

# Welsh primary schoolchildren's perceptions of e-cigarettes: a mixed method study

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## Research article

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# Abstract

**Background:** There are concerns that the growing popularity of e-cigarettes promotes experimentation among children. Current research has focused almost exclusively on children over 11 years. Given the possible lifelong health harms caused by behaviours established in early childhood, understanding younger children's perceptions is essential; to inform tobacco control policies, prevention strategies and the wider debate on further regulation of vaping. In one of the first global studies to provide insights into younger children's perceptions of e-cigarettes, we explored Welsh primary schoolchildren's (aged 7-11) awareness of e-cigarettes relative to tobacco smoking, their understanding of the risks and benefits associated with e-cigarettes and their intentions and beliefs about vaping.

**Methods:** Data was collected using a mix of methods in June and July 2017 from 8 purposively selected primary schools across Wales. Four hundred and ninety-five children (52% female), aged 7 years (n=165), 9 years (n=185) and 11 years (n=145) completed a class-administered booklet encompassing a draw and write exercise and questionnaire. Ninety-six children participated in 24 peer cohort-based discussion groups comprised of 2 boys and 2 girls. Data from the three tools were analysed independently and findings triangulated. Questionnaire analyses used frequencies, descriptive statistics and chi-squared tests. Content analysis was undertaken on the draw and write data and peer discussion groups were analysed thematically.

**Results:** Primary schoolchildren have general awareness of e-cigarettes but understanding of any health harms or the role of nicotine in e-cigarettes is poor or misperceived, particularly in the youngest children. Vaping was viewed as healthier than smoking by most and there was some recognition that e-cigarettes were used for smoking cessation. Few children intended to smoke (1.8%) or vape (3.9%) in the future but almost half thought it was okay for grownups. Children's perceptions were influenced by exposure through family and friends.

**Conclusions:** There is a need for e-cigarette education in primary schools. Health promotion efforts should reinforce the message that vaping is 'less harmful' rather than 'healthier' and highlight associated risks of e-cigarette experimentation including the potential for tobacco initiation. Further research is needed to explore whether children's perceptions influence their future use of tobacco or e-cigarettes.

## Background

There has been a global increase in the popularity of e-cigarettes amongst young people (1). In 2018 an estimated 2291 adolescents in Great Britain (GB) aged 11–18 years used e-cigarettes (2). Although some reports suggest that regular use (once a week or more) amongst youth is rare and largely limited to current or previous smokers (2–4), awareness of and experimentation with e-cigarettes is rising (2, 5–8). Similar trends have been noted in other countries including the USA and Canada (9, 10).

The escalation of youth e-cigarette use has raised significant concerns, mainly around their potential to act as a gateway to tobacco smoking and the renormalisation of smoking behaviour (6, 11, 12). There are

also concerns that adolescent e-cigarette use will promote experimentation amongst younger children. Research suggests that experimental 'ever use' of e-cigarettes may be linked to uptake of tobacco smoking (13). In a cross-sectional survey with Welsh primary school children (aged 10–11 years), e-cigarette use was found to be more common than tobacco use (14). Similarly, findings from the National Youth Tobacco Surveys (NYTS) show that in 2018, e-cigarettes were the most commonly used tobacco product (4.9%; 570,000) among U.S. middle schoolchildren (ages 11–13) (15).

Although available evidence suggests that e-cigarettes are significantly less harmful than tobacco products (16, 17) there is a general consensus that they are not risk free and of no benefit to young never smokers (18–20). Most e-cigarettes contain nicotine, a highly addictive substance. Children's brain development may be 'vulnerable' to the negative consequences of nicotine exposure (18, 19). Children are also at risk of nicotine poisoning through accidental ingestion of liquid nicotine (21, 22).

Efforts to minimise risk and protect children from exposure to and uptake of e-cigarettes are critical. Currently 98 countries have national laws regulating e-cigarettes (23) although regulation varies widely between them (24). The UK and domestic regulation enforces an age of sale lower limit of 18 years, prohibits proxy purchasing and the promotion of e-cigarettes on television, radio, online and in some print media. There are also limits on the concentration of nicotine in e-liquids, a requirement for warning labels on products and child tamper proof packaging (25).

The exponential growth of youth e-cigarette use has led to calls by some for further regulation. In 2015/16 the Welsh government proposed to ban the use of e-cigarettes in enclosed public places in Wales; the proposal was rejected by the Welsh Assembly. In 2018 the Forum of International Respiratory Societies recommended a worldwide ban on the sale of e-cigarettes to young people, the prohibition of flavourings and use of e-cigarettes where children are present (18). Recently the U.S Food and Drug Administration (FDA) announced the implementation of new and aggressive measures including the re-examination of their compliance policy regarding flavoured e-cigarettes which could potentially see the removal of some or all flavoured products (26) .

To inform development of tobacco control policies and prevention strategies, as well as the wider debate on further regulation of e-cigarettes, research on children and young people's perspectives of e-cigarettes is needed. Without knowing 'the extent of each child's knowledge and understanding... work may be irrelevant and the important health messages may have little impact (27, 28). Whilst qualitative research has been conducted with adolescents (29–32), studies that focus on primary schoolchildren perspectives of e-cigarettes are limited and commentary on this issue is hindered by the lack of empirical evidence (6, 11, 12). Only Faletau et al (33) have explored perceptions of e-cigarettes exclusively within this age group. They found 6–10 year old Maori and Pacific Islander children in New Zealand were unfamiliar with the product and at first glance could not discern the difference between electronic and tobacco cigarettes. Given the pervasiveness of e-cigarettes today, such findings are unlikely to be relevant in the current context.

Evidence from the wider substance misuse literature suggests that children assimilate knowledge about addictive substances before they reach the age of experimentation (34–36). It is widely accepted that tobacco smoking patterns begin prior to experimentation with the development of attitudes and beliefs which may influence future behaviour. Given that young children develop complex understandings of cigarette smoking which may predispose them to start smoking when older (34–36), it can be theorised that with the escalation of e-cigarette use, young children may develop equally complex understandings of e-cigarettes that may predispose them to vape in the future as well.

In view of the recognised influence of the early years on attitude and habit formation and the increasing prevalence of e-cigarette use, better understanding of how young children perceive vaping is needed, given the possible lifelong health harms caused by behaviours established in childhood. This small scale mixed method study aimed to explore Welsh primary schoolchildren's (aged 7–11) awareness of e-cigarettes relative to tobacco smoking, their understanding of the risks and benefits associated with e-cigarettes and their intentions and beliefs about vaping; to inform development of effective prevention strategies and policy responses around e-cigarette use.

## Methods

### Sampling and recruitment

Primary schools located across 8 areas in Wales ( $n = 339$ ) with varying levels of deprivation, prevalence of Welsh language spoken, urban/rural classification and prevalence of adult e-cigarette use (37) were identified for recruitment; single sex, and fee-paying schools were excluded. Schools were initially contacted by the Welsh Healthy Schools Co-ordinator to inform them about the project and then invited to participate via a letter from the research team which provided information about the study and the protocol for gaining consent/assent. Follow up emails and telephone calls were undertaken to determine interest. Of the schools willing to take part ( $n = 12$ ), one from each area ( $n = 8$ ) was purposively selected, ensuring maximum variation. All schools were single intake and the class from year 2 (age 6–7), year 4 (age 8–9) and year 6 (age 10–11) was selected for participation. Ethical approval for the study using opt-out parental consent was obtained from a higher education institutional research ethics committee (17/PBH/008). Written informed consent was obtained from all head teachers, information letters that included an option to withdraw children from the study were sent home to parents via the school and all children completed an assent form before participating.

### Data Collection

Data was collected using three methods in either English ( $n = 7$  schools) or Welsh ( $n = 1$  school), administered by 4 experienced female researchers and 2 Welsh speaking female research assistants. Tool development was guided by previous research (11, 14, 38, 39) and piloted to ensure age appropriateness. A workbook including a draw and write (D&W) exercise and a questionnaire was initially completed as a whole class for year 4 and year 6 and as a small group activity (2 children per researcher) for year 2. D&W is a widely used class based tool for capturing rich insightful data from children in a

short timescale (40, 41). Children were instructed by a researcher to draw a person who smokes and describe why they smoke, how they feel and what they would see and smell if standing nearby. This was repeated for a person using e-cigarettes. Children were then instructed to complete the questionnaire, which collected demographic information, family smoking and vaping behaviours, knowledge and beliefs about electronic and tobacco cigarettes, and their future intentions to smoke or vape. Lastly, small group mixed-sex peer discussions were conducted with a subsample of children (n = 96). Two boys and two girls from each participating class were purposively selected by the teacher on the basis they would be confident and comfortable speaking with researchers outside the classroom (38). To assess knowledge of and attitudes toward smoking and vaping, perceptions of health risks and social norms, participants were asked to discuss what they knew about electronic and tobacco cigarettes, who they thought vapes and smokes and why, the consequences of vaping and smoking and the influence of flavours on vaping behaviour. A range of photographs depicting tobacco and e-cigarettes, e-liquids and a variety of people vaping and smoking were used as elicitation devices to help prompt discussion with the children (42).

## Data Analysis

Data from the three tools were analysed independently and findings triangulated. For D&W, an iterative qualitative coding framework was developed from the responses (27). The children's written responses were coded by one researcher (LP), refined and then combined into content categories. Simple frequency counts were used and themes in the data were identified. A child's response was only counted once in each category but could be coded to several categories in the event that the answer had multiple responses. Children's drawings were not coded but used to illustrate typical themes emerging in the data. Another researcher (AG) reviewed the coding system to aid the credibility and trustworthiness of the analysis, any anomalies were discussed and a final decision was jointly made. Questionnaire data were entered, cleaned and analysed in SPSS v23. Analyses used frequencies, descriptive statistics and chi-squared tests. Peer discussions were recorded using a digital audio device, transcribed verbatim and imported into QSR NVivo 11 (QSR International Pty Ltd. Version 11, 2012) to assist with coding and analysis. The native Welsh speaking research assistants transcribed the Welsh peer discussions and checked each other's work for accuracy. Thematic analysis (43) carried out by one researcher (KRH) and cross-checked by another (LP) was both theory-driven, informed by existing literature and the topics covered in the peer discussion and data-driven, with themes emerging from the qualitative data. Transcripts were read and open coded line by line. Codes were then grouped into categories and examined for salient themes (43). Saturation was considered to be reached as no new codes were identified in the final transcripts analysed.

## Results

### Participant Characteristics

Similar numbers of children were recruited from each year group: aged 6-7 years (33.3%); 8-9 (37.4%) and 10-11 (29.3%) and 27.8% reported that they spoke the Welsh language at home. Two schools were in

urban areas, 5 were rural and 1 semi-rural. Two schools were in the most deprived and 2 schools in least deprived deprivation category (44) (Table 1).

Table 1 here

### **Awareness of e-cigarettes**

Children across the 3 year groups demonstrated a general awareness of e-cigarettes. The vast majority (94.9%) could distinguish pictures of e-cigarettes from tobacco cigarettes in the questionnaire (year 2, 89%; year 4, 96.7%; year 6, 100%:  $p < 0.001$ ). Most thought electronic and tobacco cigarettes looked different from each other (93.3%) and that the internal components were different (82.5%). Around half reported they smell different (51.1%) and the smoke was different (48.0%) (Table 2).

Table 2 here

Awareness of e-cigarettes was evident in the peer discussions as well. Children across all 3 year groups were able to discern the difference between tobacco and e-cigarettes from a series of photograph, discussed them using appropriate terminology such as 'e-cigarettes', 'e-cigs', 'electric fags' and 'vapes' and recognised they were different from tobacco cigarettes.

*"They look like different from normal fags"* (Male, Age 7, School 4)

*"They [e-cigarettes] don't have any tobacco in"* (Male, Age 9, School 7)

The youngest children were of the opinion that e-cigarettes were comprised of '*metal and oil*' or '*plastic*' and '*glass*'. Some said they contained '*chemicals*', were reusable and more durable:

*" They might be stronger longer and you don't throw it away."* (Female, Age 7, School 1)

*"I think they're better for you, you can charge them back up, you don't have to throw them out and that could start a fire."* (Male, age 7, School 6)

The older children, particularly those exposed to people who vape had a more nuanced understanding of e-cigarettes and were better able to discuss their composition, how they are used and the differing nicotine levels:

*"It's like a vape, you put liquid in them, because my step dad has one, you put liquid in them and then that burns out. It's got nicotine in it, some of them have"* (Male, Age 11, School 4)

*"E-cigarettes can have nicotine and also not because my dad is down to zero nicotine now, he doesn't use nicotine in his vape at all and you can customise the flavour and that, he prefers peach"* (Male, Age 11, School 5)

In the questionnaire, a higher proportion of children thought tobacco cigarettes were used more (59.9%) and were easier to purchase (57.8%), than e-cigarettes. 73.7% reported seeing tobacco

cigarettes more often than e-cigarettes (14.5%). Over six in ten (61.8%) also reported that e-cigarettes were safer to use than tobacco cigarettes (Table 2). This was evidenced in the qualitative findings with some of the younger children in particular highlighting that e-cigarettes did not need to be lit and therefore would not be a fire hazard:

*"I think the electronic one is more safer than the other [tobacco] one because if we blow it too hard and we drop it and it is still flaming it might cause a forest fire or a house fire"* (Male, Age 7, School 3)

*"With the other ones [tobacco cigarettes] if you light it and drop it on the carpet it can cause a fire"* (Female, Age 9, School 5)

Several of the older children brought up the fact that e-cigarettes can explode 'in your pocket' or 'in your face' and stressed the importance of getting '...a proper one from special shops' (Female, Age 11, School 6).

Flavours featured widely in children's views of e-cigarettes. Of the 401 D&W responses that describe what children see and smell when near e-cigarettes, 22.9% (n=94) specifically mentioned '*sweet, scented smoke*', '*nice smells*' and fruit flavours (year 2, n=23; year 4, n=24, year 6, n=47) (Table 3).

Table 3 here

In the peer discussions, awareness that e-cigarettes '*got fruit flavours inside of it*' was commonplace and there was a general consensus across all age groups that sweet and fruit flavoured e-liquids were more likely to appeal to young people and could '*entice*' and '*encourage*' them to vape:

*"The young ones might be encouraged to use it, the electronic one, because they love fruit and they might not know that it is really unhealthy"* (Female, Age 7, School 3)

*"I think that the younger people will want to do it because with all the different flavours, they just want to try them"* (Female, Age 9, School 1)

*"...to encourage younger people like 15 year olds because of the flavours like cherry, chocolate..."* (Female, Age 11, School 6)

Interestingly, a couple of the older children also considered the aesthetic appeal of e-liquid flavours: '*because their breath doesn't smell*' (Female, Age 11, School 7) and their commercial potential: '*I think they're trying to make it more appealing to children by making the like bubble gum flavoured and candy flavoured... so they have more buyers*' (Male, Age 11, School 1).

In peer discussions, many children were aware of a legal age of purchase for tobacco and e-cigarettes, although the majority were unsure of the exact age. Some thought that "*anyone over the age of 16*" could buy them. Many were uncertain about where to access e-cigarettes as well. Across all year groups, those with relatives who vaped were better able to identify places of purchase including specialist shops, supermarkets and online.

*"My dad has these ones [e-cigarettes], you can buy them from shops. (Male, Age 7, School 5)*

*"You can't go to the shop, well I dunno, my father buys all of his vape juice online... He gets his all off the internet, he gets them from Amazon because it's the best price for them." (Male, Age 11, School 5)*

There was some misunderstanding of the legal consequences of purchasing tobacco and e-cigarette underage, with some of the younger children believing that children or their parents could go to prison if they were found to be smoking or vaping.

*"They could get in prison" (Male, Age 7, School 4)*

*"The parents might get in jail because they're letting their children smoke" (Female, Age 7, School 4)*

Some comprehension of addiction and, to a lesser extent the role of nicotine was evident, primarily amongst the older children. Questionnaire responses identified that two-thirds of the children (66.7%) thought it would be hard to stop smoking tobacco cigarettes once started whilst nearly half (46.9%) felt the same for e-cigarettes. There were significant differences in responses across year groups for both tobacco (year 2, 66.5%; year 4, 66.8%; year 6, 68.3%:  $p < 0.001$ ) and electronic cigarettes (year 2, 53.7%; year 4, 48.1%; year 6, 38.0%:  $p < 0.001$ ).

In the D&W exercise, the word *addicted* was mentioned 103 times, almost exclusively with regard to how tobacco smokers feel and why they smoke tobacco cigarettes. Addiction in relation to tobacco smoking was mentioned in all year 6 peer discussions but rarely with reference to e-cigarettes. Nicotine was also referred to less frequently by the older children when discussing either electronic or tobacco cigarettes. Few of the younger children actually used the terms addiction or nicotine when discussing smoking or vaping but discussions did convey some recognition of the concepts:

*"Because when you start it [smoking] it's like a habit and then you can't stop" (Female, Age 7, School 7)*

*"If people still want to smoke...but they know the tobacco is affecting their lungs they just use those [e-cigarettes] cause it's got the nicotine in"* (Female, Age 7, School 6)

*"Yeah, but if you smoke and give it up, you'll feel sick for a couple of weeks, but then you'll feel better because you're getting used to no nicotine and you need the nicotine"* (Male, Age 7, School 8)

Only a couple of the older children made the connection between nicotine and addiction:

*" They can also be really bad as well because say they had a flavour in them and they had nicotine then because the flavour could be addictive and then there is nicotine in it so could be then it could be the same as a normal cigarette"* (Male, age 11, School 5)

Notably a few of the children across the discussion groups knew the amount of nicotine in e-cigarettes was variable and could be altered to aid smoking cessation. Generally these were children exposed to someone who vaped:

*"And with them [e-cigarettes]...You can cut down....you can get ones with no nicotine at all"*

(Male, Age 9, School 2)

*"My father stopped smoking about 3 years ago now, he's been on vapes since then. He has been lowering the nicotine and he is down to zero now"* (Male, Age 11, School 5)

## **Health harms of e-cigarettes**

In general, children in the study had poor understanding of any health harms related to e-cigarettes, often associating vaping and smoking with similar levels and types of harms. D&W responses for perceived health harms (n=385) ranged from considering e-cigarettes to be as bad for health as tobacco cigarettes (n= 17 (4.4%); year 2, n= 4; year 4, n=5; year 6, n=8) and/or causing death (n=14 (3.6%); year 2, n= 6; year 4, n=4; year 6, n=4) to considering e-cigarettes to be healthier and less harmful than tobacco cigarettes (n=28 (7.3%); year 2, n= 10; year 4, n=12; year 6, n=6) or not harmful at all (n=26 (6.8%); year 2, n= 8; year 4, n=12; year 6, n=6). Interestingly, three times as many older rather than younger children stated they

did not know any health harms associated with e-cigarettes (n=116 (30.1%); year 2, n= 22; year 4, n=32; year 6, n=62).

Similar misperceptions emerged in the peer discussion groups. Younger children in particular thought e-cigarettes were healthier and less harmful than tobacco cigarettes because they contained fruit flavours:

*"It's strawberry flavoured and strawberries are healthy" (Female, Aged 7, School 1)*

*"I think the electronic one [is healthier] because it has fruits in" (Female, Aged 7, School 3)*

One older child (age 11) felt 'safer' breathing in flavoured smoke rather than cigarette smoke, stating that: *"I know someone that had one once and it was cherry flavour and every time they puffed it out it smelled really nice so it made me feel a bit better and safer that I'm not breathing in all the bad things" (Girl, Age 11, School 6).*

Unsurprisingly, older children had a better grasp of the health consequences of tobacco smoking and whilst many were unsure how e-cigarettes impacted on health, many surmised that they would be better than or different to tobacco cigarettes, mainly because they of their composition:

*"There is not tobacco in them so they can't harm you as much" (Male, Age 11, School 7)*

*"They are ever so slightly better because they have no tar and stuff" (Male, Age 11, School 6)*

*"After looking at the fruit flavours, I think you would have different damage to the body because I think tobacco will have more damage to the body like lung cancer" (Male, Age 11, School 3)*

There was also some appreciation by older children that potential health harms of e-cigarettes are still unknown and therefore caution is warranted:

*"I think people get a bit like 'Oh I want to try that' but they don't actually know the harms they [e-cigarettes] can do to you" (Female, Age 11, School 6)*

*"In about 2 years' time we could find out that they're [e-cigarettes] even worse than the other ones but we don't know yet" (Male, Age 11, School 1)*

The notion that e-cigarettes were healthier than tobacco cigarettes prevailed throughout the study although e-cigarettes were still considered to be more harmful than not smoking or vaping at all. Questionnaire results showed that more than half believed that tobacco cigarettes were worse for smoker's lungs (59.6%) and worse for other people's lungs (55.4%) compared to e-cigarettes. This increased with age from 46% of children aged 7 years to 72.7% aged 11. More children (74.6%) thought smoking was never a good thing to do as compared to those who thought using an e-cigarette was never a good thing to do (57.5%). Children were less likely to feel that using an e-cigarette was never a good thing to do if they lived with somebody who used them (30.9%) compared to not living with someone using e-cigarettes (65.2%  $p < 0.001$ ) (Table 2). This view also featured in the peer discussions. Whilst children generally did not think it was okay to use e-cigarettes, some felt that people who wanted to be healthy would be more likely use e-cigarettes than smoke tobacco cigarettes.

*"Well they don't damage your lungs like tobacco ones because you don't have the ash in it" (Male, Age 7, School 5)*

*"People class them as like a healthier way of using cigarettes, people think they are better but they're not" (Female, Age 11, School 4)*

## **Motivations for vaping**

When asked why people vape, over a quarter of D&W responses (27.6% (n=102); year 2, n= 20; year 4, n=38; year 6, n=44) indicated that e-cigarettes are used primarily to stop smoking tobacco cigarettes (Table 3). Quitting was the main reason given in the peer discussions as well and an awareness of the role e-cigarettes play in smoking cessation was highlight by some:

*"If they have the real fags, they are bad and they damage your lungs. If you have them ones [e-cigarettes], they stop them, they stop the real fags and then you won't smoke them"* (Male, Age 7, School 4)

*"Because they want to stop smoking. They use it as bit of a jump. That's what they are intended for I think. They are intended to be a bit of a stepping stone to stopping"* (Male, Age 11, School 6)

*"People who smoke normal tobacco, they wanted to quit so they started smoking the electronic"* (Male, Age 11, School 3)

Notably, children who had family members who vaped or smoked were better able to discuss how using them helped parents and relatives to quit smoking:

*"He [dad] has mostly stopped using them [tobacco cigarettes] and just uses those [e-cigarettes]"* (Male, Age 7, School 5)

*"My step-dad has one, you put liquid in them and then that burns out. It's got nicotine in it, some of them have"* (Male, Age 11, School 4)

Other reasons for using e-cigarettes mentioned in D&W responses (n=370) included: because they were *better than smoking* (12%; n=44) and because they are *healthier* than tobacco cigarettes (11%; n=39), because it is *enjoyable and fun* (11%; n=40), to look cool and popular (10%; n=38) or because their friends do (2%; n=7). In peer discussions some suggested that teenagers use e-cigarettes to look cool and fit in with peer groups, although these social motivations were more widely associated with tobacco cigarettes.

*"They [e-cigarettes] look safe and you want it to look cool and you look more cool with them"* (Female, Age 9, School 6)

## **Future Intentions to vape**

Few children expressed any intention to use e-cigarettes or smoke tobacco cigarettes when older (Table 2). Of the minority reporting future intentions, slightly more thought they would vape (3.9%) rather than smoke (1.8%). Intention to smoke was significantly more likely if the child lived with someone who

smoked ( $p=0.02$ ), and intention to vape was significantly more likely if they lived with an e-cigarette user ( $p<0.001$ ) (Table 2). Older children were significantly less likely to say they would vape when older (age 10-11, 1.4%) than younger children (age 6-7, 6.7%) ( $p<0.001$ ).

Almost all peer discussion participants were adamant that they would not smoke tobacco or use e-cigarettes in the future, primarily over concerns about the health consequences:

*"I don't want to breathe a drug into my body"* (Female, Age 11, School 1)

*"Because we know the harms and everything it can do, so we don't want it doing it to our bodies – so we won't do it"* (Female, Age 11, School Powys)

A very small minority of children intimated they might experiment with vaping when older:

*"If I like it or don't like, I'm going to try it [e-cigarettes] once"* (Male, Age 9, School 8)

*"Because I want to taste them" [e-cigarettes]* (Female, Age 9, School 6)

*"If you had to smoke I would go for the vaporiser"* (Male, Age 11, School 6)

### **Acceptability of vaping and smoking**

In the questionnaire, almost half of the children reported it was okay for grown-ups to use e-cigarettes (49.6%) or tobacco cigarettes (46.2%). Results were age related, with acceptability decreasing with age for both tobacco smoking in adults ( $p<0.001$ ) and vaping in adults ( $p=0.024$ ). Acceptability in adults was influenced by exposure to e-cigarettes in the home. Over a fifth (22.4%) indicated that somebody who lives in their household uses e-cigarettes and 32.3% had somebody in their household who smoked tobacco (Table 2). Children who lived with an e-cigarette user were more likely to report that it was ok for grown-ups to use e-cigarettes (63.0%), compared with of those who did not live with someone who used e-cigarettes (45.5%) ( $p=0.03$ ) (Table 2).

Subtle familial influences were noted in peer discussion data. Findings suggest that children who had family members that were e-cigarette users or smokers were much more knowledgeable about the products and could discuss how they were used and where they could be purchased. These children were also able to comment more broadly on the variety of fruit flavoured liquids available and the use of e-cigarettes to stop smoking. Some understanding of role modelling was evident as well:

*“Also because sometimes if your mum or dad smokes they influence you because you’re trying to be like your mum or dad or grownups- so if you see somebody who inspires you smoking you kind of want to do that (Male, Age 9, School 8)*

Acceptability of e-cigarette use in children was very low. Six (1.2%) participants thought it was okay for children their age to use e-cigarettes and only 1 (0.2%) to smoke tobacco cigarettes. There were no significant differences in acceptability of e-cigarette use by gender or age. It was also low for children who lived with e-cigarette users (1.8%) and those not living with e-cigarette users (1.0%) but this difference was statistically significant ( $p=0.005$ ) (Table 2).

Many of the children in peer discussions thought it was more acceptable for adults to use electronic and tobacco cigarettes than children because of the legal age restriction. Furthermore, there was a perception that adults were better able to make decisions about behaviours that had potential risk. Some children suggested that the smoke from tobacco cigarettes was more harmful to children’s bodies because they were still developing:

*“[Older people] they will be older then and their lungs won’t be damaged that much [compared to younger people]” (Male, Age 7, School 5)*

*“Maybe your veins go stronger [when you are older], so maybe your veins can handle it” (Male, Age 9, School 1)*

## Discussion

As one of the first global studies to investigate e-cigarettes in the context of childhood, this research contributes unique and important insights into primary schoolchildren’s perceptions of vaping, confirming

that those aged 11 years and younger are already assimilating knowledge about and forming perceptions of e-cigarettes. Overall, there was general awareness of e-cigarettes which is not surprising, given the increasing popularity of e-cigarettes, and the high levels of awareness amongst adolescents demonstrated in previous studies (2, 45). Consistent with research on older populations (46), most children could differentiate between electronic and tobacco cigarettes. Viewing smoking and vaping as distinctly different is important as it may mitigate against the re-normalisation of smoking behaviour (33, 47, 48).

In line with previous studies (11, 32, 49, 50) children also had awareness of flavoured e-liquids and believed that sweeter ones might encourage young people to vape. A few of the younger children believed the fruits in flavourings made them healthier. Such findings are noteworthy given concerns about the attraction of flavoured e-cigarettes to young people and recent calls to prohibit them (18, 26). Further research is needed to understand the potential appeal of flavoured e-cigarettes to youth and assess if further regulation is warranted.

Encouragingly, our study found that many children were aware of the role e-cigarettes play in smoking cessation, particularly if a family member vaped. Evidence for the efficacy of e-cigarettes in harm reduction strategies is growing (17, 51). Policies and practices that 'normalise quitting behaviour' (33) and promote e-cigarettes as products for adult smokers who want to stop smoking should be encouraged.

One prevailing perception that emerged from our study was the belief that e-cigarettes were 'healthier' than tobacco cigarettes. Whilst this view aligns with current reports that e-cigarettes are 95% less harmful than tobacco(19), perceiving e-cigarettes as 'healthy' rather than less harmful potentially masks the fact that their use is not without risk. Given that previous research with older school children (11–16 years) in the UK concluded that never smokers who considered e-cigarettes to be a 'safer option' could be at risk of later tobacco use (8) health promotion efforts need to reframe children's perceptions of e-cigarettes, reinforcing the message that vaping is 'less harmful' rather than 'healthier' and highlighting the associated risks of e-cigarette experimentation including the potential for tobacco initiation.

Relative to smoking, most children had little or no understanding of e-cigarette health harms with over half associating vaping with the same health consequences as smoking. Whilst not unexpected given the children's developmental ages, it does reflect a wider trend (52). The proportion of 11–18 year olds in Great Britain who believe e-cigarettes are equally as harmful as tobacco cigarettes has increased over the past 3 years from 11–23% (2). Some awareness of addiction was evident but this was largely related to tobacco smoking. Similar to previous research(8), few children understood the substantive role of nicotine, particularly in relation to e-cigarettes. There was also uncertainty about the legal age of purchase for both tobacco and e-cigarettes. The lack of knowledge and prevailing misperceptions provide a strong rationale for the inclusion of e-cigarette education into the current drug education curriculum in primary schools, to help develop understanding, address uncertainties, dispel misconceptions and

discourage future uptake. Given the age-related differences that emerged, education programmes need to be developmentally appropriate.

Study findings demonstrated that exposure to e-cigarettes influences children's perceptions. Children who lived with someone who smoked or vaped appeared to have greater knowledge and understanding of the products, were more accepting of electronic and tobacco cigarettes and more likely to express intention to vape or smoke as grownups. Given the influence of the family on children's perceptions of electronic and tobacco cigarettes and knowing that children's future behaviour is related to adult's current role modelling behaviour (53, 54) familial involvement in any health promotion measures to prevent experimentation and uptake of vaping is imperative. Our study supports Faletau et al's (33) recommendation for dialogue between parents who use these products and their children, to contextualise e-cigarettes use in a culture of cessation.

Consistent with previous tobacco research (36) children generally had negative perceptions of both vaping and smoking and most did not intend to use electronic or tobacco cigarettes when older. However almost half considered both smoking and vaping to be acceptable adult behaviour. Further research is needed to understand why this acceptability persists despite extensive tobacco control efforts and pervasive anti-smoking social norms. The extent to which vaping leads to future smoking also requires further investigation.

## **Study Limitations**

Our study was based a small sample of 8 Welsh schools, purposively selected for maximum variation, and therefore findings cannot be generalised to all children in Wales. As a school based mixed method study conducted in a classroom setting, children may have influenced each other's responses, and their participation in earlier stages may have influenced responses in the later stages.

## **Conclusions**

This study provides unique insights into Welsh primary school children's perceptions of e-cigarettes and highlights the importance of exploring younger children's understanding of vaping relative to smoking. Whilst children in the study had general awareness of e-cigarettes, understanding of health harms was limited, characterised by misconception and uncertainty. The findings also demonstrate how primary school children contextualise their understanding of e-cigarettes based on their own experiences and existing knowledge of tobacco cigarettes.

Primary schoolchildren represent an important cohort for primary prevention. Understanding how they perceive e-cigarettes before experimentation is essential to inform current and future tobacco control strategies and prevent uptake in children and young people. Study findings should prompt policymakers,

practitioners, educators and parents to consider the impact of e-cigarette use on primary schoolchildren and work toward minimising potential risks via appropriate policy responses and educational practice.

## **Abbreviations**

D&W – Draw and Write Technique

FDA - US Food and Drug Administration

GB - Great Britain

NYTS - National Youth Tobacco Surveys

PHW - Public Health Wales

## **Declarations**

### **ETHICAL APPROVAL AND CONSENT TO PARTICIPATE**

Ethical approval for this study, including the use of passive consent was granted by Liverpool John Moores University Research Ethics Committee (REF 17/PBH/008). All head teachers of participating schools provided written consent, passive consent was used with parents and all children provided written assent.

### **CONSENT FOR PUBLICATION**

Not applicable

### **AVAILABILITY OF DATA AND MATERIAL**

The data generated and analysed during the study are available from the corresponding author on reasonable request.

### **COMPETING INTERESTS**

The authors declare that they have no competing interests.

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## AUTHORS' CONTRIBUTION

LP, KRH, IG, ZQ, HT, AD, AG and JB designed the study. LP, KRH, RB, CB, IG, ZQ collected and/or analysed the study data. LP and KRH wrote the first draft and all authors read, edited and approved the final manuscript.

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## References

1. Perikleous EP, Steiropoulos P, Paraskakis E, Constantinidis TC, Nena E. E-Cigarette Use Among Adolescents: An Overview of the Literature and Future Perspectives. *Front Public Health*. 2018;6(86).
2. Action on Smoking and Health (ASH). Use of e-cigarettes among young people in Great Britain. London: ASH; 2018.
3. Bauld L, MacKintosh A, Eastwood B, Ford A, Moore G, Dockrell M, et al. Young People's Use of E-Cigarettes across the United Kingdom: Findings from Five Surveys 2015–2017. *Int J Environ Res Public Health*. 2017;14(9):973.

4. Kaufmann N, Currie D. The Scottish adolescent e-cigarette user: profiling from the Scottish Schools Adolescent Lifestyle and Substance Use Survey (SALSUS). *Public Health*. 2017;147:69-71.
5. Office for National Statistics (ONS). *Smoking, Drinking and Drug Use Among Young People in England*. Cardiff: ONS; 2017.
6. de Lacy E, Fletcher A, Hewitt G, Murphy S, Moore G. Cross-sectional study examining the prevalence, correlates and sequencing of electronic cigarette and tobacco use among 11–16- year olds in schools in Wales. *BMJ Open*. 2017;7(2):e012784.
7. Sussan TE, Shahzad FG, Tabassum E, Cohen JE, Wise RA, Blaha MJ, et al. Electronic cigarette use behaviors and motivations among smokers and non-smokers. *BMC Public Health*. 2017;17(1):686.
8. Fulton E, Gokal K, Griffiths S, Wild S. More than half of adolescent E-Cigarette users had never smoked a cigarette: findings from a study of school children in the UK. *Public Health*. 2018;161:33-5.
9. Hammond D, Reid JL, Cole AG, Leatherdale ST. Electronic cigarette use and smoking initiation among youth: a longitudinal cohort study. *Can Med Assoc J*. 2017;189(43):E1328- E36.
10. Wang TW, Gentzke A, Sharapova S, Cullen KA, Ambrose BK, Jamal A. Tobacco Product Use Among Middle and High School Students- United States 2011-2017. *MMWR Morb Mortal Wkly Rep*. 2018;67(629):633).
11. Moore G, Hewitt G, Evans J, Littlecott HJ, Holliday J, Ahmed N, et al. Electronic-cigarette use among young people in Wales: evidence from two cross-sectional surveys. *BMJ Open*. 2015;5(4):e007072.
12. Best C, Haseen F, Currie D, Ozakinci G, MacKintosh AM, Stead M, et al. Relationship between trying an electronic cigarette and subsequent cigarette experimentation in Scottish adolescents: a cohort study. *Tob Control*. 2018;27(4):373-8.
13. Azagba S. E-cigarette use, dual use of e-cigarettes and tobacco cigarettes, and frequency of cannabis use among high school students. *Addict Behav*. 2018;79:166-70.
14. Moore GF, Littlecott HJ, Moore L, Ahmed N, Holliday J. E-cigarette use and intentions to smoke among 10-11-year-old never-smokers in Wales. *Tob Control*. 2016;25(2):147-52.
15. Gentzke AS, Creamer M, Cullen KA, Ambrose BK, Willis G, Jamal A, et al. Vital Signs: Tobacco Product Use Among Middle and High School Students – United States, 2011–2018. *MMWR Morb Mortal Wkly Rep*. 2019;68:157-64.
16. McNeill A, Brose LS, Calder R, Bauld L, Robson DF. *Evidence Review of e-cigarettes and heated Tobacco products 2018*. . London: Public Health England; 2018.
17. Royal College of Physicians. *Nicotine without smoke: Tobacco Harm Reduction*. London: RCP; 2016.
18. Ferkol TW, Farber HJ, La Grutta S, Leone FT, Marshall HM, Neptune E, et al. Electronic cigarette use in youths: a position statement of the Forum of International Respiratory Societies. *Eur Respir J*. 2018;51(5):1800278.
19. Office of the Surgeon General. *E-cigarette use among youth and young adults. A Report of the Surgeon General*. Atlanta, GA: Dept of Health and Human Services; 2016.

20. British Medical Association (BMA). E-cigarettes: Balancing Risks and Opportunities. London: BMA; 2017.
21. Action on Smoking and Health (ASH). Nicotine and Addiction. London: ASH; 2018.
22. Govindarajan P, Spiller HA, Casavant MJ, Chounthirath T, Smith GA. E-Cigarette and Liquid Nicotine Exposures Among Young Children. *Pediatrics*. 2018;141(5):e20173361.
23. Institute for Global Tobacco Control. County Laws Regulating E-cigarettes: A Policy Scan Baltimore, MD: Johns Hopkins Bloomberg School of Public Health; 2018 [Available from: [https://www.globaltobaccocontrol.org/e-cigarette\\_policyscan](https://www.globaltobaccocontrol.org/e-cigarette_policyscan)].
24. Kennedy RD, Awopegba A, De León E, Cohen JE. Global approaches to regulating electronic cigarettes. *Tob Control*. 2017;26(4):440-5.
25. House of Commons. The Regulation of Electronic Cigarettes. Briefing Paper number 8114, 31st Oct 2017. Westminster, London: House of Commons; 2017.
26. FDA takes new steps to address the epidemic of youth e-cigarette use, including historic action against more than 1,300 retailers and 5 major manufacturers for their roles perpetuating youth access [press release]. Silver Spring, MD: U.S. Department of Health and Human Services 2018.
27. Williams T, Wetton N, Moon A. A Picture of Health. London: Health Education Authority; 1989.
28. YouGov. SmokeFree GB Youth Survey. London: ASH; 2016.
29. Hardcastle KA, Hughes K, Worsley J. "Most people I know have got one": Young people's perceptions and experiences of electronic cigarettes. Liverpool: LJMU; 2014.
30. Akre C, Suris J-C. Adolescents and young adults' perceptions of electronic cigarettes as a gateway to smoking: a qualitative study in Switzerland. *Health Educ Res*. 2017;32(5):448-54.
31. Griesbach D, Platts A. Young adults and e-cigarettes: A qualitative exploration of awareness, experience and attitudes. Edinburgh: The Scottish Government; 2016.
32. Measham F, O'Brien K, Turnbull G. "Skittles & Red Bull is my favourite flavour": E-cigarettes, smoking, vaping and the changing landscape of nicotine consumption amongst British teenagers – implications for the normalisation debate. *Drugs (Abingdon Engl)*. 2016;23(3):224-37.
33. Faletau J, Glover M, Nosa V, Pienaar F. Looks like smoking, is it smoking?: Children's perceptions of cigarette-like nicotine delivery systems, smoking and cessation. *Harm Reduct J*. 2013;10(30).
34. Hahn EJ, Hall LA, Rayens MK, Burt AV, Corley D, Sheffel KL. Kindergarten Children's Knowledge and Perceptions of Alcohol, Tobacco, and Other Drugs. *J Sch Health*. 2000;70(2):51-5.
35. Andrews JA, Tildesley E, Hops H, Duncan SC, Severson HH. Elementary School Age Children's Future Intentions and Use of Substances. *J Clin Child and Adolesc Psychol*. 2003;32(4):556- 67.
36. Freeman D, Brucks M, Wallendorf M. Young children's understandings of cigarette smoking. *Addiction*. 2005;100(10):1537-45.
37. Public Health Wales. Welsh Health Survey. Cardiff: Public Health Wales; 2015.
38. Porcellato L, Dugdill L, Springett J. Using focus groups to explore children's perceptions of smoking: reflections on practice. *Health Education*. 2002;102(6):310-20.

39. Porcellato L, Dugdill L, Springett J, Sanderson FH. Primary schoolchildrens' perceptions of smoking: implications for health education. *Health Educ Res.* 1999;14(1):71-83.
40. McWhirter J. The draw and write technique as a versatile tool for researching children's understanding of health and well-being. *Int J Health Promot Educ.* 2014;52(5):250-9.
41. Farmer S, Porcellato L. "Thinking about drinking" Exploring children's perceptions of alcohol using the Draw and Write tool. *Health Education.* 2016;116(6):541-60.
42. Grieg A, Taylor J, Mackay T. *Doing Research with Children: A Practical Guide.* London: Sage; 2012.
43. Braun V, Clarke V. Using thematic analysis in psychology. *Qual Res in Psychol.* 2006;3(2):77- 101.
44. Office for National Statistics (ONS). *Welsh Index of Multiple Deprivation.* Cardiff: ONS; 2018.
45. Greenhill R, Dawkins L, Notley C, Finn MD, Turner JJD. Adolescent Awareness and Use of Electronic Cigarettes: A Review of Emerging Trends and Findings. *J Adolsec Health.* 2016;59(6):612-9.
46. McKeganey N, Barnard M, Russell C. Vapers and vaping: E-cigarettes users views of vaping and smoking. *Drugs (Abingdon Engl).* 2018;25(1):13-20.
47. Voigt K. Smoking Norms and the Regulation of E-Cigarettes. *Am J Public Health.* 2015;105(10):1967-72.
48. McKeganey N, Barnard M, Russell C. Visible Vaping: E-Cigarettes and the Further De- Normalization of Smoking. *Int Arch Addict Res Med.* 2016;2(2).
49. Pepper JK, Ribisl KM, Brewer NT. Adolescents' interest in trying flavoured e-cigarettes. *Tob Control.* 2016;25(Suppl 2):ii62-ii6.
50. Vasiljevic M, Petrescu DC, Marteau TM. Impact of advertisements promoting candy-like flavoured e-cigarettes on appeal of tobacco smoking among children: an experimental study. *Tob Control.* 2016;25(e2):e107-e12.
51. Levy DT, Borland R, Lindblom EN, Goniewicz ML, Meza R, Holford TR, et al. Potential deaths averted in USA by replacing cigarettes with e-cigarettes. *Tob Control.* 2018;27(1):18-25.
52. Majeed BA, Weaver SR, Gregory KR, Whitney CF, Slovic P, Pechacek TF, et al. Changing Perceptions of Harm of E-Cigarettes Among U.S. Adults, 2012–2015. *Am J Prev Med.* 2017;52(3):331-8.
53. Bandura A. *Social Learning Theory.* New York: General Learning Press; 1971.
54. Leonardi-Bee J, Jere ML, Britton J. Exposure to parental and sibling smoking and the risk of smoking uptake in childhood and adolescence: a systematic review and meta-analysis. *Thorax.* 2011;66(10):847-55.

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