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SCIENTIFIC INVESTIGATIONS

Veterans Health Administration TeleSleep Enterprise-Wide Initiative 2017–2020: bringing sleep care to our nation's veterans

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Study Objectives: The Veterans Health Administration cares for many veterans with sleep disorders who live in rural areas. The Veterans Health Administration's Office of Rural Health funded the TeleSleep Enterprise-Wide Initiative (EWI) to improve access to sleep care for rural veterans through creation of national telehealth networks.

Methods: The TeleSleep EWI consists of (1) virtual synchronous care, (2) home sleep apnea testing, and (3) REVAMP (Remote Veterans Apnea Management Platform), a patient- and provider-facing web application that enabled veterans to actively engage with their sleep care and sleep care team. The TeleSleep EWI was designed as a hub-and-spoke model, where larger sites with established sleep centers care for smaller, rural sites with a shortage of providers. Structured formative evaluation for the TeleSleep EWI is supported by the Veterans Health Administration's Quality Enhancement Research Initiative and was critical in assessing outcomes and effectiveness of the program.

Results: The TeleSleep EWI launched with 7 hubs and 34 spokes (2017) and rapidly expanded to 13 hubs and 63 spokes (2020). The TeleSleep EWI resulted in a significant increase in rural veterans accessing sleep care by utilizing home sleep apnea testing to establish a diagnosis of obstructive sleep apnea and virtual care for follow-up. Rates of virtual care utilization were greater in hubs and spokes participating in the TeleSleep EWI compared with non-EWI sleep programs. Additionally, veterans expressed satisfaction with their virtual care TeleSleep experiences.

Conclusions: The TeleSleep EWI successfully increased sleep care access for rural veterans, promoted adoption of virtual care services, and resulted in high patient satisfaction.

Keywords: telehealth, sleep, rural, Veterans Administration

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BRIEF SUMMARY

Current Knowledge/Study Rationale: Sleep disorders are highly prevalent among veterans, but rural veterans face a geographic disparity in access to sleep care. The Veterans Health Administration Office of Rural Health funded the TeleSleep Enterprise-Wide Initiative to increase access to sleep care to rural veterans by partnering well-resourced sites with rural facilities lacking sufficient sleep specialists.

Study Impact: The TeleSleep Enterprise-Wide Initiative led to a significant increase in rural veterans accessing sleep care by utilizing home sleep apnea testing to establish a diagnosis of sleep apnea and virtual care for follow-up. Rates of virtual care utilization were greater in hubs and spokes participating in the TeleSleep Enterprise-Wide Initiative compared with non–Enterprise-Wide Initiative Veterans Health Administration sleep programs. Additionally, veterans expressed high satisfaction with their virtual care TeleSleep experiences.

INTRODUCTION

The coronavirus disease 2019 (COVID-19) pandemic forced health care systems to rapidly shift from largely in-person to virtual care. Temporary waivers and policies adopted to support this shift have enabled virtual care programs to become more established. However, questions regarding whether virtual care is equivalent to in-person care and whether existing infrastructure can support long-term sustainment still need to be answered. Therefore, there is a need for specialties and health care systems already employing telehealth to deliver remote care to share their pragmatic experience through program descriptions, evaluations, and observational studies as well as through structured clinical trials.

In 2017, the Veterans Health Administration's (VHA) Office of Rural Health (ORH) funded an Enterprise-Wide Initiative (EWI) to develop and implement a National TeleSleep program, designed to address the growing demand for sleep services and to improve access to sleep care for rural veterans.[1] Rural veterans comprise a large segment of veterans who receive sleep specialty care through the United States Department of Veterans Affairs (VA). However, access to sleep care is disproportionately limited for rural veterans.

The VA National TeleSleep EWI is composed of 3 components: (1) virtual synchronous care, (2) home sleep apnea testing (HSAT, asynchronous telehealth), and (3) REVAMP (Remote Veterans Apnea Management Platform), a patient- and provider-facing web application that enabled veterans to actively engage with their sleep-care team by completing standardized questionnaires, communicating through secure messaging with providers, and providing veterans access to their own positive airway pressure (PAP) and sleep questionnaire data and trends over time (Figure 1). All 3 of these components contribute to the cross-cutting goals of streamlining the diagnosis and treatment of obstructive sleep apnea (OSA), enhancing patient experience, and improving access for sleep care among rural veterans.

The VA TeleSleep project evaluates and reports outcomes important to the organization. These metrics include data on (1) access to sleep care in rural areas, (2) utilization of HSAT, and (3) sleep referrals to the community (resulting in increased cost to the VHA and fragmented care for veterans).

We reported previously on the inception and initial implementation of this program, describing the need for a national network of telehealth-based programs within the VA to meet the rising demand for sleep care while adapting to evolving care-delivery strategies being driven at the national level.[1]

This paper provides an update on the program's progress since its inception in April 2017 through September 2020.
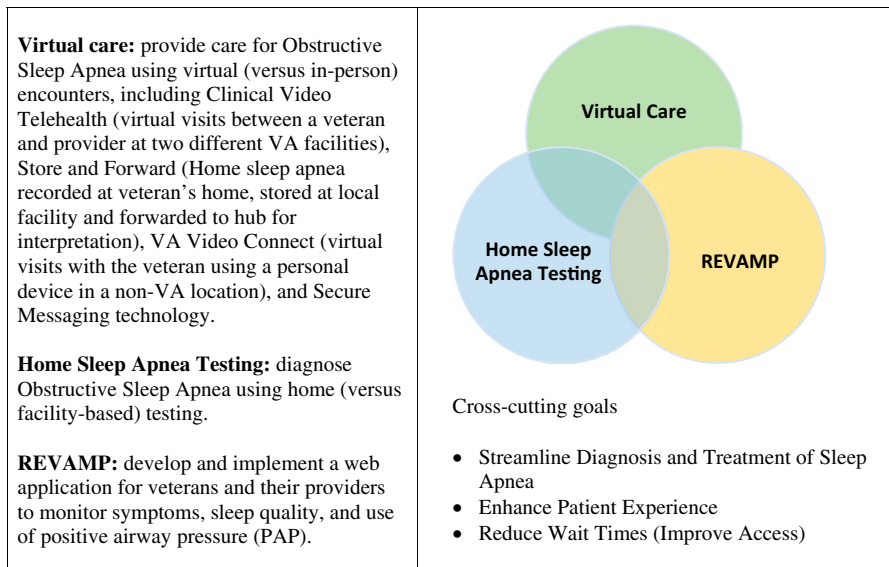
METHODS

Implementation

The VA National TeleSleep EWI utilizes a "hub and spoke" model for the deployment of virtual care services to rural veterans. In 2017, a national call was made for VA organizations to participate as either a hub or a spoke. Selection of both hubs and spokes was based on standardized eligibility criteria and interviews to ensure successful engagement. The hubs were urban VA medical centers with established VA sleep medicine programs that had the required infrastructure and expertise to provide spoke sites with reasonably rapid access to virtual sleep services through HSAT, asynchronous store-and-forward sleep-study interpretation, clinical video teleconferencing (virtual visits between a veteran and provider at 2 different VA facilities), VA video connect (virtual visits with the veteran using a personal device in a non-VA location), electronic consults, secure messaging, and remote monitoring of PAP therapeutic devices. The spokes were community-based outpatient clinics and VA medical centers with limited sleep services that served high percentages of rural veterans (ie, at least 50% of enrolled veterans at that facility lived in a rural or highly rural area).

An in-person TeleSleep EWI meeting was held in 2017 to provide standardized training for all participating sites.

HSAT

When the TeleSleep EWI was initiated, traditional in-laboratory polysomnography (PSG) was the standard of care for the diagnosis of OSA within the VHA. HSAT was much less prevalent due

Figure 1—Components of the VA TeleSleep EWI.

Virtual care: provide care for Obstructive Sleep Apnea using virtual (versus in-person) encounters, including Clinical Video Telehealth (virtual visits between a veteran and provider at two different VA facilities), Store and Forward (Home sleep apnea recorded at veteran's home, stored at local facility and forwarded to hub for interpretation), VA Video Connect (virtual visits with the veteran using a personal device in a non-VA location), and Secure Messaging technology.

Home Sleep Apnea Testing: diagnose Obstructive Sleep Apnea using home (versus facility-based) testing.

REVAMP: develop and implement a web application for veterans and their providers to monitor symptoms, sleep quality, and use of positive airway pressure (PAP).

Cross-cutting goals

- Streamline Diagnosis and Treatment of Sleep Apnea
- Enhance Patient Experience
- Reduce Wait Times (Improve Access)

EWI = Enterprise-Wide Initiative, REVAMP = Remote Veterans Apnea Management Platform, VA = United States Department of Veterans Affairs.

to providers' inexperience with devices and lack of devices at some sites. Increasing HSAT was a core activity of the TeleSleep EWI to increase access and reduce wait times for testing and to improve patients' experience by reducing veterans' travel and wait time for testing. The shift to HSAT was facilitated by the purchase of HSAT monitors to be distributed across the VHA. Facilities with longer patient wait times were prioritized for receipt of equipment.

A multichannel communication approach was developed to inform sleep medicine programs of the ability to obtain equipment, supplies, and training. First, emails were sent to clinical leaders informing them of the availability of equipment and supplies, followed by quarterly sleep medicine newsletters and a monthly webinar series to inform and educate participants in sleep medicine programs on the setup, management, and optimization of an HSAT program. Toolkits were developed to help sites start or expand HSAT programs between hubs and spokes.

Virtual care

The TeleSleep EWI trained clinicians and nonclinicians in the delivery of sleep telemedicine across the hubs and spokes. This included computer-based VHA telemedicine training as well as TeleSleep community of practice webinars and REVAMP training.

REVAMP

REVAMP is a web application developed within the VHA. It enables comprehensive telehealth care of veterans referred for sleep apnea evaluation by allowing veterans to communicate with their sleep care team directly via secure messaging, receive care at their home if preferred, and view their own PAP data.

Evaluation

All ORH EWIs, including TeleSleep, were required to partner with one of VHA's Quality Enhancement Research Initiative programs for programmatic evaluation. The TeleSleep EWI partnered with the San Francisco VA-based Measurement Science Quality Enhancement Research Initiative for this requirement. The evaluation was structured using the REAIM (reach, effectiveness, adoption, implementation, maintenance) framework (**Table S1** in the supplemental material).[2,3,10] Quantitative metrics were obtained from the VA Corporate Data Warehouse, a clinical database that contains information about all veterans who receive care at VHA facilities. Specific metrics included the number and characteristics of veterans who received sleep care at either a hub or spoke facility. Additional measures were also tracked at each hub and spoke, including (1) the number of veterans tested for OSA with HSAT and PSG; (2) the number of veterans diagnosed with OSA; (3) wait times at the hub facility; (4) volume of care delivered using telehealth vs in person; and (5) the number of veterans enrolled, evaluated, and monitored for OSA through REVAMP. Each of the 3 TeleSleep components—virtual care, HSAT, and REVAMP—was evaluated independently using relevant metrics, followed by a program-wide assessment of elements necessary to sustain all 3.

Tracking sleep care in terms of veterans served and encounters required using ICD-10-CM (*International Classification of Disease and Related Health Problems, 10th Revision, Clinical Modification*) codes (E66.2, G47.30, G47.31, G47.33, G47.34, G47.36, G47.37, G47.39, or R06.81), Current Procedural Terminology codes (95800, 95801, 95806, G0398, G0399, G0400, 95807, 95808, 95810, 95811, or 94660), and stop codes that are specialty descriptors specific to the VHA (143 or 349). The type of visit was also tracked. The VA Corporate Data Warehouse is likely to contain some errors, as do all electronic medical record systems. Site-specific numbers generated from the database were reviewed quarterly with all sites in an attempt to identify and correct basic errors.

Hub-specific measures were also tracked to evaluate whether partnering with spoke sites had any unintended negative consequences, such as reducing access to care or increasing wait times at the hub by diverting resources to a spoke. Additionally, while the immediate focus of the TeleSleep EWI was to improve access to high-quality sleep care for rural veterans at program sites, the evaluation team considered its broader impact on sleep care throughout the VA by examining whether the development and dissemination of resources (eg, toolkits, communications, webinars, and centralized resourcing of HSAT devices) improved care at sites not funded by the ORH TeleSleep program. Thus, some metrics were compared between funded and non-funded sites to understand the impact of this implementation and dissemination strategy and the ORH investment.

Each patient's residential address was classified as urban or rural based on Rural-Urban Commuting Area codes. Rural-Urban Commuting Area codes are US Census tract-based classifications that utilize the standard Bureau of Census Urbanized Area and Urban Cluster definitions.[4]

The program evaluation included qualitative analyses of semistructured phone interviews with veterans who accessed sleep medicine services. Each hub/spoke referred patients for interviews. The interview questions and probes covered 7 domains: experience with sleep problems, referral process, experience with sleep testing and TeleSleep, ongoing treatment and management, experience with community care, recommendations for improvement, and overall satisfaction. All interviews were recorded and transcribed by the VA transcription service. An initial code book was created based on these domains and then refined after evaluation staff double-coded 3 randomly selected transcripts and presented the codes to project leadership and interviewers for input. Then, all remaining transcripts were coded and illustrative, anonymized quotes were selected for each theme. The themes and quotes were shared with the large project group including representatives of hubs and spokes for feedback and validation before they were included in the annual program evaluation. Coding and analyses were conducted using Microsoft Excel (Microsoft Corp., Redmond, Washington) and Dedoose.

RESULTS

Virtual care

The TeleSleep EWI expanded from 7 hubs and 34 spokes in fiscal year 2017 (FY17) (**Figure 2A**) to support partnerships

**Figure 2**—Hubs and spokes of the ORH EWI program.
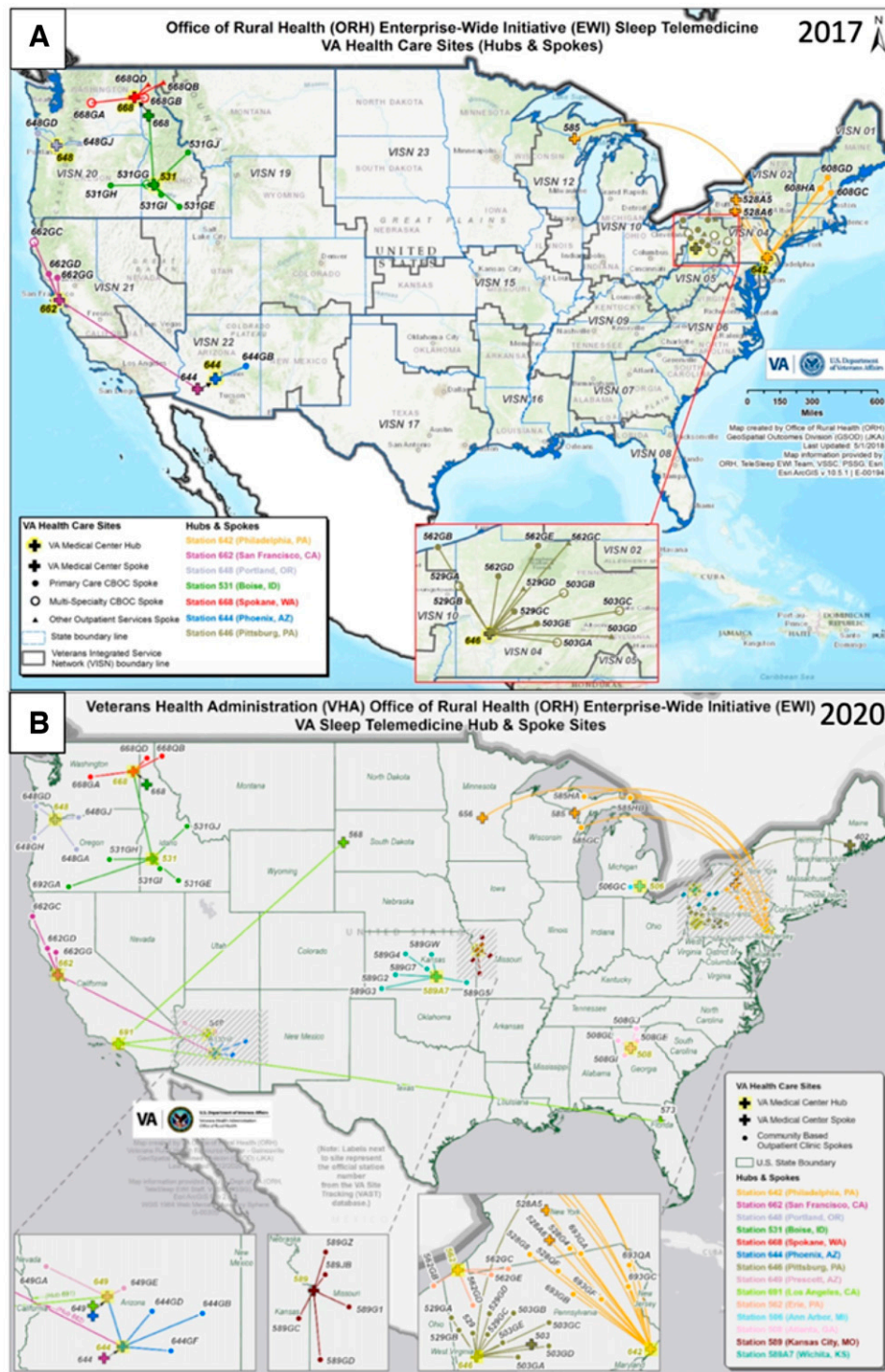
The TeleSleep EWI expanded from 7 hubs and 34 spokes in fiscal year 2017 **(A)** to support partnerships among 13 VA hubs and 63 spokes in fiscal year 2020 **(B)**. EWI = Enterprise-Wide Initiative, ORH = Office of Rural Health, VA = United States Department of Veterans Affairs, VHA = Veterans Health Association.

among 13 VA hubs and 63 spokes in FY20 (**Figure 2B**), caring for rural veterans who otherwise would have limited or no access to sleep services. The long-term goal of the TeleSleep EWI is not to financially support hub and spoke sites in the program indefinitely. Instead, the program enables hub sites to help spoke sites establish or expand the sleep medicine services they provide to veterans. In FY20 a large hub/spoke site was able to transition to permanent VA regional funding. A total of 118 clinicians and 29 nonclinicians received individual training in the delivery of sleep telemedicine across the hubs and

Figure 3—Number of sleep encounters and unique veterans served among rural veterans **(A)** and all veterans **(B)** through the EWI.
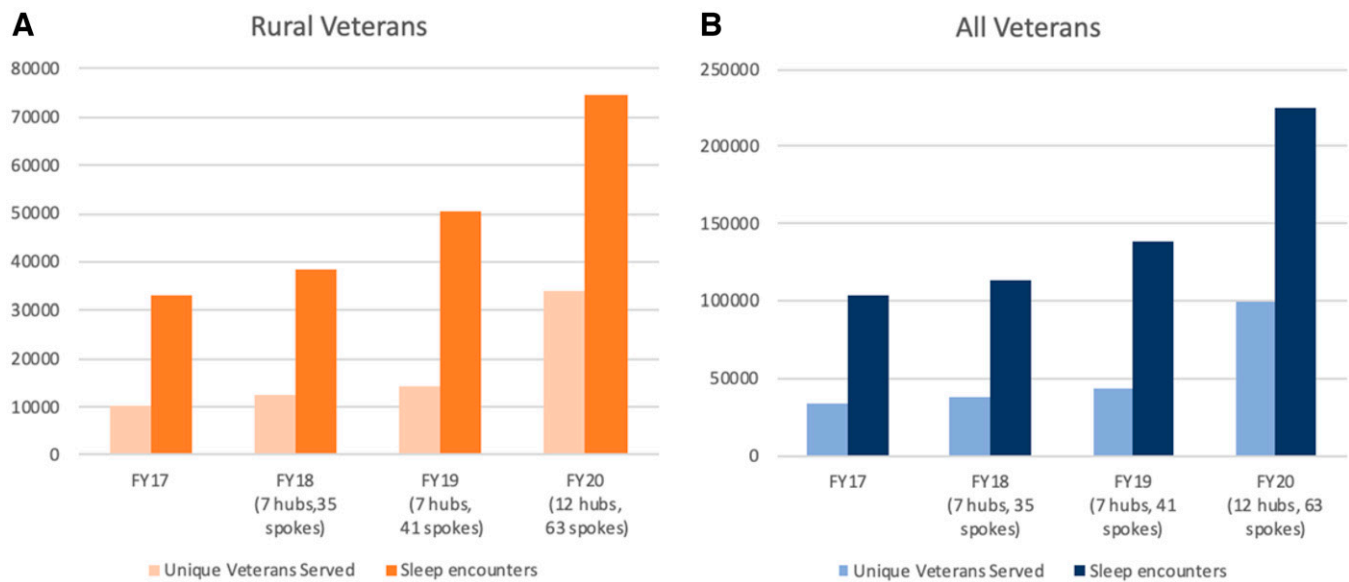
EWI = Enterprise-Wide Initiative, FY = fiscal year.

spokes. In addition, 268 VA staff members attended TeleSleep community of practice webinars and 363 attended REVAMP training.

Between 2017 and 2020, the total number of veterans receiving sleep care at the EWI sites increased from 33,725 to 98,868, and the number of sleep encounters (evaluation/management visits or sleep test procedures) more than doubled from 103,129 to 225,175. Increases of similar magnitude were observed among rural veterans. The number of unique rural veterans served by the program more than tripled from 10,702 to 33,743, and the number of sleep encounters (visits or procedures) among rural veterans more than doubled from 32,894 to 74,458 (**Figure 3**). An increase in total sleep encounters and unique veterans served was observed nationally as well.

Among veterans who had sleep encounters at the TeleSleep EWI sites in FY20 (October 1, 2019 to September 30, 2020), 29% had in-person visits only, 41% had virtual visits only, and 30% had both virtual and in-person visits. In contrast, at non-EWI sites, 37% of veterans had in-person visits only, 37% had virtual visits only, and 26% had both. During FY20 71% of veterans (up from 47% in FY18) at the TeleSleep hubs or spokes had at least 1 virtual sleep visit. This was significantly higher than the non-EWI sites, where only 63% of veterans (up from 27% in FY18) had virtual visits. However, relative increases (compared with FY18) were similar at EWI and non-EWI sites. Likewise, although the proportion of veterans who had no virtual visits in FY20 was lower at EWI compared with non-EWI sites (29% vs 37%), relative decreases (compared with FY18) were similar (**Figure 4**).

The number of veterans diagnosed with OSA increased by 33% from 1,003,015 in FY17 to 1,333,134 in FY20. The corresponding overall prevalence rate of OSA in VHA increased

from 17 to 22% (**Figure 5**). A total of 21% (268,004/1,306,436) of the veterans who received care at the 13 hubs and 63 spokes during FY20 had a diagnosis of OSA. Point prevalence of OSA across FY17 through FY20 is listed in **Table 1**.
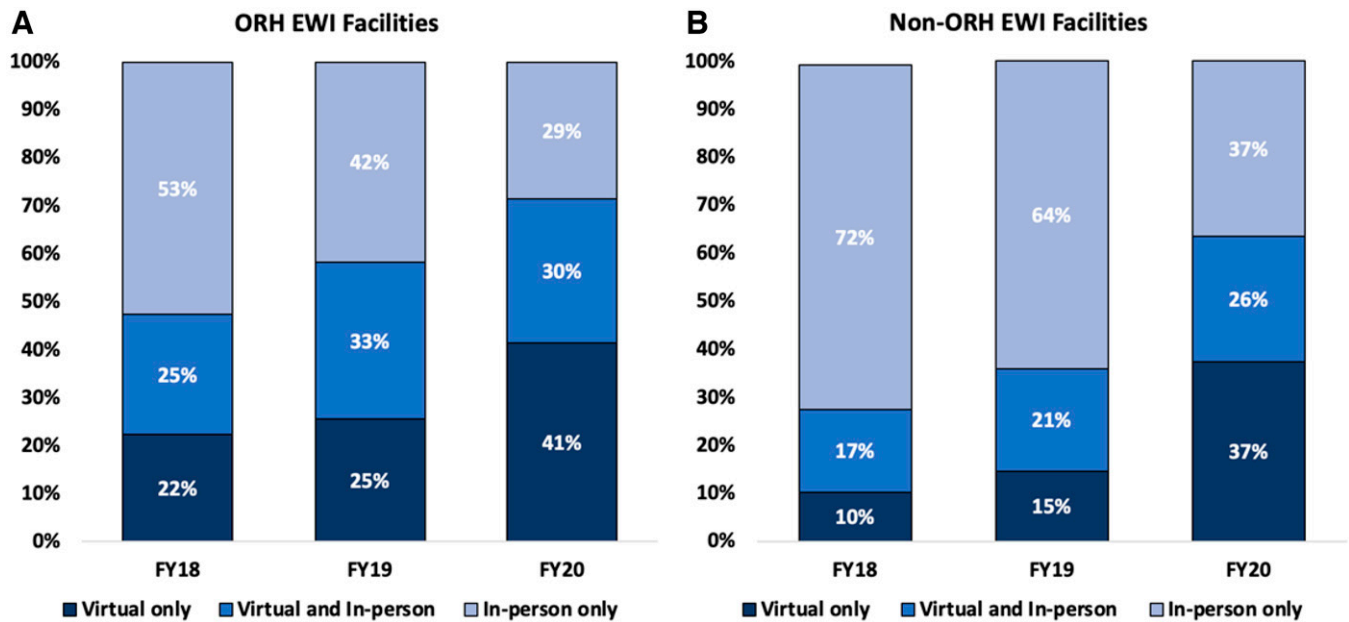
HSAT

Expansion of HSAT programs has been a national priority of the VA's Sleep Medicine Program Office to address backlogged sleep testing given that many veterans are at high risk for OSA.[5] Veterans referred for suspected sleep apnea meet high-risk criteria, given that 90% are male, average age is 59.5 years, average body mass index is 31.75, and the overall prevalence of comorbid associated diseases (eg, hypertension, diabetes, and cardiovascular and cerebrovascular disease) is high.

Prior work in assessing barriers to starting or expanding HSAT programs pointed to several critical problems including (1) lack of funding to purchase recorders, (2) lack of providers to interpret studies, and (3) lack of understanding and assistance in implementing programs. The ORH TeleSleep program spearheaded efforts to address these challenges by (1) establishing a centralized procurement process for HSAT devices with funding provided by ORH (and later the VA Office of Connected Care Telehealth Services), (2) partnering sites without sleep providers (spokes) with sites that could support this specific service (hubs), and (3) creating implementation toolkits shared both with ORH-funded and nonfunded sites (process maps, coding guidance, webinar education, and one-to-one meetings).

From 2017 to 2020, 2,231 NoxT3 respiratory sleep monitors/ recorders (Nox Medical Global, Reykjavik, Iceland) were distributed to 81 VA medical centers. ORH also distributed devices to non-ORH sites to assist with telehealth expansion.

Figure 4—Percent of virtual-only, combined virtual and in-person, and in-person-only visits for ORH EWI **(A)** and non-ORH EWI facilities **(B)**.

EWI = Enterprise-Wide Initiative, FY = fiscal year, ORH = Office of Rural Health.

Five of these sites had no VA sleep testing services prior to the distribution, and the rest sought to expand their HSAT programs.

The use of home sleep testing in both rural and urban veterans significantly increased from FY16 to FY20. The HSAT expansion efforts facilitated an increase in the proportion of HSAT compared to PSG at all facilities nationally (**Figure 6**). In FY16 (before TeleSleep EWI) the number of rural and overall veterans

Figure 5—Point prevalence of obstructive sleep apnea across FY17–20.

The number of veterans diagnosed with obstructive sleep apnea increased 33% from FY17 to FY20. FY = fiscal year.

who completed HSAT was 12,828 and 46,438. After 3 years of implementation efforts, these numbers increased to 17,268 and 63,873 by FY20. Only sites that received recorders demonstrated reductions in the use of PSG, both in rural and all veterans (**Figure 6A** and **Figure 6C**). In contrast, the number of PSGs remained flat at sites that did not receive HSAT recorders.

It should be noted, however, that the overall number of sleep tests conducted in FY20 was reduced due to the impact of COVID-19. During this time, VA sleep programs were instructed to close sleep testing because titration studies are an aerosolizing procedure, to conserve personal protective equipment and to enable realignment of staff to other critical roles supporting COVID-19 efforts. Nonetheless, 17,268 rural veterans underwent HSAT nationally in FY20. Among the 31,970 veterans who had sleep testing in FY20 at 1 of the 54 VA facilities that received HSAT recorders in FY18, 21,401 (67%) completed HSAT and 11,612 (36%) completed in-person PSGs, and 3% of veterans completed both. Among the 62,339 veterans who had sleep testing at VA facilities that did not receive HSAT recorders, 42,472 (68%) completed HSAT and 21,842 (35%) completed PSG, and 3% of veterans completed both.

At the TeleSleep EWI sites, 21,401 (including 6,019 rural) veterans underwent HSATs and only 11,612 (including 2,768 rural) veterans underwent PSGs during FY20. Nationally, between 2016 and 2020 the number of veterans tested for OSA by HSAT increased by 35% (from 12,828 to 17,268) among rural veterans and by 38% (from 46,438 to 63,873) among all veterans. Likewise, the number tested by PSG decreased by 51% (from 20,807 to 10,133) among rural veterans and by 45% (from 61,228 to 33,454) among all veterans. Although HSAT
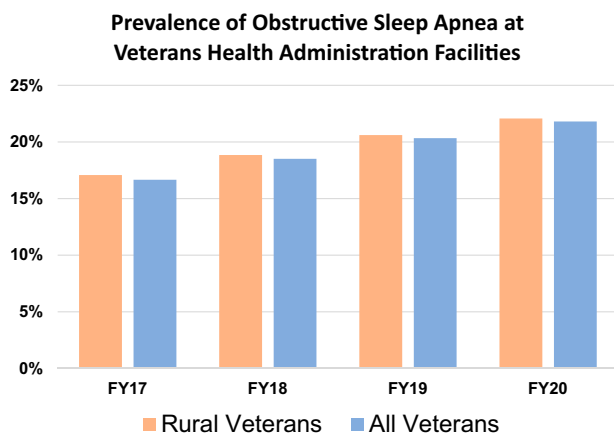
Table 1—Point prevalence of OSA in the VA nationally.

Fiscal Year (FY)	Rural Veterans			All Veterans		
	Unique Veterans with 1 or More VA Encounters During FY	Unique Veterans with Diagnosis of OSA	Prevalence	Unique Veterans with 1 or More VA Encounters During FY	Unique Veterans with Diagnosis of OSA	Prevalence
FY17	2,067,228	352,978	17%	6,021,388	1,003,015	17%
FY18	2,079,645	391,829	19%	6,099,078	1,128,797	19%
FY19	2,098,358	432,419	21%	6,195,321	1,259,577	20%
FY20	2,055,285	453,575	22%	6,113,788	1,333,134	22%

Point prevalence of obstructive sleep apnea in the VA nationally, FY17–FY20. OSA is defined as 1 inpatient or outpatient ICD-10 code (E66.2, G47.30, G47.31, G47.33, G47.34, G47.36, G47.37, G47.39, or R06.81) recorded in the electronic health record during the current or prior fiscal year. OSA = obstructive sleep apnea, VA = United States Department of Veterans Affairs.

Figure 6—Use of HSAT vs PSG at VA sites that did and did not receive ORH recorders.
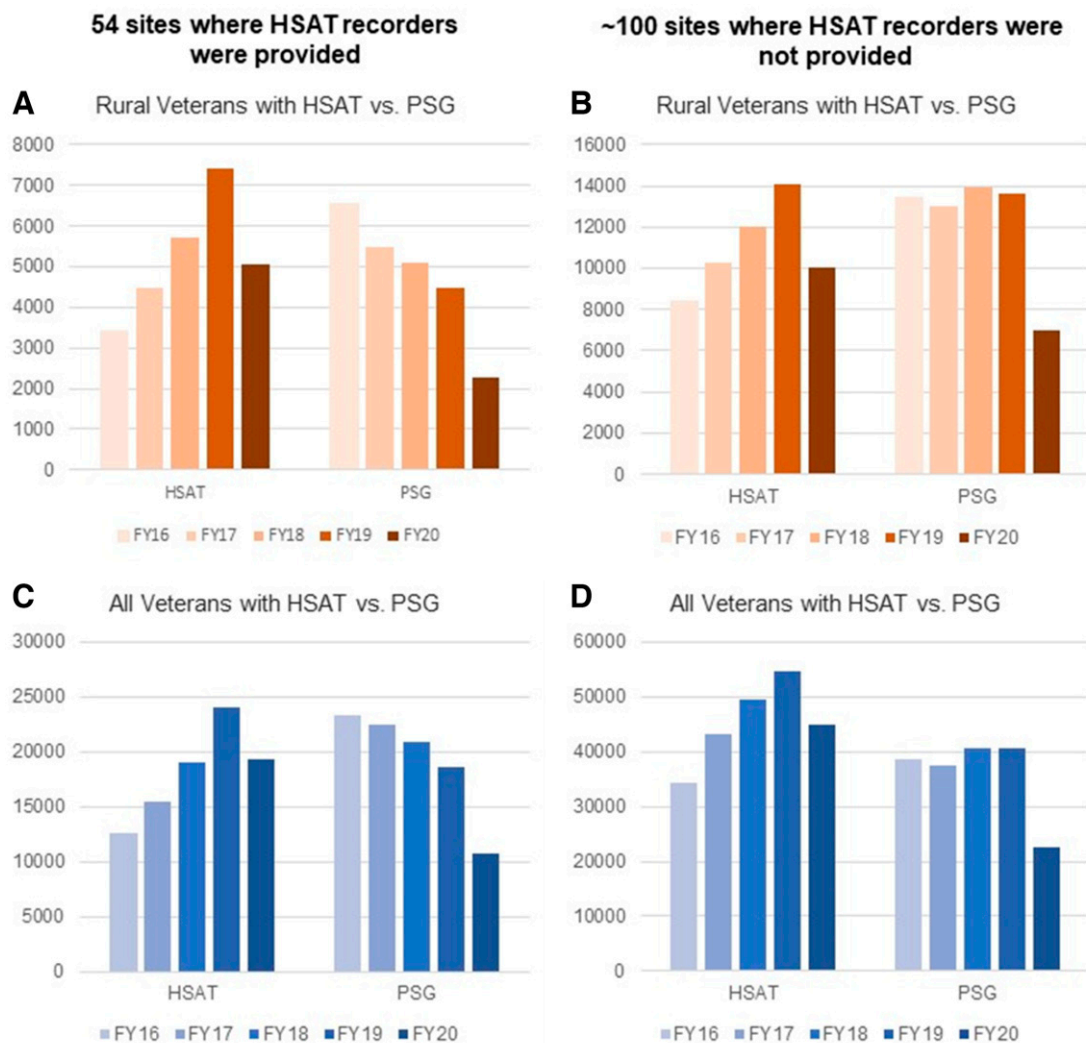
The ORH EWI facilitated the increase of HSAT and decreased the use of PSGs at ORH-funded sites. EWI = Enterprise-Wide Initiative, FY = fiscal year, HSAT = home sleep apnea testing, ORH = Office of Rural Health, PSG = polysomnography, VA = United States Department of Veterans Affairs.

numbers increased and PSGs decreased across the VA, sites that had received HSAT recorders from the EWI had a higher rate of HSAT increase.

REVAMP

REVAMP was rolled out to 63 VA facilities from 2017 through 2020.[6] From 2018 through 2020, 980 providers from 63 sites participated in REVAMP training, and 567 VA practitioners logged onto REVAMP. The number of veterans who logged onto REVAMP, completed questionnaires, and accessed PAP data markedly increased during 2020 after the onset of the pandemic. In total, 39,043 veterans were enrolled in REVAMP by their providers (a 466% increase from 2019), 6,799 veterans logged onto REVAMP (a 200% increase from 2019), 4,541 veterans completed sleep-quality questionnaires (a 175% increase from 2019), and 3,050 accessed their PAP data (a 185% increase from 2019). Cumulatively, since 2018, 47,422 veterans have been enrolled in REVAMP by their providers, 19,180 rural veterans were enrolled in REVAMP by their providers, 10,191 veterans logged into REVAMP, 7,129 veterans completed REVAMP questionnaires, 4,700 veterans (14% of enrolled PAP users) viewed their PAP data on REVAMP, and 3,890,816 patient nights of sleep were logged (as of August 31, 2020).

Impact on access at participating hubs

The impact of hub–spoke partnerships on wait times at the hub facility was tracked to evaluate whether the partnership created access at the spoke facility without diverting resources and impeding access at the hub facility. Every quarter, hub-site leads reported wait times for each type of service available at their facilities (eg, home sleep testing, PSG, sleep clinics with a provider, and continuous PAP clinic with a technician). Trends were similar since inception of the program in 2017, and although PSG and HSAT volumes decreased in 2020 during the first 6 months of the pandemic overall the number of unique veterans seen increased (43,044 in FY19 vs 98,868 in FY20) as well as the total visits with veterans (138,127 in FY19 vs 225,175 in FY20). The average number of days to third next-available (TNA) sleep appointment (in-person and telehealth combined) was cut in half from 50 days at the beginning of 2020 to 25 at the end of 2020. Similarly, the average number of days to TNA sleep study reduced from 20 days at beginning of 2020 to 13 days at end of 2020 (**Figure 7**).

Patient experience

Qualitative interviews of patients were performed annually and captured various themes related to accessing VA- and community-based sleep care and veteran experiences engaging in telehealth. Thirty-two veterans from 10 hubs completed interviews; 94% were male and 81% were rural or highly rural. The mean age of the veterans interviewed was 63 years and ages ranged from 35 to 90 years. Interview transcripts were analyzed using a rapid qualitative analysis approach. This qualitative assessment captured the veterans' voices, facilitating a better understanding of the patient experience, and provided feedback that shaped the TeleSleep program. All interviews were conducted by phone by a small number of interviewers.

The content of the interviews was analyzed qualitatively and results are presented grouped by themes.

Overall, most of the veterans interviewed were positive about their experiences receiving sleep care from VA and cited the professionalism of the staff and the convenience of getting their care and devices and follow-up all in 1 place. One respondent qualified their response with "as long as the distances are not far." Another stated, "I trust it and the way everything is set up with your secure messaging. And if you really needed something, I guess there's other ways, but the whole VA thing here has really, in the past couple years, has really, really gotten so much better. So much better."

Increased accessibility

Most veterans had experience with some form of remote care for sleep. Only 3 reported that all of their visits were in-person. The most common method of engagement was video teleconferencing from a local clinic (30%), where patients traveled to their community-based clinic and interacted with their provider located at a remote VA medical center location through video chat. Several veterans had phone visits or combinations of phone and video encounters. Four veterans had done video from home, but only 2 of these were for sleep care. Four reported that planned video visits from their clinic had been cancelled due to the COVID-19 pandemic. Most reported liking video visits, particularly when they reduced travel time, though this was not unanimous. A quote from an interview: "Yeah, it's not bad. I mean, it beats having to drive about an hour and a half to go see him in-person."

Sleep care and management

Twenty-three of the interviewed veterans used continuous PAP and 2 reported using bilevel PAP. Most were aware that their continuous PAP allowed remote monitoring through modems and they had no concerns. Two reported they were not using their devices and had overall negative experiences with PAP therapy. Almost all interviewees reported no problems setting up their device. The most common issue was finding the type of mask that worked. People reported switching masks and fixing leaks. Quotes from interviews: "They did a really good orientation and training class." "It goes straight from that machine to them. I don't have to do anything, it's awesome. Because I'm lazy and I forget stuff, so I don't have to worry about doing anything."

HSAT

Forty percent of veterans interviewed had completed sleep testing by HSAT. Most patients interviewed reported no issues with home testing and said that it was a positive experience. Quote from interview: "We had an orientation and—with some other people, it was like a group orientation. And they explained how to do it and what to expect. So, it helps me when I know what's happening before it happens, so that if I have—like at one time, they said—'Well, this might happen, and that's normal.' You know what I mean? So that I wasn't flipping out. Because if I'm doing it at home, I'm not doing it with anybody, and it's at night, when I can't contact anyone, either." Test results were communicated in a wide variety of ways: phone,

Figure 7—Average number of days to third next-available sleep appointment and sleep study.
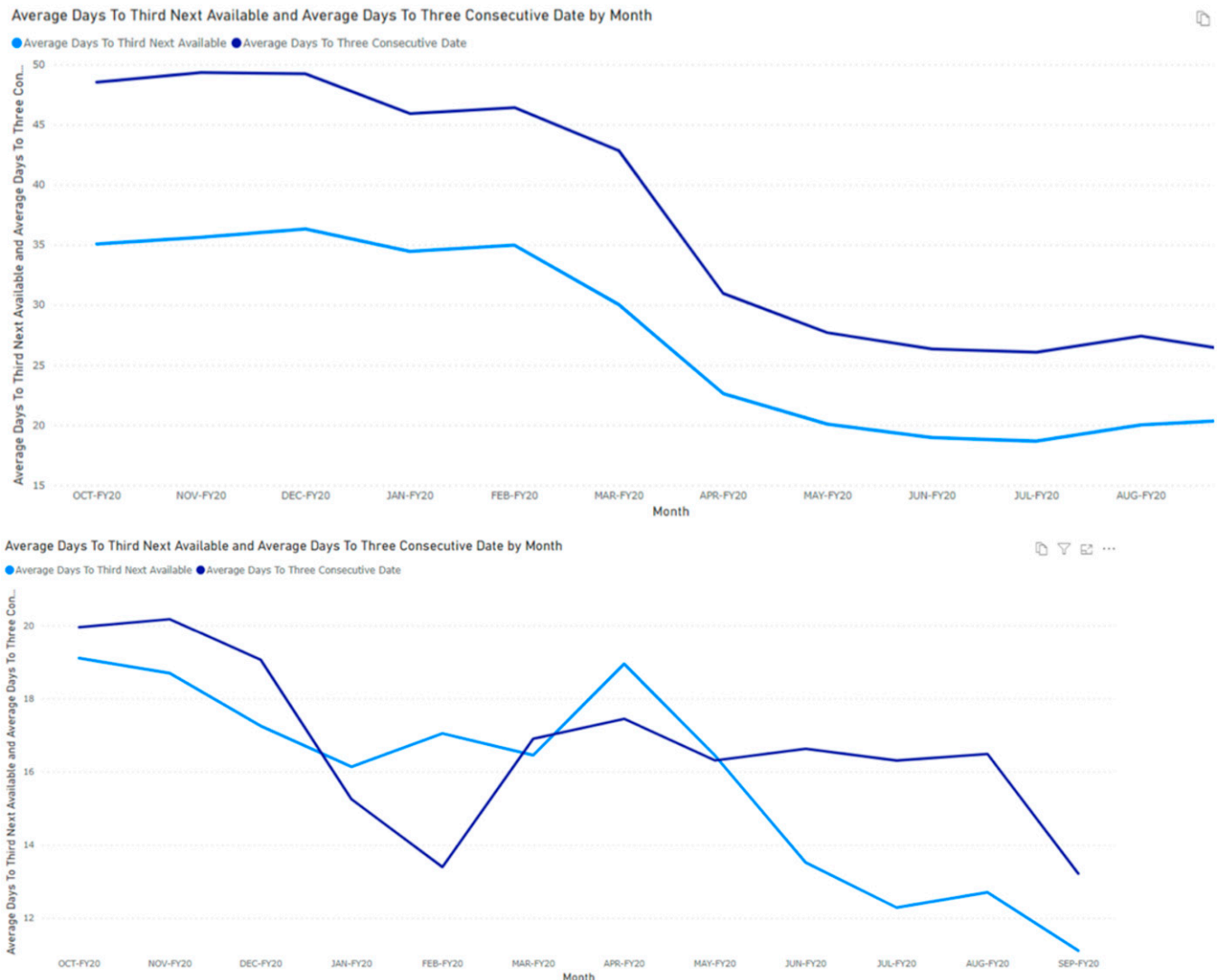
(Top) Average days to third next-available sleep appointment (light blue) and average days to 3 consecutive dates for sleep appointments (dark blue). **(Bottom)** Average days to third next-available sleep study (dark blue) and average days to 3 consecutive dates for sleep study (dark blue).

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video visit, in-person visit with primary care provider, or via REVAMP. All but 1 patient reported receiving the results quickly.

Maintenance

To assess sustainability of the hubs, we administered the Center for Public Health Systems Science's Program Sustainability Assessment Tool,[7,8] a 40-item instrument assessing 8 domains of sustainability capacity (Environmental Support, Funding Stability, Partnerships, Organizational Capacity, Program Evaluation, Program Adaptation, Communications, and Strategic Planning), to 12 hub site leads. The average score across all domains and sites was 5.3 (with 1 = not sustainable and 7 = fully sustainable), indicating strong sustainability overall. As expected, sites that were newly funded for 2020 had lower overall scores (average: 4.9) compared with sites that had been

funded since 2018 (average: 5.6). During 2020, 11 of the 12 hubs and their associated community-based outpatient clinics were active in TeleSleep, except for 1 site (Iowa City) whose representatives did not attend meetings or programs and was discontinued in FY21. Following FY20, San Francisco and Spokane sunsetted services to transition to another service model (Clinical Resource Hub, San Francisco) or into sustainment (Spokane).

DISCUSSION

The ORH TeleSleep EWI developed and implemented a national TeleSleep program that increased use of virtual care, increased use of home sleep testing, engaged veterans in remote monitoring of their sleep, and successfully improved access to

care for both rural and nonrural veterans. Additionally, the Tel-eSleep program created a patient-facing medium for veterans to engage in their care and connect with sleep-care providers regardless of their proximity to a VA medical center.

The program also provided resources to help EWI sites adapt to recent unpredicted events. During the last 2 years, the COVID-19 pandemic disrupted the global health care system. Although the pandemic presented significant challenges to the TeleSleep program, EWI sites were equipped to adapt and were enabled to create new ways to reach patients and obtain standardized questionnaire responses typically used in baseline and follow-up assessments. The establishment of the TeleSleep program facilitated the provision of increased virtual clinic visits at EWI sites compared to non-EWI sites. Although all sleep centers within and outside of the VA increased teleservices during the pandemic, teleservices were already well-established within the EWI sites prior to the pandemic and outpaced the non-EWI sites during FY20 (**Figure 4**). As one sleep provider stated, "We never cancelled a single appointment but converted everything to telephone."

REVAMP played a critical role in facilitating sleep care during the pandemic by enabling data collection and communication from patients through the patient portal to either augment video chat or telephone visits or as stand-alone asynchronous care. For both patients and providers these activities facilitated the transition to virtual care. REVAMP aligns with the increasing body of evidence demonstrating improved adherence to prescribed therapy when patients have access to their own data,[9] as well as increasing acceptance of mobile- and web-applications by patients to manage chronic disease in affected patients.

At this juncture, our evaluation of the EWI suggests that this service model is strongly sustainable, particularly in regard to adoption of telehealth modalities. The success of this program is based on the ability to practice across state lines, to provide care anywhere to anywhere (provider and patient locations), and recognition of the value of standardized processes and interoperability of systems to support shared care between facilities. The strategy of developing toolkits for sleep telehealth through the ORH TeleSleep EWI and offering these same toolkits and implementation support to programs not funded through ORH was highly effective and contributes to dissemination, adoption, and sustainment of TeleSleep services nationally.

The requirement for an evaluation partnership between a new EWI and a Quality Enhancement Research Initiative, where expert researchers and evaluators reside, must be commended as a best practice. A dedicated evaluation team focused on all aspects of establishing a program, growing a program, and sustaining a program is an invaluable investment, given that the process of implementing such services is highly iterative, particularly when strategic priorities, visions, and environmental conditions (such as the pandemic) change—often suddenly. An evaluation team facilitates providing the information needed for clinical programs to adapt and is able to measure changes over time, often for shifting metrics. Finally, the evaluation team provides the foundation for developing roadmaps for scaling the results of such programs beyond the intended program. Although the ORH TeleSleep EWI is a VHA program, many aspects of this program could be adopted by

non-VHA health care systems, particularly if Congress supports much of the recently introduced telehealth legislation and states elect to continue coverage for telehealth services beyond the current public health emergency. Our multipronged approach may serve as a framework for implementing TeleSleep programs elsewhere, particularly in large health care institutions.

Limitations

Overall, this was a successful demonstration that a national network could be created to share resources across sites within the VHA enterprise. However, there were clear limitations that hindered expansion within the EWI program and expanding the hub–spoke model within the VHA without special funding. Challenges included difficulty accessing data between sites, less than full participation by all sites in VA national accounts for remote monitoring of PAP devices, and lack of standardized clinic setup and workflows at all sites. Constraints on building out regional and national TeleSleep networks include the VHA's electronic health record transition in progress (from the Computerized Patient Record System to Cerner Millennium) and difficulties creating fund-flow models that support sharing resources between sites without special funding such as that received from ORH for this EWI.

On a more granular level, one of the objectives of the Tele-Sleep program was particularly challenging to measure. A commonly used metric to measure access to VA care was the number of days to the TNA appointment; however, this became difficult to interpret as the TNA needed to be calculated for the various modalities of patient encounters (telephone, in-person, clinic visit video, virtual video visit, etc). Each TNA calculation required averaging the TNA over multiple settings and providers. This made it impossible to attribute any variance to a single modifiable cause. In addition, with the advent of the COVID-19 pandemic, opening new telephone and video clinics after March 2020 appeared to falsely elevate availability and falsely decrease utilization. This was due to the new clinics with initial zero wait times and not due to increased capacity. Finally, the TNA was calculated for new patients awaiting initial consultation and did not account for patients who were awaiting follow-up visits. A model to better assess access for sleep care is being developed based on recognition of this specific limitation.

CONCLUSIONS

The VA TeleSleep EWI Program has achieved many of its stated goals, including (1) improved accessibility and quality of sleep care, especially for rural veterans, (2) development of toolkits available to all VA medical centers enabling initiation or expansion of sleep telemedicine, and (3) creation of a patient-facing mobile application that enables patients to actively engage in their sleep care and connect with their sleep-care providers. This successful demonstration project can serve as a framework to further develop regional and national sleep virtual care services. Additionally, results from this program can inform other health care systems on how to approach designing and evaluating the expansion of telehealth services to their own patient bases.

ABBREVIATIONS

COVID-19, coronavirus disease 2019
EWI, Enterprise-Wide Initiative
FY, fiscal year
HSAT, home sleep apnea testing
ORH, Office of Rural Health
OSA, obstructive sleep apnea
PAP, positive airway pressure
PSG, polysomnography
REVAMP, Remote Veterans Apnea Management Platform
TNA, third next-available appointment
VA, United States Department of Veterans Affairs
VHA, Veterans Health Association

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DISCLOSURE STATEMENT