Viewpoint

Condoms and seat belts: the parallels and the lessons

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Condoms and car seat belts are applied to the human body to save lives. For both, there is an abundance of evidence of benefit to individuals directly exposed to risk. When evidence of benefit is sought at population level it becomes much harder to show beneficial effects. We look at evidence that suggests that the safety benefits of seat belts are offset by behavioural adaptation, and we ask whether condom promotion could also be undermined by unintended changes in sexual risk perception and behaviour.

Seat belts—what does the evidence show?

More than 80 countries have laws that require motorists and passengers to wear seat belts. Most people believe that thousands of lives have been saved. Adams commented that "strength of convictions about what this legislation has achieved is remarkably independent of objective evidence".[1] Figure 1 shows data from the 17 countries that had 80% of the world's cars in the 1970s. Comparison of the 13 countries that passed seat-belt laws with the four countries that did not shows a large excess of deaths in those countries that passed laws. UK predictions were of 1000 lives saved and 10 000 injuries avoided each year.[2] A report on the European experience, commissioned by the UK government's Department of Transport and then suppressed by that department, concluded that "available data for eight western European countries that introduced a seat-belt law between 1973 and 1976 suggest that it has not led to a detectable change in road deaths".[1] A *Lancet* editorial in 1986[3] complained that suppression of this report was "unhelpful", and voiced concern about the failure of UK experience to bear out the predictions of 1000 lives saved and 10 000 injuries avoided per year, despite 95% compliance with the new law. Concern was also expressed about a rise in deaths among other road users. Although the UK is considered to offer the best evidence in favour of seat-belt legislation,[4] this view of the UK data is hotly disputed.[1,5] Adams has shown how the apparent benefits could be attributed to drink-drive campaigns introduced at the same time; the number of road deaths was especially lowered after midnight, which correlates closely with a decrease in alcohol-related accidents. Adams concludes that the UK law "produced no net saving of lives, but redistributed the burden of risk from those who were already the best protected inside vehicles to those who were the most vulnerable outside vehicles".[1]

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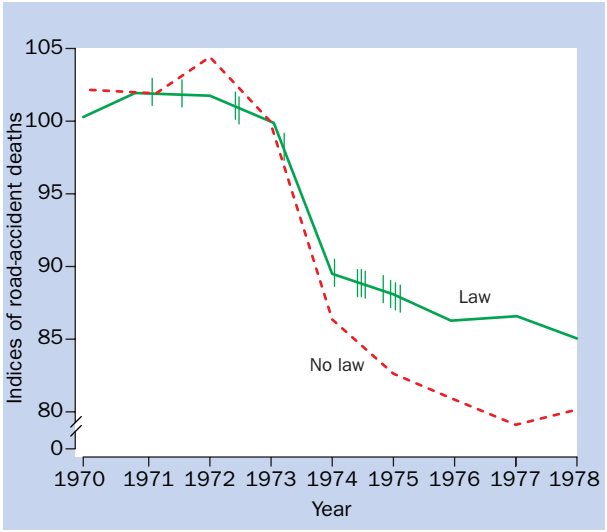

Figure 1: **Indices of road-accident deaths for 13 countries with and four countries without seat-belt laws**
1973 (the "energy crisis" year)=100. Bars indicate the dates at which laws came into effect in the "law" group. Reproduced from Adams[8] with permission.

Strong evidence that seat belts have saved lives is not currently available. In Sweden, increasing seat-belt use showed no association with reductions in death and serious injury (figure 2). Where decreases in accident rates are associated with seat-belt use, there is little evidence that such associations are causal.[5] There are much stronger associations between road-death rates and other factors such as economic downturns (eg, the 1970s energy crisis, see figure 1), or the number of vehicles per capita, which shows a strong inverse relation to the numbers of road deaths.[6]

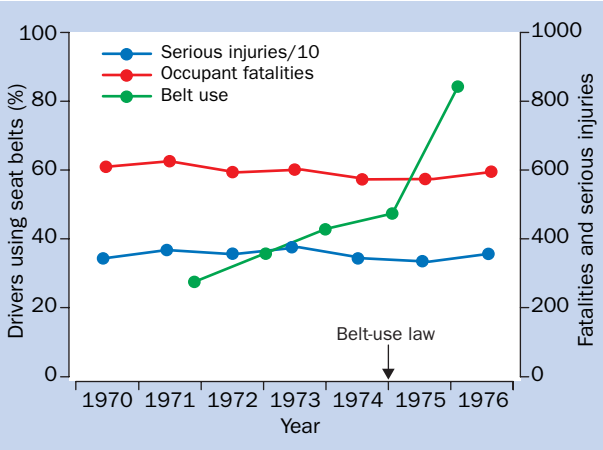

Figure 2: **Motor-vehicle-occupant fatalities, serious injuries, and seat-belt wearing, Sweden**
Reproduced from Adams[7] with permission.

The risk compensation hypothesis

Adams has suggested that drivers who wear seat belts feel safer and drive faster or more carelessly than they would do without seat belts.[7,8] The benefits of seat belts for drivers wearing belts during serious accidents could be offset by increases in the absolute number of accidents, increases in the speed at which accidents occur, and increases in deaths among unbelted road users inside or outside cars. In the 23 months that followed the introduction of the UK seat-belt law, the number of deaths among pedestrians, cyclists, and unbelted rear seat passengers rose by 8%, 13%, and 25%, respectively.[9]

Adams[8] and Wilde[10] propose a model of individual risk management that postulates that every individual is comfortable with a certain level of risk and aims to balance the rewards of risk-taking against perceived hazards. When a safety device is introduced that leads to a perception of lessened risk, the rewards of risk-taking become more attractive and engender a compensatory increase in risk-taking (risk compensation), which may bring accident rates back to their original level (risk homoeostasis[10]), or may produce a rearrangement of hazard with the new risk being transferred to others (risk displacement). The idea that interventions to reduce risk may be subverted by compensatory changes in behaviour has triggered fierce debate among safety experts. There is published experimental work to support the hypothesis,[11] but governments have invested little in exploring this issue, given the huge resources that are invested in risk management. At present, the most authoritative support for the concept of risk compensation (which confines itself to road safety) is an OECD report of 1990,[12] which presents the views of an international panel of safety experts. The report states that "behavioural adaptation exists . . . and does reduce the effectiveness of road safety programmes in a number of cases . . . The potential effect of behavioural adaptation should be considered in the development and evaluation of all road safety programmes." We believe that it is time to ask whether there are lessons here for the promotion of sexual health.

Condoms—seat belts for sex?

The huge increase in seat-belt use since 1970 has been paralleled by a similar trend in condom use since the rise of HIV. The benefits of condom use to individuals exposed to HIV or sexually transmitted diseases are substantial, well documented, and can be compared with the benefits of wearing a seat belt during a high-speed collision. However, it is hard to show that condom promotion has had any effect on HIV epidemics. The most well-known example is the 100% condom policy in Thailand,[13] which has been linked to a decrease in numbers of cases of HIV and sexually transmitted diseases,[14] but the strength of the evidence to link disease prevalence with condom promotion is unclear. Similar declines in prevalence of disease have been observed in countries with low condom uptake, such as Uganda. In Thailand, the contribution of fewer visits to prostitutes may have been underestimated. In the absence of any intervention, all epidemics eventually decline from a peak as host and pathogen evolve.[15,16]

There are three ways in which a large increase in condom use could fail to affect disease transmission. First, condom promotion appeals more strongly to risk-averse individuals who contribute little to epidemic transmission. Second, increased condom use will increase the number of transmissions that result from condom failure. Third, there is a risk-compensation mechanism: increased condom use could reflect decisions of individuals to switch from inherently safer strategies of partner selection or fewer partners to the riskier strategy of developing or maintaining higher rates of partner change plus reliance on condoms. A Canadian study cited by Wilde[10] showed that televised AIDS messages from the Ontario Ministry of Health made respondents more inclined to use condoms and less inclined to avoid casual sexual partners. A US study showed that women taught to negotiate condom use with their partners had no change in incidence of sexually transmitted disease compared with controls, with a trend to an increase in such diseases.[17]

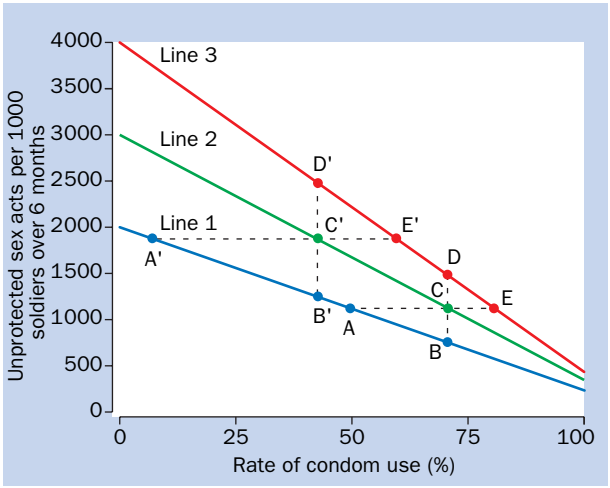

Figure 3: **Potential effects of increasing condom use among soldiers posted overseas for 6 months, assuming 10% condom failure**

Line 1=baseline (precampaign) situation, assuming a mean of two sex acts (protected or unprotected) per soldier over 6 months. Lines 2 and 3=possible post-intervention rates of sexual activity, assuming means of three and four acts, respectively. For discussion of points A–E and A′–E′, see text.

A vigorous condom-promotion policy could increase rather than decrease unprotected sexual exposure, if it has the unintended effect of encouraging greater sexual activity (figure 3). The figure shows the potential effects of increasing condom use among soldiers posted overseas for 6 months, when the condom failure rate is 10%. Data are derived from the work of Hopperus-Buma and colleagues,[18] and use the equation: total number of acts of unprotected sexual intercourse=total number of all acts of sexual intercourse$\times[(1-c)+(c\times f)]$, where f is the proportion of acts in which the condom fails, and c is the proportion of acts in which a condom is used. Point A shows that if sexual intercourse takes place on a mean of two occasions per soldier, there will be 1100 acts of unprotected sex per 1000 soldiers if condom use is 50%. Point B shows a fall in unprotected sex of 33% to 740 acts, which could be achieved by increasing condom use from 50% to 70%. Point C shows that if, as a result of condom promotion and availability, the mean number of episodes of sexual intercourse per soldier increased from two to three, the benefit of of increasing condom use from 50% to 70% would be lost. Point D shows that a doubling of acts of sexual intercourse (from two to four) would lead to a substantial (35%) increase in the amount of

unprotected sex if condom use is increased to 70%. Point E shows that condom uptake would need to increase to at least 81% to bring the level of unprotected sex back to baseline. Points A′ to E′ relate to a baseline situation of 10% condom use. In this case, to reduce the total number of unprotected sexual acts, condom use must increase to at least 44% if the total number of acts increases by 50%, and to at least 61% if the total number of acts doubles. Thus, for a condom promotion campaign to be beneficial, it must increase condom use substantially if the baseline use is low and the total number of sex acts increases.

These findings can be generalised. The mean number of partners does not affect our conclusions. For example, for any population with any total number of sex acts and a condom failure rate of 10%, if the baseline condom use is 50% and a campaign has the unintended effect of raising total sexual activity by 50%, then condom use must increase to at least 70% for the campaign to show a benefit. The effect of the condom-failure rate on our findings is not substantial. We have also considered the possible effects of a condom-promotion policy where the condom-failure rate is only 1%. Where baseline condom use is 50%, and it is desired to decrease the number of unprotected sex acts, then condom use must increase to at least 67% if total sexual activity increases by 50%, and to at least 76% if total sexual activity doubles.

Other examples of risk compensation in sexual health

There is evidence to show behavioural adaptation in response to other interventions that may affect HIV transmission. Two studies have reported that gay men are less worried about HIV infection since treatments have improved, and that they are significantly more likely to report unprotected sexual exposure than in the past.[19,20] Kalichman[21] reported that of 327 men surveyed at a Gay Pride festival in Atlanta in 1997, eight (3%) had already used antiretroviral post-exposure prophylaxis and 85 (26%) intended to do so if the occasion arose. Otten and colleagues[22] showed that rates of prevalence of sexually transmitted diseases doubled in a group of patients who had a negative HIV test and counselling for prevention. Early studies on the likelihood of HIV transmission through oral sex suggested that transmission by this route was insignificant, which led to widespread advocacy of oral sex as a safer alternative to anal sex for gay men. Since then there has been a steady increase in the number of transmissions attributed to oral sex, which has led epidemiologists to revise upwards their estimates of the likelihood of transmission from oral intercourse.[23] In an interesting theoretical paper Blower and McLean[24] have argued that a suboptimal HIV vaccine might increase transmission if lowered risk perception in the target population led to increased risk behaviour.

Can sexual risk-taking be managed effectively?

The growth of safety interventions in recent decades rests on the assumption that governments can manage risk successfully. The "success" of seat-belt legislation is held up as a prime example of what has been achieved. Research devoted to behaviour change since the advent of HIV shows a firm belief by governments that sexual health risks can and must be managed. The difficulties of implementing, evaluating, and sustaining changes in sexual behaviour have become increasingly apparent.[25,26] A theory of risk homoeostasis like that of Adams[8] and Wilde[10] may shed some light on these difficulties. According to this model, when those in authority try to reduce risk behaviour in individuals who prefer to define an acceptable level of risk for themselves, any government measures are liable to be subverted by countervailing changes in behaviour. There is evidence that the most effective way to change driving behaviour is to change drivers' perceptions of risk by either rewarding safe driving or penalising dangerous driving.[10] Clearly, it is hard to conceive of any acceptable way to apply such a "carrot and stick" approach to influence something as private as sexual behaviour.

Nonetheless, interventions to reduce risk continue to work well where individuals lack basic information that could significantly affect their perception of risk, and there is a great need for more interventions of this type in countries severely affected by the HIV pandemic. Once people have a relatively accurate perception of risk, further changes in behaviour are unlikely in those who have no desire to change. At present, much health-promotion is based on the premise that individuals have an inaccurate perception of risk and that behaviour change will follow correction of that misperception—ie, the challenge is one of risk communication.[27] When risk behaviour is viewed as a balancing act, it becomes easier to appreciate that many individuals take risks not through ignorance or incompetence, but after consciously weighing-up rewards against risk. Resentment is commonly felt by individuals towards health promoters, who bombard them with condom-promotion messages and who show little understanding of the reasons why people take risks. Equally, frustrations are felt by health promoters confronted with individuals who are seen as relapsers or recalcitrant, and in need of intensive intervention to achieve the desired goal of increased condom use.

Conclusion

Seat belts have not delivered all the safety benefits that were originally expected of them. A theory of risk compensation may explain why the obvious benefits of seat belts do not necessarily translate into benefits when they are used by whole populations. If safety interventions engender compensatory changes of risk behaviour among drivers, it is highly probable that interventions to reduce sexual health risks could also change risk behaviour. There is much preliminary evidence that sexual behaviour does respond in this way. We believe that those who plan and implement interventions in sexual health should actively look for this phenomenon and deal with it. We should ask why condom promotion is apparently not having much effect in most developing countries. We should ask whether we have the right balance between messages about condom promotion and partner reduction or selection.

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