

1 **Title:** Evaluation of E-Cigarette Use in Opioid-Dependent Patients in
2 Maintenance Treatment

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35 **Abstract**

36 **Introduction:** As tobacco smoking decreases, the use of e-cigarettes is on
37 the rise. There is a debate whether the switch from smoking to the use of
38 e-cigarettes might represent a harm reduction strategy for those who
39 smoke tobacco heavily, a habit which is often observed in individuals with
40 opioid dependence. The present study investigated the prevalence and
41 patterns of tobacco smoking and e-cigarette use in patients in opioid
42 maintenance treatment (OMT), and whether e-cigarette use contributed to
43 cessation of smoking tobacco. **Methods:** In 2014 (n=84) and in 2021
44 (n=128), patients from two OMT clinics of a psychiatric university hospital
45 were interviewed **Results:** In both surveys, patients presented with
46 comparable average age (45.6 vs 46.9 years of age), gender distribution
47 (mainly male 71.4 vs 75.8%), and length of OMT history (median: 66 vs.
48 55 months). The lifetime prevalence of e-cigarette use (45.2% in 2014, and
49 38.9% in 2021) was much higher than the current prevalence (4.9% and
50 7.8%, respectively). Few patients reported either a complete switch from
51 smoking to the use of e-cigarettes (2014, n= 1 vs. 2021, n=2) or the
52 achievement of abstinence from smoking after a temporary use of e-
53 cigarettes (2014, n=2 vs. 2021, n=1). **Discussion:** No increase in the use
54 of e-cigarettes in these groups of OMT-patients was observed. Presumably,
55 harm reduction strategies relating to the use of e-cigarettes in this group
56 need to be supported by motivational interventions. Given the high
57 morbidity and mortality due to smoking, OMT clinics should offer
58 professional help in reducing smoking.

59

60 **Key words:** opioid maintenance treatment- opioid dependence – nicotine
61 dependence – e-cigarette – harm reduction

62

63 **Introduction**

64 For decades, governments worldwide have tried to reduce the prevalence
65 of tobacco consumption to prevent further damage to smoking individuals;
66 their direct environment; and the society [1–4]. To achieve this, a range of
67 interventions (e.g., restrictions regarding commercials and distribution of
68 tobacco products, higher taxation of cigarettes and other tobacco products,
69 and awareness campaigns regarding the negative health consequences of
70 tobacco consumption) have proved to be effective, with tobacco
71 consumption generally decreasing globally [5, 6]). People with substance
72 use disorders, though, still show high rates of tobacco smoking [7-9].

73
74 In parallel with the decrease of tobacco smoking, e-cigarettes, e-vapes, and
75 tobacco vaporizers were developed. These devices were introduced to the
76 worldwide markets around 2008, and since then an overall steady increase
77 in the utilization of e-cigarettes and comparable products has been
78 observed. The current use of e-cigarette products varies between countries,
79 with 2.2% in Germany [10] compared to 3.2% in the USA [11]. The
80 prevalence of lifetime e-cigarette use varies between the groups of current
81 tobacco smokers (20.3%), former smokers (4.7%) and never-smokers
82 (1.2%) [12]. In Germany, the lifetime prevalence of e-cigarette use by
83 adolescents (aged 14-17 years) increased from 2016 to 2020, from 9.2%
84 to 13.4%, whilst in young adults (aged 18–24 years) the lifetime prevalence
85 in the same time-frame remained stable (22.4% vs 22.8%, [13]). For the
86 whole sample, current use of e-cigarettes was reported by 2.3% of
87 adolescents and 3.3% of young adults [13, 14]. The use of these e-products
88 is especially popular in persons who smoke heavily, with studies reporting
89 prevalence rates ranging from 20% [15] to 27.7% [16].

90
91 The use of e-cigarettes is not harmless; indeed, it has been discussed
92 whether it may increase the risk of developing a variety of diseases [17],
93 including cancer [18]. The debate about the health risks associated with the
94 initiation of e-cigarette use in non-smokers is beyond the scope of this

95 investigation. It has been suggested, however, that the use of e-cigarettes
96 is less harmful to people's health, compared to the use of combustible
97 tobacco products, especially because the exposure to toxic chemicals is
98 lower [19-21]. In this context, the use of e-cigarettes is discussed as a
99 possible aid to quit conventional cigarette smoking [22, 23]. For example,
100 the British National Institute for Health and Care Excellence (NICE)
101 formulated the guideline "Tobacco: preventing uptake, promoting quitting
102 and treating dependence, NG209" [24]. This guideline stresses the harm-
103 reduction benefits of e-cigarettes, based on two assumptions: a) the e-
104 cigarette is less harmful to the consumer than the conventional tobacco
105 cigarette; and b) the use of an e-cigarette product leads to increased rates
106 of abstinence for those trying to quit conventional smoking [25]. According
107 to the European Respiratory Society (ERS), however, a harm reduction
108 strategy for smokers which includes recommending alternative nicotine
109 delivery products should be reserved to the minority of high-risk tobacco
110 smokers [26].

111
112 People suffering from mental disorders such as depression, PTSD and
113 substance use disorders (SUD) show high prevalence rates of tobacco
114 smoking [27, 28]. Opioid dependent subjects are often dependent from
115 other drugs as well, which most typically includes nicotine [29]. Whereas
116 smoking rates in the general European population are reported to be of
117 25.9% [30], smoking rates of up to 94% were reported for patients in opioid
118 maintenance treatment (OMT)[7, 8]. Furthermore, patients attending OMT
119 show a higher prevalence of both smoking and heavy smoking than non-
120 OMT patients in substance abuse treatment [31]. Compared with tobacco
121 smokers from the general population, studies have reported similar rates in
122 quitting attempts in OMT patients, although success rates for smoking
123 cessation in OMT patients were very low [8, 32].

124
125 Opioid dependent tobacco smokers show a high prevalence in morbidity and
126 mortality associated with chronic obstructive pulmonary disease (COPD),

127 cardiovascular diseases and oncological disorders (e.g. in lung and other
128 regions) [33, 34]. This may well emphasize the potential benefits of
129 implementing smoking cessation, or at least harm reduction initiatives
130 tailored for these patients. In the current sample of OMT patients, we
131 investigated if there was an increase in the use of e-cigarettes in recent
132 years, similar to what was observed in the general population [13].
133 Furthermore, we aimed here at assessing the pattern and duration of
134 previous and current e-cigarette use; if the switch to e-cigarettes occurred
135 with the aim of quitting cigarette smoking; and whether this was
136 successfully achieved.

137

138

139 **Methods**

140 For the present study, cross-sectional surveys were carried out at two
141 points in time (2014 and 2021). Data were collected at the two OMT clinics
142 of the Department of Addiction Medicine and Addictive Behavior, LVR
143 University Hospital Essen, Germany. The city of Essen is part of the Rhine-
144 Ruhr metropolitan area of the Western part of Germany, an area of about
145 600,000 individuals presenting with an estimated number of 1.200 opioid
146 dependent persons, with some 600 of them being in an OMT programme.
147 Some 90 patients are treated in each of the two OMT clinics. Both clinics
148 are headed by a specialist in psychiatry and psychotherapy. Psychologists,
149 social workers as well as medical assistants are part of the treatment staff.
150 Patients visit the OMT clinics daily to take their maintenance medication
151 (e.g. racemic methadone, buprenorphine, levomethadone) under
152 supervision. Patients who appear stable with regard to abstinence from
153 alcohol and illegal drugs may be considered for a take-home prescription.
154 In case of a serious relapse into drug use and/or occurrence of mental
155 illness requiring hospitalization, there is a close cooperation with the
156 inpatient staff.

157

158 Data collection took place in 2014 in one of the two OMT clinics, and in both
159 clinics in 2021. Patients currently in OMT were informed about the study,
160 both verbally and in writing, and provided a written informed consent prior
161 to being interviewed. Participation was voluntary; refusal to take part to the
162 study was not associated with any negative consequences. Being in an OMT
163 was the main eligibility criterion; exclusion criteria included lack of sufficient
164 German language proficiency; severe cognitive impairment; and presence
165 of an acute/severe psychiatric disorder, for example a schizophrenia-
166 spectrum psychosis.

167

168 For the purpose of this study, some basic and simple questions were added
169 to the German version of the EuropASI [35]. Most of these questions were
170 in a yes/no format and regarded both the use of e-cigarettes and possible
171 smoking cessation. The survey was conducted as a 1:1 interview by trained
172 health professional staff. In order to confirm the intelligibility of the
173 questionnaire itself, a range of patients were extensively interviewed during
174 the pilot period of the project. The study variables of interest included here:
175 the patients' sociodemographic characteristics; their possible levels of
176 tobacco smoking; their previous smoking cessation treatment experiences
177 (e.g. nicotine replacement, other medications; group or individual therapy
178 attendance); their possible e-cigarette use; the characteristics and patterns
179 of their tobacco smoking and/or e-cigarette use; and their intention to quit
180 smoking. Regarding e-cigarette use, patients were asked on how many
181 occasions they had used these devices, with answering options having
182 included here: "never", "less than 5 times lifetime" and "more than 5 times".
183 They were also asked how long in total they had used e-cigarettes. Answers
184 to this question in terms of weeks, months or years were converted into
185 days. Those who indicated at least 2 weeks of regular e-cigarette use were
186 asked to answer to a list of specific reasons for this use.

187

188 In addition, patients were asked about both their possible drug use (e.g.,
189 heroin, cannabis, cocaine etc.) and the presence of psychiatric and somatic

190 disorders. Data were analyzed using the statistics' software SPSS, version
191 28 [36]. Chi-square tests of independence and Welch-t-tests were
192 calculated to assess differences between the two cohorts.

193

194 The study was approved by the Ethics' Committee of the Medical Faculty of
195 the University of Duisburg-Essen, Germany (21-10174-BO).

196

197

198 **Results**

199 Some 84 out of 90 (93.3%) patients were interviewed in 2014, and 128 out
200 of 170 patients (75.3%) in 2021. The remaining patients either refused
201 participation or fulfilled the exclusion criteria. As shown in table 1, both
202 groups were comparable in terms of age (2014: 45.6 vs 2021: 46.9; n.s.)
203 and gender distribution (males: 71.4% vs 75.8%; n.s.). Both groups
204 consisted of patients in long-term maintenance treatment (median of
205 length: 66 vs. 55 months; n.s.). During the 30 days prior of being
206 interviewed, patients had used a range of addictive substances, different
207 from nicotine, for an average of 17.3 cumulative days in 2014 vs 22 days
208 in 2021. These substances included alcohol (consumption rate 42.9% vs
209 36.2%), benzodiazepines (10.8% vs 12.6%), cannabis (46.4% vs 36.2%),
210 cocaine (9.5% vs 19.7%), heroin (14.3% vs 14.2%), amphetamines (2.4%
211 vs 7.1%) and others (see table 1). Psychiatric comorbidity were quite
212 frequent in both groups, mostly affective (30.5% vs 20.2%) and anxiety
213 disorders/PTSD (8.5% vs 10.5%; see table 1). Many participants suffered
214 from at least one respiratory disease, with the most represented having
215 been COPD (28.6% vs 16.7%) and bronchial asthma (3.6% vs 8.7%) (see
216 table 1).

217

218 **Table 1:** *Sociodemographic and medical characteristics of the two cohorts of*
219 *2014 and 2021.*

	2014 cohort (n=84)	2021 cohort (n=128)
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Age (years)		
Mean (SD)	45.6 (7.5)	46.9 (9.9)
Gender		
Male	n=60 (71.4%)	n=97 (75.8%)
Female	n=24 (28.6%)	n=31 (24.2%)
Duration of maintenance treatment (months)		
Mean (SD)	84.6 (71.7)	68.3 (58.8)
Median	66	55
Use of psychoactive substances (last 30 days):		
Alcohol	n=36 (42.9%)	n=46 (36.2%)
Benzodiazepines	n=9 (10.8%)	n=16 (12.6%)
Cannabis	n=39 (46.4%)	n=46 (36.2%)
Cocaine	n=8 (9.5%)	n=25 (19.7%)
Heroin	n=12 (14.3%)	n=18 (14.2%)
Other opiates	n=1 (1.2%)	n=0
Hallucinogens	n=0%	n=3 (2.3%)
Amphetamines	n=2 (2.4%)	n=9 (7.1%)
Cumulative number of days with concomitant substance use		
Mean (SD)	17.3 (19.8)	22.0 (26.9)
Severe respiratory diseases:		
Bronchial asthma	3 (3.6%)	11 (8.7%)
Cancer in respiratory system	1 (1.2%)	1 (0.8%)
COPD	24 (28.6%)	21 (16.7%)
Hemoptysis	0	1 (0.8%)
Partial lung resection	0	1 (0.8%)
Pneumonia	0	2 (1.6%)
Pulmonary emphysema	1 (1.2%)	2 (1.6%)
Tuberculosis	0	1 (0.8%)

Psychiatric comorbidity (except personality disorders):

No diagnosis	n=40 (48.8%)	n=82 (66.1%)
Schizophrenia (ICD F2)	n=5 (6.1%)	n=5 (4.0%)
Affective Disorders (ICD F3)	n=25 (30.5%)	n=25 (20.2%)
Anxiety disorders and PTSD(ICD F4)	n=7 (8.5%)	n=13 (10.5%)
Other	n=3 (3.7%)	n=6 (4.8%)

220

221 In both surveys, most patients were current tobacco smokers (in 2014:
 222 94.0% vs 2021: 91.4%; see table 2). The prevalence of current heavy
 223 smoking (e.g. intake of at least 20 cigarettes/day) was 60.8% in 2014 and
 224 46.2% in 2021. Regular tobacco smoking typically had started at about the
 225 age of 16 in the 2014 group, and at the age of 15.6 in the 2021 group. The
 226 number of years of regular smoking was comparable between the two
 227 groups, with a median of 30 years for each group. In both groups, most
 228 patients reported of previous attempts of quitting smoking without a
 229 professional help; e.g. 57.1% in 2014 vs 64.4% in 2021. Only a minority
 230 (2014 vs 2021; 7.5% vs 20.3%; $p=0.009$) had tried to quit smoking with
 231 the help of a professional, having most typically been prescribed with
 232 nicotine replacement products. Overall, nicotine abstinence after nicotine
 233 replacement therapy was only of short duration, typically less than 7 days
 234 (see table 2). Some 5 former tobacco smokers in the 2014 group were here
 235 identified, and 10 in 2021 (6.0% vs 7.8%; n.s.). One patient of the 2021
 236 cohort had never smoked, whilst in the 2014 cohort one patient had
 237 attended psychotherapy or counseling sessions with the aim of achieving
 238 tobacco abstinence.

239

240 **Table 2:** *Characteristics of tobacco cigarette use of both cohorts*

	2014 (n=84)	2021 (n=128)	p^1
Smoking status			
Current Smoker	n=79 (94.0%)	n=117 (91.4%)	.48

Ex-smoker	n=5 (6.0%)	n=10 (7.8%)	
Never smoker	n=0	n=1 (0.8%)	
Heavy smokers (≥ 20 cigarettes/d) among smokers	n=48 (60.8%)	n=54 (46.2%)	
Age at onset of regular nicotine use			
Mean (SD)	16.0 (3.9)	15.6 (4.2)	.40
Years of regular smoking			
Mean (SD)	29.5 (7.7)	31.2 (9.7)	.16
Self-conducted attempts of abstinence			
None	n=36 (42.9%)	n=42 (35.9%)	.30
One	n=26 (31.0%)	n=55 (47.0%)	
Two	n=8 (9.5%)	n=16 (13.7%)	
Three or more	n=14 (16.3%)	n=4 (3.4%)	
Use of nicotine replacement products during abstinence attempt (only quitters)			
Yes	n=6 (12.5%)	n=24 (32.0%)	.014
No	n=42 (87.5%)	n=51 (68.0%)	
Duration of abstinence after nicotine replacement therapy			
0-7 days	n=4	n=22	
8-90 days	n=0	n=1	
91-180 days	n=2	n=1	

Counseling or psychotherapy for achieving tobacco abstinence

Yes n=1 (1.2%) 0

241 ¹ Chi²-Test for categorical, Welch-t-Test for continuous variables.

242 *Note:* Percentages based on total number of valid responses.

243

244 Both groups presented with a substantial number of patients reporting a
 245 lifetime use of e-cigarettes (2014 and 2021; n= 38 and n= 49; 45.2% vs
 246 38.9%; n.s.; see table 3). However, current rates of use of e-cigarettes
 247 were noticeably low (4.9% vs 7.8%; n.s). A significant increase over time
 248 in the lifetime number of days of e-cigarette use between the two groups
 249 was identified, with N = 24 (SD=64) in 2014 vs N = 224 (SD = 336) in
 250 2021 (p<.001). The use of e-cigarettes occurred in order either to reduce
 251 tobacco smoking (n= 6 in 2014, vs n= 26 in 2021), or to stop it altogether
 252 (n=7 vs n=25). Other reasons for the use of e-cigarettes included:
 253 expectation of e-cigarettes being less harmful (n=6 vs n=23); tobacco
 254 smoking being more harmful (n=3 vs n=12); and money-saving reasons
 255 (n=7 vs n=28; see table 3).

256

257 **Table 3:** *Characteristics of e-cigarette use in the two cohorts.*

	2014 (n=84)	2021 (n=128)	p ¹
E-cigarette, lifetime use			
yes, less than five times	n=22 (26.8%)	n=4 (3.1%)	
yes, five times and more	n=14 (17.1%)	n=44 (34.3%)	
yes, number of occasions not specified	n=2 (2.4%)	n=1 (0.7%)	
Never	n=44 (53.7%)	n=79 (61.7%)	0.31 (yes vs. no)
Duration of e-cigarette use (days)			<.001
Mean (SD);	24 (64)	224 (336)	

Median	1	35	
E-cigarette use over a period of at least 2 weeks	n=16 (19.0%)	n=38 (29.7%)	
Reasons for e-cigarette use (at least 2 weeks of use)			
... for reduction of tobacco cigarette smoking	n=6	n=26	
... for switching from tobacco cigarette	n=7	n=25	
... for tobacco cigarette withdrawal	n=4	n=18	
... due to lesser harm expected	n=6	n=23	
... due to negative consequences of tobacco cigarette smoking	n=3	n=12	
... for saving money	n=7	n=28	
... together with acquaintances	n=1	n=5	
...other reasons	n=0	n=0	
E-cigarette, current use			
Yes	n=4 (4.9%)	n=10 (7.8%)	.41
No	n=77 (95.1%)	n=118 (92.2%)	
Dual use of e-cigarette and tobacco cigarette			
Yes	n=3	n=8	
No	n=1	n=2	

258 ¹ Chi²-Test for categorical variables, Welch-t-Test for "Duration of e-cigarette use".

259 *Note:* Percentages are based on the total number of valid responses.

260

261 The current overall use of e-cigarettes was low, with 4 participants (4.9%)
262 in 2014 and 10 participants (7.8%) having reported it in 2021. Most (3 out
263 of 4 cases in 2014; 8 out of 10 in 2021) e-cigarettes' consumers practiced
264 the so called "dual use", where e-cigarettes were used in combination with

265 tobacco smoking (see table 3). Only a few patients reported a switch from
266 the tobacco smoking to the use of e-cigarettes (2014, n= 1 vs. 2021, n=2).
267 Overall, only 3 (2 in 2014, and 1 in 2021) previous tobacco smokers stated
268 that they had successfully achieved nicotine abstinence after a temporary
269 use of e-cigarettes.

270

271 Out of the total sample, patients < 35 years of age (n=20) showed higher
272 lifetime rates of e-cigarette use (60.0%) than those aged 35-44 (n=64:
273 34.4%), 45-54 (n=40: 46.5%), or \geq 55 years (n=40: 30.0%). In addition,
274 current use was more frequent in the youngest group (15.0%) than in the
275 older groups (6.3%, 7.1%, and 2.6%, respectively); although these
276 percentages are based on small absolute frequencies. Age differences
277 between those with vs. without a lifetime e-cigarette use were small in both
278 the 2014 group (mean 45.9 [SD 7.3] years versus 46.0 [SD 7.7]), as well
279 as in the 2021 group (mean 46.2 [SD 11.0] versus 47.4 [SD 9.1]).
280 Regarding those with versus without a current e-cigarette use, the age
281 pattern was similar in 2014 (mean 43.8 [SD 6.0] vs. 45.5 [7.6]).
282 Conversely, in 2021 those currently using e-cigarettes were markedly
283 younger than those not using these devices (mean 42.1 [SD 11.6] vs. 47.3
284 [9.7] years). All mean differences were statistically not significant (all at p
285 > 0.5; Welch t-test).

286

287

288 **Discussion**

289 Consistent with previous findings [7, 8] in the present study more than 90%
290 of both samples of opioid dependent patients in OMT were smoking tobacco
291 at the time of investigation. Furthermore, about half of both samples were
292 to be considered as persons who smoke heavily (2014: 60.8%; 2021:
293 46.2%). These consistently high smoking rate over the last decade or so
294 are in sharp contrast with the trend of decreasing levels of cigarette
295 smoking in the general population of both Germany and other developed
296 countries [5].

298 In both surveys, the lifetime prevalence of e-cigarette use was much higher
299 than the current use of e-cigarettes (2014: 45.2% vs 4.9%; 2021: 38.9%
300 vs 7.8%). Hence, whilst a substantial number of patients had made an
301 experience with e-cigarettes, this was not followed by a long-term use of
302 these devices. Patients gave a variety of reasons, including cost-saving and
303 harm-reduction issues, for their resorting to the use of e-cigarettes. More
304 than half of both groups had tried at least once to quit cigarette smoking
305 without a professional support (57.1% vs 64.4%), and only a small minority
306 ever tried to quit smoking with proper professional help. However, as the
307 current rate of tobacco smoking showed, the effect of such attempts was
308 either short-lasting or unsatisfactory. It is however interesting to note the
309 significant increase in the use of nicotine replacement products (7.5% vs
310 20.3%) over time. As OMT patients seemed here to be open to be
311 prescribed with a nicotine replacement medication in combination with
312 further professional support, treatment package should be offered in OMT
313 clinics.

314

315 The lifetime prevalence of the use of e-cigarettes in the 2021 OMT group
316 (38.9%) was higher than the 2020 respective figures referring to German
317 adolescents (13.4%) and young adults (22.8%) [13]. This is of particular
318 interest, as the groups of adolescents and young adults usually show higher
319 prevalence of e-cigarette use in comparison to the group of middle-aged
320 people [37]. Also, the current use of e-cigarettes was higher in OMT patients
321 (7.8%) than in adolescents (2.3%) and young adults (3.3%) from the
322 general population [13]. Similar to what was observed in the general
323 population [13], in the current sample the < 35 years age group reported
324 more often than the older group of a former and current e-cigarette use.
325 However, due to the small overall prevalence of e-cigarette use, group
326 differences were not statistically significant. In general, there is a lack of
327 studies regarding the use of e-cigarettes in middle aged and older persons.

328 Until the beginning of the 2020s, trends relating to e-cigarette use and
329 consumption patterns were widely unknown [13]. Since then, the use of e-
330 cigarettes has been primarily studied among young people, showing that in
331 this group e-vaping use has increased very rapidly. For members of this age
332 group, e-cigarette use is considered as particularly troubling due to
333 nicotine's influence on brain development; risk of developing nicotine
334 addiction; and increased probability of initiation of traditional tobacco
335 smoking [13]. Consistent with this, the World Health Organization
336 recommended monitoring the use of both tobacco products and e-
337 cigarettes, and especially so in adolescents [38].

338

339 Only three patients who formerly smoked tobacco cigarettes switched here
340 to e-cigarettes and stopped any tobacco smoking (2014: n=1; 2021: n=2).
341 Conversely, current dual (cigarette and e-cigarette) use resulted to be a
342 popular practice (2014: 3 out of 4 users of e-cigarette, 2021: 8 out of 10).
343 Given the high prevalence of heavy cigarette smoking in these samples, one
344 could wonder why higher levels of switch from conventional to e-cigarettes
345 smoking were not observed. For long-term tobacco smokers, smoking may
346 be more than just nicotine uptake [39] and these people would find it
347 difficult to abandon both the ritual of smoking and the related sensations.
348 In short, the 'liking' of tobacco cigarette smoking may be a possible reason
349 for the lack of use of e-cigarettes [39]. Also, the overall use of the e-
350 cigarettes in older cohorts is reported to be lower than in adolescents and
351 younger adults [13]; and the average age of OMT patients was here of
352 about 46 years.

353 Opioid dependent individuals show consistently high smoking rates. The
354 reasons for these high levels of use are multifactorial [40] including early
355 onset of regular nicotine use [41], living in environments where smoking is
356 the norm [42], and a genetic vulnerability to develop a substance-related
357 disorder common to both nicotine and opioid dependence [40]. All these
358 factors contribute to make the treatment of nicotine dependence in opioid-

359 dependent individuals very difficult. To further improve the health of their
360 patients, OMT clinics should set smoking cessation of their patients as one
361 of their treatment goals, and they should offer practical support to achieve
362 this goal. This may include motivational interviewing; nicotine replacement
363 therapy; and cognitive behavioral therapy programs for smoking cessation
364 [43-45]. A harm reduction approach for those patients who are not
365 prepared to stop smoking could include the switch to an exclusive use of e-
366 cigarettes.

367

368 In order to reduce the associated health risks in this group of persons who
369 smoke heavily, a regular implementation of nicotine cessation programs
370 within OMT clinics would be highly advisable. Such measures, which should
371 focus on harm reduction advice tailored for this particular patient group,
372 would include not only a professional-led behavioral training and treatment,
373 but also provision of information about e-cigarettes as an alternative to
374 conventional cigarettes. A recent study showed that in OMT patients who
375 were instructed about the use and potential benefits of e-cigarettes and
376 were also provided with the related devices, the daily consumption of
377 tobacco cigarettes was significantly reduced [46]. In line with this, OMT
378 facilities could consider the option of providing their patients with e-
379 cigarette devices for harm-reduction purposes.

380

381 Although the present results are based on the patients' statements, they
382 confirm previous studies emphasizing the high rates of cigarette smoking in
383 OMT patients [7, 8, 30, 31]. These results seem to be both plausible and
384 consistent with the observations made by the treatment team on an almost
385 daily basis. This two-point-in-time cross-section survey lacked the ability to
386 identify any explanatory or causal relations between the different
387 parameters. However, given the lack of any former research that would
388 have granted us the possibility to define detailed hypotheses, the current
389 study was designed with the aim of obtaining first a description of the

390 tobacco smoking vs e-cigarette use changes over time in this specific group
391 of patients. Finally, due to the very low number of patients regularly using
392 e-cigarettes, we were not able to calculate any significant differences
393 between groups regarding use of e-cigarettes and its possible effects on
394 smoking cessation.

395

396 Although a substantial percentage of OMT patients made a previous
397 experience with e-cigarettes, a significant increase of the regular use of e-
398 cigarettes over time was not observed here. Apart from single cases of a
399 successful achievement of abstinence from cigarette smoking obtained with
400 the help of e-cigarettes, most e-cigarette consumers presented with a dual
401 use instead. Various attempts to quit smoking in these OMT patients were
402 observed, hence one could argue that this population is sensible regarding
403 the risks of smoking. It seems that there were no spontaneous attempts
404 towards considering harm reduction initiatives in this group of OMT patients.
405 This might be due to a variety of factors, such as a lack of motivation or
406 knowledge towards those devices associated with the harm reduction, or
407 perception of nicotine dependence as being a secondary problem compared
408 to opioid dependence. A further possible reason for the continued tobacco
409 smoking could be due to the limited amount of nicotine in e-cigarette
410 products, consistent with the Tobacco Products Directive by the European
411 Union [47]. Hence, it would be of interest to see the results of possible trials
412 focusing on the effectiveness of high nicotine dosage delivery devices. Such
413 factors should be investigated by future research, so that proper prevention
414 and treatment campaigns can be designed and implemented. In addition,
415 studies on the implementation of professional help to facilitate smoking
416 cessation in OMT clinics should be carried out to assess further possibilities
417 on how to aid the patients' smoking cessation approaches.

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