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Astrid Juhl Andersen, Murielle Mary-Krause, Emmanuel Wiernick, Marcel Goldberg, Marie Zins, et al.. Intergenerational Social Mobility and Smoking Trajectories in Middle-Aged Adults – The French CONSTANCES Cohort Study (2012–2020). *Substance Use and Misuse*, 2025, pp.1 - 9. <10.1080/10826084.2025.2577279>. <hal-05333794>

HAL Id: hal-05333794

<https://hal.science/hal-05333794v1>

Submitted on 27 Oct 2025

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To cite this article: Astrid Juhl Andersen, Murielle Mary-Krause, Emmanuel Wiernick, Marcel Goldberg, Marie Zins & Maria Melchior (23 Oct 2025): Intergenerational Social Mobility and Smoking Trajectories in Middle-Aged Adults – The French CONSTANCES Cohort Study (2012–2020), Substance Use & Misuse, DOI: [10.1080/10826084.2025.2577279](https://doi.org/10.1080/10826084.2025.2577279)

To link to this article: <https://doi.org/10.1080/10826084.2025.2577279>



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Intergenerational Social Mobility and Smoking Trajectories in Middle-Aged Adults – The French CONSTANCES Cohort Study (2012–2020)

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ABSTRACT

Introduction: Tobacco smoking remains a public health challenge, particularly among low-income populations. Beyond individuals' own socioeconomic position, their family background and the type of social trajectory they experienced, could also be related to smoking behaviors as tobacco use starts generally in adolescence. In the present study, we tested the association between intergenerational social mobility and individuals' smoking trajectories up to midlife.

Methods: Using data from the CONSTANCES cohort, a French longitudinal population-based study, we applied Group-Based Trajectory Modeling to analyze participants' smoking patterns from 2012 to 2020 among 201,731 participants. These groups were combined with baseline lifetime smoking status to differentiate between never smokers and former smokers. Participants were classified into four groups based on information about their own and their parents' occupational status: persistently high socioeconomic status (SES), upward mobility, downward mobility, and persistently low SES. Multinomial logistic regression models were used to study the relationship between social mobility patterns and smoking trajectories.

Results: Three groups of participants were identified: nonsmokers (75.4%), former smokers (9.3%), and long-term smokers (15.3%). Upward mobility was associated with decreased odds of long-term smoking, while downward mobility and persistently low SES was associated with increased odds of long-term smoking. Both upward social mobility and persistently low SES were associated with lower odds of quitting smoking compared to persistently high SES.

Conclusions: Long-term smoking behaviors are significantly associated with social mobility patterns from childhood to adulthood. This highlights the necessity to consider early life influences in smoking cessation programs.

KEYWORDS



Tobacco smoking; intergenerational trajectories; socioeconomic position; epidemiological cohort; CONSTANCES


Introduction

Tobacco smoking has been established as a leading cause of cancer and other preventable diseases, the prevalence of smoking remains alarmingly high, presenting a significant public health concern (Santé Publique France, 2021). Since the mid-twentieth century, smoking rates have decreased across industrialized countries, especially among the most educated groups of the population, leading to a significant educational gradient in tobacco consumption (Phelan et al., 2010). Currently, in high-income countries, smoking is disproportionately prevalent in low-income communities, usually due to a combination of factors including higher rates of initiation and lower rates of cessation (Thirlway, 2020). Previous research has found that the mediating contribution

of smoking to the socioeconomic gradient of all-cause mortality ranges from 19% to 32% (Petrovic et al., 2018), underscoring the critical role of smoking in explaining health disparities. In France, smoking rates are high compared to other OECD countries (OECD, 2021), and the gap in absolute differences in smoking prevalence between individuals with the lowest versus the highest education levels has increased from 1.5 percentage points (pp) to 18.5 pp between 2000 and 2020 (Pasquereau et al., 2021).

Research shows that childhood, adolescence, and young adulthood are crucial periods in terms of health inequalities (Pearce et al., 2019; Viner et al., 2015). Harmful health behaviors are more prevalent among young adults who grow up in socially disadvantaged settings (Gagné et al., 2020), due to multiple mechanisms such as high levels of exposure

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 Supplemental data for this article can be accessed online at <https://doi.org/10.1080/10826084.2025.2577279>.

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to stressful life events, parental smoking, peer smoking, and academic or school difficulties, which are associated with risk-taking behaviors such as tobacco use (Melchior et al., 2007). Beyond socioeconomic circumstances at a particular point of time in life, intergenerational social mobility, that is the trajectory between parental and own socioeconomic status, could influence smoking behaviors (OECD, 2010). Past studies have found that socioeconomic status (SES) over the life course is associated with smoking status in mid-adulthood (Avila et al., 2022; Tian et al., 2019), and family income trajectory during childhood is associated with adolescent cigarette smoking (Poonawalla et al., 2014). Further, there is evidence that grandparents' low SES has an effect on grandchildren's smoking patterns, which is mediated through their parents' SEP¹⁵. A German study has shown that young people's risk of smoking is influenced by their own level of education rather than their parents', and that upward social mobility may protect against smoking (Kuntz & Lampert, 2013). The present study aims to investigate the relationship between intergenerational social mobility and smoking trajectories in adulthood, which has not to date been established.

Methods

Study population

CONSTANCES is a population-based cohort study of more than 200,000 volunteers randomly recruited from 2012 to 2020 in France. The CONSTANCES cohort has been described in detail elsewhere (Goldberg et al., 2017); briefly, participants were aged 18 to 69 years at inclusion and were invited to complete self-administered questionnaires on health-related behaviors, occupational conditions, and socio-demographic factors. Participants receive an annual self-administered follow-up questionnaire by mail or email. CONSTANCES has obtained ethical and regulatory approval from France' National Data Protection Authority and the Institutional Review Board of the National Institute for Medical Research. All study participants signed an informed consent.

Outcome: Smoking status trajectories

Participants' smoking status was self-reported at inclusion in CONSTANCES, with participants providing information on their former smoking status, current smoking status, and age at smoking initiation and cessation. Annually, participants were asked about their current smoking status (yes, at least once per day; no or occasionally), with an average of 3.5 data points per participant (standard error (SE)=2.1). For participants enrolled after 2012, we used information on age at smoking initiation and cessation to estimate smoking status from 2012 onwards. This resulted in an average of 7.2 data points (SE = 2.3) assessing smoking status per participant which were used to assess smoking trajectories classified as follows: (1) Nonsmokers, (2) Former smokers, (3) Quitters, and (4) Long-term smokers.

Exposure: ISM

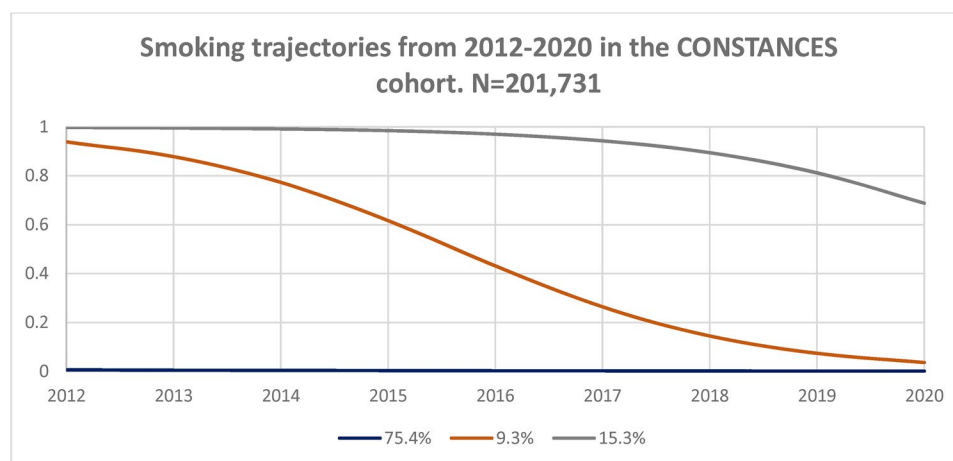
Previous research based on the CONSTANCES study showed an association between intergenerational social mobility and depression (Melchior et al., 2018). In this study, intergenerational social mobility was determined based on participants': (1) childhood SES, assessed by maternal and paternal occupational grade during adolescence ("What was your mother's/father's socio-professional group during your adolescence?"), and (2) adult SES, assessed by occupational grade at the time of inclusion in the CONSTANCES cohort. Both measures were determined using the standard occupational grade classification used in France, which categorized individuals into three occupational-grade groups: (1) high (including executive, higher intellectual profession, e.g., engineer, physician), (2) intermediate (including farmer, craftsman, shopkeeper, business owner, intermediate profession, e.g., school teacher, nurse), and (3) low (clerk or manual worker, e.g., office or commercial employee, childminder). Four intergenerational social mobility groups were created by combining childhood and adult SES (Supplementary Table S1): (1) persistently intermediate/high SES, (2) upward mobility (from low to intermediate or high), (3) downward mobility (from high or intermediate to low), and (4) persistently low SES. If information on either childhood or adult SES was missing, participants were excluded from the statistical analyses.

Covariates

To study the relationship between participants' intergenerational social mobility and their smoking trajectory, we controlled for several self-reported covariates collected at study inclusion: sex (male vs. female); age (1) less than 30 years, (2) 30 to 44 years, (3) 45 to 59 years, (4) 60 years or more); migration status (determined by combining participants' citizenship (French nationality by birth, naturalized French, or foreign nationality) and their parents' place of birth (France, Europe, North and Sub-Saharan Africa, Asia and Other), yielding three categories: (1) French by birth, (2) Descendants of immigrants (French nationality at birth and at least one parent born outside France), and (3) Immigrants (naturalized French or foreign nationality and at least one parent born outside France)); marital status: (1) married or in a civil partnership, (2) divorced, separated, or widowed, (3) never married); employment status: (1) employed, (2) unemployed (unemployed, in training, no job for health reasons, no professional activity), (3) retired; parental history of psychiatric disorder or suicide (yes vs. no); chronic health characteristics (endocrine disorders, cancer, cardiovascular disorders, respiratory diseases) (yes vs. no).

Statistical analyses

To assess the association between participants' intergenerational social mobility and participants' smoking trajectory, we proceeded as follows. First, participants' smoking trajectories from 2012 to 2020 were determined using Group-Based Trajectory Modeling (GBTM), including all participants with



Red line: Former smokers, Blue line: Non-smokers, Grey line: Long-term smokers

Figure 1. Smoking trajectories among CONSTANCES cohort participants (France) between 2012–2020: Group based trajectory modeling. $N=201,731$. Red line: Former smokers, Blue line: Nonsmokers, Grey line: Long-term smokers.

at least one available measure of smoking status. GBTM is a semiparametric finite mixture model for longitudinal data, used to identify distinct subgroups or “trajectories” of individuals who share similar patterns regarding a particular characteristic over time (Nguefack et al., 2020). In this study, GBTM was applied to identify smoking trajectories among participants with at least one measure of smoking during the data collection period ($N=201,731$). Trajectory models were estimated using a logit link, with the Bayesian Information Criteria (BIC) and Akaike Information Criteria (AIC), entropy, and average posterior probabilities (APP higher than 0.7) of trajectory membership to identify the best fitting model with the least number of trajectories (Salonen et al., 2018). The odds of correct classification (OCC) were calculated to ensure high accuracy of attribution to the group.

Second, bivariate and multivariate multinomial logistic regression models were used to estimate associations between intergenerational social mobility patterns and smoking trajectories. Additionally, we tested interactions between intergenerational social mobility and a) age and b) sex regarding smoking trajectories. We excluded participants with missing information on smoking status, childhood and adult SES, yielding a total study population of $N=163,664$ (Supplementary Figure S1: STROBE study flow diagram for exclusion details). Missing data on covariates (5.6%) were imputed using multiple imputations with fully conditional specification (10 datasets) (Bartlett et al., 2015). All statistical analyses were conducted in SAS 9.4 using proc traj, proc mi, proc logistic, and proc mianalyze (SAS, 2022).

Results

Smoking trajectories

Among CONSTANCES study participants with information on smoking status ($N=201,731$), three smoking trajectory groups were identified (Figure 1): 75.4% were nonsmokers throughout the study period, 9.3% quit smoking during the study period, and 15.3% were smoked throughout the study period.

Characteristics of the study participants

Characteristics of study participants are shown in Table 1. Women accounted for 53% of study participants; average age was 47 years. Almost half of study participants (47%) experienced persistently intermediate/high SES, 17% upward mobility, 17% downward mobility, and 18% persistently low SES. The majority of participants were French (81%), 10% were descendants of immigrants, and 9% were immigrants. Married individuals accounted for 61% of study participants, 12% were divorced, separated, or widowed, and 27% were unmarried. Most study participants were employed (71%), 10% were unemployed, and 19% were retired. 3% had a parental history of psychiatric disorder, 10% had an endocrine disease, 5% had cancer, 16% had cardiovascular disease, and 14% had respiratory disease.

Intergenerational social mobility and smoking trajectories

In bivariate multinomial logistic regression models, we found an association between intergenerational social mobility and the likelihood of either quitting smoking or being a long-time smoker (Table 2). Participants experiencing upward mobility had decreased odds of maintaining a long-term smoking pattern compared to those with persistently intermediate/high SES (odds ratio (OR)=0.88, 95% confidence interval (CI)=[0.82;0.94]). Participants who experienced either downward social mobility or persistently low SEP had an elevated risk of long-term smoking (OR = 1.50, 95%CI=[1.44;1.56] and OR = 1.59, 95%CI=[1.53;1.65], respectively) compared to those with persistently intermediate/high SES. After adjusting for potential confounders, this association remained unchanged and statistically significant (adjusted odds ratio (aOR)=0.91, 95%CI=[0.87;0.95] for upward social mobility, aOR = 1.43 [1.38;1.49] for downward social mobility, and aOR = 1.55, 95%CI=[1.49;1.61] for persistently low SES, as compared to participants with persistently intermediate/high SES). Both upward social mobility and persistently low SES were associated with decreased odds of quitting smoking

Table 1. Smoking trajectories, social mobility, and sociodemographic and health characteristics of CONSTANCES participants studied between 2012–2020 (n, %).

| | Total (n=163 664) |
|---|-------------------|
| Smoking trajectory | |
| Nonsmokers | 78 162 (47.8%) |
| Former smoker | 46 021 (28.1%) |
| Quitters | 14 360 (8.8%) |
| Long-term smokers | 25 121 (15.3%) |
| Social mobility | |
| Persistently intermediate and high SES | 77 468 (47.3%) |
| Upward mobility | 28 276 (17.3%) |
| Downward mobility | 27 964 (17.1%) |
| Persistently low SES | 29 956 (18.3%) |
| Sex | |
| Male | 76 246 (46.6%) |
| Female | 87 418 (53.4%) |
| Age | |
| 18–29 | 16 976 (10.4%) |
| 30–44 | 55 163 (33.7%) |
| 45–59 | 53 993 (33.0%) |
| 60+ | 37 532 (22.9%) |
| Migrant status | |
| French | 132 527 (81.0%) |
| Descendants of immigrants | 16 792 (10.3%) |
| Immigrants | 14 345 (8.8%) |
| Marital status | |
| Married or civil partnership | 100 155 (61.2%) |
| Divorced, separated or widower | 19 931 (12.2%) |
| Never married | 43 578 (26.6%) |
| Employment status | |
| Employed | 115 793 (70.8%) |
| Unemployed | 17 144 (10.4%) |
| Retired | 30 727 (18.8%) |
| Parental history of psychiatric disorder | |
| No | 158 732 (97.0%) |
| Yes | 4 932 (3.0%) |
| Chronic health characteristics at time of data collection | |
| Endocrine disease | |
| No | 147 005 (89.8%) |
| Yes | 16 659 (10.2%) |
| Cancer | |
| No | 155 433 (95.0%) |
| Yes | 8 231 (5.0%) |
| Cardiovascular disease | |
| No | 137 495 (84.0%) |
| Yes | 26 169 (16.0%) |
| Respiratory disease | |
| No | 140 285 (85.7%) |
| Yes | 23 379 (14.3%) |

*Calculated from the declared household income divided by the square root of the size of the household, and then dichotomized around the median.

during the study period (aOR = 0.81, 95%CI=[0.76;0.85] and aOR = 0.89, 95%CI=[0.85;0.94], respectively). Upward social mobility was found to be associated with lower odds of being a former smoker (aOR = 0.95, 95%CI=[0.92;0.98]), while persistently low social mobility was associated with a slightly higher likelihood of being a former smoker (aOR = 1.04, 95%CI=[1.00;1.07]).

Stratified analyses

In additional statistical analyses, we found interactions between participants' intergenerational social mobility and age and (Wald test p-values, respectively; <0.0001). Consequently, we stratified subsequent statistical analyses (Table 3). We found similar associations between intergenerational social mobility and long-term smoking patterns in

men and women (aOR ranging respectively between 0.92 to 1.84 and between 0.89 to 1.33), but the association between intergenerational social mobility and nonsmoking appeared stronger in men than in women. In terms of age, we found stronger associations between upward social mobility and long-term smoking among youngest participants. In the oldest age group (>=60 years), only downward social mobility was associated with a lower likelihood of long-term smoking.

Discussion

General findings

Studying participants of the CONSTANCES cohort, a large national study based in France, we found an association between intergenerational social mobility and smoking trajectories. Individuals who experienced persistently low SES and downward social mobility were more likely to be long-time smokers than those who experienced persistently intermediate/high SES. Being upwardly mobile was associated with lower odds of quitting smoking or being a long-time smoker, compared to participants who experienced intermediate/high SES. In stratified analyses, we identified some sex and age differences. This finding may reflect the fact that fewer participants experiencing upward social mobility were smokers in the first place, which can explain why the odds of quitting appear lower in this group. Our findings indicate that beyond adult SEP, long-term smoking patterns are influenced by social mobility patterns since childhood. This highlights the importance of early life influences on smoking patterns, which should be taken into consideration in programs aiming to encourage smoking cessation.

Our findings suggest that adults moving socially downward or upward tend to adopt the behaviors of their destination group. These results are consistent with previous studies conducted among adolescents (Bowes et al., 2013; Doku et al., 2020; Kuntz & Lampert, 2013). As previous researchers (Kuntz & Lampert, 2013), we found lower odds of long-term smoking among individuals who are upwardly socially mobile, compared to those with persistently intermediate/high SES, although our study focused on adults rather than adolescents. Moreover, in age-stratified statistical analyses, we found that this association was stronger among younger participants. Similarly, participants with a lower occupational grade than their parents were more likely to smoke than those with persistently intermediate/high SES, suggesting that while smoking may be stigmatized in socially advantaged groups, it is often the norm in disadvantaged communities (Hiscock et al., 2012; Hitchman et al., 2014). Low adult SES, regardless of childhood SES, may affect smoking cessation over time, as lower income, occupation, and employment status in adulthood are found to be associated with reduced opportunities to access smoking cessation treatment and cessation counselling (Avila et al., 2022; Hiscock et al., 2011).

Table 2. Association between intergenerational socioeconomic mobility and smoking trajectories (2012–2020).

| | Nonsmokers | | | Former smokers | | | Long-term smokers | | | |
|--|-------------------------|----------|-------------------------|-------------------------|----------|-------------------------|-------------------------|----------|-------------------------|--------|
| | Crude | Adjusted | | Crude | Adjusted | | Crude | Adjusted | | |
| | | OR | P-value | | OR | P-value | | OR | P-value | OR |
| Intergenerational social mobility | 1.00 | Ref. | 1.00 | 1.00 | Ref. | 1.00 | 1.00 | Ref. | 1.00 | Ref. |
| Persistently high/intermediate SES | 1.05 [1.02;1.08] | 0.0020 | 0.95 [0.92;0.98] | 0.77 [0.73;0.81] | <.0001 | 0.81 [0.76;0.85] | 0.88 [0.82;0.94] | <.0001 | 0.91 [0.87;0.95] | <.0001 |
| Upward mobility | 0.85 [0.82;0.88] | <.0001 | 1.00 [0.97;1.04] | 1.01 [0.96;1.06] | 0.9899 | 1.00 [0.95;1.05] | 1.50 [1.44;1.56] | <.0001 | 1.43 [1.38;1.49] | <.0001 |
| Downward mobility | 0.99 [0.96;1.02] | 0.5987 | 1.04 [1.00;1.07] | 0.87 [0.83;0.92] | <.0001 | 0.89 [0.85;0.94] | 1.59 [1.53;1.65] | <.0001 | 1.55 [1.49;1.61] | <.0001 |
| Persistently low SES | 1.00 | Ref. | 1.00 | 1.00 | Ref. | 1.00 | 1.00 | Ref. | 1.00 | Ref. |
| Sex | | | | | | | | | | |
| Male | 1.00 | Ref. | 1.00 | 1.00 | Ref. | 1.00 | 1.00 | Ref. | 1.00 | Ref. |
| Female | 0.63 [0.61;0.64] | <.0001 | 0.65 [0.64;0.67] | 0.75 [0.73;0.78] | <.0001 | 0.74 [0.71;0.77] | 0.72 [0.70;0.73] | <.0001 | 0.68 [0.66;0.70] | <.0001 |
| Age | | | | | | | | | | |
| Less than 30 | 1.00 | Ref. | 1.00 | 1.00 | Ref. | 1.00 | 1.00 | Ref. | 1.00 | Ref. |
| 30 to 44 | 3.30 [3.13;3.48] | <.0001 | 3.03 [2.84;3.24] | 1.02 [0.98;1.07] | 0.3125 | 1.21 [1.14;1.28] | 1.04 [1.00;1.08] | 0.0364 | 1.53 [1.45;1.60] | <.0001 |
| 45 to 59 | 5.98 [5.67;6.30] | <.0001 | 5.19 [4.86;5.55] | 0.68 [0.65;0.71] | <.0001 | 0.81 [0.76;0.86] | 0.89 [0.86;0.93] | <.0001 | 1.31 [1.24;1.38] | <.0001 |
| 60 or more | 7.42 [7.04;7.83] | <.0001 | 6.63 [6.13;7.16] | 0.38 [0.35;0.40] | <.0001 | 0.55 [0.49;0.61] | 0.43 [0.40;0.45] | <.0001 | 0.89 [0.82;0.97] | 0.0086 |
| Migration status | | | | | | | | | | |
| French by birth | 1.00 | Ref. | 1.00 | 1.00 | Ref. | 1.00 | 1.00 | Ref. | 1.00 | Ref. |
| Descendants of immigrants | 0.92 [0.89;0.96] | <.0001 | 0.99 [0.95;1.03] | 1.14 [1.07;1.20] | <.0001 | 1.09 [1.03;1.15] | 1.21 [1.15;1.26] | <.0001 | 1.10 [1.05;1.16] | <.0001 |
| Immigrants | | | | | | | | | | |
| Marital status | 0.71 [0.68;0.74] | <.0001 | 0.70 [0.67;0.73] | 0.68 [0.63;0.73] | <.0001 | 0.65 [0.60;0.69] | 0.91 [0.87;0.96] | 0.0004 | 0.79 [0.75;0.83] | <.0001 |
| Married or civil partnership | 1.00 | Ref. | 1.00 | 1.00 | Ref. | 1.00 | 1.00 | Ref. | 1.00 | Ref. |
| Divorced, separated or widower | 1.12 [1.08;1.16] | <.0001 | 1.00 [0.97;1.04] | 1.24 [1.17;1.31] | <.0001 | 1.52 [1.43;1.62] | 1.86 [1.78;1.95] | <.0001 | 2.09 [1.99;2.18] | <.0001 |
| Never married | | | | | | | | | | |
| Employment status | 0.54 [0.52;0.55] | <.0001 | 0.85 [0.83;0.88] | 1.56 [1.50;1.62] | <.0001 | 1.32 [1.26;1.37] | 2.02 [1.96;2.09] | <.0001 | 1.80 [1.74;1.86] | <.0001 |
| Employed | 1.00 | Ref. | 1.00 | 1.00 | Ref. | 1.00 | 1.00 | Ref. | 1.00 | Ref. |
| Unemployed | 0.82 [0.78;0.85] | <.0001 | 1.00 [0.96;1.05] | 1.11 [1.05;1.17] | 0.0003 | 1.13 [1.06;1.20] | 1.53 [1.47;1.60] | <.0001 | 1.38 [1.32;1.45] | <.0001 |
| Retired | 1.80 [1.75;1.85] | <.0001 | 0.96 [0.91;1.01] | 0.43 [0.41;0.46] | 0.0807 | 0.78 [0.70;0.86] | 0.43 [0.41;0.45] | <.0001 | 0.67 [0.62;0.73] | <.0001 |
| Parental psychiatric disorder | | | | | | | | | | |
| No | 1.00 | Ref. | 1.00 | 1.00 | Ref. | 1.00 | 1.00 | Ref. | 1.00 | Ref. |
| Yes | 1.21 [1.13;1.29] | <.0001 | 1.18 [1.10;1.26] | 1.14 [1.02;1.26] | 0.0166 | 1.16 [1.04;1.29] | 1.16 [1.07;1.26] | 0.0057 | 1.18 [1.08;1.28] | 0.0001 |
| Chronic health characteristics | | | | | | | | | | |
| Endocrine | 1.00 | Ref. | 1.00 | 1.00 | Ref. | 1.00 | 1.00 | Ref. | 1.00 | Ref. |
| No | 1.27 [1.23;1.32] | <.0001 | 1.10 [1.06;1.14] | 0.81 [0.76;0.87] | <.0001 | 1.08 [1.01;1.16] | 0.81 [0.77;0.85] | <.0001 | 1.01 [0.95;1.06] | 0.7808 |
| Yes | 1.00 | Ref. | 1.00 | 1.00 | Ref. | 1.00 | 1.00 | Ref. | 1.00 | Ref. |
| Cancer | 1.00 | Ref. | 1.00 | 1.00 | Ref. | 1.00 | 1.00 | Ref. | 1.00 | Ref. |
| No | 1.47 [1.40;1.54] | <.0001 | 1.10 [1.05;1.16] | 0.68 [0.62;0.75] | <.0001 | 0.95 [0.86;1.05] | 0.70 [0.65;0.76] | <.0001 | 0.94 [0.87;1.02] | 0.1129 |
| Yes | 1.00 | Ref. | 1.00 | 1.00 | Ref. | 1.00 | 1.00 | Ref. | 1.00 | Ref. |
| Cardiovascular | 1.65 [1.60;1.70] | <.0001 | 1.14 [1.10;1.18] | 0.71 [0.67;0.76] | <.0001 | 0.98 [0.92;1.04] | 0.76 [0.72;0.79] | <.0001 | 0.96 [0.91;1.00] | 0.0654 |
| No | 1.00 | Ref. | 1.00 | 1.00 | Ref. | 1.00 | 1.00 | Ref. | 1.00 | Ref. |
| Yes | 1.06 [1.02;1.09] | <.0001 | 1.07 [1.03;1.11] | 1.17 [1.11;1.23] | <.0001 | 1.13 [1.08;1.19] | 1.14 [1.10;1.19] | <.0001 | 1.10 [1.06;1.15] | <.0001 |

Bivariate and adjusted multinomial regression models: odds ratios (ORs); N = 163,664. The bold figures are statistically significant.

Table 3. Intergenerational social mobility and smoking trajectories (2012–2020) stratifying by participants' age and sex.

| | Nonsmokers | | Former smokers | | Long-term smokers | |
|--|-------------|--------------------|----------------|--------------------|-------------------|--------------------|
| | OR | 95%CI | OR | 95%CI | OR | 95%CI |
| Multivariate multinomial regression stratified by age ^a | | | | | | |
| <=Age 29 years | | | | | | |
| <i>N</i> = 16 976 | | | | | | |
| Intergenerational social mobility | | | | | | |
| Persistently high/intermediate SES | 1,00 | Ref. | 1,00 | Ref. | 1,00 | Ref. |
| Upward mobility | 0.82 | [0.66;1.01] | 0.73 | [0.61;0.87] | 0.82 | [0.71;0.96] |
| Downward mobility | 1.07 | [0.91;1.25] | 1.26 | [1.12;1.42] | 1.48 | [1.34;1.63] |
| Persistently low SES | 1.16 | [0.98;1.36] | 1.01 | [0.88;1.15] | 1.60 | [1.45;1.78] |
| 30–44 years | | | | | | |
| <i>N</i> = 55 163 | | | | | | |
| Intergenerational social mobility | | | | | | |
| Persistently high/intermediate SES | 1,00 | Ref. | 1,00 | Ref. | 1,00 | Ref. |
| Upward mobility | 0.89 | [0.84;0.95] | 0.77 | [0.72;0.84] | 0.89 | [0.83;0.95] |
| Downward mobility | 1.32 | [1.23;1.41] | 1.19 | [1.10;1.29] | 1.87 | [1.75;1.99] |
| Persistently low SES | 1.22 | [1.15;1.30] | 0.95 | [0.88;1.03] | 1.76 | [1.65;1.87] |
| Ages 45–59 years | | | | | | |
| <i>N</i> = 53 993 | | | | | | |
| Intergenerational social mobility | | | | | | |
| Persistently high/intermediate SES | 1,00 | Ref. | 1,00 | Ref. | 1,00 | Ref. |
| Upward mobility | 0.94 | [0.89;0.99] | 0.81 | [0.73;0.89] | 0.90 | [0.84;0.97] |
| Downward mobility | 1.11 | [1.04;1.17] | 0.94 | [0.85;1.04] | 1.45 | [1.35;1.56] |
| Persistently low SES | 1.15 | [1.09;1.22] | 0.92 | [0.84;1.01] | 1.63 | [1.53;1.74] |
| Ages 60+ years | | | | | | |
| <i>N</i> = 37 532 | | | | | | |
| Intergenerational social mobility | | | | | | |
| Persistently high/intermediate SES | 1,00 | Ref. | 1,00 | Ref. | 1,00 | Ref. |
| Upward mobility | 0.96 | [0.91;1.02] | 0.85 | [0.74;0.97] | 0.97 | [0.87;1.08] |
| Downward mobility | 0.68 | [0.64;0.73] | 0.58 | [0.49;0.69] | 0.84 | [0.74;0.95] |
| Persistently low SES | 0.76 | [0.72;0.81] | 0.70 | [0.60;0.81] | 1.00 | [0.89;1.11] |
| Multivariate multinomial regression stratified by sex ^b | | | | | | |
| Men | | | | | | |
| <i>N</i> = 76 246 | | | | | | |
| Intergenerational social mobility | | | | | | |
| Persistently high/intermediate SES | 1,00 | Ref. | 1,00 | Ref. | 1,00 | Ref. |
| Upward mobility | 0.97 | [0.93;1.02] | 0.79 | [0.74;0.85] | 0.92 | [0.87;0.98] |
| Downward mobility | 1.16 | [1.09;1.22] | 1.04 | [0.96;1.13] | 1.60 | [1.51;1.70] |
| Persistently low SES | 1.30 | [1.24;1.37] | 0.94 | [0.87;1.02] | 1.84 | [1.74;1.95] |
| Women | | | | | | |
| <i>N</i> = 87 418 | | | | | | |
| Intergenerational social mobility | | | | | | |
| Persistently high/intermediate SES | 1,00 | Ref. | 1,00 | Ref. | 1,00 | Ref. |
| Upward mobility | 0.91 | [0.86;0.95] | 0.80 | [0.74;0.86] | 0.89 | [0.84;0.95] |
| Downward mobility | 0.89 | [0.85;0.93] | 0.94 | [0.88;1.00] | 1.25 | [1.19;1.32] |
| Persistently low SES | 0.87 | [0.84;0.91] | 0.84 | [0.79;0.90] | 1.33 | [1.26;1.40] |

Multivariate multinomial regression models: odds ratios (ORs).

a. Adjusted for sex, migration status, marital status, employment status, parental psychiatric disorder and chronic health characteristics.

b. Adjusted for age, migration status, marital status, employment status, parental psychiatric disorder and chronic health characteristics. The bold figures are statistically significant.

Limitations and strengths of the study

The results of this study must be interpreted in light of several limitations. First, CONSTANCES is a longitudinal cohort study based on voluntary participation, and like other epidemiological cohorts, many participants have high socioeconomic status (Goldberg et al., 2017; Melchior et al., 2018). The association between intergenerational social mobility and smoking in mid-life may be stronger than reported here, as low SES individuals are underrepresented in our study. Second, we lack measurements of parental, spousal, or friends' smoking habits. Previous research suggests that parental smoking and childhood intentions to smoke moderately mediate the associations between childhood SES and mid-adulthood smoking status (Tian et al., 2019). A German study found that differences in close friends' smoking behaviors partly mediate educational level differences in adolescent smoking behaviors (Kuntz & Lampert, 2013), and this may also be the case in adults. Third, intergenerational social mobility reflects equality of opportunities including mobility in earnings, wages, and education across generations, and it is important to take into consideration that mobility is relatively low in France compared to other OECD

countries (OECD, 2010). Our results may therefore, to some extent, reflect the effect of adult SES. Finally, the use of the GBTM method does not make it possible to account for smoking initiation during the study period. However, as our study population is mainly adult, but since smoking initiation takes place in adolescence (Barrington-Trimis et al., 2020), at most we may have missed a few cases of smoking reuptake (2.9% of the study population).

Our study has several strengths worth mentioning to balance some of the limitations. First, the data included in the statistical analyses were collected in a large, community-based sample of the French population. As data were collected longitudinally, we used repeated measures of tobacco smoking, and for participants who were enrolled later than 2012 in the study, we were able to calculate smoking status retrospectively due to information on initiation and cessation age. Second, we had information on participants' socioeconomic position both in childhood and in adulthood, which allowed us to examine social mobility patterns and smoking patterns thoroughly. Third, we use GBTM, a robust method enabling the analysis of longitudinal trajectories of smoking patterns among adults.

Findings in light of previous research

Our results indicate that SES and social mobility based on occupational status are associated with individuals' smoking trajectories, consistent with previous findings regarding associations between childhood socioeconomic status, adult occupational grade, and smoking status (Bowes et al., 2013; Doku et al., 2020; Gilman et al., 2003; Gugushvili et al., 2020; 2022; Kuntz & Lampert, 2013). The inclusion of information on childhood SEP in our study emphasizes the importance of socioeconomic difficulties early in life as a key determinant of later health inequalities.

We identified statistically significant interactions between intergenerational social mobility and participants' sex. It has previously been suggested that smoking contributes slightly more to the socioeconomic gradient in all-cause mortality in men than in women (smoking estimated to account for between 12–22% of the socioeconomic gradient for all-cause mortality in male vs. 6–19% in female) (Petrovic et al., 2018). A European cross-country study investigating the effect of intergenerational educational mobility on the likelihood of smoking did indicate that both parental education and individuals' own education are important predictors of smoking among women, while among men, their own education is more crucial (Gugushvili et al., 2020), indicating different effects of ISM according to sex.

Smoking typically begins in late adolescence (Barrington-Trimis et al., 2020; Marcon et al., 2018; Sargent et al., 2017). Youths who smoke regularly are likely to maintain their smoking habit over time, with the transition between adolescence and young adulthood being a propitious period for the prevention of long-term tobacco use (Melchior et al., 2010). Previous research has shown that lower SES is associated with a lower initiation age (Gilman et al., 2003; Green et al., 2016) and that this association is largely mediated by exposure to a regular adult smokers (Taylor-Robinson et al., 2017). It has been found that smoking uptake occurs earlier in children from low-income backgrounds whose parents, family, and peers smoke, or who therefore may consider smoking as socially acceptable (Melchior et al., 2010; Stuber et al., 2008). Furthermore, it has been found that both an earlier age of cigarette smoking initiation and shorter duration of education are associated with higher nicotine dependence (Barrington-Trimis et al., 2020; Pérez et al., 2021; Siahpush et al., 2006). Following from this, higher nicotine dependence is associated with lower smoking cessation rates (Eum et al., 2022), and individuals with low educational level have lower intentions to quit smoking compared to those with higher education (Siahpush et al., 2006). Among adults aged 65 years, it has been found that those with persistently low SES or who experience downward or upward social mobility are less likely to quit smoking than those with persistent high SES¹³. Our findings showing that persistently low SEP and downward social mobility carry the highest odds of a long-time smoking pattern are in line with these previous findings.

Interventions targeting smoking in disadvantaged populations

Better understanding the mechanisms through which SES influences smoking behaviors can help develop more effective strategies to encourage smoking cessation, promote health equity, and reduce the burden of disease across populations. In situations where individuals with low SES and downward social mobility are found to be differentially exposed to smoking, there is need to continue research in this area. In terms of smoking cessation treatment, it is essential to consider socioeconomic differences in need for treatment and success. Nicotine dependence plays a central role in smoking cessation and it is crucial to understand why smoking appeals to economically disadvantaged individuals, even despite prevention efforts (Marmot et al., 2005). In addition, it has been suggested that users of nicotine replacement therapy may find it more difficult to quit smoking than non-users, as they are more likely to be long-term smokers with higher nicotine dependence and more intense craving, which is related to greater difficulty in quitting (Shiffman et al., 2005).

Conclusion

We found that intergenerational social mobility is associated with smoking patterns among adults. Our results highlight the existing social gradient in smoking behaviors. Additionally, upward social mobility has a protective effect on long-term smoking. These results were consistent with our hypothesis and provide new insights into social mobility and smoking behaviors among midlife adults in France. Previous research on social mobility and smoking status has primarily focused on smoking during adolescence, but it is equally crucial to understand smoking patterns among adults. These results indicate the importance of the social environment in relation to smoking behavior. As smoking is socially contingent, it is important to develop more personalized preventive interventions targeting specific SES groups at greater risk of long-term smoking and at greater risk of smoking-related harms.

Declaration of interest

The authors declare that they have no conflict of interest. The authors alone are responsible for the content and writing of the article.

Funding

This study was supported by Agence Nationale de la Recherche; Institut National Du Cancer; Institut pour la Recherche en Santé Publique.

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