Safety and efficacy of e-cigarettes in helping pregnant smokers quit

Peter Hajek

E-cigarettes and pregnant smokers

- Like other smokers, those who are pregnant sometimes try to limit risks by switching to vaping
- More try to quit with e-cigarette (EC) than with NRT
- Both products are forms of NRT. Pharma NRT is recommended to pregnant smokers in both UK and USA, views on EC differ
- UK: EC can help pregnant smokers quit
- US: Pregnant smokers should not use EC

Carabello et al. 2017 Prev Chronic Dis 2017; McNeill et al. 2021, PHE

How safe are vapes?

- Vapes (e-cigarettes) are significantly less harmful to health than tobacco cigarettes
- If using a vape (vaping) helps you stay smokefree, it is far safer for you and your baby than continuing to smoke
- Vapes should not be used by children or non-smokers

You should only use legal vapes purchased from a reputable source. Illegal vapes often exceed restrictions on nicotine content and may contain banned ingredients.

Can I use a vape to help me quit smoking?

- Yes, vapes can help you to quit and are much less harmful than smoking
- Nicotine replacements such as patches and gum are licenced for use during pregnancy

Can I keep smoking a little bit if I'm also vaping?

- NO - Every cigarette causes damage both to you and your baby
- Stopping smoking early in pregnancy significantly reduces the risk of damage to your baby
- You can vape as often as you need to stay smokefree

Is secondhand e-cigarette vapour harmful?

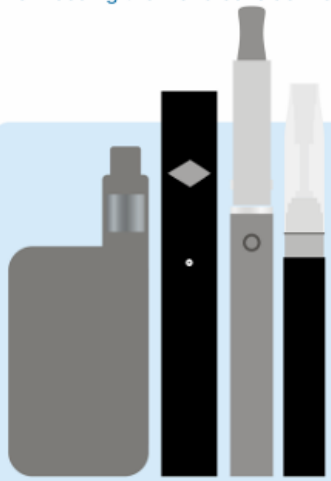
- Secondhand tobacco smoke is very harmful to you and your baby
- Secondhand e-cigarette vapour is much less harmful than tobacco smoke but is not risk free. You could consider not allowing vaping in your home and car as a precaution

Is nicotine harmful for my baby?

- While nicotine is addictive, most of the harm from smoking comes from the other chemicals in tobacco smoke. Nicotine replacement products like patches and gum are licensed for smoking cessation during pregnancy

Can I vape if I'm breastfeeding?

- Yes. If vaping is helping you to quit smoking and stay smokefree, you should carry on with it, including while breastfeeding. As a precaution, you could avoid vaping directly around babies when feeding them and consider not allowing vaping in your home and car



Vaping is far less harmful than smoking

- Nicotine in cigarettes is addictive, but almost all of the harm from smoking comes from the toxic chemicals in tobacco smoke
- Vapes don't produce tar or carbon monoxide which is the most harmful part of smoking for developing babies
- As well as being less harmful, vaping can be much cheaper than smoking

For more info on quitting smoking ask your midwife, GP or pharmacy team or search NHS Smokefree.

ash. action on smoking and health

Tommy's

Royal College of Midwives

Sands Stillbirth & neonatal death charity

Smoking, nicotine and birth outcomes 1.

- Smoking is **causally** associated with restricted pre-natal growth (higher incidence of low/premature birthweight (<2500g), lower average birthweight, small-for-gestational-age babies)
  - Assisted Reproductive Technology children (N=815), genetically unrelated or related to the 'mother'
  - Smoking in pregnancy=lower birth weight in unrelated and related mother-offspring pairs – caused by smoking; ADHD symptoms only in related pairs – a genetic effect *

* Thapar A, et al. 2009 Biol Psychiatry

Smoking, nicotine and birth outcomes 2.

- Placental abruption, miscarriage, pre-term delivery, stillbirth, birth defects and neonatal death linked to smoking
- Smoking is considered to be an important causal factor, but smoking is also associated with disadvantage
- Compared to non-smokers, stress, drug use, psychiatric illness, medication use, poverty are significantly higher in pregnant smokers - and linked to these outcomes too
- Associations of smoking in pregnancy with behavioural and cognitive outcomes seems primarily due to such factors

What is the role of nicotine vs other chemicals in tobacco smoke?

- Trials of NRT versus placebo
- Pregnancy outcomes in snus users (detrimental effect could be due to tobacco, but lack of effect would exonerate nicotine)
- Pregnancy outcomes in smokers who switched to vaping

NRT vs placebo

- Two reviews concluded that existing data do not provide clear evidence on whether use of NRT harms the fetus Claire et al. 2020 Cochrane Review; Taylor et al. 2021 Addiction
- In the largest patch study, nicotine arm had better birth and infant outcomes than the placebo arm through two years post-partum (via smoking reduction?) Cooper et al. 2014 Lancet Respir Med
- The findings only concern nicotine use in late pregnancy – all women smoked in the first 3+ months

Snus use and intrauterine growth

- Snus delivers as much nicotine as smoking
- Birthweight, vs non-nicotine users: smokers ↓190g, snus users ↓39g England et al. 2003 AJOG (↓246g and ↓106g Rygh et al. 2019 BMC Pregnancy&Childbirth)
- No effect on birthweight in a newer sample Kreyberg et al. 2019 ERJ Open Res
- Swedish births 1999-2012, no clear link of snus use to SGA Madley-Dawd et al. 2021 Int J Epidemiol
- **Siblings with discordant snus use**: Birthweight not significantly affected by snus use (4K+ sibling pairs) Juarez and Merlo 2013, PLOS ONE
- New review found effects, but with selective use of data Brinchmann et al. 2022 Addiction

EC use and pregnancy outcomes

- 176,822 US pregnancies
- Low gestational weight gain according to product use in the last trimester
- Smokers: 28%; dual users: 26%; vapers 22.1%; non-nicotine users: 22.1%
- EC use does not seem to affect intrauterine growth

Wen et al. 2023 Int J Gynaecol Obstet

A new meta-analysis claims it shows risks of vaping

- Because vapers had worse birth outcomes than never-smokers

BUT

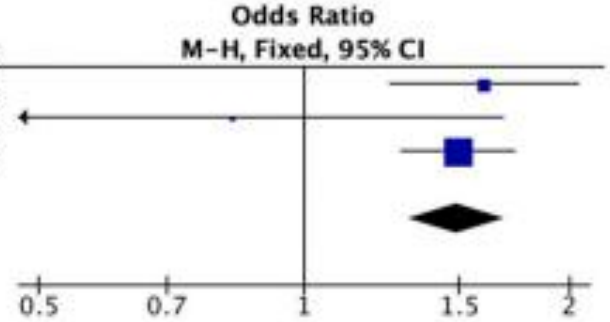
- They typically smoked until late pregnancy
- The results in fact suggest a benefit rather than any risk of vaping
  - Despite selective study inclusion

Vallee et al. 2025 Women and Birth

A

Study or Subgroup	EC Events	EC Total	never users Events	never users Total	Weight	Odds Ratio M-H, Fixed, 95% CI	Year
Kim 2020	86	337	9073	51430	24.2%	1.60 [1.25, 2.05]	2020
McDonnell 2020	24	218	14	108	4.6%	0.83 [0.41, 1.68]	2020
Amnar 2023	236	977	30482	173574	71.2%	1.50 [1.29, 1.73]	2023
Total (95% CI)		**1532**		**225112**	**100.0%**	**1.49 [1.32, 1.69]**	
Total events	346		39569				

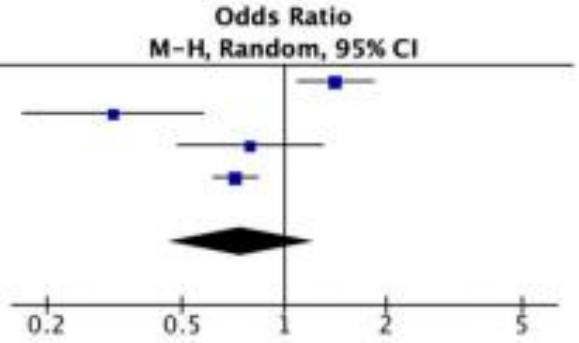
Heterogeneity: $Chi^2 = 2.97$, df = 2 (P = 0.23); $I^2 = 33\%$
Test for overall effect: Z = 6.27 (P < 0.00001)



B

Study or Subgroup	EC Events	EC Total	Tobacco smoking Events	Tobacco smoking Total	Weight	Odds Ratio M-H, Random, 95% CI	Year
Kim 2020	86	337	752	3848	27.6%	1.41 [1.09, 1.82]	2020
McDonnell 2020	24	218	28	99	20.5%	0.31 [0.17, 0.58]	2020
Regan 2021	18	189	738	6310	23.0%	0.79 [0.49, 1.30]	2021
Amnar 2023	236	977	4532	14752	29.0%	0.72 [0.62, 0.83]	2023
Total (95% CI)		**1721**		**25009**	**100.0%**	**0.75 [0.46, 1.22]**	
Total events	364		6050				

Heterogeneity: $Tau^2 = 0.21$; $Chi^2 = 29.62$, df = 3 (P < 0.00001); $I^2 = 90\%$
Test for overall effect: Z = 1.16 (P = 0.25)



C

Study or Subgroup	EC Events	EC Total	Dual users Events	Dual users Total	Weight	Odds Ratio M-H, Random, 95% CI	Year
McDonnell 2020	24	218	60	195	31.6%	0.28 [0.17, 0.47]	2020
Regan 2021	18	189	76	585	31.1%	0.70 [0.41, 1.21]	2021
Amnar 2023	206	977	324	1404	37.3%	0.89 [0.73, 1.09]	2023
Total (95% CI)		**1384**		**2184**	**100.0%**	**0.57 [0.29, 1.15]**	
Total events	248		460				

Heterogeneity: $Tau^2 = 0.32$; $Chi^2 = 16.79$, df = 2 (P = 0.0002); $I^2 = 88\%$
Test for overall effect: Z = 1.57 (P = 0.12)

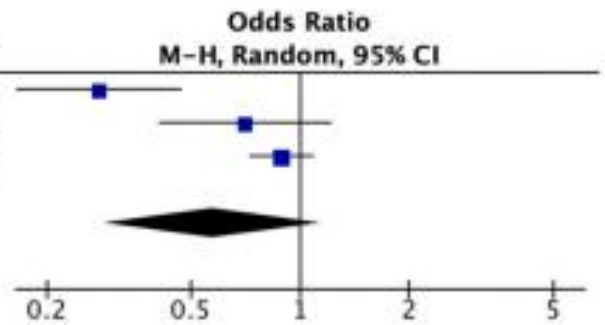
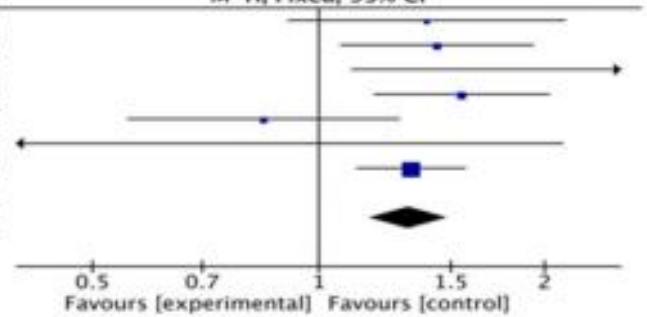


Fig. 4. Comparative Forest Plots of LBW among vaping Users, Non-Users, Smokers, and Dual Users. A: vaping compared to never users; B: vaping compared to tobacco smokers; C: vaping compared to dual users.

A

Study or Subgroup	EC Events	EC Total	never users Events	never users Total	Weight	Odds Ratio M-H, Fixed, 95% CI
Wen 2023	26	152	1217	9432	7.3%	1.39 [0.91, 2.13]
Wang 2022	50	406	8002	89908	14.4%	1.44 [1.07, 1.93]
Nanninga 2023	2	10	77	1706	0.2%	5.29 [1.10, 25.33]
Kim 2020	66	337	6981	51430	16.7%	1.55 [1.18, 2.03]
Hawkins 2022	24	301	4757	51153	11.7%	0.85 [0.56, 1.28]
Cardenas 2020	0	18	186	1062	1.5%	0.13 [0.01, 2.12]
Amnar 2023	163	977	22751	173574	48.4%	1.33 [1.12, 1.57]
Total (95% CI)		**2201**		**378265**	**100.0%**	**1.32 [1.17, 1.48]**
Total events	331		43971			

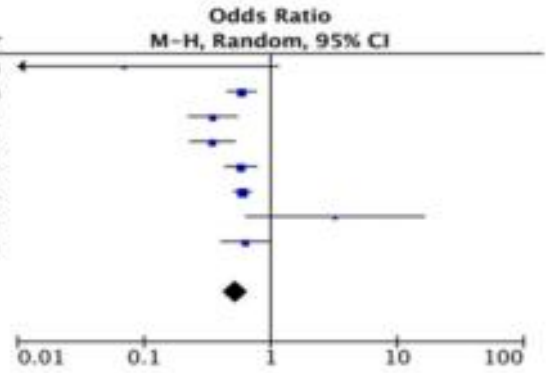
Heterogeneity: $Chi^2 = 11.81$, df = 6 (P = 0.07); $I^2 = 49\%$
Test for overall effect: Z = 4.60 (P < 0.00001)



B

Study or Subgroup	EC Events	EC Total	tobacco smoking Events	tobacco smoking Total	Weight	Odds Ratio M-H, Random, 95% CI	Year
Cardenas 2020	0	18	104	372	0.6%	0.07 [0.00, 1.16]	2020
Kim 2020	66	337	1017	3484	18.6%	0.59 [0.45, 0.78]	2020
Regan 2021	21	189	1662	6310	12.5%	0.35 [0.22, 0.55]	2021
Hawkins 2022	24	301	1013	5063	13.5%	0.35 [0.23, 0.53]	2022
Wang 2022	50	406	1586	8164	17.8%	0.58 [0.43, 0.79]	2022
Amnar 2023	163	977	3689	14752	22.8%	0.60 [0.51, 0.71]	2023
Nanninga 2023	2	10	15	209	1.7%	3.23 [0.63, 16.60]	2023
Wen 2023	26	152	177	719	12.5%	0.63 [0.40, 1.00]	2023
Total (95% CI)		**2390**		**39073**	**100.0%**	**0.53 [0.42, 0.66]**	
Total events	352		9263				

Heterogeneity: $Tau^2 = 0.05$; $Chi^2 = 16.83$, df = 7 (P = 0.02); $I^2 = 58\%$
Test for overall effect: Z = 5.64 (P < 0.00001)



C

Study or Subgroup	EC Events	EC Total	dual users Events	dual users Total	Weight	Odds Ratio M-H, Random, 95% CI	Year
Cardenas 2020	0	18	38	100	3.9%	0.04 [0.00, 0.75]	2020
Regan 2021	21	189	141	585	21.9%	0.39 [0.24, 0.64]	2021
Wang 2022	50	406	166	723	23.6%	0.47 [0.33, 0.66]	2022
Hawkins 2022	24	301	89	529	22.1%	0.43 [0.27, 0.69]	2022
Amnar 2023	50	977	368	1404	24.0%	0.15 [0.11, 0.21]	2023
Nanninga 2023	2	10	1	12	4.6%	2.75 [0.21, 35.84]	2023
Total (95% CI)		**1901**		**3353**	**100.0%**	**0.33 [0.18, 0.61]**	
Total events	147		803				

Heterogeneity: $Tau^2 = 0.37$; $Chi^2 = 33.73$, df = 5 (P < 0.00001); $I^2 = 85\%$
Test for overall effect: Z = 3.54 (P = 0.0004)

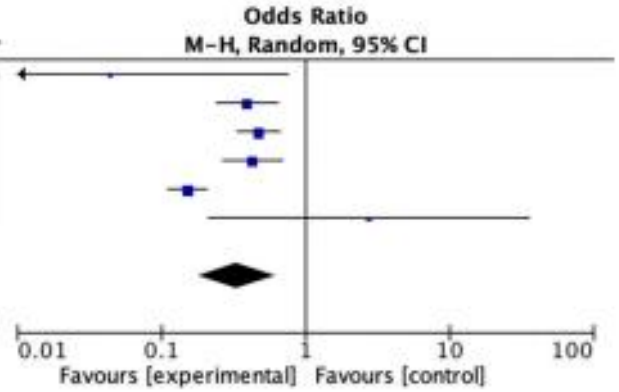


Fig. 2. Comparative Forest Plots of SGA among vaping Users, Non-Users, Smokers, and Dual Users. A: vaping compared to never users; B: vaping compared to tobacco smokers; C: vaping compared to dual users.

RCT of EC vs NRT in pregnancy

- 1,140 pregnant smokers, weekly supportive calls for 6 weeks
- NRT: 16mg patches, encouraged to add short-acting products
- EC: Refillable EC, two 10ml bottles of e-liquid (18mg/ml nicotine)
- Pre-specified sensitivity analysis excluded abstainers regularly using non-allocated products (more use of EC in NRT arm expected than the other way round)

Hajek et al. 2022 Nature Medicine

Smoking cessation

	EC (N=571)	NRT (N=569)	Difference
Validated sustained at EOP	6.8%	4.4%	p=0.08
Quitters with other product excluded	6.8%	3.6%	p=0.02
Self-reported at EOP (7 days)	20.7%	13.7%	p=0.002
Quitters with other product excluded	19.8%	9.7%	p=0.001
Reduction in cigs/day of at least 50% **in non-abstainers**			
Full sample	42.4%	33.8%	p=0.007
Switchers excluded	41.7%	27.8%	p<0.001

Safety outcomes

	EC (N=546)	NRT (N=549)	Difference
Low birthweight	9.6%	14.8%	p=0.01
All other adverse birth outcomes			ns
Number of any AEs and SAEs	476	479	ns
Women with any AEs or SAEs	285	292	ns

Common adverse reactions potentially related to products			
Nausea	17	36	
Cough	39	0	
Application site irritation	0	81	

Analysis based on EC use

- Comparing women using and not using EC and NRT regularly during pregnancy (rather than the randomised arms)
- More used EC (vapers) then NRT (47% vs 22%)
- Abstainers and smokers using nicotine products had no worse pregnancy outcomes or more adverse events than abstainers and smokers not using them

Pesola et al. 2024 Addiction

Effect of nicotine use on birth weight and on mothers' respiratory symptoms

- Infants of women who stopped smoking but used nicotine regularly: 3.3 kg
- Infants of women who did not stop smoking: 3.1 kg
- Infants of women who stopped smoking and did not use nicotine regularly (N=18): 3.0 kg (small sample, not significantly different from either)
- EC users reported significantly more improvements than non-users in cough [aRR) = 0.59] and phlegm (aRR = 0.53) when controlling for smoking status

Implication for clinical practice

- Pregnant smokers seeking help to quit can be advised that in a large trial, quitting with EC led to a higher quit rate than quitting with NRT
- Both treatments had the same safety profile but mothers in the EC arm had a reduced risk of having a low-birth-weight baby

https://onlinelibrary.wiley.com/doi/10.1002/ctm2.1064

With thanks to PREP Trial team

- Dunja Przulj, Francesca Pesola, Chris Griffiths, Robert Walton, Hayden McRobbie, Tim Coleman, Sarah Lewis, Rachel Whitemore, Miranda Clark, Michael Ussher, Lesley Sinclair, Emily Seager, Sue Cooper, Linda Bauld, Felix Naughton, Peter Sasieni, Isaac Manyonda & Katie Myers Smith
- Queen Mary University of London; University of New South Wales; University of Nottingham; St George's University of London; University of Stirling; University of East Anglia; Kings College London; St George's University Hospital NHS Foundation Trust