

Using Novel Carbon Monoxide Devices in Remote Smoking Cessation Treatment: A Utilization and Reliability Analysis

Joshua C. Ayala, Yong Cui, Jason D. Robinson, Charles E. Green, Jennifer A. Minnix, Maher Karam-Hage, Paul M. Cinciripini

Department of Behavioral Science, Division of Cancer Prevention and Population Sciences, Cancer Prevention and Research Training Program, The University of Texas MD Anderson Cancer Center
Correspondence: JCayala1@mdanderson.org

Introduction

Background

- Smoking is the leading cause of preventable death in the world and accounts for a third of cancer-related deaths.
- Researchers of smoking cessation have aimed at conducting smoking cessation remotely, due to pandemic concerns and availability of smartphones.
- For remote interventions, the standard measurement of verifying smoking abstinence is breath derived carbon monoxide (CO), a biochemical indicator of smoking/abstinence status.
- Laboratory based research has shown that smartphone-based carbon monoxide (CO) devices yield reliable evaluations of smoking abstinence status.

Current Study

- Overall Objective:** Examine if smartphone-enabled CO devices are utilized and produce reliable measures among community smokers enrolled in a remote smoking cessation trail.
- Specific questions:**
 - 1. What is the frequency that treated smokers use the mobile CO devices?
 - 2. Are the CO measures reliable?

Methods

Participants

In a remote trail for smoking cessation, participants seeking smoking treatment were recruited from across the entire state of Texas. As a secondary analysis to a parent study known as "PISCES", a total of 322 participants were analyzed. On average the participants were 42.2 years old, smoking a rate of 15.3 cigarettes per day. The demographics of participants were 64.6% female, with 70.0% European American 12.1%African American and 13.7% of Hispanic origin.

Study Procedure

The smoking cessation study was remote, in which all staff-patient interactions were conducted over phone and through videoconference. Following enrollment, each participant was mailed a study kit which contained the following; Samsung A10e smartphone, a mobile CO device, and prescribed medications.

Each participant followed a 12-week comprehensive smoking cessation program that included counseling and medication prescription. Participants were instructed to use the CO devices at specific time points during the treatment course totaling three CO measures. In addition, participants could obtain extra CO measures at their own discretion.

Study Timeline

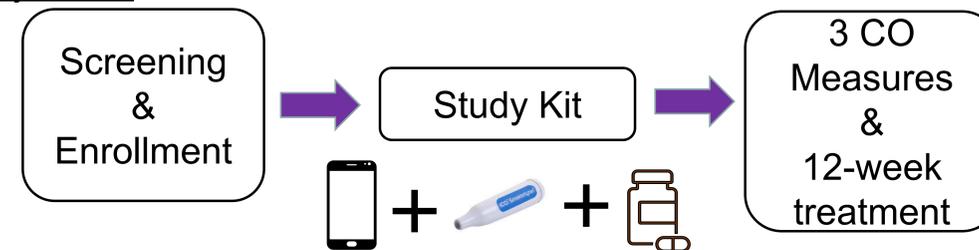


Fig. 1 Demonstrates the study timeline of the remote smoking cessation trial with the contents of the study kit : smartphone, mobile CO device, and medication

Mobile CO Measures

The iCO personal Smokerlyzer monitors (Bedfront Scientific LTd. UK) were the mobile CO devices used in the study. The obtained data could be uploaded automatically to our database hosted at MD Anderson Cancer Center through the smartphone which contained the adapted version of the manufacturers Smokelyzer app. Participants were able to voluntarily view their CO records in the in-house developed study app on the provided smartphone. The app also tracked how many times a participant viewed their records.

Self-reported Measures

During screening for eligibility, participants completed smoking and demographic questionnaires. Using Qualtrics, participants completed a diary during the 12-week treatment period which assessed their daily cigarette consumption from the previous day.

Data Analysis

The obtained data was processed and analyzed using statistical software such as Python based tools.

Results

1. Participants used the mobile CO devices more than required.

Variable	Count, Mean (STD)		
	Total	Day	Night
CO Measurement	5.2(4.0)	3.8(2.9)	1.4(2.3)
Viewing CO Records	4.8 (3.8)	3.3 (3.0)	1.5 (2.0)
	Frequency, N (%)		
	< 3 times	3 times	4 or more times
CO Measurement	265 (32.4%)	115(14.1%)	438(53.5%)
Viewing CO Records	78 (33.1%)	39 (16.5%)	119(50.4%)

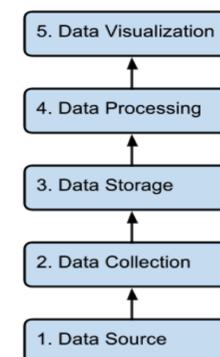
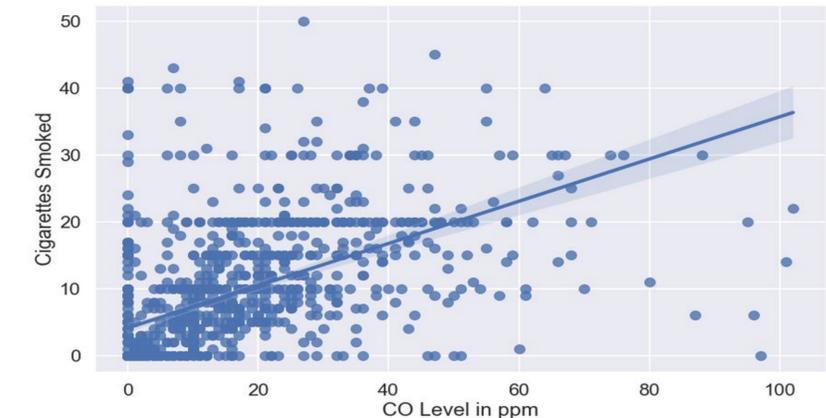


Fig.2 demonstrates steps in data processing

2. The CO levels were significantly correlated with the self-reported daily cigarette consumption (Pearson's $r > 0.5$, p -value < 0.0001).



3. A CO level of < 6 ppm was the best discriminating cutoff to differentiate smoking from abstinent status.

CO Cutoff	Specificity	Sensitivity	Total Score
3 ppm	0.88	0.73	1.61
4 ppm	0.87	0.80	1.67
5 ppm	0.86	0.84	1.70
6 ppm	0.85	0.86	1.71
7 ppm	0.83	0.88	1.71
8 ppm	0.81	0.89	1.70
9 ppm	0.79	0.90	1.69

Conclusions

- Participants were able to utilize the smartphone enabled CO devices in a real-world trial more than required.
- Participants showed interest in tracking their CO records.
- Smartphone-based CO devices provided reliable measure to identify smoking abstinence.
- Smartphone-based CO devices serve as the future basis in remote smoking cessation intervention.

Disclosure

This project was supported by MD Anderson Cancer Center's Moonshot Program Funds and NCI's Cancer Center Support Grant (P30CAD16672). No conflict of interest was declared by authors.