Electronic Nicotine Delivery Systems (ENDS) use Among Members of a Community Engagement Program

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Abstract
Electronic nicotine delivery systems (ENDS) are relatively new and ENDS use data from community engagement programs may help us understand usage patterns and facilitate targeted longitudinal studies. Community members in Florida, USA, were asked about ENDS use, tobacco use, and health history/concerns by Community Health Workers. Among 7253 members recruited during 2014 to 2021 into our HealthStreet program, 1177 had ever used ENDS; the proportion increased from 12 to 27% from 2014 to 2021 (adjusted odds ratio (aOR) 2.5; 95% CI 1.7–3.5; Ever versus never used ENDS). Ever tobacco use was strongly associated with ENDS use; 69% of ever users were current tobacco users. Demographic determinants (sex, age, race) and food insecurity were strongest predictors of ENDS use. Most who had ever used ENDS were aged 18–25 (aOR 5.9; 95% CI 4.6–7.6; vs. aged 60 + years), White (aOR 3.7; 95% CI 3.2–4.3; vs. Black/African American), male (aOR 1.5; 95% CI 1.3–1.7; vs. female), and recently food insecure (aOR 1.8; 95% CI 1.5–2.0; vs. not recently food insecure). Those with respiratory issues were more likely to have used ENDS compared to those without (aOR 2.0; 95% CI 1.6–2.6; aOR 1.3; 95% CI 1.1–1.5). Members concerned about hypertension were less likely to have used ENDS (aOR 0.7; 95% CI 0.5–0.9). In this relatively rural, micropolitan sample, tobacco use, socio-economic determinants, and certain health history/concerns were strongly associated with ENDS use. Community outreach approaches are needed to further understand these factors and implement interventions.

Keywords Electronic nicotine delivery systems (ENDS) · Community engagement · Socio-economic determinants · Tobacco use · HealthStreet

Introduction
Electronic nicotine delivery systems (ENDS), also known as e-cigarettes, were first imported to the United States (US) commercially in 2006 [1]. In 2017, 4.4% of US adults were current ENDS users, with the highest prevalence among those aged 18–24 years (10.1%) [2]. Over 14% of high-school aged students currently use e-cigarettes [3].

ENDS are often promoted as a healthier alternative to traditional tobacco products due to using water vapor created by heating ‘e-liquids’ instead of combusting tobacco leaves; thus, ENDS users theoretically avoid inhaling thousands of chemicals known to be present in smoked tobacco [4–6]. People who are concerned about tobacco associated health conditions may turn to using ENDS, instead of smoking cigarettes. [4, 7]. Tobacco-associated health conditions include asthma, COPD/emphysema, other breathing/lung problems, cancer, and heart/circulation problems [8–10].

E-liquids used in ENDS usually contain nicotine, flavors, solvents, and sometimes THC (tetrahydrocannabinol) and CBD (cannabidiol) [11]. Although using ENDS is sometimes purported to be a ‘harm reduction’ strategy, users may be unwittingly increasing nicotine dose per unit smoked [12]. Tobacco cigarettes typically contain 7–15 mg nicotine/cigarette, but some “5% nicotine” e-liquid brands contain 59 mg/mL nicotine [13–16]. Rao et al. found ten puffs of...
one ENDS brand resulted in serum nicotine levels five times higher than serum nicotine levels after ten puffs of a tobacco cigarette [14]. Leavens et al. determined a convenience sample study of 101 persons who used ENDS daily, consumed 10.5 ENDS pods per month on average [17].

The US Food and Drug Administration (FDA) states “There are no safe tobacco products, including ENDS”, citing health risks to ENDS users from lung injuries, seizures, and fires/explosions [18]. In 2019–2020, there was a highly publicized outbreak of EVALI (e-cigarette, or vaping, product use-associated lung injury) cases. ENDS users experienced severe short-term issues – some fatal; physical modification of the ENDS device or customized e-liquids were responsible for most problems in the outbreak [19–26]. In June 2022 the FDA instructed an ENDS manufacturer to stop distribution and sale of all products stating, “insufficient evidence to assess … toxicological risks”, however this Marketing Denial Order was overturned in court [27].

ENDS-associated health issues are not fully understood. Recent meta-analyses showed strong evidence that ENDS-risks include toxic substance exposure, nicotine dependence, respiratory health problems, and initiation of smoking regular cigarettes [28]. Other risks may include cognition and brain development problems, particularly in youth, due to the nicotine content of ENDS [29]. Impaired endothelial function has been observed [14]. A positive association between the number of COVID-19 cases/deaths and proportion of ENDS users in US states has been noted [30]. Recently, a study found an association between ENDS use and fragility fractures, suggesting harm to bone health [31]. Given the gap in the literature about ENDS in the population, this analysis focused on ENDS use among a sample of HealthStreet members in Florida.

**Methods and Data Analysis**

University of Florida’s HealthStreet (HSt) is a Community Engagement program in Alachua County, Florida, directed and co-directed by two authors respectively (LBC and CWS), aiming to promote health equity. Since 2011, data have been collected from over 12,700 HSt members [32]. Based on Community Health Worker (CHW) outreach into the North Central Florida communities, people who are interested complete a written informed consent process, are interviewed face-to-face by a CHW with a 20 min Health Needs Assessment which includes social determinants of health (e.g., sex, age, race, ethnicity), socioeconomic status (e.g., food security status, education level), and health issues (e.g., medical history, and health concerns).

In 2014, HSt updated their survey to include questions on use of e-cigarettes and vaping ENDS devices, by asking “Have you ever used e-cigarettes or a vaping device?” Those who responded ‘yes’ were asked if they had used in the past 30 days; those who responded ‘no’ or ‘don’t know’ were coded Never Used ENDS. Similarly, participants were scored as Never Used, or Ever Used tobacco, by combining “yes” responses to questions asking about smoking cigarettes, cigars, cigarillos, hookah, bong, or water pipe (hereafter referred to as [tobacco]). Ever Used [tobacco] “yes” responses were then further divided into Current or Former tobacco use, depending on whether they answered “yes” or “no” to the follow-up question: “Have you used [tobacco] in the last 30 days?”

Our sample included 7253 HSt members ≥ 18 years old who joined HSt from 2014 to 2021. A secondary analysis was run on 5139 HSt members with 1 + tobacco associated health condition(s), as discussed in the introduction. In all analyses, members answering ‘don’t know’ to specific questions were classified as ‘no’. Similarly, members who answered, ‘don’t know’ when asked if they had heart/circulation or breathing/lung conditions, were classified as ‘no’.

Between-group differences for ENDS use groups were calculated for demographic variables, tobacco associated health conditions, and health concerns (e.g., hypertension, heart problems, and/or cancer). Unadjusted and adjusted odds ratios for Ever Used versus Never Used ENDS in any variable group (compared to reference group) were determined using multinomial logistic regression models. The distribution by year of Ever versus Never ENDS use was analyzed. Unadjusted and adjusted odds ratios for Ever Used versus Never Used in individual years were calculated using 2014 as the baseline year. Models were adjusted for demographic variables, tobacco associated health conditions, and naming a tobacco associated health problem as one of their top-three health concerns. Statistical significance was accepted for p-values less than 0.05.

Data analyses were conducted using SAS® software version 9.4, using the functions PROC LOGISTIC, PROC FREQ, PROC GLM AND PROC TABULATE. The R programming language Version 4.0.3 [33] packages tidyverse [34], cowplot [35], RColorBrewer [36], and ggsci [37] were used to create figures.

**Results**

The data show an increasing overall trend in Ever Use of ENDS, from 12% and 13% in 2014 (main, and sub analyses respectively), to 27% in 2021 (Tables S1, S5, Figs. 1a, S7a). However, in 2020, the Ever-Used ENDS trend line dipped downward (to 18% and 16%, main, and sub-analyses). The unadjusted and adjusted odds ratios of Ever versus Never Used ENDS mirrored the proportion trend: increasing trend from 2014 to 2021, with a dip for 2020 (Figs. 1b and S7b). Adjusted odds ratios (aOR) comparing ENDS use in 2014
with 2019 and 2021 were statistically significant for the main analysis, but only for 2014 versus 2021 in the sub-analysis (Figs. 1b and S7b). By 2021 participants were more than twice as likely to have ever used ENDS compared to 2014 (main analysis: aOR 2.5, 95% CI 1.7–3.5; sub-analysis: aOR 2.2, 95% CI 1.5–3.4; Tables S1, S5, Figs. 1b, S7b). A total of 1,177 HSt members (16%) including 849 (17%) of the members with 1+ tobacco associated conditions had used ENDS (2014–2021), with significantly different distribution of Ever vs. Never ENDS use by year (p < 0.0001, Tables S1 and S5).

Statistically significant differences were observed between Ever Used and Never Used populations (Tables 1, S3, Figs. S1, S2, S4, & S5). Males were 50% more likely to have ever used ENDS compared to females, with an adjusted odds ratio (aOR) of 1.5 (95% CI 1.3–1.7 main analysis; 95% CI 1.2–1.7 sub-analysis) after adjusting for race, ethnicity, age, education status, food insecurity status, tobacco associated health conditions and concerns (Table 2, S4, Fig. S3, S6).

Members in the 18–25 age group were 5.9 times (aOR 95% CI 4.6–7.6) more likely to have ever used ENDS compared to those in the 60+ age group for the main analysis (Table 2, Fig. S3). However, this likelihood increased to 6.2 times (aOR 95% CI 4.6–8.5) for members in the 18–25 age group who had tobacco-related conditions, compared to those in the 60+ age group (Table S4, Fig. S6). The average age for females and males who had ever used ENDS was similar in the main analysis (41.3 and 41.0 years respectively, Table 1, Fig. S1d), but on average, females who had tobacco-related conditions, who had ever used ENDS, were older than males (44.1 vs. 43.5 years, Table S3, Fig. S4d). Between-group differences for Ever versus Never Used ENDS were significant for 18–25, 26–40, 41–59, and 60+ age groups in both the main and the sub-analyses. Among those with tobacco associated health conditions, 27% of those aged 18–40 years had ever used ENDS (Table S3, Fig. S4b), slightly more compared to the general HSt population, where 24% and 23% of 18–25 and 26–40 years respectively had used ENDS (Table 1, Fig. S1b).

Compared to Black/African American (AA) HSt members, White HSt members were 3.7 times more likely (aOR 95% CI 3.2–4.3) overall to have Ever Used ENDS (Table 2, Fig. S3). Among those with tobacco-related health conditions, this likelihood decreased to 3.3 times more likely (aOR 95% CI 2.7–3.9, Table S4, Fig. S6). HSt members with Latino/Hispanic ethnicity were less likely to be Ever versus Never Used ENDS compared to those who did not identify as Latino/Hispanic (main analysis: aOR 0.7, 95% CI 0.6–0.9; sub-analysis: aOR 0.6, 95% CI 0.4–0.8, Tables 2, S4, Figs. S3, S6).

Almost half the HSt members had been food insecure in the past 12 months (i.e., did not have enough money to buy food, Tables 1, S3, Figs. S1e, S4e). Adjusted odds ratios show HSt members who had been food insecure in the past 12 months, were almost twice as likely to have used ENDS compared to those who were not food insecure (main analysis: aOR 1.8, 95% CI 1.5–2.0; sub-analysis: aOR 1.9, 95% CI 1.6–2.2; Tables 2, S4, Figs. S3, S6).

Only 1181 (16%) of HSt members overall—including 866 (17%) of members with tobacco-related conditions—had less than 12 years education; 223 (19%) and 169 (20%) of these groups had used ENDS (Tables 1, S3). The majority
|                        | All participants n = 7253 | Never used ENDS n = 6076 (84%) | Ever used ENDS n = 1177 (16%) | p-valuea |
|------------------------|---------------------------|---------------------------------|-------------------------------|----------|
| Sex, n (%)             |                           |                                 |                               |          |
| Male                   | 2677 (36.9%)              | 2171 (35.7%)                    | 506 (43.0%)                   | <0.0001  |
| Female                 | 4576 (63.1%)              | 3905 (64.3%)                    | 671 (57.0%)                   |          |
| Average age, years, mean (SD) |                      |                                 |                               |          |
| Male                   | 48.7 (16.4)               | 50.5 (16.1)                     | 41.0 (15.4)                   | <0.0001  |
| Female                 | 47.6 (17.3)               | 48.7 (17.4)                     | 41.3 (15.2)                   | <0.0001  |
| Age groups, n (%)      |                           |                                 |                               |          |
| 18–25 years old        | 1002 (13.8%)              | 758 (12.5%)                     | 244 (20.7%)                   | <0.0001  |
| 26–40 years old        | 1557 (21.5%)              | 1196 (19.7%)                    | 361 (30.7%)                   |          |
| 41–59 years old        | 2617 (36.1%)              | 2211 (36.4%)                    | 406 (34.5%)                   |          |
| 60 + years old         | 2077 (28.6%)              | 1911 (31.5%)                    | 166 (14.1%)                   |          |
| Race, n (%)            |                           |                                 |                               |          |
| Black/African American | 3510 (48.4%)              | 3205 (52.7%)                    | 305 (25.9%)                   | <0.0001  |
| White                  | 3221 (44.4%)              | 2463 (40.5%)                    | 758 (64.4%)                   |          |
| Other                  | 522 (7.2%)                | 408 (6.7%)                      | 114 (9.7%)                    |          |
| Ethnicity, n (%)       |                           |                                 |                               |          |
| Latino/Hispanic        | 582 (8.0%)                | 475 (7.8%)                      | 107 (9.1%)                    | 0.1411   |
| Not Latino/Hispanic    | 6671 (92.0%)              | 5,601 (92.2%)                   | 1070 (90.9%)                  |          |
| Economic determinants, n (%) |                       |                                 |                               |          |
| <12 years education    | 1181 (16.3%)              | 958 (15.8%)                     | 223 (18.9%)                   | 0.0068   |
| ≥12 years education    | 6072 (83.7%)              | 5118 (84.2%)                    | 954 (81.1%)                   |          |
| Food insecure (in past yr) |                      |                                 |                               | <0.0001  |
| Not food insecure (in past yr) |                      |                                 |                               |          |
| Health conditions, n (%)b |                       |                                 |                               |          |
| Asthma                 | 1484 (20.5%)              | 1187 (19.5%)                    | 297 (25.2%)                   | <0.0001  |
| COPD/emphysema         | 562 (7.7%)                | 415 (6.8%)                      | 147 (12.5%)                   | <0.0001  |
| Other respiratory issuec | 2206 (30.4%)              | 1768 (29.1%)                    | 438 (37.2%)                   | <0.0001  |
| Cancer (all types)     | 815 (11.2%)               | 695 (11.4%)                     | 120 (10.2%)                   | 0.2165   |
| Heart/Circulationd     | 4130 (56.9%)              | 3505 (57.7%)                    | 625 (53.1%)                   | 0.0036   |
| Top-level health concern, n (%) |                 |                                 |                               |          |
| Hypertension           | 1796 (24.8%)              | 1628 (26.8%)                    | 168 (14.3%)                   | <0.0001  |
| Heart problems         | 993 (13.7%)               | 836 (13.8%)                     | 157 (13.3%)                   | 0.7012   |
| Cancer                 | 885 (12.2%)               | 746 (12.3%)                     | 139 (11.8%)                   | 0.6534   |
| Tobacco use, n (%)f    |                           |                                 |                               |          |
| Never used             | 2915 (40.2%)              | 2850 (46.9%)                    | 65 (5.5%)                     | <0.0001  |
| Former usef            | 1951 (26.9%)              | 1648 (27.1%)                    | 303 (25.7%)                   |          |
| Current usef           | 2387 (32.9%)              | 1578 (26.0%)                    | 809 (68.7%)                   |          |

*a*Ever versus Never Used ENDS, Chi-square-test, except continuous age which used ANOVA  
*b*Participants may have no, or more than one health-issue  
*c*Chronic bronchitis, chronic sinus infections, pneumonia  
*d*Arrhythmias, chest pain/angina, clots, coronary artery disease, heart attack, heart murmur, heart palpitations, high cholesterol, high blood pressure, mitral valve prolapse, deep vein thrombosis, other heart/circulation conditions  
*e*Cigarettes, cigars, cigarillos, hookah, bong, water pipe  
*f*No use in past 30 days  
*g*Used in past 30 days
Table 2 Unadjusted and adjusted odds ratios for Ever versus Never Used ENDS for HealthStreet members (2014–2021)

|                                | n = 7253 | Ever vs. Never Used ENDS | OR (95% CI) |
|--------------------------------|----------|--------------------------|------------|
|                                |          | Unadjusted | Adjusted |
| **Sex**                        |          |            |          |
| Male                           | 2677     | 1.4 (1.2–1.5) | 1.5 (1.3–1.7) |
| Female                         | 4576     | Ref         | Ref      |
| **Age groups at baseline**     |          |            |          |
| 18–25 years old                | 1002     | 3.7 (3.0–4.6) | 5.9 (4.6–7.6) |
| 26–40 years old                | 1557     | 3.5 (2.9–4.2) | 5.1 (4.0–6.4) |
| 41–59 years old                | 2617     | 2.1 (1.7–2.6) | 2.4 (2.0–3.0) |
| 60+ years old                  | 2077     | Ref         | Ref      |
| **Race**                       |          |            |          |
| Black/African American         | 3510     | Ref         | Ref      |
| White                          | 3221     | 3.2 (2.8–3.7) | 3.7 (3.2–4.3) |
| Other                          | 522      | 2.9 (2.3–3.7) | 3.0 (2.3–3.8) |
| **Ethnicity**                  |          |            |          |
| Latino/Hispanic vs. not Latino/Hispanic | 582 | 1.2 (0.9–1.5) | 0.7 (0.6–0.9) |
| **Economic determinants**      |          |            |          |
| <12 years vs. ≥ 12 years education | 1181 | 1.2 (1.1–1.5) | 1.2 (1.0–1.4) |
| Food Insecure vs. not food insecure | 3371 | 1.7 (1.5–2.0) | 1.8 (1.5–2.0) |
| **Health conditions**          |          |            |          |
| Asthma                         | 1484     | 1.4 (1.2–1.6) | 1.1 (0.9–1.3) |
| COPD/emphysema                 | 562      | 1.9 (1.6–2.4) | 2.0 (1.6–2.6) |
| Any other respiratory issue    | 2206     | 1.4 (1.3–1.6) | 1.3 (1.1–1.5) |
| Cancer (any cancer vs. none)   | 815      | 0.9 (0.7–1.1) | 1.0 (0.8–1.3) |
| Heart/Circulation              | 4130     | 0.8 (0.7–0.9) | 1.1 (1.0–1.3) |
| **Top-level health concerns**  |          |            |          |
| Hypertension                   | 1796     | 0.5 (0.4–0.5) | 0.7 (0.5–0.9) |
| Heart problems                 | 993      | 1.0 (0.8–1.2) | 0.9 (0.6–1.3) |
| Cancer                         | 885      | 1.0 (0.8–1.2) | 1.1 (0.8–1.5) |
| Hypertension and/or heart problems and/or cancer | 3124 | 0.6 (0.6–0.7) | 1.1 (0.7–1.6) |

*a* Adjusted for age (categorical), race, ethnicity, ≥ 12 years of education (yes/no), food insecure (yes/no), type of health condition, health concern  
*b* Adjusted for sex, race, ethnicity, ≥ 12 years of education (yes/no), food insecure (yes/no), type of health condition, health concern  
*c* Adjusted for sex, age (categorical), ethnicity, ≥ 12 years of education (yes/no), food insecure (yes/no), type of health condition, health concern  
*d* Adjusted for sex, age (categorical), race, ≥ 12 years of education (yes/no), food insecure (yes/no), type of health condition, health concern  
*e* Adjusted for sex, age (categorical), race, ethnicity, food insecure (yes/no), type of health condition, health concern  
*f* Food security status during past 12 months, adjusted for sex, age (categorical), race, ethnicity, ≥ 12 years of education (yes/no), type of health condition, health concern  
*g* Members may have zero, or more than one, health condition;  
*h* Reference is ‘no health condition’, adjusted for sex, age (categorical), race, ethnicity, ≥ 12 years of education (yes/no), food insecure (yes/no), health concern  
*i* Chronic bronchitis, chronic sinus infections, pneumonia  
*j* Arrhythmias, chest pain/angina, clots, coronary artery disease, heart attack, heart murmur, heart palpitations, high cholesterol, high blood pressure, mitral valve prolapse, deep vein thrombosis, other heart/circulation conditions  
*k* Reference is ‘not concerned about any of these health conditions’, adjusted for sex, age (categorical), race, ethnicity, ≥ 12 years of education (yes/no), food insecure (yes/no), type of health condition
of HSt members (main analysis: 6072, 84%; sub-analysis: 4273, 83%) had 12 or more years of education; 16% of these members had used ENDS (main & sub-analysis: 954 & 680 members respectively). Adjusted odds of being an Ever/ Never ENDS user as regards education level were not statistically significant (Tables 2, S4, Figs. S3, S6).

Of the 7253 HSt members, 5139 members (71%) had one or more tobacco associated health conditions: 1484 members (29%) had asthma, 562 (11%) had COPD/emphysema, 2206 (43%) had other breathing/lung problems, 815 (16%) had cancer, and 4130 (80%) had heart/circulation problems (Table S3, Fig. S5a). Significant Ever versus Never Used ENDS distributions were found for all health conditions except cancer (Table S3, Fig. S5a).

Compared to HSt members in general, those who had COPD/emphysema were significantly more likely to have Ever Used than Never Used ENDS (aOR 2.0, 95% CI 1.6–2.6); this was also the case for those reporting types of breathing conditions other than asthma (aOR 1.3, 95% CI 1.1–1.5), but none of the other adjusted odds for tobacco associated health histories were significant (Table 2, Fig. S3). Members who listed hypertension as one of their top three health concerns were significantly less likely have ever used ENDS (aOR 0.7; 95% CI 0.5–0.9, Table 2, Fig. S3). There were no significant ENDS use between-group differences, nor were there any significant adjusted odds ratios, among those who were concerned about heart problems or cancer (Tables 1, 2).

The majority of those who had ever used ENDS were current tobacco users: 809 (69%) of members in the main analysis, and 601 (71%) among members with tobacco associated health history (Tables S2, S6, Fig. 2). In contrast just 2% of those who had never used tobacco (65 and 40 members, main & sub-analyses) had ever used ENDS (Tables S2, S6, Fig. 2). Around 5% of ENDS users had never used tobacco (main analysis: 65, 6%; sub-analysis: 40, 5%; Tables S2, S6, Fig. 2).

**Discussion**

Demographic and socioeconomic trends we observed for ENDS use within the HealthStreet Community mirrored national findings. Ever-use of ENDS was more frequent in members who were White, young, male, recently food-insecure, and/or had respiratory health issues compared to other groups [2, 38]. However, decreased ENDS use in HealthStreet data during 2020 (relative to 2019 and 2021, Fig. 1a, Table S1), contrasted with studies suggesting no change or increased use of ENDS during 2020 [39, 40]. We attributed this anomaly to the COVID-19 lockdown restrictions which limited how many HSt members CHW could survey in 2020.

When this analysis was conceptualized, we anticipated patterns of ENDS use would be different for HSt members who had a history of tobacco associated health conditions, compared to the overall sample. We expected that HSt members who had tobacco associated health history would be more likely to be former or current ENDS users (‘Ever Used ENDS’), and less likely to be classified as ‘Never Used ENDS’. As ENDS are frequently used as smoking cessation aids, it is likely that those who had tobacco associated health conditions would have been more likely to have tried ENDS as a lesser-harm alternative. This was
based on the premise that after experiencing a health problem attributed to or made worse by tobacco, HSt members may have turned to using ENDS as smoking cessation devices [21]. Instead, the patterns of tobacco/ENDS usage from the HSt population overall and for those who had tobacco associated health conditions were almost identical (Fig. 2, Tables S2, S6). For example, about one third of HSt members (main analysis: 36%, sub-analysis: 37%) had never used tobacco or ENDS devices. Allowing for the fact that there is limited evidence on health issues attributable to ENDS, and looking at tobacco data alone, the percentage of those who currently use, formerly used, or have never used tobacco is virtually the same for those who did (38%, 29%, 33%) and did not (40%, 27%, 33%) report tobacco associated health conditions. Health messaging may encourage tobacco users to switch to ENDS to try to minimize risks. However, ENDS use patterns in HSt suggest perhaps tobacco users who turn to ENDS use for tobacco smoking cessation purposes may need additional support to successfully quit.

A limitation of our study is that ENDS are new, and most users are young, so exploring associations between ENDS use and older-age related health conditions may give rise to low estimates. Despite this limitation, HSt members reporting COPD/emphysema were twice as likely to be ever-users than never-users of ENDS (aOR 2.0, 95% CI 1.6–2.6, Table 2). We anticipate an even stronger association in the future. COPD is typically diagnosed over the age of 40, and more usually over age 65 [41], and of our 4,694 HSt members aged > 40 years, only 572 (12%) had used ENDS (Table 1). Another limitation is potential misclassification bias as regards ‘Ever Use’ because if a HSt member had used an ENDS device one time, they were categorized as ‘Ever Used ENDS’. Also, misclassification of tobacco associated heart condition status could have occurred, if a member had early coronary artery disease without symptoms [42].

An important strength of our study is the huge number of members in the HealthStreet community, and the consistency in ENDS-related data collection from 2014 to date. This ensures that we can compare data over the years to examine trends. CHW are actively recruiting new members, widening their scope of questions, and forming a Cancer Survivor Cohort which will link medical records with HSt data [43]. Thus, moving forward we will be able to see how ENDS use changes associations in future years, and link ENDS use with medical records on health conditions.

HealthStreet’s longitudinal data collection on ENDS use and a multitude of demographic, economic, and other health variables, will help us understand associations between ENDS use, and long-term health – including data from medical records will potentially enable identification of sub-populations to target public health and medical resources more effectively.

**Supplementary Information** The online version contains supplementary material available at https://doi.org/10.1007/s10900-022-01169-2.

**Author Contributions** RJAD participated in contributions to conception and design, methodology, data interpretation, project administration, article drafting, article revision, and final manuscript approval. PVC participated in data curation, data analysis, data interpretation, article revision, and final manuscript approval. T-YDC participated in contributions to conception and design, conception and design, methodology, supervision, and final manuscript approval. GK participated in visualisation, data interpretation, article revision, and final manuscript approval. CWS participated in contributions to funding acquisition, acquisition of data, methodology, project administration, supervision, article revision, and final manuscript approval. LBC participated in contributions to funding acquisition, acquisition of data, methodology, project administration, supervision, article revision, and final manuscript approval.

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**Data Availability** Participants of this study did not agree for their data to be shared publicly, so supporting data is not available.

**Code Availability** R code is available on request.

**Declarations**

**Conflict of interest** The authors declare no competing interests.

**Ethical Approval** HealthStreet protocol was approved by the University of Florida Institutional Review Board.

**Informed Consent** All participants provide their written consent.

**Consent for Publication** All authors consent to publish this manuscript and supplemental materials.

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