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## ABSTRACT

**Objective** To obtain a more rigorous estimate of the cost-effectiveness of No Smoking Day (NSD), an annual UK-wide campaign to encourage smokers to quit, than has been possible hitherto.

**Design** Comparison of reported quit attempts in the month following NSD for three consecutive years with adjacent months using repeated national surveys of quit attempts.

**Setting** England.

**Participants** A total of 1309 adults who had smoked in the past year who responded to the surveys in the month following NSD (April 2007—2009) and a comparison group of 2672 adults who smoked in the past year who responded to the survey in the two adjacent months (March and May 2007—2009).

**Main outcome measures** The number of additional smokers who quit permanently in response to NSD was estimated from the survey results. The incremental cost-effectiveness ratio (ICER) was calculated by combining this estimate with established estimates of life years gained and the known costs of NSD.

**Results** The rate of quit attempts was 2.8 percentage points higher in the months following NSD (120/1309) compared with the adjacent months (170/2672; 95% CI 0.99% to 4.62%), leading to an estimated additional 0.07% of the 8.5 million smokers in England quitting permanently in response to NSD. The cost of NSD per smoker was £0.088. The discounted life years gained per smoker in the modal age group 35—44 years was 0.00107, resulting in an ICER of £82.24 (95% CI 49.7 to 231.6). ICER estimates for other age groups were similar.

**Conclusions** NSD emerges as an extremely cost-effective public health intervention.

## INTRODUCTION

No Smoking Day (NSD) is an annual UK-wide campaign, taking place on the second Wednesday in March every year, that 'helps smokers who want to stop smoking by creating a supportive environment and highlighting the help available for smokers who want to stop'.[1] The campaign was introduced in 1984 and now works closely with local National Health Service Stop Smoking Services and others to provide ongoing support. It involves a national social marketing campaign and provides materials such as posters and leaflets to local organisations to use in events and promotional activities. The total annual direct cost of delivering the campaign is approximately £750 000.[2] The question arises as to whether NSD is a cost-effective method of encouraging smokers to quit. Previously estimates may have been biased because they were based on reported quitting when subjects were asked if they had quit in response to NSD and did not take into account the background quit rate of the population.[3] This report attempts to produce a more rigorous test of cost-effectiveness using national smoking behaviour survey data and by comparing the rate of quit attempts during the month following NSD with the rate in the two adjacent months.

## METHODS

### Estimating effectiveness

The 'Smoking Toolkit Study' (STS) involves computer-assisted face-to-face household surveys in England undertaken around the middle of every month.[4] The surveys use a random location sampling design; within each location respondents are selected using quotas that take into account the probability of being at home (gender, part time working and age). A detailed description of the methodology used has been published elsewhere.[5]

We used STS data from respondents who smoked cigarettes (including hand-rolled) or any other tobacco product (eg, pipe or cigar) daily or occasionally at the time of the survey or during the preceding 12 months. We defined this group as 'smokers'.

The number of quit attempts in the last year was assessed by asking: 'How many serious attempts to stop smoking have you made in the last 12 months? By serious attempt I mean you decided that you would try to make sure you never smoked again. Please include any attempt that you are currently making and please include any successful attempt made within the last year'. Smokers who had made at least one quit attempt were asked to report whether it was in the past month.

Because we asked about quitting in the past month and NSD occurs in the middle of March, the April surveys were designated to correspond with any NSD effect while the March and May surveys identified quitting in the months preceding and following the NSD period. Thus, we calculated the attempts to stop smoking that can be attributed to NSD by comparing the percentage of smokers who reported making a quit attempt in the past month from the surveys in April 2007, 2008 and 2009 with the percentage of smokers who reported making a quit attempt in the past month from the surveys in March and May 2007, 2008 and 2009. We estimated that 2.5% of these quit attempts would result in permanent success, based on previous evidence that about 4% of smokers making an attempt abstain for at least 12 months,[6] and that about 65% of those who achieve 12-month cessation will remain permanently abstinent.[7]

### Cost-effectiveness modelling

We calculated the incremental cost-effectiveness ratio (ICER) of NSD as the ratio of the cost of NSD per smoker divided by the discounted life years

gained (LYG) per smoker that can be attributed to NSD. We used LYG rather than quality adjusted life years because LYG can be accurately estimated from epidemiological studies and do not require an often controversial judgment concerning the 'quality' and 'value' of years gained.

We used as the basis of our calculations an updated version of a previously published model of cost-effectiveness for smoking interventions.[8] We applied this to age groups <35 years, 35–44 years, 45–54 years and 55–64 years at the time of quitting for whom the average gain in undiscounted years of life has been estimated to be 10, 9, 6 and 3 years, respectively.[9] We used the currently favoured annual discount rate of 3.5% to discount these years from the time of quitting until the expected age of death, leading to discounted LYG (DLYG) of 1.65, 2.15, 2.14 and 1.56, for the four age groups, respectively. We also made an adjustment for the 'natural' background cessation rate expected over the course of a smoker's life. Many of those who quit in response to NSD would have stopped smoking anyway later in life, gaining some of the life years that would otherwise have been attributed to NSD. We used a 2.5% annual cessation rate until the expected age of death to estimate this effect. This adjustment reduced the DLYG that we would otherwise attribute to NSD by 32%, 29%, 23% and 17%, respectively, for those quitting at ages <35 years, 35–44 years, 45–54 years and 55–64 years, giving final attributable DLYG figures for these age groups of 1.10, 1.53, 1.65 and 1.29.

## RESULTS

### Permanent cessation in response to NSD

Figure 1 shows the monthly rate of smokers reporting that they had tried to quit in the last month for the period from November 2006 through May 2009. As expected there were peaks in quit attempts in January each year and in July and August 2007 when a national ban on smoking in indoor public places was introduced in England.

A total of 1309 respondents to the survey in the months April 2007–2009 (the month following NSD) and 2672 respondents to the survey in the adjacent months March and May 2007–2009 reported that they had smoked in the past year. Respondents to the survey in the month following NSD were comparable to those in the adjacent months with regard to mean age (42.3, SD=13.6 and 42.2, SD=13.9), mean cigarettes smoked per day (13.6, SD=9.0 and 13.9, SD=9.1) and sex (males=46.1%, n=604 and 48.8%, n=1304) (all comparisons non-significant). We also found no significant difference between the two comparison periods in the proportion of quitters that used any medication or behavioural support during their quit attempt.

In order to check that the data could be collapsed over the 3 years of the study, we undertook an analysis to assess whether the April versus March/May difference was similar across the three years. We found no evidence of heterogeneity between the 9 monthly quit attempt rates for March-May 2007–2009 after adjustment for year and NSD month (ie, April versus March/May) ($\chi^2$=4.41, df=5, p>0.5). Consequently, data were pooled across years and for March/May to estimate the effect of NSD.

The quit attempt rate was 9.2% (120/1309) for April 2007-2009 compared with 6.4% (170/2672) for March/May 2007–2009 (difference=2.8%; $\chi^2$=10.325, df=1, p=0.001; 95% CI 0.99% to 4.62%). Based on the additional attempt rate that we attribute to NSD, we estimate that 2.8%×2.5% (permanent cessation rate) = 0.07% (95% CI 0.025% to 0.116%) of the smoking population quit permanently in response to NSD each year. Interestingly, the quit attempt rate for April 2007-2009 was also significantly higher than for all other months combined (difference 1.9%, $\chi^2$=5.987, df=1, p=0.014), although this is a less appropriate comparison than April versus March/May given the systematically high rate at the beginning of each year.

### Incremental cost-effectiveness ratio calculation

With 8.5 million smokers in England[10] and a total direct NSD cost of £750 000, the cost of NSD for each smoker is £750 000/8.5 million=£0.088.

From the above, the expected discounted LYG gained by a smoker in the modal 35–44-year-old group is 0.0007×1.53=0.00107 (95% CI 0.00038 to 0.00177). Therefore, the ICER is £0.088/0.00107=£82.24 (95% CI 49.7 to 231.6). Similar calculations give point-estimate ICERs of £114.29, £76.19 and £97.45 for age groups <35 years, 45–54 years and 55–64 years, respectively.

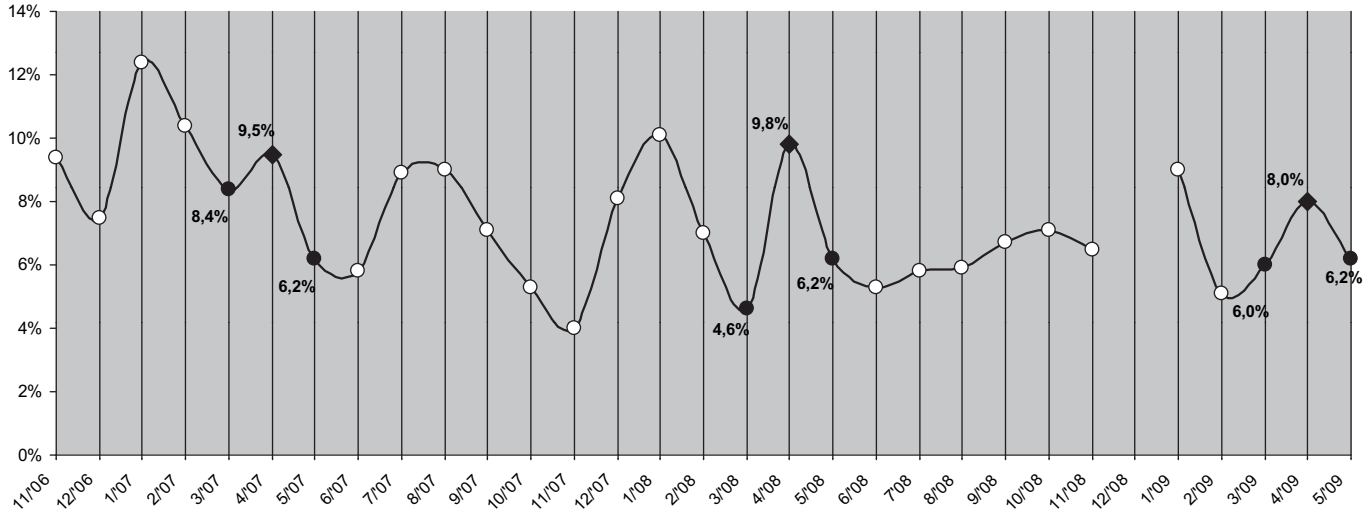


**Figure 1** Percentage of smokers who reported having made a quit attempt in the past month during the period of November 2006 through May 2009. No Smoking Day (NSD) takes place in England in March every year. The data points marked as black diamonds represent the survey month following NSD (April 2007, 2008, and 2009) and the data points marked as black dots represent the two adjacent months (March/May 2007, 2008, and 2009). There was no survey in December 2008. The other peaks correspond to New Year and to the introduction of the smoke-free legislation in July 2007.

On the assumption that costs are known and LYG at each age have been estimated fairly precisely, the 95% CI, based on the confidence interval of the estimated cessation rate attributable to NSD gives a sensitivity analysis of our ICER estimates. For even more robust sensitivity limits, we assumed that the true rate of permanent cessation attributable to NSD was only half that we observed (ie, 0.035%, rather than 0.07%). This might be appropriate if quit attempts in the month following NSD were less successful than expected because NSD induced some smokers to make a quit attempt when they were not ready and prepared. Using a rate of 0.035% has the effect of doubling the estimated ICER the modal 35—44-year-old age group to £164.48 (95% CI 99.4 to 463.2).

## DISCUSSION

Our analysis over a period of three consecutive years showed a consistent pattern of peaks in the percentage of smokers attempting to quit during the month following NSD. The rate of quit attempts was 2.8 percentage points higher than in adjacent months. Accordingly, the point-estimate of the cost of NSD for smokers from different age groups varied between a minimum of £76 and a maximum of £114 per discounted life year gained. Even if the true rate of permanent cessation attributed to NSD was only half that which we estimated, the upper limit for the cost-effectiveness ratio in the modal age group was only £463. For comparison, the cost-effectiveness of a UK mass media campaign to prevent the uptake of smoking in children and young people was estimated to be between £40 and £2000 per life year gained, based on adult reductions in prevalence of 7% and 2%, respectively.[11] When compared with medical interventions for smoking cessation, the ICERs for NSD are in the region of 10% of those for nicotine replacement therapy or bupropion.[12]

The unique feature of our study is that we used monthly survey data from representative samples of the English population to independently estimate the effect of NSD. This methodology is likely to be more rigorous than using self-reported attempts to quit in response to NSD. A limitation is that we were only able to include the direct costs of NSD. The additional indirect and opportunity costs would have been extremely difficult to include because of the great variety of work done locally to support NSD and the fact that almost all of this is undertaken by volunteers and staff paid for other duties. Against this, we included the full UK cost of NSD, although use of the Smoking Toolkit Study meant that only English health benefits were included. Had quit attempts from Scotland, Wales and Northern Ireland been included, the health benefit would probably have been about 10%-20% higher, based on population sizes, and the cost-effectiveness ratios about 10%—20% lower. Also, our estimate of the NSD health benefit is likely to be conservative in not attributing to NSD any enduring effect there might be leading to cessation at later times.

Our data support the view that NSD represents exceptional value for money as a life-saving public health intervention.

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**Competing interests** RW undertakes research and consultancy for, and has received travel expenses and hospitality from companies that develop and market smoking cessation medications. He has a share on a patent for a novel nicotine delivery device. LO is a member of the board of No Smoking Day. DK and JS have no competing interests.

**Ethics approval** This study was conducted with the approval of the University College London.

**Provenance and peer review** Not commissioned; externally peer reviewed.

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