A Quality Improvement Randomized Clinical Trial to Evaluate Electronic Portal Messaging, Embedded Asynchronous Care and Physician Versus System as Message Sender on Physician-Assisted Smoking Quit Attempts of Primary Care, Adult Patients

Oklahoma State University Center for Health Systems Innovation

In Collaboration with
Oklahoma State University’s Rural Oklahoma Network (ROK-Net)

ClinicalTrials.gov ID: NCT05172219

Protocol Writing:
Marjorie Erdmann, M.S.
M. Tomi Adewumi, M.S., M.H.A.
William Paiva, Ph.D.
Bryan Edwards, Ph.D.

Steering Committee:
Marjorie Erdmann, M.S.
M. Tomi Adewumi, M.S., M.H.A.
William Paiva, Ph.D.
Bryan Edwards, Ph.D.
Scott Shepherd, D.O.
Cari Marshall
Protocol Writing .................................................................................................................. 1
Steering Committee ........................................................................................................... 1

Synopsis .................................................................................................................................. 3

Abbreviations ........................................................................................................................ 4

1. Introduction ......................................................................................................................... 5
  1.1 Rationale .......................................................................................................................... 5
  1.2 Problem Description ......................................................................................................... 5
  1.3 Available Knowledge ........................................................................................................ 7

2. Objective and Endpoints .................................................................................................... 8
  2.1 Research Questions .......................................................................................................... 8

3. Study Design ....................................................................................................................... 9
  3.1 2x2 Factorial Design ....................................................................................................... 9
  3.2 Study Population ............................................................................................................. 10
  3.3 Setting ............................................................................................................................. 10
  3.4 Study Inclusion and Exclusion ......................................................................................... 11

4. Asynchronous Care Implementation ................................................................................. 11
  4.1 Asynchronous Care Workflow ....................................................................................... 12

5. Data Collection .................................................................................................................. 12

6. Statistical Methods ............................................................................................................. 12
  6.1 Variables and Coding ..................................................................................................... 12
  6.2 Randomization ................................................................................................................. 13
  6.3 Masking ........................................................................................................................... 14
  6.4 Sample Size ..................................................................................................................... 14
  6.5 Statistical Analysis ......................................................................................................... 14
  6.6 Missing Data ................................................................................................................... 15

7. Ethics and Regulatory ........................................................................................................ 15

8. Consent ............................................................................................................................... 15

9. Confidentiality .................................................................................................................... 16

10. Funding ............................................................................................................................ 16

References ............................................................................................................................ 16

Appendix 1. Elements of the Smoking Cessation Outreach .................................................. 19
### Synopsis

| **Title** | A Quality Improvement Randomized Clinical Trial to Evaluate Electronic Portal Messaging, Embedded Asynchronous Care and Physician Versus System as Portal Message Sender on Physician-Assisted Smoking Cessation Quit Attempts of Primary Care, Adult Patients |
| **Setting** | Extracted EHR data post intervention from a large health system in southern US. OSU CHSI provided analyses |
| **Study Duration** | Quit attempts were measured 30 days after intervention; physician attitudes were measured 6 months after intervention. |
| **Study Design** | Quality Improvement Randomized Clinical Trial utilizing a 2×2 factorial design. |
| **Study Intervention** | We compared the effects of four technology-based smoking cessation messaging strategies on quit attempts by smokers identified in the health system. Specifically, we used a fully crossed between-subjects 2 (link to survey on smoking cessation guide: yes/no) × 2 (message source: PCP-generated vs. health system-generated) experimental design to which participants were randomly assigned to one of four intervention groups using a computerized random number generator |
| **Inclusion Criteria** | Adults aged 18 years and older who were designated as a smoker in the EHR who had at least one face-to-face visit with their PCP in the prior 12 months and had a patient portal account. To ensure equal representation across the 10 physicians, we randomly selected 20 patients under each physician to serve in the sample. |
| **Exclusion Criteria** | Patients were excluded if they no longer see the PCP, had a diagnosis for which the outreach program would be insensitive (e.g., lung cancer), previously expressed not wanting smoking cessation counseling, or were no longer a smoker. (Patients were post-hoc excluded if EHR indicated that they had received smoking cessation treatment 60 days prior to portal message intervention. This issue was overlooked at time of patient selection.) |
| **Outcomes** | EHR documented quit-attempts 30 days after intervention |
| **Sample Size** | 200 |
| **Statistical Analyses** | Multivariable logistic regression, Chi Square, Odds Ratio |
| **Physician Survey** | Physician Perspective Likert Survey on workflow, workload, value of outreach program |
### Abbreviations

| Abbreviation | Description |
|--------------|-------------|
| OSU CHSI     | Oklahoma State University Center for Health Systems Innovation |
| AC           | Asynchronous Care |
| SL           | Electronic Messaging with Survey Link that connected patients to asynchronous care questionnaires |
| NSL          | Electronic Messaging without Survey Link |
| PSL/PNSL     | Physician sent SL or NSL messages |
| SSL/SNSL     | System sent SL or NSL messages |
| EMR/EHR      | Electronic Medical Record/Electronic Health Record |
| PAQA         | Physician-assisted quit attempts |
1. Introduction

1.1 Rationale:

The Center for Disease Control (CDC), the Centers for Medicare and Medicaid Services (CMS), the American Academy of Family Physicians (AAFP), and the US Surgeon General’s goals for primary care physicians is to encourage and motivate smoking patients to quit, to educate patients on the increased success of quit attempts with prescription cessation medications, and to improve quit attempts, promote benefits of quitting, and reduce smoking rates.

This QI will help increase patient access to smoking cessation medication and other avenues of support by combining online, digital messaging with access to smoking cessation medications and cessation counseling.

1.2 Problem Description:

Cigarette smoking continues to be a leading cause of preventable death and disability worldwide [1], and the United States (US) is no exception [2]. Over 40 million smokers reside in the US, and more than $300 billion is spent annually on diseases related to smoking and over $156 billion is lost in productivity [3,4].

Troubling disconnects exist between smoking cessation desire and success. Seventy percent of smokers report wanting to quit [5]. However, only 4.7% use an evidence-based approach of both medication and counseling [6], and less than a third use either medication or counseling [7]. The vast majority of smokers attempt to quit on their own without physician assistance, even though smoking cessation is more likely to be successful with the use of prescription medication [8] [9][6] [10].

Smokers’ low usage of physician services has been a long-term concern [11][12,13]. Physician assistance currently occurs in-person during appointments, which creates
inefficiencies and logistical barriers. The 5A approach (Ask, Advise, Assess, Assist, and Arrange) [14] recruits patients one at a time, identifies very few interested smokers, and generates few physician-assisted quit attempts (PAQAs). The conversation is time-consuming, and many physicians consider it a “waste of time” [15]. In-person care creates logistical barriers owing to financial costs, travel, and time away from work. These barriers disproportionately affect younger smokers and rural smokers, 2 populations in which smoking is concentrated. In addition, tobacco use is 24% higher among persons aged 25-44 years [5], an age group known to visit doctors less [16]. Tobacco use is higher in rural populations, and the odds of being a smoker is 30% greater in these populations, while health care is less accessible [17] [18,19]. In Oklahoma, the rural health access barriers are amplified. Thirty-four percent of the population lives rurally in Oklahoma, compared with 20% nationally, and rural Oklahoma generally has a critical shortage of primary care physicians [20].

The impact of logistical barriers on younger smokers’ access to PAQAs is particularly detrimental. If smokers quit by 35-44 years of age, they avoid most of the mortality risks caused by smoking [21]. In addition, if they can quit before their children are teens, they can greatly decrease the odds that their teens will smoke and become nicotine dependent [22].

It is unclear if smokers are aware of the benefits of physician assistance in smoking cessation. Millions of dollars have been spent on mass media campaigns to motivate quit attempts, but these campaigns do not tell smokers how to collaborate with a physician to successfully quit [21]. It is possible that quit lines, which are only equipped with over-the-counter nicotine replacement treatment, may inadvertently drive patients away from resources that lie only with physicians and other prescribers even though use of prescription medication is associated with higher rates successful cessation. Physicians themselves do not regularly promote how they can help patients quit smoking and mostly concentrate on screening and documenting tobacco use rather than explaining and providing treatment options [23]. In the 5A approach, physician resources are discussed nearly last (fourth).
Looking to resolve the physician-smoker disconnect, we embrace these possibilities: (1) patients may lack awareness of the benefit of physician assistance; (2) current face-to-face, during appointment care for smoking cessation may be inefficient in finding smokers interested in a physician assistance; and (3) smokers interested in physician help may be discouraged by logistic barriers to obtaining that assistance.

We embrace the 2018 Food and Drug Administration approach “Every Try Counts” [24] and aim to increase the number of PAQAs. We will apply technology to more efficiently find and help smokers interested in quitting.

We will design electronic outreach messaging to smoking patient to: inform the patients about how to successfully quit (medication to control cravings and counseling to sustain motivation) and proactively offer physician assistance as well as a link to counseling. We will test if click-through asynchronous care (AC) embedded in the outreach increases physician-assisted quit attempts versus invitations to standard in-clinic care. Given the demographic differences among smokers and smoking populations, we will investigate if embedded AC reaches typically difficult to reach populations.

1.3 Available Knowledge on Quit Promotion and Technology Role:

Promotion of smoking cessation through the mass media and health care professionals has increased quit attempts, but both approaches are costly. Health care attempts have required additional workforce trained in motivational interviewing [25,26]. However, brief advice from physicians is associated with higher quit attempts; interventions do not need to be intensive [27]. Therefore, we hypothesized that advice via digital communication could increase PAQAs.

Digital health outreach has been shown to activate other types of patients, for example, by improving sleep apnea care compliance [28,29], and has been proposed by marketing scholars to elevate patient engagement through meeting patient preferences, providing
more precise care, and creating process improvements [30]. Technology, including motivational texting and real-time support, has been successfully applied to remotely help smokers [31–33]. Technology has also been successfully used during regularly scheduled appointments in clinics to improve patient-physician shared decision making for quit attempts [34].

There is hope that technology and electronic health data can be leveraged to improve smoking cessation rates, but the evidence is quite limited [2] [35]. In particular, the use of technology to remotely connect smokers to evidence-based, primary care physician-assisted quit attempts has not been attempted.

2. Objectives and Endpoints

The purpose of this study is to demonstrate the benefits of using electronic health data, portal messaging, and AC to improve PAQAs.

- Improve current practice of physicians encouraging quit attempts among their established, adult smoking patients.
- Improve access to cessation medication through an asynchronous digital physician consultation platform.
- Increase quit attempts and rates by decreasing patient barriers to smoking cessation.
- Measure quit attempts among patients using a digital consultation platform.
- Investigate patient populations reached through the program.
- Collect physician feedback on the platform.

The endpoint of study is EHR documented quit attempts measured 30 days after intervention.

2.1 Research Questions

- The Primary research question: Is outreach more effective if the care is readily available (click-through/asynchronous care versus office visit)?
Secondary research question: Does it matter if the outreach is sent by the health system or the patient’s personal primary care provider?

Tertiary research questions: What type of patients utilized the AC? What are the primary care attitudes about a digital outreach program with embedded asynchronous care access?

3. Study Design

This is a quality improvement randomized clinical trial where the intervention strategies are carried out in 4 groups to be compared. Data will be extracted from the EHR, deidentified by the health system, and provided to OSU CHSI for analysis.

Two hundred patients will be randomly assigned to one of four test conditions.

- We will evaluate if message sender (“your physician” or system name) is associated with differences in physician-assisted quit attempt rates. Sender will be visible to patient in their inbox and the signatory of the outreach message will match the sender (name of personal PCP or name of system).
- We will evaluate if message type (outreach alone or outreach with AC) is associated with different PAQA rates.
- Salient patient traits will be collected through EHR data extraction and de-identified.

EMR documented physician-assisted quit attempts will be tracked 30 days after outreach.

3.1 2×2 Factorial Design:

|                | Physician | System | Total |
|----------------|-----------|--------|-------|
| No Survey Link*| PNSL = 50 | SNSL = 50 | 100   |
| Survey Link**  | PSL = 50  | SSL = 50 | 100   |
| Total          | 100       | 100     | 200   |

*Patient invited to clinic if interested in physician assistance.
**Patient offered asynchronous care access via survey link if interested in physician assistance in quit attempt. If patient completes and submits the survey it initiates asynchronous care with physician.
Description of the 4 Arms:

- Arm 1: Message Type PNSL: Physician sender, No Survey Link
  - In this arm, the Physician is message sender and the message does not include a link to a survey that initiates asynchronous care.

- Arm 2: Message Type PSL: Physician sender, Survey Link
  - In this arm, the Physician is message sender and the message does include a link to a survey that initiates asynchronous care.

- Arm 3: Message Type SNSL: System sender, No Survey Link
  - In this arm, the Health System is message sender and the message does not include a link to a survey that initiates asynchronous care.

- Arm 4: Message Type SSL: System sender, Survey Link
  - In this arm, the Health System is message sender and the message does include a link to a survey that initiates asynchronous care.

3.2 Study population:

This project will utilize the classification of self-reported “smoker” in an already established patients’ EHR. In alignment with practice standards, physicians will communicate to smokers to address smoking as a high-risk behavior and encourage quit attempts and to provide these smokers with cessation-related advice.

3.3 Setting:

The study will be conducted by the Oklahoma State University Center for Health Systems Innovation (OSU CHSI) in partnership with a large health care system in the southern US where data from the electronic health record (EHR) will be extracted. The health system provides ~ 400,000 patient encounters per year and operates 35 primary care clinics accounting for more than 140 PCPs. Ten PCPs will be recruited by the site-coordinator. The
asynchronous survey will be developed on-site by leveraging the health system’s current technology resources: EPIC EHR and MyChart patient portal platform.

3.4 Study inclusion and exclusion:

Inclusion Criteria:

- Adults aged 18 years and older
- Currently designated “smoker” in the EHR
- Has had at least one face-to-face visit with their PCP within 12 months
- Has a patient portal account.

Exclusion Criteria:

- No longer a patient of the PCP
- Has a diagnosis for which the proactive outreach to encourage quit attempt for health would be insensitive (e.g., lung cancer)
- Previously expressed not wanting physician or care provider to provide smoking cessation counseling
- No longer a smoker

4. Asynchronous Care Implementation Plan

| Part 1 | Part 2 | Part 3 | Part 4 |
| --- | --- | --- | --- |
| **Preparation** | **Patient Outreach** | **Physician Interaction** | **Program Evaluation** |
| Construct Communication | Send Messages | Treatment Plan Determined | Outcomes |
| 1. inform how to successfully quit. | 1. Patient opens messages | 1. Doctor receives survey answers. | 1. Portal Message Opening |
| 2. Physician proactively offers assistance | 2. Interested Patient answers AC questions and submits | 2. Doctor reviews Safety and Quit History Questions | 2. Documented Physician Assisted Quit Attempt |
| 3. Build Asynchronous Care Process | Trackable Patient Process | 3. Doctor reviews medical record for other safety concerns. | 3. Provider Survey |
| 4. Build scripted responses | 1. Patient opens messages | 4. Guidelines based treatment orders. | |
| 5. Determine time period for program access | 2. Interested Patient answers AC questions and submits | | |
| **Identification of Patients** | **Send Messages** | **Treatment Plan Determined** | |
| 1. Identified as smoker in EHR | Send Messages | 1. Doctor receives survey answers. | |
| 2. ≥ 18 years old | 1. Patient opens messages | 2. Doctor receives Safety and Quit History Questions | |
| 3. Portal Active in last year | 2. Interested Patient answers AC questions and submits | 3. Doctor reviews medical record for other safety concerns. | |
| 4. Face-to-face in last year | | 4. Guidelines based treatment orders. | |
| **Train Physicians & Care Providers** | **Program Evaluation** | **Outcomes** | |
| 1. Workflow for Asynchronous Care | 1. Doctor congratulates patient for quit attempt | 1. Portal Message Opening | |
| 2. Prescribing refresher | 2. Communicates Quit Attempt plan to patient | 2. Documented Physician Assisted Quit Attempt | |
| 3. How to connect patients to counseling resources | 3. Confirms if Rx is sent to pharmacy on record | 3. Provider Survey | |
4.1 Asynchronous Care Workflow

5. Data collection and management

Site coordinators will be responsible for extraction of data from the EHR, deidentifying the data and sharing the data with PI at OSU CHSI. Identified data will remain within the health system. All data used for evaluation will be managed by OSU CHSI.

6. Statistical methods

Quit attempts is the dependent variable. We will compare group rate differences as well as individual patient characteristic differences.

JMP Pro 15.0.0 will be used for statistical analyses. Our criterion for evaluating statistical significance will be \( p \leq .05 \). We will report odds ratios results with 95% confidence intervals for all effects. We will rely on Standards for Quality Improvement Reporting Excellence (SQUIRE) reporting guideline for quality improvement studies and Consolidated Standards of Reporting Trials (CONSORT).

6.1 Variables and Coding:

| Variable     | Definition                                                                 | Coding  |
|--------------|---------------------------------------------------------------------------|---------|
| Rural/Urban  | Rural was determined by patient’s home city and its CMS rural clinic      | Rural   |
|                | Description                                                                 |
|----------------|------------------------------------------------------------------------------|
| **Age**        | Age is by year as recorded in EHR.                                           |
| **Gender**     | Gender is as recorded in EHR.                                                |
| **Distance to PCP** | Distance is miles from home address in EHR to PCP address.                  |
| **# Chronic Diseases (0-3)** | Diseases counted were hypertension, diabetes, heart disease as recorded in EHR. |
| **Payer Type** | Payer was categorized as Commercial or Government.                           |
| **Quit Attempts** | Quit attempts were documented in the EHR by the PCP.                        |

### 6.2 Randomization:

We will use a 2×2 experimental design. Patients will be pulled from the EMR using the inclusion criteria stated above. After the initial patient population has been collected, we will then screen patients using the exclusion criteria stated above. 200 participants will be selected randomly following exclusion. Randomization will be achieved using a computer randomization system such as Excel, this will assign participants randomly to one of four groups with 50 patients in each group. Group 1 will receive message from physician as sender and the message will not include a link to a survey that initiates asynchronous care. Group 2 will receive message from physician as sender and the message will include a link to a survey that initiates asynchronous care. Group 3 will receive message from health system as sender and the message will not include a link to a survey that initiates asynchronous care. Group 4 will receive message from health system as sender and the message will include a link to a survey that initiates asynchronous care.

### 6.3 Masking:
Quadruple Masking: Participant, Care Provider, Investigator, Outcomes Assessor

- Participants: The patients will not be informed of other portal messages. The portal message they receive (if it had a link to asynchronous care or not and if it was sent by physician or system) will be determined by random assignment.
- Care Providers: After reviewing patients for exclusion criteria, the physicians will not be informed which intervention group patients are assigned.
- Investigators: The data will be extracted from the EHR and deidentified prior to sharing it with the investigators. Therefore, the investigators will also be blind to patients and patient assignment.
- Outcomes Assessor: Outcomes will be assessed only from deidentified data.

6.4 Sample Size:

The decision is to use 50 participants per condition for a total $N = 200$ based on two primary criteria. First, the large health care system where we conducted the study prefers to limit the study to 200 participants total out of concern for the unknown added workload to the physicians. Second, we conducted a power analysis to determine the minimum sample size to detect a moderate effect. Based on power – 95% and alpha level = .95, G*Power indicated that a sample size $N = 191$ is sufficient to detect a moderate-sized effect. Based on these two criteria, we agreed to the $N = 200$ decision.

6.5 Statistical Analysis:

Multivariable logistic regression with Quit Attempts as Dependent Variable:

- To test if intervention groups are associated with quit attempts, controlling for PCP.
- To assess the main effects of each factor, to determine if either factor had a significant relationship.
To evaluate if the outreach message is associated with quit attempts, quit attempts among only those who opened the message will be analyzed.

To determine if patient-related characteristics are associated with opening messages and quit attempts. Given that PCP may covary with patient characteristics (e.g. rurality and distance to a PCP) analyses will be conducted with and without controlling for the PCP.

**Chi-Square:**
- To compare quit attempts between the intervention groups.

**Odds Ratios:**
- To compare quit attempts between groups

### 6.6 Missing Data:

Because all data exists in patient records within the EPIC system and will be extracted by the site coordinators for all enrolled patients, we expect that no data will be missing.

### 7. Ethics and regulatory

The Oklahoma State University Center for Health Sciences Institutional Review Board granted a quality improvement exemption for non-human subject research for this study, and a waiver of informed consent to use the present data for research purposes. The health system was provided the IRB application and determination letter and accepted the determination. The Medical Director of the system’s emerging technologies department and Director of that project will act as the site collaborators.

### 8. Consent

Patients give their consent to be messaged education, products or services in their Notice of Privacy Practices Agreement. Consent is implied by the voluntary process where the
patients themselves need to initiate the asynchronous care by clicking the link to the survey, completing the survey and submitting the survey.

9. Confidentiality

During the program, the intervention will utilize EPIC and MyChart for confidential communication. After extraction, data will be deidentified by the health system prior to sharing data with the OSU CHSI.

10. Funding

This program was partially funded by Pfizer, Inc, in coordination with Oklahoma State University Center for Health Systems Innovation (CHSI) rural health medical quality project. Pfizer, Inc. had no role in design and conduct of the study; collection, management, analysis, and interpretation of the data; preparation, review, or approval of the manuscript; and decision to submit the manuscript for publication. The health system where this program was implemented received no funds from CHSI or Pfizer, Inc.

References

1. GBD 2015 Tobacco Collaborators. Smoking prevalence and attributable disease burden in 195 countries and territories, 1990-2015: a systematic analysis from the Global Burden of Disease Study 2015. Lancet. 2017;389: 1885–1906.

2. Chang SS. Re: Smoking Cessation: A Report of the Surgeon General. Journal of Urology. 2020. pp. 384–384. doi:10.1097/ju.0000000000001114

3. CDC TobaccoFree. 2014 surgeon general’s Report: The health consequences of smoking—50 years of progress. 25 Feb 2020 [cited 27 Mar 2021]. Available: https://www.cdc.gov/tobacco/data_statistics/sgr/50th-anniversary/index.htm

4. Xu X, Bishop EE, Kennedy SM, Simpson SA, Pechacek TF. Annual healthcare spending attributable to cigarette smoking: an update. Am J Prev Med. 2015;48: 326–333.
5. Creamer MR, Wang TW, Babb S, Cullen KA, Day H, Willis G, et al. Tobacco product use and cessation indicators among adults—United States, 2018. MMWR Surveill Summ. 2019;68: 1013.

6. Stead LF, Koilpillai P, Fanshawe TR, Lancaster T. Combined pharmacotherapy and behavioural interventions for smoking cessation. Cochrane Database Syst Rev. 2016;3: CD008286.

7. Babb S, Malarcher A, Schauer G, Asman K, Jamal A. Quitting Smoking Among Adults — United States, 2000–2015. MMWR. Morbidity and Mortality Weekly Report. 2017. pp. 1457–1464. doi:10.15585/mmwr.mm6552a1

8. Klemperer EM, Mermelstein R, Baker TB, Hughes JR, Fiore MC, Piper ME, et al. Predictors of Smoking Cessation Attempts and Success Following Motivation-Phase Interventions Among People Initially Unwilling to Quit Smoking. Nicotine Tob Res. 2020;22: 1446–1452.

9. Niaura R, Taylor Hays J, Jorenby DE, Leone FT, Pappas JE, Reeves KR, et al. The efficacy and safety of varenicline for smoking cessation using a flexible dosing strategy in adult smokers: a randomized controlled trial. Current Medical Research and Opinion. 2008. pp. 1931–1941. doi:10.1185/03007990802177523

10. Stead LF, Koilpillai P, Lancaster T. Additional behavioural support as an adjunct to pharmacotherapy for smoking cessation. Cochrane Database of Systematic Reviews. 2015. doi:10.1002/14651858.cd009670.pub3

11. Bal DG, Lloyd JC, Manley MW. The role of the primary care physician in tobacco use prevention and cessation. CA Cancer J Clin. 1995;45: 369–374.

12. Dickinson JA, Wiggers J, Leeder SR, Sanson-Fisher RW. General practitioners’ detection of patients’ smoking status. Med J Aust. 1989;150: 420–2, 425–6.

13. van Eerd EAM, Bech Risør M, Spigt M, Godycki-Cwirko M, Andreeva E, Francis N, et al. Why do physicians lack engagement with smoking cessation treatment in their COPD patients? A multinational qualitative study. NPJ Prim Care Respir Med. 2017;27: 41.

14. Gold JA, Spurlin D. Ask, assess, advise, assist, arrange are keys to smoking cessation. WMJ. 2001;100: 77–78.

15. Meijer E, Kampman M, Geisler MS, Chavannes NH. “It’s on everyone's plate”: a qualitative study into physicians’ perceptions of responsibility for smoking cessation. Subst Abuse Treat Prev Policy. 2018;13: 48.

16. Glauser W. Primary care system outdated and inconvenient for many millennials. CMAJ. 2018;190: E1430–E1431.
17. Doogan NJ, Roberts ME, Wewers ME, Stanton CA, Keith DR, Gaalema DE, et al. A growing geographic disparity: Rural and urban cigarette smoking trends in the United States. Prev Med. 2017;104: 79–85.

18. Matthews KA, Croft JB, Liu Y, Lu H, Kanny D, Wheaton AG, et al. Health-Related Behaviors by Urban-Rural County Classification — United States, 2013. MMWR. Surveillance Summaries. 2017. pp. 1–8. doi:10.15585/mmwr.ss6605a1

19. CDC. Leading causes of death in rural America. 25 Mar 2020 [cited 27 Mar 2021]. Available: http://www.cdc.gov/ruralhealth/cause-of-death.html

20. HPSA Find. [cited 27 Mar 2021]. Available: https://data.hrsa.gov/tools/shortage-area/hpsa-find

21. United States Public Health Service Office of the Surgeon General, National Center for Chronic Disease Prevention and Health Promotion (US) Office on Smoking and Health. Smoking Cessation: A Report of the Surgeon General. Washington (DC): US Department of Health and Human Services; 2020.

22. Kandel DB, Griesler PC, Hu M-C. Intergenerational Patterns of Smoking and Nicotine Dependence Among US Adolescents. Am J Public Health. 2015;105: e63–72.

23. Bartsch A-L, Härter M, Niedrich J, Brütt AL, Buchholz A. A Systematic Literature Review of Self-Reported Smoking Cessation Counseling by Primary Care Physicians. PLoS One. 2016;11: e0168482.

24. Center for Tobacco Products. Every Try Counts campaign. 12 Oct 2020 [cited 27 Mar 2021]. Available: https://www.fda.gov/tobacco-products/every-try-counts-campaign

25. Burke MV, Ebbert JO, Schroeder DR, McFadden DD, Hays JT. Treatment Outcomes From a Specialist Model for Treating Tobacco Use Disorder in a Medical Center. Medicine . 2015;94: e1903.

26. Fu SS, van Ryn M, Sherman SE, Burgess DJ, Noorbalooshi S, Clothier B, et al. Proactive tobacco treatment and population-level cessation: a pragmatic randomized clinical trial. JAMA Intern Med. 2014;174: 671–677.

27. Stead LF, Buitrago D, Preciado N, Sanchez G, Hartmann-Boyce J, Lancaster T. Physician advice for smoking cessation. Cochrane Database Syst Rev. 2013; CD000165.

28. Chen C, Wang J, Pang L, Wang Y, Ma G, Liao W. Telemonitor care helps CPAP compliance in patients with obstructive sleep apnea: a systemic review and meta-analysis of randomized controlled trials. Ther Adv Chronic Dis. 2020;11: 2040622320901625.
Appendix 1. Elements of the Smoking Cessation Outreach Quality Improvement Randomized Clinical Trial

| Element                                | Description                                                                                                                                                                                                                                                                                                                                                   |
|----------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| EHR                                    | The system used EPIC electronic health record (EHR) software.                                                                                                                                                                                                                                                                                                  |
| Portal Message                         | Portal messaging used MyChart program.                                                                                                                                                                                                                                                                                                                        |
| Eligible Smokers                       | EHR-documented smokers with a face-to-face visit within 12 months and an active portal account that met inclusion and exclusion criteria.                                                                                                                                                                                                               |
| Electronic Outreach Messages           | Electronic outreach messages were emailed portal messages sent encouraging smokers to make a quit attempt, informing them how to successfully quit, and proactively offering physician help.                                                                                                                                                                         |
| Asynchronous Care                      | Asynchronous care was a structured electronic questionnaire confirming interest in physician assistance in a quit attempt and assessing medication safety questions and quit attempt history.                                                                                                                                                                       |
| Embedded Asynchronous Care             | The link to the asynchronous care was embedded within the portal message.                                                                                                                                                                                                                                                                                  |
| Mode of Interaction                    | The email sender and message signatory was either the health system or the smoker's primary care physician.                                                                                                                                                                                                                                                   |
| Outreach Script Without Asynchronous Care Survey Link, showing System as the sender (Group 3) | Dear (name of patient),

As a part of your ongoing health and wellness, we at (system name) are sending you this note to encourage you to make an attempt to quit smoking and to make this attempt easier for you.

If you are ready to consider quitting smoking for good, or at least cutting back, we want to help you. Below are two options for you to consider as you take this important step to improving your health:

First, since quit attempts are more successful with medication to control nicotine cravings, we wanted you to be aware of the number of over-the-counter nicotine supplements (patches, lozenges, inhalers) available to you. If you are interested in your physician’s guidance or prescription medications to help you quit, please call your physician’s office to schedule an appointment to discuss and create a plan together.

Second, quit attempts are also more successful with support to stay motivated. Free support is available through the Oklahoma Tobacco Hotline (1-800-QUITNOW) as well as via this link to the OK to Quit program.

The decision to quit smoking is a commitment to your health. We know this is hard, but we also believe you can do it--and we are here to help.

We look forward to hearing from you.

(system name)
Dear (name of patient),

As a part of your ongoing health and wellness, I am sending you this note to encourage you to make an attempt to quit smoking and to make this attempt easier for you.

If you are ready to consider quitting smoking for good, or at least cutting back, I want to help you. Below are two options for you to consider as you take this important step to improving your health:

First, since quit attempts are more successful with medication to control nicotine cravings, I am offering you the opportunity to participate in a program to request smoking cessation medication or other guidance from me without an office visit and with no initial cost*.

[Click here to go to the Tobacco Cessation Questionnaire and begin participating in the program by answering a few simple questions.]

Second, quit attempts are also more successful with support to stay motivated. Free support is available through the Oklahoma Tobacco Hotline (1-800-QUITNOW) as well as via this link to the OK to Quit program.

The decision to quit smoking is a commitment to your health. I know this is hard, but I also believe you can do it--and I am here to help.

I am piloting this program via MyChart to see if offering access to tobacco cessation resources via this app is an effective resource to my patients. Since this pilot is time limited, MyChart access to this program is only available until January 23.

I look forward to hearing from you.

Sincerely,

(primary care physician name)

*Subsequent office visits or medications may have a cost.
