

Implementing a CPAP PI Program

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Objectives

- Discuss the AASM clinical guidelines.
- Discuss how to perform superior PAP Titration Studies and use the Task Force recommendation grading system on what an acceptable PAP titration is.
- Explain how to integrate a CPAP PI Program into the Sleep Center
- Describe the benefits and success of a CPAP PI Program for the Sleep Center
- Discuss the importance of such a PI Plan for Sleep Centers in this new day and age of the Sleep Profession.



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- In order to proceed with a process of improvement, there must be a plan, some sort of guidelines or recommendations to follow.
- **American Academy of Sleep Medicine**



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- The American Academy of Sleep Medicine (AASM) is the leader in setting clinical standards for the fields of sleep medicine, promoting education and research by publishing practice parameters, systemic reviews, clinical guidelines and best practice guides.



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The Development of the Task Force

- In April 2007, the Board of Directors of the AASM approved the development of PAP titration recommendations. A Task Force of members was appointed in July 2007.
- Multiple research studies were conducted after review of the available literature. Once a consensus was reached, the task force made its recommendations
- This was a huge development for Sleep Centers. The most important thing we do in the Sleep Lab are titrations!



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So once the recommendations were established, the data was published.

- In the April 15, 2008 issue, the AASM published an article in the Journal of Clinical Sleep Medicine, outlining in detail the PAP recommendations set forth by the AASM.
- In this article, clinical guidelines offer recommendations for conducting CPAP and BIPAP titrations in patients with OSA.
- The article also offers clinical guidelines to establish what an acceptable PAP titration study is.
- These guidelines were aimed at increasing the effectiveness of PAP titrations.



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Background

- The manual titration of positive airway pressure has been going on for 25 years. However no standardized protocols existed for this procedure.
- The lack of standardization results in clinicians and technologists from different sleep laboratories developing their own protocols.
- Implementing a Standardized protocol would aid in the development of an optimal pressure for CPAP which can be reproducible and utilized in all titrations.



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Remember!!!

These are only recommendations of the Task Force. Sleep facilities, sleep technologists and clinicians should combine their experience and judgment with the application of these recommendations to attain the best possible titration in any given patient.



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Before we begin.....

- What do you think is the **most important factor** required to perform that superior titration?



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PAP Education



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AASM Recommendations

- All PAP titration candidates should receive **adequate** PAP education, hands on demonstration, careful **mask fitting** and **acclimatization** prior to titration.



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What is adequate PAP education:

The Task Force recommends:

- * The indications, rationale for use, and side effects of PAP therapy should be discussed in detail with the patient or caregiver prior to the PAP titration study.



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PAP Education

- Educating the patient on breathing systems and how PAP therapy works, what it will feel like and how it will help improve their sleep?
- Explaining to the patients what sleep apnea is and how important PAP therapy is to treating sleep apnea.
- Educate the patient on the severity of sleep apnea.



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PAP Education

Mask Fitting

*The patient should be carefully fitted for the interface (nasal mask, nasal pillows, full face mask) with the goals of maximizing comfort, compensating for significant nasal obstruction, and minimizing leak prior to the PAP titration.



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PAP Education

- * There should be several different types of PAP interfaces (nasal masks, nasal pillows, full face masks) and accessories (chinstraps, heated humidifiers) available if the patient encounters problems like mouth leak, nasal congestion or oronasal dryness during the night.



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PAP Education

Acclimatization to PAP

- *The patient should be acclimated to the PAP equipment prior to lights off.
- *The patient should wear the interface with the pressure on to acclimate themselves to the pressure and feel of PAP therapy.



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- Let's discuss the clinical guidelines set forth by the AASM regarding the manual titration of positive airway pressure in patients with obstructive sleep apnea.



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The Task Force Recommendations for Conducting PAP Titration Studies in Adult Patients with Obstructive Sleep Apnea



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Recommendations

- **CPAP** (IPAP and or EPAP for patients on BIPAP) **should be increased until the following obstructive respiratory events are eliminated or the recommended maximum CPAP is reached: apneas, hypopneas, respiratory effort-related arousals (RERAS's), and snoring.**



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Task Force Recommendations

- The recommended minimum starting CPAP pressure should be 4cm H₂O (BIPAP 8/4 cm H₂O)
- The recommended maximum CPAP pressure should be 20cm H₂O (BIPAP 30cm H₂O).
- IPAP-EPAP minimum differential 4cm H₂O
- IPAP-EPAP maximum differential 10 cm H₂O



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Task Force Recommendations

- CPAP (IPAP and EPAP for BIPAP) should be increased by at least 1cm H₂O with an interval no shorter than 5 minutes with the goal of eliminating obstructive respiratory events.
- CPAP (IPAP and EPAP for patients on BIPAP) should be increased from any CPAP (or IPAP) level:
 - If at least 2 obstructive apneas are observed
 - If at least 3 hypopneas are observed
 - If at least 5 RERA's are observed
 - If 3 minutes of loud or unambiguous snoring are observed .



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Recommendations Cont...

- If patient is uncomfortable or intolerant of high pressures on CPAP, then BIPAP may be attempted.
- If there are continued obstructive respiratory events at 15cm H₂O on CPAP during the titration study, the patient may be switched to BIPAP.



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Recommendations cont...

Goal of titration

- The pressure of CPAP or BIPAP selected for patients use following the titration study should reflect control of the patient's obstructive respiration by a low respiratory disturbance index or (RDI) (preferably <5 per hour) at the selected pressure, a minimum oxygen saturation above 90% at that pressure, and a leak within acceptable parameters at that pressure.



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Putting it all together

- So now you have your Task Force recommendations on how to perform PAP titrations and all the important factors required to perform a superior titration.
- How do you know if you have a superior titration or not?



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The Grading System

The Task Force has developed a recommended grading system to establish what an acceptable PAP titration is.

- **Optimal**
- **Good**
- **Adequate**
- **Unacceptable**



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Optimal Titration

- An optimal titration reduces the RDI <5 for at least a 15 minute duration and should include supine REM sleep at the selected pressure that is not continually interrupted by spontaneous arousals or awakenings.



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Good Titration

- A good titration reduces the RDI ≤ 10 or by 50% if the baseline RDI < 15 and should include supine REM sleep that is not continually interrupted by spontaneous arousals or awakenings at the selected pressure



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Adequate Titration

- An adequate titration does not reduce the $RDI \leq 10$ but reduces the RDI by 75% from baseline (especially in severe OSA patients), or one in which the titration grading criteria for optimal or good are met with the exception that supine REM sleep did not occur at the selected pressure.



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Unacceptable Titration

- An unacceptable titration is one that does not meet any one of the above grades.



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We have discussed the guidelines of how to perform PAP titrations and how to adequately grade a titration as **Optimal, Good, Adequate** or **Unacceptable.**



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Now we have definitions and standardized guidelines.

How do we take this data and use it to implement a PI Program which will result in improving PAP titrations in the lab!



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So what did Carolinas Sleep Services do to implement this grading system?

- In 2008, Carolinas Sleep Services implemented a plan to improve our titrations.
- We sampled titrations in November of 2008. After careful and detailed review of these titrations, we found **63%** of the titrations were Optimal or Good using the criteria set forth by the AASM



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Our Plan for Improvement

- Since there was nothing out there that stated where we should be, we established our benchmark from the data we collected.
- From this, we established goals for improvement and began our process.

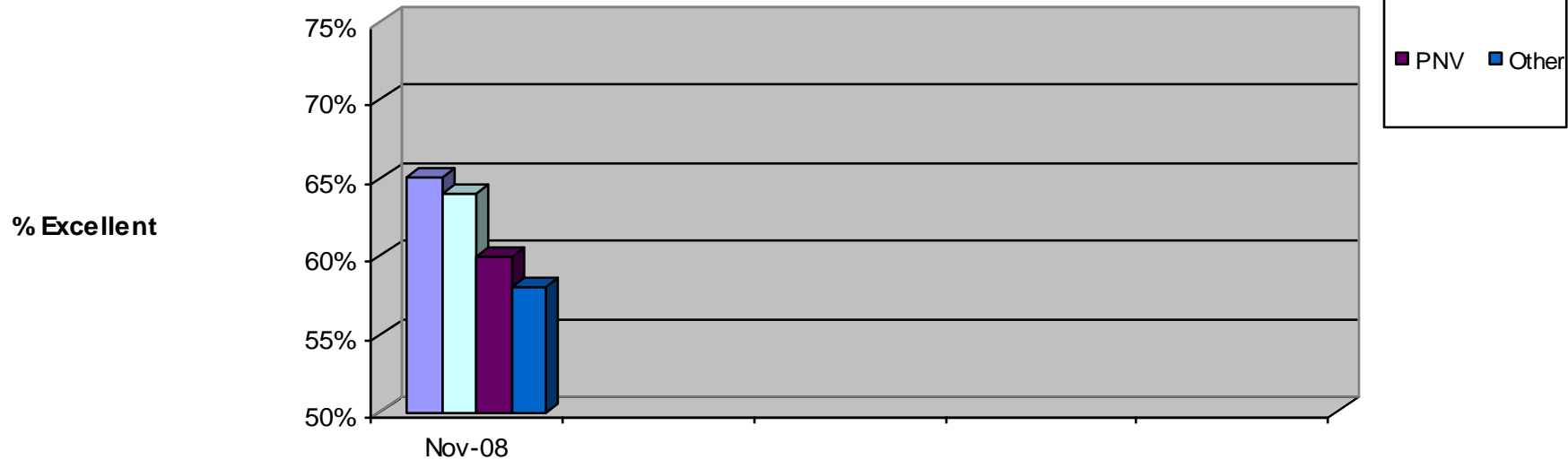


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Optimal and Good Titrations Benchmark 63%

**Carolinas Sleep Services
% of Good & Optimal Titrations**



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Our Aim / Goal to Improve

- After establishing the benchmark, we decided that the reasonable first step for our Sleep Facility was to focus on the first two categories.
- The goal of the project was to improve the percentage of Optimal and Good PAP Titrations to:

> 75% for 2009



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What was our Process?

- First we identified all the factors that could potentially influence the titrations.
- **(For example: Tech, mask type, severity of apnea in diagnostic study, physician, etc...)**
- Then we put together an excel spreadsheet to collect our data and adequately grade each titration.



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This is what we came up with initially.

- Patient name Physician
- Date of Study Technician
- Mask utilized Final Pressure
- Optimal Pressure RDI AHI Nadir
- Lights Out Lights On 2nd Study
- Diagnostic AHI Diagnostic RDI Diagnostic Nadir



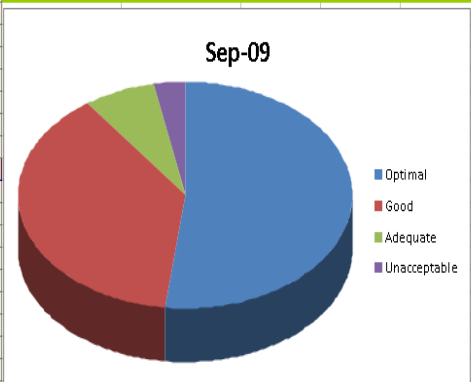
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Carolinas Sleep Services

Pineville PDSA Titration Project

	Sep-09	(61/68) 90% Optimal/Good	Tech	Optimal	Good	Adequate	Unacceptable	% Optimal/Good
Optimal	52%	35/68	TM	3	5	1	1	8/10 80%
Good	38%	26/68	TG	6	3	2	0	9/11 82%
Adequate	7%	5/68	JB	6 (3)	3 (2)	0 (3)	0	14/17 82%
Unacceptable	3%	2/68	JC	4	7	2	0	11/13 85%
			JW	3	4	0	0	7/7 100%
			LP	9	2	0	0	11/11 100%
			CG	3	0	0	1	3/4 75%
			CT	1	0	0	0	1/1 100%
			LP	0	1	0	0	1/1 100%
			TB	0	1	0	0	1/1 100%



Patient Name	Titration Grade	Physician	Date of Study	Study Type	Tech	Mask	Final Pres	Opt Pres	RDI	AHI	Nadir	Lights Out	Lights On	2nd Study	Diag AHI	Diag RDI	Diag Nadir	Comments
Patient Name	Adequate	ET	9/1/2009	SPLIT	TG	Comfort Gel	14/8	14/8	35.3	33.2	88%	2215	537	SPLIT	38.4	41.3	79%	Patient had REM sleep but RDI high due to persistent centrals.
Patient Name	Good	ET	9/1/2009	CPAP	TM	Activa LT	15	11	8.3	0.0	92%	2236	519	DIAG	9.8	23.7	85%	1.5 minutes of REM supine
Patient Name	Optimal	ML	9/1/2009	CPAP	JB	Comfort Fusion	9	8	3.8	3.8	90%	2237	605	DIAG	No Diag	No Diag	No Diag	1.5 hours of Rem supine
Patient Name	Adequate	JP	9/1/2009	SPLIT	TG	Fisher Paykel 407	7	7	0.0	0.0	93%	2245	620	SPLIT	33.6	45.0	82%	No REM supine throughout study - pt on Cymbalta
Patient Name	Good	SL	9/2/2009	SPLIT	JC	Fisher Paykel Zest	12/12/3	10/10/3	9.9	5.0	91%	2146	646	CPAP	8.8	42.9	84%	5 minutes of REM supine
Patient Name	Good	EC	9/2/2009	CPAP	JC	Comfort Gel Full	12/12/3	12/12/3	8.4	8.4	91%	2222	521	SPLIT	12.0	17.5	78%	16 minutes of REM supine
Patient Name	Optimal	ET	9/2/2009	CPAP	CG	Comfort Gel Full	11	11	2.2	1.1	91%	2301	546	DIAG	18.7	28.1	81%	38 minutes of REM supine
Patient Name	Good	ET	9/3/2009	CPAP	JC	Swift LT	12	2	6.9	0.0	96%	2210	735	1 pt night	19.1	26.0	85%	14 minutes of REM supine
Patient Name	Good	ML	9/3/2009	CPAP	JW	Swift	11/11/2	8/8/2	6.7	0.0	91%	2321	559	DIAG	20.8	41.0	87%	3 minutes of REM supine
Patient Name	Optimal	Peck	9/4/2009	CPAP	CT	Swift LT	9	9	1.7	0.9	93%	838	1538	Day Study	7.2	13.1	80%	57 minutes of REM supine
Patient Name	Optimal	EC	9/4/2009	CPAP	JC	Comfort Gel Full	14/14/3	13/13/3	0.0	0.0	92%	2225	553	SPLIT	29.7	30.4	44%	24 minutes of REM supine
Patient Name	Optimal	JP	9/4/2009	CPAP	LP	Swift LT	8	7	1.0	0.5	90%	2241	556	DIAG	23.5	32.6	86%	52 minutes of REM supine
Patient Name	Optimal	MG	9/4/2009	SPLIT	JC	Swift LT	6/6/2	6/6/2	0.0	0.0	91%	2246	556	CPAP	17.9	28.5	79%	30 minutes of REM supine
Patient Name	Optimal	ET	9/6/2009	SPLIT	TG	Comfort Fusion	9/9/3	9/9/3	0.0	0.0	96%	2224	547	CPAP	79.8	85.6	84%	21 minutes of REM supine

Ready | Jan. / Feb. / Mar. / April / May / June / July / Aug. / Sep. / Oct. / Nov. / Dec.

Windows taskbar showing: start, neXus Control - [CSS...], About the AASM - A..., General Concepts an..., J:\QA\Valerie PDSA)..., Titrations.pdf - Adobe R..., Microsoft Excel - Pin..., HOLY TRINITY GREE...

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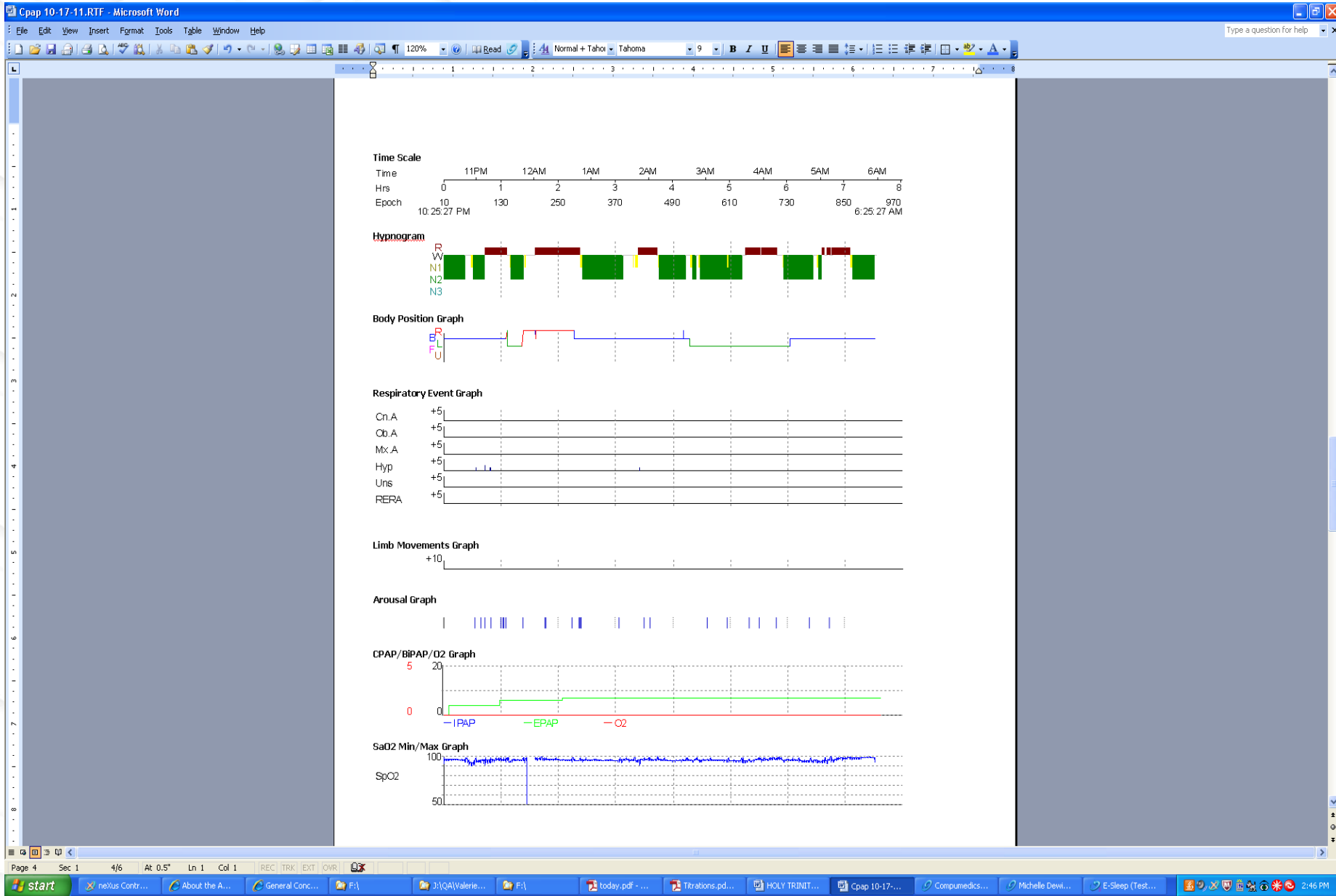
CPAP Respiratory Table

CPAP/O2 or Flex	Total Sleep Time	REM Sleep Time	Number Hypopneas	Number Central Apneas	Number Obstructive Apneas	Number Mixed Apneas	AHI	Flow Limitation Event	RDI	REM SpO2 Nadir	NREM SpO2 Nadir	Sleep SpO2 Nadir
4/4/0	0:47:22.0	0:12:2.0	5	0	0	0	6.3	0	6.3	91	91	91%
6/6/0	0:49:23.0	0:34:53.0	0	0	0	0	0.0	0	0.0	94	94	94%
7/7/0	4:45:35.0	1:39:5.0	1	0	0	0	0.2	0	0.2	91	93	91%

*AHI denotes the average number of apneas and hypopneas per sleep hour. AHI >5 is abnormal, although lower numbers may still reflect some degree of respiratory abnormality. RDI denotes the average number of respiratory events per hour of sleep. Hypopnea is defined as a significant reduction in airflow for a duration of >10 seconds with 4% SAO2 desaturation. Flow Limitation Event (RERA) is defined as a significant reduction in airflow for a duration of >10 seconds with an arousal in the EEG, and a SAO2 desaturation of < 4%.

CPAP Sleep Fragmentation Table

CPAP/O2 or Flex	Respiratory Arousal	Respiratory Arousal Index	Limb Movement Arousals	Limb Movement Arousal Index	Spontaneous Arousals	Spontaneous Arousal Index	Total Arousals	Total Arousal Index
4/4/0	0	0.0	0	0.0	4	4.5	4	4.5
6/6/0	0	0.0	0	0.0	7	6.5	7	6.5
7/7/0	0	0.0	0	0.0	15	2.7	15	2.7



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- After collecting and analyzing a month of reasonable data in November 2008, we did a thorough analysis of identifying any positives or negatives.
- Were there any **contributing factors**?
- Were there any **common trends** with optimal titrations versus non optimal titrations?



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What did the data show?

- Increase in the correlation between bedtime and the titration outcome.
- The significance of obtaining supine data.
- Mask preference by the technician



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Changes for Improvement

- Increase in the correlation between bedtime and the titration outcome.

Added a bedtime criteria to our policy.

- From the data, patients who went to bed late (after 11:30 pm), had a lower percentage of optimal titrations than patients who went to bed earlier.

The majority of our studies are ordered as Split procedures. We found that these patients in particular had a lower percentage of optimal or good titrations due to the limited amount of time left to titrate them.



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Changes

- Educated the staff on importance of obtaining supine sleep and implemented this change in our policy.
- Held in-services and education meetings with staff on importance of obtaining supine sleep.



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More Changes.....

- Addressed mask preference by individual technologist.
- From sampling, we found that there was a certain mask preference by some technologists. These technologists were exclusively using a certain mask, regardless of patient comfort or tolerance.



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RESULTS

Changes bring results!



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2009

- In 2009, Carolinas Sleep Services surpassed the **75%** goal we had set.
- **82%** of the titrations performed at Carolinas Sleep Services were Optimal or Good titrations



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Our Goal for 2010

- Since we implemented the new changes, CSS surpassed the goal set for 2009.
- We decided to aim for a higher goal for 2010 – that goal was set at 85% of all titrations to be Optimal or Good.



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2010

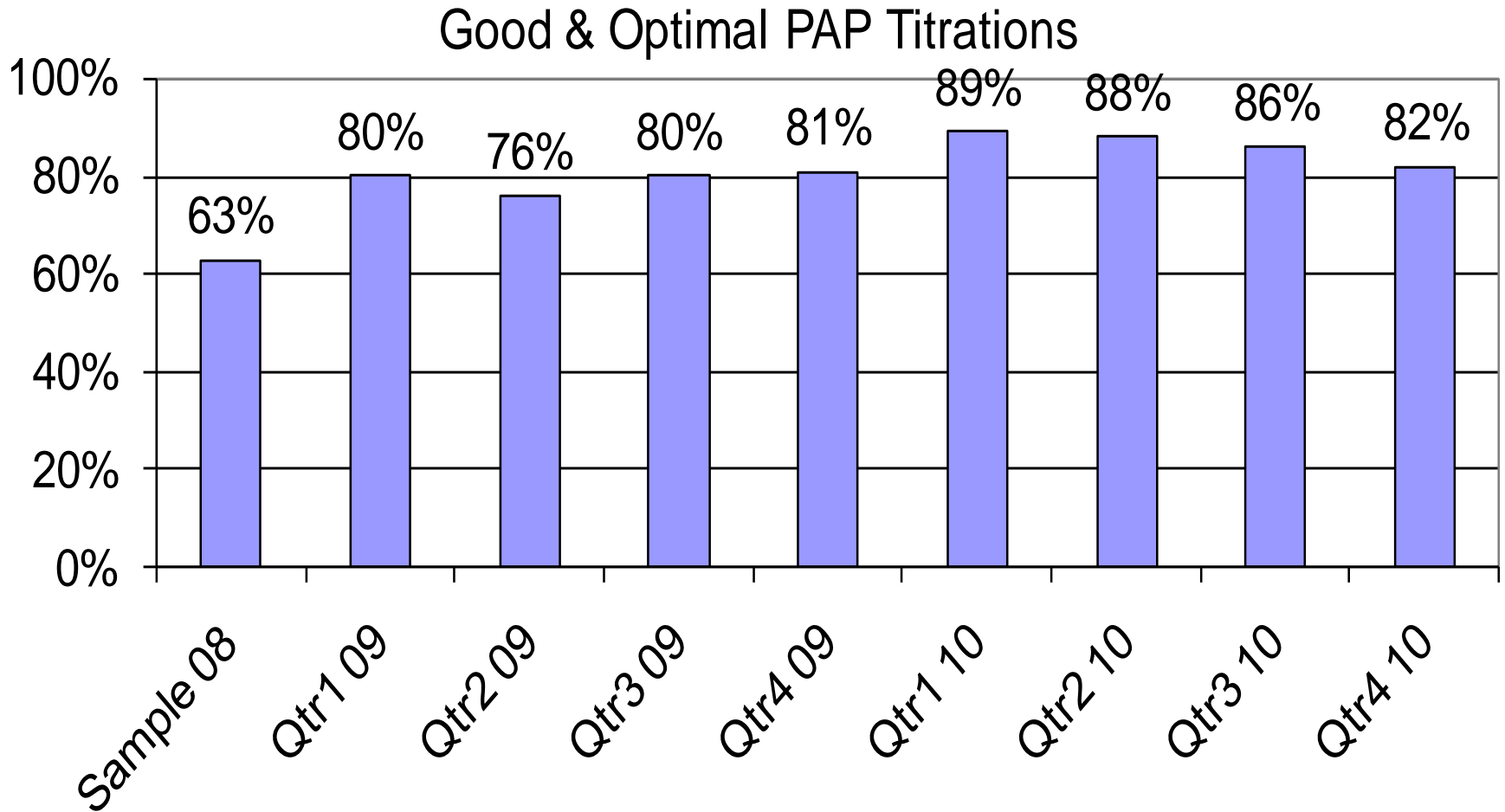
- In 2010, the goal of 85%, was also surpassed at 86% of Optimal and Good titrations performed at CSS.



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Optimal/Good Titrations Improvements



New Goals

- So once we achieved and surpassed our goals for **Optimal and Good** Titrations, we decided to add an additional goal to increase our **Optimal** Titrations.



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In 2010....

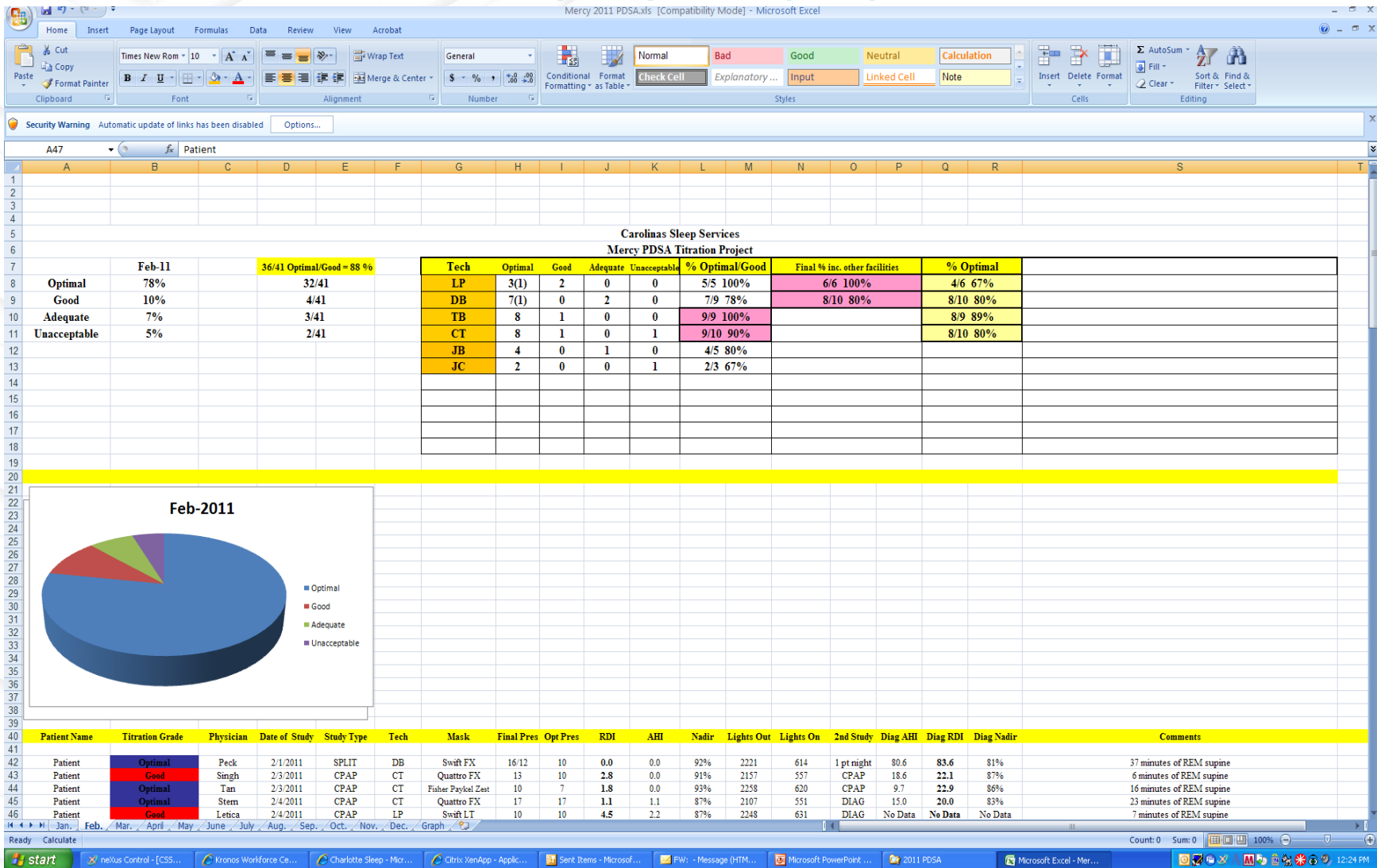
- In 2010, we added the goal of achieving 60% Optimal titrations for the year.



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More Data

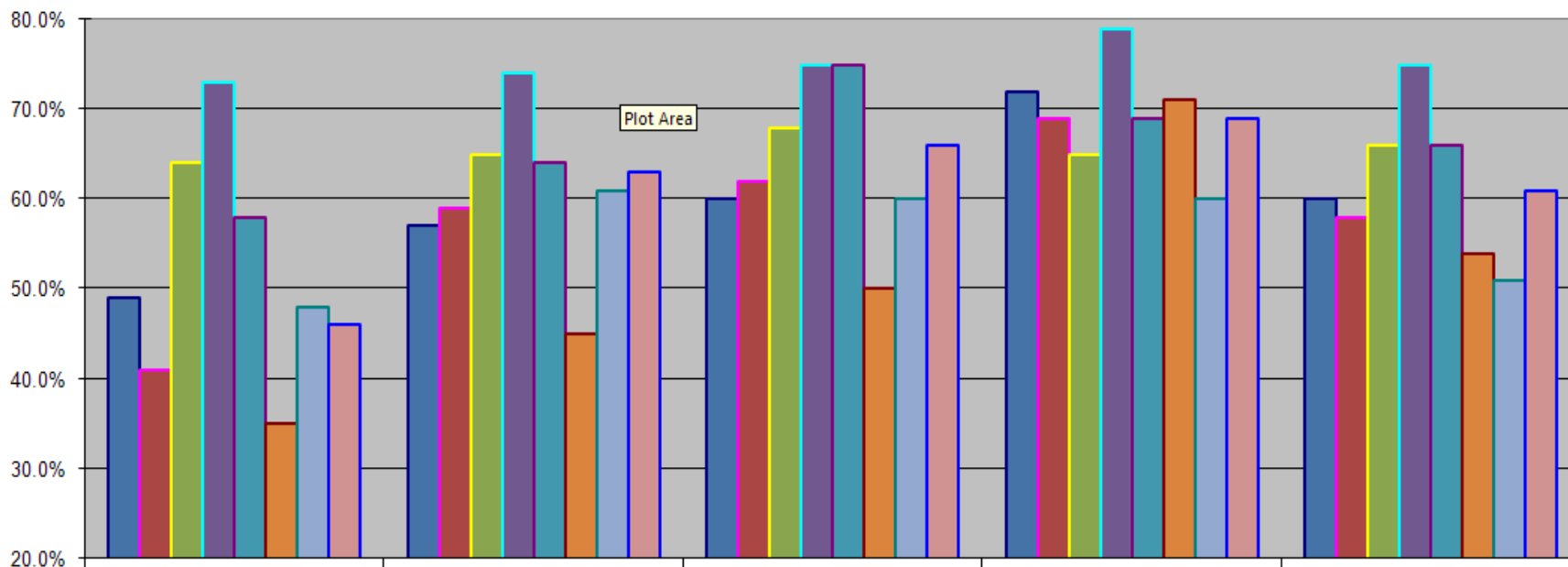


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Optimal Titration Data 2010

Optimal Titrations



	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	2010 Total
CSS Pineville	49.0%	57.0%	60.0%	72%	60.0%
CSS Union	41.0%	59.0%	62.0%	69%	58.0%
CSS Mercy	64.0%	65.0%	68.0%	65%	66.0%
CSS University	73.0%	74.0%	75.0%	79%	75.0%
CSS HTV	58.0%	64.0%	75.0%	69%	66.0%
CSS Cald	35.0%	45.0%	50.0%	71%	54.0%
CSS Linc	48.0%	61.0%	60.0%	60%	51.0%
CSS Total	46.0%	63.0%	66.0%	69.0%	61.0%

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In 2011.....

- We increased our **Optimal Titration** goal to 68%.
- Maintain **Optimal and Good** Titration Goal of 85%, improve all outlying techs and facilities.
- Of course 100% is not an achievable goal. There will always be variables which will not allow for this.

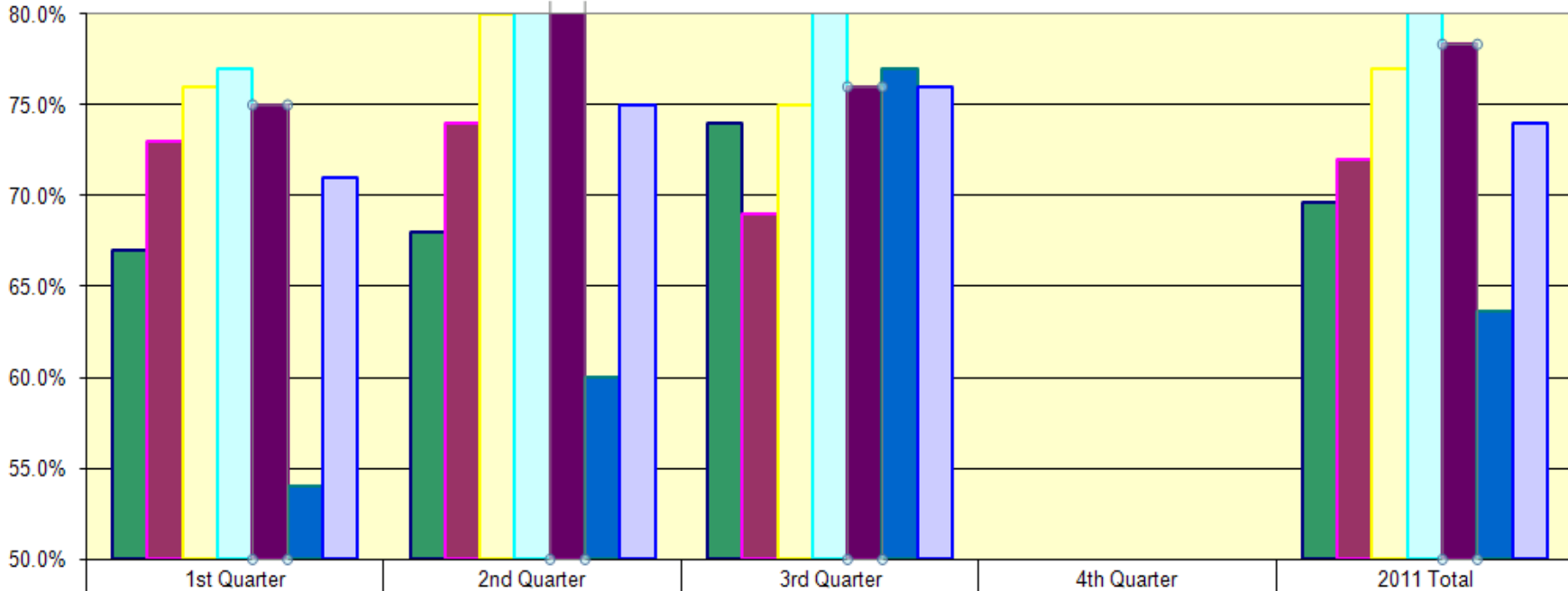


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Optimal Titrations 2011

Optimal Titrations



	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	2011 Total
■ CSS Pineville	67.0%	68.0%	74.0%		69.7%
■ CSS Union	73.0%	74.0%	69.0%		72.0%
■ CSS Mercy	76.0%	80.0%	75.0%		77.0%
■ CSS Universtiy	77.0%	85.0%	84.0%		82.0%
■ CSS HTV	75.0%	84.0%	76.0%		78.3%
■ CSS LMC	54.0%	60.0%	77.0%		63.7%
■ CSS Total	71.0%	75.0%	76.0%		74.0%

So where to we go from here?

- CSS will continue to maintain the goal for Optimal and Good titrations, and also maintain the goal for Optimal titrations.
- In the new year, CSS will implement a new plan to improve specialty procedures, such as (BIPAP and ASV).



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New Goals

- These specialty procedures are currently being looked at and data is being compiled.
- From this data, protocols are being revised to improve titration results for these patients.
- With the collection of this data, staff will be educated and informed on the new processes so continued improvement in all titration effectiveness will occur.



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So what are the benefits of implementing a CPAP PI Program?

- Improved patient outcome
- Improved physician satisfaction
- Availability of data
- Improved Staff Satisfaction



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Benefits

- Improved patient outcome

(More successful titrations - patients not having to return to sleep center for re-titration)

Much higher CPAP compliance due to adequate PAP education and expertise of the in lab titration.



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Benefits...

- **Improved physician satisfaction**

(Motivation for Sleep Center Titrations vs Auto Titration in the home)

Physician satisfaction has increased in the last 2 years since the PI program has been put into place. Our physicians expect and know that CSS will provide them a quality titration.

In this new age of home testing advances, this is very important for Sleep Labs to have a reputation for excellent titrations.

- **Data available**

Now we have data to support our claim that in lab titrations are far more effective than any home devices.



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Benefits...

- Improved staff satisfaction

A Sleep technician can make a difference in a patient's life. By providing that superior "optimal" titration, they have improved the health of that patient.



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To Conclude

- Guidelines and standards set forth by the AASM.
- Performing the superior titration.
- Integrating the CPAP PI Program into your Sleep Center
- The benefits and success of such a program.
- The significance of collecting data to prove that our in lab titrations are superior!



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Credits

- American Academy of Sleep Medicine for all the information and guidelines established to help us implement our PI Process.



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