PEER REVIEW HISTORY

BMJ Open publishes all reviews undertaken for accepted manuscripts. Reviewers are asked to complete a checklist review form (http://bmjopen.bmj.com/site/about/resources/checklist.pdf) and are provided with free text boxes to elaborate on their assessment. These free text comments are reproduced below.

ARTICLE DETAILS

| Authors | Moran, MB; Czaplicki, Lauren; Tadesse, Lidya; Handy, Jessica; Welding, Kevin; Kelley, Dannielle; Kennedy, Ryan David |

VERSION 1 – REVIEW

| REVIEWER | Julia Vassey |
| REVIEW RETURNED | 03-Jan-2023 |

GENERAL COMMENTS

The manuscript is clearly written and it is interesting to see the year over year dynamic of changes in prevalence of flavors in ENDS ads. The manuscript requires several clarifications:

1. A more clear description of ads provided by Numerator, for example the prevalence of text-based vs images vs videos or anything else. One or two illustration figures would help. Were these ads or promotions? Was price included? Any other characteristics that could provide more details about the sample?
2. How many coders participated? How were the coders trained to recognize flavors? How was the code book constructed?

I appreciate if you provide these methodological clarifications.

| REVIEWER | Nicholas I. Goldenson |
| REVIEW RETURNED | 08-Feb-2023 |

GENERAL COMMENTS

The present manuscript reports the results of a content analysis of e-cigarette advertisements (N=4,546) that ran between 2015-2020, specifically examining the prevalence of flavored descriptors. The study found that almost half of the advertisements included explicit reference to flavored ENDS products and the proportion of ads containing tobacco- and menthol-flavored ENDS generally decreased until 2020—when advertisements for menthol-flavored ENDS increased.

This succinct manuscript addresses a question of public health significance, as use of ENDS among youth and young adults continues to be a pertinent issue facing tobacco control, and use of flavored ENDS products in particular remains prevalent. Strengths of the manuscript include the longitudinal design and relatively large sample of advertisements over multiple years. However, the potential impact is diminished by several methodological limitations.
which make the findings challenging to interpret. The paper would be strengthened by aligning its terminology and coding scheme for ENDS flavors with established precedent and providing additional information in several places to more fully explicate and parse the data.

Major Points

- It is unclear what constitutes advertisements for non-flavored ENDS products: what were the 55.5% of advertisements that did not feature flavored products? Unflavored pods or devices without pods? Given that these advertisements comprise the majority of the sample additional detail is needed to interpret the findings.
- The definition of a flavored ENDS product is somewhat confusing as it departs from established convention – in national surveys tobacco-flavored ENDS are not considered to be flavored (vs. non-tobacco flavors). I recommend changing this throughout the manuscript so that the distinction between flavored vs. tobacco is more clear. It may also be helpful to use a 3- or 4-level (to separate menthol and mint) flavor classification scheme (e.g., tobacco vs. menthol/mint vs. non-tobacco/menthol/mint).
- It would be informative to include a cross-section of representative advertisements in the manuscript or online supplement.
- The time trends are only reported descriptively, it would be helpful to test the statistical significance of the trends with inferential statistics.
- For the advertisements that were coded by more than investigator please report a measure of inter-rater reliability.
- In addition to classifying the advertisements by brand it would be informative to further subdivide them by ENDS generation (e.g., pod-based, disposable, tank, mod) and product type (e.g., e-liquid vs. device vs. entire closed system).
- The percentages reported by brand on pg. 7 are confusing – several of the individual brands sum to more than 100%.
- In the Discussion it is noted that flavor is used as persistent marketing tactic but more than half of the advertisements did not include specific mention of a flavor. Please reconcile this finding and conclusion.

Reviewer: 1
Dr. Julia Vassey, USC
Comments to the Author:
The manuscript is clearly written and it is interesting to see the year over year dynamic of changes in prevalence of flavors in ENDS ads.

The manuscript requires several clarifications:

1. A more clear description of ads provided by Numerator, for example the prevalence of text-based vs images vs videos or anything else. One or two illustration figures would help. Were these ads or promotions? Was price included? Any other characteristics that could provide more details about the sample?

   We now describe the channels the ads were run in, writing “Ads included static text/images, video and/or audio copy, and were run in multiple channels including print (e.g., magazines), radio, TV, online, and direct mail/email.” We have also included exemplary ad images as a supplemental file. We unfortunately did not code ads for the presence of product price, so cannot provide data on that. We
note this as a limitation, writing "We additionally did not collect data on other features such as product price or device generation or type; future research could examine difference in flavor presence by these features."

2. How many coders participated? How were the coders trained to recognize flavors? How was the code book constructed?
We now provide these details, writing, “Eleven coders were trained through an iterative process of reviewing the codebook, applying it to exemplar ads, coding a batch of about 30 practice ads, assessing reliability, and re-reviewing appropriate sections of the codebook when coding was not reliable; this process was repeated until coders were reliable on the full set of codes.” We additionally specify that, “The coding instrument was developed based on review of prior literature and qualitative review of the ads.”

I appreciate if you provide these methodological clarifications.

Reviewer: 2
Dr. Nicholas I. Goldenson, Juul Labs Inc

Comments to the Author:
The present manuscript reports the results of a content analysis of e-cigarette advertisements (N=4,546) that ran between 2015-2020, specifically examining the prevalence of flavored descriptors. The study found that almost half of the advertisements included explicit reference to flavored ENDS products and the proportion of ads containing tobacco- and menthol-flavored ENDS generally decreased until 2020—when advertisements for menthol-flavored ENDS increased.

This succinct manuscript addresses a question of public health significance, as use of ENDS among youth and young adults continues to be a pertinent issue facing tobacco control, and use of flavored ENDS products in particular remains prevalent. Strengths of the manuscript include the longitudinal design and relatively large sample of advertisements over multiple years. However, the potential impact is diminished by several methodological limitations which make the findings challenging to interpret. The paper would be strengthened by aligning its terminology and coding scheme for ENDS flavors with established precedent and providing additional information in several places to more fully explicate and parse the data.

Major Points
• It is unclear what constitutes advertisements for non-flavored ENDS products: what were the 55.5% of advertisements that did not feature flavored products? Unflavored pods or devices without pods? Given that these advertisements comprise the majority of the sample additional detail is needed to interpret the findings.
We have clarified that the ads that did not feature flavored products typically did not display any product at all, or displayed a device with no indication of flavor. In the Results section, when characterizing the percentage of ads featuring flavored products, we write, “Ads that did not feature flavored products typically did not feature any product at all (e.g., an online ad that displayed only a brand name with no product featured), or displayed a device with no corresponding language or imagery to indicate presence of a flavored liquid.”

• The definition of a flavored ENDS product is somewhat confusing as it departs from established convention – in national surveys tobacco-flavored ENDS are not considered to be flavored (vs. non-tobacco flavors). I recommend changing this throughout the manuscript so that the distinction
between flavored vs. tobacco is more clear. It may also be helpful to use a 3- or 4-level (to separate menthol and mint) flavor classification scheme (e.g., tobacco vs. menthol/mint vs. non-tobacco/menthol/mint).

We believe it is important to include tobacco-flavored ENDS products, as they are distinct from unflavored e-liquid, and are often marketed and described similarly to other flavors (e.g., advertising that describes tobacco flavors as “rich”). Therefore, understanding how tobacco flavored products are presented is important. We believe that Table 1’s presentation of unique flavors allows readers to accurately compare tobacco-flavored products to other flavors. This table similarly allows readers to compare menthol, mint, and tobacco-flavors. To help avoid confusion, we now note in the methods, “We additionally counted tobacco-flavored products as flavored.”

• It would be informative to include a cross-section of representative advertisements in the manuscript or online supplement.

We have included exemplar ad images in a supplemental file.

• The time trends are only reported descriptively, it would be helpful to test the statistical significance of the trends with inferential statistics.

We now specify in the Methods section that we used “chi-square tests to analyze differences in presence of flavor across study year.”

• For the advertisements that were coded by more than investigator please report a measure of inter-rater reliability.

In the Methods section, we have clarified that, “We set an a priori reliability standard of .80; inter-rater reliability among the coders exceeded this standard.”

• In addition to classifying the advertisements by brand it would be informative to further subdivide them by ENDS generation (e.g., pod-based, disposable, tank, mod) and product type (e.g., e-liquid vs. device vs. entire closed system).

We unfortunately did not code ads for this and have added this as a limitation, writing “We additionally did not collect data on other features such as product price or device generation or type; future research could examine difference in flavor presence by these features.”

• The percentages reported by brand on pg. 7 are confusing – several of the individual brands sum to more than 100%.

Percentages may sum to more than 100% because ads could feature more than 1 flavor. We now clearly state this in the Table 1 note, writing, “Flavored product type categories were not mutually exclusive (i.e., more than one flavor could be present in an ad). Because of this, percentages may sum to >100%.”

• In the Discussion it is noted that flavor is used as persistent marketing tactic but more than half of the advertisements did not include specific mention of a flavor. Please reconcile this finding and conclusion.

Across the years analyzed in this study, there was no notable drop-off in the percentage of ads with a flavored product. Based on these findings, and findings from other the other studies referenced, we believe characterization of this pattern as persistent is appropriate.

**VERSION 2 – REVIEW**

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**GENERAL COMMENTS**

Thank you for providing the revisions. I have no further comments.
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**VERSION 2 – AUTHOR RESPONSE**

Reviewer: 2

The revised manuscript addresses my prior comments.

Thank you for your helpful comments!

While I recognize that there was a consistent trend in the percentage of ads that included flavored products, I find it notable that a large proportion of ads did not display any product at all or displayed a device with no indication of flavor—perhaps this should also be noted in the Discussion.

We believe that this is reflected in the current opening sentence of the discussion, and we have revised this sentence to further note this: “Slightly less than half (45%) of the ENDS ads in our sample explicitly mentioned flavored products, including tobacco flavor."

Reviewer: 1

Thank you for providing the revisions. I have no further comments.

Thank you for your review of this paper!