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4 **Nicotine vaping product use, harm perception and policy support among pharmacy**
5 **customers in Brisbane, Australia**

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21 **[Short running title:** Pharmacy customers' use and opinion on vaping]

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26 **Abstract**

27 **Introduction and Aims.** Despite regulatory barriers for accessing nicotine liquid, use of
28 nicotine vaping products (NVPs) has increased rapidly in Australia. Legal use of NVPs to aid
29 smoking cessation requires a prescription, and pharmacies report receiving enquiries about the
30 use of and access to NVPs. In this study, we assessed NVPs use, harm perception and policy
31 support among community pharmacy customers.

32 **Design and Methods.** A cross-sectional survey was conducted among customers (n=470) from
33 a large community pharmacy chain in Brisbane, Australia. Multivariable logistic regression
34 was used to examine perception of NVPs as less harmful than combustible cigarettes and
35 regulatory recommendations in relation to demographics, smoking status and NVP use.

36 **Results.** Almost one-third of the sample (31%) had either tried NVPs in the past (16%) or were
37 current vapers (15%), the majority of them being current smokers (67%) who are trying to quit
38 (31%) or substitute smoking (41%). Vapers primarily depended on family/friends as a source
39 of information (76%). Current smokers and vapers were more likely to perceive NVPs as less
40 harmful than cigarettes than non-smokers and non-vapers. Perceiving NVPs as safer than
41 cigarettes was correlated with a recommendation to regulate as a tobacco product.

42 **Discussion and Conclusions.** There was widespread misperception about relative risk of
43 nicotine-containing products, with 37% of respondents perceiving nicotine-containing NVPs
44 to be as harmful as combustible cigarettes. Community pharmacies represent an ideal setting
45 for educating smokers about smoking and vaping. Thus, pharmacy staff need educational
46 support to ensure that they are equipped to provide current evidence-based information to
47 customers.

48 **Key words:** E-cigarette, Harm perception, Vaping, Australia

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54 **Introduction**

55 Nicotine vaping products (NVPs), also known as electronic nicotine delivery systems
56 (exemplified by electronic cigarettes or e-cigarettes), are a group of products that deliver
57 nicotine in the form of an aerosol (1). There has been a rapid increase in NVP use globally
58 since their first introduction into the market in mid 2000s (2). Acceptance and patterns of use
59 vary considerably across countries with rapid uptake evident in countries that have more liberal
60 regulations concerning the use and marketing of these products (3, 4). For instance, these
61 products are now more popular than nicotine replacement therapies (NRTs) for smoking
62 cessation in the UK, where they are widely available as consumer products (5).

63 In Australia, the laws regulating NVPs are complex and vary between jurisdictions. In all states
64 and territories, apart from Western Australia, vaping devices without nicotine can be sold as
65 consumer products. Over the past five years, most Australian states and territories have
66 introduced further regulations on the sale and use of nicotine-free vaping products similar to
67 regulations that are applied to combustible cigarettes. However, it is illegal to use nicotine
68 (classified as a dangerous poison or Schedule 7) in vaping products unless for a therapeutic
69 purpose such as quitting smoking, in which case nicotine delivered by lung inhalation is
70 classified as a prescription-only medicine (Schedule 4) and the user must hold a valid medical
71 prescription written by a registered medical practitioner. The Therapeutic Goods
72 Administration (TGA) has indicated that it is possible for a nicotine-containing NVP to be
73 approved as an aid to quit smoking (6), but as no product has progressed through the regulatory
74 system there is currently no commercial product available to be prescribed. So, currently
75 Australians can only access nicotine for use in NVPs using one of the legal pathways for
76 accessing unapproved therapeutic goods: personal importation, the Special Access Scheme,
77 Authorised Prescriber Scheme and extemporaneous compounding (7). Despite this regulatory
78 barrier, use of NVPs among Australian smokers significantly increased between 2013 and 2016
79 (8). In 2016, approximately one third of smokers in Australia (31%) had tried vaping and 4.4%
80 reported currently vaping (8). It is unclear what proportion of those respondents vape with
81 nicotine, but in a separate study conducted in 2016, 91% of NVP users in Australia reported
82 that their devices contained nicotine (9). The public's understanding of the regulations, and
83 their beliefs on what future regulatory frameworks should look like, could inform regulatory
84 efforts and implementation of new NVP-related policies. Assessing risk perceptions and policy
85 opinions of smokers, particularly those who have difficulty quitting smoking, are valuable
86 since they are the population who may benefit from using NVPs to quit smoking. The views of

87 non-smokers are also relevant because of concerns about non-smoking youth accessing NVPs
88 and potentially becoming addicted to nicotine.

89 Understanding perceptions of individuals about the relative safety of a particular behaviour
90 provides a basis for a predictive relationship between perception and engagement in such
91 behaviours. For instance, there appears to be a direct relationship between smokers' perception
92 of the relative harm of tobacco cigarettes and NVPs and the likelihood of switching from
93 smoking to vaping (10, 11). A longitudinal study showed that smokers/ex-smokers who
94 perceived NVPs as less harmful than smoking were more likely to subsequently try them (10).
95 In the majority of studies that assessed perceptions regarding the continuum of risk across
96 nicotine products, NVPs, hookah and smokeless tobacco products were perceived as less
97 harmful compared to combustible cigarettes (12). However, a considerable proportion of
98 smokers also report lack of knowledge about the relative safety (13), or believe NVPs are
99 equally harmful to tobacco cigarettes (13, 14). Similar misperceptions have also been reported
100 for nicotine in general, with a belief that nicotine is responsible for most smoking-related death
101 and disease (14, 15). Such lack of knowledge or misperception regarding relative harm could
102 potentially impede switching from smoking to lower-risk alternative products such as NVPs.

103 In a study conducted to evaluate the effect of recruitment setting on the composition of samples
104 consisting of adult smokers, community pharmacy settings were found to be better than general
105 practice sites in terms of recruiting hard-to-quit smokers and those who are pre-contemplators
106 of smoking cessation (16). This conclusion led the authors to suggest that community
107 pharmacies, being situated at the interface between primary health care and the general public,
108 represent an ideal recruitment site for targeting smokers who are either unwilling or less likely
109 to succeed at quitting. In addition, community pharmacies are an ideal setting for brief
110 interventions (e.g. providing smoking cessation counselling in the form of ask, advise and refer
111 approach) particularly to underserved and priority populations (17). Pharmacy staff represent
112 a highly accessible trained workforce and are uniquely positioned to provide evidence-based
113 information about the relative risks of various nicotine-containing products to smokers(18). A
114 recent study conducted in Australia found that pharmacy staff are frequently asked about NVPs
115 by their customers, but reported feeling uninformed about these products and indicated the
116 need for more information and guidance about NVPs (19). Exploring customers' level of
117 knowledge, harm perceptions and motivations for use of NVPs could, therefore, inform the
118 development of practice guidelines for pharmacy staff that will ultimately assist in providing a
119 customised, evidence-based and unbiased information to their customers. In this study, we

120 assessed pharmacy customer use of NVPs, reason/motivation for use, and source of
121 information as well as perceived beliefs regarding the relative risk of various nicotine-
122 containing products (i.e. smokeless tobacco products, NRTs, NVPs and combustible tobacco
123 cigarettes). We also asked respondents to indicate their views regarding how the sale of NVPs
124 (with and without nicotine) should be regulated in Australia.

125 **Methods**

126 A cross-sectional survey of pharmacy customers was conducted. All adult pharmacy customers
127 who visited four pharmacies of a large private pharmacy chain in various suburbs of Brisbane,
128 Queensland, Australia, during a one-week period in March 2015 for each pharmacy, were
129 approached and invited to participate. These were a convenience sample selected to access a
130 range of pharmacy customers (two based in the city and two in suburban areas). Human
131 Research Ethics approval was granted by the University of Queensland, School of Pharmacy
132 Ethics Committee. Participants were provided with an information sheet explaining the aim of
133 the survey and consent to participate was confirmed verbally prior to data collection.
134 Participants were given the option to complete the survey via a face-to-face interview or to
135 complete the questionnaire themselves in the presence of the data collector. Participation was
136 voluntary and no incentive was provided.

137 No suitable validated tool was identified, so the questionnaire was developed based on other
138 surveys conducted by our collaborators about consumer views and preferences of lower-risk
139 alternatives to smoking including NVPs (20-22). The questionnaire was piloted for
140 comprehensibility with five members of the general public recruited through the research
141 team's social networks, and slight adjustments made accordingly. The final questionnaire
142 included three sections. Section one contained questions on demographic characteristics of the
143 participants including age, gender, educational status, ever use of combustible cigarettes and
144 quit attempts. Among smokers who had previously made a quit attempt, a follow up item
145 queried the type of smoking cessation methods used/tried. Respondents were also asked
146 whether they had ever tried and/or were currently vaping, and asked to specify whether they
147 used nicotine or non-nicotine NVPs. All respondents who had ever used and/or were currently
148 using NVPs were asked about their reasons for using them with the following possible answers,
149 selecting all that apply from the following list: to quit smoking; to cut down the number of
150 tobacco cigarettes I smoke; as a substitute for smoking tobacco; because it does not have
151 smoke; because it is safer than smoking tobacco; to use in areas where smoking is banned; my

152 friends or family members recommended them; my health professional (Pharmacist, Doctor,
153 Counsellor etc.) recommended them; I like the taste; and to save money.

154 Section two assessed the perceived beliefs of respondents regarding the relative risk of various
155 nicotine-containing products including smokeless tobacco products, NRTs, NVPs compared to
156 combustible tobacco cigarettes with the question, “How harmful are the following
157 items/products, compared to regular tobacco cigarettes?” Responses were measured on a 5-
158 point Likert scale ranging from “Much less harmful” to “Much more harmful”. Perception
159 regarding short and long term safety of nicotine-containing NVPs were also assessed by the
160 questions “Nicotine-containing e-cigarettes are safe to use for (1) short term (<6 months); (2)
161 long term (>6 months or lifetime)” and “Nicotine-containing e-cigarettes are safer than NRTs”.
162 Responses were measured on a 5-point Likert scale ranging from “Strongly disagree to
163 “Strongly agree”.

164 Finally, respondents were asked to indicate their views on whether the sale of NVPs (with or
165 without nicotine) should be regulated in Queensland as consumer, tobacco, or medicinal
166 products, with the following options: 1) Should be sold on the shelf in general retail outlets; 2)
167 Should be sold under the counter to adults, like tobacco; 3) Should only be sold in pharmacies
168 with advice from a pharmacist; 4) should require a prescription from a doctor; and 5) should
169 be illegal to sell.

170 **Data analysis**

171 The data were entered into and analysed using IBM SPSS Statistics 24.0 (SPSS Inc., Chicago,
172 IL, USA). Descriptive statistics (frequencies and percentages) were employed to summarise
173 demographic and smoking characteristics of participants, stratified as ‘never’, ‘former’ or
174 ‘current’ NVP users. Descriptive statistics were also used to explore respondents’ views on the
175 sale of NVPs, stratified by smoking status (‘current’, ‘former’, and ‘non-smoker’). Bivariate
176 analysis and multivariable logistic regression analysis were employed to determine factors
177 associated with (1) perceiving NVPs as less harmful than combustible cigarettes (vs equally or
178 more harmful) and (2) regulatory recommendations (a consumer product, a tobacco product,
179 medicinal product or complete ban) were examined using multivariable logistic regressions.
180 The results were adjusted for demographics characteristics, smoking status and NVP use. Odds
181 ratio (OR) with 95% confidence interval (95% CI) were also computed along with
182 corresponding p -value; $p < 0.05$ was taken as indicating statistical significance.

183 **Results**

184 **Demographic and smoking characteristics**

185 A total of 744 pharmacy customers were invited to participate, of which 470 respondents
186 consented and completed the questionnaire giving a response rate of 63.2%. The socio-
187 demographic characteristics of respondents are described in Table 1. The sample consisted of
188 approximately equal proportion of men (52%) and women (48%), nearly half (47%) had a
189 tertiary level qualification and a small proportion identified as Aboriginal and/or Torres Strait
190 Islander (12%). Over half of the respondents (53.6%) were either current smokers (31.5%) or
191 ex-smokers (22.1%). Among current smokers, 112 (76%) indicated having tried to quit
192 smoking at least once, with the most common methods being ‘cold turkey’ (91%), NRTs (64%)
193 and NVPs (51%).

194

195 **Use of NVPs**

196 Almost a third of the respondents (30.8%) had either tried NVPs in the past (15.9%) or were
197 current users (14.8%). The majority of vapers (former and current) were male (70.3%, OR 4.64,
198 95% CI: 2.22-10.10, $p < 0.001$) and current smokers (66.7%, OR 79.3, 95% CI: 25.39-247.1,
199 $p < 0.001$). Of the 70 people that reported being current NVP users, all except one of them
200 were current or former smokers (Table 1). The most commonly mentioned reasons for NVP
201 use were ‘as a substitute for smoking tobacco’ (41.4%), ‘it is safer than smoking tobacco’
202 (40%), ‘to quit smoking’ (31%) and ‘to cut down the number of cigarettes I smoke’ (26.2%).
203 The majority of vapers reported that family/friends (75.9%) had recommended they try NVPs,
204 with only two (1.4%) users reporting being advised to try them by a healthcare professional.

205 **Perceived safety of NVPs**

206 Over half of respondents (56%) agreed or strongly agreed that short-term use (less than 6
207 months) of NVPs is safe. However, respondents were wary of long-term or lifetime use of
208 NVPs; more respondents disagreed (62%) than agreed (18%) with the statement that lifetime
209 use of NVP is safe (Figure 1).

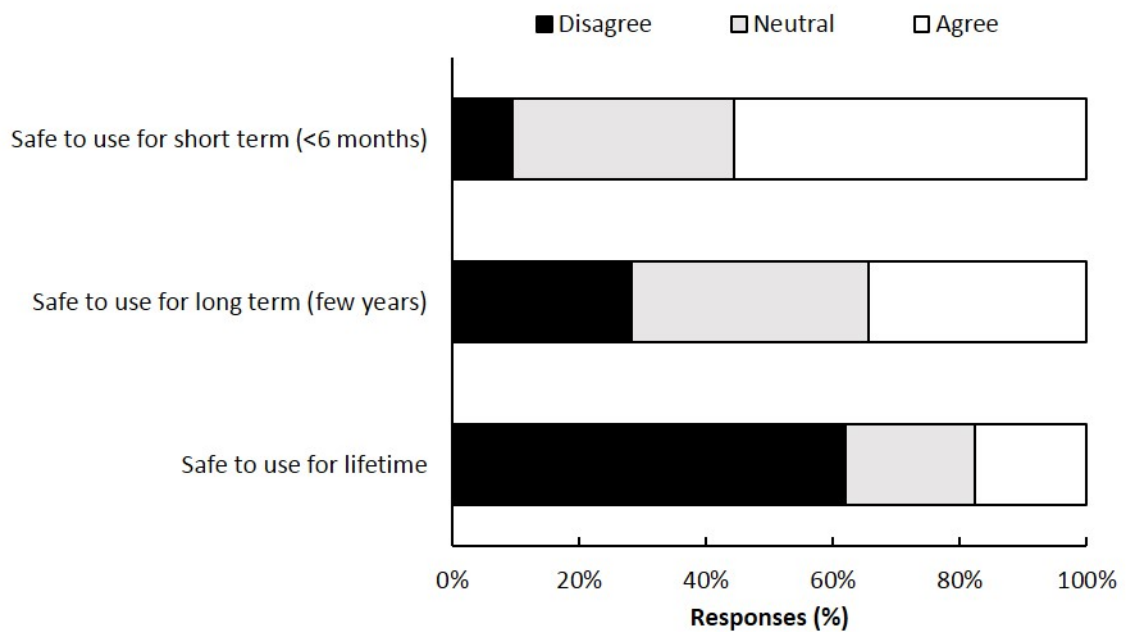
210 The majority of respondents believed that NVPs with nicotine (61.5%) or without nicotine
211 (83.2%) are less harmful than combustible cigarettes (Table 2). When stratifying harm
212 perception according to NVP use, the difference in harm perception among current, former and
213 never vapers is apparent. Current vapers perceived NVPs as less harmful than combustible

214 cigarettes, irrespective of whether they contained nicotine (93%) or were nicotine-free (97%).
215 In contrast, nearly half of non-users (46.5%) perceived nicotine-containing NVPs to be equally
216 as harmful as smoking, however this dropped to 20% for NVPs without nicotine. The majority
217 of respondents disagreed (60%) and few agreed (12%) with the statement that NVPs are safer
218 than NRTs. Nearly all respondents who disagreed (255 out of 282 respondents) did not use
219 NVPs, with only 3 current vapers disagreeing with the statement.

220

221 **Figure 1.** Respondents' opinions about the safety of e-cigarettes containing nicotine, n=470

222



223

224 **Table 1.** Demographic and smoking characteristics of participants, stratified by NVP use,
 225 n=470

Variables	NVP use, n (%)						Total n (%)	
	Never		Former		Current			
Gender								
Male	142	(30.2)	51	(10.8)	51	(10.8)	244	(51.9)
Female	183	(38.9)	24	(5.1)	19	(4.0)	226	(48.1)
Age								
18-25	40	(8.5)	16	(3.4)	33	(7.0)	89	(18.9)
26-35	86	(18.3)	35	(7.4)	27	(5.7)	148	(31.5)
36-45	63	(13.4)	14	(3.0)	8	(1.7)	85	(18.1)
≥46	136	(29.9)	10	(2.0)	2	(0.4)	148	(31.5)
Educational level								
Less than year 12	14	(3.0)	6	(1.3)	2	(0.4)	22	(4.7)
Senior school certificate	79	(16.8)	29	(6.1)	18	(3.8)	126	(26.8)
Post-school qualification	67	(14.2)	17	(3.6)	17	(3.6)	101	(21.5)
University level	165	(35.1)	23	(4.9)	33	(7.0)	221	(47)
Ethnicity (n=458)								
Australian	192	(58.5)	29	(9.7)	21	(6.3)	242	(74.5)
Aboriginal or Torres Strait	27	(8.2)	26	(8.0)	14	(4.3)	67	(20.5)
European	37	(11.3)	8	(2.4)	12	(3.6)	57	(17.3)
East Asian	42	(12.8)	8	(2.4)	15	(4.5)	65	(19.0)
Other*	30	(9.0)	2	(0.6)	7	(2.1)	39	(11.7)
Smoking status								
Current	43	(12.8)	54	(15.5)	51	(14.8)	148	(43.1)
Former	69	(20.1)	17	(4.9)	18	(5.2)	104	(30.8)
Never	213	(62.1)	4	(1.2)	1	(0.3)	218	(66.1)

226 *Other: the Americas, Southern & Central Asian and African descent

227

228

229 **Table 2.** Perceived safety of various nicotine-containing products compared to combustible
 230 cigarettes, n=470

Relative safety compared to tobacco cigarettes*	NVP use status			Total
	Current, n (%)	Former, n (%)	Never, n (%)	
Nicotine replacement therapies				
Less harmful	68 (97.1)	71 (94.7)	318 (97.8)	457 (97.2)
Equally harmful	2 (2.9)	4 (5.3)	7 (2.2)	13 (2.8)
More harmful	0	0	0	0
E-cigarettes with nicotine				
Less harmful	65 (92.8)	56 (74.7)	168 (51.7)	289 (61.5)
Equally harmful	5 (7.2)	18 (24)	151 (46.5)	174 (37)
More harmful	0	1 (1.3)	6 (1.8)	7 (1.5)
E-cigarettes without nicotine				
Less harmful	68 (97.1)	67 (89.3)	256 (78.8)	391 (83.2)
Equally harmful	2 (2.9)	8 (10.7)	65 (20)	75 (16)
More harmful	0	0	4 (2.2)	4 (0.8)
Herbal cigarettes				
Less harmful	28 (40)	35 (46.7)	161 (49.5)	224 (47.6)
Equally harmful	41 (58.6)	37 (49.3)	155 (47.7)	233 (49.6)
More harmful	1 (1.4)	3 (4.0)	9 (2.8)	13 (2.8)
Smokeless tobacco products				
Less harmful	33 (47.1)	36 (48)	127 (39.1)	196 (41.7)
Equally harmful	28 (40)	31 (41.3)	137 (42.1)	196 (41.7)
More harmful	9 (12.9)	8 (10.7)	61 (18.8)	78 (16.6)

231 *responses for ‘less harmful’ and ‘much less harmful’ were combined and presented as
 232 ‘less/more harmful’. Responses for ‘more harmful’ and ‘much more harmful’ were combined
 233 and presented as ‘more harmful’.

234

235 In the adjusted logistic regression model (Table 3), age, use of NVPs and smoking status were
 236 strongly correlated with accurately perceiving NVPs as less harmful compared to traditional
 237 cigarettes. Respondents in the age range of 18-25 years were 4.62 times more likely to perceive
 238 NVPs as less harmful compared to combustible cigarettes than those greater than 45 years old
 239 (OR 4.62, 95% CI: 2.30-9.26, $p < 0.001$). Current smokers (OR 2.61, 95% CI: 1.39-4.92,
 240 $p < 0.002$) and NVPs users (OR 3.89, 95% CI: 1.37-11.06, $p < 0.010$) were also more likely
 241 to perceive NVPs as less harmful compared to combustible cigarettes than non-smokers and
 242 NVP non-users.

243 **Table 3.** Logistic regression analyses of the perception that NVPs are less harmful than
 244 combustible cigarettes (vs equally/more harmful), adjusted for age range, smoking status and
 245 NVP use, n=470

Variables	β	S.E.	Odds ratio	95% CI		<i>p</i> -value
				Lower	Upper	
Age range (ref: ≥ 46)						< 0.001
18-25	1.53	0.35	4.62	2.30	9.26	< 0.001
26-35	1.19	0.27	3.29	1.92	5.68	< 0.001
36-45	0.59	0.88	1.81	1.03	3.18	0.039
Smoking status (ref: non-smokers)						0.011
Current smokers	0.96	0.32	2.61	1.39	4.92	0.002
Former smokers	0.41	0.28	1.52	0.87	2.64	0.137
NVP use (ref: non-user)						0.035
Current users	1.36	0.53	3.89	1.37	11.06	0.010
Former users	-1.32	0.79	0.27	0.06	1.26	0.095

246 Model summary: Chi-square: 99.13 ($p < 0.001$); Cox & Snell R Square (0.190); Nagelkerke
 247 R Square (0.258); Hosmer and Lemeshow Test (9.12; $P = 0.332$)

248

249 **Opinion regarding regulation of NVPs**

250 The majority of non-smokers supported regulating nicotine-containing NVPs either as a
 251 medicinal product (45%) or completely banning them (42.2%). They also believed that NVPs
 252 without nicotine should be treated the same as tobacco (38.1%) and only sold ‘under the
 253 counter’, which involves products being shielded from view of the general public with sale to
 254 over 18s only. Alternatively, a third (33.5%) viewed regulation as a medicinal product to be
 255 appropriate. On the other hand, the majority of current smokers recommended regulating both
 256 NVPs with (66.2%) and without nicotine (73.6%) as tobacco products, with only a minority of
 257 them recommending a medicinal route (22.3% for nicotine-containing and 6.8% for NVPs
 258 without nicotine) (Table 4). In the logistic regression model, perceiving nicotine-containing
 259 NVPs as safer than combustible cigarettes (vs equally or more harmful) was correlated with
 260 the recommendation to regulate them as tobacco products (OR 4.61, 95% CI: 1.65-12.84, $p =$
 261 0.03).

262

263

264 **Table 4.** Opinions regarding the sale of nicotine and non-nicotine NVPs in Queensland,
265 (n=470).

Regulation of NVPs	Smoker Status, N (%)					
	Current		Former smoker		Non-smoker	
How do you think e-cigarettes containing nicotine should be regulated?						
As consumer products	12	(8.1)	16	(15.4)	1	(0.4)
As tobacco products	98	(62.2)	25	(24)	27	(12.4)
As medicinal products*	33	(22.3)	30	(28.8)	98	(45)
Should be illegal to sell	5	(3.3)	33	(31.7)	92	(42.2)
How do you think e-cigarettes without nicotine should be regulated?						
As consumer products	26	(17.6)	23	(22.1)	8	(3.7)
As tobacco products	109	(73.6)	38	(36.5)	83	(38.1)
As medicinal products*	10	(6.7)	25	(24)	73	(34.5)
Should be illegal to sell	3	(2.1)	18	(17.4)	54	(24.8)

266 *pharmacy only or prescription only

267

268 **Discussion**

269 In this study, we surveyed adult pharmacy customers about their use and harm perceptions
270 about NVPs, and opinions on their regulation. Approximately one-third of the sample had
271 either tried NVPs in the past or were current vapers, the majority of them being current smokers
272 who are trying to quit smoking. Although pharmacy customers did not believe vaping to be
273 more harmful than smoking combustible cigarettes, many respondents (37%) perceived
274 nicotine-containing NVPs to be as harmful as combustible cigarettes. This misperception about
275 relative risk of various nicotine-containing products was also reflected in respondent regulatory
276 recommendations as they tended to prefer a more restrictive regulatory approach for NVPs
277 containing nicotine, supporting a complete ban or regulation as a medicinal product.

278 In Australia, the number of smokers who have tried NVPs has significantly increased in recent
279 years. While only 1.2% of adults reported currently using NVPs in the 2016 National Drug
280 Strategy Household Survey, nearly a third of smokers (31%) reported having ever having tried
281 NVPs (23). NVP users (current or former) in our study perceived them as safer than smoked
282 tobacco and had or were using them for the purpose of quitting, substituting or reducing the
283 number of cigarettes smoked. Similar published studies also found male gender and being a

284 smoker (ex- or current) as factors associated with NVP use (24-26). While ever use of NVPs
285 in our sample was higher (31%) than an online survey of 1,001 adults conducted in New South
286 Wales (13%), both studies identified males and current smokers as mostly likely to be NVP
287 users, and smoking cessation as the most common reason for using NVPs (27). Similar
288 perceived advantages of NVP use were also reported in other studies (24, 28-30).

289 Over two-thirds of respondents believed that NVPs are less harmful than combustible
290 cigarettes. In the multivariable logistic regression analysis, respondents in the age range of 18-
291 25 years, current smokers and NVP users were more likely to perceive NVPs as less harmful
292 than combusted tobacco. Stratifying harm perception according to NVP use generated an
293 interesting finding. Current vapers perceived NVPs as less harmful than combustible cigarettes,
294 irrespective of whether they contained nicotine or not. In contrast, the majority of non-users
295 considered NVPs as less harmful than cigarettes if they were nicotine-free, but fewer non-users
296 believed this for NVPs containing nicotine. Even though we did not specifically ask the
297 respondents for their views on nicotine, these findings indicate a potential misperception
298 among people who have never tried NVPs that nicotine is an important source of any harm
299 from using NVPs. Indeed, studies conducted across the globe have reported that many believe
300 NVPs to be less harmful than combustible cigarettes, yet a significant proportion have concerns
301 and misperceptions regarding nicotine (10, 13, 15, 31). Nicotine is a highly addictive substance,
302 but it is the mixture of more than 4,000 chemicals (tar) that is produced as a result of the
303 combustion that kills nearly half of long term smokers (32). While the majority of respondents
304 believed that short term use of NVPs is safe, they become wary when asked about safety of
305 long term use of NVPs and relative safety compared to NRTs. Due to being relatively new
306 products, safety of long term use of NVPs is currently not known. Findings from various
307 toxicological and short-term human studies, however, suggest that completely switching from
308 smoking to vaping reduces short term adverse health outcomes (33).

309 Generally, Australia follows a highly restrictive regulatory approach to NVPs. Few Australian
310 health and medical organisations have endorsed them as a cessation aid or harm reduction tool
311 for smokers. Rather, policy briefings, media releases and position statements from notable
312 health bodies focus mainly on the potential dangers associated with NVPs (34) unlike some
313 other western countries (35). This portrayal of NVPs as dangerous products could have an
314 impact on attitudes held by smokers and the general public towards their safety and what is an
315 appropriate regulatory approach. The majority of non-smokers in our study supported a
316 complete ban or a medicinal route for NVPs containing nicotine while allowing NVPs without

317 nicotine to be sold as tobacco products, mirroring current Australian regulations (36). Most
318 jurisdictions in Australia (except Western Australia) allow NVPs without nicotine to be legally
319 sold and used in places where smoking is allowed. However, since nicotine is classified as a
320 'dangerous poison' when not in human therapeutic or veterinary products (37), it is illegal to
321 use NVPs containing nicotine unless the person holds a valid medical prescription (7). Such a
322 regulatory approach is difficult to monitor and enforce owing to the difficulty of differentiating
323 nicotine-containing from nicotine-free solutions. It is also difficult to regulate product quality
324 under the current legislation. For instance, a recent study reported that e-liquids sold in
325 Australia as 'nicotine-free' actually contained nicotine (38), albeit at low levels, and most
326 Australian vapers rely on overseas online sources for nicotine-containing e-liquids (39).

327 A significant proportion of current smokers supported a regulatory environment that would
328 allow NVPs (with or without nicotine) to be regulated in the same way as tobacco products.
329 This regulatory option was also preferred by respondents who perceived NVPs as safer than
330 combustible cigarettes. In a similar study conducted among US smokers and non-smokers, it
331 was reported that perceived beliefs in the relative safety of NVPs was directly correlated with
332 their regulatory preference, such that respondents who believe NVPs are harmful will more
333 likely support policies that minimize use (40). Studies also reported that NVP users,
334 respondents having accurate knowledge about nicotine, and those who perceived NVPs as less
335 harmful than tobacco cigarettes were more likely to support a less restrictive regulatory
336 approach (41).

337 The majority of vapers in our study reported receiving information about NVPs from their
338 family/friends whereas only 1.4% of users had been advised by a HCP to use NVPs. Previous
339 studies conducted in the US have reported that most adults learnt about NVPs either through a
340 personal contact (a friend or family member), seeing them displayed in retail outlets (42) or
341 from the internet and social media (43). However, information sourced from the media and/or
342 anecdotal experiences may be biased and could lead to confusion as the content may not be
343 scientifically valid. The finding that few participants had received advice from a healthcare
344 professional about NVPs corroborates findings from a recent systematic review, which found
345 healthcare professionals do not engage in routine communication with patients regarding NVPs
346 and other low risk alternatives to smoking (18). Due to their geographic distribution and ease
347 of accessibility, community pharmacies represent an ideal setting to educate the public and
348 promote behaviours that improve health, one of which is smoking cessation. More than one-
349 third of staff (39%) in community pharmacies in Brisbane, Australia report being asked about

350 NVPs by their customers (19), yet nearly all of the pharmacy staff felt uninformed about these
351 products and were unsure how to handle customer enquiries amidst the scientific uncertainty
352 and lack of guidance from peak professional bodies. Thus, pharmacists need to be provided
353 with education/training and relevant resources so that they can provide unbiased and evidence-
354 based advice for customers.

355 Our study has a number of methodological limitations and caveats that should be taken into
356 account while interpreting the results. First, the questionnaire used for assessing the perception
357 of respondents was not validated. As this study employed a descriptive cross-sectional study
358 design and recruited a convenience sample of individuals attending urban pharmacies in
359 Brisbane, the results may not be generalizable to the wider population. Moreover, this study
360 should be regarded as a snapshot in time as the science surrounding NVPs is fast moving and
361 beliefs of respondents may have changed since data collection, although the regulatory
362 framework in Australia has remained unchanged since the study was conducted. Nonetheless,
363 this survey provides valuable insight into the existing gap in public perception of relative harm
364 of nicotine-containing products and informs the development of educational material for
365 pharmacy staff to facilitate provision of evidence-based information to their customers.

366 **Conclusions**

367 Although pharmacy customers did not believe NVPs to be more harmful than combustible
368 cigarettes, many respondents (particularly non-users) perceived nicotine-containing NVPs to
369 be as harmful as combustible cigarettes. Misperceptions about relative risk of various nicotine-
370 containing products were also reflected in respondent regulatory recommendations as they
371 tended to prefer a more restrictive regulatory approach if NVPs contain nicotine, supporting a
372 complete ban or regulation as a medicinal product that requires a medical professional to
373 control access. As tobacco smoking is associated with compromised health status, often
374 requiring medical intervention, community pharmacies are an ideal setting for educating
375 smokers about less harmful alternatives such as NVPs. The development of practice guidelines
376 for pharmacy staff will ultimately assist in providing a customised, evidence-based and
377 unbiased information to their customers.

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389 **Competing interest**

390 All authors declare that there is no actual or potential conflict of interest.

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