Comparison of Methods for Measurement of Electronic Cigarette Topography
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Abstract:

Electronic cigarettes (ECIGs) use a power source (e.g., battery) and a heating element (e.g., resistance wire coil) to aerosolize a liquid solution ("e-liquid") that contains nicotine, solvents, and flavorants for inhalation by the user. Their ability to deliver nicotine, however, differs as a function of not only these product characteristics, but also user behavior. Thus, the FDA is in need of methods that can predict how users may respond to a given set of product configurations to extract safe and effective levels of nicotine. One method involves the measurement of ECIG users' puffing behavior, or their puff topography:puff number, volume, duration, inter-puff-interval, and flow rate. Traditionally, topography measurement is accomplished with direct observation (e.g., video recordings of natural puffing) or computerized device methods. Our team developed the first computerized ECIG topography device, the eTop, which has proven sensitive to ECIG topography differences between smokers with and without ECIG experience. Still, the eTop requires the use of a mouthpiece that may alter subjective aspects of ECIG use and is compatible only with models that a have a cylindrical mouthpiece shape (cigalikes). Notably, ECIG models with contoured mouthpieces (tanks and "mods") may be the most popular among current ECIG users. Thus, a computerized topography device is needed that can measure the topography of ECIG models of nearly any design and mouthpiece style. To meet this need, we have developed the mouthpiece-free eTop 2.0, though it has not been examined systematically. The purpose of this proof-of-concept study is to examine the sensitivity, reliability, and validity of mouthpiece-based eTop, mouthpiece-free eTop 2.0, and natural observation. ECIG-naive cigarette smokers (n=30) and ECIG-experienced users (n=30) will participate in three conditions that differ by these three measurement methods.Within each condition, participants will complete three ECIG puffing bouts, respond to subjective questionnaires before and after each bout, and have their heart rate and blood pressure sampled continuously. Results will be used to determine which ECIG topography measurement methods offer a regulatory tool for scientists to keep pace with rapidly evolving ECIG technology.