**Background:** Up to a third of patients with diabetes are undiagnosed, and therefore go untreated. Widely available consumer technologies could detect diabetes at an early stage. Since diabetes is associated with vascular changes, we examined whether diabetes could be detected using only the photoplethysmography (PPG) signal, a measurement readily obtained from smartphones and wearable devices, using a convolution neural network (CNN).

**Methods:** We studied 22,298 individuals enrolled in the Health eHeart Study, an IRB-approved UCSF study, who used the Azumio smartphone app. Users were randomly divided into separate training (70%), development (10%), and test (20%) datasets. We fit a 34-layer CNN using the training dataset to predict self-reported prevalent diabetes. The development dataset was used for model tuning, and model discrimination was measured using area under the receiver-operating characteristic curves (AUC) in the test dataset.

**Results:** The mean age was 47.0 ± 14.0 years, 69% were male and 1,331 (6.0%) had diabetes. Of 1,440,000 PPG measurements that were utilized, 101,455 (7.0%) were derived from diabetic participants. The AUC for predicting prevalent diabetes in the test dataset was 0.772 (95% CI 0.747 - 0.797).

**Conclusion:** We demonstrate that deep learning can be used to detect prevalent diabetes from the PPG signal alone with reasonable discrimination. This study constitutes the first proof-of-concept demonstration that smartphone-based PPG can be used for diabetes
detection.