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Tobacco, electronic nicotine delivery system, nicotine replacement therapy, and cannabinoid use during pregnancy: A descriptive cross-sectional survey --Manuscript Draft--

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Full Title:	Tobacco, electronic nicotine delivery system, nicotine replacement therapy, and cannabinoid use during pregnancy: A descriptive cross-sectional survey
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Keywords:	Tobacco; electronic nicotine delivery system; Nicotine replacement therapy; cannabinoids; pregnancy; smoking cessation counseling
Abstract:	<p>Introduction Tobacco smoking is associated with adverse health outcomes for both pregnant women and their offspring. Smoking cessation counseling is an effective method to help women quit smoking. Developing a targeted smoking cessation intervention could benefit those who struggle to quit tobacco and potentially reduce the harm due to any co-occurring tobacco use. Assessing the prevalence of tobacco, electronic nicotine delivery systems (ENDS), nicotine replacement therapy (NRT), and cannabinoid use in pregnancy is key to developing such interventions. Thus, we aimed to assess the prevalence and patterns of tobacco, ENDS, NRT, and cannabinoid use in pregnancy. We further aimed to assess the prevalence of smoking cessation counseling intervention.</p> <p>Materials and Methods We conducted a cross-sectional survey among pregnant women attending regular clinical visits at Spitalzentrum Biel between February and May 2023 (n=262). Frequency and proportion along with 95% confidence intervals (CI) were reported for tobacco, ENDS, NRT, and cannabinoid use in pregnancy.</p> <p>Results Tobacco use was reported among 7.6% (20/262, 95% CI: 4.2%-11.1%) of the included pregnant women. Tobacco cigarettes (conventional or roll-on) were used by 7.3% (19/262, 95% CI: 3.8%-10.7%) of the surveyed pregnant women, with 0.8% (2/262, 95% CI: 0.0%-3.4%) of them reporting use of cigarettes along with ENDS and 0.4% (1/262, 95% CI: 0.0%-3.8%) reporting use of the cigarettes with NRT. Cannabinoid use was reported by 3.8% (10/262, 95% CI: 1.1%-7.0%) of pregnant women and all of them used products with Cannabidiol (CBD) only. Additionally, only 25% (5/20, 95% CI: 10.0%-48.3%) of tobacco users had received smoking cessation counseling intervention.</p> <p>Conclusion The estimated prevalence of tobacco, ENDS, NRT, and cannabinoid use among the pregnant women in this survey was 7.6%, 0.8%, 0.4%, and 3.8% respectively. However, among tobacco users, only one-fourth received smoking cessation counseling intervention.</p>
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Original Article

Tobacco, electronic nicotine delivery system, nicotine replacement therapy, and cannabinoid use during pregnancy: A descriptive cross-sectional survey

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Short title: Tobacco, ENDS, NRT, Cannabinoid Use in Pregnancy

1 **Abstract**

2 **Introduction**

3 Tobacco smoking is associated with adverse health outcomes for both pregnant women and
4 their offspring. Smoking cessation counseling is an effective method to help women quit
5 smoking. Developing a targeted smoking cessation intervention could benefit those who
6 struggle to quit tobacco and potentially reduce the harm due to any co-occurring tobacco use.
7 Assessing the prevalence of tobacco, electronic nicotine delivery systems (ENDS), nicotine
8 replacement therapy (NRT), and cannabinoid use in pregnancy is key to developing such
9 interventions. Thus, we aimed to assess the prevalence and patterns of tobacco, ENDS, NRT,
10 and cannabinoid use in pregnancy. We further aimed to assess the prevalence of smoking
11 cessation counseling intervention.

12 **Materials and Methods**

13 We conducted a cross-sectional survey among pregnant women attending regular clinical visits
14 at Spitalzentrum Biel between February and May 2023 (n=262). Frequency and proportion
15 along with 95% confidence intervals (CI) were reported for tobacco, ENDS, NRT, and
16 cannabinoid use in pregnancy.

17 **Results**

18 Tobacco use was reported among 7.6% (20/262, 95% CI: 4.2%-11.1%) of the included
19 pregnant women. Tobacco cigarettes (conventional or roll-on) were used by 7.3% (19/262,
20 95% CI: 3.8%-10.7%) of the surveyed pregnant women, with 0.8% (2/262, 95% CI: 0.0%-
21 3.4%) of them reporting use of cigarettes along with ENDS and 0.4% (1/262, 95% CI: 0.0%-
22 3.8%) reporting use of the cigarettes with NRT. Cannabinoid use was reported by 3.8%
23 (10/262, 95% CI: 1.1%-7.0%) of pregnant women and all of them used products with

24 Cannabidiol (CBD) only. Additionally, only 25% (5/20, 95% CI: 10.0%-48.3%) of tobacco
25 users had received smoking cessation counseling intervention.

26 **Conclusion**

27 The estimated prevalence of tobacco, ENDS, NRT, and cannabinoid use among the pregnant
28 women in this survey was 7.6%, 0.8%, 0.4%, and 3.8% respectively. However, among tobacco
29 users, only one-fourth received smoking cessation counseling intervention.

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50 **Introduction**

51 Smoking tobacco in pregnancy is a prevalent, modifiable risk factor for infant mortality and
52 morbidity [1,2]. The global prevalence of smoking during pregnancy was estimated at 1.8%,
53 with Europe reporting a prevalence of 8.1% [3]. In the USA, 5.4% of women who gave birth
54 in 2021 reported smoking while being pregnant [4]. In 2022, 8.3% of women giving birth in
55 Australia admitted to smoking during the first 20 weeks of pregnancy, with 71% of them
56 continuing to smoke throughout their pregnancy [5]. Smoking during pregnancy is associated
57 with an increased risk of several adverse maternal and neonatal outcomes such as placenta
58 previa, placental abruption, premature rupture of membranes, stillbirth, preterm birth, and
59 small for gestational age [6–10]. However, smoking cessation can help reduce these adverse
60 effects [11–13].

61 Smoking cessation counseling has been beneficial in supporting pregnant women to quit
62 tobacco use, but some might need additional support with smoking cessation aids to quit
63 smoking [14–16]. In addition to nicotine replacement therapy (NRT) and pharmacotherapy
64 (Varenicline or Bupropion), women view electronic nicotine delivery systems (ENDS) as an
65 aid for smoking cessation during pregnancy [17]. Indeed, a randomized controlled trial (RCT)
66 observed ENDS to be more effective when compared to NRT for smoking cessation,
67 showcasing the potential for promising smoking cessation support in pregnant tobacco users
68 [18]. However, there is limited evidence on the safety of using ENDS and NRT in pregnancy
69 [19–23]. Yet, women who find it difficult to quit tobacco continue to use ENDS or NRT
70 throughout pregnancy. In the UK, pregnant smokers struggling to quit tobacco are
71 recommended to use tobacco-free alternatives such as ENDS and NRT as a smoking cessation
72 intervention [16,24]. Notably, ENDS are perceived as a “safer alternative to tobacco” by
73 pregnant women, which has led to a substantial increase in the use of ENDS during pregnancy
74 [19,25]. The Behavioral Risk Factor Surveillance System Survey, a large health survey that

75 included adult women between 18 and 44 years, was conducted in the USA and observed that
76 ENDS use in pregnancy had almost doubled between 2016 and 2018 [26].
77 Furthermore, cannabinoids have also been reportedly consumed in pregnancy to treat issues
78 such as nausea, vomiting, increase in body weight, sleep issues, stress, anxiety, depression,
79 post-traumatic stress disorder, and chronic pain [27,28]. The data from the cannabis policy
80 study conducted between 2019 and 2021 on individuals aged 16-65 years in the USA and
81 Canada highlighted that approximately 20% of surveyed pregnant women used CBD-
82 containing products [27]. In 2022, a national survey conducted in the USA on substance use
83 observed that around 7.9% of the pregnant population consumed cannabis (which contained a
84 mixture of THC and CBD) [29]. Cannabinoids like CBD and THC are commonly
85 smoked/vaped and also consumed in the form of oils, edibles, and topical skin preparations
86 [30,31]. When cannabinoids are smoked, they are more likely to be co-used/mixed with
87 tobacco, resulting in an increased risk of adverse neonatal outcomes, thus limiting evidence on
88 the safety of the use of cannabinoids in pregnancy [31–36].
89 Given these observations, developing personalized, evidence-based, targeted interventions for
90 smoking cessation could potentially provide better support to those struggling to quit/reduce
91 tobacco use and also reduce the harm associated with any co-occurring tobacco use
92 [4,23,26,37–40]. Nonetheless, to develop such targeted interventions, understanding the
93 current prevalence of tobacco, ENDS, NRT, and cannabinoid use among pregnant women is
94 essential. Although nationwide surveys conducted in Switzerland until 2012 indicated that
95 around 10% of women smoked during pregnancy, current evidence on tobacco, ENDS, NRT,
96 and cannabinoid use among pregnant women in Switzerland is limited [41–45]. To bridge this
97 gap, this cross-sectional survey was designed with the primary objective of estimating the
98 prevalence and patterns of tobacco, ENDS, NRT, and cannabinoid use among pregnant women
99 attending regular clinical visits at Spitalzentrum Biel in Switzerland. The secondary objective

100 was to estimate the intention to quit using tobacco among pregnant users. The survey also
101 aimed to assess the prevalence of smoking cessation counseling intervention.

102 **Materials and Methods**

103 **Study design**

104 This was a cross-sectional monocentric survey.

105 **Setting**

106 The data for the study were collected from pregnant women coming to Spitalzentrum Biel, a
107 public hospital in Switzerland, between 1st of February and 24th of May 2023. The data was
108 collected in a fully anonymized and irreversible form. Thus, The Ethics Commission of the
109 Canton of Bern, Switzerland, waived the requirement for a formal submission, as the project
110 did not fall under the scope of the Swiss Federal Human Research Act (HRA), Article 2,
111 Paragraph 1, due to the way the data were collected (Req-2022-01416).

112 **Participants**

113 The participants included in the survey were pregnant women who came in for a regular clinical
114 visit (excluding emergency) at Spitalzentrum Biel between February and May 2023. Each
115 participant was eligible to take the survey once. To ensure this, at the beginning of each survey,
116 participants were questioned if they had already taken part in the survey (“*Befragung bereits*
117 *bei früherer Visite durchgeführt*” translated as “survey already conducted during the previous
118 visit”). Only those who answered “no” to this question were eligible to continue the survey.

119 **Outcomes**

120 The primary outcome of the study is the frequency and proportion of pregnant women using
121 tobacco products (tobacco cigarettes (conventional cigarettes or roll-on cigarettes) cigars,
122 pipes), tobacco heating systems (like IQOS, GloTM, Ploom), or smokeless tobacco (like snus)

123 and the use of ENDS, NRT and cannabinoid (cannabidiol only (CBD) or with
124 tetrahydrocannabinol (THC) >1%) products.

125 The secondary outcomes include frequency and proportion of i. pregnant women intending to
126 reduce/quit/have no change to the current use of tobacco products, ii. pregnant women
127 receiving smoking cessation counseling along with a descriptive summary of suggested
128 alternatives (like NRT, ENDS, pharmacotherapy (Bupropion/Varenicline), and other).

129 **Demographic characteristics**

130 Information on the maternal age and the gestational age (weeks of pregnancy) was collected
131 from the pregnant women at baseline.

132 **Instrument**

133 The information for this survey was collected through a questionnaire. The data were collected
134 by midwives who filled in the questionnaires, and the collected data were irreversibly
135 anonymized. The collected information includes demographic information (such as maternal
136 age and gestational age), information on the use of tobacco, ENDS, and NRT products in the
137 last 7 days, types and frequency of use of these products per day/ week, intent to quit using
138 these products during pregnancy, receiving smoking cessation counseling, and cannabinoid use
139 in last 30 days.

140 **Statistical analysis**

141 Descriptive analysis was conducted to summarize baseline characteristics and to report the
142 primary and secondary outcomes. Means and standard deviations were reported for the
143 maternal age. Median and interquartile range (IQR) were reported for the gestational age of the
144 women. The frequency and proportion, along with 95% confidence intervals (CI), were
145 reported for all the outcomes and were stratified based on the trimester of pregnancy. The 95%

146 CI was calculated using the multinomCI function in R from the DescTools package. All the
147 analyses were conducted with R version 4.3.2 [46].

148 **Results**

149 **Baseline characteristics**

150 For this survey, 337 completely anonymized responses were collected at Spitalzentrum Biel.
151 Among the collected responses, 262 responses were included in the analysis, while 75
152 incomplete responses were excluded from the analysis. The excluded responses included a
153 “yes” to the question “Befragung bereits bei früherer Visite durchgeführt” which translates to
154 “survey already conducted during the previous visit”. The average age of the included pregnant
155 women was 31.35 ± 5.11 years. More than half (55.3%, 145/262) of the included women were
156 in their third trimester (>28 weeks of pregnancy), and the rest were in their second trimester
157 (between 13-27 weeks of pregnancy). The median gestational age of women included in this
158 survey was 34.9 (IQR: 18.5-37.2) weeks.

159 **Prevalence of use of tobacco, ENDS, NRT, and cannabinoid in** 160 **pregnancy**

161 In this survey, 7.6% (20/262, 95% CI: 4.2%-11.1%) of the included pregnant women reported
162 use of tobacco products. The tobacco products that were reportedly used in this study included
163 tobacco cigarettes (7.3%, 19/262, 95% CI: 3.8%-10.7%) and tobacco heating systems (0.4%,
164 1/262, 95% CI: 0.0%-3.8%). Tobacco cigarettes were used along with ENDS in 0.8% (2/262,
165 95% CI: 0.0-3.4%) and with NRT in 0.4% (1/262, 95% CI: 0.0-3.8%) of the pregnant women
166 in the survey. Cannabinoid use was reported among 3.8% (10/262, 95% CI: 1.1%-7.01%) of
167 the pregnant women. All the cannabinoid product users reported using products containing
168 CBD only, and no one used products with $\text{THC} > 1\%$. No concomitant use of tobacco and
169 cannabinoids was reported among the pregnant women. The results are presented in Table 1

170 **Table 1. Prevalence of tobacco, electronic nicotine delivery systems, nicotine replacement therapy, and cannabinoid use in pregnancy**

Prevalence of tobacco, electronic nicotine delivery systems (ENDS), nicotine replacement therapy (NRT), and cannabinoid use in pregnancy	N=262	Proportion	95% confidence interval (CI)
Non-use of tobacco, ENDS, NRT, and cannabinoids	221	84.4%	80.5%-88.8%
Missing data on use of tobacco, ENDS, NRT, and cannabinoids	11	4.2%	3.8%-8.6%
Tobacco use ^a	20	7.6%	4.2%-11.1%
Tobacco cigarettes (Conventional or roll-on cigarettes)	19	7.3%	3.8%-10.7%
with ENDS	2	0.8%	0.0%-3.4%
with NRT	1	0.4%	0.0%-3.8%
Tobacco heating systems	1	0.4%	0.0%-3.8%
with other products ^b	1	0.4%	0.0%-3.1%
Cannabidiol use (Exclusive cannabidiol (CBD) users) ^c	10	3.8%	1.1%-7.0%

171 **Footnotes**

172 ^aInformation on tobacco use was not available for 9 participants and for 1 participant the interview was not possible.

173 ^bOther products that were not specified in the survey.

174 ^cInformation on cannabinoid use was not available for 10 participants and for 1 participant the conversation on cannabinoid use was not possible during the survey.

175 **Prevalence of use of tobacco, ENDS, NRT, and cannabinoids:**
176 **stratified by trimester of pregnancy**

177 When stratified by trimester, 10.3% (12/117,95% CI: 5.1%-16.1%) of pregnant women in their
178 second trimester reported using tobacco products while only 5.5% (8/145, 95% CI: 1.4%-9.9%)
179 of the pregnant women in their third trimester reported any such use. Among pregnant women
180 in their second trimester, all tobacco users were tobacco cigarette smokers, with 1.7%
181 (2/117,95% CI:0.0%-7.9%) using tobacco cigarettes along with ENDS and 0.9% (1/117,95%
182 CI:0.0%-7.1%) reporting use of tobacco cigarettes with NRT. In the case of pregnant women
183 in their third trimester, 4.8% (7/145, 95% CI:0.7%-9.1%) of pregnant women reported smoking
184 tobacco cigarettes and 0.7% (1/145, 95% CI:0.0%-4.9%) reported using tobacco heating
185 system. No use of ENDS or NRT was reported among the included pregnant women in their
186 third trimester. Cannabinoid use (CBD only) was reported by 5.1% (6/117,95% CI: 0.1%-
187 9.6%) of pregnant women in their second trimester and by 2.8% (4/145,95% CI: 0.0%-6.9%)
188 in their third trimester. The results are shown in Table 2.

189 **Table 2. Prevalence of tobacco, electronic nicotine delivery systems, nicotine replacement therapy, and cannabinoid use in pregnancy**
 190 **stratified based on trimester of pregnancy**

Prevalence of tobacco, electronic nicotine delivery systems (ENDS), nicotine replacement therapy (NRT), and cannabinoid use in pregnancy	Second Trimester (N=117)			Third Trimester (N=145)		
	N	Proportion	95% confidence interval (CI)	N	Proportion	95% confidence interval (CI)
Non-use of tobacco, ENDS, NRT, and cannabinoids	95	81.2%	75.2%-88.5%	126	86.9%	82.1%-92.0%
Missing data on use of tobacco, ENDS, NRT, and cannabinoids	4	3.4%	0.0%-22.7%	7	4.8%	0.0%-9.9%
Tobacco use ^a	12	10.3%	5.1%-16.1%	8	5.5%	1.4%-9.9%
Tobacco cigarettes (Conventional or roll-on cigarettes)	12	10.3%	5.1%-16.1%	7	4.8%	0.7%-9.1%
with ENDS	2	1.7%	0.0%-7.9%	0	-	-
with NRT	1	0.9%	0.0%-7.1%	0	-	-
Tobacco heating systems	0	-	-	1	0.7%	0.0%-4.9%
with other products ^b	0	-	-	1	0.7%	0.0%-4.9%
Cannabidiol use (Exclusive cannabidiol (CBD) users) ^c	6	5.1%	0.1%-9.6%	4	2.8%	0.0%-6.9%

191 **Footnotes**

192 ^aAmong the women in their second trimester, three had missing data on tobacco use due to unavailable information. In the third trimester, six women had missing data on
 193 tobacco use; for five of them, the information was not available, and for one, the interview could not be conducted.

194 ^bOther products that were not specified in the survey.

195 ^cRegarding cannabinoid use, among the participants in their second trimester, data was unavailable for three women, while one could not be interviewed during the survey. For
 196 those in their third trimester, seven participants had missing data on cannabinoid use, with no information available for any of them

197 **Frequency and prevalence of use of different types of tobacco**
198 **products, ENDS, and NRT among pregnant users**

199 Among pregnant women reporting tobacco use, 90.0% (18/20, 95% CI: 85%-100%) reported
200 smoking conventional cigarettes, and 50% of them used less than 5 cigarettes per day. Roll-on
201 cigarettes were used by 5.0% (1/20, 95% CI: 0.0%-19.8%) of the tobacco users and 5.0% (1/20,
202 95% CI: 0.0%-19.8%) also reported using tobacco heating systems. Among the ENDS and NRT
203 users, 2 (50.0%,95% CI: 25.0%-100.0%) pregnant women reported using ENDS, and 1 (25%,
204 95% CI: 25.0%-86.0%) pregnant women reported use of NRT. The results are summarized in
205 Tables 3 & 4.

206 **Table 3. Prevalence and Frequency of use of tobacco in pregnancy**

Tobacco products	Tobacco Users (N= 20)		Frequency (Number/day) N (%)					
	N (%)	95% Confidence interval (CI)	<5	6-10	11-15	>15	Other	No information
Conventional Cigarette	18(90.0%)	85.0%-100.0%	9(50.0%)	5 (27.8%)	0	1 (5.6%)	0	3 (16.7%)
Roll-on Cigarette	1(5.0%)	0.0%-19.8%	0	1 (100.0%)	0	0	0	0
Tobacco heating system	1(5.0%)	0.0%-19.8%	0	0	0	0	0	1(100.0%)

207

208 **Table 4. Prevalence and Frequency of use of electronic nicotine delivery systems, nicotine replacement therapy, and other products in**
 209 **pregnancy**

Electronic nicotine delivery systems (ENDS), nicotine replacement therapy (NRT), and other products use in pregnancy	Number of participants (N=4)		Frequency (Number/day)/ (ml/day [for liquids]) N (%)					
	N (%)	95% Confidence interval (CI)	<5	6-10	11-15	>15	Other	No information
ENDS users								
ENDS without nicotine	2(50.0%)	25.0%-100.0%	0	2 (100.0%)	0	0	0	0
NRT users								
Inhaler	1(25.0%)	0.0%-86.0%	0	1 (100.0%)	0	0	0	0
Other product users	1(25.0%)	0.0%-86.0%	0	0	0	0	0	1 (100.0%)

210

211 **Intention to quit/reduce/not change the use of tobacco**

212 On questioning the pregnant women reporting tobacco cigarette use about their intention to
213 quit or reduce their current use, it was observed that 31.6% (6/19,95% CI: 10.5%-54.7%)
214 wanted to quit, 36.8% (7/19,95% CI: 15.8%-60%) wanted to reduce, and 26.3% (5/19,95% CI:
215 5.3%-49.5%) wanted no change to the current use of tobacco cigarettes. However, one of two
216 ENDS users reported an intention to quit smoking, while the only NRT user also reported her
217 intention to reduce tobacco smoking. The results are presented in Table 5.

218 **Table 5. Preference to quit/change tobacco use: by tobacco, electronic nicotine delivery systems, nicotine replacement therapy, other**
 219 **products users in pregnancy**

220

Preference	Conventional or roll-on cigarette users (N=19)		Tobacco heating system users (N=1)		Electronic nicotine delivery systems (ENDS) users (N=2)		Nicotine replacement therapy (NRT) user(N=1)		Other product user ^d (N=1)	
	N (%)	95% CI	N (%)	95% CI	N (%)	95% CI*	N (%)	95% CI	N (%)	95% CI
Want to quit	6(31.6%)	10.5%-54.7%	0	-	1(50.0%)	50.0%-100.0%	0	-	0	-
Wants to reduce	7(36.8%)	15.8%-60%	0	-	-	-	1(100%)	-	0	-
No change	5(26.3%)	5.3%-49.5%	1 (100.0%)	-	1 (50.0%)	50.0%-100.0%	0	-	1 (100%)	-
Missing ^a	1(5.3%)	0.0%-28.4%	0	-	-	-	0	-	0	-
Interested in a study to switching to ENDS ^b	1(5.3%)	0.0%-20.8%	0	-	0	-	0	-	0	-
Missing ^c	1(5.3%)	0.0%-20.8%	0	-	0	-	0	-	0	-

221

Footnotes

222

^aNo information was available for these participants

223

^bThis variable was only recorded for those who used tobacco [conventional/roll-on cigarette or tobacco heating system (IQOS)]

224

^cOnly 1 participant had missing information on interest in the study to switch to e-cigarettes.

225

^dOther products that were not specified in the survey.

226

CI: Confidence Interval.

227 **Prevalence of smoking cessation counseling intervention in**
 228 **pregnancy**

229 Only 25% (5/20, 95% CI: 10.0%-48.3%) of those who used tobacco products in pregnancy had
 230 received a smoking cessation counseling intervention, and all those who received this
 231 intervention reported smoking tobacco cigarettes. Only one among those who received the
 232 smoking cessation intervention was recommended to use NRT as an alternative. None received
 233 a recommendation for pharmacotherapy. The results are presented in Table 6.

234 **Table 6. Smoking cessation intervention for pregnant tobacco product users and**
 235 **alternatives suggested**

Smoking cessation intervention	Tobacco users (N=20)	
	N (%)	95% Confidence Interval (CI)
Received a smoking cessation counseling ^a	5 (25.0%)	10.0% -48.3%
Suggested Alternative		
Nicotine replacement therapy (NRT)	1(5.0%)	0.0-27.8%
Not specified	1(5.0%)	0.0-27.8%
Missing ^b	3 (15.0%)	0.0%-37.8%
Missing ^c	2 (10.0%)	0.0%-33.3%

236 **Footnotes**

237 ^aAll tobacco users who received smoking cessation counseling were conventional or roll-on cigarette users.

238 ^bNo information was available for these individuals regarding the alternative suggested

239 ^bNo information was available for these individuals on whether they had received smoking cessation counseling

240 **Discussion**

241 In this cross-sectional survey of 262 pregnant women coming for their regular clinical visits in
 242 one center in Switzerland, we found a prevalence of tobacco products at 7.6%, ENDS at 0.8%,
 243 NRT at 0.4%, and cannabinoid use at 3.8%.

244 Previously conducted studies observed the prevalence of tobacco use among pregnant women
245 in Switzerland to vary between 7.0% and 21.0% [47–49]. This is in line with the current study
246 showing a prevalence of 7.6%. The prevalence of tobacco use observed in our study is,
247 however, lower than that observed in the National perinatal survey conducted in France. In the
248 French perinatal survey, 16.6% of women smoked tobacco in their third trimester of pregnancy
249 in 2016, which then decreased to 12.2% in 2021 [50–52]. Additionally, upon stratifying
250 tobacco use by trimester, we observed that the number of tobacco product users in the second
251 trimester was nearly twice as high as in the third trimester. It is, however, not clear if this
252 difference is due to ceasing tobacco use fearing adverse effects during later stages of
253 pregnancy, due to underreporting, or chance [53,54].

254 While assessing the prevalence of cannabinoid use, none of the pregnant women reported using
255 cannabinoid products with $\text{THC} > 1\%$ but reported use of only CBD products. This could be due
256 to potential underreporting of THC use, as the use of cannabinoid products with $\text{THC} > 1\%$ for
257 recreational purposes is to date prohibited in Switzerland [55]. Additionally, unlike THC, CBD
258 is less psychoactive and thus perceived to be “safe” when compared to THC [35]. Nevertheless,
259 there is a paucity of evidence on the safety of using CBD in pregnancy. Preclinical studies have
260 pointed out potential gender-specific deficits in problem-solving, motor, and discriminatory
261 abilities [56,57]. However, more studies with real-world data are necessary to fully understand
262 the effect of CBD on perinatal outcomes. Like tobacco use, when stratified by trimester, the
263 number of CBD product users in the third trimester was approximately half of that observed in
264 the second trimester. In Switzerland, the use of CBD products containing 3-20% CBD and
265 $\text{THC} < 1\%$ for smoking is increasing [58,59]. A survey conducted among the general population
266 in Switzerland has highlighted the co-use of tobacco, in addition to e-cigarettes and cannabis
267 among CBD users [60]. Although no co-use of these products was observed in our study, this

268 could still be due to potential underreporting. Additionally, the form or route of consumption
269 of CBD was not collected in this study.

270 On assessing their intention to quit smoking, 32% of pregnant women in this survey wanted to
271 quit smoking tobacco cigarettes. Observational studies conducted in the past found a significant
272 association between quitting tobacco use during pregnancy and a positive impact on birth
273 weight & neonatal body composition in infants [14,61–64]. A cross-sectional study on live
274 births between 2011 and 2017 observed that women who quit smoking after knowing about
275 pregnancy or during the first trimester had a lower risk of preterm birth compared to those who
276 smoked throughout the pregnancy [65]. Nevertheless, 37% of tobacco cigarette smokers in this
277 survey sample wanted to reduce the use of tobacco in pregnancy. Although quitting tobacco
278 use during pregnancy provides numerous benefits and should be the primary goal, reducing
279 tobacco use can still have positive effects for women who find it difficult to quit. Therefore,
280 they should be encouraged to reduce their tobacco use [14]. Around 26% of pregnant women
281 smoking cigarettes in this survey sample wanted no change in the use of tobacco. Educating
282 this subgroup of pregnant women on the merits of smoking cessation by healthcare providers
283 could be beneficial [66].

284 In our study, a small proportion of women reported ENDS (0.8%) and NRT (0.4%) use. Among
285 them, one ENDS user mentioned her intent to quit using tobacco, and the sole NRT user also
286 intended to reduce smoking. Additionally, NRT was also suggested as an alternative to support
287 smoking cessation to one pregnant woman who reportedly smoked tobacco and also received
288 smoking cessation counseling in our study. In addition, none were suggested with
289 pharmacotherapy as an alternative. ENDS, NRT, and pharmacotherapy with Varenicline or
290 Bupropion are reportedly used for smoking cessation in pregnancy and can help mitigate the
291 harmful effects associated with tobacco [25,67]. An RCT assessing the impact of the use of
292 NRT in pregnancy observed a significant reduction in the number of smoked cigarettes among

293 pregnant women and an increase in birth weight and gestational age with NRT use [68]. The
294 Pregnancy trial of E-cigarettes and Patches (PREP) study, a recently conducted RCT,
295 highlighted that the use of ENDS and NRT can improve smoking cessation without increasing
296 the risk of adverse outcomes in pregnancy when compared to abstainers who do not use such
297 products [69]. A recently published retrospective cohort study also observed that the use of
298 NRT, Varenicline, or Bupropion during pregnancy was not associated with an increased risk
299 of major congenital malformations compared to smoking during the first trimester. Although
300 more research is required to assess the effectiveness and safety of NRT and pharmacotherapy
301 use in pregnancy, providing cessation support using these resources could be beneficial in
302 reducing the adverse outcomes due to smoking in pregnancy [14, 70,71].

303 It is noteworthy that, despite many pregnant tobacco users willing to quit or reduce tobacco
304 use, only 25% of pregnant tobacco users received smoking cessation counseling in our study.
305 This could be due to the potential underreporting of tobacco use in pregnancy to healthcare
306 providers. Underreporting of tobacco use in pregnancy could arise due to the stigma and
307 stereotypes associated with it [53]. The stigma associated with smoking could motivate women
308 to conceal smoking and sometimes encourage them to binge smoke, which could have harmful
309 effects on the mother and fetus [72]. The fact that a considerable proportion of pregnant women
310 smoking cigarettes reported their intentions to quit (32%) or reduce (37%) tobacco use in this
311 anonymous survey highlights the potential need for an intervention that effectively maintains
312 patient anonymity to support smoking cessation efforts. A digital intervention, such as a
313 smartphone app for smoking cessation, could be an effective solution, as it is cost-effective,
314 highly flexible, and preserves patient anonymity [73]. Further studies should be conducted to
315 fully understand the potential for a personalized digital intervention for smoking cessation in
316 pregnant women. In our anonymized survey, 4.2% of included pregnant women still did not
317 provide any response when questioned on their tobacco, ENDS, NRT, and cannabinoid use. In

318 these cases, using digital intervention to collect such information, while preserving the
319 anonymity of the patient might improve the response rate.

320 **Strengths and limitations**

321 In contrast to previous studies, this study assessed the frequency of use of tobacco, ENDS,
322 NRT, and cannabinoid products stratified by pregnancy trimester. Notably, it is among the few
323 studies that also examined cannabinoid use among pregnant women. Nonetheless, the study
324 has several limitations. This is a single-centered study with a small sample size, and
325 information on the socioeconomic and psychological characteristics of the women included in
326 the study was not collected. Thus, it was not possible to assess if our study cohort was a
327 representative sample of the pregnant population in Switzerland or a high-risk group. Another
328 **important limitation is that all substance use has been self-reported**, which could also be prone
329 to underreporting, thus resulting in an underestimation of the prevalence of such use in our
330 sample. In the case of cannabinoid use, legal constraints on THC use in Switzerland could also
331 have resulted in the underreporting of THC use in pregnancy, resulting in an underestimation
332 of its prevalence. Also, the form of consumption of CBD was not collected, which limits the
333 knowledge on the potential co-use of tobacco by pregnant women. Thus, the result of this study
334 needs to be interpreted with caution.

335 **Conclusion**

336 This monocentric cross-sectional survey conducted in Switzerland focused on assessing the
337 proportion of tobacco, ENDS, NRT, and cannabinoid use among pregnant women at a hospital
338 for regular check-ups in Biel, Switzerland. The results showed that 7.6% of pregnant women
339 used tobacco products. ENDS and NRT were reportedly used by 0.8% and 0.4% of the pregnant
340 women, and 3.8% of the pregnant women reported the use of cannabinoids, particularly
341 products containing only CBD during pregnancy. Although many pregnant tobacco users were

342 willing to reduce or quit smoking, only 25% of them received smoking cessation counseling.
343 The use of digital intervention could improve reporting of tobacco use and promote
344 participation in smoking cessation counseling. Future studies should, however, evaluate the
345 potential of such digital strategies. Additionally, further research is required to collect
346 comprehensive information on the form of cannabinoid use among pregnant women in
347 Switzerland to understand the co-use of tobacco among cannabinoid users.

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