analysis of the full sample will seem to reveal a changing slope with increasing age—that is, a nonlinear age association. Here an interaction masquerades as a nonlinearity. Alternatively, if the true association with age is nonlinear, but the same among men and women, an analysis with a linear age term and an interaction by sex will likely find a significant interaction. This has led many to believe nonlinear modelling is a bridge too far. However, the problem in the above example is that the exposure (age) is associated with the effect modifier (sex). In the paper of Castaldi et al\(^2\) they have been careful to examine whether smoking was associated with the genotype they studied as a modifier, and report no association. And for gene-environment interactions this is less likely than for other modifiers. Moreover, there are ways to deal with the association. In the above example, for instance, one could test whether the association with age was not linear within sex.

In modern statistical software, testing for nonlinearity, and fitting dose-response models that do not assume constant slopes is straightforward. It is time to stop making a default assumption that continuous predictors have linear associations with health outcomes.

**Competing interests** None.

### Preventing adolescents’ uptake of smoking

Tim Coleman,\(^1\) Linda Bauld\(^2\)

Smoking is the principal preventable cause of ill health worldwide.\(^1\) It not only affects smokers themselves but is also extremely harmful to non-smokers who inhale environmental tobacco smoke (ETS).\(^2\) In non-smoking adults, ETS exposure causes lung and other cancers, ischaemic heart disease, stroke, chronic obstructive pulmonary disease, asthma and other respiratory illnesses.\(^3\) Perhaps less well known by the general public is the threat that ETS inhalation poses for infants and children; there are strong associations with children’s asthma, lower respiratory tract infection, sudden infant death syndrome, middle ear infection and bacterial meningitis.\(^3\) Knowledge of the health risks of ETS exposure have led many countries, including the UK, to introduce laws that prohibit smoking in indoor public spaces like bars and pubs (smoke-free legislation).\(^5\) Advocates of smoke-free laws successfully argued for these on the basis of protecting non-smokers who might work in or visit smoky environments. Consequently, as tobacco smoke has been completely eliminated from most situations in which adult non-smokers might encounter it, they are well protected from ETS. No similar protection exists for the children of smokers. Most of children’s exposure to tobacco smoke occurs domestically\(^1\) \(^4\) but, internationally, there are no smoke-free laws which forbid smokers from ‘lighting up’ in their homes when children are present. Children’s domestic ETS exposure therefore remains an important public health concern which, as Leonardi-Bee and colleagues\(^6\) show in this issue of *Thorax*, is even more harmful than was previously thought. The authors show that children’s exposure to ETS from parental smoking has a pervasive inter-generational behaviour-modelling effect such that the children of smokers are much more likely to become smokers themselves. Their systematic review and meta-analysis collated findings from 58 epidemiological studies investigating associations between parental smoking and the subsequent development of established smoking in offspring. When both parents smoke, the risk of their children becoming smokers almost triples; if only one parent or a sibling smokes the risk is lower but, even then, children are between 1.75 times and twice as likely to become smokers than those not exposed to parents’ or siblings’ smoking. The consistency of findings from individual studies comprising the review is striking; virtually all component studies reported a positive association between parental/sibling smoking and children’s subsequent uptake of the habit, lending strong support to the authors’ conclusion that associations are probably causal. Of course, smoking is strongly associated with household psychosocial problems\(^7\) \(^8\) and it is possible that, for some young people, these issues have more of an impact on their future smoking behaviour than parental smoking itself. Nevertheless, it seems very unlikely that the normalising impact of persistent parental smoking within the home would have no effect. Parental smoking in the home therefore has direct, substantial and immediate impacts on children’s health from inhaled ETS and also, in those children who become adult smokers as a consequence of learned smoking behaviour, it has serious longer-term indirect effects mediated by their future smoking. Leonardi-Bee and colleagues call for ‘radical changes in public policy and behaviour and in the acceptability of smoking in places where children are present’. However, while arguments for eliminating smoking in the presence of children are compelling, quite how this could be achieved remains unclear.

Legislative changes that curtail widespread behaviours need both robust public support (to ensure that new laws are obeyed) and effective compliance mechanisms (to ensure that breaking new laws has a reasonable chance of incurring penalties). There was strong public support for smoke-free laws before these were introduced in the UK and public

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support increased after the introduction of the legislation, even among smokers.9

Observance of the smoke-free laws was rigorously enforced by local authority
environmental health departments. These factors probably explain why in Scotland
smoke-free legislation has been thorough-ly implemented with high compli-
ance,10 and in England it is now highly
unusual to inhale other people’s tobacco
smoke in indoor public spaces.11 Not all
public health-orientated legislation is
adhered to as comprehensively—for
example, using a mobile telephone while
driving is also illegal in the UK but car
drivers are often seen talking on their
telephones.

A radical change in public health policy
might be to ban smoking in public
outdoor places where children are present
(eg, children’s play areas or in all school
grounds). Such a law has recently been
introduced in Spain and its impacts need
evaluating.12 However, many Spanish
smokers will still probably smoke in the
home, ‘teaching’ their children to smoke
and exposing them to ETS. Indeed, it is
difficult to envisage how public health-orientated legislative changes could influ-
ence parents’ smoking behaviour to such
an extent that their children would never
see them smoking. Laws banning smoking
in homes where children live would be
unlikely to have much effect; many
smokers at whom such laws would be
targeted would probably oppose them and
there would be no clear mechanism for
enforcing compliance. If people choose to
ignore the law and smoke in their homes,
how and by whom would this be
detected? For law breakers, would there be
any significant risk of sanction? If legis-
lation is unlikely to stop children from
seeing their parents smoke or inhaling ETS
from their cigarettes, then what other
measures could achieve this? Ideally, any
smokers who become parents would
immediately stop smoking, transforming
themselves into positive health role
models for their children. Some parents do
manage this but many do not—illustrated,
for example, by the very high rates of
relapse to smoking after childbirth
observed among women who managed to
stop smoking while pregnant.13 It is
therefore clear that a proportion of parents
will continue to smoke in their homes
when children are present; finding and
implementing strategies for minimising
the impacts of this destructive behaviour
should be a public health priority.

Completely preventing children from
observing parental smoking is likely to be
an elusive goal, but smoking uptake can be
prevented in other ways such as
restricting young people’s access to cigare-
ettes.14 15 Reviews have shown that
legislative restrictions on the purchase of
-cigarettes by young people are effective
when concurrent measures are taken to
ensure that retailers obey such laws.14 15

Previous studies have generally investi-
gated the impact of restrictions on the
purchase of cigarettes by young persons
and not on their smoking behaviour; the
few studies that have looked for a link
between purchase restrictions and
smoking prevalence have found none.14
However, Millett and colleagues use robust
national survey data to demon-
strate that increasing the legal purchase
age of cigarettes in the UK (from 16 to
18 years) caused concurrent reductions in
smoking by English children aged
11–15 years.16 Purchase restrictions were
introduced at a time when the prevalence
of smoking among teenagers was already
falling, so the authors used multivariate
analyses to investigate the impact of the
new law and other factors on smoking
prevalence in the years before and imme-
diately after the new restrictions were
introduced. They found that the preva-
ience of smoking fell more than expected
after cigarette purchase restrictions were
introduced, even after taking into account
other factors and the underlying down-
ward trend in smoking behaviour over
time.

The oldest children surveyed were only
15 years old and, as fewer 15-year olds
than 16–17-year olds regularly smoke, one
would expect the impact of purchase
restrictions to be less in the survey sample
than in all young smokers affected by
legislation. The authors postulated that
young people from economically disad-
antaged backgrounds might
find it easier to circumvent the new restric-
tions by obtaining cigarettes from family,
friends and other non-retail sources, but this
did not happen. Young smokers who received
free school meals (a proxy for lower
socioeconomic status) were no more likely
to buy cigarettes from sources other
than shops. The legislation therefore not
only contributed to lower smoking by
11–15-year olds but it affected students
from different socioeconomic groups
equally.

Preventing smoking uptake by young
people is essential to ensure that falls in
smoking prevalence are sustained in the
longer term; uptake must be low to guar-
antee that, at a population level, older
‘quitters’ are not simply replaced by
similar numbers of younger people
starting to smoke. However, the evidence
base for prevention is relatively weak
compared with that for cessation,17 18; in
the UK there is no coherent national
strategy for smoking prevention but cost-
effective cessation interventions19–21 are
routinely used in clinical practice. It now
seems likely that effectively restricting
young people’s access to cigarettes reduces
their propensity to smoke; however, we
also now know that smoking behaviour is
vertically transmitted between genera-
tions. Preventive interventions aimed at
young people, although important, may
be too late for some. Approaches towards
preventing smoking uptake by young
people need to begin before birth and
should engage anyone who is actively
considering becoming a parent as well as
those who already have children.

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Protecting young people from smoking imagery in films: whose responsibility?

Ailsa Lyons, John Britton

Every day thousands of children try a cigarette for the first time, a seemingly innocuous step that for many leads to a lifelong and ultimately fatal addiction to smoking. Preventing this early experimentation is crucially important to preventing the huge toll of death and disability—particularly from respiratory diseases—that smoking causes. There is now increasing international evidence that exposure to smoking behaviour and other imagery in films is a major cause of smoking experimentation and uptake among children and young people. 

Three new studies in this issue of *Thorax* provide further evidence on this effect, this time in UK populations.

In a study of 15-year-old adolescents in the Avon birth cohort, Waylen et al demonstrate a direct relation between exposure to smoking in films and experimentation with smoking which remains significant even after exhaustive adjustment for potential confounders. Among Scottish adolescents exposed to smoking in films, Hunt et al report an exposure-related increase in the odds of smoking that was enhanced by allowance for repeated viewings. In a wider European study, Morgenstern et al demonstrate exposure-related increases in the odds of smoking among adolescents exposed to smoking in films in six countries, including the UK, demonstrating that this association applies across different cultural contexts and levels of implementation of other tobacco control policy. These new studies thus provide further and urgent evidence in support of calls—as yet unheeded—for a radical overhaul of film classification to protect all children and young people from this pervasive and highly damaging imagery.

The British Board of Film Classification (BBFC) is an independent organisation which, in return for fees paid by film makers, allocates all UK films intended for general release into one of five age classifications (table 1). The BBFC lists drug misuse and dangerous imitable behaviours as examples of harmful behaviour, and both U and PG category guidance specifically proscribes ‘potentially dangerous behaviour which young children are likely to copy’. Smoking imagery is excluded from these categories, however, and acknowledged only, and if at all, in consumer advice printed on publicity materials and DVD cases or in extended classification information published on the BBFC website. As a result, as we have recently demonstrated, smoking and other forms of smoking imagery are extremely common in films classified as suitable for viewing by children and young people in the UK, and particularly so in films classified as suitable for viewing by children aged 12 and over.

Our strong impression formed while carrying out that work is that, while some smoking in age-restricted films appears to be justified on artistic or factual grounds, the great majority is not. An example of the latter occurs in *Avatar*, the most popular film of all time and classified 12A in the UK, in which a lead adult character emerges from a sleeping pod in a science base on a distant planet over a century into the future to say, “Who’s got my goddamn cigarette?” She then lights up and smokes throughout a conversation with other characters in a working environment in which smoking would be inconceivable even on 21st century Earth. The director of *Avatar*, James Cameron, justified the smoking on the grounds that ‘from a character perspective, we were showing that Grace doesn’t care about her human body, only her Avatar body’. Another and more egregious example is *Remember Me*, a 2010 romantic drama set in New York City during the summer of

<table>
<thead>
<tr>
<th>Table 1</th>
<th>British Board of Film Classification age-rated restriction categories for films viewed in UK cinema</th>
</tr>
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<tbody>
<tr>
<td><strong>Category</strong></td>
<td><strong>Description</strong></td>
</tr>
<tr>
<td>Universal (U)</td>
<td>Suitable for all audiences</td>
</tr>
<tr>
<td>Parent guidance (PG)</td>
<td>General viewing, but some scenes may be unsuitable for young children</td>
</tr>
<tr>
<td>12/12A*</td>
<td>(12) Suitable for 12 years and older; (12A) under 12s must be accompanied by an adult</td>
</tr>
<tr>
<td>15</td>
<td>Suitable for 15 years and over</td>
</tr>
<tr>
<td>18</td>
<td>Suitable for 18 years and older</td>
</tr>
</tbody>
</table>

*12 and 12A rated films have been amalgamated since the 12A film rating replaced the 12 rating for cinema film viewing in 2002.

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