

**2019 ACMT Annual Scientific Meeting
MedTox Shark Tank Research Forum**

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Title

A mobile application to detect visual reaction time and psychomotor vigilance in the setting of opioid use

Background and Significance

The incidence of opioid use in the United States has seen a considerable rise. As opioids have become more commonly prescribed, more individuals are using opioids while performing all activities of daily living, including tasks that are potentially dangerous to both the patient and to the population at large, such as operating a motor vehicle. While the opioid epidemic continues to shape the discussion of health care policy on a national scale and substantial efforts have been implemented to curb abuse of opioids, there is a paucity of definitive evidence regarding the effect of therapeutic opioid use on psychomotor function and reaction time. Prescribing physicians are left in the unenviable position of attempting to adequately treat their patients' pain without a clear understanding of the safety hazards associated with therapeutic use of opioids while performing standard daily activities. Patients who use opioids on a daily basis similarly lack safety information regarding these medications.

Mobile phones and tablets are now nearly universally available technology in the United States, and considerable data exists regarding their utility in quantifying reaction time and psychomotor vigilance. While the act of operating a motor vehicle represents an amalgamation of several different cognitive tasks and psychomotor facilities, simple tests of visual reaction time and psychomotor vigilance have been validated in the context of fatigue and alcohol intoxication. We believe that similar technology could be used to provide data regarding the effect of therapeutic use of opioid medications on an individual's visual reaction time and psychomotor vigilance, helping prescribing physicians understand the safety hazards associated with therapeutic use of opioids. Furthermore, if testing in the setting of therapeutic opioid use reveals a significant difference in performance, this technology could be deployed to patients using opioids who are unsure of their ability to perform tasks such as driving, allowing them to make a more informed decision regarding transportation. This data could help shape public policy regarding opioid use and driving, and this technology could be deployed to law

enforcement, who presently lack a quantifiable tool to assess impairment as it relates to opioid use.

The Reaction® application is a free application presently available in the App Store from Apple Inc. It functions as a psychomotor vigilance test, measuring reaction time. The user is shown a screen and tasked with pressing a button as soon as a light appears on the screen. This is then repeated multiple times with the visual stimulus appearing at random time intervals to mitigate a “learning effect.” Mean reaction time is then calculated, along with other parameters.

Aims

The ultimate aim of our work is to reduce morbidity and mortality associated with therapeutic opioid use in the context of driving or performing other similar dangerous tasks. Our specific aims are as follows.

1. Utilize the Reaction® app, an application capable of detecting changes in reaction time and psychomotor vigilance to assess for changes in patients during and after therapeutic opioid use. *We hypothesize that mobile technology will demonstrate a change in patients’ performance in reaction time and psychomotor vigilance testing with regard to opioid use.*
2. Determine if there is a difference between patients’ self-assessment of their ability while using opioids and their measured ability. *We hypothesize that patients will overestimate their reaction speed and psychomotor vigilance while using opioids.*

Methods

1. Setting

Massachusetts has been particularly impacted by the opioid epidemic. The Massachusetts Executive Office of Health and Human Services estimates 2061 individuals died from opioid related overdoses in 2017. The Massachusetts Prescription Monitoring Program shows that 247,151 individuals received a schedule II opioid prescription from July through September of 2018. The University of Massachusetts Medical Center in Worcester, Massachusetts is a large tertiary care center that also serves as a safety net hospital system for a large portion of the state. Over the same July 2018 – September 2018 timeframe, 31,762 patients in Worcester County received a schedule II opioid prescription. Our institution represents an ideal environment in which to conduct research related to therapeutic use of opioids.

2. Adequacy of study population

The University of Massachusetts Medical Center treats approximately 135,000 patients per year. These patients are treated for a variety of painful medical conditions, some of whom will be prescribed opioid medications as an outpatient for pain control.



3. Inclusion Criteria

- Patient who is prescribed opioids from the emergency department
- Has access to a mobile phone or tablet compatible with the application

4. Exclusion Criteria

- Unable to provide informed consent
- Physical limitations preventing the patient from using the application
- Chronically on opioids

5. Specific Aim #1: Deploy mobile technology capable of detecting changes in reaction time and psychomotor vigilance to assess for changes in patients during and after therapeutic opioid use.

Patients who are receiving a prescription for an opioid medication from the emergency department will be identified by a research assistant and approached for enrollment in the study. Patients who are enrolled in the study will be provided with information regarding the download and installation of the Reaction® application. They will be instructed to use the application to measure their reaction time and psychomotor vigilance one hour after using their prescribed opioid. After they have completed their course of opioids, they will return to collect a gift card, at which time they will repeat the testing in order to receive the card. Their reaction time in the absence of opioid use will be compared to their reaction time after completing their course.

6. Specific Aim #2: Determine if there is a difference between patients' self-assessment of their ability while using opioids and their measured ability.

At the conclusion of the study, patients will be asked to estimate whether their performance was better, worse, or the same after using their prescribed opioids.

Major Limitations/Questions

Relying on the patient to perform the task at home means we would not be able to control other variables, including concurrent substance use, fatigue, patient attention level while performing the task, or another individual completing the task for the patient.

We will be comparing reaction time while using opioids for an acutely painful condition to reaction time while the patient is no longer using opioids and no longer in acute pain. The study will not address differences in reaction time and psychomotor vigilance between patients in acute pain and patients who are treating their acute pain with opioid analgesics.