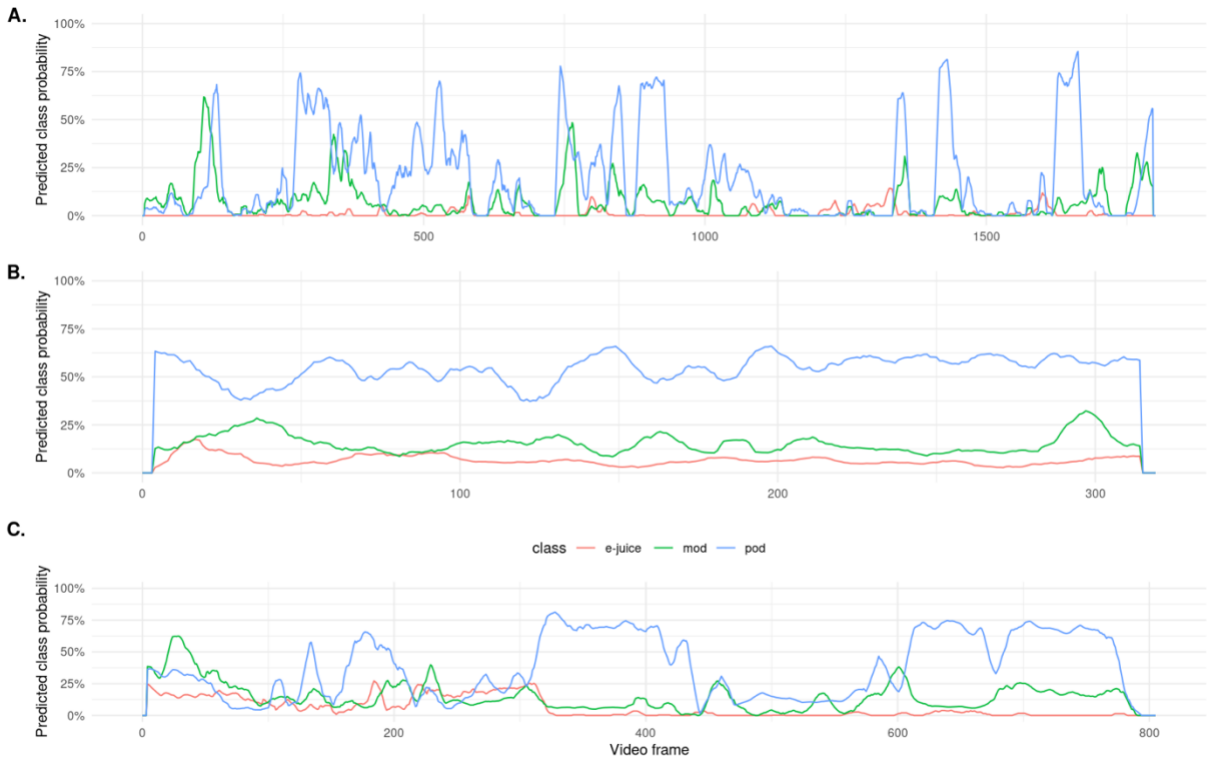
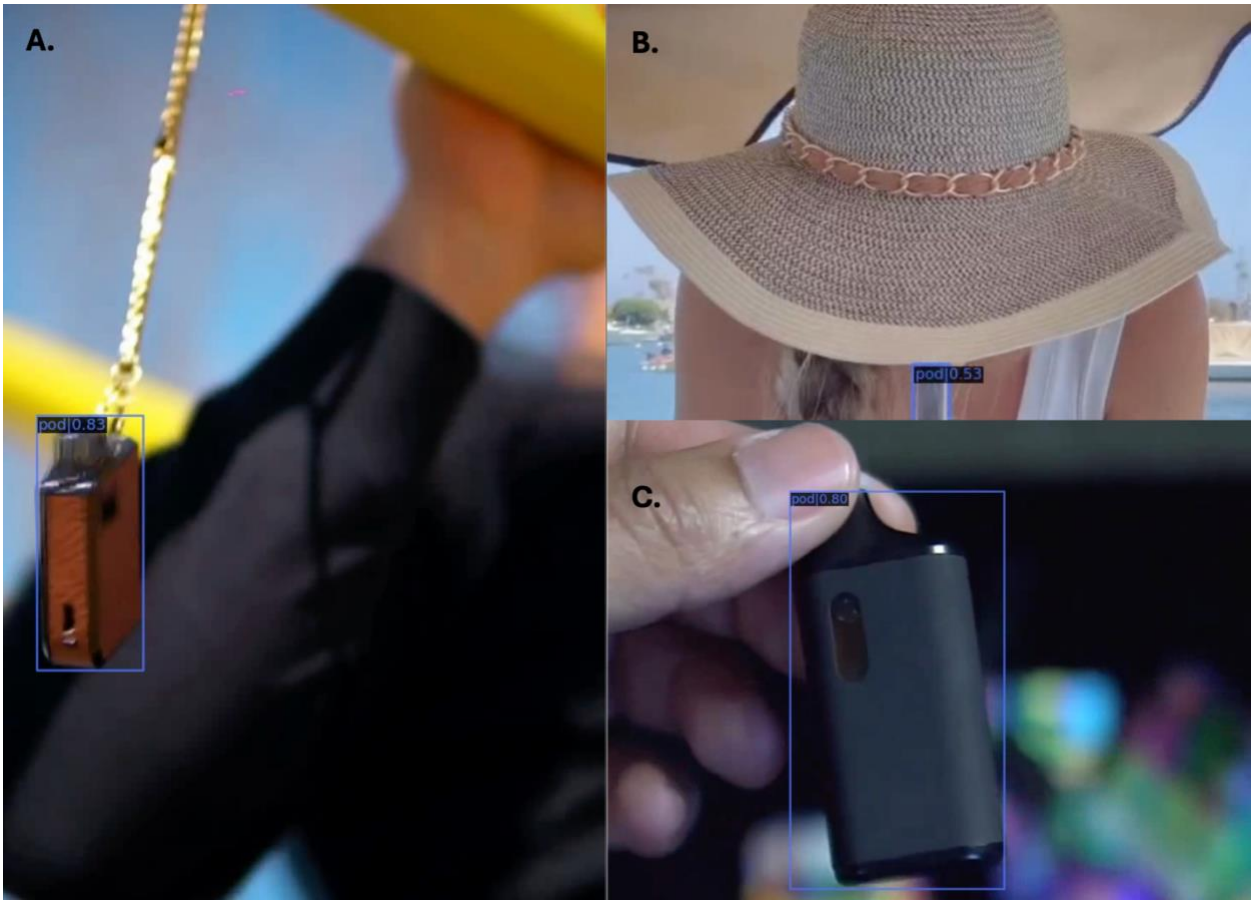

A.
Predicted class probability
100%
75%
50%
25%
0%
0
500
1000
1500
B.
Predicted class probability
100%
75%
50%
25%
0%
0
100
200
300
C.
class
e-juice
mod
pod
Predicted class probability
100%
75%
50%
25%
0%
0
200
400
600
800
Video frame


A.
pod 0.83
B.
pod 0.53
C.
pod 0.80

Supplementary Figure 2. Confidence score distributions per each of the three e-cigarette object labels (e-juice, mod, and pod) detected by the specialized computer vision DyHead e-cigarette object detection model, which was used for validation of the GPT 4o model accuracy for nicotine vaping theme detection. In our prior research the DyHead model was trained to identify e-cigarette vaping devices such as *pod* (a small vaping device, e.g., a disposable vaping device), *mod* (a large vaping device), or *e-juice* (e-liquid to vape nicotine). To validate the GPT 4o model accuracy for nicotine vaping theme detection against the DyHead model accuracy for e-cigarette object detection, we combined pod, mod and e-juice (by selecting the maximum confidence scores for either of these objects) into one theme such as nicotine vaping.

The confidence scores in the charts A, B and C were calculated by the DyHead model based on the three videos (screenshots A, B and C respectively) selected as examples out of all the 102 videos in the study sample the DyHead validation model was applied to. The screenshots feature micro-influencers who use or display e-cigarette products. The screenshots also show examples of confidence scores (inside the blue bounding boxes drawn by the model over an e-cigarette device) in one frame of a video.
Charts A and C (at the top of Figure 1) illustrate high (chart A) and moderate (chart B) variation in confidence score distributions of the identified pod devices that appear in some frames of videos A and C, but not in all the frames. Chart B illustrates a relatively low variation in confidence score distribution corresponding to the continuous presence of the identified vaping device throughout the whole duration of video B.

Note that the DyHead model's accuracy was calculated based on 408 frames from the study sample of the 102 TikTok videos, with 4 evenly distributed frames selected from each video. The e-cigarette object confidence scores (predicted probabilities) across 102 videos were calculated as the maximum probability among the four sampled frames per video. A probability of above 50% (0.5) was classified as nicotine vaping present in a video. The validation accuracy was calculated using four frames per video, selected evenly throughout the video, based on how the GPT-4 model analyzed theme detection, rather than using the entire video.

The validation results should be interpreted with understanding that the DyHead model (used for validation in this study) is an object detection model trained on a dataset where e-cigarette objects were localized with bounding boxes, a technique that focuses on spatial recognition of objects with a calibrated confidence score. The GPT-4o model was used to identify broader video-level themes, including nicotine vaping, by analyzing data without spatial localization (i.e., without drawing bounding boxes over an object of interest). As such, while using DyHead model predictions as a comparator for the GPT-4o model's results is reasonable, the DyHead model provides more detailed frame-level inference (by focusing on spatial recognition through bounding boxes) not currently possible via GPT and was intended for a different use case than video-level theme identification. As such, comparing theme-detection accuracy between the two models captures only one aspect of their respective utilities.

A publicly available video featuring a person in screenshot A was sourced from the public Instagram account of a micro-influencer Fabio in August 2023 (Fabio (@fabioexclusive91) • Instagram photos and videos).

A publicly available video featuring a person in screenshot B was sourced from the public Instagram account of a micro-influencer Chamillioneyes in August 2023 (Published Model Corina Stone (@chamillioneyes) • Instagram photos and videos).
A publicly available video featuring a person in screenshot C was sourced from the public Instagram account of a micro-influencer Cali.trickzz in August 2023 (Cali Trickzz (@cali.trickzz) • Instagram photos and videos).