Sleep Medicine Change Agents

University Sleep Medicine Program

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Sleep medicine as a discipline has constantly evolved since its beginnings half a century ago. Over the last two decades, the understanding of the complexities of breathing during sleep has led to novel therapies for the management of sleep apnea. This along with the realization that the long-term care of patients with sleep apnea falls upon the shoulders of sleep medicine providers has placed sleep centers at the forefront of the challenge of managing vast numbers of individuals with sleep-disordered breathing. This challenge of addressing the high burden of sleep apnea within the general population has only been magnified by the shortage of sleep professionals and declining sleep revenues. Consequently, sleep programs have had to continuously innovate to develop care models that are efficient, economic and patient focused.

This summary outlines care processes developed over the last five years at our sleep program. Like many academic sleep centers, our sleep program henceforth known as University Sleep Center (USC) combines goals of patient care along with education and research.

This summary will be first outline the scope of the sleep clinical practice at the UHC in terms of the geography, numbers of patients served and organization of personnel and facilities within the program. Subsequently the challenges presented by clinic backlogs, limited personnel and market forces are discussed. Finally, the measures taken to address these challenges using a population health-directed strategy is discussed.

A. Structure of the University Health Center and University Sleep Center
B. Challenges in sleep apnea care within the University Sleep Center
C. Solutions to improve sleep apnea care at the University Sleep Center
D. Anticipated future of the University Sleep Center

A. STRUCTURE OF THE UNIVERSITY SLEEP CENTER PROGRAM

University Health System

The sleep medicine program is part of the University Health Care System (UHC), currently one of the topmost academic medical centers within the US that has an extraordinary history of ground-breaking achievements in healthcare. Serving a population of more than 3 million, the UHC is comprised of the following

- Five hospitals and 12 community health care centers
- University Medical Group with 1,700+ members
- 190,000+ member health plan, offering medical, mental health, and pharmacy benefits for fully insured and self-funded employer groups, individuals, and families, as well as Medicare and Medicaid
- Numerous institutes and centers reflecting the health system's strengths in oncology, cardiology, diabetes treatment, genetics, ophthalmology, orthopaedics, neuroscience, psychiatry, precision medicine, population health, and global health

Market analysis

The UHC is a close second to IYC, a not-for-profit health care system (founded in 1975) in terms of provision of healthcare provider in the Intermountain west operating 25 hospitals, 225 clinics and urgent care facilities. Despite being competitors for patient and employer health plans, the UHC and IYC collaborate on a number of fronts including shared residency and fellowship programs (Internal Medicine, Pulmonary & Critical Care, Sleep Medicine), pediatric care through their Children's hospital and population health initiatives. In addition to IYC, there are two other healthcare systems and 4 other individual or physician owned facilities that have sleep clinics. Despite this, sleep demand at the UHC sleep program has remained consistently high (see below). Sleep referrals originate from the following –

1. Internal referrals from the UHC Sleep program.
2. External referrals from outside clinics within adjoining areas and adjoining states

The payer mix for referrals includes Medicare and Medicaid (predominantly Medicare) and commercial payers such as UHC-related Regence BCBS, Cigna, Altius, PEHP, etc. Table 1 includes the proportion of different payers for sleep studies over the last 6 months.

BLUE CROSS	**54%**
CIGNA	**7%**
COMMERCIAL	**12%**
MEDICAID	**1%**
MEDICAID HMO	**13%**
MEDICAID OOS	**0%**
MEDICARE	**4%**
MEDICARE ADV	**1%**
SELECT HEALTH	**0%**
UUHP	**7%**

Table 1. Different payer-mixes for patients undergoing sleep studies at UHC

University Sleep Center (USC)

From its beginnings in the 1990s, the USC has functioned as an independent entity even though it is reliant upon the School of Medicine and Hospital Administration for its functioning.

The organization of sleep program is as shown in Figure 1. Over the last few years, there has been a concerted effort to coalesce all faculty and advanced practice provider (APP) appointments under the Department of Medicine. A multidisciplinary faculty drawn from Divisions of Pulmonary & Internal Medicine, Departments of Neurology, Psychiatry and Family Practice along with advanced practice providers (APPs) from Pulmonary & Internal Medicine currently comprise the 15 providers (including two ABSM-certified psychologists and 1 post-doctoral behavioral psychologist) that deliver both outpatient and inpatient sleep care through multiple clinics within the UHC's healthcare system.

Besides the main UHC clinic (SWC), patients with sleep problems are seen at 4 other clinics (FH, SJ, SH and University clinics) (Figure 2). At each of facilities, besides availability of consultative visits, there is provision of home sleep apnea testing, oximetry and actigraphy. Attended polysomnography studies are available at the AASM-accredited laboratories within the main SWC (6 beds to be expanded to 12 beds) and the SJ Health Clinic (4 beds).

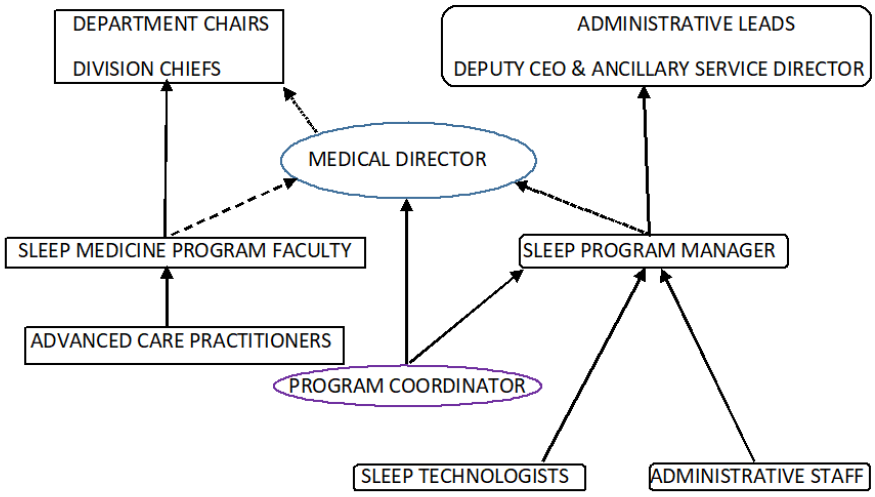


Figure 1. Organization of the University Sleep program

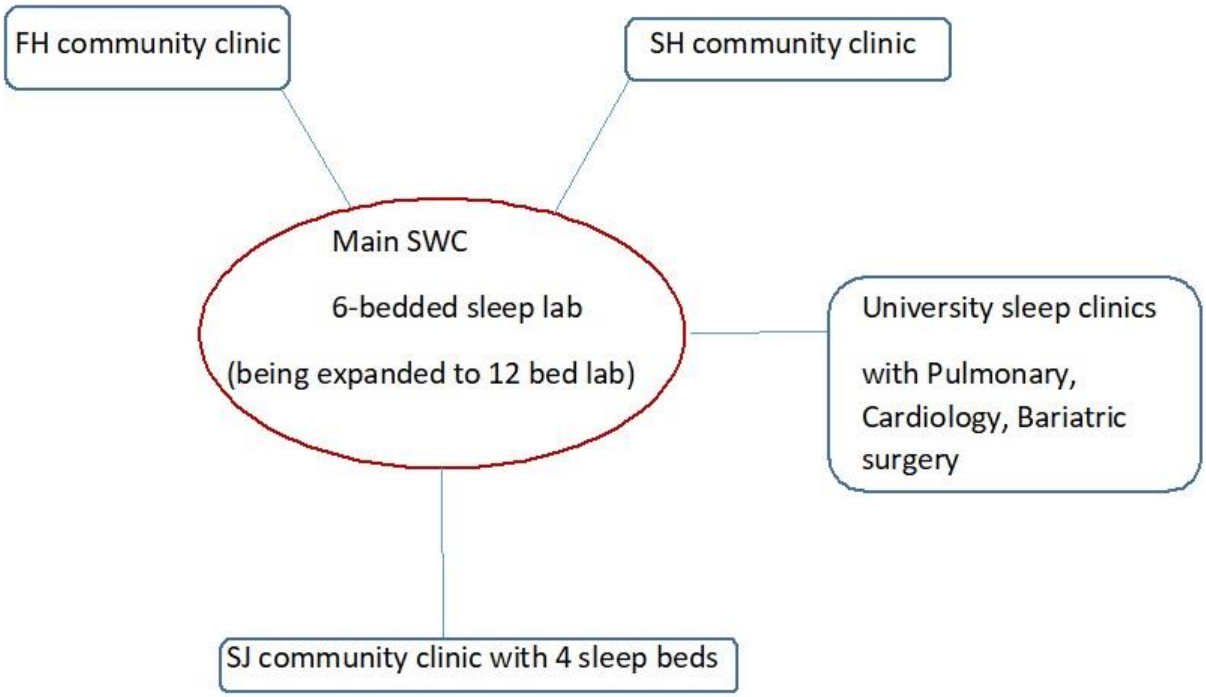


Figure 2. Clinics and labs within the University Sleep program

B. CHALLENGES IN SLEEP APNEA CARE WITHIN THE UNIVERSITY SLEEP CENTER PROGRAM

Challenges faced by our sleep medicine program include the following –

PATIENT STANDPOINT

1. High clinic backlog of new patients waiting to be evaluated and treated for sleep problems (Figure 3 shows numbers of patients seen over the last 2 years and Table 3 shows numbers over the last 6 months).
2. Limited number of USC providers resulting in long wait-times for clinic visits.
3. Need for long-term care of patients established on different forms of therapy for sleep apnea.
4. Coordination with referring health providers – PCPs, subspecialists caring for patients at high-risk for OSA (patients with heart disease, bariatric surgery patients) and multiple other disciplines for optimal sleep apnea care

PROVIDER STANDPOINT

1. Meet RVU expectations.
2. Ensure that clinic schedules reflect a consistent 1:2 ratio for new patient visits to return patient visits.

SYSTEM PERSPECTIVE

1. Optimization of patient to bed ratio
2. Bed occupancy for PSGs is 90% or higher (Table 3)
3. Expand numbers of personnel commensurate with increasing numbers of patients covered through UHC health plans.
4. Increase number of new patient visits and sleep studies (particularly in-lab studies) due to declining RVU payments for procedure codes 95806 (unattended level III sleep study), 95810 (attended diagnostic level IV sleep study) and 95811 (attended split or titration level IV sleep study. Average reimbursements for different procedure codes are roughly a third of the billed amounts (15-55%) for codes 95810 and 95811 and close to half for code 95806 (16-60%).

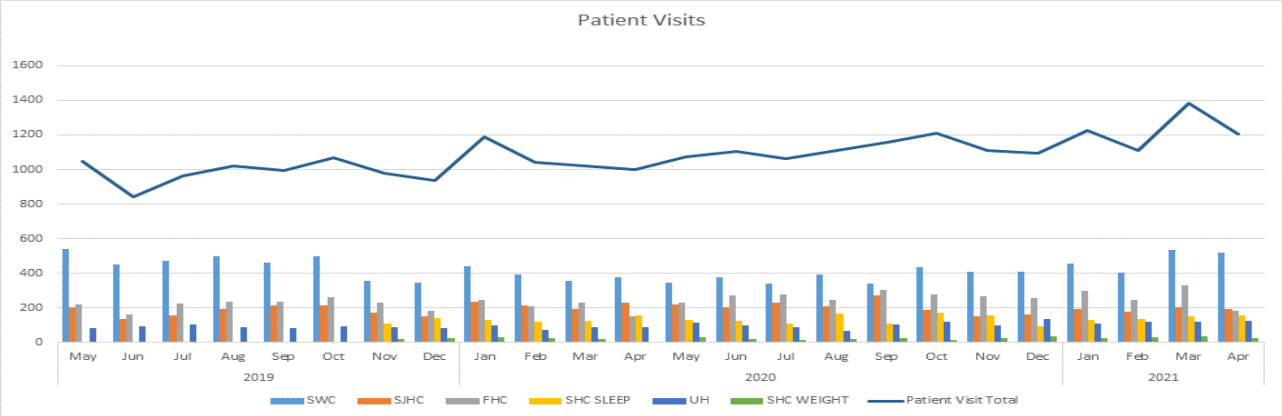


Figure 3. Trend of total new and return patient visits at multiple clinics within the UHC over the last 2 years.

New patient lag time (Days)		2020		2021				
		Nov	Dec	Jan	Feb	Mar	Apr	Total
SWC	No. of referrals	160.0	134.0	148.0	139.0	176.0	154.0	911.0
	Median lag time	43.50	58.50	45.00	49.00	49.50	59.00	49.00
FH	No. of referrals	114.0	104.0	116.0	91.0	113.0	70.0	608.0
	Median lag time	45.50	42.00	40.00	40.00	48.00	57.50	41.00
SJ	No. of referrals	44.0	59.0	60.0	67.0	111.0	123.0	464.0
	Median lag time	94.00	47.00	58.00	51.00	25.00	22.00	41.50
SH SLEEP	No. of referrals	44.0	31.0	41.0	37.0	48.0	47.0	248.0
	Median lag time	94.00	98.00	72.00	55.00	54.00	63.00	61.00
UH	No. of referrals	28.0	45.0	40.0	48.0	39.0	36.0	236.0
	Median lag time	19.00	26.00	26.50	20.00	24.00	23.00	24.00
SH weight	No. of referrals	12.0	17.0	13.0	17.0	22.0	15.0	96.0
	Median lag time	35.50	11.00	61.00	48.00	62.00	74.00	48.00
Return Patient Lag Time (Days)		**2020**		**2021**				
		Nov	Dec	Jan	Feb	Mar	Apr	Total
SW	No. of referrals	189	214	265	226	284	300	1,478
	Median lag time	29.00	42.00	83.00	52.00	39.00	38.00	43.00
FH	No. of referrals	124	137	153	123	197	73	807
	Median lag time	35.00	41.00	43.00	34.00	29.00	43.00	35.00
SJ	No. of referrals	93	91	112	92	79	63	530
	Median lag time	59.00	58.00	60.50	26.00	17.00	25.00	36.00
SH SLEEP	No. of referrals	89	50	73	73	96	98	479
	Median lag time	114.00	113.00	122.00	122.00	130.00	133.00	121.00
UH SLEEP	No. of referrals	68	86	72	66	80	88	460
	Median lag time	43.50	53.00	57.00	56.00	47.00	51.50	52.00
SH weight	No. of referrals	14	18	15	14	14	12	87
	Median lag time	35.00	77.00	63.00	56.50	62.50	63.00	62.00

Table 2. New patient and return patient lag times over the last 6 months at sleep clinics within UHC

Visit type	Nov-20	Dec-20	Jan-21	Feb-21	Mar-21	Apr-21	Total
PSG	107	91	90	94	123	129	707
HST	210	272	240	213	237	210	1590
Total	317	363	330	307	360	339	2636
Beds available	124	104	108	103	128	144	813
%Bed Utilization	86%	88%	83%	91%	96%	90%	87%
Total beds	180	186	186	168	186	180	1272
% total beds	59%	49%	48%	56%	66%	72%	56%

Table 3. Number of polysomnography (PSG) and home sleep tests (HST) done over the last 6 months. Due to COVID, only the beds at SWC site was used and the SJ site was closed.

C. SOLUTIONS TO IMPROVE SLEEP APNEA CARE AT THE UNIVERSITY SLEEP CENTER PROGRAM

While an obvious solution to this problem is to train and hire more sleep providers, there exists a current shortage of sleep-boarded physicians. This coupled with the need to maintain appropriate ratios between supervising physicians and advanced practice providers (APPs) makes it mandatory to optimize existing personnel and resources to address the sleep demand. Therefore, our strategies were devised around the following goals to address the multiple challenges faced by providers, patients and sleep center.

1. Optimize APP roles in the sleep clinic.
2. Provide necessary technical and administrative coordinator support for clinicians in the care of patients with sleep-disordered breathing
3. Advance roles of registered sleep technologists.
4. Creation of pathways to address and improve long-term compliance with prescribed therapies.
5. Integrate electronic databases for targeted population management of different sleep apnea patients treated with different therapies for OSA.
6. Measure therapy compliance in different sleep apnea populations to continually improve treatment efficacy.

This is discussed under the following headings –

1. ADVANCING THE ROLE OF ADVANCED PRACTICE PROVIDERS (APPs)
2. PROVISION OF OPTIMAL SUPPORT FOR CLINCIANS DURING OUTPATIENT CLINICS – CREATION OF A CPAP COORDINATOR
3. PATHWAYS FOR POPULATION HEALTH UTILIZING REGISTERED SLEEP TECHS
4. MONITORING COMPLIANCE THROUGH CREATION OF SPECIALIZED DATABASES AND TRACKING PROGRAMS

1. <u>ADVANCING THE ROLE OF ADVANCED PRACTICE PROVIDERS (APPs)</u>

The UHC program employs almost equivalent number of APPs as physicians. These APPs undergo a 3-month training program that includes self-study, didactic sessions, case-discussions with sleep faculty of commonly-encountered sleep problems, sessions with RPSGTs and physicians on PSG and HSAT scoring and interpretation. New APPs shadow faculty and senior APPs throughout their training and start seeing patients at end of this training under the supervision of attending physicians. APPs thereafter function as independent providers taking care of all types of sleep problems. Difficult cases are regularly discussed in monthly case conferences and APPs interpret and report on sleep studies that are then signed off by supervising faculty. Based on final interpretations of sleep studies, APPs contact patients with results and manage patients with all types of sleep-disordered breathing including complex forms of sleep apnea.

APPs are integral to the functioning of specialized programs in collaboration with cardiology, pulmonary and bariatric surgery. Majority of patients from these programs are routed specially for early appointments with APPs. In addition, APPs have taken key roles in functioning of stable CPAP clinic, hypoglossal nerve stimulator and phrenic nerve stimulator clinics (see below).

In all the above roles, they are under the close supervision of the attending physician they are assigned to.

The expansion of roles of APPs have allowed the following –

1. *Considerable increase in patients seen within the sleep clinics*: Currently APPs see nearly 70% of new and return patient visits within USC (Table 4). This has reduced the new patient visit (NPV) and return patient visit (RPV) clinic visit lag times. The APPs have excellent access to their supervising attending so that difficult cases can be discussed – these include patients requiring advanced forms of positive airway pressure and patients requiring further testing such as MSLT. The APP and supervising attending clinics are co-localized that has allowed for the care of complex patients with sleep disordered breathing and other allied conditions such as narcotic use, psychiatric comorbidities, and cardiac problems. Satisfaction with patient care by APPs is tracked through exceptional patient experience scores. Regular meeting with the Lead APP on a 2-3 monthly basis allows for specific APP concerns to be addressed by sleep program leadership.

Physician	**Total**	**252**	**249**	**281**	**333**	**291**	**308**	**379**	**303**	**424**	**325**	**3145**
	Visit type	**Jul-2020**	**Aug-2020**	**Sep-2020**	**Oct-2020**	**Nov-2020**	**Dec-2020**	**Jan-2021**	**Feb-2021**	**Mar-2021**	**Apr-2021**	
	NPV	60	37	37	33	17	3	7	2	38	36	270
	RPV	97	80	104	65	43	10	12	11	21	30	473
	VNPV	0	0	40	124	139	150	169	142	155	133	1052
	VRPV	0	0	49	107	91	142	191	147	210	126	1063
	VV	95	132	51	4	1	3	0	1	0	0	287
APPs	**Total**	**711**	**692**	**805**	**791**	**715**	**679**	**736**	**734**	**841**	**783**	**7487**
	NPV	163	95	87	51	38	21	19	30	73	80	657
	RPV	126	124	134	110	80	66	68	121	171	192	1192
	VNPV	0	0	88	164	181	190	198	203	213	175	1412
	VRPV	0	0	165	234	288	298	335	266	277	233	2096
	VV	388	446	233	103	10	12	2	6	2	2	1204
	CPV	34	27	29	35	20	17	31	29	32	54	308
	VCPV	0	0	69	94	98	75	83	79	73	47	618

Table 4. Proportion of different visit types seen by physicians and APPs. Abbreviations: NPV – New patient visit; RPV – Return patient visit; VNPV – Virtual new patient visit; VRPV – Virtual return patient visit; VV – virtual visit; CPV – stable CPAP clinic visit; VCPV – virtual stable CPAP clinic visit.

2. *Improved access for specific programs (Cardiology, Pulmonary, Inpatient Sleep Medicine and Bariatric surgery)*: Given the high burden of disease in patient with cardiovascular disease, pulmonary disease and those requiring bariatric surgery, APPs are placed in these specific clinics with their clinic schedules exclusively devoted to patients referred from Cardiology, Pulmonary and bariatric surgery. The direct referral of patients into these specialized clinics has relieved the burden of long wait times and allowed early access for these patients with high morbidity. The

reduced lag time for an initial sleep consultation has also reduced patient no-show rates allowing for better patient follow-up and therapy compliance. The expedited care of Cardiology patients has also allowed the development of the phrenic nerve stimulator program through channeling of patients with heart failure into specific sleep clinics dealing with this group of patients. Since the beginning of this year, we have seen 113 cardiology patients and 29 bariatric surgery patients in these specialty clinics. In addition, the Inpatient Sleep Program also includes one week of APP rotating a month with other inpatient sleep medicine faculty.

3. *Optimal evaluation of patients before sleep testing* – Due to APPs, our program has had a significant increase in provider visits that has allowed for optimal evaluation for patients before they are subjected to sleep studies. Meeting with sleep medicine provider prior to testing and treatment has been shown in multiple studies to be the most important factor with CPAP compliance. Currently more than 95% of the patients are seen by one of the providers before they undergo further sleep testing. This has resulted in high compliance rates (overall compliance for 2020 up to 79%.

4. *Support to physicians* - The availability of APPs has also helped to address the shortage of sleep-credentialed physicians that are available for recruitment. The preliminary interpretation of sleep studies of patients seen by APPs has also reduced the time it takes for supervising physician to review the sleep studies and finalize the report.

5. *Improved PSG bed occupancy, HSAT numbers and expansion of sleep program* - The increased number of sleep studies through APPs has allowed for high proportion of PSG bed occupancy. It has also augmented the number of HSATs done at any of the sleep clinics. All this has added substantially to the revenue generated by the USC program and supported the addition of registered sleep techs and the doubling in size of the bed capacity at the main sleep program.

Physicians	Jul 2020	Aug 2020	Sep 2020	Oct 2020	Nov 2020	Dec 2020	Jan 2021	Feb 2021	Mar 2021	Total
PSG	683	809	780	693	701	740	883	626	6494	286
HST	98	87	130	128	107	102	108	137	149	1046
APPs	**Jul 2020**	**Aug 2020**	**Sep 2020**	**Oct 2020**	**Nov 2020**	**Dec 2020**	**Jan 2021**	**Feb 2021**	**Mar 2021**	**Total**
PSG	316	333	417	374	320	336	359	442	2130	628
HST	222	249	296	261	229	246	265	319	170	2257

Table 4. Proportion of sleep studies done over the last 9 months following referrals by physicians vs. APPs. Abbreviations: PSG – polysomnography; HST – home sleep studies.

2. <u>PROVISION OF OPTIMAL SUPPORT FOR CLINCIANS DURING OUTPATIENT CLINICS – CREATION OF A CPAP COORDINATOR</u>

The care of a patient with sleep apnea requires the need for a positive airway pressure device (PAP device) most of the time. Current federal and state laws require the use of durable medical equipment providers (DMEs) that are often aligned with specific insurance

payers. Most insurance payers follow the Centers of Medicare/Medicaid Services (CMS) criteria for both prescription and long-term supply of PAP devices and accessories. Like supplemental oxygen delivery system, PAP therapy requires pre-approval and certificates of medical necessity (CMN) that needs to be completed in a timely manner to ensure uninterrupted supply of PAP accessories and regular replacement of PAP devices.

To assist providers with the day-to-day task of tasks of providing PAP care and other duties outlined below, a CPAP coordinator position has been created at each of the sleep clinics with support from Hospital administration.

These CPAP coordinators at each of the clinics (SWC, SJ, FH, SH, University sleep clinics) function to address the following –

1. Manage all the necessary communication with insurances and DME to initiate and maintain PAP therapy.
2. Engage in an early CPAP adherence program at each clinic that includes creation of an agreed upon encounter form in the electronic medical record (EMR) at the time of CPAP initiation. Following CPAP prescription, the CPAP coordinator at each clinic follows the patient at 1 week and 3 weeks after PAP delivery capturing early adherence information (Figure 3). Any early problems with PAP therapy can be identified and treated (including mask changes within the 1-month timeframe during which most DMEs provide a different mask free of charge) (Figure 3) .
3. Mask-fitting during patient visits are done by the CPAP coordinator. This allows for patients struggling with PAP therapy to trial new masks and be educated on machine settings, humidification and heating etc. Often these mask-fitting visits include a short periods of time on different CPAP pressures to understand mask leaks better.
4. Online CPAP Patient Education classes are conducted on a monthly basis by different CPAP coordinators for patient education particularly for new PAP initiation. These classes are available online to improve access
5. All electronic communication regarding mask or machine problems are first routed to CPAP coordinators that reduces time by the provider on the EMR and free up provider time for direct patient care and other activities.
6. The availability of a coordinator who ensures that patients receive the necessary PAP care is a huge service for patients navigating the complex journey of sleep apnea care. This has had direct impacts on patient satisfaction scores and patient outcomes based on CPAP compliance.

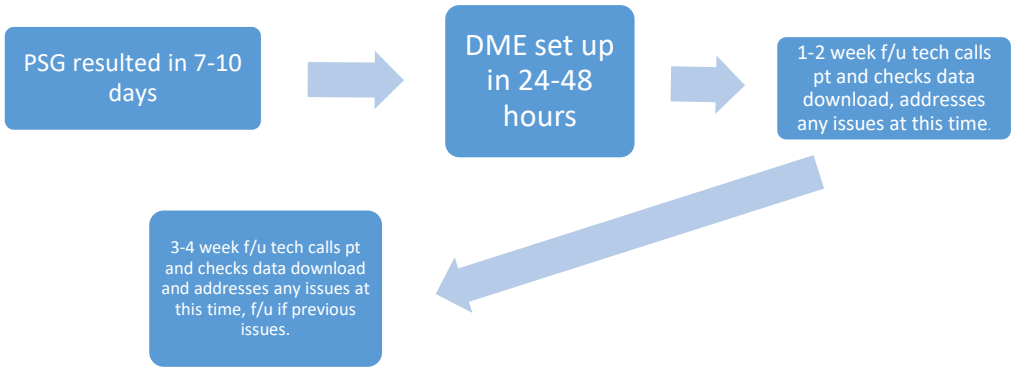


Figure 3. Process of early care of patient diagnosed with OSA.

3. PATHWAYS FOR POPULATION HEALTH UTILIZING REGISTERED SLEEP TECHS

The high prevalence of sleep apnea and its impact on every organ system has led to the need to create pathways that ensure a high degree of success with rendered therapies. Sleep clinics have large numbers of patients that utilize different interventions for sleep apnea – PAP therapy, hypoglossal nerve stimulator (HNS), mandibular advancement devices (MAD) and a bevy of other treatments such as positional therapies, oromyofunctional therapy, and new tongue stimulation devices that can be used in daytime for reducing nocturnal snoring.

Increased understanding of factors that drive sleep-disordered breathing such as upper airway collapsibility, respiratory instability from sleep-state changes etc. all have led to personalizing care for each patient with sleep apnea. Given the nature of disease from obstructive sleep apnea, such therapies are rendered for the lifetime of the patient. A unique aspect of most therapies include the opportunity to monitor adherence (and also efficacy in the case of PAP therapy) through remote-tracking systems. Such tracking systems allow easy retrieval of patient data from an online "cloud". As a center, we have evolved software systems to maximize not only the availability of this data but incorporate them into the day-to-day care of sleep apnea. This has required allocation of necessary personnel trained to manage patients based on the population of sleep apnea patients they fall in – such categorization has helped to delegate resources to each population accordingly. This strategy of population health is best exemplified in the care of patients that are well-adjusted to their CPAP and require no more than annual visits to provide documentation of their adherence to their therapy. Creating these programs has necessitated the involvement of both RPSGTs and APPs who now run these programs with minimal oversight from the Medical Director.

Stable CPAP Clinic (SCC) - Of all the therapies, CPAP remains the most effective therapy but yet the one with least compliance (~50% long-term adherence based on current literature). Despite ensuring early adherence which most clinics now focus upon (given how it affects long term adherence), there is loss of PAP compliance over time. The availability of PAP usage tracking data that is obtainable on a nightly basis has unleashed the possibility of monitoring PAP usage long-term. While the long-term usage is dependent on the commitment to PAP therapy by a motivated patient, every sleep center needs to invest in personnel (and processes) that track CPAP usage and efficacy data.

The following outlines the goals, structure, evolution and metrics of the current stable CPAP clinic as they run within the UHC program

Goals –

1. Ensure long-term follow-up of patients using PAP therapy. This clinic will maintain continuity of care for patients with sleep apnea who are adherent to therapy and have minimal treatment barriers or significant sleep co-morbidities such as insomnia or restless legs syndrome (Appendix A).
2. To provide access to experienced sleep tech-educator for problems with PAP machine or mask that are often not addressed by DMEs in a timely manner.

3. To have flexibility for clinic visits to get CMNs and driver's license forms completed for patients using PAP therapy.
4. Monitor metrics of CPAP compliance.
5. Integrate novel metrics of patient outcomes such as sleep duration, heart-rate variability etc. into long-term monitoring (see in future goals)

Structure

The key personnel include 1 experienced RPSGT who has undertaken sleep-educator course and is facile with all aspects of PAP care. At its inception of this stable clinic program 5 years ago, we had 3 separate clinic coordinators managing CPAP populations for their respective clinics. Following the need for tele-visits due to pandemic and reimbursements for tele-visits from Medicare/Medicaid, we are consolidating the stable clinic under one location. Most of these stable CPAP clinic patients are now managed through telehealth. Designated RPSGTs work with 2-3 APPs whose clinic templates have been adjusted to include stable clinic patients 1-2 days a week.

Patients are referred to the Stable CPAP clinic by all providers within the USC program. Inclusion criteria include optimal CPAP adherence, lack of other sleep problems such insomnia or restless legs syndrome and patient agreement in transferring into the stable CPAP clinic (see appendix A). Moving patients stable on their CPAP from their clinics to a dedicated clinic allows providers to take on new patients in their schedule and reduces backlog of patients waiting to be seen.

As a team, the RPSGT and APP will assess the patient for specific CPAP adherence and tolerance factors and efficacy of therapy. The APP has the discretion to remove the patient from stable CPAP clinic and refer them back to the referring sleep provider.

Encounter Process:

The RPSGT will retrieve PAP download data either from the "cloud" or from the patients' machine or SD card. The RPSGT will review the download data and document patient's self-reported total sleep time, sleep latency, sleep disruptions (qualitative and quantitative), wake after sleep onset time and use of hypnotics and/or other sleep aids. Furthermore, the RPSGT will assess general benefit of therapy and current Epworth Sleepiness Scale. This data is entered into an encounter template within the patient's electronic medical record (Appendix B).

After the RPSGT has finished taking the history, the APP will then see the patient (mostly via the tele-health portal) and address any concerns the patient (or the RPSGT) has regarding the patient's sleep and PAP use.

A specially-designed software program developed in conjunction with UHC's Information Technology (IT) team enables scheduling of visits, review of CPAP use and creates reminders to the RPSGT for upcoming CPAP clinic visits so that he or she can start acquiring PAP downloads (see below).

The time for each clinic encounter can range from 10-20 minutes and this team of RPSGT and APP can meet with 12-20 patients in four hours of stable CPAP clinic. The documentation of

optimal PAP use allows for further approval of PAP supplies from CMS and non-CMS payers for approving further PAP supplies.

Evolution

The concept for the stable CPAP clinic originated 5 years ago and over this period, there has been considerable work done with IT to develop a software program through the UHC's technology office. In addition, the sleep program leadership has worked with the Hospital Administration to show the value of this process so that registered sleep techs can be used during the daytime to run this program. During the pandemic, this clinic has been able to rapidly adapt to the need for telehealth while ensuring that patients are well-served. In fact, the shift to tele-health has allowed for better access for a large swath of patients well-adjusted to CPAP.

Metrics

The stable CPAP clinic has allowed us to track not only individual patient compliance and efficacy data but also that of different clinics and different providers. Table 6 shows CPAP usage durations of the patients from different clinics within the UHC for different providers. All these patients had AHI_{flow} from machine downloads of <5 (all patients with AHI_{flow} more than 5/hr were referred back to regular follow up visits)

	SWC (n=840)	SJH (n=279)	FH (n=483)	SH (n=496)
	Hours of usage	Hours of usage	Hours of usage	Hours of usage
Overall usage (hours)	7.37	6.94	7.1	7.38
Provider 1	8.8	6.6	8.2	8.2
Provider 2	7	6.3	7	7
Provider 3	7.6	6.8	7	7
Provider 4	7.3	6.8	6	7.3
Provider 5	6.7	7.2	7.3	
Provider 6	7.7	6.8		
Provider 7	6.7	8		
Provider 8	7.2	6.3		
Provider 9	7.4	7.8		
Provider 10	7.3	6.8		

Table 6. Hours of usage for the stable CPAP clinic population at different clinics within the UHC system

Publication

This work has been discussed at international meetings (CHEST platform presentation. Creation of "Stable CPAP Clinic" for population management of PAP-adherent patients through sleep coordinators. Talk in session titled – Comorbid diseases and sleep apnea. Oct 10, 2018).

Hypoglossal nerve stimulator (HNS) program

Similar to the stable CPAP clinic, a designated RPSGT follows all patients receiving a hypoglossal nerve stimulator. Our program has performed approximately 20 HNS implants over the last few years (the pandemic limited the numbers considerably).

We have an ENT surgeon who works closely with referrals from the UHC sleep program and from the community. All community referrals for a HNS are first evaluated by an APP to ensure that meet criteria for HNS placement before they are seen by the ENT surgeon. Following the implantation, the HNS RPSGT is notified following which the RPSGT undertakes the following

1. Scheduling for activation
2. Following patient for problems with HNS (awakenings from the HNS firing, ongoing snoring and ongoing daytime fatigue/sleepiness despite HNS etc.)
3. Scheduling sleep study once patient settings on HNS are optimized.
4. Long-term follow up of patients once optimal settings following sleep study results are established.

The initial HNS visits post-implantation are staffed by sleep medicine physician till optimal settings on HNS are found. Following this, long-term follow up is done with an APP and the HNS-RPSGT. The patients are tracked in the manner as the stable CPAP clinic through a population approach. Patients are tracked as a different group within the IT-created population-targeted sleep apnea management software program. Data from HNS "cloud" is uploaded into a software program for compliance tracking and then is utilized for long-term management of HNS patients (Appendix C).

Mandibular advancement device (MAD), tongue stimulation devices and oromyofunctional therapy programs

The UHC program works mainly with two dentists specialized in MAD therapy for OSA patients. Besides these two dentists, there are three more dentists in the community who also do MADs for patients within the UHC program. Challenges with dental referrals and follow-ups have included the following -

1. Variations between dentists in insurance requirements and coverage for MAD.
2. Failure of patient follow-up after receipt of MAD
3. Patient-related concerns regarding the MAD-referral process are not adequately addressed by dentists.
4. Due to the number of different dentists that are involved, most of whom are not affiliated with the UHC program, it has been difficult to keep track of outcomes.

To address all these above problems, an experienced RPSGT was designated to serve as the coordinator for the MAD program (MAD-coordinator) 2 years ago. The MAD-coordinator receives all the referrals for MADs, works with dentists and referred patients, and after the application of a custom-fitted MAD facilitates getting the patient referred back to the sleep clinic (Table 5). Most importantly, a sleep study depending on the preference of the sleep

provider is performed once optimal MAD protrusion settings are reached and changes in AHI due to MAD are tabulated (Table 5).

The identification of a MAD-coordinator has allowed for better coordination of care with dentists, sleep providers, sleep center and the assessment of outcomes following the initiation of MAD therapy. Additionally, the MAD-coordinator also has been working with coordination of care with physiotherapy clinics for patients deciding to use tongue stimulation device with or without oromyofunctional therapy.

Dx severity	**Referral count**	**Change in OSA severity following MAD**	
Mild	**154**	Severe- mild	**1**
Moderate	**58**	Severe- moderate	**1**
Severe	**23**	Moderate-mild	**8**
Snore/UARS	**32**	Mild to <5	**20**
		Increased AHI	**7**
Total	**267**	**Total**	**37**

Table 5. Referrals for mandibular advancement device (MAD) over the last 2 years with results of follow up testing results for patients seen this year.

Phrenic nerve stimulator program

The phrenic nerve stimulator program was developed along the lines of HNS program and involves a RPSGT and a designated APP for long-term followup under the supervision of the Medical Director. Due to the pandemic, this program has delayed its proposed start in 2020. The approval for PNS placement, training of electrophysiologist involved in the implantation of PNS and collaborating heart failure group cardiologists has been completed.

4. <u>MONITORING COMPLIANCE THROUGH CREATION OF SPECIALIZED DATABASES AND TRACKING PROGRAMS</u>

One of the key aspects of sleep apnea care is the need to monitor compliance and efficacy through remote monitoring and/or through patient assessments. Additionally, current EMR systems are not geared for population health and the ability to customize software platforms through large PAP vendors or in the EMR is extremely limited. While a number of remote tracking platforms allow the ability to obtain data about compliance and efficacy of therapy, none of these allow the possibility of separating population of patients based on compliance or nature of therapy.

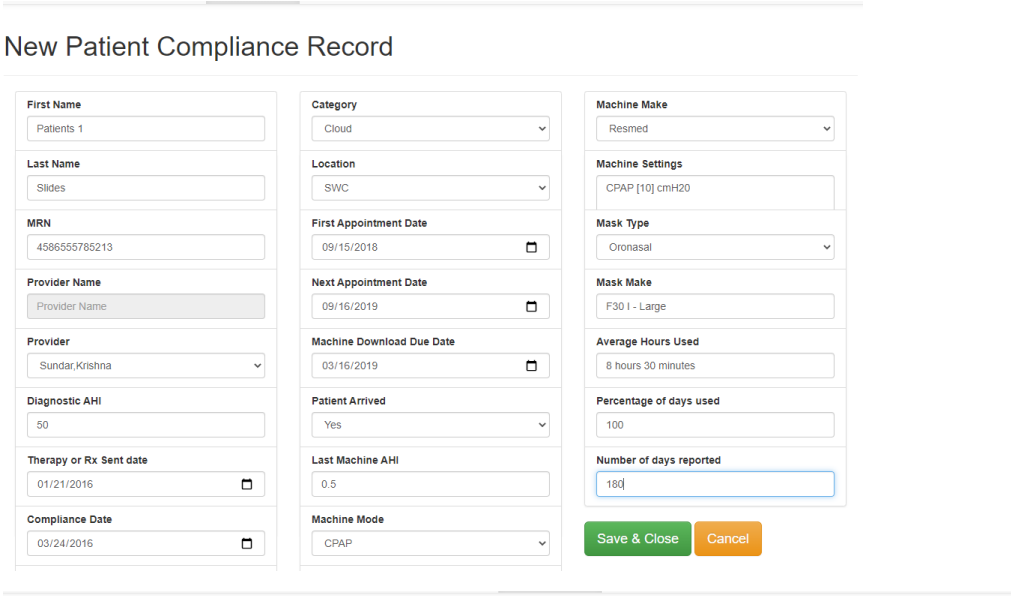
The UHC team has partnered with the University's IT team to create a software program that separates patients into different populations

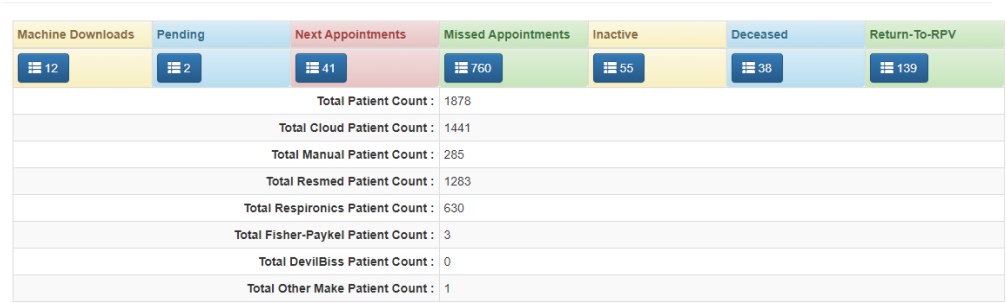
A. Stable CPAP clinic
B. Hypoglossal nerve stimulator
C. Phrenic nerve stimulator
D. Positional therapy (data on which can be obtained through remote downloads)

These software platforms allow for the following

1. Provide reminders for RPSGT leading each of these programs regarding patient visits
2. Obtain serial compliance and efficacy information on individual patients, for individual provider's patients or individual clinic's patients.
3. Allow easy obtainment of therapy information that reduces time involved for provider to get through clinic visit.
4. Add further monitoring of sleep parameters and use that for patient care as discussed below.

Some snapshots of information from this software program as outlined below





D. ANTICIPATED FUTURE OF THE UNIVERSITY SLEEP CENTER PROGRAM

Given the rapid changes in sleep technologies to diagnose and treat sleep apnea (that include automated technologies to score sleep studies) and changing reimbursement structures (that may include migration to an Accountable Care Organization model), it is clear sleep programs have to be nimble enough to adjust to technological disruptors and market forces. The bulwarks of our strategy for the future remain outcomes-based care through constantly evolving new information in the field of sleep medicine while simultaneously working on operational efficiencies. We feel that involvement in research with an aim to improve outcomes along with a constant awareness of our consumer base is necessary to keep us thriving through the 21st century.

Research and Development:

As a sleep program committed to patient care and exploring innovative strategies to improve outcomes, we have made considerable advancements to incorporate sleep apnea therapy-related remote tracking data. There are a wide variety of new methodologies to track cardiac, neurologic, autonomic and other types of signals during sleep that are being validated for clinical use. In addition, sleep durations using actigraphy has not been incorporated routinely into EMR or other platforms. One of our goals is to continually integrate such data into our software platforms so that we can utilize new data to take better care of our patients and use it to understand disease outcomes.

We also aim to find the correct balance between telehealth vs. in-person clinic visits. During the COVID pandemic, we completely switched to tele-health and currently most physicians and APPs have switched back to a combination of in-person and tele-visits. Particularly for sleep-disordered breathing, the creation of populations of sleep apnea patients has allowed us to use telehealth for stable CPAP clinic patients and utilize in-person visits for a good majority of new patient visits. The strategy of using telehealth for patients with sleep apnea has worked not only for patients that are stable on CPAP but also for patients located in remote areas or have difficulty getting to sleep clinics. The development of improved sleep medicine access and affordability for marginalized and underserved populations is necessary to reduce the disproportional health disparities and inequitable health seen in our local and surrounding communities.

Marketing and Sales:

Growth strategy – Given the role that the institution we are a part of plays in the healthcare delivery to our state and the Intermountain region, we are constantly faced with a huge backlog of our patients. Our growth strategy includes not only adding physicians but equivalent number of APPs who will be well-trained for outcome-driven and evidence-based clinical care. We are centralizing in-lab testing to 2 sites (one adjacent to the main campus of the UHC system and the other in the most rapidly growing location of state) while all sleep clinics will provide HSAT, oximetry and actigraphy testing.

How will we communicate with customers? The availability of an electronic medical record platform such as EPIC has allowed communication with patients using the EPIC-virtual portal and via

Mychart. In addition, our coordinators use phone and email communications to contact patients in individual programs. Furthermore, outreach to underserved communities through concordant community agencies is an objective that is aligned within UHC and USC initiatives.

What are the trends? Referrals for sleep evaluation have increased dramatically over the last five years despite the program growing 3-4 fold over the last five years. Similar to the alliances created with individual clinics such as cardiology, pulmonary and bariatric surgery, we hope to create relationships with disciplines such as endocrinology, nephrology etc. to create pathways for improved access of patients from these clinics.

What do our competitors do well? One aspect of sleep referrals we have not encouraged are direct referrals. The reasons for this are multiple. First based on evidence from peer-reviewed literature, the main factor improving PAP compliance is a prior visit with a sleep provider. Meeting with a sleep provider not helps to understand risk of sleep apnea but also understand the myriad social, economic and behavioral problems in addition to dissecting impact of comorbidities and phenotypes. This is not possible if a patient goes directly to a sleep study. Secondly, an adverse lab experience with CPAP can have a devastating effect on future compliance. Thirdly, if patients do not receive the PAP therapy for some reason within a certain duration of time (particularly for CMS), studies have to be repeated and the healthcare systems have to bear the costs of repeat testing. For these reasons, we have not increased the number of direct referrals. We however hope to develop programs with a select group of primary care providers adept at the evaluation of sleep apnea and educating patients to create direct referral patterns to expedite testing for sleep-disordered breathing.

What new to market technologies can we explore and implement into sleep program?

We have mainly used airflow-type testing devices for HSAT testing. We have acquired peripheral arterial tone based testing systems that we are yet to incorporate in a widespread manner for sleep apnea diagnosis. Additionally we have to incorporate other measures of sleep such as activity monitors into our software tracking systems to improve our understanding of our patients and their problems. Moreover, we need to educate underserved communities on sleep, sleep health and role of sleep medicine.

CONCLUSION

The UHC sleep program has evolved over the last 5 years to address rapid changes in sleep apnea care by an integrated approach that is designed to maximize the roles of advanced practice providers and sleep technologists. Besides traditional routes of patient care, we have innovated population-health based strategies that categorizes patients based on type of therapy and degree of adjustment to therapy. We have developed specialized tracking tools through our IT department for long-term monitoring of sleep apnea patients. We have also developed novel pathways of care, streamlined electronic health record data and collaborated across most disciplines across our health-care campus. We hope to continue to expand and innovate as we grow to enable our patients to reach the highest possible level of sleep health and consequent overall health.

APPENDIX A **-** Criteria for entry into stable CPAP clinic:

Usage of CPAP > 80% nights for >4hrs of average use per night for 6 months or more

Machine AHI_{flow} <10

Other criteria

- No ASV/AVAPs/iVAPS
- ESS <10
- No CHF with EF < 40% or use of long-acting opiates
- Periodic breathing < 5% on PAP download
- No significant leak on machine download

APPENDIX B **-** Encounter form created within electronic medical record for the stable CPAP clinic

Virtual Visit Information:
HISTORY OF PRESENT ILLNESS:
Test name is a *** year old adult who is here to follow up on sleep disordered breathing, PAP therapy usage, and PAP equipment management. He is seen via video teleconference due to COVID-19 Pandemic after last being seen on ***, where his PAP therapy stayed the same at a pressure of *** cm H20.

Date of last PSG/HST: ***
AHI in initial PSG: ***
Weight on PSG date: ***
Date of CPAP initiation: ***

Sleep medications: {type:637} Sleep schedule: ***
Sleep latency ***
Nighttime awakenings: {type:637}
Total Sleep Time ***
Morning headache: {type:637}
Difficulty with nasal congestion at night: {type:637}
Drowsy driving or accidents from drowsy driving: {type:637}
Difficulty with air blowing in the eyes: {yes no:314532}
Aerophagia: {yes no:314532}
Oral venting: {yes no:314532}
Excessive Dryness: {type:637}
Snoring on CPAP: {yes no:314532}
Mask fit problems: {yes no:314532}
Mask Type: ***
Mask size ***
Equipment problems: {yes no:314532}
Supplemental O2: {type:637}
Durable Medical Equipment company: ***
CPAP Compliance
AHI 0.4/hr
Average time in large leak: 0.5
Average PAP duration/TST: 100 %
Additional oxygen therapy: No
Average number of hours (days used): ***
Average number of hours (total days): ***
Percentage of days used >4 hours: 100%
Days used 30
ESS 2/24
Impression: ***
Plan:
-Order new supplies today
-Continue on current therapy of {PAPtherapy:12606}
-Return to stable CPAP clinic in *** months.
Patient Education :
-Discussed mask and machine care and advised patient to call our office with any concerns regarding usage or therapy equipment.
-Reviewed the 30-day mask exchange program with DME.
-Discussed to avoid drowsy driving.
-Discussed 6 month review of PAP compliance download.

Signed: ***

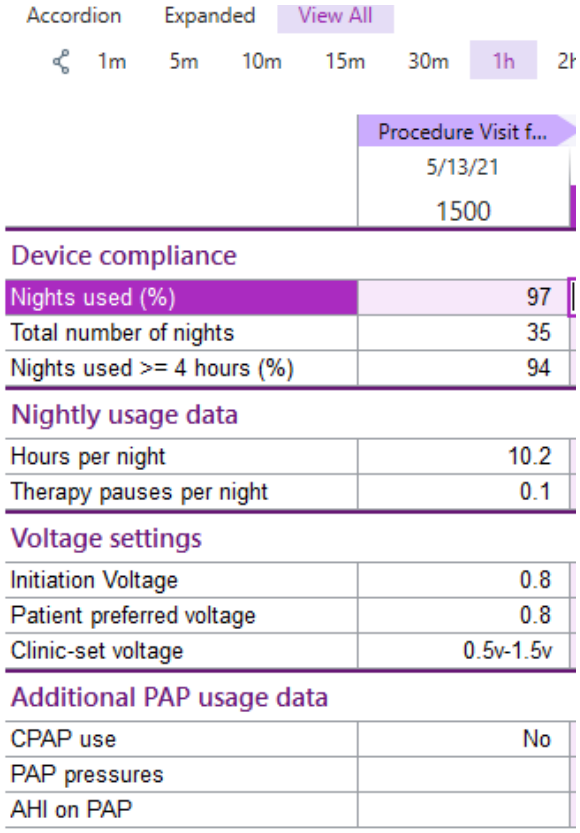
APPENDIX C **-** Encounter documentation within electronic medical record for Hypoglossal Nerve Stimulator

Procedure: Hypoglossal cranial nerve activation
Performed activation and simple programming of hypoglossal cranial nerve simulator, consisting:
Amplitude: 0.6
Patient control range: 0.5- 1.5
Default electrode configuration, pulse width and rate were used.
Patient tolerated the activation well and stimulation was found to be comfortable for the patient.

Also performed sense lead waveform testing with no abnormalities found.
Patient educated on the use of the sleep remote.
Instructed to use Inspire all night every night.

Patient to step up stimulation one level every week to achieve comfortable, restful sleep.
Will call patient in 2-3 days with follow up
Technologist signature:

NERVE STIMULATOR EMR flowsheet documentation:



	Procedure Visit f... 5/13/21 1500
Device compliance	
Nights used (%)	97
Total number of nights	35
Nights used >= 4 hours (%)	94
Nightly usage data	
Hours per night	10.2
Therapy pauses per night	0.1
Voltage settings	
Initiation Voltage	0.8
Patient preferred voltage	0.8
Clinic-set voltage	0.5v-1.5v
Additional PAP usage data	
CPAP use	No
PAP pressures	
AHI on PAP	

Device compliance:
Nights used (%): 97
Total number of nights: 35
Nights used >= 4 hours (%): 94

Nightly usage data
Hours per night: 10.2
Therapy pauses per night: 0.1

Voltage settings
Initiation Voltage: 0.8
Patient preferred voltage: 0.8
Clinic-set voltage: 0.5v-1.5v

Additional PAP usage data
CPAP use: No