditional cigarettes among youth (47), and may also increase ND in dual-users (48), thus reinforcing nicotine use. Another cause of concern is the use of adulterated "vaping fluids": while these products have better safety profiles in regards to tar and CO production, the light regulations of vaping fluids has led to the commercialization of mixtures containing tetrahydrocannabinol and cannabidiol, leading to the onset of acute lung injury in e-cigs users – a phenomenon defined as "E-cigs, or Vaping, product use-Associated Lung Injury", or EVALI (49). Given the sharp rise in popularity of e-cigs and heat-not-burn products, physicians will likely be dealing with a growth in information requests and advice from patients regarding these products (50). Additional training in this area for undergraduate and graduate medical students is therefore strongly encouraged.

In our student sample, smokers showed significantly lower post-course scores and improvements compared to non-smokers. It is possible that current smokers overestimated their competence and devoted less attention to the courses. Regarding intention to quit, 70% of smokers made a recent attempt to quit, and about 36% were considering giving up smoking in the near future. We did not follow up on our sample to verify if the course had an impact on quitting; however, this could be addressed in a future e-learning course. For example, students who express intention to quit smoking may then be re-directed to a tobacco dependence treatment program. Implementing a culture of health promotion is critical for preparing physicians to be smoke-free before they begin their careers.

Student participation in this e-learning course was much higher than the first time it was offered (33). The implementation of "lockdown" measures in Italy to contain virus spreading during the COVID-19 pandemic likely had an impact, as social distancing measures required students to be confined at home. This could have resulted in greater motivation to enrol in the course. It also confirms, however, that students recognize the importance of a training in ND and treatment during their medical formation (51).

The e-learning modules can be implemented as a standalone course but could also be combined with in-person instruction to enhance learning, knowledge gained, and competence. The "role-playing" method, for example, where students exchange roles (doctor, patient, observer) in a predeveloped scenario, and training methods that use standardized patient were both effective in improving knowledge among medical and dental students (52,53). When directly compared to the "role playing" didactic method, e-learning was equally successful in improving smoking-cessation counselling skills among medical students, as assessed through both knowledge questionnaires and an objective structured clinical examination (54). Another study instead showed that both "role playing" and interaction with patients

were significantly more effective in improving these skills than both lectures and web-based courses (55). The improvement in theoretical knowledge was however comparable between methods. In our view this suggests that e-learning courses such as the one described here may serve as a theoretical basis that could ideally be complemented with additional training in clinical intervention.

Based on our experiences, e-learning may have several advantages in Medical School training compared to the traditional didactic method. First, there is a great deal of flexibility, as it is accessible in any place at any time: this is of importance also in consideration of future lockdowns. Second, students may also complete the modules at their own speed, investing more time on selected topics. Third, the rapidly evolving evidence in the field of electronic nicotine products, for example, requires a platform that is nimble and thus able to be updated quickly: this can be achieved online by the instructors and students can benefit in real time. Forth, the impact of an online course on improving knowledge can be quickly evaluated using automated tests, thus providing valuable feedback to students and instructors, who could adjust the course elements to improve learning outcomes. On the other hand, a possible disadvantage is the requirement of a computer access and a good internet connection: slow connections may in fact affect the access to the courses, possibly causing frustration on the student (56). Some students may also suffer the lack of face-to-face interactions. More importantly, as previously discussed, while medical knowledge may surely benefit from new online tools such as this, other specific skills that are part of a medical curricula and essential for the clinical practice may require different or more traditional types of learning and interactions.

Limitations of the study

There are some limitations to this study. First, the e-learning courses were completed in an uncontrolled environment, so it was not possible to exclude the use of other information sources to complete the post-course questionnaires. Second, the participating students may have been more interested in the topic, therefore more motivated to score higher in the post-course evaluation; this might have skewed our results due to participation bias. Third, smoking status of participating students was only assessed by means of self-report, possibly leading to underestimated smoking prevalence among participants. Fourth, planned follow-up evaluations are needed to assess retention of the information learned across the modules.

Conclusions

An online e-learning course offered to medical students was effective in increasing knowledge of ND and treatment, and electronic nicotine products that are alternatives to cigarettes. Unfortunately, medical education still largely underestimates the importance of tobacco and ND. In order to reduce tobacco-related morbidity and mortality, future physicians should be prepared to ask all patients about their tobacco use status, advise users to quit and assist them during the attempt. To routinely implement this behavior, specific and up-to-date training in the area should be consistently provided to future physicians during their undergraduate studies.

Conflict of Interest

The authors declare that they have no conflict of interest.

Sources of Funding

No funding was used for this project.

References

1. Wang H, Naghavi M, Allen C, et al. GBD 2015 Mortality and Causes of Death Collaborators. Global, regional, and national life expectancy, all-cause mortality, and cause-specific mortality for 249 causes of death, 1980–2015: a systematic analysis for the Global Burden of Disease Study 2015. Lancet. 2016;388:1459-1544. doi:10.1016/S0140-6736(16)31012-1. Erratum in Lancet 2017, 389(10064):e1.
2. Pacifici R, Di Pirchio R, Palmi I, et al. Indagine ISS-DOXA2019. Il fumo di tabacco in Italia. Tabaccologia 2019; 3:9-11
3. Gallus S, Tramacere I, Boffetta P, et al. Temporal changes of under-reporting of cigarette consumption in population-based studies. Tob Control. 2011;20:34-39. doi: 10.1136/tc.2009.034132
4. Lugo A, Zuccaro P, Pacifici R, et al. Smoking in Italy in 2015-2016: Prevalence, Trends, Roll-your-own Cigarettes, and Attitudes towards Incoming Regulations. Tumori. 2017;103(4):353-59. doi:10.5301/tj.5000644
5. Jha P, Ramasundarahettige C, Landsman V, et al. 21st-century hazards of smoking and benefits of cessation in the United States. N Engl J Med. 2013;368:341-50. doi: 10.1056/NEJMsa1211128
6. Carrozzi L, Falcone F, Carreras G et al. Life gain in Italian smokers who quit. Int. J Environ Res Public Health. 2014;11(3):2395-2406. doi: 10.3390/ijerph110302395
7. Critchley JA, Capewell S. Mortality risk reduction associated with smoking cessation in patients with coronary heart disease: a systematic review. JAMA. 2003;290(1):86–97. doi:10.1001/jama.290.1.86
8. Corona G, Sansone A, Pallotti F, et al. People smoke for nicotine, but lose sexual and reproductive health for tar: a narrative review on the effect of cigarette smoking on male sexuality and reproduction. J Endocrinol Invest. 2020;43(10):1391–1408. doi: 10.1007/s40618-020-01257-x
9. Collin L, Smiley SL, Moore RA, et al. Physician tobacco screening and advice to quit among U.S. adolescents – National Survey on Drug Use and Health, 2013. Tob Induc Dis. 2017;15:2 doi:10.1186/s12971-016-0107-6
10. Stead LF, Bergson G, Lancaster T. Physician advice for smoking cessation. Cochrane Database Sys Rev. 2008;2:CD000165. doi: 10.1002/14651858.CD000165.pub3
11. Ferketich AK, Gallus S, Colombo P, et al. Physician- delivered advice to quit smoking among Italian smokers. Am J Prev Med. 2008;35(1):60-63. doi:10.1016/j.amepre.2008.03.022

12. Nobile CG, Bianco A, Biafore AD, et al. Are primary care physicians prepared to assist patients for smoking cessation? results of a national Italian cross-sectional web survey. Prev Med. 2014;66:107-12. doi:10.1016/j.ypmed.2014.06.009
13. Fiore MC, Jaén CR, Baker TB. Treating Tobacco Use and Dependence: 2008 Update. Clinical Practice Guideline. Rockville, MD: U.S. Department of Health and Human Services. Public Health Service 2008.
14. Aveyard P, Begh R, Parsons A, et al. Brief opportunistic smoking cessation interventions: a systematic review and meta-analysis to compare advice to quit and offer of assistance. Addiction. 2012;107:1066-73. doi:10.1111/j.1360-0443.2011.03770.x
15. National Institute for Health and Clinical Excellence. Brief interventions and referral for smoking cessation in primary care and other settings. PH001, 1–36. London: National Institute for Health and Clinical Excellence; 2006
16. Gallus S, Lugo A, Garattini S, et al. General Practitioners and Dentists: A Call for Action Against Tobacco. Nicotine Tob Res. 2016;18(12) 2016:2202-08. doi.10.1093/ntr/ntw162
17. La Torre G, Saulle R, Unim B et al. Smoking in Italy in 2015-2016: Prevalence, Trends, Roll-your-own Cigarettes, and Attitudes towards Incoming Regulations. Tumori 2017;103(4):353-359. doi:10.5301/tj.5000644
18. Richmond R, Zwar N, Taylor R, et al. Teaching about tobacco in Medical Schools: a worldwide study. Drug Alcohol Rev. 2009;28(5):484-97. doi: 10.1111/j.1465-3362.2009.00105.x
19. Grassi MC, Chiamulera C, Baraldo M, et al. Cigarette smoking knowledge and perceptions among students in four Italian Medical Schools. Nicotine Tob Res. 2012;14(9):1065-72. doi:10.1093/ntr/ntr330
20. Frisinghelli A, Cesana F, Clavario P, et al. Cardiologi italiani e fumo di tabacco. survey su prevalenza e conoscenza del tabagismo e delle strategie antifumo di una coorte di cardiologi italiani. G Ital Cardiol. 2015;16(7-8):426-32. doi: 10.1714/1954.21244
21. Unim B, Del Prete G, Gualano MR, et al. Are age and gender associated to tobacco use and knowledge among general practitioners? Results of a survey in Italy. Ann Ist Super Sanita. 2013;49(3):266-71. doi: 10.4415/ANN_13_03_06
22. Lina M, Mazza R, Borreani C, et al. Hospital doctors' smoking behavior and attitude towards smoking cessation interventions for patients: a survey in an Italian Comprehensive Cancer Centre. Tumori. 2016;102(3):244-51. doi:10.5301/tj.5000501
23. Ficarra MG, Gualano MR, Capizzi S, et al. Tobacco use prevalence, knowledge and attitudes among Italian hospital healthcare professionals. Eur J Public Health. 2011;21(1):29-34. doi: 10.1093/eurpub/ckq017
24. Thy T, Boker T, Gallefoss F, et al. Hospital doctors' attitudes toward giving their patients smoking cessation help. Clin Respir J. 2007;1:30-6. 10.1111/j.1752-699X.2007.00005.x
25. Meshefedjia GA, Gervai A, Tremblay M, et al. Physician smoking status may influence cessation counseling practices. Can J Public Health 2010;101:290-3. doi: org/10.1007/BF03405288
26. Willaing I, Ladelund S. Smoking behavior among hospital staff still influences attitudes and counseling on smoking, Nicotine Tob Res. 2004;6(2):369-75. doi:10.1080/14622200410001676422
27. Grassi MC, Baraldo M, Chiamulera C, et al. Knowledge about health effects of cigarette smoking and quitting among Italian university students: the importance of teaching nicotine dependence and treatment in the medical curriculum. Biomed Res Int 2014;321657. doi: 10.1155/2014/321657
28. Vaona A, Banzi R, Kwag KH, et al. Elearning for health professionals. Cochrane Database of Sys Rev. 2018;1:CD011736. doi: 10.1002/14651858.CD011736.pub2
29. Cook DA, McDonald FS. E-learning: si there anything special about the "E"? Perspect Biol Med. 2008;51(1):5-21. doi:10.1353/pbm.2008.0007
30. George PP, Papachristou N, Belisario JM, et al. Online eLearning for undergraduates in health professions: A systematic review of the impact on knowledge, skills, attitudes and satisfaction. J Glob Health. 2014;4(1):010406. doi:10.7189/jogh.04.010406
31. Petrarca CA, Warner J, Simpson A, et al. Evaluation of eLearning for the teaching of undergraduate ophthalmology at Medical School: a randomised controlled crossover study. Eye (Lond). 2018;32(9):1498-1503. doi:10.1038/s41433-018-0096-1
32. Al-Balas M, Al-Balas HI, Jaber HM, et al. Distance learning in clinical medical education amid COVID-19 pandemic in Jordan: current situation, challenges, and perspectives. BMC Med Educ. 2020;20**:**341. doi.org/10.1186/s12909-020-02257-4
33. Grassi MC, Sansone A, Basili S, et al. Knowledge of nicotine dependence and treatment in clinical practice improved after an e-learning course among medical students. Clin Ter. 2019;170(4):e252-e257. doi: 10.7417/CT.2019.2142
34. Miech RA, Johnston LD, O'Malley PM, et al. Adolescent vaping and nicotine use in 2017–2018: U.S. national estimates. N Engl J Med. 2019;380:192–193. doi:10.1056/NEJMc1814130
35. Stepanov I, Woodward A. Heated tobacco products: things we do and do not know. Tob Control. 2018;27:s7-s8. doi:10.1136/tobaccocontrol-2018-054774
36. European Commission – Health promotion knowledge gateway: Alcoholic beverages, 2019. (Accessed May 11, 2021, at https://knowledge4policy.ec.europa.eu/health-promotion-knowledge-gateway/alcoholic-beverages_en)
37. Morean ME, Krishnan-Sarin S, S O'Malley S. Assessing nicotine dependence in adolescent E-cigarette users: The 4-item Patient-Reported Outcomes Measurement Information System (PROMIS) Nicotine Dependence Item Bank for electronic cigarettes. Drug Alcohol Depend. 2018;188:60-63. doi: 10.1016/j.drugalcdep.2018.03.029
38. Joossens L, Raw M. The Tobacco Control Scale: a new scale to measure country activity. Tob Control. 2006;15:247-53. doi:10.1136/tc.2005.015347
39. Hinderake K, Power DV, Allen S, et al. What do medical students know about e-cigarettes? A cross-sectional survey from one U.S. Medical School. BMC Med Edu. 2018;18:32. doi.org/10.1186/s12909-018-1134-1
40. Zhou S, Van Devanter N, Fenstermaker M, et al. A Study of the Use, Knowledge, and Beliefs About Cigarettes and Alternative Tobacco Products Among Students at One U.S. Medical School. Acad Med. 2015;90(12):1713-1719. doi:10.1097/ACM.0000000000000873
41. Erku DA, Gartner CE, Morphett K, et al. Beliefs and Self-reported Practices of Health Care Professionals Regarding Electronic Nicotine Delivery Systems: A Mixed-Methods Systematic Review and Synthesis. Nicotine Tob Res. 2020; 22(5):619-629. doi: 10.1093/ntr/ntz046
42. Kanchustambham V, Saladi S, Rodrigues J et al. The knowledge, concerns and healthcare practices among physicians regarding electronic cigarettes. J Commu-

nity Hosp Intern Med Perspect. 2017;13;7(3):144-150. doi: 10.1080/20009666.2017.1343076
43. Grana RA, Ling PM. "Smoking revolution": a content analysis of electronic cigarette retail websites. Am J Prev Med 2014;46(4):395-403. doi: 10.1016/j.amepre.2013.12.010
44. Sansone A, Limoncin E, Colonnello E, et al. Harm Reduction in Sexual Medicine. Sex Med Rev. 2021;S2050-0521-(21)00007-X. doi:10.1016/j.sxmr.2021.01.005
45. Kenneth E Warner. How to Think-Not Feel-about Tobacco Harm Reduction, Nicotine Tob Res. 2019;21(10):1299-1309. doi:10.1093/ntr/nty084
46. Benowitz NL, Fraiman JB. Cardiovascular effects of electronic cigarettes. Nat Rev Cardiol. 2017;14:447-456. doi:10.1038/nrcardio.2017.36
47. Soneji S, Barrington-Trimis JL, Wills TA, et al. Association Between Initial Use of e-Cigarettes and Subsequent Cigarette Smoking Among Adolescents and Young Adults: A Systematic Review and Meta-analysis. JAMA Pediatr. 2017;171(8):788-797. doi: 10.1001/jamapediatrics.2017.1488 Erratum in: JAMA Pediatr 2020 1;174(5):509
48. Martínez Ú, Martínez-Loredo V, Simmons VN, et al. How Does Smoking and Nicotine Dependence Change After Onset of Vaping? A Retrospective Analysis of Dual Users. Nicotine Tob Res. 2020;22(5):764-770. doi: 10.1093/ntr/ntz043. Erratum in: Nicotine Tob Res. 2020 21;22(5):864
49. Heinzerling A, Armatas C, Karmarkar E, et al. Severe Lung Injury Associated With Use of e-Cigarette, or Vaping, Products-California, 2019. JAMA Intern Med. 2020;180(6):861–869. doi:10.1001/jamainternmed.2020.0664
50. Singh B, Hrywna M, Wackowski OA et al. Knowledge, recommendation, and beliefs of e-cigarettes among physicians involved in tobacco cessation: a qualitative study. Prev Med Rep. 2017;8:25-29. doi:10.1016/j.pmedr.2017.07.012
51. Armstrong GW, Veronese G, George PF, et al. Assessment of Tobacco Habits, Attitudes, and Education Among Medical Students in the United States and Italy: A Cross-sectional Survey. J Prev Med Public Health. 2017;50(3):177-187. doi:10.3961/jpmph.15.061
52. Park KY, Park HK, Hwang HS. Group randomized trial of teaching tobacco-cessation counseling to senior medical students: a peer role-play module versus a standardized patient module. BMC Med Educ. 2019;19**:**231. https://doi.org/10.1186/s12909-019-1668-x
53. Singleton JA, Carrico RM, Myers JA et al. Tobacco cessation treatment education for dental students using standardized patients. J Dent Educ. 2014;78:895–905.
54. Lauerer E, Tiedemann E, Polak T,et al. Can smoking cessation be taught online? A prospective study comparing e-learning and role-playing in medical education. Int J Med Educ. 2021;12:12-21. doi:10.5116/ijme.5ff9.bccc
55. Stolz D, Langewitz W, Meyer A, et al. Enhanced didactic methods of smoking cessation training for medical students--a randomized study. Nicotine Tob Res. 2012 Feb;14(2):224-8. doi: 10.1093/ntr/ntr186
56. Bangert AW, Easterby L. Designing and delivering effective online nursing courses with evolve electronic classroom. CIN: Computers, Informatics, Nursing. 2008;26:54-60