Self-Reported Smoking Status 10-Months After a Single Session Intervention Including an Education Conference About Smoking Harms and Announcement of Spirometric Lung-Age

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ABSTRACT

BACKGROUND: Studies investigating the effects of announcing spirometric lung-age (SLA) on the smokers’ self-reported smoking status reported conflicting results.

MAIN OBJECTIVE: To evaluate the effects of a single session intervention including an education conference about smoking harms and announcement of SLA on the participants’ self-reported smoking status.

METHODOLOGY: An interventional study was conducted in a cable factory. The intervention included four steps: PowerPoint presentation about raising smoking hazards awareness; general questionnaire; measurement of the anthropometric and spirometric data, and announcement of SLA; and evaluation of the smokers’ self-reported smoking status 10 months later (quitted smoking, decreased consumption; stable consumption, increased consumption).

RESULTS: Thirty-six smokers completed the four steps. Ten months after the intervention, 11.1% of smokers quitted smoking, 52.7% decreased their consumption by 7 ± 4 cigarettes/day, 30.5% kept a stable consumption, and 5.5% increased their consumption by 9 ± 6 cigarettes/day.

CONCLUSION: Providing an education conference combined with announcing SLA motivated 64% of smokers to quit smoking or to reduce their cigarette consumption.

KEYWORDS: Nicotine Dependence, Occupational Medicine, Respiratory Function, Smoking Cessation, Tobacco Smoking

Indroduction

In 2015, around a quarter (24.9%) of the global population aged 15 years, were current-users of some form of tobacco.¹ The costs of smoking have been estimated to drain around US$1.4 trillion dollars from the global economy in a single year.⁻¹ The costs of smoking have been estimated to drain around US$1.4 trillion dollars from the global economy in a single year.² The costs of smoking have been estimated to drain around US$1.4 trillion dollars from the global economy in a single year.³ The costs of smoking have been estimated to drain around US$1.4 trillion dollars from the global economy in a single year.⁴ The costs of smoking have been estimated to drain around US$1.4 trillion dollars from the global economy in a single year.⁵ The costs of smoking have been estimated to drain around US$1.4 trillion dollars from the global economy in a single year.⁶ However, the effectivenesses and the costs vary largely from non-medical to medical interventions (respectively, 3% and £11 for the brief-advice, and 31% and £430 for the RC and bupropion) result in lower costs, and lead to a reduction in the number of smokers, fewer comorbidities and more quality-adjusted life year.⁷ However, the effectivenesses and the costs vary largely from non-medical to medical interventions (respectively, 3% and £11 for the brief-advice, and 31% and £430 for the RC and bupropion).⁸ Communicating the chronic risk of smoking on lungs by calculating a theoretical “effective age” could be another non-medical motivational strategy to help smokers quit smoking.⁹ This intervention consists in announcing accelerated lung deterioration through the estimation of a spirometric lung-age (SLA).¹⁰ The concept
of SLA reports spirometric data using the age of an average healthy individual with similar spirometry results (ie, “you are 40 years old, nevertheless you have the lungs of a 60-year-old person”).6,10 An elevated SLA signifies poor lung function as if the lungs have aged beyond the individual’s chronological-age.11 SLA can provide an easy interpretation of spirometric results and can therefore detect lung function abnormalities.12 Confronting smokers with their SLA has been used by general practitioners and primary care providers as a tool to encourage them to quit smoking.13,14

Interventional studies using SLA as a motivational tool for smoking cessation are scarce, especially in Africa and the underdeveloped countries. To the finest of the authors’ knowledge, only 10 original papers had investigated the effects of confronting smokers with SLA on their smoking attitudes.10,11,14–21 The aforementioned studies reported conflicting results. While some authors reported that communicating SLA prompts smoking cessation,11,14–17,21 others highlighted its ineffectiveness.10,18–20 For example, while Parkes et al.16 concluded that “telling smokers their SLA promoted successful smoking cessation”, Foulds et al.18 reported that “baseline SLA feedback did not improve quit rates or compliance at 28-day follow-up in smokers seeking intensive treatment”. These discrepancies could have at least three explanations. On the one hand, some studies10,14–16,19,20 have applied old SLA norms established more than 35 years ago by Morris and Temple.22 The use of these old norms to calculate SLA22 is widely questionable for at least six reasons.9,23,24 First, the Morris and Temple norms22 were performed on an unrepresentative sample of a “normal” population with 79% of participants recruited from two churches in rural America. The principles of these churches prohibit the use of tobacco, alcohol and caffeine and promote a vegetarian diet. Second, Morris and Temple used historical data established 50 years ago,22 and the age distribution of their participants was biased towards younger participants, since the privileged place of occupational physicians in smoking prevention has been documented by many authors,24,35 the main aim of this interventional study was to evaluate the combined effects of announcing SLA and providing an education session about the smoking harms on the self-reported smoking status of factory employees. The second aim was to determine the profile of participants who quitted smoking or decreased their consumption.

Population and methods

Study design

This interventional study was conducted in DRÄXLMAIER group in Sousse, Tunisia. The latter is a factory specialized in coating and assembling interior parts of automobiles (n = 587 employees). All the study procedures were in accordance with the Helsinki Declaration. All the employees were invited to an intervention program to raise awareness with respect to the smoking hazards. Approval for the study was obtained.
from the Farhat HACHED Hospital Ethical Committee (approval number 12092018). Oral consent was obtained from all the participants in the presence of at least one witness. The participants were individually informed about the study proposes, about their right to refuse to participate and/or to withdraw from participating in the study, and they were informed that their data are confidentially protected.

Sample size

The sample size was estimated using this formula:
\[ N = \frac{[(Z_{0.025})^2 \times P \times (1 - P) \times D]}{E^2} \]
where \( E \) was the margin of error, \( Z_{0.025} \) was the normal deviate for two-tailed alternative hypothesis at a level of significance, \( D \) was the design ( \( = 1 \) for simple random sampling), and \( P \) was the proportion of the main event of interest (in the present study, one year after informing participants \( n = 35 \)) about their SLA, eight of them quit smoking \((p = 0.2285)\). Assuming a confidence interval of 85\% \((Z_{0.025} = 1.44)\) and an \( E \) of 0.10, the total sample size was 37 participants. The assumption of 30\% for non-response during the 10-month telephonic call gave a revised sample of 52 participants \( \left[ \frac{52}{(1.0-0.30)} \right] \).

Population

The target population was the employees who were working the day of the intervention and who volunteered to undergo the study. Only current male exclusive cigarette-smokers were included. In order to assess the “stage of change”, the participants were asked whether they intend to quit smoking in the next year. The integrative model of change introduced by Prochaska and DiClemente, which includes six “stages of change” (ie; pre-contemplation, contemplation, preparation, action, maintenance, and relapse) was used. Only participants in the pre-contemplative stage (answering “no” when asked whether they intend to quit smoking in the next year) were included. The following non-inclusion criteria were applied: narghile smoking, failing to fill the questionnaire or to correctly perform the spirometric test. Participants who did not respond to phone calls (in at least five times during a week) ten months post-intervention were excluded from the analysis.

Protocol

The protocol comprised two parts (Figure 1). The first part, which coincided with the world occupational health and safety day (September 26th 2018), includes four steps. The first step involved an education session. It was a PowerPoint conference lasting 45 min, presented by the project leader (HBS in the authors’ list). The conference, presented to both smokers [60], addressed the following points: cigarette components, harmful effects of smoking on the different organs, some statistics about smoking-related diseases (mainly COPD and lung cancer), tobacco-induced disabilities and deaths, hospital costs, and benefits of smoking cessation, especially the ones related to the cardiorespiratory system. During the second step, anthropometric data were determined, and the participants completed a self-questionnaire related to their demographic data, smoking habits and physical dependence on nicotine. Chronological-age was determined by collecting the smokers’ date of birth. Height (cm) and weight (kg) were measured, and body mass index (BMI, kg/m\(^2\)) and body surface area (m\(^2\)) were calculated. Smoking data (ie, number of cigarettes per day [cig/day], number of years of smoking) were collected and cigarette consumption was calculated in pack-years \( [PY = \frac{(cig/day \times years of smoking)}{20}] \). A validated Arabic version of the Fagerström test for cigarette dependence (FTCD) was used for measuring physical dependence on nicotine. The FTCD is composed of six questions, and according to the answers given, a score of 0 to 10 was obtained. Dependence was considered null if the score was 0 to 2, low if it was 3 or 4, average if it was 5 to 6 and strong if the score was 7 to 10. The third step was reserved for the spirometric tests, which were supervised by a qualified technician (CM in the authors’ list). A NEO®-6 spirometer [model 4000, Vitalograph, Ennis, Ireland] was used to determine spirometric data [ie; forced expiratory volumes in one second (FEV\(_1\)) and in six seconds (FEV\(_6\), FEV\(_1/FEV_6\)]. The NEO®-6 spirometer was validated and used for the assessment of spirometric data, screening for COPD, and helping smokers quit smoking. At least three tests were performed. The one presenting the highest sum “FEV\(_1\) + FEV\(_6\)” was retained for statistical analysis. No information was given to participants with regard to their spirometric data. The last step consisted in calculating SLA, using the following sex specific North African equation:

### Figure 2

Study flow chart. FTCD: Fagerström test for cigarette dependence. SLA: spirometric lung-age.
Table 1. Baseline characteristics of the participants.

|                          | Total Sample (n = 36) | Nondependent group (n = 6) | Dependent group (n = 30) | P-value |
|--------------------------|-----------------------|---------------------------|--------------------------|---------|
| Chronological-age (years)| 34.29 ± 5.80          | 33.54 ± 4.99              | 34.45 ± 6.02             | 0.730   |
| Spirometric lung-age (years) | 38.84 ± 11.35        | 35.21 ± 14.27            | 39.56 ± 10.82            | 0.390   |
| ‘Change in age’ (years)  | −4.54 ± 11.89*        | −1.68 ± 14.40            | −5.11 ± 11.52*           | 0.520   |
| Height (cm)              | 174 ± 7               | 174 ± 8                  | 174 ± 7                  | 0.960   |
| Weight (kg)              | 76 ± 14               | 85 ± 17                  | 74 ± 13                  | 0.080   |
| Body mass index (kg/m²)  | 25.0 ± 4.2            | 28.2 ± 5.8               | 24.4 ± 3.6               | 0.043   |
| Fagerstrom score         | 5.3 ± 1.8             | 2.7 ± 0.5                | 5.8 ± 1.4                | 0.001   |
| Corpulence status        |                       |                          |                          |         |
| Underweight              | 2 (5.6)               | 0 (0)                    | 2 (6.7)                  | 0.510   |
| Normal weight            | 20 (55.6)             | 5 (83.3)                 | 15 (50)                  | 0.130   |
| Overweight               | 14 (38.9)             | 1 (16.7)                 | 13 (43.3)                | 0.220   |
| Smoking status           |                       |                          |                          |         |
| Cigarettes/day           | 18.8 ± 6.2            | 12.8 ± 4.0               | 2.0 ± 5.9                | 0.008   |
| Pack-years               | 14 ± 9                | 8 ± 6                    | 15 ± 9                   | 0.072   |

*Change in age*: difference between the chronological-age and the spirometric lung-age. P: probability. Quantitative and categorical data were expressed as mean ± SD and number (%), respectively. 

Applied statistical tests for comparison:
Between the chronological-age and the spirometric lung-age for the same group: Wilcoxon test (p < 0.05).
Of categorical data between the 2 groups: Two-sided Chi-square Of quantitative data between the 2 groups: Student test.

SLA (years) = 42.85 - 20.74 × FEV₁ (l) + 47.41 × body surface area (m²) - 0.62 × BMI. The “change in age” (= chronological-age minus SLA), years was calculated, and a negative value is synonym of accelerated lung aging.9

The second part of the intervention, with respect to the outcome measures, was carried out 10 months after the intervention (July 2019). The participants were contacted by phone by a trained interviewer (KD in the authors’ list) having no prior contact with them in order to evaluate their self-reported smoking status: quit smoking (yes/no), decrease smoking, maintain stable consumption or increase consumption. In the cases involving a decrease or an increase in cigarette consumption, the change in daily consumption (cig/day) was noted.

Data management

The corpulence status was identified42; underweight (BMI < 18.5 kg/m²), normal weight (BMI: 18.5 - 24.9 kg/m²), overweight (BMI: 25.0 - 29.9 kg/m²), and obesity (BMI ≥ 30.0 kg/m²). For the cigarette-dependence status, two groups of participants were identified: nondependent (FTCD score ≤ 2) and dependent (FTCD score ≥ 3). For the spirometry test, three spirometric patterns were possible43: “no” bronchial obstruction (FEV₁/FEV₆ ≥ 0.80), “possible” bronchial obstruction (0.70 ≤ FEV₁/FEV₆ < 0.80) and “most likely” bronchial obstruction (FEV₁/FEV₆ < 0.70). According to the SLA values, two scenarios arise. If the SLA matched the chronological-age, the physician (KHM in the authors’ list) informed the participant that the test results were normal and that his lungs seemed to be normal at that time. Yet, the physician informed the participant that the risk of having other smoking-related health problems would remain, and that continuing to smoke would lead to having higher SLA in the future.17 If the SLA was greater than the chronological-age, the physician announced the SLA to the participant and informed him that his SLA is suggestive of a possible harm due to smoking. The participant was also informed that smoking cessation would slow down the worsening rate of his lung function, bringing it to a physiological age-related decline. However, the smoking-related lung harms would not be restored.17

Ten months after the intervention, participants were divided into two groups: participants who quit or decrease smoking; and participants who maintain stable or increase consumption.

Statistical analysis

Categorical data (i.e., spirometric pattern, corpulence-, smoking-, dependence- and self-reported smoking- status) were expressed as relative frequency. The Shapiro-Wilk test was used to analyze quantitative data (i.e., chronological-age, SLA, “change in age”, anthropometric and spirometric data, Fagerstrom score) distributions. The quantitative data were determined to be distributed normally. Therefore, means and standard deviation (SD) were used as summary statistics. Wilcoxon test was used to compare quantitative data in the same group (e.g, chronological-age vs SLA). Comparisons of
quantitative and categorical data between groups (eg; dependent vs nondependent groups; quit or decrease smoking vs maintain stable or increase consumption) were performed, respectively, by the Student T-test and the two-sided Chi-square test. Analyses were carried out using the Statistica software (Statistica Kernel version 6; StatSoft, Paris, France). Significance was set at the 0.05 level.

Table 2. Spirometric data of the participants.

|                         | Total sample (n = 36) | Nondependent group (n = 6) | Dependent group (n = 30) | P-value |
|-------------------------|-----------------------|---------------------------|-----------------------|---------|
| FEV₁ (l)                | 3.80 ± 0.66           | 4.09 ± 0.92               | 3.74 ± 0.60           | 0.240   |
| FEV₆ (l)                | 4.37 ± 0.69           | 4.61 ± 1.11               | 4.33 ± 0.59           | 0.360   |
| FEV₁/FEV₆ (absolute value) | 0.85 ± 0.06           | 0.89 ± 0.04               | 0.85 ± 0.06           | 0.080   |
| Spirometric pattern     | No bronchial obstruction: FEV₁/FEV₆ ≥ 0.80 | 28 (77.8) | 6 (100) | 22 (73.3) | 0.150 |
|                         | Possible bronchial obstruction: 0.70 ≤ FEV₁/FEV₆ < 0.80 | 8 (22.2) | 0 (0) | 8 (26.7) | 0.150 |

FEV₁: forced expiratory volume in one second. FEV₆: forced expiratory volume in six seconds. P: probability. Quantitative and categorical data were expressed as mean ± SD and number (%), respectively.

Table 3. Characteristics of the participants 10 months after the intervention (n = 36).

|                                  | Quit smoking or decreased consumption (n = 23) | Stable or increased consumption (n = 13) | P-value |
|----------------------------------|-----------------------------------------------|-----------------------------------------|---------|
| Chronological-age (years)        | 34.48 ± 5.05                                  | 33.96 ± 7.168                           | 0.80    |
| Spirometric lung-age (years)     | 42.24 ± 10.95                                 | 32.81 ± 9.73                            | 0.010   |
| 'Change in age' (years)          | −7.76 ± 10.21                                 | 1.15 ± 12.89                            | 0.020   |
| Height (cm)                      | 175 ± 7                                       | 173 ± 6                                 | 0.560   |
| Weight (kg)                      | 79 ± 13                                       | 71 ± 14                                 | 0.080   |
| Body mass index (kg/m²)          | 25.8 ± 3.9                                    | 23.5 ± 4.6                              | 0.120   |
| Fagerstrom score                 | 5.22 ± 1.73                                   | 5.46 ± 1.94                             | 0.690   |
| Smoking status                   | Cigarettes/ day                               | 18.4 ± 5.5                              | 0.660   |
|                                  | Pack-years                                    | 13 ± 7                                  | 16 ± 11  | 0.340   |
| FEV₁ (l)                         | 3.69 ± 0.69                                   | 3.98 ± 0.59                             | 0.210   |
| FEV₆ (l)                         | 4.28 ± 0.71                                   | 4.53 ± 0.65                             | 0.300   |
| FEV₁/FEV₆ (absolute value)       | 0.86 ± 0.06                                   | 0.84 ± 0.05                             | 0.350   |
| Dependence status (Yes)          | 19 (82.6)                                     | 11 (84.6)                               | 0.870   |
| Possible bronchial obstruction (0.70 ≤ FEV₁/FEV₆< 0.80) | 4 (17.4)                                     | 4 (30.8)                                | 0.350   |

'Change in age': difference between the chronological-age and the spirometric lung-age. FEV₁: forced expiratory volume in one second. FEV₆: forced expiratory volume in six seconds. P: probability. Quantitative and categorical data were expressed as mean ± SD and number (%), respectively.

Results

Fifty-three male participants attended the education session and volunteered to take part in the study. Among these participants, 11 were not included (seven narghile-smokers and four participants did not answer the FTCD). Among the 42 participants who completed the four steps of the intervention protocol, only 36 (86%) answered the phone call 10 months
later. The six remaining participants were contacted at least five times during a week, but they could not be reached. Therefore, they were excluded from the analysis (Figure 2).

Table 1 presents the baseline characteristics of the participants. Thirty (83.33%) and six (16.67%) participants were, respectively, nicotine-dependent and nicotine-nondependent. The dependent and nondependent groups had similar chronological-age and SLA values. Compared to the nondependent group, the dependent one had lower BMI and higher daily cigarettes consumption. The SLAs of the total sample and the dependent group were higher than their chronological-ages by 4.54 (p = 0.01) and 5.11 (p = 0.044) years, respectively.

Table 2 presents the participants’ spirometric data. All participants had a FEV/FEV, 0.70. The dependent and nondependent groups had similar spirometric data and included similar percentages of participants with “no” or “possible” bronchial obstruction.

Ten months after the intervention, four (11.1%) and 33 (88.9%) participants reported that they quit smoking and did not quit smoking, respectively. Among the 33 participants who did not quit smoking, 19 (52.7%) decreased their consumption, 11 (30.5%) maintained stable their consumption, and two (5.5%) increased their consumption. In the groups who decreased and increased their consumption, the mean ± SD of cig/day were 7 ± 4 and 9 ± 6, respectively.

Compared to the group who maintain stable or increase its consumption, the group who quit smoking or decrease its consumption had significantly higher SLA by ≥10 years (p = 0.010) and higher “change in age” by ≥8 years (p = 0.020) (Table 3).

Discussion
The announcement of SLA combined with an education session about smoking harms had motivated 23 (64%) participants to improve their self-reported smoking status: four participants (11%) quit smoking and 19 (53%) decreased their consumption by 7 ± 4 cig/day. The profile of participants who quit smoking or decrease cigarette consumption was characterized by a significantly higher SLA and a significantly worse “change in age”.

Ceasing and eliminating smoking requires integrated, multifaceted strategies addressing both physical dependence and social context. These strategies often include prevention measures (involving quitting; helping to prevent non-smokers from starting this habit, which is the most important strategy) involving quitting (involving quitting and avoid relapse, which is vital for an active and healthy lifestyle), and protection (from the harmful effects of smoking and from the tobacco industry marketing influences). For smoking cessation, numerous procedures of evidence-based treatments for tobacco-dependence (brief-advice, short information from health specialists, telephone call quit lines, pharmacotherapy) are available in many countries. While brief-advice is the method having the best cost/effectiveness ratio in public health if it is systematically delivered, middle- and low-income countries appear in the penultimate position in the international ranking with regard to the frequency of advice given to smokers. Among the methods used to help smokers quit smoking, is the announcement of SLA. The concept of SLA was initially established as a psychological instrument to show smokers the apparent aging of their lungs. SLA is usually appraised from regression equations for the FEV1 in healthy non-smokers, and constitutes the age at which the FEV1 measured in an individual equals the predicted value of FEV1, taking into account age, height, sex and ethnicity. More details about the conceptual framework for the use of SLA is developed in the Supplementary file 1.

Studies analyzing the effects of announcing SLA as a motivational tool for smoking cessation are scarce and presented conflicting results. The designs and the main results of the studies announcing SLA only or associated with other methods (e.g., pharmacotherapy or RC) are exposed in Supplementary files 2 (Table 1S) and 3 (Table 2S), respectively.

Discussion of Results
Frequencies of participants who changed their smoking attitudes (Tables 1S and 2S)
Our single intervention had motivated 64% of participants to improve their self-reported smoking status. This confirmed the privileged position of occupational physicians in smoking prevention. Results of the studies reporting the effects of announcing SLA (alone in addition to some other interventions) on participants quit smoking are conflicting. On the one hand, one study reported no effect of SLA and respiratory symptoms feedback on the desire to quit, although participants were divided into those having a SLA lower or higher than chronological-age. On the other hand, it appears that 22.9% of participants quit smoking, 61.1% increased their motivation to quit, and 48.6% had the intention to quit in the future. Second, some case-control studies reported inconsistent results. While two studies identified a significantly higher percentage of cases who quit smoking compared to controls (13.6 vs 6.4%, 22.1 vs 12.0%, respectively), three other studies noted similar percentages of cases and controls who quit smoking (32 vs 24%, 50.8 vs 52.4%; 59.6 vs 41.9%, respectively). In addition, no significant difference was identified between cases and controls even when participants were divided into those having a normal (18 vs 33%, respectively) or a high (39 vs 17%, respectively) SLA. Third, one study including four groups (usual care, SLA, SLA plus contingency management, contingency management) highlighted similar percentages of participants who quit smoking (4%, 0%, 0%, and 14%, respectively). Fourth,
Segnan et al.\textsuperscript{20} reported similar frequencies of biologically verified smoking cessation 12 months after four different interventions [minimal intervention (4.8%), RC (5.5%), RC and use of nicotine gum (7.5%), RC and announcement of SLA (6.5%)].

Our conclusions are intermediate with those reported in the literature.\textsuperscript{10,11,14–19} First, our frequency of participants quit smoking ($\chi^2$ 11.1%) is lower than the reported frequencies,\textsuperscript{14–16,21} which varied between 22.1\textsuperscript{21} and 84.6%.\textsuperscript{16} Second, our frequency of participants who did not quit smoking ($\chi^2$ 84.6%) was significantly lower than the one observed in controls (90.4%).\textsuperscript{16} Third, in participants who did not quit smoking, the means of daily cigarette consumption reported in our study (7 ± 4 cig/day) was lower than the ones reported in similar studies (eg: 10.9,\textsuperscript{14} 11.7 ± 9.7\textsuperscript{16} and 14.4 ± 4.8.\textsuperscript{15}) Fourth, in one-case-control study, the mean ± SD daily cigarette decrease in cases was significantly lower than the one observed in controls (11.7 ± 9.7 vs 13.7 ± 10.5).\textsuperscript{16}

Profile of participants who quit or decrease cigarette smoking (tables 1S and 2S)

Investigating the profile of participants who quit or decrease cigarette smoking is rarely tackled in the literature. In our study, among all the evaluated data, only high SLA and high “change in age” appear to influence the smoking cessation (Table 3). Conflicting results have been advanced with regard to the factors influencing smoking cessation after telling participants their SLA (alone or in addition to other interventions).\textsuperscript{10,11,14–19} On the one hand, some studies reported similar findings to those identified in our study.\textsuperscript{14,19,21} First, Lorenzo et al.\textsuperscript{14} reported that the presence of an “abnormal” SLA is related to the increased motivation to quit. Second, Lipkus and Prokhorov\textsuperscript{19} identified that cases with SLA ≥ chronological-age increase their perceived comparative risk from baseline to follow-up. On the other hand, some studies reported different findings compared to our study. First, Parke et al.\textsuperscript{16} noted that participants with a high SLA are no more likely to quit. Second, Kaminsky et al.\textsuperscript{11} reported no significant association between attempts to quit and the interaction of group assignment and SLA. Third, Ojedokun et al.\textsuperscript{21} reported that within the intervention group, smokers with more advanced SLAs were just a likely to stop smoking as those with SLAs closer to their chronological-age. Fourth, Lipkus and Prokhorov\textsuperscript{19} reported that increasing SLA is not related to the desire to quit after partialling baseline desire to quit. They also reported that cases and controls (with SLA < chronological-age) perceive a comparative risk decrease from baseline to the lab follow-up and that increasing SLA in cases is not correlated with any risk or worry outcome although the cases were divided into those having SLA lower or higher than chronological-age. Fourth, no significant difference in the clinical characteristics (SLA, “change in age”, FEV$_1$, FEV$_1$/FEV$_{60}$ treatment status) was reported between the quit smoking and non-quit smoking in cases.\textsuperscript{17} Finally, additional factors that influence smoking cessation have been advanced: less nicotine dependence, high socioeconomic-level, high schooling-level, Varenicline/nicotine patch, stage on the wheel of change, and age.\textsuperscript{11,15,17,21} For example, Tanihara and Momose\textsuperscript{46} have reported that “nicotine dependence level of current smokers was negatively associated with cessation attempts during the previous 12 months”, and Ojedokun et al.\textsuperscript{21} have reported that “stage on the wheel of change was a strong predictor of smoking cessation, with smokers in the action stage being much more likely to quit than those in pre-contemplation”.

Mechanism by which our intervention attained its effect remains

The precise mechanism by which our intervention attained its effect remains uncertain. While spirometric results would offer a perfect educational occasion for smokers to notice their lung health status, this method failed to encourage long-term smoking cessation.\textsuperscript{17,47} This may be because the lay public usually fails to comprehend the full connotation of spirometry in the context of long-term health and life span.\textsuperscript{17} In contrast, the term “SLA”, predictable from some spirometric data seems to be cooler and more suitable for smokers.\textsuperscript{17} Announcing SLA may successfully appeal to smokers as it informs them about the risk of developing lung conditions.\textsuperscript{17} Helping smokers to recognize their lung health status would, then, encourage them to quit smoking.\textsuperscript{17}

What are the reasons for inconsistent results between-studies?

Three reasons for inconsistent results are exposed in the “Introduction”. Additional reasons related to the study design (eg: target population), type of smoking cessation” intervention, characteristics of participants (eg: sex, age), and smoking status (eg: mean of cigarette consumption, mean FTCD score, Prochaska and Diclemente (“stage of change”) can explain a big part of the results’ divergences observed in similar studies. These factors will be detailed in the following paragraphs.

In our study, only males were included. In other related studies, the percentage of males varied between 35%\textsuperscript{11} and 100%.\textsuperscript{15} In Tunisia, smoking is a taboo subject for working females who often refuse to participate in interventions of this kind. It appears that there is a sex-related beliefs and attitudes about smoking cessation.\textsuperscript{48} A recent study reported that females are ambivalent about quitting smoking or not, and males mention not needing professional support.\textsuperscript{48} Moreover, one American study reported that “successful smoking quitters” were more likely to be older and male.\textsuperscript{49} In this study, similar to another one,\textsuperscript{15} the target population was composed of employees working in a factory. This was different from previous studies, where participants were recruited from those referred to a hospital lab,\textsuperscript{11} an outpatient clinic\textsuperscript{17} or a general
practitioner’s medical office. 14, 20, 21 Other participants were recruited from colleges 19 or from the community. 10, 16, 18 It is possible that for participants referred to a medical institution 11, 14, 17, 20, 21 due to some breathing problems, finding a “normal SLA” may have reduced anxiety, thus leading to a diminished desire to quit. 31 This might not have been the case for participants included in our study as, by virtue of their consent; they might have been more open to health campaign. 11, 16, 50 However, this study results should be interpreted vigilantly since it is uncertain whether they can be generalized to community and other employee population. The mean age (in years) of our participants (34 ± 6) was higher than the one of Lipkus and Prokhorov 19 (21 ± 2), closer to the one of Ben Mdella et al. 15 (36 ± 7) or Ojedokun et al. 21 (38 ± 15), and lower than those of other related studies (46, 14 47 ± 12, 18 52 ± 11, 17 53 ± 12 14). It appears that with increasing age, many heavy smokers eventually stop smoking. 49 The mean of cigarette consumption of our participants (14 ± 9) was closer to the one in other studies (16 ± 7, 19 16 ± 16 14), but lower than the ones in other studies (26, 14 31 ± 18, 16 39 ± 25 17). The mean of daily cigarette consumption of our participants (18.8 ± 6.2) was higher than those reported in other related studies (13.3, 14 16 ± 6, 15 16.5 ± 9.0, 16 17.6 ± 7.8 14). One study had reported that a higher daily cigarette consumption was associated with lower odds of smoking cessation success. 51 In this study, the mean FTCD score was 5.3 ± 1.8, and 83.3% of participants were nicotine-dependent. In some related studies, 10, 14, 18 different values were reported. The mean and the median of FTCD score were 4.6 ± 1.9 18 and 3.5 (2-4) for the SLA group, 10 respectively. In another study, only 36.4% of participants were nicotine-dependent. 14 According to a recent study, having a lower nicotine dependence was among the significant predictors of sustained smoking abstinence. 52 In our study, all participants were at a pre-contemplative stage. 37 This was not the case of the participants included in the study of Ojedokun et al., 21 where 19.7%, 42.5%, and 38.8% of cases were respectively, at the following stages: pre-contemplation, contemplation and preparation. In this study, an education session about the harmful effects of smoking preceded the announcement of SLA. In some related studies, SLA announcement was associated with different other interventions (eg: respiratory symptoms feedback, RC, contingency management, exhaled carbon monoxide [CO], smoking cessation sessions and nicotine patch, Varenicline or nicotine patch and education). 10, 17–21 However, a Cochrane review of the use of individual biomarkers (eg: CO measurements) revealing the damaging effects of smoking concluded “there is little evidence about the effects of biomedical risk assessment as an aid for smoking cessation.” 53 In this study, and similar to others, 10, 15–18 the main outcomes were related to the participants’ self-reported smoking status and their self-reported amount of daily cigarette consumption. Some additional outcomes were verified in other related studies (eg: quit attempts, 10, 11 attending smoking cessation counseling, 35, 18 intention to quit in the future, 15, 19 smoking cessation motivation, 14 exhaled CO 18 patch-use, 18 changes in FTCD score, 10 total number of visits attended, 10 interim visits, 10 alteration in self-efficacy, 10 desire to repeat SLA test, 19 Prochaska’s wheel of change 21). In this study, among all the collected spirometric data (FEV1, FEV6, FEV7/FEV6, spirometric patterns, and SLA), only SLA was announced to participants. When SLA was in the normal range, participants were told that persistent smoking might lead to health problems. 17 This precaution was considered since Kaminsky et al. 11 suggested that participants with “normal” SLA are less likely to make quit attempts if they are informed of their normal lung function. In other related studies, several approaches were applied: announcing SLA alone, 10, 15, 17, 19 or combined with other data (eg: FEV1, 11, 14, 18 forced vital capacity, 14 FEV1/forced vital capacity, 14 Fletcher and Peto graphic 11, 16). In this study, participants were given enough time (ie: 10 months) to try smoking cessation gradually since it is possible that SLA feedback may have a “sleepier effect” (ie: a psychological impact on longer term smoking cessation). 38 On the one hand, evaluating smoking cessation attempts at only one or three months 11, 17, 18, 21 provided a restricted timeframe for evaluating the effect of the intervention. 11 On the other hand, in some related studies, the follow-up period ranged from instantaneously 19 to some months (one, 11, 18, 21 three, 17, six, 10, 20 nine 14 and 12 15–17, 20). Study strength and limitations One strong point of this study, as done in another one, 17 was the use of local SLA norms. 28 In two previous studies, 11, 18, 21 the applied SLA norms were unspecified, and in six studies, 10, 14–16, 19, 20 old norms were applied. 20 This study presents some limitations. The first is related to the study design (before-after trial in a single group) and the lack of a control-group, which makes data interpretation “uncertain”. This situation limits the value of our results and restricts their interpretation to only strong trends. The inclusion of a control-group, as done in some studies, 10, 11, 16–19 would have provided more solid and objective conclusions. The second limitation concerns the nature of the intervention itself (ie: combination of SLA announcement and an education session about the smoking harms). It is possible that results could have been different if the two interventions were presented separately. For example, one previous study 54 compared education alone or education plus a supplementary motivational intervention containing instantaneous comment about the participants’ exhaled CO, spirometric results, and pulmonary symptoms. The authors reported that 20 versus 7% of participants remained abstinent 12 months later, respectively. 54 The third limitation is related to the description “quality of our
intervention, and therefore its practical replicability. For that reason, in future similar interventional studies aiming to evaluate the impact of announcing SLA on participants’ self-reported smoking status; it is preferable to use the template for intervention description and replication checklist and guide.55 The latter improves the reporting of interventions and make it easier for authors to structure accounts of their interventions, reviewers and editors to assess the descriptions, and readers to use the information.55 The fourth limitation is related to the ten-month gap between intervention and completing phone interview. During this relatively “long” period, many other potential confounders could have resulted in the participants quitting/not quitting, smoking more/less. Moreover, a simple telephone call probably lacks precision compared to a visual consultation.14 For that reason, it have been better if there were monthly phone follow-up and/or education session. The fifth limitation is linked to the lack of a biochemical validation for self-reported smoking cessation rates. In this study, as done in some related ones,11,14,15,21 the smoking attitudes were assessed via a telephonic call and were based on a self-report of the smoking status. In other related studies, more rigorous biological methods were applied (eg cotinine salivary measurements, exhaled CO, plasma cotinine, salivary cotinine).10,16–18,20 The interest of biochemical validation versus self-report indices of quitting has been studied hitherto.56–58 On the one hand, a previous review aiming to assess the usefulness of biomarkers has advocated “that in large-population, low-intensity trials, biochemical verification was neither feasible nor necessary”.58 The same review recommended that “while it is probable that quit rates are overestimated when using self-reports, the extent of inflation is small”.58 On the other hand, a large survey has reported commonly high levels of correctness, specificity and sensitivity for self-report.59 In brief, self-reporting may be a reasonable practical pointer of smoking status among smokers that attend their physicians for routine visits.21 The sixth limitation concerns the sample size which was calculated using an 85% confidence interval ($Z_{\alpha/2} = 1.44$). Calculation of the “required” sample size is a vital point since determining the sample best size assurances enough power to differentiate statistical significance.60 On the one hand, our sample size ($n = 36$) was closer to the samples of some related two studies ($n = 34, 35$). On the other hand, it was lower than the samples of other studies ($n = 48, 52, 56, 57, 61, 74, 120, 140, 280, 292$). It was better to choose a confidence interval of $95\%$ ($Z_{\alpha/2} = 1.96$), and therefore a sample size of 68 smokers. The last limitation is related to the calculation of SLA via a small hand-held mini-electronic spirometer (ie, NEO®-6 spirometer). On the one hand, possibly another type of spirometry equipment could have been advisable and more reliable to use. However, spirometry will screen smokers for chronic lung conditions, nevertheless it is neither practical nor economical to use in occupational care to encourage smoking quit.21 Compared to a spirometer, the Vitalograph device is inexpensive, simply reachable and needs no training for use.21 On the other hand, our method was previously used by some authors21 who stated that “compared to a spirometer, the Vitalograph is much cheaper, easily accessible and requires no additional training for use”.

To conclude, SLA announcement combined with an education session appears to be a practical tool for promoting smoking cessation since 64% of participants quit smoking or reduced their smoking consumption. The profile of participants who quit smoking was characterized by a significantly higher SLA. Even though evaluating SLA does add four to five minutes to the consultation time, this can convert into clinically operative action, which can be simply integrated into routine first consultation lines.21 In clinical practice, the authors recommend to perform a spirometry (FEV$_1$, FEV$_{50}$) on all smokers and to calculate their SLA in the first consultation lines (eg, general practitioners, occupational health consultation, and basic health centers).

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Conflicts of Interest
H Ben Saad reports personal fees from AstraZeneca, Opalia Recordati and Chiesi. The authors have no other relevant affiliations or financial involvement with any organization or entity with a financial interest in or financial conflict with the subject matter or materials discussed in the manuscript apart from those disclosed.

Research Ethics Section and Patient Consent
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Supplemental material

Supplemental material for this article is available online.

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List of Abbreviations

- BMI: body mass index
- cig/day: cigarettes per day
- CO: carbon monoxide
- COPD: chronic obstructive pulmonary disease
- FEV₁: forced expiratory volume in one second
- FEV₆: forced expiratory volume in six seconds
- FTCD: Fagerström test for cigarette dependence
- PY: pack-years
- RC: repeated counselling
- SD: standard deviation
- SLA: spirometric lung-age