Modelling a two-tier tobacco excise tax policy to reduce smoking by focusing on the addictive component (nicotine) more than the tobacco weight

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Abstract

Aim To determine whether adding a low tax category for very-low nicotine content (denicotinised or Denic) cigarettes would facilitate higher excise and reduced consumption of addictive cigarettes (AddictiveCigs, defined as containing ≥2 mg nicotine per cigarette).

Method Nicotine content was laboratory-tested to classify cigarettes into two tiers for excise. PubMed was searched for studies of low nicotine content cigarettes. Nicotine delivery studies and estimated current and future cigarette prices provided the basis for estimating the effect of smoking a mix of AddictiveCigs and Denics.

Results The test results indicated that mean nicotine content per cigarette for the 22 most popular New Zealand brands was 8.7 mg (range 5.6–12.4 mg); only AddictiveCigs were sold. Annual 10% excise increases now legislated are estimated to increase price to $17.60 per 20s packet by 2016. A minority of smokers will quit, by abstaining from AddictiveCigs. Continuing smokers if able to buy lower-priced Denics ($11 a packet), could partly switch to these, which although no less toxic would relieve cravings, reduce nicotine inhaled by 68–86%, and contain smoking costs, without reducing total cigarettes smoked per day.

Conclusion Introducing a lower excise rate for Denics would: (1) allow smokers to select their own mix of AddictiveCigs and Denics; (2) make Denics available to reduce cravings, reduce addiction, and reduce smoking costs of continuing smokers; (3) increase the political feasibility of increasing excise on AddictiveCigs sufficiently to greatly reduce addictive smoking; and (4) enable smokers to reduce their addiction before they quit, and therefore probably become more likely to succeed when they do so.

In 2010, in this Journal, the End Smoking New Zealand trust identified tobacco taxation and reducing the nicotine in cigarettes as two of the most powerful policies for reducing smoking.¹

In this paper we do not seek to supplant those policies, but to combine aspects of each to create a new tobacco tax policy focused on nicotine, to reduce tobacco addiction.

Very low nicotine “Denic” cigarettes (not currently on sale in New Zealand) have become commercially available this year in the United States, and we propose that these cigarettes, which actually assist smokers to quit² and which can reduce tobacco addiction,³⁴⁵ merit a lower rate of excise to make them available at a lower price than other (addictive) cigarettes.
The concept of a second-tier lower excise rate has precedent. Customs up until 2010 taxed hand-rolled (roll your own or RYO) cigarette tobacco at a lower rate, and levies lower rates of excise on beer than on wine or spirits. A lower excise based on a lower content of either the toxic or addictive substance thus has precedent.

Since 2010, equalisation of the excise on RYOs and factory-made (FM) cigarettes on the basis of tobacco content has meant that all smokers face similar increases in the cost of smoking. With respect to Denics however, this paper proposes a lower tax classification, so that during 2013–16 and beyond, Denics can be taxed at a flat and steady lower rate, while AddictiveCigs would be taxed at an increasing rate. Such a two-tier excise system would require cigarettes to be classified as either (highly) addictive, or of very low addictive potential, according to nicotine content.

A study of 25,000 New Zealand year 10 adolescent smokers found that of those who had smoked either one or two cigarettes only, one-quarter had developed symptoms of addiction. It is this addictiveness which we consider should be taxed most heavily.

All cigarettes generate toxic chemicals in the smoke regardless of nicotine content, but reducing the degree of addiction would make success easier for the one third of smokers who attempt to quit each year. Parents may be concerned that Denic cigarettes would lead young smokers to smoke AddictiveCigs but Denics used on their own actually decrease tobacco addiction and AddictiveCigs are becoming increasingly expensive. Lifetime addiction to tobacco smoking is the underlying factor in nearly 5000 cigarette-attributable deaths annually, which make up one sixth of all deaths in New Zealand.

In 2010 the Māori Affairs Parliamentary Select Committee (MASC) completed its Tobacco Inquiry recommending halving tobacco consumption and smoking prevalence by 2015 to make “New Zealand a smoke-free nation by 2025.” In 2011 Government replied: “The Government agreed to set specific mid-term targets as a means to ensure meaningful progress towards the longer term goal of making New Zealand essentially a smoke-free nation by 2025.” Government’s adoption of this goal is a major step, but it will need effective policies to achieve it, but with a goal and a date to achieve it by, a wider range of policies and some new products could be needed.

For example, in 2010, 119 of 121 members of parliament (MPs) voted for three increases in tobacco excise during 2010–12. Then in its May 2012 Budget Government announced four further excise increases on tobacco of 10% annually. Health groups submitted to Parliament’s Finance and Expenditure Committee that 10% increases would not achieve the 2025 goal until 2050, and asked for excise increases averaging 25% annually. The Committee said that the Customs and Excise (Tobacco Products-Budget Measures) Amendment Bill was “to encourage smokers to quit without punishing unduly those who are unable or unwilling to do so.” Accordingly the Committee recommended that Parliament pass the Bill unchanged, but also recommended that Government “monitor closely the progress made over the next few years towards the goal of a smokefree New Zealand by 2025 and implement further excise tax increases after 2016 if its achievement is in doubt.” The main objection to increased excise is that very high cigarette prices would further increase the observed stress in the majority of smokers who fail to quit, and this
remains true as long as no substitute inhalable nicotine products which produce smoke or visible vapour are on sale, as is currently the case in New Zealand.

Accordingly, End Smoking NZ in its written and oral submission proposed (a) legalised sale of nicotine electronic cigarettes and (b) a reduced excise rate for denicotinised (Denic) cigarettes. The Committee said they would like to see further research undertaken on these types of substitutes and indeed clinical trials on both are in progress at the National Institute of Health Innovation, University of Auckland.

This paper explains and models the Denic proposal for the first time, for possible adoption as part of tobacco excise policy in due course.

The bill was enacted 23 October 2012, increasing tobacco excise rates 10% above the level of inflation annually through to 2016, commencing 1 January 2013.

Nicotine electronic cigarettes and denicotinised cigarettes both replace the smoking experience, both relieve cravings for tobacco cigarettes, and both would relieve financial pressure on smokers. Otherwise they are different—the electronic cigarette is a nicotine vaporizer and thus is far safer than any combustible cigarette including the Denic, but the Denic could reduce addiction for the majority of smokers reluctant to either quit or switch to electronic cigarettes.

Denics have no attraction to smokers if priced the same as AddictiveCigs, and manufacturers have no commercial interest in their sale. If Denics however, were taxed at a lower rate and thus cheaper, some smokers could be expected to substitute Denics for some of their daily cigarettes. Once the excise difference increased sufficiently, the trade could be expected to offer Denics for sale at a price lower than for AddictiveCigs. As excise rates for AddictiveCigs increased, fewer of them would be smoked, and even allowing for more intensive smoking, less nicotine would be inhaled, making quitting more likely.

Smokers themselves want less addictive cigarettes: 86% of current smokers support laws to make their cigarettes less addictive, even if smoking them would be less pleasurable; one third of smokers try to quit each year and of these fewer than 10% succeed, despite graphic disease warnings on the packets since 2008, and large ‘Smoking kills’ warnings at point of sale.

As a second stage or complementary policy, government might wish to progressively lower nicotine content across all brands, a policy first proposed in the United States in 1994. This policy could yet be necessary. Meantime half a million New Zealand smokers would say they are addicted, and whereas mandated nicotine reduction could take many years to become law, introducing a lower excise rate for Denics would allow smokers to reduce their nicotine consumption voluntarily, and so could win political acceptance sooner.

Proposal—The two-tier excise policy would

- Strengthen current government policy to annually increase the excise rate on AddictiveCigs and other smoking tobacco products above the level of inflation, and:
• Introduce at the earliest a lower excise rate for Denic cigarettes, levied for example, at 80% of the 2012 excise rate, that is, at $0.353 per cigarette. This rate would be adjusted annually for inflation, but not increased above it.

• Provide continuing smokers with a price incentive to smoke fewer AddictiveCigs in favour of more Denics, become less addicted, and become more likely to quit smoking entirely.

In this paper we investigate the nicotine content of popular New Zealand cigarette brands, examine recent studies of Denic cigarettes, and model the effects of the two-tier excise policy on cigarette prices, the daily cost of smoking, and nicotine delivery to smokers.

In short, this paper explores the effects of introducing a lower excise rate for denicotinised cigarettes as a way to reduce smokers’ addiction, and so improve the effectiveness of the national programme to achieve the 2025 smokefree nation goal.11

Method

Nicotine content of the un-burnt commercial cigarette is significantly and strongly correlated with how much nicotine is absorbed from smoking it,22 and is selected as the best basis for nicotine taxation. In contrast, nicotine yield tested by traditional machine testing of the smoke of commercial cigarettes is weakly correlated if at all with nicotine absorbed23 and so is no longer printed on cigarette packaging.

In 2011 22 popular brand cigarettes (based on highest brand sales by volume in 2010,24 list available from the author) were purchased from a Christchurch retailer, and nicotine extracted and analysed by Canterbury Health Laboratories, Christchurch, New Zealand for 10 factory-made (FM) brands, and 6 hand-rolled (roll-your-own [RYO]) tobacco brands of 0.7 g tobacco each. The most popular brands at low nicotine yields from 0.1 mg to 0.6 mg were separately tested to ensure testing of the lowest nicotine content brands on sale.

Estimations of daily consumption per smoker were based on 2009 Ministry of Health data.8

A standard cigarette was defined as either a factory-made (FM) cigarette containing <0.8 g tobacco, or a RYO cigarette containing 0.7 g tobacco, on the basis that from May 2010 standard cigarettes attracted equal rates of excise per cigarette.

Prices Separate indices for RYO and FM AddictiveCigs were obtained from Statistics NZ and used to calculate the consumer price of RYO and FM standard cigarettes. The actual 2012 price of a standard cigarette ($0.65) is lower than given by the combined consumer price index for cigarettes and tobacco which assumes 1 g of tobacco per RYO cigarette. Standard cigarettes whether RYO or FM have attracted the same excise rate since 2010 standard cigarettes and are priced similarly. Future prices for 2012-16 in 2012 dollars were based on the incremented 10% annual real excise increases now legislated. during 2013–16.13 The ratio of standard cigarette price to excise in 2012 was 1.47 and was assumed to decrease to 1.35 in 2016. The price elasticity for sales was estimated at -0.76, based on 2009–10 data on weekly supermarket sales and prices.25

Bioavailability of nicotine was estimated from a mouth exposure study of 391 New Zealand smokers of leading brands of New Zealand cigarettes.26 Maximum nicotine extracted per AddictiveCig, as when only 1 or 2 AddictiveCigs per day were smoked per day, was estimated at two standard deviations above this mean22 and from a clinical study.27

The effect of selling Denics alongside AddictiveCigs was estimated from a laboratory study by Johnson et al28 in which smokers carried out a repetitive task to earn three puffs of (addictive) cigarettes while exposed to simulated price increases, which caused smokers to reduce consumption of the AddictiveCig brand, allowing estimation of elasticity of demand. (This simulates current government policy.) When Denics (not identified to participants as such) were concurrently available at a steady lower price (as this paper proposes) AddictiveCig consumption reduced more steeply; the price elasticity was 4.95% greater.28 Denic sales in their first year on sale were estimated very approximately at 10% of AddictiveCigs sold, based on 10% of AddictiveCig smokers using Denics if available.28
Previous studies—The US National Library of Medicine database (www.pubmed.org) was searched for studies of reduced nicotine content, denicotinised and very low nicotine content cigarettes. In addition, we searched for studies relating nicotine delivery, cigarette consumption, addiction, and the likelihood of quitting.

The nicotine content definitions for Denics and AddictiveCigs were selected on the basis of these studies of both types of cigarette.

Results

Due to legislated 10% excise increases, cigarettes are estimated to increase in price (in 2012 dollars) by some 7% annually to $17.60 per 20s packet by 2016 and result in (very approximately) 10,000 fewer smoking each year, In current dollars, at say 3% inflation, some brands could cost over $20 over the counter by 2016.

Published studies found that cigarettes containing as little as 5 mg of nicotine maintained addiction to smoking\(^5\) while cigarettes of less than 2 mg nicotine (Denics) actually reduced addiction.\(^2,4,5\)

Nicotine content (Table 1)—was measured in 22 brands of New Zealand cigarettes—the most popular brands in their category in 2010.\(^{24}\) Mean content across all brands was 8.65 mg per standard cigarette. Nicotine concentration of the tobacco was 30% higher per standard RYO cigarette than for factory-made brands. All cigarettes contained >5 mg nicotine.

Table 1. Nicotine and tobacco content and nicotine concentration per cigarette in 2011 for the 22 most popular brands in 2011

<table>
<thead>
<tr>
<th>Product category and sales of brands tested as % of total sales in 2010 in each category</th>
<th>Nicotine content mean [SD] (range) mg /cigarette</th>
<th>Tobacco content mean [SD] (range) g per cigarette</th>
<th>Nicotine concentration mean [SD] (range) % of tobacco weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factory-made manufactured cigarettes, (FM) 10 brands, 55% of category sales</td>
<td>8.1 [1.26] (5.6–9.6)</td>
<td>0.68 [0.05] (0.56–0.72)</td>
<td>1.19 [0.12] (1.00–1.35)</td>
</tr>
<tr>
<td>FM with yields 0.6 mg or less 6 brands, 76 % of category sales</td>
<td>7.32 [0.65] (6.4–7.9)</td>
<td>0.62 [0.07] (0.51–0.71)</td>
<td>1.20 [0.19] (1.01–1.51)</td>
</tr>
<tr>
<td>RYO tobacco 6 brands, 85% of category sales</td>
<td>10.9 [1.25] (9.5–12.4)</td>
<td>0.70 (standard cigarette)</td>
<td>1.55 [0.18] (1.36–1.77)</td>
</tr>
</tbody>
</table>

SD= standard deviation. FM = factory-made. RYO= roll-your-own cigarettes. Tobacco was measured as moist weight.

No reports were found of brands with 2.0–4.9 mg nicotine content among New Zealand brands (Table 1) and few studies were found globally for brands in this category. To eliminate any grey area between the two categories, cigarettes ≥ 2.0 mg were defined as AddictiveCigs, and Denics were defined as <2.0 mg nicotine content on the basis of recent research studies.\(^2–5,23\)

Addictive Cigarettes sold in New Zealand and tested on New Zealand smokers, delivered a mean 1.62 mg (SD 0.49 mg) of nicotine to the mouth.\(^25\) AddictiveCigs
include the Quest 2 research cigarettes with nicotine content 5 mg, and nicotine yield 0.3 mg. Even at this low yield, Quest 2 was found to maintain addiction.\textsuperscript{5}

**Denicotinised Cigarettes** These cigarettes contained < 2 mg nicotine and yielded as little as 0.05 mg\textsuperscript{5} of nicotine within the 0.05 to 0.2 mg range (such as the Vector Quest 3 research cigarette containing 1.5 mg nicotine, yielding 0.1 mg nicotine). Denics yielding 0.05 mg had a cessation rate equal to nicotine lozenges.\textsuperscript{5}

In a large randomised controlled trial Walker et al found that for New Zealand smokers wishing to quit smoking, Denics prolonged abstinence from 2 weeks for usual care out to 2 months.\textsuperscript{2} Denics but not AddictiveCigs were found to decrease addiction to smoking, and they increased the time from waking to first cigarette of the day,\textsuperscript{3} decreasing addiction scores within days or weeks.\textsuperscript{4,5} Denics decrease the urge to smoke by 31\% compared with an AddictiveCig.\textsuperscript{3} Denics increase quitting success in studies of smokers intending to quit.\textsuperscript{2,4,5} Denics were accompanied by low levels of compensatory smoking, approximately 20\% for compliant subjects on DeNics for 2 months.\textsuperscript{4,5,29}

The smoke from Denic and AddictiveCigs is assumed to be equally toxic though, due to less nicotine in the smoke, NNK, a tobacco-specific nitrosamine and nicotine-derived lung carcinogen in smoke, is reduced.\textsuperscript{29} A Denic binds and occupies 26\% of the main type (alpha\textsubscript{4}beta2) of brain nicotine acetylcholine receptors and does not satisfy, whereas a single regular AddictiveCig can occupy and saturate 88\% of these receptors, sufficient to release dopamine, lift mood and give satisfaction.\textsuperscript{30}

Unlike AddictiveCigs, Denics fail to increase plasma nicotine or heart rate.\textsuperscript{31} Smokers blinded to AddictiveCigs and Denics rated AddictiveCigs more stimulating,\textsuperscript{32} while in another study AddictiveCigs were associated with a higher level of “exhilaration.”\textsuperscript{33} On the other hand, Denics relieve cravings as strongly as AddictiveCigs.\textsuperscript{3}

When AddictiveCigs and Denics are both on sale, smokers prefer AddictiveCigs,\textsuperscript{34} but not entirely: a Denic cross-elasticity of 0.2\textsuperscript{28} means that if AddictiveCig prices increased 10\% annually, Denic sales would increase 2\% annually due to switching from AddictiveCigs.

Figures 1 and 2 model the options for the average smoker, as prices increase under the legislated 10\% excise increases, as smokers juggle expenditure with their need for nicotine, assuming Denics were an option.

**Modelling smokers’ costs in the face of increasing excise rates (Figure 1)—**

Denics, if taxed at a steady lower excise level of $0.353 per standard cigarette (80\% of the 2012 excise rate of $0.442), could be priced at 55 cents each, or $11 per packet of 20, assuming 2012 price to excise ratio and trade margins as for AddictiveCigs. For comparison, the April-June 2012 consumer price for 20 standard cigarettes was $13.00; supermarkets reported an average $15 price for 20; this price was discounted in dairies.

Figure 1 depicts the expenditure options for continuing smokers smoking 12 cigarettes a day in 2012, based on legislated excise increases of 10\% per year.

*The upper plot line* (no change in smoking) depicts the increasing expenditure required to smoke 12 cigarettes per day (cpd) as excise increases packet prices over time to an average $17.60 per 20s packet in 2016.
The middle plot line (cigarette reduction) depicts the expenditure required for a smoker gradually reducing AddictiveCig consumption from 12 cpd in 2012 to 9 cpd in 2016. Expenditure remains unchanged around $8 throughout, but the smoker will have to wait longer each year until the next cigarette, which, depending on their Latency To Next Cigarette, may increase the distress for some smokers if the reduction is sudden, as after a price increase.

The lower plot line (nicotine reduction) shows the effect of reducing AddictiveCigs from 12 to 1 cpd over 4 years, replacing these with Denics, to maintain consumption at 12 cpd, and using Denics to relieve cravings for the next AddictiveCig. Expenditure is controlled and is 12% lower and $1 a day less in real terms by 2016. As reducing from three AddictiveCigs in 2015 to one AddictiveCig in 2016 would save 50 cents a day, many might prefer to not reduce below 3 AddictiveCigs per day, in the absence of media campaigns to urge them to quit altogether.

Figure 1. Expenditure options for continuing smokers during 2013–16, based on the legislated excise increases of 10% annually; estimated at 2012 prices

Modelling smokers’ nicotine intake as excise is increased (Figure 2)—Smoking fewer cigarettes per day tends to save smokers more money than switching to cheaper brands. In 1985 New Zealand smokers smoked a mean 26 cigarettes per day (cpd), 14 a day in 2009, and an estimated 12 cpd in 2012. Smokers in 2012 spent an estimated average $8 a day. As prices increase further, most will smoke fewer cigarettes, but as noted, the cravings induced depends on each smoker’s latency before the next cigarette.
Figure 2 models the daily nicotine obtained from New Zealand cigarettes, as the prices increase, based on the estimated mean nicotine mouth delivery to New Zealand smokers, of 1.62 mg per cigarette. Estimated nicotine absorbed per day declines 86% from left to right in Figure 2 as smokers switch progressively to Denic cigarettes. Smokers shifting to Denics would be rewarded by a reduction in expenditure of up to $1 per day. (The lower plot, copied from the lower plot in Figure 1.)

*The left hand column* represents the average smoker in 2012, smoking 12 cigarettes per day (cpd) and inhaling a mean 19 mg of nicotine per day.

*In the middle column,* nicotine is nearly halved to 10 mg, by reducing AddictiveCigs from 12 to 6 cpd, assuming Denics yield 0.1 mg nicotine per cigarette. However, simply reducing the number of AddictiveCigs (Smoking reduction) would result in a longer period of unrelieved cravings between AddictiveCigs. Instead this middle column depicts smoking a mix of Denics and AddictiveCigs to make up 12 cigarettes a day as before.

*The two columns on the right* in Figure 2 show the effect of smoking three, then only one AddictiveCig per day, thus reducing nicotine intake by 68% then by 86% below 2012 levels, and consequently reducing the number of nicotine puffs and strong nicotine pulses to the brain. As noted above, Denic cigarette puffs send much weaker pulses of nicotine which occupy only one quarter of nicotine receptors, but this is enough to reduce cravings.

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**Figure 2. Effect of reducing AddictiveCigs and increasing Denics, to maintain consumption at 12 cigarettes per day, on mean daily nicotine delivery and daily dollar cost**

![Graph](image)

*Source: Mariner.*

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26 Benowitz.
Exposure to cigarette smoke nicotine and the likelihood of quitting—At lower rates of nicotine supply, the Latency To Next Cigarette might be expected to gradually lengthen, but this is not yet known for Denic cigarettes. Less nicotine absorbed however, predicts quitting success. And less addicted smokers are more likely to successfully quit.

The Health Survey for England found that smokers who normally extract less nicotine per cigarette and who also smoke fewer cigarettes per day absorbed the least nicotine. Mean nicotine daily mouth delivery to New Zealand smokers was high (30 mg mean, SD 15.6 mg), and varied greatly among smokers, as did daily cigarette consumption (mean 18.8, SD 9.1).

Discussion

Main findings and interpretation—A two-tier excise policy with exemption of Denic cigarettes from future excise increases would make it easier to justify legislated increases in AddictiveCig excise rates, as the smoker switching to Denics could control and reduce the cost of smoking as in Figures 1 and 2. Denic smoke being as toxic as AddictiveCig smoke but less addictive would merit an excise rate set and held at say 80% of the 2012 rate, creating price incentives for smokers to switch from their current AddictiveCig brands, and for manufacturers and importers to make or sell Denic cigarettes. Sale of Denic cigarettes wherever AddictiveCigs are sold would provide an escape product for addicted smokers facing higher prices each January over the next four years.

Smokers could smoke a mix of AddictiveCig and Denic cigarettes in any quantity, combination or sequence they chose, to balance their cravings for more AddictiveCigs within their current smoking budget. Denics would be available for all smokers to buy alongside AddictiveCigs and could substantially reduce cigarette nicotine consumption for most smokers.

Repeated annual real excise increases of 10% for AddictiveCigs begun in 2010 will now extend to 2016, and if continued to 2025 would raise the price of 20 cigarettes to over $40. Normally this would cause distress for smokers, but not if smokers switch to an Denic-AddictiveCig mix (smoking only 3 AddictiveCigs per day then only 1 per day, otherwise mostly smoking Denics) The switch can be gradual. Then even if AddictiveCigs cost $40 smokers would spend no more than $7 a day on cigarettes. In any given year, smokers of such a mix would be absorbing 68% to 86% less nicotine than in 2012, making for more success in quitting.

Denicotinised Cigarettes—We would expect Denic sales to increase sharply within weeks of any increase in excise. However for quitting, Denics might work best by boosting the success rate of the next quit attempt. As one-third of smokers try to quit each year, making an average two attempts per year, Denics could boost success for up to 1000 quit attempts a day. At population level Denics might thus take several years to exert their full effect on stopping smoking.

Regular and random surveillance of the nicotine content of all cigarettes and labelling whether Denic or not, would be essential to prevent tax evasion. Current arrangements for manufacturers to report nicotine yields analysed by their own laboratories would not suffice. Manufacturers would compete to sell the less-taxed, less-costly Denic
cigarettes which relieve cravings. Lower price would incentivise many AddictiveCig smokers to use them, and without compulsion. As a new product class, Denics would normally need several years to gain market share, and particularly because tobacco products cannot be advertised or displayed.

The planned annual increases in excise rates for AddictiveCigs are likely to ensure increased Denic sales. Manufacturers also have freedom to flavour Denic tobacco to make it more appealing to smokers as there is no restriction on cigarette ingredients.

**Concomitant sale of AddictiveCigs and Denics**—Smokers would select their own daily mix of AddictiveCig and Denic cigarettes to maintain satisfaction and addiction, but as AddictiveCig prices increased smokers would include more Denics, as in Figure 2. A lower excise rate for Denics would make them price-attractive, decrease AddictiveCig sales, and reduce daily nicotine absorbed,\(^25\) even after allowing for more nicotine extracted per cigarette if 3 or fewer AddictiveCigs are smoked per day.\(^26\)

Studies comparing nicotine inhaled in cigarette smoke against the likelihood of quitting\(^37–39\) suggest that those smoking the fewest AddictiveCigs tend to absorb less nicotine and have the greatest chance of stopping smoking. Current online prices in June 2012 suggested that smokers could smoke three cigarettes and stay addicted for $2 a day.

The legislated 10% increases from 2013 to 2016, at current price elasticities imply that half a million will still be smoking in 2016, suggesting that much steeper increases in excise on AddictiveCigs may be required after 2016.

**Strengths and limitations of this study**—Denics could succeed in New Zealand, as smokers would not be asked to quit smoking, only to smoke less nicotine. New Zealand due to its distance from other nations, its strong tobacco control legislation, no commercial tobacco growing, its effective border control, the government’s goal of a smokefree nation by 2025, and government’s interest in increasing tobacco excise for the next 4 years to achieve that goal, provides a favourable environment for developing such a policy.

We propose that AddictiveCigs be smoked mixed with Denics, but information on concomitant use is limited. Excise-induced reduction in AddictiveCig sales with partial switching to Denics would send fewer strong nicotine surges to the brain and over weeks and months the urge to smoke may reduce in some smokers; research is planned to elucidate this matter.\(^17\)

A small study may also be needed to determine whether smoking an AddictiveCig would suppress brain nicotine receptors for some hours so that the receptors were not activated by the much weaker pulse from Denic smoking, leaving cravings unrelieved.

On the other hand Denics may have powerful placebo effects on cravings. Use of a placebo cigarette look-alike non-nicotine inhaler to treat cravings in those smokers who gave above average importance to smoking rituals and cigarette handling, was found to double quitting success.\(^41\)

Estimations of the price elasticity of AddictiveCigs when sold with Denics, and of Denics when sold with AddictiveCigs are based on a single study.\(^28\) The Denic
cigarette is novel, and its market share would depend on the price of AddictiveCigs, as Denics are a true economic substitute for AddictiveCigs.\textsuperscript{28}

The policy is novel and the current trial\textsuperscript{17} will help find out how many smokers will smoke Denics, and how many Denics and AddictiveCigs they will smoke each day. The proportion of smokers who would initially use Denics is uncertain but not critical, as their price advantage will increase as the price of AddictiveCigs is increased by taxation.

**Implications for surveillance and further research**—A well-resourced ongoing programme of regular and random laboratory testing of Denic cigarettes for nicotine content would be necessary to protect this new government revenue stream, with substantial penalties for false labelling and excise evasion. The Smokefree Environments Act may need strengthening at Section 35 (Returns and Reports) to require more frequent electronic monitoring of cigarette sales. The three cigarette firms which account for 98\% of the 3 billion standard cigarettes sold last year have access to weekly electronic national retail sales data by brand and price down to store level, and top-line quarterly and regional reports could be mandated under the Act, separately for AddictiveCigs and Denics, so that national and District Health Board goals can be set and policy effects monitored. Ongoing research studies and surveys would be needed to map the effects of smoking different mixes of AddictiveCig and Denic cigarettes on addiction scores and on quitting.

**Policy implications**—A lower excise rate for Denic cigarettes would require an amendment to the Customs Act schedules. Regulations would also be required for nicotine content testing and labelling of tobacco packaging. Manufacturers would need due notice to make or source denicotinised cigarettes.

Denic cigarettes are designed to lessen addiction—which otherwise keeps smokers from quitting; and quitting too late results in cigarette deaths— around 5000 annually. Many studies attest that as smoking prevalence declines, cigarette attributable deaths reduce to near zero with full effect 15–20 years later. In addition, life expectancy would increase by nearly 5 years for the Māori population and by 3 years for non-Māori. Going smoke-free as a nation by 2020 (compared to no change from the 2006 Census smoking prevalence), would close ethnic inequalities in life expectancy by nearly 2 years.\textsuperscript{41}

The Māori Affairs Select Committee was concerned that Māori should fully achieve the MASC national goals, such as halving (AddictiveCig) sales by 2015. Health groups’ tax recommendations could have achieved this goal by 2016, but annual excise increases of 10\% now legislated, using linear projections and current price elasticities, means that AddictiveCigs sales may not be halved until 2025.

A lower tax rate for Denics would remove the main ethical objection to tobacco taxation of poor smokers\textsuperscript{42} and would also narrow the absolute differences in smoking prevalence between ethnic groups. Maori and Pacific smokers, more sensitive to price, may quit sooner.

Border control services’ success in keeping out smuggled AddictiveCigs could be aided by regulations to require manufacturers to provide markings to distinguish AddictiveCigs, Denics, and duty-paid cigarettes, and to disclose nicotine content. A Denic-driven resurgence of smoking is unlikely, as Denics are negatively rated, are
not addictive, and help smokers quit.\textsuperscript{2} Limited cultivation of home-grown RYO AddictiveCig tobacco for personal use is currently permitted, but if used to fortify Denic cigarettes, its sale would be illegal.

**Conclusion**

A two-tier excise policy would be importantly kinder to smokers, as it would allow them to select and smoke a mix of expensive AddictiveCigs and low-cost Denics to control smoking costs, reduce cravings and facilitate quitting. A lower tax rate classification for Denics would make it politically easier to increase the price of addictive cigarettes and thereby reduce smoking more rapidly to much lower levels.

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