QUERI

Evidence Brief: Comparative Effectiveness of Appointment Recall Reminder Procedures for Follow-up Appointments

July 2015

Prepared for:
Department of Veterans Affairs
Veterans Health Administration
Quality Enhancement Research Initiative
Health Services Research & Development Service
Washington, DC 20420

Prepared by:
Evidence-based Synthesis Program (ESP)
Coordinating Center
Portland VA Medical Center
Portland, OR
Mark Helfand, MD, MPH, MS, Director

Investigators:

Kim Peterson, MS
Ellen McCleery, MPH
Johanna Anderson, MPH
Kallie Waldrip, MS
Mark Helfand, MD, MPH, MS

VA HEALTH CARE | Defining EXCELLENCE in the 21st Century

PREFACE

The VA Evidence-based Synthesis Program (ESP) was established in 2007 to provide timely and accurate syntheses of targeted healthcare topics of particular importance to clinicians, managers, and policymakers as they work to improve the health and healthcare of Veterans. QUERI provides funding for four ESP Centers, and each Center has an active University affiliation. Center Directors are recognized leaders in the field of evidence synthesis with close ties to the AHRQ Evidence-based Practice Centers. The ESP is governed by a Steering Committee comprised of participants from VHA Policy, Program, and Operations Offices, VISN leadership, field-based investigators, and others as designated appropriate by QUERI/HSR&D.

The ESP Centers generate evidence syntheses on important clinical practice topics. These reports help:

- Develop clinical policies informed by evidence;
- Implement effective services to improve patient outcomes and to support VA clinical practice guidelines and performance measures; and
- Set the direction for future research to address gaps in clinical knowledge.

The ESP disseminates these reports throughout VA and in the published literature; some evidence syntheses have informed the clinical guidelines of large professional organizations.

The ESP Coordinating Center (ESP CC), located in Portland, Oregon, was created in 2009 to expand the capacity of QUERI/HSR&D and is charged with oversight of national ESP program operations, program development and evaluation, and dissemination efforts. The ESP CC establishes standard operating procedures for the production of evidence synthesis reports; facilitates a national topic nomination, prioritization, and selection process; manages the research portfolio of each Center; facilitates editorial review processes; ensures methodological consistency and quality of products; produces "rapid response evidence briefs" at the request of VHA senior leadership; collaborates with HSR&D Center for Information Dissemination and Education Resources (CIDER) to develop a national dissemination strategy for all ESP products; and interfaces with stakeholders to effectively engage the program.

Comments on this evidence report are welcome and can be sent to Nicole Floyd, ESP CC Program Manager, at Nicole.Floyd@va.gov.

Recommended citation: Peterson K, McCleery E, Anderson J, Waldrip K, Helfand M. Evidence Brief: Comparative Effectiveness of Appointment Recall Reminder Procedures for Follow-up Appointments. VA ESP Project #09-199; 2015.

TABLE OF CONTENTS

FIGURES AND TABLES

EXECUTIVE SUMMARY

After 5 years of mandated use, the 2010 Recall Reminder policy is being revisited because significant decreases have not been observed from 2010 to 2014 in overall appointment no-shows or cancellations and staff members have criticized the time and resource intensity of the system. We found published literature to be of little help in deciding whether to keep, modify, or replace the current Class I VHA recall reminder software. This is because the published literature has not evaluated the effect of alternatives on a complete set of related system outcomes: no-show rates, backlog, call center waiting time, administrative burden, and patient satisfaction. It also has not evaluated policy options such as:

1) *More flexibility.* This option could give clinicians and patients a choice of recall reminder or scheduling a future appointment >90 days, more options for mode and threshold of notification, and the option to contact a dedicated phone line in the pertinent clinic versus a general call center number with redirection to specific clinics.

2) *Adaptation to local circumstances.* This option may involve using a different cutoff than 90 days depending on a facility's backlog of new patients, call center hold time, or the patient population.

The studies we identified (Table A) provided limited evidence that use of a recall reminder scheduling system can decrease the rate of missed appointments by 7 percentage points compared to '365 scheduling' in elderly Veterans. However, this evidence did not evaluate resource use or the impact on backlog, and the specific circumstances and practices of the medical center in which the study was performed are not generalizable to the VA health system overall. Studies that compared appointment reminder methods, regardless of scheduling method or whether patients were new or established, suggest that the Access and Clinic Administration Program (ACAP) should explore the use of live telephone reminders and text message reminders as an alternative to the current postal reminders. However, the independent effect of the scheduling component versus the reminder component remains unknown. Directions for future VA quality improvement initiatives include evaluation of (1) a complete set of pertinent and related system outcomes, (2) policy options of more flexibility and adaptation to local circumstances, (3) the impact of potential patient, provider, and system effect modifiers, (4) the impact of variation in recall reminder scheduling system design (*ie*, how and when Veterans are contacted), (5) the independent contributions from the scheduling and reminder components, (6) the use of agent-based models to identify areas with greatest potential for change, and (7) tailoring the scheduling approach to the individual Veteran.

Background

As part of the VHA's focus on improving Veteran access, the ACAP requested that the ESP CC conduct a rapid evidence brief to evaluate the comparative effectiveness of appointment recall reminder procedures for follow-up appointments, by (1) considering their overall net benefit in reducing follow-up appointment missed opportunities, while not worsening organizational outcomes and (2) identifying potential effect modifiers. Findings from this evidence brief will be used to inform a potential revision of the 2010 VHA Directive 2010-027 that prohibits scheduling of >90-day follow-up appointments at the time Veterans leave the clinic and mandated the use of recall reminder procedures.

Methods

We searched MEDLINE®, the Cochrane Database of Systematic Reviews, and the Cochrane Central Registry of Controlled Trials using terms for appointments, reminders and schedules. We used prespecified criteria for rating internal validity and strength of the evidence for each outcome and comparison. See our PROSPERO protocol for our full methods.

Table A: Main Findings

Comparison (setting)	Difference		Limitations
Comparison of methods for *scheduling* established patient follow-up visits			
Recall reminder letter 30-days prior vs 365 scheduling at end of visit (Miami VA Geriatrics Clinic)	⬇	Decreased missed appointments: 18% to 11% (P=.000)	No information about the time and resource impact of the recall reminder system or about its engineering characteristics (*eg*, methods for managing recall delinquencies, letter content, etc)
	⬇	Decreased rate of patients with wait times longer than 1 month when making next appointment (0% vs 15%)	
Comparison of methods for *reminding* patients of existing appointments			
Live vs automated phone reminders (Non-VA multispecialty clinics)	⬇	Live calls decreased no-shows: Automated calls had more no-shows (17.3 vs 13.6%, OR=1.28, 95% CI, 1.11-1.47)	
Text vs live phone reminders (Non-VA Asian and Swiss clinics)	=	Similar attendance in Asian studies (RR=0.99, 95% CI 0.95-1.02) and similar no-show rate in Swiss substance abuse clinic (OR=1.0, 95% CI 0.7-1.3)	No information about what scheduling methods were used or whether patients were new or established
	⬆	Borderline lower no-show rate for phone in Swiss primary care setting (OR=0.8, 95% CI, 0.7-1.0)	
	⬇	Text reminders decreased cost: 55% to 65% lower for text than cost per call reminder in Asian studies and total costs in euros of 230 vs 8,910 in Swiss study	
	=	Similar satisfaction: % patients rates as useful; 98.4% vs 98% in primary care and 88% vs 86% in substance abuse clinic	

EVIDENCE BRIEF

INTRODUCTION

PURPOSE

As part of the VHA's focus on improving Veteran access, the ESP Coordinating Center (ESP CC) is responding to a request from the Acting Deputy Under Secretary for Health for Operations Management (DUSHOM) through the Access and Clinic Administration Program (ACAP) for an evidence brief on the comparative effectiveness of appointment recall reminder procedures for established patients returning for follow-up appointments. Recall appointments are defined as future patient appointments in which the patient needs to be seen in more than 90 days. The main purpose of this brief review is to summarize the evidence on the comparative effectiveness of the current Class I VHA recall reminder software, alternative recall reminder software or approaches, and scheduling follow-up appointments at the time of leaving the office in reducing missed opportunities for Veteran follow-up appointments without negatively impacting opportunity costs.

The ACAP will use the findings from this evidence brief to help inform refinement of clinical manager training development and scheduling policies, processes, and standard operating procedures (SOPs). In addition, findings will drive recall reminder software development intended to increase the ease of patient scheduling, decrease patient no-show rates, cancellation rates, and loss to follow-up, and enhance health care delivery and access.

BACKGROUND

Missed health care appointments are a major source of potentially avoidable cost and resource inefficiency that can adversely affect organizational workflow and increase clinic wait times. Missed appointments also may reflect needed care that was not delivered that can result in delays in diagnosis and appropriate treatment and decrease patient health outcomes.[1-4]

In 2008, an audit by the Office of Inspector General (OIG) found that the Veterans Health Administration's (VHA) efforts to reduce unused outpatient appointments were inadequate and recommended establishment of procedures to (1) measure and track unused outpatient appointments, (2) measure the effectiveness of processes for reducing missed opportunities and implement best practices nationwide, and (3) require facility directors to ensure unused appointments are used.[5] A few examples of VHA efforts to address the 2008 OIG's recommendations include (1) 2010 implementation of a standardized computerized system for tracking and reducing missed opportunities for >90-day follow-up appointments (Class I Recall Reminder software) and (2) in 2011, the Pittsburgh Healthcare System Veterans Engineering Resource Center (VAPHS VERC) developed the National Initiative to Reduce Missed Opportunities (NIRMO) for tracking missed opportunities, understanding and analyzing factors that predict them, and developing and deploying strategies for improvement.

In the VA, the farther out an appointment is scheduled, the less likely the appointment will happen (45%-60% for appointment age >90 days vs 70-80% for appointment age <14 days; J. Prentice, S.D. Pizer, unpublished data, 2015). Starting in 2010, VHA Directive 2010-027 prohibited continued scheduling of greater than 90-day follow-up appointments at the time

Veterans were leaving the clinic and mandated the use of strategies for contacting patients closer to the time of the needed visit to remind them to schedule the appointment ('Recall Reminder').[6] Under this system, when a patient checks out after seeing a provider, a future appointment is made only if the patient is to return to clinic within 90 days. Otherwise, (1) VA staff use the software to schedule the Recall Reminder, (2) 2-4 weeks prior to the recall date, software automatically notifies clinic staff that it is time to remind the Veteran of the need to schedule a follow-up visit, (3) a mail or phone reminder is sent to the patient, and either (4) the patient calls to schedule, or (5) patient does not call to schedule and goes onto a delinquency list and has to be contacted by VA staff.

After 5 years of mandated use, the 2010 Recall Reminder policy is being revisited because VHA Support Service Center data have shown no significant decreases from 2010 to 2014 in no-shows overall (7.1% vs 7.4%), canceled by clinic rate (9.2% vs 9.9%), or canceled by patient rate (14.8% vs 15.0%) and some staff using the Recall Reminder system have criticized the system, asserting that it is very time- and resource-intensive (written communication, March 2015). For example, as a result of requiring Veterans to call in to schedule their follow-up appointment rather than scheduling the follow-up as they are leaving the office, the VISN 8 Call Center reported a 10% increase in their call volume from 2010 to 2014 (written communication, March 2015). Another common complaint from the field is that manual management of the delinquency list is very labor-intensive (VISN3, email communication, December 24, 2014). Other potential unintended consequences of using the Recall Reminder system include negative impacts on patient follow-up, Veteran satisfaction (if Veterans want to leave with an appointment), cost and other organizational outcomes (*eg*, productivity, turn over, grievances, training requirements, infrastructure requirements, etc). Recall Reminders could be implemented in several different ways, potentially leading to increased or decreased scheduler burden and other adverse events, so how best to implement the system is an important question. For example, if sending Veterans due for follow-up appointments a notice at 60 days, 30 days, and calling them at 20 days, 18 days, and 15 days doesn't significantly reduce no-shows beyond a less intensive approach of calling Veterans at 18 days and 15 days, then the less intensive approach may be preferable due to the decreased workload burden.

Although NIRMO has not yet evaluated the specific impact of the Recall Reminder system, they surveyed Veterans about reasons for missed appointments and VA staff regarding scheduling practices and implementation of strategies to reduce missed appointments.[7] NIRMO's survey of 4,749 Veterans found that the top reported reasons for missed appointments were that they forgot (19%), miscellaneous (reasons other than those listed, 16%), not aware of the appointment (15%), no transportation (8%), poor weather (7%), sick (7%), something unexpected came up (7%), and cancelled the appointment beforehand (5%). NIRMO also surveyed 1,493 VA staff to identify scheduling practices and strategies used to reduce missed appointments. Compared to a missed appointments rate of 18.7% for the strategy of negotiating appointments only, reminder calls reduced the missed appointments rate to 16.0%. The rate was reduced to 14.7% with both reminder calls and promotion of provider continuity, and to 13.7% with reminder calls, promoting provider continuity, and receiving appointment cancellations through main facility phone line instead of individual clinic phone line.

Taking into account Veteran and staff surveys, NIRMO has recommended 10 general strategies for reducing missed appointments: (1) cancel appointments as they are received, (2) negotiate all appointments, (3) coordinate appointments with transportation and other appointments already

scheduled, (4) offer open access or same-day access, (5) use nontraditional modes of care, (6) manage the schedule to ensure clinics run on time, (7) improve interactions between patients and providers, patients and clerks, and between staff members, (8) disseminate educational posters, (9) use the Recall Reminder software to schedule follow-up visits beyond 90 days, and (10) perform live targeted reminder calls to patients that they've identified as having a 20% or greater no-show probability using a predictive model they developed.

VHA is taking several steps to determine how to optimize the use of Recall Reminder processes. First, the VA is undertaking a quality improvement initiative that will evaluate the effectiveness of various Recall Reminder approaches across 6 pilot sites, comparing sequence and timing of reminder postcards and calls and the traditional approach allowing Veterans to schedule appointments before leaving the office (up to a year in advance). Second, through the ACAP, the DUSHOM requested that the ESP CC conduct a rapid evidence brief to evaluate the comparative effectiveness of the current Class I VHA recall reminder software, alternative recall reminder software or approaches, or scheduling follow-up appointments at the time of leaving the office in reducing missed opportunities for established Veteran follow-up appointments without negatively impacting opportunity costs.

SCOPE

The objective of this evidence brief is to synthesize the literature on the comparative effectiveness of appointment recall reminder systems. The ESP Coordinating Center investigators and representatives of the Access and Clinic Administration Program (ACAP) worked together to identify the population, comparator, outcome, timing, setting, and study design characteristics of interest. The ACAP approved the following key questions and eligibility criteria to guide this review:

KEY QUESTIONS

Key Question 1: For adult patients who are targeted for follow-up appointments, what is the comparative effectiveness of the current Class I VHA recall reminder software, alternative recall reminder software or approaches, or scheduling follow-up appointments at the time of leaving the office?

Key Question 2: For adult patients who are targeted for future appointments, does the comparative effectiveness of Appointment Recall Reminder (RR) procedures versus other kinds of follow-up appointment scheduling systems differ according to:

  a) Patient factors: Preference, clinical characteristics

  b) Appointment scheduling systems engineering design and management factors: Mode of notification (mail, phone, electronic), threshold for notification (1 month, 2 weeks), mode of patient response, reminder type

  c) Facility characteristics: Efficiency, backlogs.

ELIGIBILITY CRITERIA

The ESP included studies that met the following criteria:

  · *Population:* Adult patients who are targeted for follow-up appointments.

- *Intervention:* Any procedures for scheduling established patients' follow-up appointments. We accepted any type of procedures. These included, but were not limited to strategies incorporating the following procedures:

(1)   365 scheduling: Negotiation of follow-up visit upon leaving the clinic, regardless of how far in the future the appointment is needed;

(2)   Strategies for reducing appointment age – after patients leave the office, contacting the patients closer to the time the future appointment is needed by:
   a. Recall Reminder: Sending a notification requesting that the patient contact the office to schedule an appointment
   b. Blind scheduling: Sending a notification of an appointment that has been scheduled on behalf of the patient without their input about preference on date or time.

   The highest-priority studies were those that most directly addressed our questions about the comparative effectiveness of different systems for scheduling established patients' follow-up appointments, with or without reminders. To address gaps in the highest-priority evidence, we also accepted lower-priority studies that either (a) focused on scheduling new patients for initial visits or (b) focused only on the reminder component.

- *Comparison:* Mandated versus flexible use of a recall reminder system; comparison of different recall reminder engineering designs; comparison of recall reminder versus other strategies for reducing appointment age.

- *Outcomes:* Primary outcomes of interest include no-show rates and cancel rates. Secondary outcomes of interest include appointment wait times, patient loss to follow-up (undelivered needed care), scheduler learning and behavior, organizational outcomes (*eg*, productivity, turnover, grievances, training, infrastructure requirements), and patient satisfaction.

- *Timing:* No restrictions.

- *Setting:* Within and outside of the VA. We will prioritize VA studies, but will look outside of the VA to fill gaps in VA evidence, including international studies.

- *Study design:* Longitudinal studies. Using a Best Evidence approach, we will prioritize evidence from systematic reviews and multisite studies that adequately controlled for potential patient-, provider-, and system-level confounding factors. Inferior study designs (*eg*, single-site, inadequate control for confounding) will only be accepted to fill gaps in higher-level evidence.

We are aware of the large volume of evidence on the effectiveness of reminders for increasing vaccine and screening test uptake. However, we excluded those from this review because they generally focus on ultimate uptake regardless of whether it encompassed multiple failed appointment attempts and/or the procedures can sometimes be completed in walk-in clinics and don't always involve any scheduling.

ANALYTIC FRAMEWORK

The analytic framework below illustrates the populations, interventions, outcomes, and adverse effects that guided this review and their relationship to the Key Questions.

Figure 1: Analytic Framework
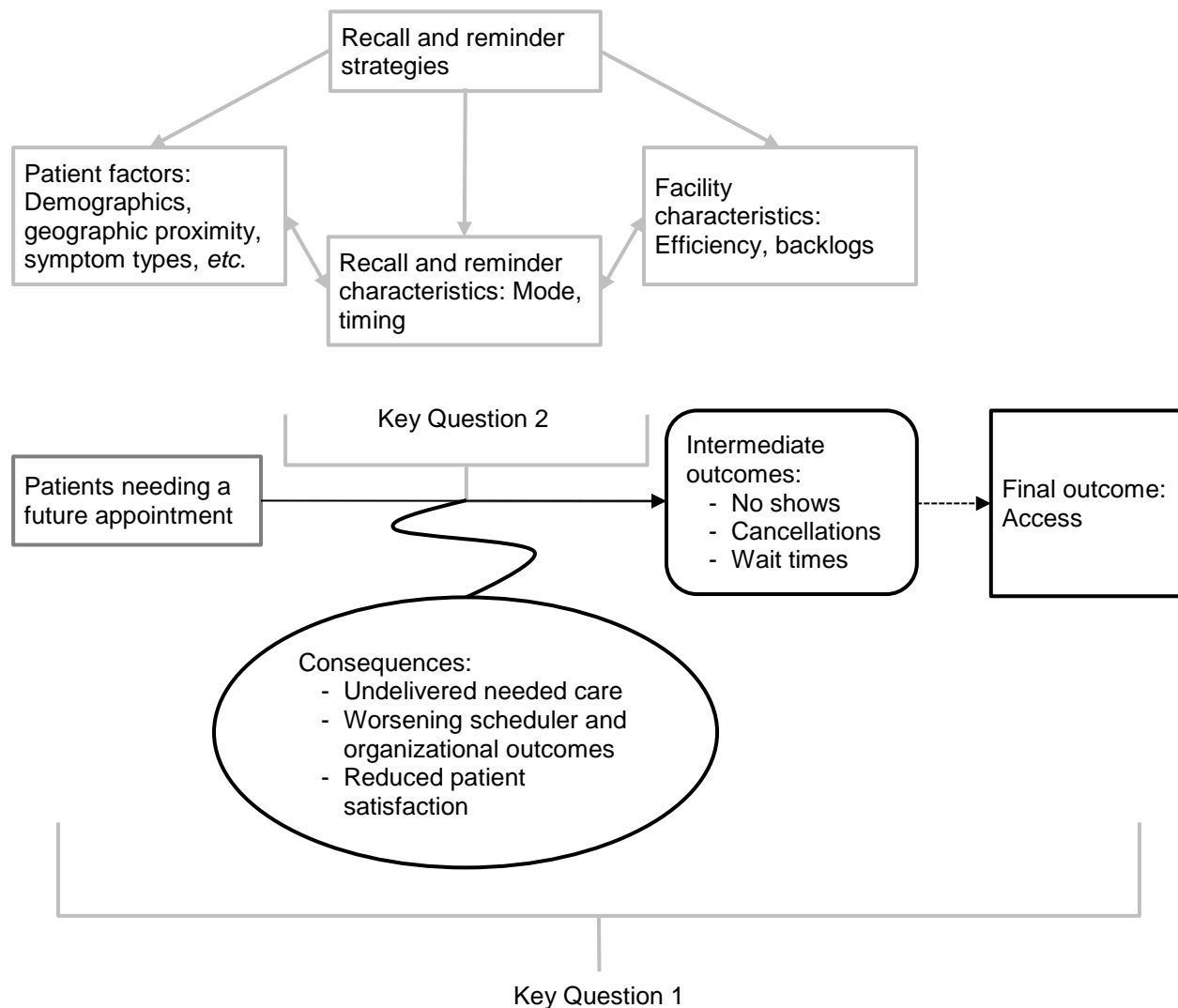
METHODS

To identify relevant citations, our research librarian searched MEDLINE®, the Cochrane Database of Systematic Reviews, and the Cochrane Central Registry of Controlled Trials on March 5, 2015 and April 7, 2015 using terms for *appointments*, *reminders* and *schedules*. As our initial review of the search results found numerous systematic reviews that adequately covered the literature through 2010, we limited our search for primary literature to articles published in or after 2010. The exact search strategies are provided in the supplemental materials. To rate the internal validity of included studies, we used Cochrane's Risk of Bias Tool for controlled trials and the Drug Effectiveness Review Project's Tool for observational studies.[8,9] We graded the

strength of the overall body of evidence using the AHRQ Methods Guide for Comparative Effectiveness Reviews which is based on the risk of bias of individual studies (study design and internal validity), consistency, directness, and precision. We followed the February 2015 AHRQ Guidance for determining when strength of evidence rating from existing systematic reviews could be used and for determining whether new primary studies would change the strength of the evidence or conclusions of previous reviews.[10] However, for lower-priority existing reviews that either (a) focused on scheduling *new* patients for *initial* visits or (b) focused only on the reminder component (see eligibility criteria above), to fit the abbreviated timeline of this rapid review, we modified the AHRQ-recommended approach for rating strength of evidence. When lower-priority existing reviews did not complete strength of evidence ratings and did not provide adequate detail about the primary studies for us to do so, we described the strength of the evidence as unclear and noted which details were lacking.

The complete description of our full methods can be found on the PROSPERO international prospective register of systematic reviews website (http://www.crd.york.ac.uk/PROSPERO/; registration number CRD42015020654).

RESULTS

LITERATURE FLOW

We screened 529 unique records and included 25 articles in this evidence brief (Figure 2): 13 systematic reviews and 12 primary studies. For Key Question 1, we only identified 2 flawed single-site, non-concurrently controlled cohort studies that compared different approaches to scheduling follow-up appointments[11,12] and one systematic review that compared different methods of scheduling initial appointments.[13] Of the 2 follow-up appointment scheduling cohorts, one was a VA study, but because it focused on a single geriatric clinic, its findings may have limited applicability to the broader VA population.[11]

Because neither study of scheduling future appointments addressed the effects of differences in patient factors, engineering design, or facility characteristics (Key Question 2), we looked at studies of these factors on the effectiveness of reminders for *existing* appointments. Due to the large volume of systematic reviews on reminders for existing appointments available that evaluated the primary literature through 2010,[1-3,13-22] we only included primary studies on reminders for existing appointments published from 2010 onward. Table 1 shows which reminder types are compared in the included systematic reviews and primary studies.

We identified 13 systematic reviews and 12 primary studies that met our inclusion criteria. Four of the primary studies are randomized controlled trials,[23-26] 7 are non-concurrent cohort studies,[11,12,27-31] and one is an uncontrolled before-after study.[32]

We rated most of the included systematic reviews as fair or good quality.[2,3,13-15,17-19,21] We rated 3 systematic reviews as poor quality for providing insufficient detail and not rating the quality of included primary studies.[16,20,22] We rated 3 of the 4 included RCTs as low risk of bias[23,25,26] and one as medium risk of bias[24] since allocation concealment was not described. We rated 7 of the 8 observational studies as poor quality for not accounting for temporal trends[11,12,27-29,31,32] and one as fair quality.[30] Three included primary studies were conducted at VA medical centers: one at

the Miami VA Geriatrics Clinic,[11] one at 3 HIV primary care clinics in the Los Angeles VA system,[30] and one at the Providence VA Medical Center homeless primary care clinic.[32]

Table 1: Reminder types included in systematic reviews and primary studies

Publication	Email	Live phone	Auto phone	Postal	Text	No reminder	Head-to-head comparison	Comparison to no reminder
Systematic reviews								
Atherton 2012*	X	X	X	X	X	X	X	X
Car 2012		X		X	X	X	X	X
Free 2013		X		X	X	X	X	
George 2003		X		X				X
Gurol-Urganci 2013		X		X	X	X	X	X
Guy 2012					X	X		X
Hasvold 2011		X	X			X		X
Liu 2014		X				X	X	X
Macharia 1992		X		X		X		X
McLean 2014		X	X	X	X	X		X
Reda 2012		X		X	X	X	X	X
Schauman 2013		X	X	X		X		X
Stubbs 2012	X	X	X	X	X	X		X
Primary studies								
Brannan 2011					X	X		X
Farmer 2014					X	X		X
Haufler 2011		X				X		X
Henry 2012			X	X			X	
Junod Perron 2013		X			X		X	
Junod Perron 2010		X		X	X		X	
McInnes 2014					X			X
Parikh 2010		X	X			X	X	X
Perry 2011					X	X		X
Taylor 2012					X	X		X

*This systematic review did not identify any primary studies meeting the authors' inclusion criteria.

Figure 2: Literature flow chart

```
┌─────────────────────────────────────┐   ┌─────────────────────────────────┐
│ 518 records identified through       │   │ 11 records identified through   │
│ database searching                   │   │ hand searching                  │
│     471 from MEDLINE on 4-7-2015     │   │                                 │
│     34 from the Cochrane Central     │   │                                 │
│     Register of Controlled Trials    │   │                                 │
│     on 3-5-2015                      │   │                                 │
│     13 from Cochrane Database of     │   │                                 │
│     Systematic Reviews on 3-5-2015   │   │                                 │
└─────────────────────────────────────┘   └─────────────────────────────────┘

┌───────────────────────────────────────────────────────────────────────────┐
│ 529 records screened for eligibility after removal of duplicates            │
└───────────────────────────────────────────────────────────────────────────┘

                                      ┌─────────────────────────────────────┐
                                      │ 427 titles and abstracts excluded   │
                                      └─────────────────────────────────────┘

┌───────────────────────────────────────────────────────────────────────────┐
│ 102 full-text articles assessed for eligibility                             │
└───────────────────────────────────────────────────────────────────────────┘

┌─────────────────────────────────────┐   ┌─────────────────────────────────┐
│ 25 articles included in synthesis    │ ← │ 77 full-text articles excluded  │
│                                      │   │ (see supplemental materials)    │
└─────────────────────────────────────┘   └─────────────────────────────────┘

┌─────────────────────────────────────┐
│ 3 articles addressing KQ1*           │
└─────────────────────────────────────┘

┌─────────────────────────────────────┐
│ 23 articles addressing KQ2*          │
└─────────────────────────────────────┘
```

*≠ 25, one article addresses more than one Key Question.

KEY QUESTION 1: For adult patients who are targeted for follow-up appointments, what is the comparative effectiveness of appointment Recall Reminder (RR) procedures versus other kinds of follow-up appointment scheduling systems?

Comparison of different methods for follow-up patient scheduling

We only identified 2 non-concurrently controlled studies that compared different methods scheduling established patients for follow-up visits.[11,12] The more relevant of the 2 studies[11] demonstrated that using a recall reminder system to schedule follow-up appointments in the Miami VA Geriatric Clinic in fiscal year 2006 decreased the rate of missed appointments from 18% to 11% (P=.000) compared to '365 scheduling.' But the usefulness of this benefit is unclear in the absence of accompanying information about how the recall reminder impacted other key factors of patient follow-up, scheduler time burden, or organizational outcomes. Also, because this study lacked important system design details (*eg*, methods for managing recall delinquencies, letter content, etc), the applicability of its findings to the current Class I VHA recall reminder software is unclear.

In fiscal year 2006, the Miami VA Geriatrics Clinic demonstrated a decrease in rate of missed appointments from 18% to 11% (P=.000) and rate of patients with wait times longer than 1

month (15% vs 0%) after changing their system of scheduling future appointments from the traditional model of scheduling at the end of each visit to sending patients a letter advising them to call and make an appointment 30 days before their next anticipated visit.[11] The reduction in missed appointments appeared to be independent of any underlying trends over time. The monthly missed appointment rate was fluctuating between 14% and 25% in the year prior to implementation with no clear pattern, compared to a range of 6% to 18% in the year after implementation. However, the lack of a concurrent control group still prevents us from ruling out the potential confounding effects of other organizational changes, such as staffing changes. The between-group difference may also have been confounded by differences in unmeasured patient and appointment characteristics. Although this was a study of a Veteran population, its applicability is still limited because it only involved a single site of geriatric patients. Finally, we don't know exactly to what type of geriatric patients, appointments, or reminder letters these findings apply since those details were not provided.

The second study compared non-concurrent cohorts of 2,116 follow-up appointment patients from an ophthalmology practice at Dartmouth-Hitchcock Medical Center who were either sent a reminder postcard advising patients to call and make a follow-up appointment or sent a computer-generated letter of a "blind" scheduled appointment 4 weeks before the appointment. Compared to the blind scheduled group, the reminder postcard group had a slightly lower rate of no-shows (absolute difference of -2%; 4.5% compared with 6.5%; P=.09).[12] However, the blind-scheduling approach had the advantages of keeping more patients in contact with the office (100% vs 56%) and increasing estimated billing revenue for the first year by $74,878. Patient satisfaction and scheduler effort were similar between the 2 approaches (data not reported).[12] However, because blind scheduling is not an alternative the VA is considering and this study is in a narrow non-VA population, the applicability of these findings to the broad VA population is likely low.

Other methodological limitations include unreliable methods for analyzing no-shows and potential confounding. For the analysis of no-shows, although the publication reported a significantly larger increase in no-shows for the blind scheduled group (+4.5%; P<.0001), we believe this was an overestimation. The no-show rate for the reminder postcard group cited in the paper (2%) appears to have been calculated based on a denominator that included 463 patients who never made a reappointment in the first place. Therefore, we used a no-show rate of 4.5% for the reminder postcard that was based only on patients who made an appointment (N=599). However, regardless of how the no-shows were calculated, another possible explanation for the higher rate in the blind scheduled group may be the difference in season of scheduling. Compared to the postcard group who were contacted in spring, the blind scheduled group was scheduled in the summer months, where appointment attendance may be less reliable in general due to higher rates of vacation and recreation. Also, for the postcard group, there was no information on the amount of time between when they called to make the appointment and the scheduled date of the appointment (*ie*, appointment age). If the appointment age was lower for the postcard group compared to the 4 weeks for the blind scheduled group, this may have contributed to the higher no-show rate in the blind scheduled group. Finally, the between-group difference may have been confounded by differences in unmeasured patient and appointment characteristics. Reasons for reappointments ranged from contact lens checks to ocular surgery follow-up, but there was no analysis of whether no-shows varied based on appointment type. Also, the lack of detail about the content of the postcard reminder limits it applicability. We

know that the cards were inscribed by hand and included the phone number, but we do not know the nature of the message.

Comparison of different methods for new patient scheduling

Because reasons for no-shows may be different between new and established patients, we considered evidence on the comparative effectiveness of different scheduling practices for new patients to be indirect to answering our questions about impact on established patients. However, because we found very limited evidence that compared different methods of scheduling established patients for follow-up appointments, we also explored the evidence on scheduling new patients for any useful insights. A good-quality systematic review provided insufficient evidence of the overall comparative effectiveness for different scheduling approaches.[13] Although there is low-strength evidence of similar attendance rates for blind versus patient-initiated scheduling and accelerated versus standard access, risk of potential adverse effects was not reported.[13] The authors of this systematic review searched through June 2012 and we did not find any more recent primary studies.

Blind scheduling versus patient-initiated

Three small single-site UK RCTs (N=451) provided low-strength evidence that requiring patients to contact the clinic to make an appointment did not consistently improve attendance at the *initial* mental health appointments compared with a blind scheduling approach.[13] Effects on attendance ranged from a slight decrease from 48% to 45% (RR 0.94; 95% CI 0.70 to 1.26) in a marital and sexual difficulties clinic to an increase from 67% to 79% (RR 1.67; 95% CI, 1.06 to 2.55) in a specialist psychotherapy clinic. The risk of bias for these studies was described as "mainly unclear."

Accelerated access

Two small single-site RCTs from substance abuse clinics in the US (N=245) provided low-strength evidence that offering appointments on the same day or within 48 hours did not improve *initial* appointment attendance compared with scheduling appointments further in the future.[13] In a community-based substance abuse agency, attendance increased from 41% to 65% (RR 1.60; 95% CI, 0.91-2.82) when participants were offered same-day appointments and discussed their obstacles to attending appointments compared to standard scheduling with unspecified average wait times. In a substance abuse research clinic, attendance increased from 57% to 67% (RR 1.18; 95% CI, 0.79 to 1.76) when appointments were scheduled within 48 hours compared with within an average of 5 days.

KEY QUESTION 2: For adult patients who are targeted for future appointments, does the comparative effectiveness of appointment Recall Reminder (RR) procedures versus other kinds of follow-up appointment scheduling systems differ according to patient factors, scheduling system engineering design and management factors, or facility characteristics?

We did not identify any evidence on how the comparative effectiveness of appointment recall reminder procedures versus other kinds of follow-up appointment scheduling systems differ according to other factors. But below we summarize evidence on how the comparative effectiveness of reminders for existing appointments differs according to other factors. In general, there is low-strength evidence that reminders may be less effective in new patients compared with established patients and in patients with depression, but no evidence that the comparative effectiveness of reminders for existing appointments differs by other individual patient factors (such as gender, deprivation status, employment status, substance abuse, ethnicity, mental health, other health problems, symptomatic compared with non-symptomatic health status, diagnostic stage, or perceived severity of the patient's health condition).

A.   Patient factors

A1. New versus established patients

One RCT provides low-strength evidence that new patients had higher no-show rates compared with established patients after a telephone reminder from clinic staff or after an automated telephone reminder in an outpatient multispecialty practice, but that there was no difference in no-show rates between new and established patients among the group that did not receive a reminder.[25]

A2. Patient clinical factors

One non-concurrent cohort study in a VA HIV primary care clinic provides low-strength evidence that a diagnosis of depression may moderate the effectiveness of an appointment reminder. Adding an automated telephone reminder 2 weeks before the appointment to standard appointment reminders 3 days before the appointment was effective in reducing no-shows among patients without depression (18.2% vs 23.4, $p<.05$), but not effective in reducing no-shows among patients with depression (30.9% vs 24.9, $p>.05$).[30]

A3. Patient preference

We did not identify any studies that reported on how the comparative effectiveness of existing appointments differs by patient preference. The association between the mode of the appointment reminder and participant satisfaction is discussed below.

A4. Patient age

One systematic review concluded that the use of SMS reminders was related to an increased appointment attendance compared with no reminder and that there were no significant subgroup differences by target age group (pediatric versus older).[17] However, it is unclear how generalizable these results are to the VA, since the age group "older than pediatric" was not broken down further to examine how the effectiveness of SMS reminders varies.

A5. Other patient factors

One systematic review reported insufficient evidence to draw conclusions about whether the comparative effectiveness of reminders for existing appointments differs by other individual patient factors (such as gender, deprivation status, employment status, substance abuse, ethnicity, mental health, other health problems, symptomatic compared with non-symptomatic health status, diagnostic stage, and perceived severity of the patient's health condition).[3] The systematic review cites only one study in an orthodontic practice that evaluated how gender and age affects attendance and concludes that this evidence is insufficient to make any conclusions about how patient characteristics mediate the association between a reminder and attendance outcomes.

B. Appointment scheduling systems engineering design and management factors

B1. Mode of notification

We found no studies that compared different modes of notification within the same recall reminder system.

B2. Threshold for notification (1 month, 2 weeks)

Previous systematic reviews provide consistent evidence that appointment attendance does not clearly vary based on differences in timing of the SMS text reminders (24, 24, and 72+ hours),[17] postal reminders (1 vs 3 days),[21] or telephone reminders (1-7 days).[18] However, the strength of the evidence from the previous reviews is unclear as they provided insufficient detail to evaluate how variation in primary study quality may have affected outcomes or the precision of the estimates.

B3. Mode of patient response

We found no studies that compared different modes of patient response within the same recall reminder system.

B4. Reminder mode

Regardless of scheduling method, the evidence does not demonstrate that any particular reminder type (*ie*, phone, postal, or text) has a clear net benefit over any other (Table 2). One large, good-quality RCT (N=8,071) provides moderate-strength evidence that a live telephone reminder from clinic staff 2 days prior to an outpatient specialty appointment significantly reduced no-shows compared to an automated telephone reminder. But there was no difference in cancellation rate between the 2 groups and impact on our other secondary outcomes of interest was not evaluated.[25] Text messaging may be a potential alternative to live telephone reminder calls. A good-quality systematic review of 3 fair-quality RCTs of from China and Malaysia (N=2,509) consistently found that text message reminders result in similar attendance rates and cost less than telephone reminders.[2] However, a larger and more recent RCT from a Swiss urban academic primary care clinic (N=5,200) found higher no-shows in the group sent an automatic text-message reminder via 'Easy SmartCare' software 24 hours before their appointment compared to live telephone reminder calls.[24] Because we have very little information about the patients, appointment types, and reminder content in any of the studies, we cannot determine the reason for the differing results in the Asian and Swiss studies.

Postal reminders have been less widely studied than phone and text reminders. Low-strength evidence from 3 small RCTs (N=326) included in one systematic review suggests that postal reminders do not improve attendance to outpatient mental health appointments for people with serious mental illness.[21] Another review concluded that postal reminders reduced the nonattendance rate to 7.6% on average in 6 RCTs and 1 historically-controlled cohort (range -3% to -17%; N= 6,621) in a variety of settings (orthodontics, women's health, general outpatient, colposcopy).[22] Still, it is unclear whether this finding is reliable since the review did not account for potential differences in quality across the included studies and we could not judge the precision of the average attendance rates because measures of variance were not reported.

We rated the remainder of the evidence that compared different single-mode reminders as insufficient or unclear due to each comparison being supported by either one small study with medium to high limitations, or by systematic reviews that provided insufficient detail on included primary studies to rate their strength.

Few studies have evaluated how reminders using a combination of modes compare to single modes or no reminders. There is low-strength evidence that adding a text message to a postal reminder improved attendance at ear, nose, and throat clinics in one UK district general hospital (94% vs 86%; RR=1.10, 95% CI, 1.02-1.19) compared to a postal reminder alone.[2] The systematic review that included this study did not report on any other outcomes. Evidence from one small RCT of 66 participants with unknown randomization and blinding methods provided insufficient evidence to draw conclusions about the combination of a text and telephone reminder compared with no reminder for outpatient mental health visits.[21]

Table 2: Comparative effectiveness of reminder modes for existing appointments (Strength of Evidence: ●●●=High, ●●○=Moderate, ●○○=Low)

	Phone	Postal	Text	None
Phone	Live calls é attendance vs automated at outpt multispecialty appt: Automated calls had é no-shows (17.3 vs 13.6%, OR=1.28, 95% CI, 1.11-1.47) and ó cancellations (17.6 vs 16.9%, not significantly different)[25] ●●○ Adding an reminder call 2 weeks prior ó attendance at an HIV clinic vs calling just 3 days prior (OR=0.93, 95% CI: 0.75-1.15)[30] ●○○	Insufficient evidence from 1 small fair-quality RCT of N=75 in Reda 2012 SR[21]	ó/ê Attendance for text: ó attendance in 3 Asian RCTs from 2006-2008 (N=2509, RR=0.99, 95% CI 0.95-1.02)[2] and ó no-show for Swiss substance abuse clinic in 2013 RCT (OR=1.0, 95% CI 0.7-1.3)[24], but ê no-show for phones in Swiss primary care in 2013 (OR=0.8, 95% CI, 0.7-1.0)[24] ●○○ ê Cost: 55% to 65% lower for text than cost per call reminder in 2 Asian studies from 2006-2008[2] and total costs (230 vs 8,910 euros) in 2013 Swiss RCT[24] ●○○ ó Satisfaction: ó % patients rates as useful: 98.4% vs 98% in primary care and 88% vs 86% in substance abuse clinic[24] ●○○	ó Nonattendance at outpatient mental health apt: RR=0.84, 0.66-1.07[21] ●●○ Reminder calls ê no-shows, but é cancellations at outpatient multispecialty appt[25] ●○○ No call vs automated call: no-shows=23.1 vs 17.3%, OR=1.52, 1.34-1.71; cancellations=14.5 vs 17.6%, p=.0001 No call vs manual call: no-shows=23.1 vs 13.6%, OR=1.93, 1.69-2.19; cancellations=14.5 vs 16.9%, p=.003
Postal	NA	Insufficient evidence from 1 small fair-quality RCT of N=120 in Reda 2012 SR[21]	Insufficient evidence from 1 small fair-quality non-RCT of N=301 in Free 2013 SR[15]	ó Nonattendance at outpatient mental health appt: 26% vs 32%; RR=0.76 (95% CI, 0.43-1.32) in 3 RCTs (N=326) in Reda 2012 SR[21] ●○○ Nonattendance at various appointments: Insufficient evidence from SR of 6 RCTs and 1 historically-controlled cohort (N= 6,621) from Stubbs 2012 SR[22]
Text	NA	NA	No evidence	é/ê attendance; RR=1.06, (1.05-1.07) to OR=1.48 (1.33-1.72) at varied appts (●●○)[2,15,17], but é no-show none vs SMS at physical therapy appt (16 vs 11%; OR=1.61, 1.03-2.51; NNT=19, 9-275)[26] (●○○)

é=Increased; ê=Decreased; ó=No differences; Abbreviations: CI=confidence interval; NNT=number needed to treat; OR=odds ratio; RCT=randomized controlled trial; RR= risk ratio; SR=systematic review

C. Facility characteristics

One systematic review concluded that the effectiveness of text message reminders in increasing appointment attendance did not differ based on variation in clinic type (primary care vs hospital outpatient clinics).[17] But the strength of the evidence is unclear as the review provided insufficient detail to evaluate how variation in primary study quality may have affected outcomes or the precision of the estimates.

SUMMARY AND DISCUSSION

We only identified 2 studies that compared different methods of scheduling established patients for follow-up visits. The more relevant of the 2 studies provided limited evidence that use of a recall reminder scheduling system can decrease the rate of missed appointments by 7 percentage points compared to '365 scheduling' in elderly Veterans seen in the Miami VA Geriatric Clinic in fiscal year 2006. However, the study provided no information about the time and resource impact of the recall reminder system or its engineering characteristics (*eg*, methods for managing recall delinquencies, letter content, etc), or the specific circumstances and practices of the medical center in which the study was performed.

Studies that compared appointment reminder methods suggest that ACAP should explore the use of live telephone reminders and text message reminders as an alternative to the current postal reminders. Live telephone reminders decreased no-shows by 4 percentage points compared with automatic phone reminders in non-VA multispecialty clinics. Compared to live telephone reminders, text messaging resulted in similar to borderline higher no-shows and similar satisfaction, but had the benefit of decreasing costs. However, these studies provided no information about the scheduling method used or whether patients were new or established. The independent effect of the Recall Reminder scheduling versus the appointment reminder components remain unknown, because studies only evaluated the comparative effectiveness of *either* the scheduling component *or* the reminder component, without accounting for their potential interaction.

LIMITATIONS

The main methodological limitation of this evidence brief is that because of the shortened timeframe our strength of evidence ratings were limited for lower-priority evidence that (a) focused on scheduling *new* patients for *initial* visits rather than scheduling follow-up visits for established appointments or (b) focused only on the appointment reminder component, regardless of how the appointment got scheduled (*see eligibility criteria*). However, because the findings from the lower-priority evidence are less relevant, we do not think this limitation would affect our overall conclusions.

There are 3 main gaps in the published literature. First, it has not evaluated the effect of alternatives on a complete set of related system outcomes: no-show rates, backlog, call center waiting time, administrative burden, and patient satisfaction. Second, published literature has not evaluated policy options such as:

1) *More flexibility.* This option could give clinicians and patients a choice of recall reminder or scheduling a future appointment >90 days, more options for mode and threshold of notification, and the option to contact a dedicated phone line in the pertinent clinic versus a general call center number with redirection to specific clinics.

2) *Adaptation to local circumstances.* This option may involve using a different cutoff than 90 days depending on a facility's backlog of new patients, call center hold time, or the patient population.

Third, we were not able to distinguish the effect of the scheduling component versus the reminder component of the Recall Reminder system, because studies only evaluated *either* the

scheduling component *or* the reminder component, without accounting for their potential interaction.

FUTURE RESEARCH

The Recall Reminder procedure is part of a complex system that affects or is affected by the clinic backlog, the call center, and other parts of clinic administration. Previous research has focused narrowly on the no-show rate and a few other outcomes, missing, for example, the effect of burdening the call system or of patients' satisfaction with scheduling.

A VA quality improvement initiative is currently underway evaluating the effectiveness of various Recall Reminder approaches across 6 pilot sites and comparing sequence and timing of reminder postcards and calls and the '365 scheduling approach' of allowing Veterans to schedule appointments up to a year in advance before leaving the office.

A systems approach to designing research would provide a clearer picture of the relationship between inputs, changes, and effects (outputs) of the system and could make it easier to measure or predict the effect of introducing incremental changes or adaptations to local circumstances (Table 3). In conjunction with a data collection system plan, a subset of VA centers could be encouraged to identify variations that might work better for their centers, and flexible, rapid experimental research on the effectiveness of these changes given different inputs could be developed. Eventually, the VA could develop a comprehensive and validated agent-based model to simulate, and reduce the need for, experiments by helping to predict the possible impact of changes and tweaks to the RR system.

Table 3: Potential systems approach research design for evaluating the Recall Reminder system

Inputs (*May influence the effects of changes to the system*)	Changes (*Changes that a facility might make to the current system*)	Effects
· Administrative characteristics (*eg*, current backlog of patients waiting for primary care, call waiting time, rate of misdirected calls, staffing levels) · Population characteristics (*eg*, cell phone use, homelessness, proximity to facilities, etc)	· Cutoff for recall reminder (90 days, 120 days, etc) · Flexible approach to recall (option for patient or clinician to schedule out longer) · Flexible notification mode (*eg*, patient chooses email, phone, postcard) · 365 scheduling	· Missed appointment rate · Backlog · Call center wait time · Administrative burden · Patient satisfaction

To inform this approach, we recommend also systematically collecting data directly from patients regarding the reliability of their transportation, scheduling preferences, satisfaction with appointment characteristics (*eg*, date, time, and provider), perceptions of purpose and need of appointment, relationship with provider, and other factors that have been found to predict missed opportunities. To address unanswered questions about other potential effect modifiers, we also recommend evaluating the impact of variation in system and provider factors, particularly clinic backlog level.

As VA data has shown that forgetfulness is the top reason for missed appointments, more study is needed to isolate the added value of different types of appointment reminders when combined with using a recall reminder system to schedule follow-up appointments closer to the date they are needed. More study is also needed on the impact of variation in recall reminder scheduling system design, such as whether there are differences between using postal, phone, or text message reminders to contact Veterans or whether there are differences in contacting Veterans one day, one week, one month, or longer before the needed appointment. A factorial designed study could isolate both how much of the benefit of a recall reminder system versus 365 scheduling may be due to scheduling the appointment just in time versus the type of appointment reminder used and variation in the recall reminder system design. For example, a potential design could involve comparison of 3 types of scheduling approaches (*ie*, 365 scheduling, recall reminder scheduling by postcard, recall reminder scheduling by phone) and 2 types of reminders (*ie*, letter, phone), for a total of 6 treatment combinations: (1) 365 scheduling plus postal reminder, (2) 365 scheduling plus phone reminder, (3) recall reminder scheduling by postcard plus letter reminder, (4) recall reminder scheduling by postcard plus phone reminder, (5) recall reminder scheduling by phone plus letter reminder, and (6) recall reminder scheduling by phone plus phone reminder.

Additionally, the VA may consider exploring more targeted use of established patients' follow-up appointment scheduling procedures depending on the no-show probability of individual patients as determined based on a validated prediction model. NIRMO and other VA studies have primarily suggested and evaluated use of no-show modeling to inform targeting of reminder calls and improvement of clinic efficiency through selective overbooking strategies.[33,34] However, the VA could consider piloting a study where a patient's method of follow-up appointment scheduling could be tailored based on no-show probability. For example, the Veterans with the lowest no-show probability could be offered the least labor-intensive option of 365 scheduling and Veterans with the highest-risk of no-show could be mandated for more intense scheduling approaches.

CONCLUSIONS

We found published literature to be of very little help in deciding whether to keep, modify, or replace the current Class I VHA recall reminder software. Published studies provided limited evidence that use of a recall reminder scheduling system can decrease the rate of missed appointments by 7 percentage points compared to '365 scheduling' in elderly Veterans, but without also evaluating resource use or the impact on backlog. Once appointments are scheduled, evidence also suggests that ACAP consider exploring use of live telephone reminders and text message reminders as an alternative to the current postal reminders to reduce Veterans' forgetfulness of their appointments. However, the independent effect of the scheduling component versus the reminder component remains unknown. Directions for future VA quality improvement initiatives include evaluation of (1) a complete set of pertinent and related system outcomes, (2) policy options of more flexibility and adaptation to local circumstances, (3) the impact of potential patient, provider and system effect modifiers, (4) the impact of variation in recall reminder scheduling system design (*ie*, how and when Veterans are contacted), (5) the independent contributions from the scheduling and reminder components, respectively, (6) the use of agent-based models to identify areas with greatest potential for change, and (7) tailoring the scheduling approach to the individual Veteran.

REFERENCES

1.   Car J, Gurol-Urganci I, de Jongh T, Vodopivec-Jamsek V, Atun R. Mobile phone messaging reminders for attendance at healthcare appointments. *Cochrane Database of Systematic Reviews.* 2012;7:CD007458.

2.   GurolUrganci I, de Jongh T, VodopivecJamsek V, Atun R, Car J. Mobile phone messaging reminders for attendance at healthcare appointments. *Cochrane Database of Systematic Reviews.* 2013(12).

3.   McLean S, Gee M, Booth A, et al. *Targeting the Use of Reminders and Notifications for Uptake by Populations (TURNUP): a systematic review and evidence synthesis.* Southampton UK: National Institute for Health Research; 2014.

4.   McMullen MJ, Netland PA. Lead time for appointment and the no-show rate in an ophthalmology clinic. *Clin Ophthalmol.* 2015;9:513-516.

5.   *Audit of Veterans Health Administration's Efforts to Reduce Unused Outpatient Appointments.* Washington, DC: Department of Veterans Affairs Office of Inspector General; 2008.

6.   VHA Directive 2010-027: VHA Outpatient Scheduling Processes and Procedures. Washington, DC; 2010.

7.   Goffman R. The Veterans Health Administration's Position Regarding Reducing Missed Opportunities. Paper presented at: Healthcare Systems Process Improvement; February 19, 2015, 2015; Orlando, FL.

8.   Higgins JP, Altman DG, Gotzsche PC, et al. The Cochrane Collaboration's tool for assessing risk of bias in randomised trials. *BMJ.* 2011;343:d5928.

9.   McDonagh MS, Jonas DE, Gartlehner G, et al. Methods for the drug effectiveness review project. *BMC Medical Research Methodology.* 2012;12:140.

10.   Robinson KA, Chou R, Berkman ND, et al. *Integrating Bodies of Evidence: Existing Systematic Reviews and Primary Studies Methods Guide for Effectiveness and Comparative Effectiveness Reviews*. Rockville, MD; 2008.

11.   Cherniack EP, Sandals L, Gillespie D, Maymi E, Aguilar E. The use of open-access scheduling for the elderly. *Journal for Healthcare Quality.* 2007;29(6):45-48.

12.   Saine PJ, Baker SM. What is the best way to schedule patient follow-up appointments? *Joint Commission Journal on Quality & Safety.* 2003;29(6):309-315.

13.   Schauman O, Aschan LE, Arias N, Beards S, Clement S. Interventions to increase initial appointment attendance in mental health services: a systematic review. *Psychiatric Services.* 2013;64(12):1249-1258.

14.   Atherton H, Sawmynaden P, Meyer B, Car J. Email for the coordination of healthcare appointments and attendance reminders. *Cochrane Database of Systematic Reviews.* 2012;8:CD007981.

15.   Free C, Phillips G, Watson L, et al. The effectiveness of mobile-health technologies to improve health care service delivery processes: a systematic review and meta-analysis. *PLoS Medicine / Public Library of Science.* 2013;10(1):e1001363.

16.   George A, Rubin G. Non-attendance in general practice: a systematic review and its implications for access to primary health care. *Family Practice.* 2003;20(2):178-184.

17.   Guy R, Hocking J, Wand H, Stott S, Ali H, Kaldor J. How effective are short message service reminders at increasing clinic attendance? A meta-analysis and systematic review. *Health Services Research.* 2012;47(2):614-632.

18.   Hasvold PE, Wootton R. Use of telephone and SMS reminders to improve attendance at hospital appointments: a systematic review. *Journal of Telemedicine & Telecare.* 2011;17(7):358-364.

19.   Liu Q, Abba K, Alejandria MM, Sinclair D, Balanag VM, Lansang MA. Reminder systems to improve patient adherence to tuberculosis clinic appointments for diagnosis and treatment. *Cochrane Database of Systematic Reviews.* 2014;11:CD006594.

20.   Macharia WM, Leon G, Rowe BH, Stephenson BJ, Haynes RB. An overview of interventions to improve compliance with appointment keeping for medical services. *JAMA.* 1992;267(13):1813-1817.

21.   Reda S, Rowett M, Makhoul S. Prompts to encourage appointment attendance for people with serious mental illness. *Cochrane Database of Systematic Reviews.* 2012(8).

22.   Stubbs ND, Geraci SA, Stephenson PL, Jones DB, Sanders S. Methods to reduce outpatient non-attendance. *American Journal of the Medical Sciences.* 2012;344(3):211-219.

23.   Junod Perron N, Dao MD, Kossovsky MP, et al. Reduction of missed appointments at an urban primary care clinic: a randomised controlled study. *BMC Family Practice.* 2010;11:79.

24.   Junod Perron N, Dao MD, Righini NC, et al. Text-messaging versus telephone reminders to reduce missed appointments in an academic primary care clinic: a randomized controlled trial. *BMC Health Services Research.* 2013;13:125.

25.   Parikh A, Gupta K, Wilson AC, Fields K, Cosgrove NM, Kostis JB. The effectiveness of outpatient appointment reminder systems in reducing no-show rates. *American Journal of Medicine.* 2010;123(6):542-548.

26.   Taylor NF, Bottrell J, Lawler K, Benjamin D. Mobile telephone short message service reminders can reduce nonattendance in physical therapy outpatient clinics: a randomized controlled trial. *Archives of Physical Medicine & Rehabilitation.* 2012;93(1):21-26.

27.   Brannan SO, Dewar C, Taggerty L, Clark S. The effect of short messaging service text on non-attendance in a general ophthalmology clinic. *Scottish Medical Journal.* 2011;56(3):148-150.

28.   Farmer T, Brook G, McSorley J, Murphy S, Mohamed A. Using short message service text reminders to reduce 'did not attend' rates in sexual health and HIV appointment clinics. *International Journal of STD & AIDS.* 2014;25(4):289-293.

29.   Haufler K, Harrington M. Using nurse-to-patient telephone calls to reduce day-of-surgery cancellations. *AORN Journal.* 2011;94(1):19-26.

30.   Henry SR, Goetz MB, Asch SM. The effect of automated telephone appointment reminders on HIV primary care no-shows by veterans. *Journal of the Association of Nurses in AIDS Care.* 2012;23(5):409-418.

31.   Perry JG. A preliminary investigation into the effect of the use of the Short Message Service (SMS) on patient attendance at an NHS Dental Access Centre in Scotland. *Primary Dental Care.* 2011;18(4):145-149.

32.   McInnes DK, Petrakis BA, Gifford AL, et al. Retaining homeless veterans in outpatient care: a pilot study of mobile phone text message appointment reminders. *American Journal of Public Health.* 2014;104 Suppl 4:S588-594.

33.   Alaeddini A, Yang K, Reddy C, Yu S. A probabilistic model for predicting the probability of no-show in hospital appointments. *Health Care Manag Sci.* 2011;14(2):146-157.

34.   Daggy J, Lawley M, Willis D, et al. Using no-show modeling to improve clinic performance. *Health Informatics J.* 2010;16(4):246-259.