Does the offer of e-cigarettes benefit smoking cessation among unselected smokers?

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Letter to the editor

Addiction recently published an editorial about the use of Bayes factors to analyse findings from randomised controlled trials, particularly when it comes to avoiding the all-too-common error of concluding no effect on the basis of failing to find a statistically significant difference between conditions [1, 2]. A high profile case in point was recently published in the New England Journal of Medicine (NEJM) and we offered that journal the opportunity to publish a letter correcting the error which they declined without explanation. We believe that this kind of problem is sufficiently important that this kind of error must not be allowed to stand without some form correction so we offer our observations and analysis to Addiction readers in the hope that the addiction research community will be encouraged to make greater use of Bayesian methods and avoid the kind of misleading conclusions presented in the NEJM paper.

The NEJM paper reported a pragmatic trial of e-cigarettes, incentives, and pharmacotherapy for smoking cessation in a population of unselected smokers [3]. The authors concluded that offer of e-cigarettes 'did not provide a benefit' compared with usual care because the p-value adjusted for multiple comparisons was greater than 0.05. The odds ratio for this comparison was not reported in the full text but we derived it on the basis of the reported percentages and overall numbers in each group: sustained 6-month abstinence rates were 0.1% in the usual-care group (n=813) and 1.0% in the e-cigarettes group (n=1199). Thus, rounded numbers quitting successfully for usual care was 1 (0.001*813) and for e-cigarettes was 12 (0.01*1199). We have already raised the common fallacy of failing to reject a null hypothesis and concluding a treatment is ineffective [4, 5]. This seems particularly problematic when the OR for e-cigs vs usual care =(12/1187)/(1/812)=8.21 (unadjusted 95%CI: 1.07, 63.25).

Nevertheless, it can be difficult to interpret results that do not meet pre-specified thresholds for p-values. As mentioned above, the calculation of Bayes factors disambiguates such findings [4-7]. We calculated a Bayes factor (BF) using an online calculator (http://www.lifesci.sussex.ac.uk/home/Zoltan_Dienes/inference/Bayes.htm) to compare the null hypothesis with an alternative hypothesis in which the offer of an e-cigarette has an effect on cessation compared with usual care. We believe the effect size for these types of e-cigarettes is likely OR=1.6. We represented this alternative hypothesis with a half-normal distribution in which the mean of the corresponding normal distribution equalled 0 and the standard derivation equalled the expected effect size OR=1.6 (which was transformed to a mean difference for use of this online calculator, ln(1.6)=0.47). The use of this distribution means that plausible values for there being this sort of effect (OR=1.6) have been represented between zero and twice the effect size, with smaller values more likely. We also transformed the OR obtained from the trial to a mean difference (Ln (8.2)=2.11) and calculated the associated standard error (Square root(1/12+1/1+1/1187+1/812)=1.04). The resulting Bayes factor indicated the obtained data were insensitive but if anything supported there being an effect of e-cigarettes (Bayes factor=2.05 – see https://goo.gl/61JUpw for further details). So the conclusion of no benefit is incorrect. Rather the data provide weak evidence of there being an effect of e-cigarettes of similar size to that reported in the Cochrane review on the topic [8].

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