Gender Differences in Satisfaction Ratings for Nicotine Electronic Cigarettes by First-Time Users

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Abstract

Introduction. Nicotine electronic cigarettes (NECs) are becoming increasingly popular as a potentially safer alternative to tobacco but little is known regarding their subjective effects, including possible gender differences.

Method. Participants were New Zealand smokers with no intention to quit \(N=357\) and whom had never used an NEC. During an interview in November-December 2012, participants sampled an NEC and rated it and their own-brand tobacco for satisfaction on a 10-point visual analogue scale. Participants were contacted again in February-March 2013 after a 10% increase in the tobacco excise tax on 1 January 2013.

Results. Overall participants rated NECs 83.3% as satisfying as own-brand tobacco. Females rated NECs more highly than males. Of those who agreed to be re-interviewed \(n=227\), 37.8% said they had cut back or made a change in their smoking habit and 7% had quit in February-March 2013. NEC satisfaction ratings predicted changes in smoking habit and reductions in nicotine dependence after controlling for covariates including demographic variables, factory-made vs. roll-your-own tobacco preference, and addiction scores.

Conclusion. Smokers' first impressions of NECs were very favourable, and were correlated with readiness to change after a tobacco tax increase. NECs appear to be particularly attractive for female smokers, and their use may help to improve the efficacy of nicotine replacement therapy for women.

Key words: electronic cigarettes, subjective effects, nicotine dependence, nicotine replacement therapy, gender differences.
Nicotine electronic cigarettes (NECs) were first marketed in 2004 in China and have become increasingly popular worldwide (Adkison et al., 2013; Dockrell et al. 2013; Pearson et al., 2012). NECs have been proposed as a safer alternative for smokers and an option for nicotine replacement therapy (NRT) because they function similarly to tobacco cigarettes from the user’s perspective (Wagener, Siegel, & Borrelli, 2012), although concerns have been raised about their potential harm and liability for abuse, particularly with young persons (Cobb & Abrams, 2011). A recent systematic review found limited research on NECs, with particular needs for studies on liability for abuse, topography of ‘real world’ use, and subjective effects (Evans & Hoffman, 2014).

There is currently little information about gender differences related to NECs. In an international survey of users from English and French websites (N=3587), Etter and Bullen (2011) found that 61% were male, but no other gender differences were reported. Dawkins et al. (2013) conducted an international survey of visitors (N=1347) to websites of two firms that market ECs internationally. The majority (70%) of their respondents were male, similar to Etter and Bullen (2011). Although Dawkins et al. (2013) reported no significant gender differences in reasons for use, and effects on tobacco consumption or craving, they found that females tended to prefer sweet flavours (e.g., chocolate) and endorse statements related to subjective liking of NECs (‘liked the e-cigarette because it looks and feels like a cigarette’).

To our knowledge, only one study has compared the responses of males and females after sampling an NEC. Dawkins et al. (2012) randomly assigned smokers (N=86) to three groups: 1) NEC with 18 mg/ml nicotine (active); 2) NEC with 0 mg/ml nicotine (placebo); and 3) controls that could just hold the NEC. The active and placebo groups were allowed ad lib puffing for 5 min. They found that the active and placebo groups reported significantly
less craving after 20 min than controls. Males in the active group reported significantly less craving after 20 min compared with the placebo group, whereas for females the difference between active and placebo groups was not significant. These results suggest that the nicotine content was more important for the male smokers.

A gender difference in the subjective effects and evaluation of NECs may have important implications for their use in NRT. Research has consistently demonstrated that males achieve higher quitting rates with NRT than females (Cepeda-Benito, Reynoso, & Erath, 2004; Wetter et al., 1999), with the most recent meta-analysis estimating the odds ratio for quitting at 1.60 for females versus 2.20 for males (Perkins & Scott, 2008). Given evidence that nicotine may be more reinforcing for males and that non-nicotine-related stimuli are more important for females in maintenance of smoking (Perkins, Donny, & Caggiula, 1999), an implication is that NECs may be particularly useful for NRT with females.

We interviewed a sample of New Zealand smokers (N=357) in November-December 2012. After participants had sampled an NEC, we asked them to rate it as well as their own-brand tobacco for satisfaction and liking. Although electronic cigarettes are legal for sale in New Zealand, NECs are not (nicotine-containing liquid is only available by import), and none of our sample had previously used one. Based on Dawkins et al (2013), we predicted that females would rate NECs more favourably. We contacted the sample again three months later after there had been an 10% increase in the tobacco excise tax. Decreases in smoking habit after the tax increase have been reported by Grace et al. (2014a). As a secondary question, we asked if satisfaction ratings might predict changes in smoking habit. We anticipated that smokers who had higher satisfaction ratings for NECs would be more likely to decrease their smoking after the tax rise.
Method

Participants

Adult smokers (N=357) were recruited by newspaper, community and internet advertising from four major NZ cities: Auckland (n=72), Wellington (n=151), Christchurch (n=71), and Dunedin (n=63). Participants needed to be daily smokers, over 18 years old, who purchased their own tobacco and with no intention to quit prior to 1 January 2013. Excluded were current or past users of e-cigarettes, current use of antismoking medication or non-cigarette tobacco, and pregnant/breastfeeding women. All were interviewed in November-December 2012 (Wave 1). The sample was contacted and re-interviewed in February-March 2013 (Wave 2). All received a NZ$15 shopping voucher and a chance to win a NZ$250 tablet computer for each interview.

The study was approved by the University of Canterbury Human Ethics Committee, and participants provided written consent.

Procedure

Participants were given a paper-and-pencil questionnaire, which asked about demographics and type of cigarettes smoked (factory-made or roll-your-own tobacco). They completed several addiction questionnaires, including: Fagerstrom Test of Nicotine Dependence (FTND; Heatherton et al., 1991), Autonomy Over Smoking Scale (AUTOS; DiFranza et al., 2009), and the Glover-Nilsson Smoking Behavior Questionnaire (GNSBQ; Glover et al., 2005). For more information on these questionnaires see Grace et al. (2014b).

Participants were given the opportunity to sample an NEC. The experimenter explained how the NEC (Safe Cigarette brand) produced a vapour containing nicotine when inhaled and could be puffed similarly to a regular cigarette. The NEC had tobacco extract flavour (no actual tobacco) and was listed as 18 mg/mL nicotine content. On analysis, the
Safe Cigarette yielded 13.95 mg/mL nicotine, and 200 hand-drawn puffs at 20mg of nicotine per puff. After taking several puffs on the NEC, participants were asked to rate both their regular cigarette and the NEC for liking and satisfaction on a single-item 10-point Likert scale (1=don’t like at all; 10=like very much).

Results

Table 1 shows demographic information. Of the sample, 53.4% (n=186) were female and 46.6% (n=162) were male. The average age was 36.96 years (SD=13.39). 30.0% (n=104) identified as Māori/Pacific Islands ethnicity, and 70.0% (n=242) as European/Other (including Asian). About one-third smoked roll-your-own (RYO) tobacco (31.7%; n=113) and two-thirds (68.3%; n=244) used factory-made cigarettes.

Overall, smokers rated their own-brand tobacco more favourably, but satisfaction ratings for NECs were 83.3% as high as those for own-tobacco. The average satisfaction ratings were $M=6.20$ (SD=2.82) and $M=7.53$ (SD=2.35), for NECs and own-brand tobacco, respectively, $t(349)=6.36, p<.001$.

Table 2 shows correlations between satisfaction ratings, continuous demographic variables (age, income and education level) and addiction scores (FTND, GNSBQ, and AUTOS). Own-brand ratings were positively correlated with the GNSBQ and AUTOS, $r_s=.19$ and .22, respectively, $ps<.001$, and negatively correlated with NEC ratings, $r=-.14$, $p<.01$. Income was positively correlated with age and level of education, but none of the demographic variables were significantly related to satisfaction ratings. As expected, the addiction scores (FTND, GNSBQ and AUTOS) were positively correlated.

Figure 1 shows the average own-brand and NEC satisfaction ratings by gender. We conducted a repeated-measures ANOVA with cigarette type (own-brand/NEC) and gender as
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within- and between-subjects factors. The gender x own-brand/NEC interaction was significant, $F(1,340)=11.26$, $p=.0009$. NEC ratings were significantly greater for females than males, $M$s=6.88 and 5.55, respectively (Tukey HSD, $p<.0001$), whereas there was no difference in own-brand ratings ($M$s=7.56 and 7.49; $p=.99$). The main effects of gender and cigarette type were also significant, $F(1,340)=12.02$, $p=.0006$ and $F(1,340)=39.84$, $p<.0001$.

At Wave 2, 63.6% of the sample ($n=227$) agreed to be re-interviewed. Overall, 44.9% ($n=101$) indicated that they had decreased their smoking habit: 7.0% ($n=16$) said they had quit and 37.8% ($n=85$) had cut back on cigarettes/day. About one-eighth (12.4%; $n=28$) said they had purchased an e-cigarette (without nicotine). Excluding quitters, nicotine dependence (FTND) at Wave 2 ($M=3.87$) was significantly lower than at Wave 1 ($M=4.19$), $t(210)=-2.98$, $p=.003$.

We tested whether satisfaction ratings would predict changes in smoking habit after the tax increase. First, we used hierarchical logistic regression with occurrence of change (or quitting) at Wave 2 as the outcome variable. Covariates (including demographic variables, FM/RYO tobacco preference, and nicotine dependence [FTND]) were entered at Step 1, and satisfaction ratings were entered at Step 2. Second, we conducted hierarchical multiple regressions with nicotine dependence (FTND) at Wave 2 as the outcome variable.

Results are shown in Table 3. Satisfaction ratings predicted change at Wave 2 when added to the model including gender, Māori/Pacific ethnicity, age, income, education, and nicotine dependence, $\chi^2(df=2)=11.14$, $p=.004$. Participants who rated the NEC more favourably and their own-brand tobacco less favourably were more likely to change their smoking habit by Wave 2, $B=.143$, $OR=1.154$ and $B=-.154$, $OR=0.857$. The only other significant predictor was FM/RYO, $B=-1.059$, $OR=0.351$, where RYO smokers were less likely to make a change than FM smokers.
For nicotine dependence at Wave 2 as measured by the FTND, the addition of satisfaction ratings to the model resulted in a significant increase in explained variance, $\Delta R^2 = .025$, $F(2,170) = 5.11$, $p = .007$, $R^2_{\text{overall}} = .59$, $p < .001$. Participants who rated NECs more favourably showed a reduction in FTND scores at Wave 2, $\beta = -.16$, $p = .005$, but own-brand satisfaction was not significant, $\beta = .05$, $p = .38$. The only other significant predictors were FTND scores at Wave 1, $\beta = .73$, $p < .001$, and FM/RYO, $\beta = .13$, $p = .01$, which indicated that RYO smokers had a higher level of nicotine dependence.

We conducted analyses to check if participants who declined to be interviewed at Wave 2 were different in terms of demographics, tobacco preference, and addiction scores. No significant or systematic differences were found.

Discussion

Average satisfaction ratings for first-time NEC users were 83.3% as high as those for own-brand tobacco. Although several previous studies have documented high levels of satisfaction with NECs (e.g., Bullen et al., 2013; Dawkins et al., 2013; Etter & Bullen, 2011), to our knowledge these are the first results which directly compare ratings for NEC and own-brand tobacco, and provide additional evidence that smokers regard NECs favourably.

Female smokers rated NECs as more satisfying than males, whereas there was no gender difference for own-brand ratings. This result confirms our prediction that females would evaluate NECs more positively than males. We found a gender difference even though all NECs in the present study were tobacco flavoured, which according to Dawkins et al. (2013) was the favourite flavour of male smokers (with females tending to prefer chocolate and sweet flavours). This is notable because NRT therapy for smoking cessation with traditional products such as nicotine gum has consistently been found to be less effective
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for women (Perkins & Scott, 2008; Wetter et al., 1999). Reasons that have been proposed for the reduced effectiveness of NRT with females include that nicotine may be more reinforcing for males (Perkins et al., 1999; Perkins et al., 2002), and that females are more susceptible to cravings induced by smoking-related cues (Doran, 2013; Perkins et al., 2001). Taken together with the present results, the implication is that NECs should be a particularly effective delivery vehicle for NRT with women.

Also notable was that smokers who had higher NEC satisfaction ratings when interviewed at Wave 1 had significantly lower nicotine dependence and were more likely to have made a decrease or change in their smoking habit at Wave 2, after controlling for covariates. The most likely explanation is that participants who rated NECs more favourably were those with a higher readiness to change (and conversely, those who rated NECs poorly had a lower readiness to change). Arguably, how a smoker responds on first use of a potential substitute for cigarettes should provide some information about the strength of their cigarette habit - smokers who have doubts about their habit and are thinking about making changes (Prochaska, DiClemente, & Norcross, 1992) should be more likely to respond positively to NECs.

Some limitations should be noted. We asked participants to rate satisfaction using a single-item measure after only a brief exposure to NECs. Bullen et al. (2013) suggested that smokers may have a 'honeymoon' period when first using NECs, but their enthusiasm may reduce over time. Thus it is unknown whether the high levels of NEC satisfaction that we observed, particularly for females, would be maintained longer term. A single-item measure would be expected to have lower reliability compared with multiple-item measures. However, any such reduction would attenuate correlations with other variables, and so is unlikely to have contributed to the results we observed. Previous studies have also successfully used single-item measures for overall satisfaction (e.g., Schneider et al, 2004,
Second, we did not verify nicotine use through a biochemical marker (e.g., cotinine) and so the reduced nicotine dependence at Wave 2 may have been affected by self-report bias. However, our study also had a number of strengths. Because NECs are not legal for purchase in New Zealand, we could obtain a sample with no prior experience with them and thus a clear measure of their first impressions. Our sample was also generally representative of New Zealand smokers in terms of gender, ethnicity, and tobacco preference (FM/RYO).

Overall, results of the present study show that smokers' first impressions on NEC use are highly favourable, especially for female smokers. Although debates about the abuse potential and effects of widespread advertising of NECs remain (Cobb & Abrams, 2011), they may be a particularly effective delivery vehicle in NRT for female smokers.
Role of Funding Sources

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Contributors Statement

RCG and ML designed the study, RCG, BK, and ML acquired and analyzed the data, and RCG drafted the manuscript with revision feedback from BK and ML. All authors approved the submission.

Competing Interests Statement

The authors declare no competing interests.

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Table 1. Demographic and cigarette preference data.

**Gender**
- Male 46.6% \((n=162)\)
- Female 53.4% \((n=186)\)

**Cigarette Preference**
- Factory-made (FM) 68.3% \((n=244)\)
- Roll-your-own (RYO) 31.7% \((n=113)\)

**Ethnicity**
- NZ European 63.3% \((n=219)\)
- Asian/other 6.6% \((n=23)\)
- Māori/Pacific Islands 30.0% \((n=104)\)

**Age**
- 18-24 23.0% \((n=79)\)
- 25-34 30.2% \((n=104)\)
- 35-44 17.2% \((n=59)\)
- 45-54 18.0% \((n=62)\)
- 55+ 11.6% \((n=40)\)

**Education**
- No school qualifications 19.6% \((n=66)\)
- 5th Form School certificate (level 1 NCEA) 9.5% \((n=32)\)
- 6th Form School certificate (level 2 NCEA) 8.6% \((n=29)\)
- University entrance (level 3 NCEA) 9.8% \((n=33)\)
- Post-secondary qualification 27.6% \((n=93)\)
- Undergraduate University Degree 10.7% \((n=36)\)
- Postgraduate University Degree 14.2% \((n=48)\)

**Employment Status**
- Student 16.8% \((n=55)\)
- Unemployed 22.9% \((n=75)\)
- Employed 60.4% \((n=198)\)

**Income**
- <NZ$20,000 25.6% \((n=99)\)
- NZ$20,000 \(\leq\) x < NZ$30,000 12.4% \((n=48)\)
- NZ$30,000 \(\leq\) x < NZ$40,000 8.5% \((n=33)\)
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- NZ$40,000 $\leq x < $NZ$50,000$: 8.5% ($n=33$)
- NZ$50,000 $\leq x < $NZ$60,000$: 9.6% ($n=37$)
- NZ$60,000 $\leq x < $NZ$70,000$: 7.0% ($n=27$)
- $\geq$NZ$70,000$: 18.1% ($n=70$)
Table 2. Correlations between demographic variables (income, age, education level), nicotine dependence and addiction scores (FTND = Fagerstrom Test of Nicotine Dependence; GNSBQ = Glover-Nilsson Smoking Behavior Questionnaire; AUTOS = Autonomy Over Smoking Scale), and satisfaction ratings for Own-Brand tobacco and nicotine electronic cigarettes (NECs).

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<td>3. Education</td>
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<td>.19***</td>
<td>.22***</td>
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Table 3. Results of logistic regression predicting change in smoking habits at Wave 2, and linear regression predicting nicotine dependence (FTND = Fagerstrom Test of Nicotine Dependence) at Wave 2.

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<td><strong>Own-Brand Satisfaction</strong></td>
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Figure 1. Average satisfaction ratings for Own-Brand cigarettes and NECs, shown separately for males and females. Bars indicate +1 SE.
References


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