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Received: 7 February 2024 | Revised: 28 April 2024 | Accepted: 28 April 2024

DOI: 10.1111/dar.13864

ORIGINAL PAPER

Drug and Alcohol REVIEW APSAD WILEY

E-cigarette use in pregnancy in Australia: A cross-sectional survey of public antenatal clinic attendees

Alice Rice[1,2] | **Melanie Kingsland**[1,2,3,4] | **Emma Doherty**[1,2,3,4] | **Milly Licata**[1,2] | **Belinda Tully**[5,6] | **John Wiggers**[1,2,3,4] | **Luke Wolfenden**[1,2,3,4] | **Michelle Foster**[7] | **Christophe Lecathelinais**[1] | **Justine Daly**[1,2,3,4]

[1]Hunter New England Population Health, Hunter New England Local Health District, Newcastle, Australia

[2]Hunter Medical Research Institute, Newcastle, Australia

[3]School of Medicine and Public Health, College of Health, Medicine and Wellbeing, The University of Newcastle, Newcastle, Australia

[4]Priority Research Centre in Health Behaviour, University of Newcastle, Newcastle, Australia

[5]Gomeroi Nation, New South Wales, Australia

[6]Armajun Aboriginal Health Services, Inverell, Australia

[7]Nursing and Midwifery Services, Hunter New England Local Health District, Newcastle, Australia

Correspondence
Justine Daly, Booth Building, Longworth Ave, Wallsend, Awabakal Country, NSW 2287, Australia.
Email: justine.daly@health.nsw.gov.au

Funding information
Hunter New England Local Health District

Abstract

Introduction: E-cigarette use has rapidly increased amongst young people in Australia, however the prevalence of use amongst pregnant people is not known. The aim of this study was to examine the prevalence of e-cigarette use and dual use of e-cigarettes and tobacco cigarettes, characteristics associated with use and reasons for use amongst a sample of pregnant Australian people attending public antenatal clinics.

Methods: A cross-sectional survey was conducted with 4024 pregnant people attending antenatal appointments, between July 2021 and December 2022, in one local health district in New South Wales, Australia. Main outcome measures were current use of e-cigarettes, dual use with tobacco cigarettes, participant characteristics associated with use and reasons for use.

Results: 1.24% of pregnant people used e-cigarettes, 34% of these were dual smokers. Being a current smoker (OR 39.49; 95% CI 9.99–156.21) or ex-smoker (OR 29.86; 95% CI 8.75–101.95) were associated with e-cigarette use. Quitting smoking was the most reported reason for use (52%).

Discussion and Conclusions: This study is the first to report on the prevalence of e-cigarette use amongst pregnant people in Australia. We found that a small proportion of pregnant people use e-cigarettes and that many are dual users or ex-smokers. E-cigarette use and rates of dual use in pregnancy in Australia appear lower than internationally, however they are similarly being used as a smoking-cessation aid by many. As regulatory environments relating to e-cigarette access change in Australia, large-scale studies are required to continue to monitor e-cigarette use and dual use in pregnancy.

KEYWORDS
maternal health, population health, pregnancy, smoking, vaping

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Key Points

- Strict regulatory environments relating to e-cigarettes exist in Australia.
- E-cigarette use in pregnancy in Australia appears to be lower than internationally.
- Most e-cigarette users are dual smokers or ex-smokers.
- Users often report using e-cigarettes as a smoking cessation aid.

1 | INTRODUCTION

Electronic cigarettes (e-cigarettes) are battery powered devices that heat an 'e-liquid' to produce an aerosol which is inhaled by the user [1]. These devices primarily serve as electronic nicotine delivery systems and contain chemicals and toxic substances that increase risk of cancer [1]. Long term health effects are not yet established, however their use may be associated with heart and respiratory disease [2].

While the adverse effects of smoking tobacco during pregnancy on perinatal and child health are well known [3], there is limited data on the safety of e-cigarette use during pregnancy. Emerging research suggests that e-cigarette use during pregnancy may be associated with increased risk for small for gestational age when compared to non-e-cigarette users [4, 5]. Guidance for clinicians in New Zealand and the UK endorses the use of e-cigarettes to support smoking cessation if a pregnant woman is unable to quit smoking using other methods [6–8]. However, in the USA and Australia, it has been recommended that pregnant people avoid the use of e-cigarettes [9, 10]. The Australian Pregnancy Care Guidelines do not currently address e-cigarette use in pregnancy [11].

Regulation of the availability of nicotine containing e-cigarettes varies internationally from an age-restricted consumer good (UK, NZ and USA) to a doctors' prescription only model (Australia) [12]. Population based studies from the USA and UK, report prevalence of current e-cigarette use amongst pregnant people between 2.2% and 4.6% [13, 14]. Obisesan et al. [13] found that 2.2% of pregnant people in the USA ($N = 7434$, 2016–2018) were current e-cigarette users, with 46% reporting dual use with tobacco cigarettes. Bowker et al. [14] found that 4.6% of pregnant people in the UK were current users of e-cigarettes and 72.8% were dual users. Given the rapidly evolving nature of e-cigarette use globally, and when these studies were conducted, these rates may be underestimates of current use. In Australia, no pregnancy specific prevalence data on current use of e-cigarettes have been reported. Population surveys conducted in New South Wales (NSW) (2021–2022) found the prevalence of current e-cigarette use in females of childbearing age to be 15.7% (16–24 years), 7.0% (25–34 years) and 3.5% (35–44 years) [15]. However, given pregnancy may influence patterns of use [4] prevalence of e-cigarette use amongst pregnant people in Australia remains unknown.

Few studies have examined characteristics associated with e-cigarette use in pregnancy. Rollins et al. [16] found that pregnant people in the USA who reported e-cigarette use were significantly more likely to identify as non-Hispanic White, have depression symptoms during pregnancy, and use drugs or alcohol during pregnancy compared to people who reported no e-cigarette use [16]. Further, a 2018 UK study found that, smoking during pregnancy was the characteristic most strongly associated with e-cigarette use in pregnancy [17]. No research has examined characteristics associated with e-cigarette use in pregnancy in the Australian context.

To inform government health policy and support health care professionals to provide appropriate assessment and effective management for e-cigarette use in pregnancy, it is important to understand why pregnant people use e-cigarettes. A 2021 systematic narrative review found the most common reasons reported for e-cigarette use during pregnancy were: to help reduce or quit smoking; prevent relapse to smoking; and to reduce smoking related harm [18]. However, none of the included studies were conducted in Australia, and therefore the generalisability of these results to Australian pregnant people is not known.

Considering the gaps in current understanding of the prevalence and nature of e-cigarette use during pregnancy in Australia this study aimed to examine:

- the prevalence of current e-cigarette use;
- the prevalence of dual use of tobacco cigarettes and e-cigarettes;
- characteristics associated with current e-cigarette use; and
- and reasons for e-cigarette use;

in a sample of pregnant people attending public antenatal clinics.

2 | METHODS

2.1 | Study design and setting

A cross-sectional survey was undertaken from 19 July 2021 to 22 December 2022 with pregnant people who were receiving public antenatal care from one local

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health district in NSW, Australia. The district covers urban and regional/rural areas, including one tertiary referral hospital (approximately 4000 births annually) and 14 smaller regional hospitals (approximately 50–2000 births annually). In NSW approximately 78% of births are in public hospitals [19].

2.2 | Sampling and recruitment

People were eligible to participate in the survey if they were: at least 18 years of age, between 12- and 37-week gestation, attended their first, 27–28 week or 35–36-week antenatal appointment within the previous week, had sufficient level of English language proficiency to complete the survey, were mentally and physically capable of completing the survey and had not had an adverse pregnancy outcome.

Each week, all eligible Aboriginal and/or Torres Strait Islander people (the term Aboriginal will be used from this point when referring to Aboriginal and/or Torres Strait Islander people), all people from smaller regional hospitals, and a random sample of people from the two largest hospitals were selected to participate. Selected people were mailed a participant information statement outlining the survey and its purpose. Aboriginal people were first sent a text message offering survey participation via online or telephone. People were then telephoned up to 10 times over 2 weeks, to elicit consent and complete the survey, with non-Aboriginal people being offered online if telephone was declined.

2.3 | Data collection procedures

The online and telephone surveys were identical in questions and help provided. The online survey was developed using REDCap [20] and was accessible via email or text message using a unique survey link. Telephone surveys were undertaken by trained female interviewers. The online and telephone surveys were reviewed for cultural appropriateness for Aboriginal people and pilot tested prior to use.

2.4 | Measures

2.4.1 | Current e-cigarette use

All participants were asked 'Have you ever used an e-cigarette or vaping device?' (Yes/No/Don't know). Participants who responded 'Yes' were then asked 'How often do you currently use an e-cigarette or vaping device? Responses were categorised by use (current users [Daily; At least once a week; Once a month; Less often than once a month] and not current users [Not at all/I don't use one now] and frequency) [21].

2.4.2 | Current and recent smoking

All participants were asked 'Which of the following statements is true for you now?' Response options were categorised by smoking status (smoker [I smoke every day about the same as before I was pregnant; I smoke every day, but I've cut down since finding out I was pregnant; I smoke every once in a while], ex-smoker [I don't smoke tobacco products now, but I used to] or non-smoker [I have never smoked or smoked less than 100 cigarettes in my life]) [22]. Ex-smokers were asked 'Can you tell me when you stopped smoking?' responses were categorised as >6 months before pregnancy, <6 months before pregnancy, 0–3 months of pregnancy, 4+ months of pregnancy. Participants who were both current smokers and e-cigarette users were defined as dual users.

2.4.3 | Reasons for e-cigarette use

Current e-cigarette users were asked 'What is your main reasons(s) for using an e-cigarette or vaping device?'. Response options were categorised by theme (Preferable to smoking tobacco cigarettes [they are less harmful than regular cigarettes; they are cheaper than regular cigarettes; they taste better than regular cigarettes; when I cannot or am not allowed to smoke; seem more acceptable than regular cigarettes], To help me quit smoking regular cigarettes, To cut down on number of regular cigarettes I smoke/ed, To avoid returning to smoking regular cigarettes, Out of curiosity/just wanted to try them, Other) [21, 23].

2.4.4 | Participant characteristics

Participant characteristics collected in the survey included age, Aboriginal origin, relationship status, smoking status, partner smokes, education, first pregnancy and current week gestation. Residential postcode was collected from the medical records.

2.5 | Analysis

Descriptive statistics were used to describe current e-cigarette use, dual use and reasons for using e-cigarettes

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in pregnancy. Residential postal codes were categorised using the Socio-Economic Indexes for Area with index quintiles collapsed into 'most disadvantaged (quintiles one and two), 'mid disadvantaged' (quintile three) and 'least disadvantaged' (quintiles four and five) [24]. Associations between use of e-cigarettes and participant characteristics, as outlined in the previous paragraph, were assessed using simple logistic regression models (nine models), as well as a multivariable logistic regression model which included all nine characteristics. Statistical analysis was completed using SAS V9.3, with alpha level of 0.05 used to denote statistical significance.

2.6 | Ethics

Ethics approval was obtained from Hunter New England Local Health District Human Research Ethics Committee (16/11/16/4.07) and the NSW Aboriginal Health and Medical Research Council (1236/16). The study met the Committees guidelines for protection of human subjects concerning their safety and privacy.

3 | RESULTS

3.1 | Participation

Over the 18-month survey period, 9352 people were selected to participate. Of these, 7790 (83.30%) were contactable, 7046 (90.45%) were deemed eligible on the day of attempted contact and 4024 (57.1%) gave consent and completed the survey.

3.2 | Participant characteristics

Participants were an average of 26 weeks gestation with a mean age of 30 years. Most participants were married or living with a partner (90%), 9% identified as Aboriginal and 7% were current smokers (Table 1).

3.3 | Current use of e-cigarettes and dual e-cigarette and tobacco cigarette use

Of the 4024 participants surveyed, 722 (18%) reported having ever used an e-cigarette and 50 (1.24%) reported currently using e-cigarettes. Approximately half of current e-cigarette users reported daily use (54%) (Table 1). Of the 50 current e-cigarette users, 17 (34%) were also current smokers (i.e., dual users) and 29 (58%) were ex-smokers (Table 1). Rates of use were higher amongst 18–25 years olds (2.5%), single

TABLE 1 Characteristics, e-cigarette use and dual use of tobacco cigarettes for participants in the study sample ($N = 4024$).

	n	%
Age, years		
18–25	806	20.0
26–35	2732	67.9
36+	486	12.1
Mean (SD)	30 years	(5 years)
Aboriginal, or Torres Strait Islander, or both ($n = 4018$)	373	9.3
Relationship status ($n = 4001$)		
Single	416	10.4
Live with partner or married	3585	89.6
Education ($n = 4008$)		
High school or less	1146	28.6
TAFE Certificate or Diploma	1288	32.2
University Degree or higher	1574	39.3
Socio economic disadvantage ($n = 4019$)[a]		
Most disadvantaged	2052	51.1
Mid disadvantaged	1236	30.8
Least disadvantaged	731	18.2
First pregnancy ($n = 4009$)	1761	42.6
Current weeks gestation		
Mean (SD)	26 weeks	(8 weeks)
Smoking status ($n = 4020$)		
Current smoker	278	6.9
Ex-smoker	876	21.8
Non-smoker	2864	71.2
Time since quit smoking (ex-smokers $N = 874$[b])		
>6 months before pregnancy	494	56.5
<6 months before pregnancy	111	12.7
0–3 months of pregnancy	241	27.6
4+ months of pregnancy	28	3.2
Partner smokes ($n = 4020$)	708	17.6
Ever used an e-cigarette	722	17.9
Currently using an e-cigarette	50	1.24
Current smoker (Dual user)	17	34.0
Ex-smoker	29	58.0
Non-smoker	3	6.0
Frequency of current e-cigarette use ($N = 50$)		
Daily	27	54.0
At least once a week	5	10.0
Once a month	9	18.0
Less often than once a month	9	18.0
Time since quit smoking (e-cigarette users who are ex-smokers $N = 29$)		
>6 months before pregnancy	9	31.0
<6 months before pregnancy	8	27.6

(Continues)

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TABLE 1 (Continued)

	n	%
0–3 months of pregnancy	10	34.5
4+ months of pregnancy	2	6.9

[a]Socioeconomic disadvantage categorised as: Most disadvantaged (quintiles 1 and 2), mid disadvantaged (quintile 3), least disadvantaged (quintile 4 and 5).
[b]Six ex-smokers either didn't know or didn't answer the question.

people (3.6%), those with lower education levels (2.5%) and Aboriginal people (3.5%). (Table 2). These higher numbers of Aboriginal people using e-cigarettes should be interpreted in the context of the historic and ongoing impacts of colonisation.

3.4 | Characteristics associated with current e-cigarette use

Younger age (18–25 years), Aboriginal origin, being single, having a partner that smokes, high school or lower level education or TAFE certificate/diploma and being a current or ex-smoker were all found to be significantly associated with current e-cigarette use. After adjusting for all characteristics, only smoking status remained significant ($p < 0.001$). Being a current (odds ratio [OR] 39.49, 95% confidence interval [CI] 9.99–156.21) or ex-smoker (OR 29.86, 95% CI 8.75–101.95) significantly increased the odds of current e-cigarette use (Table 2).

3.5 | Reasons for using e-cigarettes in pregnancy

The most frequently reported reasons for current use of e-cigarettes were to quit smoking (52%), cut down smoking (20%) and avoid returning to smoking (18%) (Table 3).

4 | DISCUSSION

This study is the first to report on the prevalence of e-cigarette use amongst pregnant people in Australia. The study found that a small proportion of pregnant people attending public antenatal clinics in Australia were current e-cigarette users (1.24%), however rates of use were higher amongst some demographic groups. Just over a third of current users reported dual use with tobacco cigarettes. Smoking status was the most significant characteristic associated with current e-cigarette use, with current and ex-smokers having over 29 times the odds of using e-cigarettes in pregnancy compared to non-smokers. The most commonly reported reason for current e-cigarette use in pregnancy was to quit smoking (52%).

The prevalence of current e-cigarette use in pregnancy reported in this study (1.24%) is lower than that reported by previous international studies in the UK (2.2%) [13] and USA (4.6%) [14]. In the UK, reported use may be higher due to some professional bodies endorsing e-cigarettes as a smoking cessation aide for pregnancy [7, 8], and the lower cost of e-cigarettes compared to other countries [25]. Prevalence of use in both the UK and USA may reflect their increased accessibility as an approved consumer product as well as increased exposure to promotional media [26]. This contrasts with the stricter regulatory environment in Australia where e-cigarettes are only legally available with prescription, have a higher cost than in other countries, advertising e-cigarettes to consumers is prohibited [27] and use is not supported as a cessation aid in pregnancy [10]. Rates of use were higher amongst 18–25 year olds, Aboriginal people, single people and those with lower education levels. Such findings suggest that e-cigarette use may be more prevalent amongst some demographic groups. It is important to recognise that the ongoing impacts of colonisation and the multifaceted nature of smoking and e-cigarette use contribute to higher rates amongst Aboriginal people. Further population wide surveys of pregnant people in Australia and internationally are required to develop a clear understanding of how many people are using e-cigarettes in pregnancy, to determine prevalence of use across different demographic groups and examine how the different regulatory environments are impacting on rates of use.

Consistent with previous research, being a current smoker (OR 39.49, 95% CI 9.99–156.21) or ex-smoker (OR 29.86, 95% CI 8.75–101.95) were the characteristics most strongly associated with current e-cigarette use [17]. Of the current e-cigarette users 34% reported that they were also current smokers. Internationally, studies have reported that 46% to 73% of pregnant e-cigarette users continue to smoke tobacco cigarettes [13, 14] and that patterns of smoking, vaping and dual use can vary throughout pregnancy with dual users commonly continuing dual use or returning to exclusive smoking by late pregnancy [28]. Further research is needed to explore patterns of e-cigarette use during pregnancy and to understand the outcomes of dual use given the frequency of this behaviour.

In our study, nearly two thirds of current e-cigarette users were ex-smokers, the majority reporting quitting smoking in either the six months prior to (28%) or during pregnancy (41%). The most commonly reported reason for current e-cigarette use in pregnancy was to quit

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TABLE 2 Characteristics associated with current e-cigarette use ($N = 4024$).

		Non-e-cigarette user ($N = 3972$)		Current e-cigarette users ($N = 50$)		Simple regression			Multiple regression		
		n	%	*n*	%	OR	95% CI	*p*-value	OR	95% CI	*p*-value
Age, years								0.003			0.26
	18–25	785	97.52	20	2.48	3.07	1.04–9.04		3.65	0.76–17.45	
	26–35	2705	99.05	26	0.95	1.16	0.40–3.33		2.80	0.64–12.20	
	36+	482	99.18	4	0.82	Ref			Ref		
Aboriginal origin		$N = 3966$									
	Yes	359	96.51	13	3.49	3.53	1.86–6.70	<0.001	1.24	0.60–2.58	0.56
	No	3607	98.98	37	1.02	Ref			Ref		
Relationship status		$N = 3951$		$N = 48$							
	Single	400	96.39	15	3.61	4.04	2.17–7.49	<0.001	1.52	0.75–3.08	0.24
	Married or living together	3551	99.08	33	0.92	Ref			Ref		
Education		$N = 3970$						<0.001			0.75
	High school or less	1116	97.47	29	2.53	8.15	3.15–21.13		1.53	0.51–4.55	
	TAFE Certificate or Diploma	1271	98.76	16	1.24	3.95	1.44–10.81		1.41	0.49–4.10	
	University degree or higher	1569	99.68	5	0.32	Ref			Ref		
Smoking status		$N = 3969$		$N = 49$				<0.001			<0.001
	Current smoker	261	93.88	17	6.12	62.12	18.08–213.34		39.49	9.99–156.21	
	Ex-smoker	847	96.69	29	3.31	32.65	9.92–107.45		29.86	8.75–101.95	
	Non-smoker	2861	99.90	3	0.10	Ref			Ref		
Partner smokes		$N = 3970$		$N = 48$							
	Yes	693	97.88	15	2.12	2.15	1.16–3.98	0.015	0.83	0.42–1.65	0.60
	No	3277	99.00	33	1.00	Ref			Ref		
Socioeconomic disadvantage		$N = 3968$		$N = 49$				0.42			0.07
	Most disadvantaged	2024	98.68	27	1.32	0.87	0.43–1.77		0.44	0.21–0.94	
	Mid disadvantaged	1225	99.11	11	0.89	0.59	0.25–1.36		0.42	0.17–1.01	
	Least disadvantaged	719	98.49	11	1.51	Ref			Ref		
First pregnancy		$N = 3957$									
	Yes	1676	98.70	22	1.30	1.07	0.61–1.88	0.82	1.08	0.57–1.08	0.81
	No	2281	98.79	28	1.21	Ref			Ref		
Weeks gestation	Mean (SD)	25.89	7.94	25.98	7.46	1.00[a]	0.97-1.04	0.94	0.99[a]	0.96–1.03	0.76

Abbreviations: CI, confidence interval; OR, odds ratio.

[a]Odds ratio for weeks gestation corresponds to a one-week increase.

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TABLE 3 Participants reported reasons for current e-cigarette use in pregnancy ($N = 50$).

	Current smoker ($N = 17$)		Ex-smoker ($N = 29$)		Non-smoker ($N = 3$)		Total ($N = 50$)	
	n	%	*n*	%	*n*	%	*n*	%
To help me quit smoking regular cigarettes	9	52.9	16	55.2	1	33.3	26	52.0
To cut down on the number of regular cigarettes I smoke/smoked	7	41.2	3	10.0	0	0.0	10	20.0
To avoid returning to smoking regular cigarettes	1	5.9	7	24.1	0	0.0	9	18.0
Preferable to smoking tobacco cigarettes (cheaper, less harmful, taste better)	0	0.0	5	17.2	0	0.0	5	10.0
Out of curiosity/just wanted to try them	1	5.9	3	10.0	1	33.3	5	10.0
Other	2		3	10.0	1	33.3	3	6.0
To be social	1	5.9	1	3.3	0	0.0	2	4.0
Stress relief	0	0.0	1	3.3	1	25.0	2	4.0
When run out of cigarettes	1	5.9	0	0.0	0	0.0	1	2.0

smoking (52%). This supports previous research, where greater than 70% of pregnant e-cigarette users reported use to assist with quitting smoking [29]. Expert consensus concludes there is currently insufficient evidence to support the efficacy and safety of e-cigarettes as a smoking cessation treatment in pregnancy [9, 10, 30]. Cochrane reviews [31, 32] currently recommend behavioural interventions plus approved nicotine replacement therapies as best practice care for supporting pregnant people to quit. While some individual Australian State health department policies and medical association guidelines [10, 33] have recently incorporated specific guidance to avoid e-cigarette use during pregnancy, the current Australian Clinical Practice Guidelines for Pregnancy Care [11] do not include any information on the use of e-cigarettes in pregnancy. The Australian Pregnancy Care Guidelines need to provide clear guidance on assessment and support for people who are using e-cigarettes in pregnancy.

The findings of this study should be considered in light of its strengths and limitations. The study was conducted with a large sample of randomly selected or complete sampling of pregnant people attending public antenatal services from metropolitan, rural and regional areas of NSW and achieved a consent rate of 58.7%. When compared to people who gave birth in NSW in 2021, mean age was comparable (30 vs. 31 years) however the study sample had slightly more participants who identified as Aboriginal (9.6% vs. 5.1%) [34] and smoking rates amongst all study participants were slightly lower (6.8% vs. 7.9%) which may suggest actual e-cigarette use could be higher [34]. Finally, while a significant association was found between e-cigarette use and some indicators of socio economic disadvantage (education level and marital status), no such association was found for residential postcode. This may be due to the large geographic areas covered by some rural postcodes and the considerable variation in socio-economic status within these areas.

5 | CONCLUSION

The findings of this study suggest that pregnant people may be using e-cigarettes primarily to assist in quitting smoking, however many appear to continue to smoke. Further large-scale population-based studies of pregnant people are required to monitor e-cigarette use, dual use and patterns of use through pregnancy, particularly given the evolving Australian regulatory environment relating to e-cigarette access and the rapidly increasing rates of e-cigarettes use since this study was conducted. Further research is needed to understand the risks of e-cigarettes use and dual use, and their efficacy as a smoking cessation aid in pregnancy.

AUTHOR CONTRIBUTIONS

Each author certifies that their contribution to this work meets the standards of the International Committee of Medical Journal Editors.

ACKNOWLEDGEMENT

Open access publishing facilitated by The University of Newcastle, as part of the Wiley - The University of Newcastle agreement via the Council of Australian University Librarians.

FUNDING INFORMATION

This research was supported by Hunter New England Local Health District. Constraints on publishing: none.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

DATA AVAILABILITY STATEMENT

The de-identified data we analysed are not publicly available, but requests to the corresponding author for the data will be considered on a case-by-case basis. All authors had full access to all of the data (including statistical reports and tables) related to the study.

ORCID

Alice Rice https://orcid.org/0000-0002-4678-1063
Melanie Kingsland https://orcid.org/0000-0002-4744-8465
John Wiggers https://orcid.org/0000-0001-6361-9685

REFERENCES

1. Banks E, Yazidjoglou A, Brown S, Nguyen M, Martin M, Beckwith K, et al. Electronic cigarettes and health outcomes: systematic review of global evidence. Report for the Australian Department of Health. Canberra: National Centre for Epidemiology and Population Health; 2022.
2. Tsai M, Byun MK, Shin J, Crotty Alexander LE. Effects of e-cigarettes and vaping devices on cardiac and pulmonary physiology. J Physiol. 2020;598:5039–62.
3. U.S. Department of Health and Human Services. The health consequences of smoking: a report of the Surgeon General. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health; 2004.
4. Shittu AAT, Kumar BP, Okafor U, Berkelhamer SK, Goniewicz ML, Wen X. Changes in e-cigarette and cigarette use during pregnancy and their association with small-for-gestational-age birth. Am J Obstet Gynecol. 2022;226:730.e1–730.e10.
5. Kim S, Oancea SC. Electronic cigarettes may not be a "safer alternative" of conventional cigarettes during pregnancy: evidence from the nationally representative PRAMS data. BMC Pregnancy Childbirth. 2020;20:557.
6. New Zealand Ministry of Health. The New Zealand guidelines for helping people to stop smoking. Wellington: Ministry of Health; 2021.
7. NHS. Stop smoking in pregnancy 2023. Available from: https://www.nhs.uk/pregnancy/keeping-well/stop-smoking/
8. Smoking in Pregnancy Challenge Group. Use of electronic cigarettes before, during and after pregnancy: a guide for maternity and other healthcare professionals. n.d.
9. American College of Obstetricians and Gynecologists' Committee on Obstetric Practice. Tobacco and nicotine cessation during pregnancy. Obstet Gynecol. 2020;135:221–9.
10. RANZCOG (The Royal Australian and New Zealand College of Obstetricians and Gynaecologists). Smoking and pregnancy. East Melbourne: RANZCOG (The Royal Australian and New Zealand College of Obstetricians and Gynaecologists); 2020. Available from: https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&ved=2ahUKEwj--KHNx4mGAxW-RWwGHUrDDzgQFnoECB8QAQ&url=https%3A%2F%2Franzcog.edu.au%2Fwp-content%2Fuploads%2F2022%2F05%2FSmoking-and-pregnancy.pdf&usg=AOvVaw0q2WZgQ0Ney1-wOwR0tUpU&opi=89978449
11. Department of Health. Clinical practice guidelines: pregnancy care. Canberra: Australian Government Department of Health; 2020.
12. TGA (Therapeutic Goods Administration). Nicotine vaping products hub Canberra: the Department of Health and Aged Care. 2023. Available from: https://www.tga.gov.au/products/medicines/prescription-medicines/nicotine-vaping-products-hub
13. Obisesan OH, Osei AD, Uddin SMI, Dzaye O, Cainzos-Achirica M, Mirbolouk M, et al. E-cigarette use patterns and high-risk behaviors in pregnancy: behavioral risk factor surveillance system, 2016–2018. Am J Prev Med. 2020;59:187–95.
14. Bowker K, Lewis SJ, Phillips L, Orton S, Ussher M, Naughton F, et al. Pregnant women's use of e-cigarettes in the UK: a cross sectional survey. BJOG. 2021;128:984–93.
15. HealthStats NSW. E-cigarette use 2023. Available from: https://www.healthstats.nsw.gov.au/#/indicator?name=-beh-smo-ecig-phs&location=NSW&view=Trend&measure=prevalence&groups=Electronic%20cigarette%20use&compare=Electronic%20cigarette%20use&filter=Electronic%20cigarette%20use,Ever%20used,Current%20user
16. Rollins LG, Sokol NA, McCallum M, England L, Matteson K, Werner E, et al. Electronic cigarette use during preconception and/or pregnancy: prevalence, characteristics, and concurrent mental health conditions. J Womens Health (Larchmt). 2020;29:780–8.
17. Opondo C, Harrison S, Alderdice F, Carson C, Quigley MA. Electronic cigarette use (vaping) and patterns of tobacco cigarette smoking in pregnancy-evidence from a population-based maternity survey in England. PLoS One. 2021;16:e0252817.
18. Calder R, Gant E, Bauld L, McNeill A, Robson D, Brose LS. Vaping in pregnancy: a systematic review. Nicotine Tob Res. 2021;23:1451–8.
19. N.S.W. Ministry of Health. Centre for Epidemiology and Evidence, population and public health division. New South Wales mothers and babies 2021 report. Sydney: NSW Ministry of Health, Evidence CfEa, Division PaPH; 2023.
20. Harris PA, Taylor R, Thielke R, Payne J, Gonzalez N, Conde JG. Research electronic data capture (REDCap)—a metadata-driven methodology and workflow process for providing translational research informatics support. J Biomed Inform. 2009;42:377–81.
21. Pearson JL, Hitchman SC, Brose LS, Bauld L, Glasser AM, Villanti AC, et al. Recommended core items to assess e-cigarette use in population-based surveys. Tob Control. 2018;27:341–6.
22. Mullen PD, Carbonari JP, Tabak ER, Glenday MC. Improving disclosure of smoking by pregnant women. Am J Obstet Gynecol. 1991;165:409–13.
23. Cancer Institute NSW. NSW smoking & health survey 2021. Sydney: Cancer Institute NSQ; 2022.
24. Australian Bureau of Statistics. Socio-economic indexes for areas (SEIFA) 2016 technical paper. Australia: Australian Bureau of Statistics Canberra; 2018.
25. Cheng K-W, Shang C, Lee HM, Chaloupka FJ, Fong GT, Borland R, et al. Costs of vaping: evidence from ITC four country smoking and vaping survey. Tob Control. 2021;30:94–7.
26. Ashford K, Rayens E, Wiggins AT, Rayens MK, Fallin A, Sayre MM. Advertising exposure and use of e-cigarettes among female current and former tobacco users of childbearing age. Public Health Nurs. 2017;34:430–6.

14653362, 2024, 7, Downloaded from https://onlinelibrary.wiley.com/doi/10.1111/dar.13864 by Edith Cowan University, Wiley Online Library on [13/12/2024]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

27. Amin S, Dunn AG, Laranjo L. Exposure to e-cigarette information and advertising in social media and e-cigarette use in Australia: a mixed methods study. Drug Alcohol Depend. 2020;213:108112.
28. Bowker K, Lewis S, Ussher M, Naughton F, Phillips L, Coleman T, et al. Smoking and vaping patterns during pregnancy and the postpartum: a longitudinal UK cohort survey. Addict Behav. 2021;123:107050.
29. DeVito EE, Fagle T, Allen AM, Pang RD, Petersen N, Smith PH, et al. Electronic nicotine delivery systems (ENDS) use and pregnancy I: ENDS use behavior during pregnancy. Curr Addict Rep. 2021;8:347–65.
30. National Institute for Health and Care Excellence. Tobacco: preventing uptake, promoting quitting and treating dependence: update. National Institute for Health and Care Excellence: Guidelines. London, UK: National Institute for Health and Care Excellence (NICE); 2023.
31. Chamberlain C, O'Mara-Eves A, Porter J, Coleman T, Perlen SM, Thomas J, et al. Psychosocial interventions for supporting women to stop smoking in pregnancy. Cochrane Database Syst Rev. 2017;2:CD001055.
32. Claire R, Chamberlain C, Davey MA, Cooper SE, Berlin I, Leonardi-Bee J, et al. Pharmacological interventions for promoting smoking cessation during pregnancy. Cochrane Database Syst Rev. 2020;3:CD010078.
33. Centre for Population Health. Reducing the effects of smoking and vaping on pregnancy and newborn outcomes. 2022.
34. Centre for Epidemiology and Evidence. New South Wales mothers and babies 2021. Sydney: NSW Ministry of Health; 2023.

How to cite this article: Rice A, Kingsland M, Doherty E, Licata M, Tully B, Wiggers J, et al. E-cigarette use in pregnancy in Australia: A cross-sectional survey of public antenatal clinic attendees. Drug Alcohol Rev. 2024;43(7):1733–41. https://doi.org/10.1111/dar.13864

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