The Adolescent Label Impact Index in a Multicentric Observational Study. Have the Tobacco Advertisements an Impact on the Adolescents?

14 authors, including:

Alice Mannocci
Sapienza University of Rome
269 PUBLICATIONS   2,460 CITATIONS

SEE PROFILE

Fabrizio Guerra
Sapienza University of Rome
76 PUBLICATIONS   366 CITATIONS

SEE PROFILE

Vittoria Colamesta
Catholic University of the Sacred Heart
53 PUBLICATIONS   241 CITATIONS

SEE PROFILE

Insa Backhaus
Heinrich-Heine-Universität Düsseldorf
40 PUBLICATIONS   162 CITATIONS

SEE PROFILE

Some of the authors of this publication are also working on these related projects:

Project   Assessment of subclinical vascular damage in patients with polymyalgia rheumatica with non invasive cardiovascular risk markers View project

Project   Air Pollution and TVE View project

The Adolescent Label Impact Index in a Multicentric Observational Study. Have the Tobacco Advertisements an Impact on the Adolescents?

Alice Mannocci, Fabrizio Guerra, Vittoria Colamesta, Insa Backhaus, Alberto Firenze, Sandro Provenzano, Maria Fiore, Maria Ferrara, Elisa Langiano, Elisabetta De Vito, Chiara Lorini, Guglielmo Bonaccorsi, Paolo Villari, Giuseppe La Torre & Collaborative Group

View supplementary material 🔗

Submit your article to this journal 🔗

View related articles 🔗

Published online: 16 Jul 2020.

Article views: 21

View Crossmark data 🔗

Taylor & Francis
Taylor & Francis Group

Check for updates

The Adolescent Label Impact Index in a Multicentric Observational Study. Have the Tobacco Advertisements an Impact on the Adolescents?

Alice Mannocci[a,b]* (ID), Fabrizio Guerra[a]*, Vittoria Colamesta[a]*, Insa Backhaus[a]* (ID), Alberto Firenze[c]*, Sandro Provenzano[c]*, Maria Fiore[d]*, Maria Ferrara[e]*, Elisa Langiano[e]*, Elisabetta De Vito[e]*, Chiara Lorini[f]* (ID), Guglielmo Bonaccorsi[f]* (ID), Paolo Villari[a]* (ID), Giuseppe La Torre[a]* (ID), and Collaborative Group

[a]"Sapienza" University of Rome, Roma, Italy; [b]Universitas Mercatorum, Rome, Italy; [c]University of Palermo, Palermo, Italy; [d]University of Catania, Catania, Italy; [e]University of Cassino and Southern Lazio, Cassino, Italy; [f]University of Florence, Florence, Italy

ABSTRACT

Background: Pictorial warnings may contribute to lower attractiveness of smoking, particularly among adolescents. The present study compared the impact of two different label styles of tobacco product warnings (textual and pictorial) among adolescents in a new standardized way, using the Adolescent Label Impact Index (ALII).

Methods: A school-based cross-sectional study was conducted. Adolescent aged 10–20 years completed an online questionnaire. The ALII score was used to assess the impact of only-textual (ALII-T) and pictorial advertisements (ALII-P).

Results: A total of 1,759 students (68.4% response-rate) declared that graphic warnings have a significant impact than textual ones ($p < 0.05$). The younger group, which has never smoked or just tried and believed in the harmful effects of tobacco, is associated with both scales of ALII scales (T and P) ($p < 0.01$). The socioeconomic status was associated with ALII-T ($p < 0.01$), but not ALII-P; female gender, smoker-peers, perception of the body weight are related to the ALII-P ($p < 0.05$) but not ALII-T.

Conclusions: The pictorial labels represent a policy of tobacco use control that has potential effects, in particular in reducing communication inequalities between socio-economic categories, reinforcing the knowledge about the damage of smoking, discouraging adolescents, especially the younger ones who do not have never smoked or have just tried to become smokers.

COLLABORATIVE GROUP

- Siriana Campioni, Department of Public Health and Infectious Disease, "Sapienza" University of Rome
- Gabriele Castorina, Armando Platania, Specialization School of Hygiene and Preventive Medicine, Department "GF Ingrassia" Hygiene and Public Health, University of Catania, Italy;
- Ilenia Bellini, School of Specialization in Hygiene and Preventive Medicine, University of Florence
- Omar Enzo Santangelo, Specialization School of Hygiene and Preventive Medicine, Department of Sciences for Health Promotion and Mother and Child Care "Giuseppe D'Alessandro," University of Palermo
- Clara Ferrara, Department of Gynecology and Obstetrics Palermo Civic Hospital and National Center of Clinical Excellence (ARNAS Di Cristina-Benfratelli) Palermo, Italy.

Introduction

The World Health Organization (WHO) emphasizes that tobacco packaging interventions are one of the most effective tools to combat the tobacco epidemic (WHO, 2011). Health warnings on tobacco products should be used to inform the risks associated with tobacco consumption. The evidence states that knowledge of the danger of smoking increased in countries where health warnings are mandatory (Hammond et al., 2006).

Currently, there are three main methods for communicating the health risk of smoking on tobacco products: images, symbols, and text. The effectiveness of the pictorial method is well-known and described in several scientific studies (La Torre, 2013; Li & Grigg, 2009; Miller et al., 2011; Noar et al., 2016; Wilson, 2011). Despite the evidence, the adoption of the pictorial advertisement is not uniform in the world. In 2018 the Canadian Cancer Society has published the "Cigarette Package Health Warnings: International Status Report" and reported that out of 206 countries, 118 countries worldwide required or adopted pictorial warnings. In Europe, 22 countries implemented the pictorial warnings, of which 14 among, including Italy, implemented them in 2016 (Canadian Cancer Society, 2018). Furthermore, improvements on tobacco packaging legislation have been made in a few countries, such as the standardized packaging law.

The currently available literature on this issue is encouraging. Dunlop and colleagues found that among Australian adolescents and young adults, plain packaging discouraged smoking initiation and positive effects on quitting-related behaviors and thoughts (Dunlop et al., 2017). In 2013 an Italian exploratory survey collected the opinions of adults on the warnings illustrated on plain packaging, compared to textual ones on branded packaging. The authors found that plain packaging generally discouraged the initiation of smoking and increased the motivation to stop smoking or reduce smoking (Mannocci et al., 2013).

In Italy, the first legislation on the advertisements of tobacco products entered into force in 2003: a set of textual messages was imposed on the packaging of all tobacco products. The law, in May 2016, introduced the definitive transition from textual into graphical warnings. The textual message led to greater awareness of smoking-related diseases and attempts to quit (Mannocci et al., 2014). The aim of the law is to increase the prevalence of former smokers, to moderate tobacco consumption and to reduce the incidence of new smokers, especially among adolescents.

Precisely with regard to adolescents, Peterson and colleagues (2010) demonstrated that graphic images generated higher levels of visual attention in teens (12–14 years) (Peterson et al., 2010). In additional studies, the authors found out that adolescents perceived graphic warning labels as a more effective mean of preventing them from smoking in comparison to textual warnings (Macy et al., 2016; Vardavas et al., 2009).

Although there is considerable literature on this topic, the comparability of the results on the effectiveness of the health warnings on tobacco products remains problematic. In 2012, Hitchman et al. preformed and validated a tool, called the Labels Impact Index (LII) (Hitchman et al., 2012). Just five years later, in 2017, Guerra et al. adapted the tool for adolescents and created the Adolescent Label Impact Index, ALII (Guerra et al., 2017). The present study aimed to (a) compare the impact of the two different styles of warnings (textual and pictorial) on tobacco products among adolescents using the ALII and (b) assess possible significant factors that are associate with the ALII score.

Methods

The current study was a multi-center cross-sectional school-based surveys of adolescents in Italy conducted from November 2015 until June 2016. The study was conducted according to Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement (von Elm et al., 2008). The study was approved by the Teaching Hospital "Umberto 1" and Sapienza University of Rome Ethics Committee.

Sample and procedure

Participating middle or high schools ($n = 7$) were situated in three Italian Regions (Tuscany, Latium, and Sicily). The selection of the schools was based on a convenience sample and on their availability to participate in the study. The sample considered students aged 10–20 years.

Prior to study begin, the deans of the schools were contacted by phone and by e-mail in advance, who then in informed parents about the study aims. Participation in the study was voluntary and anonymous and parents had the option of withdrawing their child from the data

collection ("opt-out" consent procedure). Students were invited to complete an online questionnaire. Personal computers, tablets, smartphones or computers of the classrooms were used to fill out the questionnaire.

A combination of two researchers (FG, AF, MF, MF, CL, SC, GC, SP, and CF) presented the study and questionnaire to the students and supported the teachers during the phase of administration.

The overall completion time of the questionnaire was 30 minutes.

Measures

A multiple-choice questionnaire was used, comprising four sections: demographic data, tobacco habits, ALII items and socio-economic status (SES). Demographic information included: age, gender, place of residence, educational levels and parents' professional activities, participation in sports (Yes/No), height (cm) and weight (kg). Concerning tobacco habits, the questionnaire items focused on knowledge about the harmfulness of smoking and on smoking habits by family members and friends. The status of smoker was identified by a combination of answers to the following seven sentences:

- "I have never smoked in my life" (never);
- "I have smoked just once" (ex);
- "I have smoked more once cigarettes in my life, but now I do not smoke" (ex);
- "I sometimes smoke, less than once a week" (intermittent);
- "I smoke 1–7 cigarettes per week" (intermittent);
- "I smoke more than 7 cigarettes per week" (smoker intermittent or daily);
- "I do not want to answer" (missing);

A binary variable "Never teen smoker" (yes/no) was created considering the first use of tobacco (i.e., never vs. ex + intermittent + daily). A second binary variable "teen smoker" (yes/no) was created considering those who smoked regularly or intermittent smokers, (i.e., daily + intermittent smoker vs. never + ex)(de Lacy et al., 2017; Rubinstein et al., 2014; Schane et al., 2010).

The effectiveness of health warnings was measured using the ALII. The ALL is a validated tool which was developed by (Guerra et al., 2017). The ALII is an adapted version of the international validated measure LII. The LII is a composite measure of warning effects on adults (Hitchman et al., 2012). The LII Italian version was published in 2016 and was used as a starting point of the ALII (Mannocci et al., 2016). The ALII is designed for adolescents and is composed of four questions (salience; harm; quitting; forgoing) with a point-scale of answers (see supplementary file) (Guerra et al., 2017).

The normalized ALII score was used (the score ranged from 0 to 100): a high score means a great impact of the advertisement. The ALII was computed for both different styles of warnings: only text warnings (ALII-T = textual) and pictorial warnings (ALII-P).

Furthermore, one question included a set of eight pictures with damages on human health. The pictures are similar to the set of pictures used in Italy. The participants were asked to indicate the most shocking picture/photo (Figure 1).

An adolescent's SES was measured using the Family Affluence Scale (FAS)(Boyce et al., 2006; Currie et al., 1997, 2008). The FAS asks information on family wealth and includes items such as ownership of a family car, bedroom, telephone and family holidays per year. On the basis of the FAS answers, the Family Affluence Level (FAL) was calculated for each student. The FAL score was interpreted using the following ranges on (WHO, 2008):

- Low income: FAL 0–2;
- Middle income: FAL 3–5;
- High income: FAL 6–9.

Statistics

All statistical analyses were performed using SPSS version 20.0 (SPSS Inc., Chicago, IL USA). Descriptive statistics of the socio-demographic characteristics, smoking habits and SES were performed using mean, SD, median and range for continuous variables, while frequencies and percentages for qualitative ones. Inferential statistics were applied in order to explore whether

Figure 1. Pictorial health warnings in the questionnaire: "Looking at the pictorial messages on the damages of smoke on health, which ones of these are the most shocking for you?"

socio-demographic factors, smoking habits and SES influence the effectiveness of pictorial and textual warnings. Quantitative variables were analyzed with Student-t test for independent samples. A univariate analysis to assess the factors associated to the ALII-T and ALII-P was carried out after checking the normality distribution using the Kolmogorov-Smirnov's test. Independence of the ALII from gender, age, Body Mass Index (BMI), extra-school physical activity, geographical area of the school, smoking habits, tobacco's use among family members and SES was checked by using the Mann–Whitney and Kruskal-Wallis tests. Then, variables with epidemiological interest and with a statistical significance level of $p < 0.2$ at the univariate analysis were included in a multivariate model.

The multivariate approach was assessed using the linear regression model in order to control confounding. The ALII-P and ALII-T scores were considered as dependent variables of two models. Each of these models was built considering a stepwise approach and the backward elimination procedure setting the removal level at $p > 0.1$. The R^2 was computed to establish the goodness of fit of the models. All tests were two-tailed. The significance threshold was set at $p < 0.05$.

Results

Characteristics of participants

A total of 2,571 students from seven schools (three secondary and four high schools) agreed to participate. Table 1 shows the characteristics of the participants, tobacco use and different aspects such as knowledge, habits, family contest and peers. Out of 2,571 students who began the survey, 1,759 (68.4%) provided responses to the questionnaire. Two thirds of the sample were females. The percentage of the responders was uniform in the three age groups. 4% of students had a low FAL score concerning the SES. Furthermore, 3.4% of students stated that they had never seen textual warnings on a tobacco product. Those were consequently removed from the analysis according to the ALII administration guidelines (Guerra et al., 2017; Hitchman et al., 2012).

While the majority of participants (83%) were aware about the harmfulness of tobacco, 15%

Table 1. Description of the sample.

Variables	N (%)
Demographic data	
Gender (N = 1,758)	
Female	1,139 (64.8)
Male	619 (35.2)
Age groups year (N = 1,758)	
10–13[a]	525 (29.9)
14–16[b]	665 (37.8)
17–20[c]	568 (32.3)
Extra-school physical activity	
Yes	1,186 (68)
No	565 (32)
Geographical area where is located the School in Italy (N = 1,682)	
North	154 (9.2)
Center	752 (44.7)
South	776 (46.1)
BMI (N = 1,711)	
Low	482 (28.2)
Normal	1,063 (62.1)
Overweight	137 (8.0)
Obese	29 (1.7)
Family Affluence Scale	
Does your family own a car?	
No	35 (2.0)
1	442 (25.1)
≥2	1,282 (72.9)
Do you have your own bedroom?	
No	680 (38.7)
Yes	1,079 (61.3)
How many times did you travel away on holidays during the past 12 months?	
Never	378 (21.5)
Once	685 (38.9)
Twice	335 (19)
≥3 times	361 (20.5)
How many computers does your family own?	
No	62 (3.5)
1	519 (29.5)
2	620 (35.2)
≥3	558 (31.7)
FAL (N = 1,758)	
Low	68 (3.9)
Medium	732 (41.6)
High	958 (54.5)
Smoking information (perception of risk, own and family habits on tobacco)	
The image on the damage of smoke on the health most shocking to me is …[d]	
n.3 (gangrene)	954 (54.2)
n.6 (mouth and teeth)	401 (22.8)
n.1 (lung)	175 (9.9)
I believe that tobacco damages my health	
Yes	1,460 (83)
Maybe, yes	270 (15.4)
No	29 (1.6)
My mother smokes	
No	1,270 (72)
Yes, sometimes	172 (9.8)
Yes, daily	290 (16.5)
I don't know, I don't live with her	26 (1.5)
My father smokes (N = 1,693)	
No	1,084 (64.7)
Yes, sometimes	183 (10.4)
Yes, daily	425 (24.2)
I don't know, I don't live with her	66 (3.7)
My best friend smokes	
Yes	569 (32.3)
No	1,072 (61)
I don't know	117 (6.7)
My boy/girl-friend smokes	
Yes	269 (15.3)
No	457 (26)
I don't know or I haven't	39 (2.2)
My smoking habits	
I've never smoked (NEVER)	942 (53.6)
I don't smoke, I have tried once (EX)	195 (11.1)

(*continued*)

Table 1. Continued.

Variables	N (%)
I have tried, but now I don't smoke (EX)	192 (10.9)
I sometimes smoke, no more one cigarette per week (SMOKER)	124 (7.0)
I sometimes smoke, I smoke 1–7 cig per week (SMOKER)	101 (5.7)
I smoke more than 7 cigarettes per week (SMOKER)	205 (11.7)
I do not want to answer	0
My mother smokes	
No	1,270 (72)
Yes, sometimes	172 (9.8)
Yes, daily	290 (16.5)
I don't know, I don't live with her	26 (1.5)
My father smokes (N = 1,693)	
No	1,084 (64.7)
Yes, sometimes	183 (10.4)

[a]Middle-school students (compulsory education).
[b]High-school students (compulsory education).
[c]High-school students (non-compulsory education).
[d]See Figure 1.

stated that they were not sure whether or not tobacco is harmful or not. 54% of the respondents had never smoked and 23% were sporadic smokers or daily smokers; the remaining 23% had tried a first cigarette but did not currently smoke.

Warnings effects

Pictorial warnings featuring graphic depictions of diseases such Gangrene (54%) or a mouth with black teeth (23%) were rated as most shocking warnings.

Concerning the impact of the warnings the ALII scores for the two types of warning, textual and pictorial, show mean values of 54.7 (SD = 24.9) for ALII-T and 80.1 (SD = 22.1) for ALII-P, with a significant difference ($p < 0.001$).

The univariate analyses for the ALII are shown in Table 2. The analysis explored those who were more impressed from both types of advertisements: the younger students (<14 years), who were noncurrent or intermittent smokers or those who were never smokers, who believed that smoking damages their own health, who are not close friends with a smoker (best friend or boy/girlfriend), whose parents did not smoke, and those who had an BMI score out of the healthy limits. The variables gender, extra-school physical activity and FAL did not show different impact level of the graphical advertisements ($p > 0.05$).

Table 2 also illustrates the mean ALII values obtained in the two different packaging styles stratifying by different characteristics of teens.

For almost all characteristics, the pictorial warnings have a significant higher impact in comparison with the textual ones ($p < 0.001$), except for the statement "I don't believe that tobacco damages my health" (ALII-T = 35.3 and SD = 29.6 versus ALII-P = 46.0 and SD = 35.4; $p = 0.091$).

The smokers showed the lowest mean value for ALII-P than never smokers (mean = 66.9 and SD = 24.7), although was significantly different from the one of ALII-T (mean = 37.8 and SD = 18.3, $p < 0.001$).

The multivariate approach was assessed using the linear regression models, one for each ALII score (Table 3). The first model indicated that age, FAL, smoking habits, and beliefs about harmful tobacco influenced significantly and directly the value of the ALII-T. The value of goodness of fit was $R^2 = 0.277$. The second model showed agreement with the first concerning: age, smoking habits, and beliefs about harmful tobacco; whereas the FAL was not associated to ALII-P ($p = 0.405$). Additionally, the second model presented all of these other significant variables: gender, BMI and dating peer smokers. An association with extra-school physical activity was not found. The goodness of fit of the ALII-P model was 0.205.

Discussion

Main finding of this study

This study contributes to the growing evidence of the effectiveness of pictorial warnings on tobacco products and confirmed that pictorial warnings

Table 2. Univariate analysis to assess the association between ALII score and characteristics of the sample (left side) and within groups (right side).

Variables	ALII-T[c] Percentiles 25th	Median	75th	p	ALII-P[d] Percentiles 25th	Median	75th	p	Difference of the medians of the two paired ALII scores[e] p
Gender									
Male	36	56	80	0.315[a]	68	88	100	0.438[a]	**<0.001**
Female	32	52	72		68	88	100		**<0.001**
Age group (years)									
10–13	56	76	88	**<0.001[b]**	80	92	100	**<0.001[b]**	**<0.001**
14–16	32	48	68		66	84	96		**<0.001**
17–20	28	40	60		64	80	92		**<0.001**
Extra-school physical activity									
Yes	36	56	76	**0.002[a]**	68	88	100	0.074[a]	**<0.001**
No	32	52	72		68	88	96		**<0.001**
FAL									
High	32	52	72	**0.003[b]**	68	88	100	0.585[b]	**<0.001**
Medium/Low	36	56	76		68	88	100		**<0.001**
BMI									
Overweight/Obese	32	48	72	**<0.001[b]**	72	86	100	**<0.001[b]**	**<0.001**
Normal	32	52	72		68	84	100		**<0.001**
Underweight	40	64	84		76	92	100		**<0.001**
SMOKERS[f]									
Yes	24	36	52	**<0.001[a]**	48	72	88	**<0.001[a]**	**<0.001**
No	40	64	80		76	92	100		**<0.001**
NEVER SMOKER[g]									
Yes	44	68	84	**<0.001[a]**	80	92	100	**<0.001[a]**	**<0.001**
No	28	40	60		60	80	92		**<0.001**
I believe that tobacco damage my health									
Yes	36	56	76	**<0.001[b]**	72	92	100	**<0.001[b]**	**<0.001**
Maybe yes	32	44	64		59	80	92		**<0.001**
No	12	24	62		0	36	72		0.091
Both parent smokers									
Yes	32	52	72	0.053[a]	64	84	92	**0.003[a]**	**<0.001**
No	36	56	76		72	88	100		**<0.001**
Best friend and/or boy/girl-friend smoker									
At least one	28	40	60	**<0.001[a]**	56	80	92	**<0.001[a]**	**<0.001**
None	40	64	80		76	92	100		**<0.001**

[a]Mann–Whitney's test.
[b]Kruskal–Wallis's test.
[c]ALII for textual warnings.
[d]ALII for pictorial warnings.
[e]Wilcoxon's test for paired samples.
[f]The group "SMOKERS": "yes" includes "daily + intermittent"; "no" includes "never smokers + ex."
[g]The group "NEVER SMOKERS": "yes" includes only "never smokers"; "no" includes "ex + intermittent + daily."
Bold: p < 0.05.

Table 3. The Multivariate Linear Regression models for the ALII scores.

Covariates	ALII-T β[a]	ALII-T p	ALII-P β[a]	ALII-P p
Gender				
Male	−0.03	0.116	−0.07	**0.002**
Female[b]	−		−	
Age (years)				
<14	0.04	**<0.001**	0.09	**0.001**
14–16	0.27	**<0.001**	−0.04	0.126
>16[b]	−		−	
Extra-school physical activity				
Yes	0.03	0.160	0.02	0.445
No[b]	−		−	
FAL				
Medium/Low	0.08	**<0.001**	0.02	0.405
High[b]	−		−	
BMI				
Overweight/Obese	0.02	0.437	0.05	**0.012**
Normal	−0.04	0.075	−0.03	0.329
Underweight[b]	−		−	
Smoking habits				
Who have tried or EX	0.16	**<0.001**	0.25	**<0.001**
NEVER smoker	0.35	**<0.001**	0.33	**<0.001**
SMOKER (Daily/intermittent)[b]	−		−	
I believe that tobacco damages my health				
Yes	0.23	**0.001**	0.59	**<0.001**
Maybe yes	0.16	**0.019**	0.48	**<0.001**
No[b]	−		−	
Both parents smokers				
Yes	−0.2	0.376	−0.02	0.327
No[b]	−		−	
Best friend and/or boy/girlfriend smoker				
At least one	−0.05	0.050	−0.08	**0.005**
None[b]	−		−	
R^2	0.277		0.205	

[a]Standardized.
[b]Reference group.
Bold: $p < 0.05$.

can be more effective than textual warnings only (Hammond et al., 2012). Only adolescents who thought smoking was not harmful reported that the impact for textual and pictorial advertisements was indifferent. This is in line with the first phase of the trans-theoretical model: individuals in the phase of pre-contemplation. In fact, this is the stage where people do not think about changing their behavior or beliefs (i.e., to stop smoking in the near future). People belonging to this group tended to avoid reading, talking, or thinking about their beliefs and habits. Hence, they can be classified as resistant (Siahpush et al., 2006). In this case tools, policies or advertisements would not work well: the pre-contemplation subjects are not likely to be receptive to any kind of messages about the health benefits of quitting smoking.

According to the literature the graphical approach has the same impact across the different SES groups. Whereas the textual advertisement shows a significant lower effect in the medium-low SES groups (Cantrell et al., 2013). In the present study the ALII scores are consistent with these considerations. In particular, this finding indicates that the visual communication can be more powerful than verbal or textual communication, and that it has a direct route to long-term memory. It is an important contribution to reducing health inequalities and underlines that pictorial health warnings on tobacco packages can be used to control tobacco consumption and can reach people from all SES (Hammond, 2011; Hammond et al., 2012).

Another important point is that about one student out of almost seven (15% of the sample) stated that they were not sure whether tobacco is harmful or not. A similar finding was shown by Backhaus et al. (2017) who demonstrated that only 4.3% of the adolescents aged between 14 and 16 years declared that tobacco smoking is

harmful and 20% considered it to be harmful but did not care much about the effects. Moreover, the authors observed that the agreement on the harmfulness of smoking was higher among non-smoking students (Backhaus et al., 2017). It represents a valuable finding and constitutes in itself a serious questioning on the quality and reach of public health messages.

The results also indicate that there is a different impact of tobacco warnings in case of smoker's peers' influence. Peer smoking increase the likelihood of smoking initiation and reduces the risk perceptions among adolescent (Gilman et al., 2009; Voorhees et al., 2011). The findings presented an increase in the impact of graphical labels among females and in overweight subjects. Studies with young people and tobacco advertisements reported not evident gender difference except for a limited set of the warnings: Vardavas et al. found that teenager girls more than boys judged the pictorial warnings concerning themes on pregnancy, harms for baby and protection of the children more effective in preventing smoking (Vardavas et al., 2009).

Furthermore, there is a possible connection between body weight perception and smoking status (Camp et al., 1993; Charlton, 1984). As Boles et al. indicate in their study on adolescents, 15% of the current smokers adhered to the belief that cigarettes helped the weight control (Boles & Johnson, 2001), while in the textual warnings this connection did not produce differences. These results were consistent with the literature (Lundborg, 2006).

The present study reported the first application of the ALII. It is, also, the first standardized measurement of the impact of the tobacco products labels that compares the textual and pictorial style in an Italian adolescent sample. The scores obtained from the application to the ALII were in line with the literature.

Limitations of this study

This study has limitations that should be noted. The first one includes the different exposure to the two types of warnings. The pictorial warnings were shown for the first time to the participant, who had never seen this types of warning before

(pre-policy): the ALII-P score was computed considering the first impression. On the contrary, the ALII-T was based on the memory of the textual advertisement. Secondly, data collected was based on a self-report (i.e., self-reported data on smoking habits and SES). Consequently, response bias cannot be excluded. Thirdly, the participation rate, with 68% can be considered quite low particularly for an on-the-spot survey. Possible factors that can explain such modest rate might be related to the introduction to the questionnaire. Fourth, the importance of adolescents' opinions should have been more emphasized and so as the fact that their answers would be taken into serious account for future actions. In the future, in addition to self-reported questionnaires, a face-to-face interview would be preferable.

Moreover, the extra-school physical activity data were collected asking whether the student practiced sports. It is important to note that neither intensity nor time spent were included in the questionnaire.

Both schools and classes were not randomly selected and the majority of the schools involved were classic, artistic or scientific lyceums. Hence, selections bias might have influenced the findings and the study sample may not be sufficiently representative of the entire population, although the gender distribution founded (two third was female), is according to the ISTAT data of the Italian students: the female proportion of the lyceum students ranged between 2% to 68% (ISTAT, 2017).

Lastly, the goodness of fit of both models was quite low. Probably the predictors considered represent just a panel of the factors involved in the causality relationship of the impact of advertisement. Other aspects such as hobbies, happiness, assertive ability, family stability should be included in the analysis or the same characteristics considered differently collected.

Conclusions

In conclusion, this study showed that pictorial warnings on tobacco products are effective including improved memory about the harmful effects of smoking. Pictorial health messages that evoke fear may negatively influence the decision

to initiate tobacco smoking by adolescents. Continued research needed to assess the impact of pictorial warnings on young people and to estimate the effect of warnings to reduce tobacco initiation among young people.

Ethical approval

Received from Ethics Committees of the Teaching Hospital Umberto I, Sapienza University of Rome (Prot.460/14).

Authors' contributions

AM, GLT conceived the study and drafted the manuscript. AM and FG performed the measurements. AM, FG, AF, SP, MFi, MFe, EL, EDV, CL, GB collected the data. AM and VC performed the analysis. IB and GLT critically revised the manuscript. AM wrote the manuscript in consultation with PV and GLT.

Disclosure statement

No potential conflict of interest was reported by the author(s).

ORCID

Alice Mannocci http://orcid.org/0000-0002-8527-6940
Insa Backhaus http://orcid.org/0000-0002-5638-9057
Chiara Lorini http://orcid.org/0000-0003-3170-1857
Guglielmo Bonaccorsi http://orcid.org/0000-0002-5171-4308
Paolo Villari http://orcid.org/0000-0002-3139-0668
Giuseppe La Torre http://orcid.org/0000-0002-1233-2040

References

Backhaus, I., D'Egidio, V., Grassucci, D., Gelardini, M., Ardizzone, C., & La Torre, G. (2017). Link between perceived smoking behaviour at school and students smoking status: A large survey among Italian adolescents. *Public Health*, *151*, 169–176. https://doi.org/10.1016/j.puhe.2017.07.004

Boles, S. M., & Johnson, P. B. (2001). Gender, weight concerns, and adolescent smoking. *Journal of Addictive Diseases*, *20*(2), 5–14. https://doi.org/10.1300/J069v20n02_02

Boyce, W., Torsheim, T., Currie, C., & Zambon, A. (2006). The family affluence scale as a measure of national wealth: Validation of an adolescent self-report measure. *Social Indicators Research*, *78*(3), 473–487. https://doi.org/10.1007/s11205-005-1607-6

Camp, D. E., Klesges, R. C., & Relyea, G. (1993). The relationship between body weight concerns and adolescent smoking. *Health Psychology*, *12*(1), 24–32. https://doi.org/10.1037/0278-6133.12.1.24

Canadian Cancer Society (2018). *Cigarette package health warnings: International status report*. https://www.tobaccofreekids.org/assets/global/pdfs/en/WL_status_report_en.pdf

Cantrell, J., Vallone, D. M., Thrasher, J. F., Nagler, R. H., Feirman, S. P., Muenz, L. R., He, D. Y., & Viswanath, K. (2013). Impact of tobacco-related health warning labels across socioeconomic, race and ethnic groups: Results from a randomized web-based experiment. *PLoS One.*, *8*(1), e52206. https://doi.org/10.1371/journal.pone.0052206

Charlton, A. (1984). Smoking and weight control in teenagers. *Public Health*, *98*(5), 277–281. https://doi.org/10.1016/s0033-3506(84)80003-7

Currie, C. E., Elton, R. A., Todd, J., & Platt, S. (1997). Indicators of socioeconomic status for adolescents: The WHO Health Behaviour in School-aged Children Survey. *Health Education Research*, *12*(3), 385–397. https://doi.org/10.1093/her/12.3.385

Currie, C., Molcho, M., Boyce, W., Holstein, B., Torsheim, T., & Richter, M. (2008). Researching health inequalities in adolescents: The development of the Health Behaviour in School-Aged Children (HBSC) family affluence scale. *Social Science & Medicine (1982)*, *66*(6), 1429–1436. https://doi.org/10.1016/j.socscimed.2007.11.024

de Lacy, E., Fletcher, A., Hewitt, G., Murphy, S., & Moore, G. (2017). Cross-sectional study examining the

prevalence, correlates and sequencing of electronic cigarette and tobacco use among 11-16-year olds in schools in Wales. *BMJ Open*, *7*(2), e012784. https://doi.org/10.1136/bmjopen-2016-012784

Dunlop, S., Perez, D., Dessaix, A., & Currow, D. (2017). Australia's plain tobacco packs: Anticipated and actual responses among adolescents and young adults 2010-2013. *Tobacco Control*, *26*(6), 617–626. https://doi.org/10.1136/tobaccocontrol-2016-053166

Gilman, S. E., Rende, R., Boergers, J., Abrams, D. B., Buka, S. L., Clark, M. A., Colby, S. M., Hitsman, B., Kazura, A. N., Lipsitt, L. P., Lloyd-Richardson, E. E., Rogers, M. L., Stanton, C. A., Stroud, L. R., & Niaura, R. S. (2009). Parental smoking and adolescent smoking initiation: An intergenerational perspective on tobacco control. *Pediatrics*, *123*(2), e274–e281. https://doi.org/10.1542/peds.2008-2251

Guerra, F., Mannocci, A., Colamesta, V., De Luca, G., Fiore, M., Firenze, A., Ferrara, M., Langiano, E., De Vito, E., Bonaccorsi, G., & La Torre, G. (2017). Reliability of adapted version of Italian Label tobacco Impact Index for the adolescent: ALII. *La Clinica Terapeutica*, *168*(4), e258–e261.

Hammond, D. (2011). Health warning messages on tobacco products: A review. *Tobacco Control*, *20*(5), 327–337. https://doi.org/10.1136/tc.2010.037630

Hammond, D., Fong, G. T., McNeill, A., Borland, R., & Cummings, K. M. (2006). Effectiveness of cigarette warning labels in informing smokers about the risks of smoking: Findings from the International Tobacco Control (ITC) Four Country Survey. *Tobacco Control*, *15 Suppl 3*, iii19–25. https://doi.org/10.1136/tc.2005.012294

Hammond, D., Thrasher, J., Reid, J. L., Driezen, P., Boudreau, C., & Santillán, E. A. (2012). Perceived effectiveness of pictorial health warnings among Mexican youth and adults: A population-level intervention with potential to reduce tobacco-related inequities. *Cancer Causes & Control: CCC*, *23 Suppl 1*, 57–67. https://doi.org/10.1007/s10552-012-9902-4

Hitchman, S. C., Mons, U., Nagelhout, G. E., Guignard, R., Mcneill, A., Willemsen, M. C., Driezen, P., Wilquin, J.-L., Beck, F., Du-Roscöat, E., Pötschke-Langer, M., Hammond, D., & Fong, G. T. (2012). Effectiveness of the European Union text-only cigarette health warnings: Findings from four countries. *European Journal of Public Health*, *22*(5), 693–699. https://doi.org/10.1093/eurpub/ckr099

ISTAT. (2017). *Studenti e scuole dell'Istruzione primaria e secondaria in Italia. Differenze strutturali tra scuole statali e paritarie.* https://www.istat.it/it/files/2017/04/Studenti-e-scuole.pdf

La Torre, G. (2013). *Smoking prevention and cessation.* Springer.

Li, J., & Grigg, M. (2009). New Zealand: New graphic warnings encourage registrations with the quitline. *Tobacco Control*, *18*(1), 72. https://doi.org/10.1136/tc.2008.027649

Lundborg. (2006). *Smoking, information sources, and risk perceptions – New results on Swedish data.* https://arno.uvt.nl/show.cgi?fid=80449

Macy, J. T., Chassin, L., Presson, C. C., & Yeung, E. (2016). Exposure to graphic warning labels on cigarette packages: Effects on implicit and explicit attitudes towards smoking among young adults. *Psychology & Health*, *31*(3), 349–363. https://doi.org/10.1080/08870446.2015.1104309

Mannocci, A., Colamesta, V., Conti, V., Cattaruzza, M. S., Paone, G., Cafolla, M., Saulle, R., Bulzomì, V., Antici, D., Cuccurullo, P., Boccia, A., La Torre, G., & Terzano, C. (2014). Impact of cigarette packages warning labels in relation to tobacco-smoking dependence and motivation to quit. *Biomed Research International*, *2014*(2), 1–107. https://doi.org/10.1155/2014/723035

Mannocci, A., Colamesta, V., & La Torre, G. (2016). Labels Impact Index (LII): An Italian version of a tool to assess the impact of advertisement on tobacco products. *Senses and Sciences*, *3*, 193–196. https://doi.org/10.14616/sands-2016-2-193196

Mannocci, A., Colamesta, V., Mipatrini, D., Boccia, A., Terzano, C., & La Torre, G. (2013). How would plain packaging and pictorial warning impact on smoking reduction, cessation and initiation? *Epidemiologia e Prevenzione*, *37*(6), 400–405. [].

Miller, C. L., Quester, P. G., Hill, D. J., & Hiller, J. E. (2011). Smokers' recall of Australian graphic cigarette packet warnings & awareness of associated health effects, 2005-2008 . *BMC Public Health*, *11*, 238. https://doi.org/10.1186/1471-2458-11-238

Noar, S. M., Hall, M. G., Francis, D. B., Ribisl, K. M., Pepper, J. K., & Brewer, N. T. (2016). Pictorial cigarette pack warnings: A meta-analysis of experimental studies. *Tobacco Control*, *25*(3), 341–354. https://doi.org/10.1136/tobaccocontrol-2014-051978

Peterson, E. B., Thomsen, S., Lindsay, G., & John, K. (2010). Adolescents' attention to traditional and graphic tobacco warning labels: An eye-tracking approach. *J Drug Educ*, *40*(3), 227–244. https://doi.org/10.2190/DE.40.3.b

Rubinstein, M. L., Rait, M. A., Sen, S., & Shiffman, S. (2014). Characteristics of adolescent intermittent and daily smokers. *Addictive Behaviors*, *39*(9), 1337–1341. https://doi.org/10.1016/j.addbeh.2014.04.021

Schane, R. E., Ling, P. M., & Glantz, S. A. (2010). Health effects of light and intermittent smoking: A review. *Circulation*, *121*(13), 1518–1522. https://doi.org/10.1161/CIRCULATIONAHA.109.904235

Siahpush, M., McNeill, A., Hammond, D., & Fong, G. T. (2006). Socioeconomic and country variations in knowledge of health risks of tobacco smoking and toxic constituents of smoke: Results from the 2002 International Tobacco Control (ITC) Four Country Survey. *Tobacco Control*, *15 Suppl 3*, iii65–70. https://doi.org/10.1136/tc.2005.013276

Vardavas, C. I., Connolly, G., Karamanolis, K., & Kafatos, A. (2009). Adolescents perceived effectiveness of the proposed European graphic tobacco warning labels. *The*

European Journal of Public Health, *19*(2), 212–217. https://doi.org/10.1093/eurpub/ckp015

von Elm, E., Altman, D. G., Egger, M., Pocock, S. J., Gøtzsche, P. C., Vandenbroucke, J. P. & STROBE Initiative. (2008). The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement: Guidelines for reporting observational studies. *Journal of Clinical Epidemiology*, *61*(4), 344–349. https://doi.org/10.1016/j.jclinepi.2007.11.008

Voorhees, C. C., Ye, C., Carter-Pokras, O., MacPherson, L., Kanamori, M., Zhang, G., Chen, L., & Fiedler, R. (2011). Peers, tobacco advertising, and secondhand smoke exposure influences smoking initiation in diverse adolescents. *American Journal of Health Promotion: Ajhp*, *25*(3), e1–11. https://doi.org/10.4278/ajhp.090604-QUAN-180

WHO. (2008). *Inequalities in young people's health: Health Behavior in School-Aged Children (HBSC)* (International report from the 2006 survey). http://www.euro.who.int/__data/assets/pdf_file/0005/53852/E91416.pdf

WHO. (2011). *WHO report on the global tobacco epidemic, 2011.Warning about the dangers of tobacco.* http://apps.who.int/iris/bitstream/10665/44616/1/9789240687813_eng.pdf

Wilson, N. (2011). Smokers respond to pictorial health warnings. *Science (New York, N.Y.)*, *333*(6044), 822. https://doi.org/10.1126/science.333.6044.822-a