significantly worsen the rate of lung function decline in early HIV infection. We caution that our participants were relatively young, with recent HIV diagnoses, so generalizability to older persons and those with longer duration of HIV infection is not clear. We also had limited power for sex-specific analysis, which is relevant, given the general population data that women have unique susceptibility factors for cigarette smoke–related COPD (6, 7). Our data also suggest that the class of initial ART selected does not affect subsequent lung function decline, although we had limited ability to accurately estimate FEV_1 slope in the increasingly prescribed INSTI class of first-line ART (8). ■

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Microbial Toxins in Nicotine Vaping Liquids

To the Editor:

In 2019, a nationwide outbreak of severe lung illnesses and deaths associated with vaping raised serious concerns about the safety of vaping products (1). E-cigarette fluids are known to contain multiple toxic compounds (2), but the specific cause of the epidemic of vaping-induced injury is not yet known.

One of the potential causes of acute lung inflammation is exposure to microbial-derived toxins, which was previously associated with lung inflammation via smoking (3). In a previous study, we first reported microbial contamination in e-cigarette cartridge products (first generation, also known as cigarlikes) and e-liquid products (refillable e-liquid bottle) sold by the top-selling U.S. brands based on 2013 market research data (4). However, no data are available regarding

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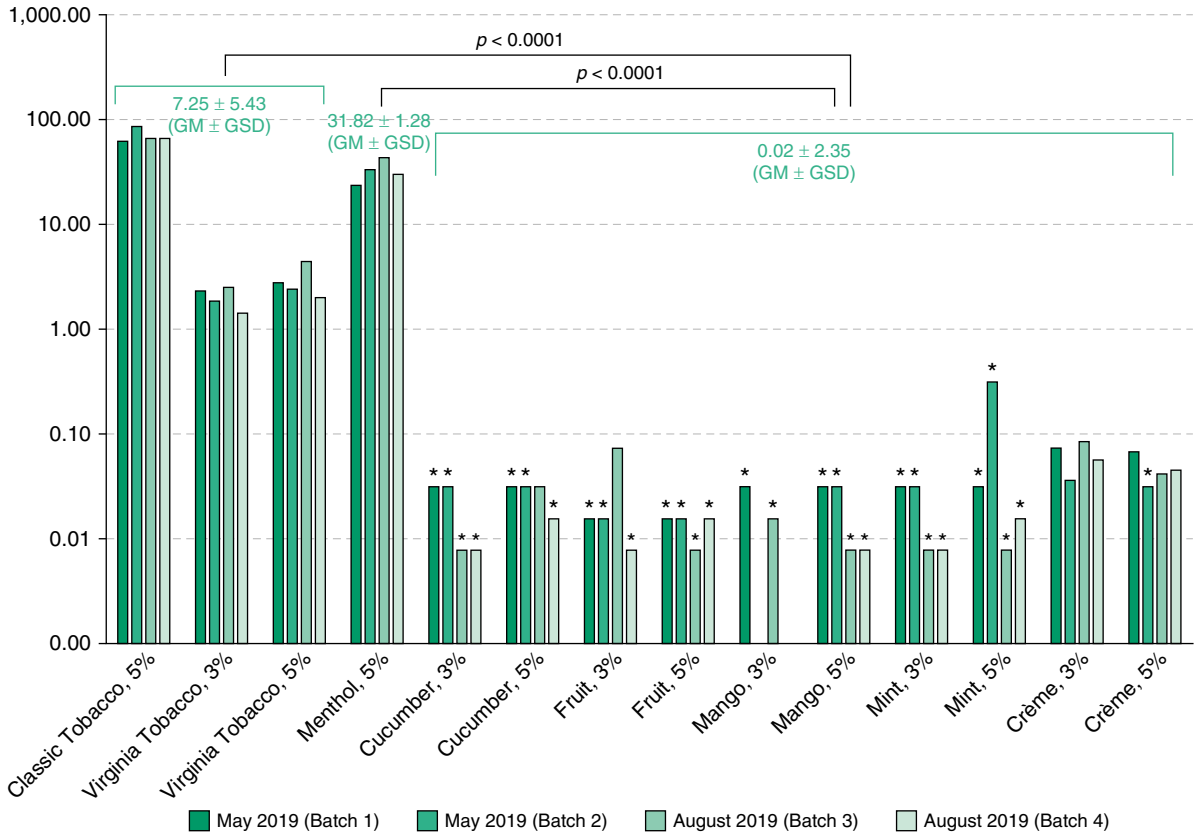

Figure 1. (1→3)-β-D-Glucan concentrations (ng/ml) in JUUL products by flavor and batch. Product flavors were categorized as tobacco (classic tobacco or Virginia tobacco), menthol, or other (cucumber, fruit, mango, mint, and creme). Sample levels below the limit of detection (LOD) are substituted by one-half of the LOD, indicated by an asterisk. LODs ranged from 15.6 to 62.5 pg/ml for glucan. GM = geometric mean; GSD = geometric standard deviation.

microbial contamination in JUUL pod products, which have become the dominant e-cigarettes in the United States, with the greatest market share (5), since their debut in 2015. Therefore, we assessed the levels of microbial toxins such as endotoxin (or LPS), part of the outer membrane of gram-negative bacteria, and (1→3)-β-D-glucan, a fungal cell wall component, in these vaping products. In addition, we analyzed the results including our previously reported data based on 2013 market research.

We collected samples of all available individual JUUL pod products four times, resulting in a total of 54 samples (27 samples were purchased in May 2019 [batch 1 ($n = 14$) and batch 2 ($n = 13$)], and 27 samples were purchased in August 2019 [batch 3 ($n = 14$) and batch 4 ($n = 13$)]). Eight flavors of JUUL pods were available: Virginia tobacco, classic tobacco, menthol, cucumber, fruit, mango, mint, and creme. All pod products were purchased from the company website, except for mango (nicotine strength 3%) in batches 2 and 4. Samples were shipped to the laboratory where all sample preparation and assays were performed (Associates of Cape Cod, Inc.) (4). Product flavors were categorized as tobacco ($n = 12$), menthol ($n = 4$), or other ($n = 38$), consistent with our previous classifications (4). Values below the limit of detection (LOD) were imputed as the LOD/2 (4). Data were analyzed using the SAS Statistical Package (version 9.4; SAS Institute Inc.). Linear regressions were applied to estimate differences in $\log_{10}$-transformed glucan concentrations according to flavor. Model estimates were converted to percent differences as $(10^{\beta} - 1) \times 100\%$, where β is the estimated regression coefficient. Next, we analyzed the results including our previously reported data on these microbial markers in e-cigarette products ($n = 75$) sold by the top 10 U.S. brands during 2013 to confirm our previous findings (4). This resulted in a total of 129 samples.

Endotoxin levels were below the LOD in all of the JUUL products, whereas glucan levels were above the LOD in 25 products (46%). After substituting values < LOD with LOD/2, the geometric mean concentration (±geometric standard deviation) of glucan in all tested JUUL products was 0.14 ng/ml (±20.56; range, 0.03–86.30 ng/ml). Figure 1 shows the concentrations of glucan in JUUL products by flavor and batch. The glucan concentrations in tobacco- and menthol-flavored JUUL products were 307 (95% confidence interval [CI], 153–618) and 1,353 (95% CI, 447–4,089) times higher than those in other-flavored products ($r^2 = 0.88$), which is similar to our previous results (4). When analyzed along with our previously reported data adjusted for brand and product type (cartridge or e-liquid), the glucan concentrations were 78 (95% CI, 30–203) and 34 (95% CI, 11–104) times higher in tobacco- and menthol-flavored products than in fruit-flavored products (Figure 2).

We found that JUUL pod products were contaminated with microbial toxins, and that the tobacco and menthol flavors were substantially much more contaminated than other flavors. These

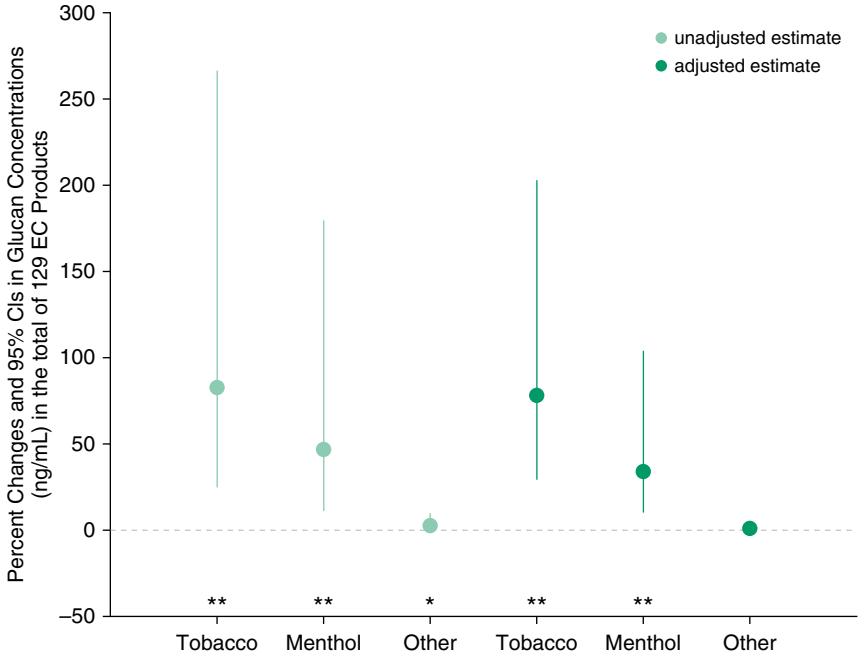

Figure 2. Percent changes and 95% confidence intervals (CIs) for (1→3)-β-D-glucan levels (ng/ml) associated with flavor in a total of 129 e-cigarette products. Adjusted percent changes were estimated after adjusting for brand and product type (cartridge or e-liquid). *$P < 0.05$ and **$P < 0.0001$. EC = e-cigarette.

findings are consistent with our previously reported finding that tobacco and menthol flavors were more contaminated with microbial toxins. The main limitation of the current study is that we did not evaluate contamination of aerosols inhaled by users. Further research is needed to assess microbial contamination in aerosol samples and to evaluate the health effects of microbial toxins in users of nicotine vaping products.

This study highlights the microbial contamination in nicotine vaping pod products sold in the United States. The contamination in tobacco-flavored vaping products is of particular concern because, as of this writing, tobacco flavors are excluded from the plan by the U.S. Food and Drug Administration to ban flavored e-cigarettes and pods from the market (6). ■

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Multidisciplinary Authorship in Clinical Practice Guidelines: An Opportunity for Inclusion

To the Editor:

I read with great interest the long-anticipated updates to the clinical practice guidelines (CPG) for the management of community-acquired pneumonia (CAP) by the American

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