Development of Objective Measure of Psychotropic Substances Abuse Using Automatic Retinal Image Analysis (ARIA)

Executive Summary

Background: Automatic Retinal Image Analysis (ARIA) is an advance non-invasive technology that can screen for different diseases by analyzing a retinal image of an individual at a relatively low cost.

Objectives: 1. To compare the retinal images characteristics of drug abusers versus age-gender matched healthy subjects, and 2. To establish a prediction model of ARIA for detecting abusers of psychotropic substances.

Methods: This was a matched case-control study conducted in Hong Kong with 100 cases and 200 controls. Case subjects were defined as adults who have been or were now abusing psychoactive substances and have registered with local drug treatment and rehabilitation centres. Control subjects were general adults without drug-taking history. Retinal characteristics were obtained via ARIA with deep learning algorithm. Data analyses were further conducted to identify independent retinal characteristics as well as a multivariate model building.

Results: Retinal characteristics such as exudates, bifurcation coefficient of venule, bifurcation angle of arteriole and venule, and fractal dimension were significantly different between the controls and the psychoactive substance abusers ($p < 0.05$). The complex retinal characteristic components obtained by deep learning algorithms were also significantly associated with the drug abuse ($p < 0.001$). The performance of the prediction models achieved a high accuracy of 95.0% and an area under the receiver operating characteristic curve (AUC) of 0.987 in discriminating the psychoactive substance abusers and the controls.

Conclusion: With the promising exploratory findings, ARIA is expected to apply to screening applications, including an effectiveness monitoring of different anti-addiction treatments or rehabilitation programs for rehabilitee, thus to help clinicians and social workers planning suitable programs.