

CPAP/BiPAP (PAP) data downloading and interpretation

Pei-Lin Lee MD, PhD, FAASM

Clinical Associated Professor of Internal Medicine, National Taiwan University, College of Medicine
Director, Center of Sleep Disorder, National Taiwan University Hospital

Use of PSG and HSAT for the longitudinal management of adult OSA

- ❖ **Not recommend** for routine reassessment of asymptomatic patients with OSA on PAP therapy
 - Can be used to reassess patients with recurrent or persistent symptoms, despite good PAP adherence
- ❖ **Recommended** to assess response to treatment with non-PAP interventions

Why: rationale for device download

❖ Adherence monitoring

- Factor associated with adherence
 - Perception of benefit from treatment
(endpoint specific to OSA phenotype)
 - Improvement in AHI
 - Behavioral modification
 - Managing side effect
 - Intensive education
- Good compliance definition
 - CV outcome, ESS: $\geq 4\text{hr/night}$ on $\geq 70\%$ of all days
 - MSLT: 6hr and memory: $\geq 6\text{hr/night}$
 - FOSQ: $\geq 7.5\text{hr/night}$

❖ Identify PAP efficacy

❖ Find clues for non-adherence

- Subjective / objective lack of benefit
- Poor habitual sleep pattern
- Side effect

Who and When: PAP data download

- ❖ Anyone who receive PAP
- ❖ Plan rollout when you prescribe CPAP
- ❖ Clinic visit interval
 - USA: 6-12 month
 - Japan: every 1-3 month
 - NTUH: 1st, 3rd, 6th, 12th month in first year, then 6-12 month
- ❖ Compliance in first 2-4 weeks are crucial

What: CPAP parameters parameters look into

❖ Setting

- Mode, pressure, ramp, flex (EPR), rounding

❖ Time

- Date, period, time zone

❖ Habitual sleep pattern

❖ Efficacy

- Pressure tracing
- Residual breathing event
 - AHI, AI, OI, CI, HI, NOI
 - Flow limitation
 - RERA

❖ Adherence

❖ Leak

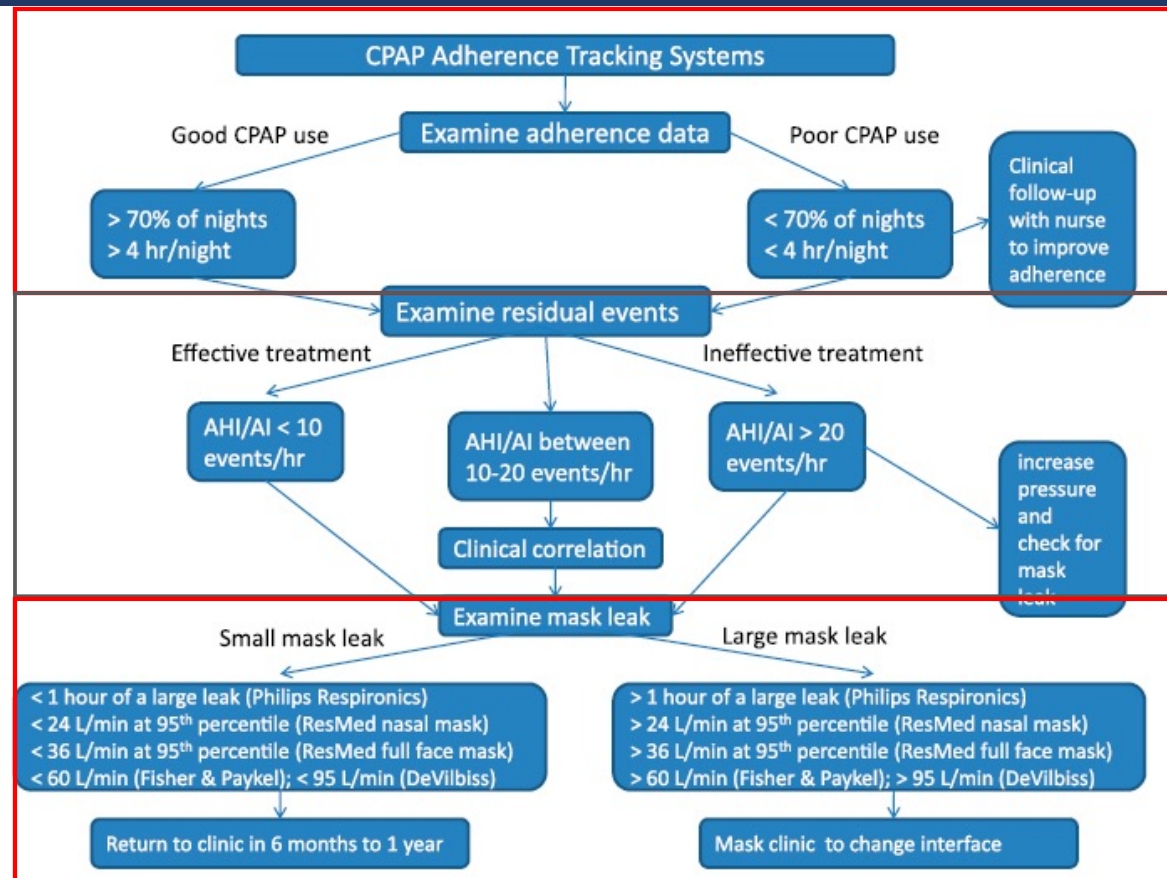
- Unintentional leak vs intentional leak

PAP Tracking: adherence, residual event, leak

compliance

Residual event

leak



Schwab RJ Am J Respir Crit Care Med 2013

*Children: residual AHI<5/hr

Automatic event detection (AED) on CPAP

❖ AHI detection

- Underestimated for manual scored AHI>10/hr and overestimated for manual scored AHI<10/hr with the difference mainly in hypopnea

Manufacturer	Apnea Event Detection	Hypopnea Event Detection
ResMed unit (S9 model)	Apnea is defined when the 2-s moving average root mean square ventilation (based on a pneumotachograph) falls below 25% of the long-term ventilation for 10 s	Hypopnea is defined when all of the following conditions are met: 1. The 12-s moving average root mean square ventilation falls below 50% of the long-term ventilation 2. The hypopnea is not immediately followed by an apnea 3. The hypopnea contains one or more partially obstructed breaths
Phillips Respironics unit (System One model)	Apnea is detected after a moving window of 3-4 min is established and flow decreases by more than 80% for at least 10 s	Hypopnea is detected when moving window of 3-4 min is established and flow decreases by 40–80% for at least 10 s
DeVilbiss Healthcare IntelliPAP unit (SmartCode remote data retrieval system)	A reduction in a flow signal of >90% of the baseline flow for 10 s	A reduction in a flow signal of >50% of the baseline flow for 10 s
Fisher & Paykel InfoSmart software	>80% reduction in flow relative to a baseline determined from previous breaths	>40% reduction in flow relative to a baseline determined from previous breaths

CPAP mask leak measurement

❖ Total leak= unintentional leak+ intentional leak

CPAP Manufacturer	How Leak Is Measured	Large Leak Threshold
Phillips Respironics	Intentional leak subtracted from total flow	Leak condition where the leak level exceeds a preset “flow vs. pressure” curve (the averaged leak through all mask exhalation ports at various pressure)
ResMed	Unintentional leak (device flow-intentional leak) + mouth leak	95th percentile leak (<24 L/min with nasal interface and <36 L/min with full face interface)
Fisher & Paykel	Total leak, including mask and exhaust flow from mask	A leak value of >60 L/min
DeVilbiss Healthcare IntelliPAP	Records high leak flow time as a percentage of the time the leak was above 95 L/min	A leak value of >95 L/min

Schwab RJ Am J Respir Crit Care Med 2013

Philips Dreamstation CPAP-Usage pattern

出生日期: 1951/10/5 Location: 博兆, VH1台大醫院 Date Range: 2022/2/14 - 2022/7/27
NHS Number: Address: H1台大醫院 Setup Date: 2022/7/28
患者 ID : H1台大醫院, 台灣 1234 Mask:
Phone Number: 链接的应用程序:
Phone Number: 12345678
设备: DreamStation Auto CPAP V1.1.8.3313 (500X150) J25077293ABE7

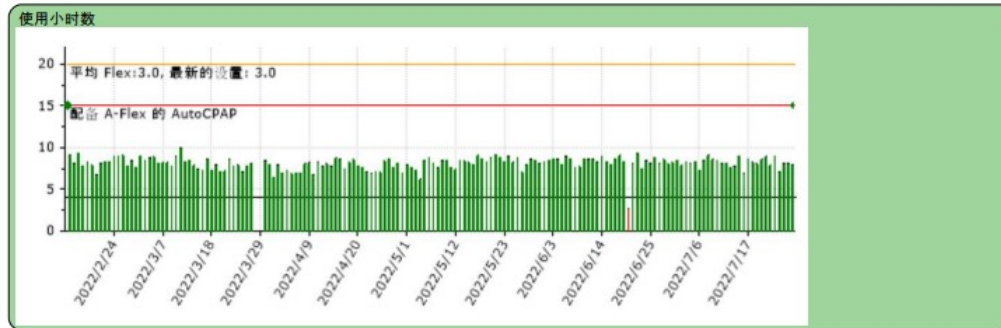
Care Team

台大醫院, H1 博兆 TWN

医嘱依从性信息

2022/2/14 - 2022/7/27

A-Flex™



Microsoft Edge
PDF Document

使用时间图示

二月, 2022



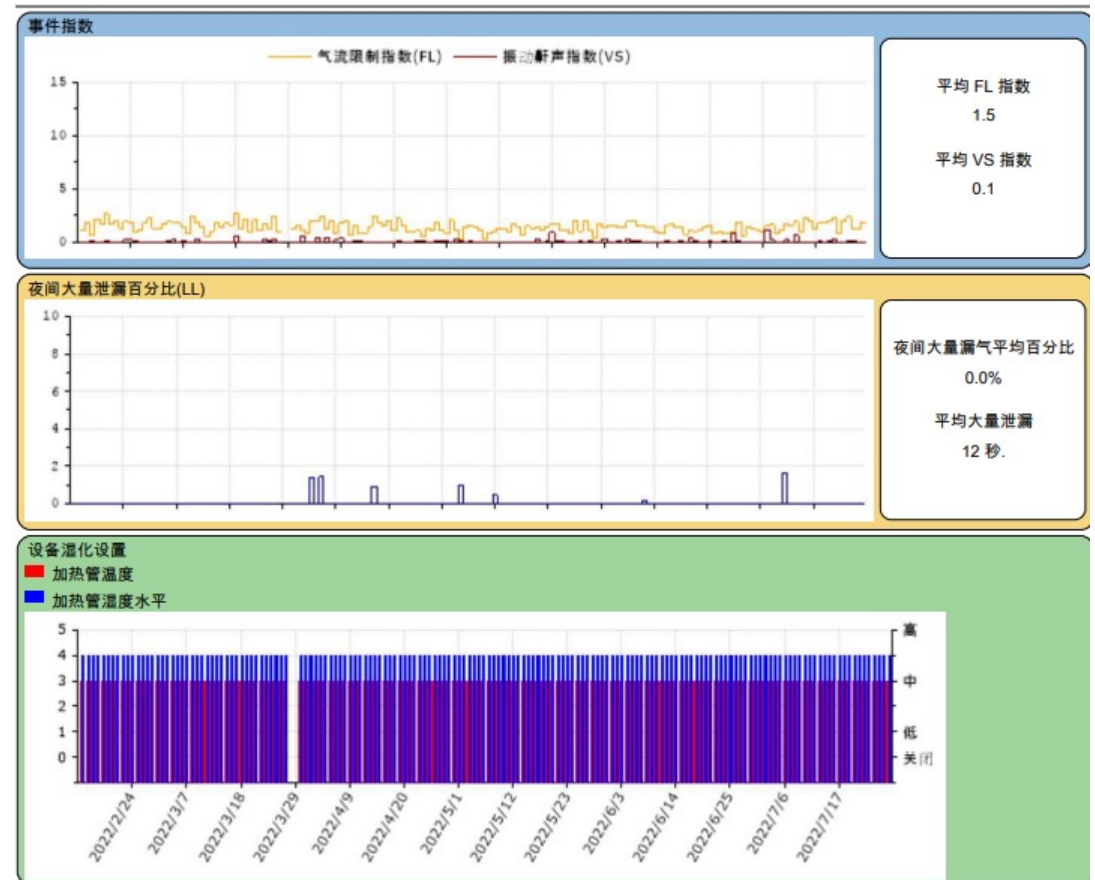
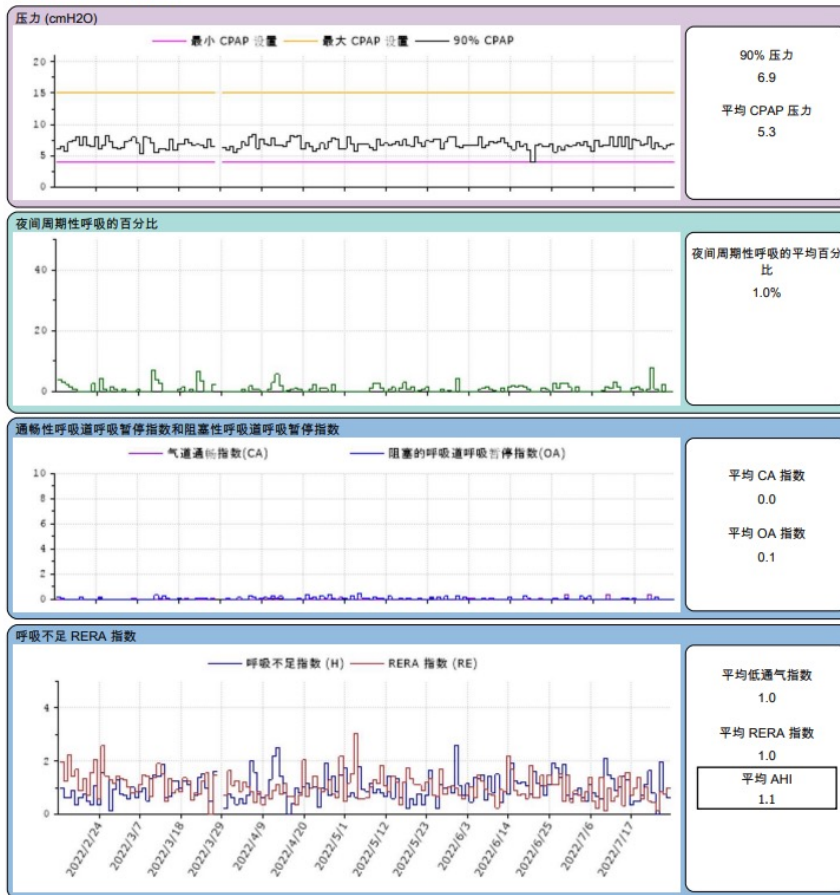
三月, 2022



Philips Dreamstation CPAP-Summary Graphs

睡眠治疗长期趋势

2022/2/14 - 2022/7/27

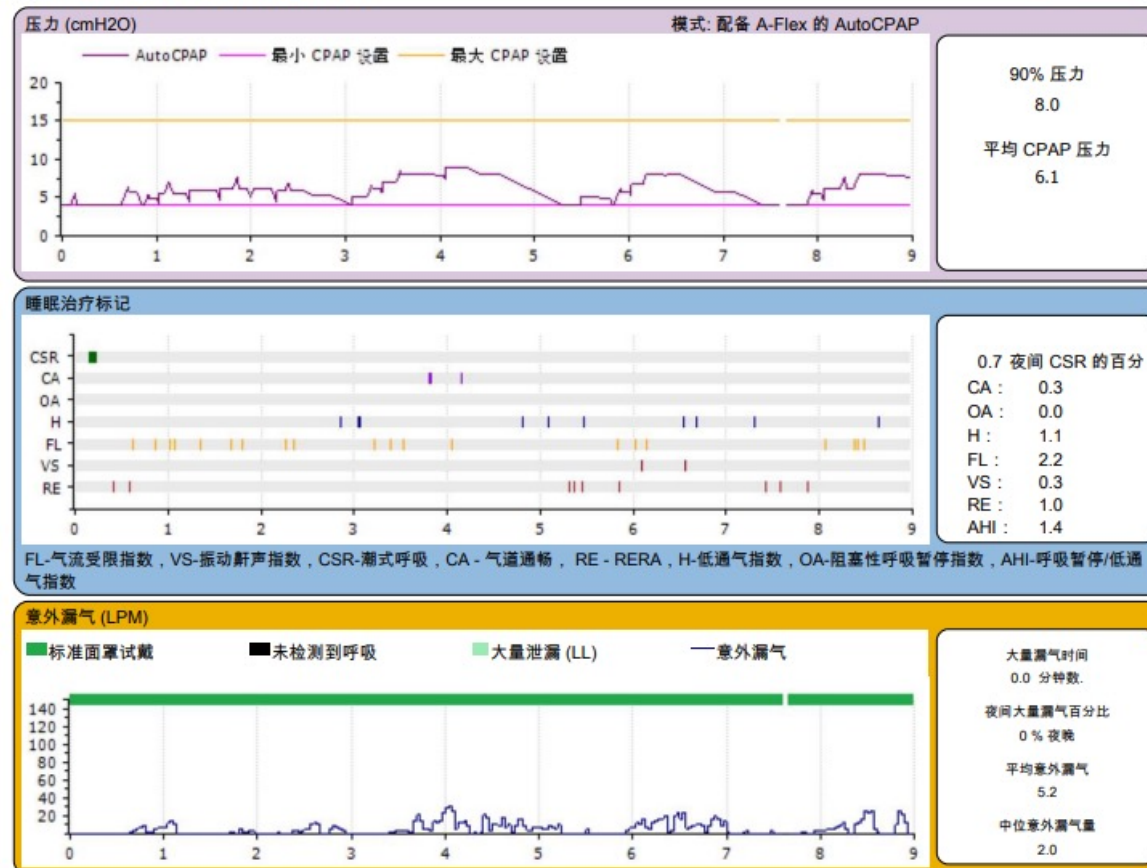


Philips Dreamstation CPAP-Daily detail

每日详细信息

2022/7/21 下午 10:35 - 2022/7/22 上午 07:34

A-Flex™



Philips Dreamstation CPAP-Setting & Statistics

compliance

医嘱依从性摘要	
日期范围	2022/2/14 - 2022/7/27 (164 天数)
使用设备天数	162 天数
未使用设备的天数	2 天数
使用设备天数百分比	98.8%
累计使用时间	54 天数 18 小时, 20 分钟数, 11 秒.
最多使用时间(1天)	10 小时, 2 分钟数, 42 秒.
平均使用时间(所有天数)	8 小时, 51 秒.
平均使用时间(使用的天数)	8 小时, 6 分钟数, 47 秒.
最少使用时间(1天)	2 小时, 42 分钟数, 24 秒.
使用时间 >= 4 小时的天数百分比	98.2%
使用时间 < 4 小时的天数百分比	1.8%
总送气小时数	54 天数 18 小时, 21 分钟数, 27 秒.

Pressure and event

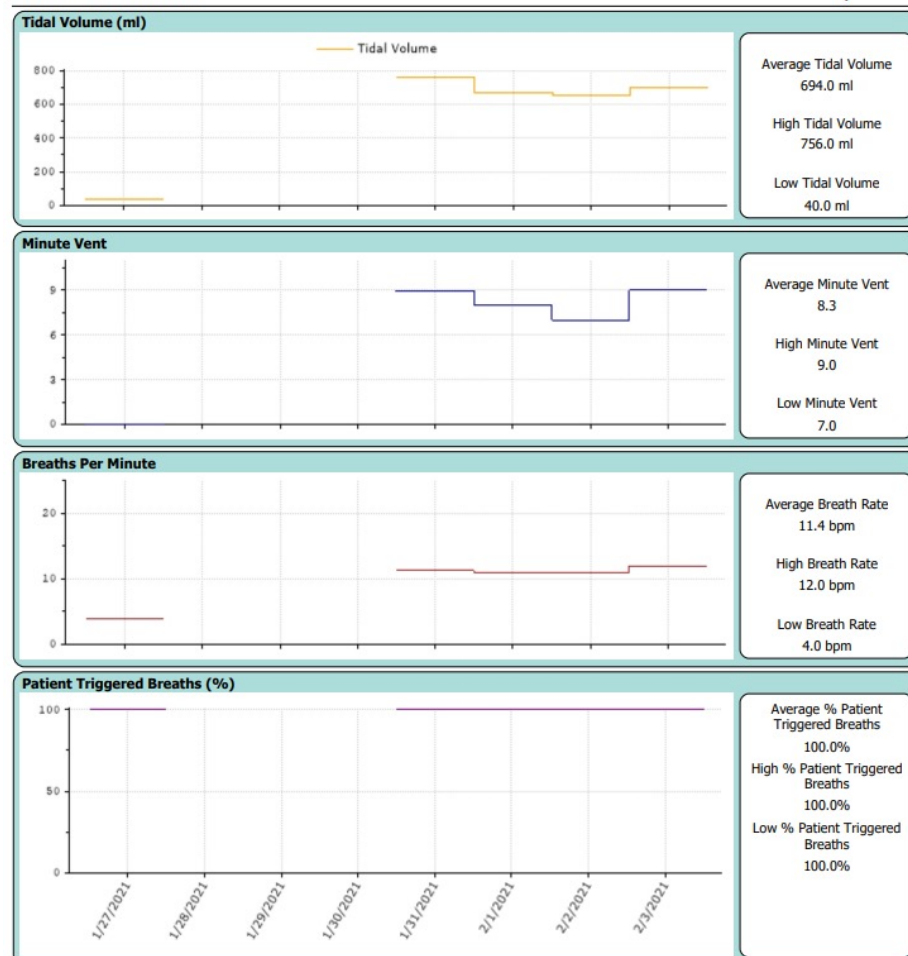
AutoCPAP 摘要	
AutoCPAP 平均压力	5.3 cmH2O
AutoCPAP 的峰值平均压力	7.0 cmH2O
<=90%时间的设备压力	6.9 cmH2O
平均每天大量泄漏的时间	12 秒.
平均AHI	1.1

Setting and period

设备设置		2022/7/27
设备模式	AutoCPAP - A-Flex	
设备设置		
参数	数值	
Min Pressure	4 cmH2O	
Max Pressure	15 cmH2O	
A-Flex Setting	3	
A-Flex Lock	Off	
Auto Off	Off	
Auto On	On	
View Optional Screens	Off	
Ramp Type	Linear	
Ramp Time	30 分钟	
Ramp Start Pressure	4.0 cmH2O	
Mask Resistance	1	
Mask Resistance Lock	Off	
Tubing Type	15 HT	
Tubing Type Lock	Off	
Opti-Start	Off	
EZ-Start	Disabled	
Tube Temperature	3	
Humidifier	4	
Humidification Mode on Heated Tube Disconnect	Adaptive	

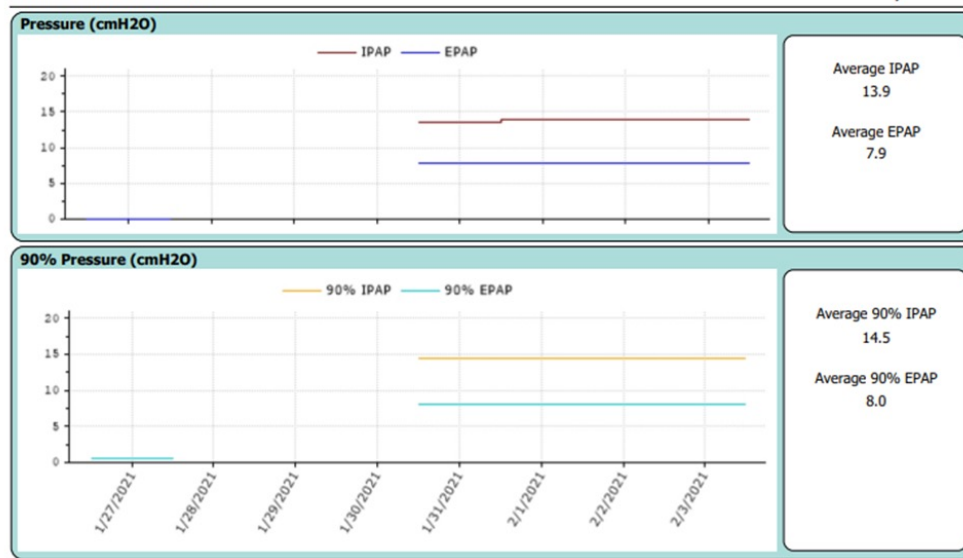
Philips Dreamstation BPAP-Summary Graphs

Patient ID: EncoreCompany221



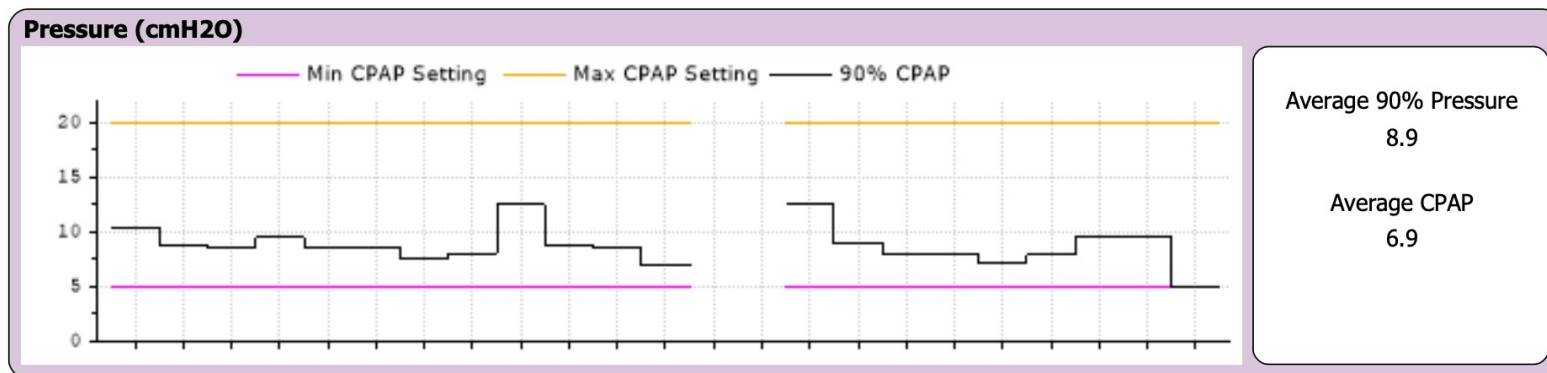
- Setting
 - Mode, IPAP/EPAP, rising time, ramp
 - Flex, EPR, rounding
- Ventilation
 - TV, RR, MV
 - Patient trigger

Patient ID: EncoreCompany221



Manufacture comparison - Pressure

	單位	Devibliss	F&P	Philips	ResMed	SEFAM
95th percentile pressure	cmH2O	V			V	
90th percentile pressure	cmH2O	V	V	V		V
Median pressure	cmH2O				V	
Mean pressure	cmH2O	V	V	V		V

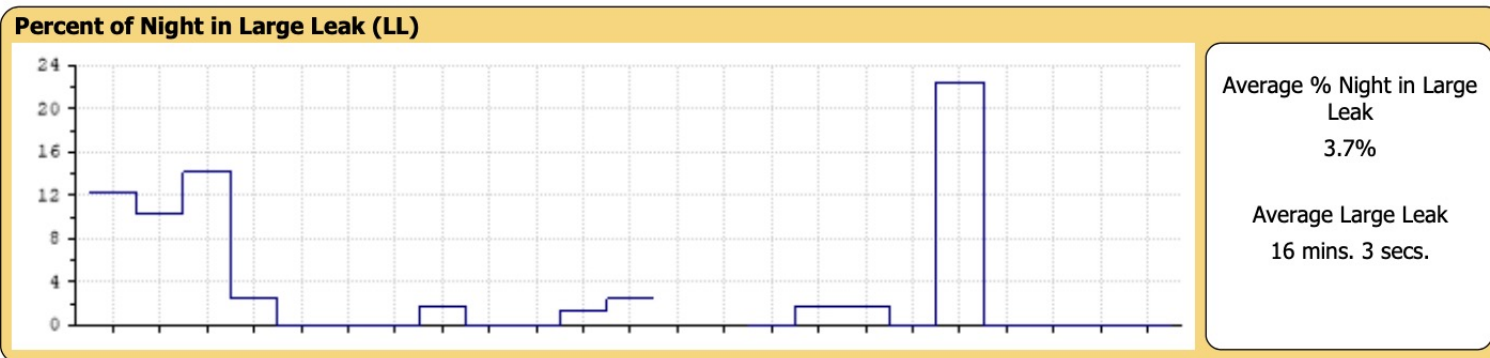


Manufacture comparison - Compliance

	單位	devibliss	F&P	Philips	ResMed	SEFAM
Average usage (total days)	hr/night	V	V	V	V	V
Average usage (days used)	hr/night		V	V	V	V
Usage days \geq 4hrs	%	V	V	V	V	V
Days used at least 4 hours	day	V				
Days with any usage	day	V				
Median usage (days used)	hr/night				V	
total used hours	hr	V	V	V	V	

Manufacture comparison - Leak

	單位	Devibliss	F&P	Philips	ResMed	SEFAM
Large leak threshold		> 95L/min	> 60L/min	> 1hr	N > 24 L/min; ON>36L/min	> 48 L/min
95th percentile leaks	L/min	V			V	
90th percentile leaks	L/min	V	V			V
Time in large leak	___min___secs		V	V		V

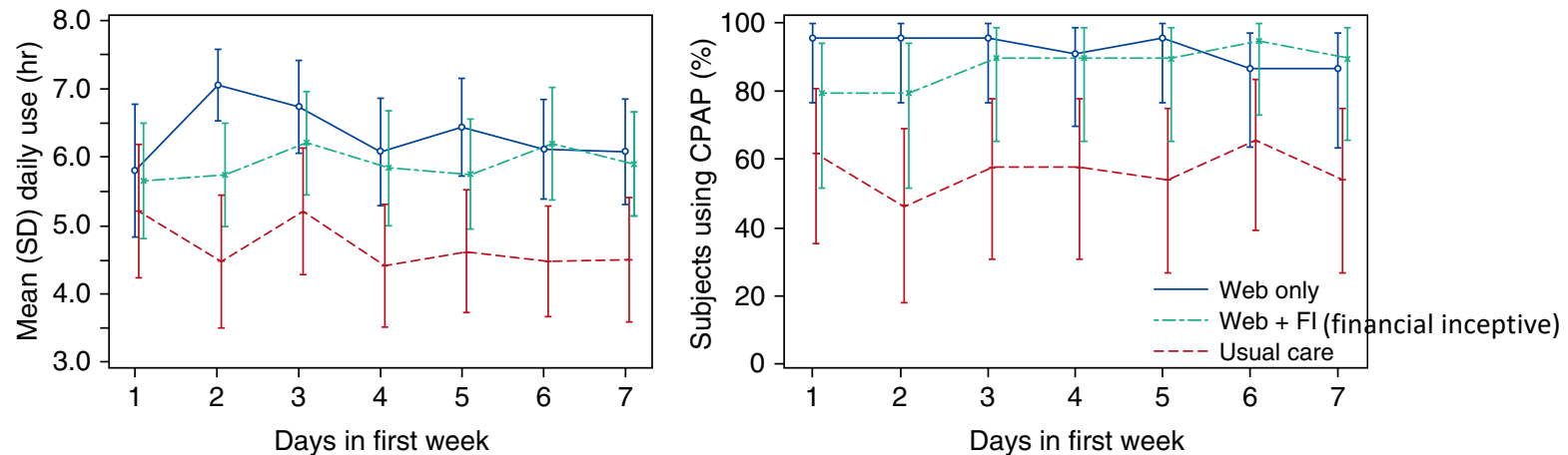


How: Accessing device data

- ❖ CPAP device and cable
 - APEX
- ❖ Smart card
- ❖ Modem device
 - Philips-Respironic
- ❖ Wireless transmission
 - 4G (ResMed AirView, SEFAMconnect)
 - Wi-Fi (Fisher& Pack Infosmart)
 - Bluetooth connected to mobile App

CPAP treatment: patient participation

❖ Web-based access to CPAP data to improve compliance



❖ CPAP blue tooth transmission plus cloud based access (ResMed: AirView, Philips Respironics: EncoreAnywhere)

Trouble shooting

❖ Inadequate effectiveness

- CPAP FU questionnaire
- Blood pressure monitoring

❖ Side effect

- Dry throat
- Condensation
- Skin irritation

❖ Inadequate compliance

- Correct habitual sleep pattern
- Provide tips for enhance convenience

[呼吸器衛教影片](#)

by 台大睡眠中心



[呼吸器清潔及常見問題](#)

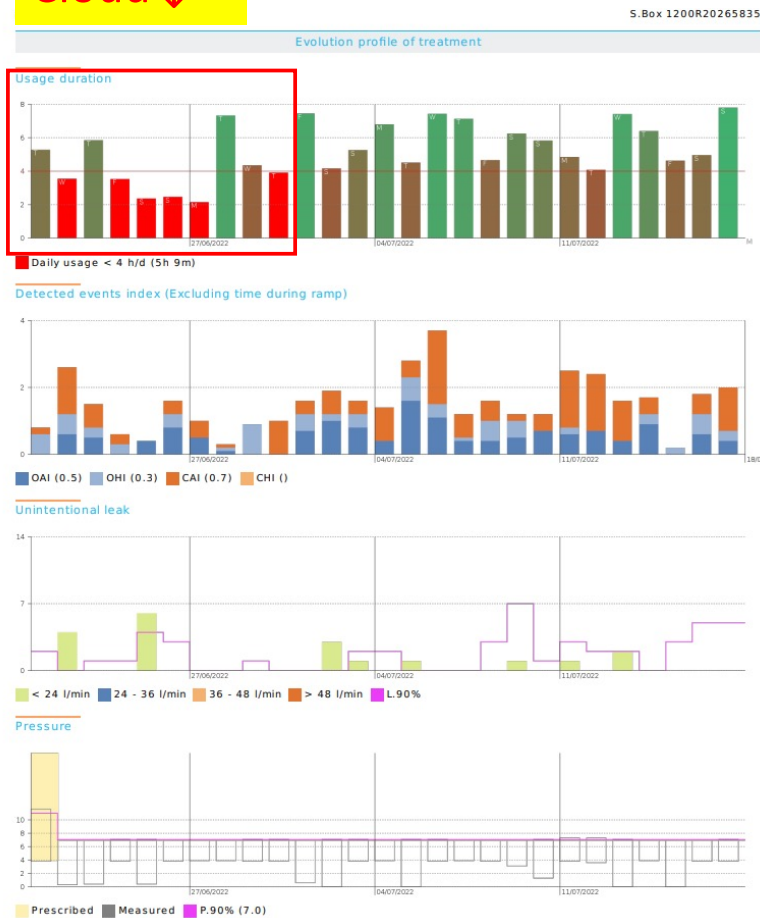
by 台大睡眠中心



SEFAM S.BOX-Summary

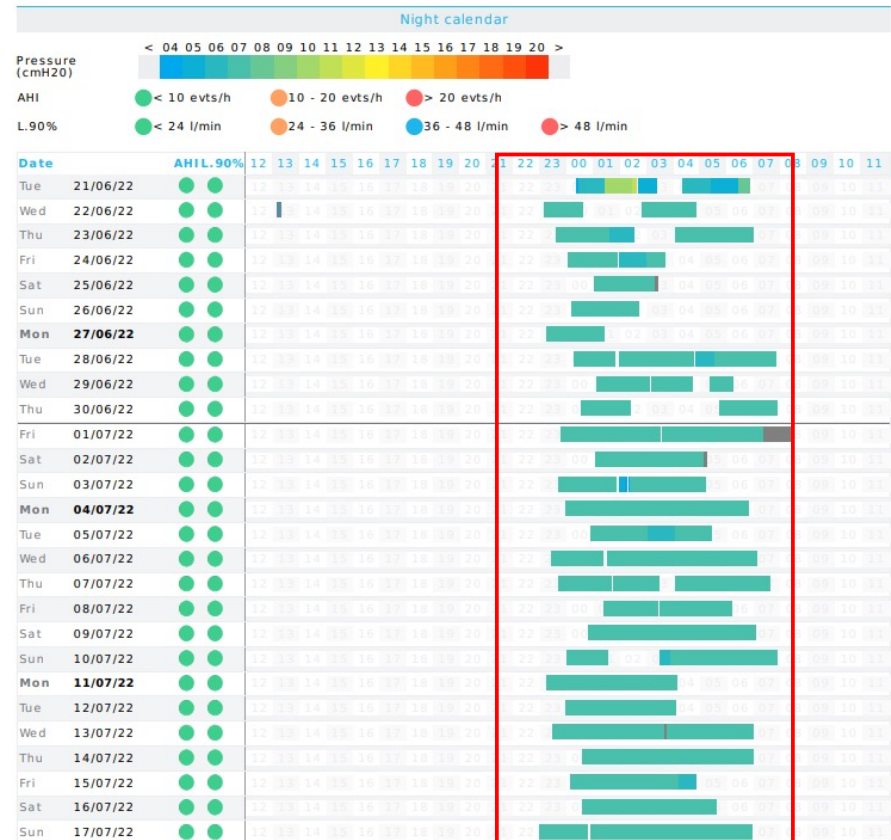
Cloud↓

usage



00 - 0002 (09/01/1972)

S.Box 1200R20265835



SEFAM S.BOX-Detail

2022/7/18 上午8:15



Cloud↓

Curves - SEFAMConnect

Curves 台大 試用機2

Patient information

Treatment start date 10-09-2021

Last transmission date 18/07/2022 06:51:06

[Abstract](#)

Period selection

Last week

Start 10/07/2022

End 17/07/2022

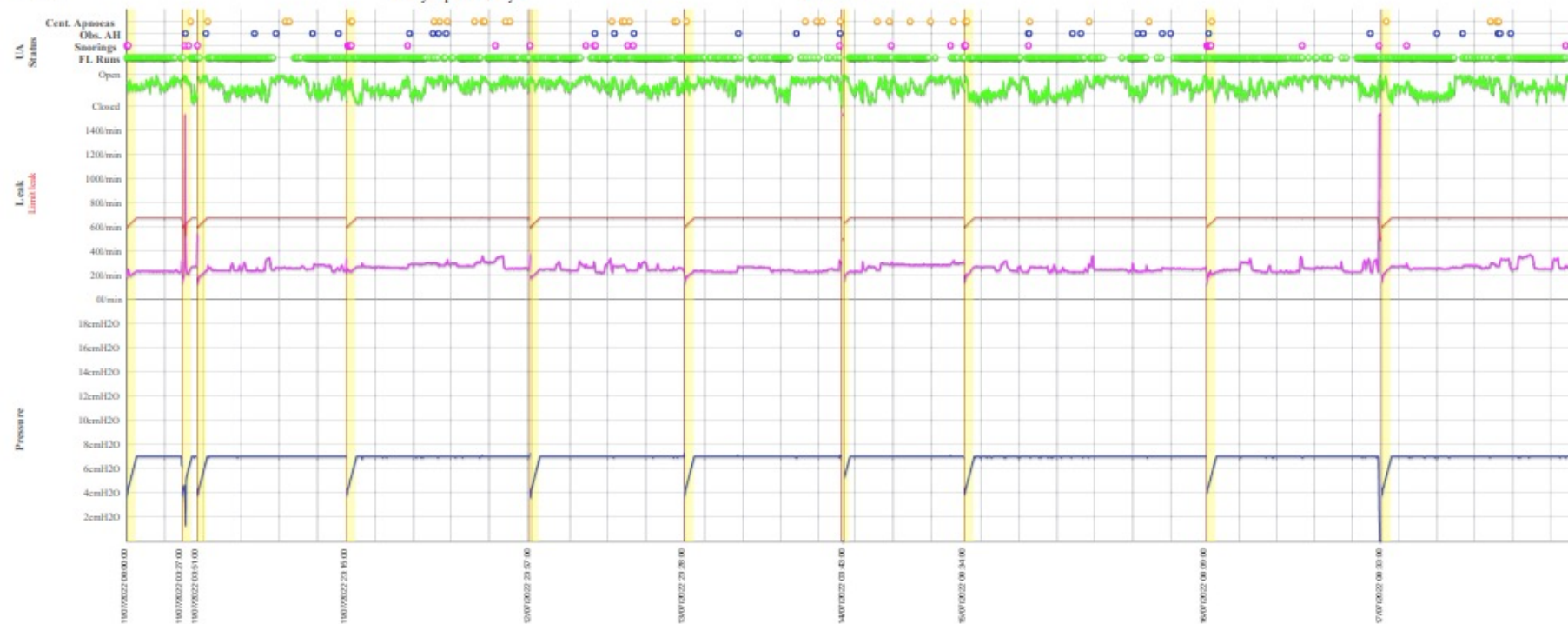
Analysis period: 7 days

• SefamConnect v.3.10.6.20220707134133

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production



RESMED Airsense10-Setting&Statistics

Smart card↓



Cloud↓

台大試用機268, 22201307101

11/07/2022 - 07/08/2022

Patient ID: 22201307101

DOB: 03/06/2021

Age: 1 years

ResScan™ Date of Birth: 23 / 八月 1959
Report prepared by: ntuuser on 2022/8/10 at 上午 10:21

Statistics

2022/8/8 - 2022/8/9

Device: AirSense 10 AutoSet (S/N: 22201307101)

Device Settings

Therapy Mode: CPAP

EPR Level: 3.0 cmH2O

Ramp Enable: OFF

Leak - L/min

Median: 0.0

Respiratory Indices - events/hr

Apnea Index: 0.7

Obstructive: 0.0

% Time in CSR: 0.0

Total Usage

Used Days >= 4 hrs : 1

Days not used: 0

Median daily usage: 3:19

Set Pressure: 5.0 cmH2O

EPR Enable: OFF

Ramp Time: 5.0 Minutes

95th Percentile: 13.8

Hypopnea Index: 0.5

Central: 0.7

Used Days < 4 hrs : 1

Total days: 2

Average daily usage: 3:19

EPR: FULL_TIME

EPR Patient Enable: OFF

Essentials: PLUS

Maximum: 16.8

AHI: 1.2

Unknown: 0.0

% Used Days >= 4 hrs : 50

Total hours used: 6:39

015100

Compliance Report

Usage 11/07/2022 - 07/08/2022

Usage days 26/28 days (93%)

>= 4 hours 23 days (82%)

< 4 hours 3 days (11%)

Usage hours 149 hours 57 minutes

Average usage (total days) 5 hours 21 minutes

Average usage (days used) 5 hours 46 minutes

Median usage (days used) 6 hours 7 minutes

Total used hours (value since last reset - 07/08/2022) 1,543 hours

AirSense 10 AutoSet

Serial number 22201307101

Mode CPAP

Set pressure 5 cmH2O

EPR Off

Therapy

Leaks - L/min Median: 0.2 95th percentile: 16.8 Maximum: 21.6

Events per hour AI: 0.6 HI: 0.4 AHI: 1.0

Apnoea Index Central: 0.5 Obstructive: 0.0 Unknown: 0.0

Cheyne-Stokes respiration (average duration per night) 0 minutes (0%)



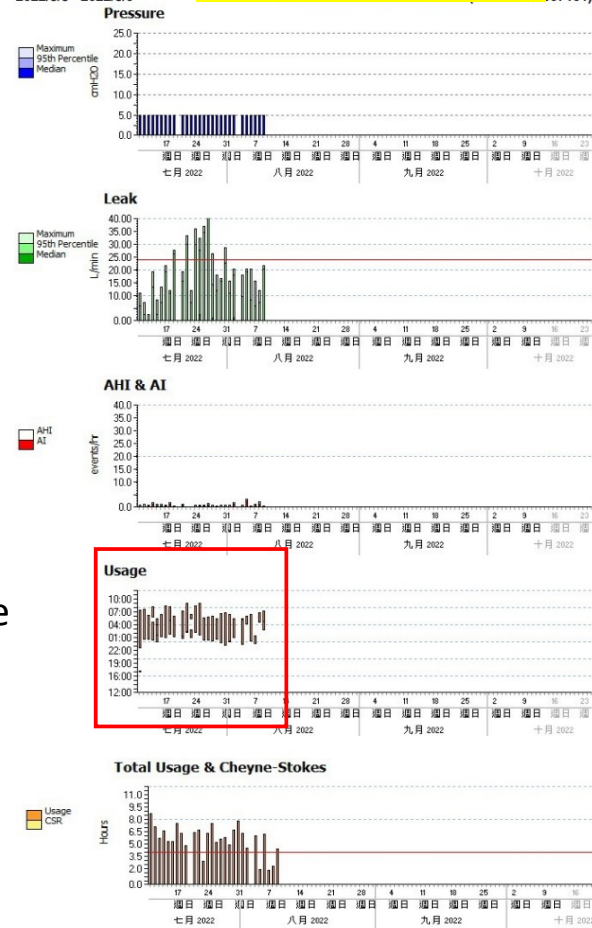
RESMED Airsense10-Summary Graphs

Smart card ↓

Cloud ↓

Summary Graphs
2022/8/8 - 2022/8/9

22201307101



usage

AirView™

Therapy Report

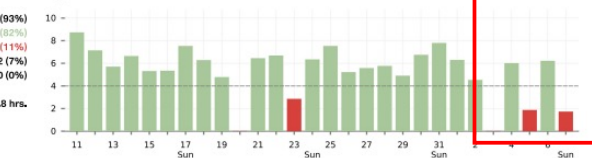
AirSense 10 AutoSet

SN: 22201307101

Usage days
≥ 4 hour days
< 4 hour days
Days not used
Days no data
Used/day (avg.)

26/28 (93%)
23 (82%)
3 (11%)
2 (7%)
0 (0%)
5.8 hrs.

Usage (hours)



大試用機268, 22201307101
Click to patients

22201307101
Patient ID

03/06/2021
D.O.B.

04/06/2021
Setup date

Compliant

Prescription Remote Assist Notes Logs Preferences

Fired time period

28

day period ending 07/09/2022

Update

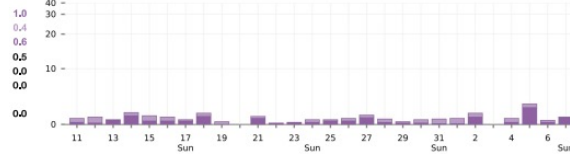
Usage



AHI (events/hour)

AHI
HI
AI
CAI
OAI
UAI
CSRs (avg.)

1.0
0.4
0.6
0.5
0.0
0.0
0.0



睡眠中心

Smart card↓

Efficacy Statistics		
(All efficacy statistics are averages over the report period.)		
AHI	3.3	
CAI	1.1	
Apnea Length	15	s
Average Pressure	4.0	cmH2O
90th Percentile Pressure	5.5	cmH2O
% Time at Maximum Set Pressure	0	%
System Leak	23.0	l/min
90th Percentile System Leak	31.0	l/min
% Time with Excessive Leak	1	%

SensAwake Statistics		
Average Number Of SensAwake Detections	0	per night
% Time with SensAwake On	0	%

% night >= 4 hours use	
Start Date - End Date	2022/3/7 - 2022/6/4
>= 4 hrs usage in a 30 day window (in 90 day(s) timeframe)	18 day(s)(60% in 30-day window) from 2022/3/7

>= 4 hrs usage in a 30 day window (in 90 day(s) timeframe)

≥ 4 hrs usage in a 30 day window (in 90 day(s) timeframe) 18 day(s) (60% in 30-day window) from 2022/3/7

Cloud↓

15 7月 2022 - 27 7月 2022

病患詳細資訊

截至 27 7月 2022

順從性

效能**

環境

使用

平均:

使用天數:

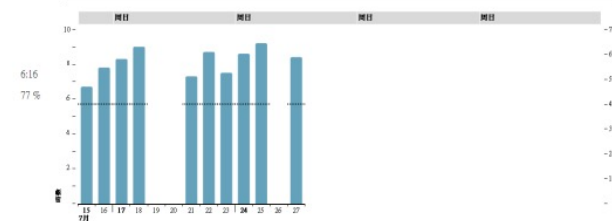
■ 運行時

- 使用總

■ 使用 <

湿度

環境溫度： 27℃

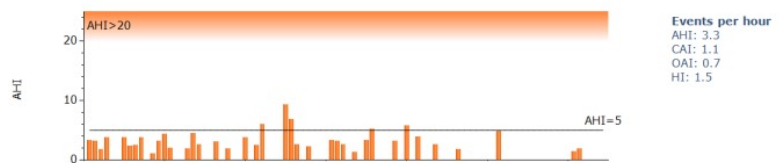


中心

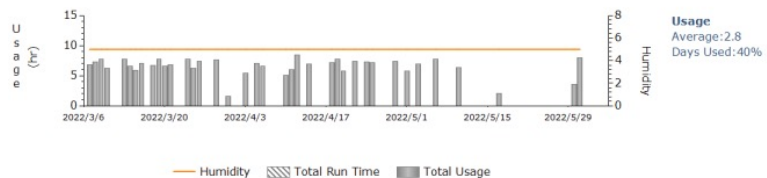
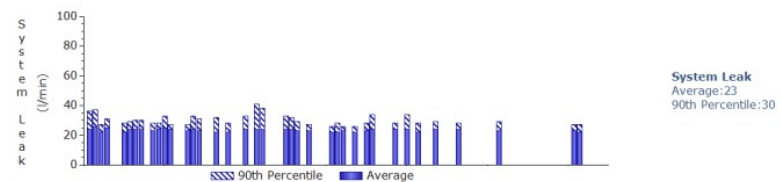
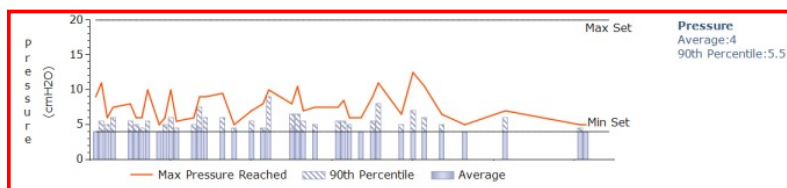
F&P sleep style-Summary Graphs

Smart card↓

DATA SUMMARY



pressure



F&P InfoSmart™

Cloud↓

病患匯總報告

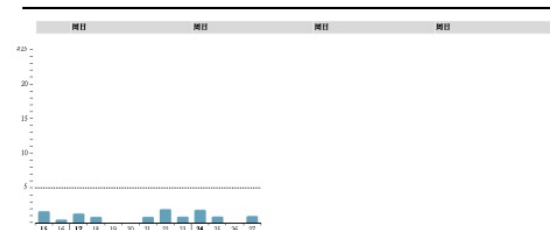
15 7月 2022 - 27 7月 2022

病患詳細資訊

AHI
每小時事件數

AHI: 1.1
CAI: 0.1
OAI: 0.1
HI: 0.8

總 AHI
AHI = 5



壓力

平均: 5.0
百分之 90: 6.0

總 AHI
AHI = 5

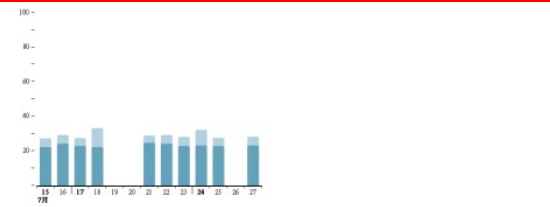


系統漏氣

升/分鐘

平均: 23
百分之 90: 29

總 AHI
AHI = 5

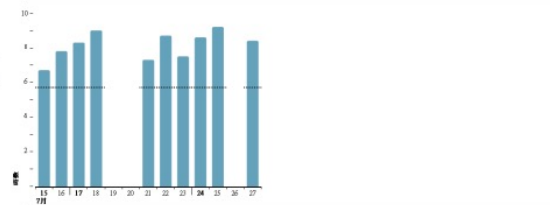


使用

小時

平均: 6.16
使用天數: 77 %

總 AHI
AHI = 5

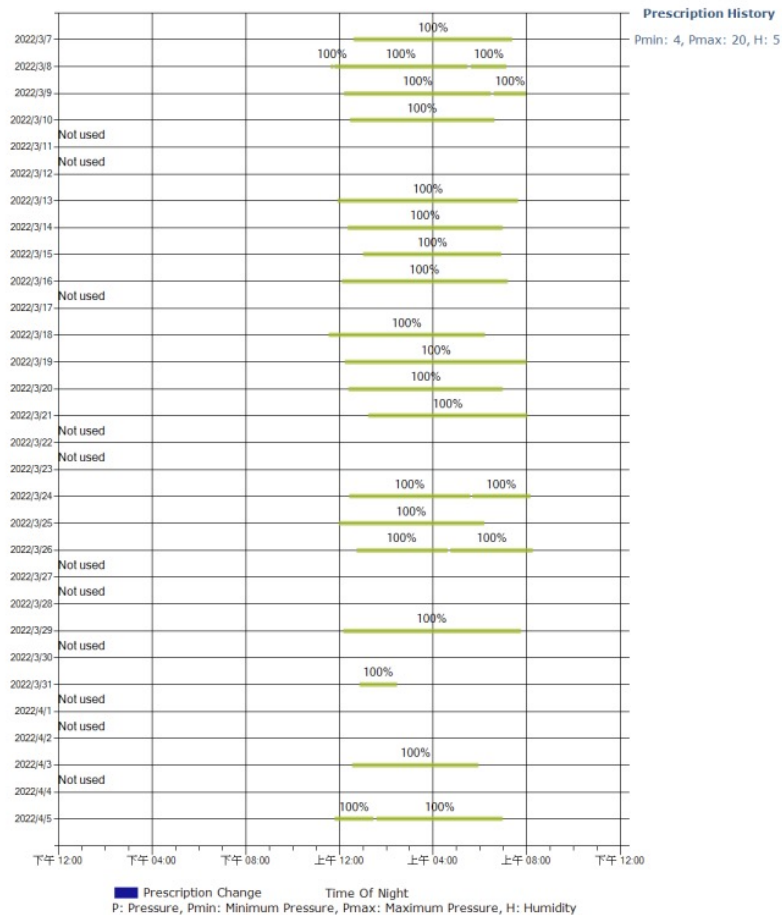


睡眠中心

F&P sleep style-summary

COMPLIANCE SUMMARY

Smart card↓



F&P InfoSmart™

Cloud↓

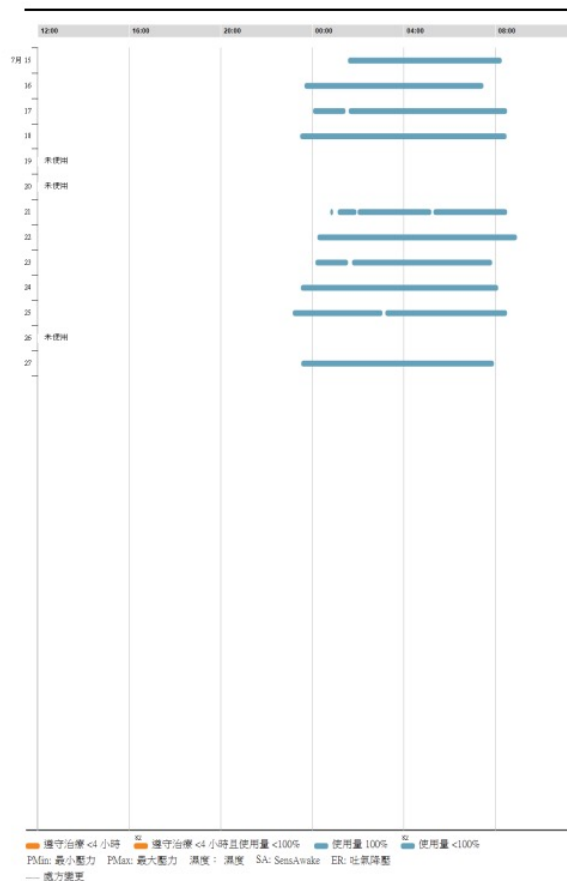
病患匯總報告

15 7月 2022 - 27 7月 2022

順從性摘要

處方歷史記錄

PMin: 3.0 PMax: 20.0
濕度: 4.0 SA: 0.0 ER: 0.0



睡眠中心

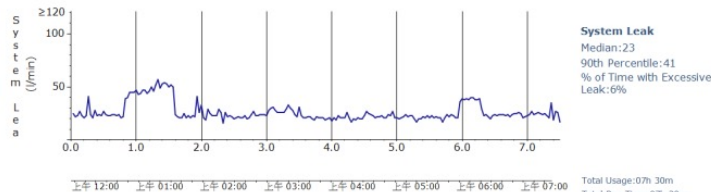
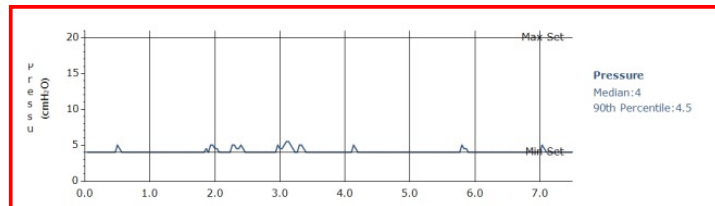
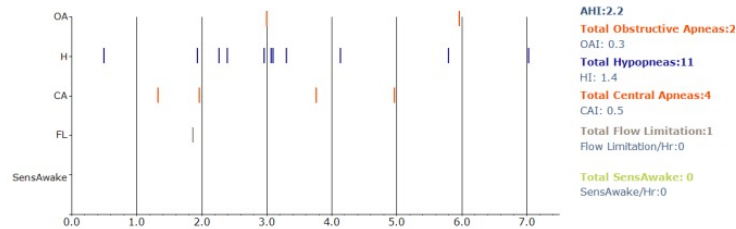
F&P sleep style-Detail

Smart card↓

Cloud↓

pressure

2022年7月3日 (2022/7/3 下午 11:36:48-2022/7/4 上午 07:06:48)



Time and events at pressure

P (cmH ₂ O)	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
T (mins)	388	58	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OA	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H	0	10	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FL	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

F&P InfoSmart™

病患匯總報告

15 7月 2022 - 27 7月 2022

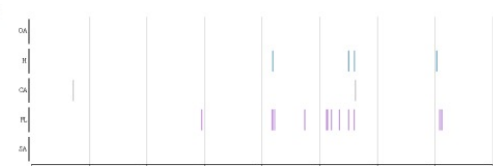
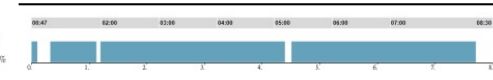
21 7月 2022
 周五 22 7月 2022 00:47 -
 周五 22 7月 2022 06:30

運轉時間

運行時間: 7:18
 使用百分比: 100 %

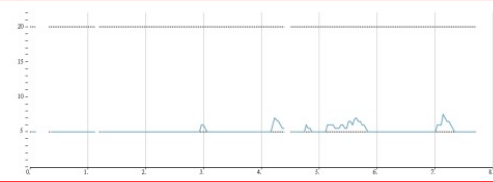
事件

AHI: 0.8
 阻塞型呼吸中止: 0
 OAI: 0.0
 通呼吸: 4
 HI: 0.5
 中樞型呼吸中止: 2
 CAI: 0.3
 流量限制: 14
 流量限制小時: 1.9
 SensAwake 總計: 0
 清醒時間小時: 0.0



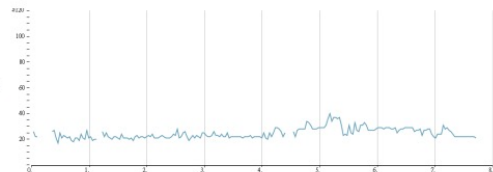
壓力

中位數: 5.0
 百分之 90: 6.0
 標準升基期
 最小/最大



系統漏氣

升/分鐘
 中位數: 23
 百分之 90: 29
 過度漏氣的時數:



處於壓力狀態的時間和事件

壓力 (cmH ₂ O)	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
時間 (分鐘)	0	11	60	24	2	0	0	0	0	0	0	0	0	0	0	0	0
OA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HI	0	0	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
FL	0	0	9	3	2	0	0	0	0	0	0	0	0	0	0	0	0

院H睡眠中心

Devibiss CPAP-Setting & summary

Smart card ↓

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Patient

Patient ID:	6300854	Patient ID2:	
First Name:		Last Name:	
Gender:		Therapy Started:	

Devices

Serial Number	Model Number	Device Name	Oximeter	Mask
JD054277	DV53D	IntelliPAP Standard Plus		

Prescription

Operating Mode:	CPAP	CPAP Pressure:	12.0 cmH2O
Delay Pressure:	4.0 cmH2O	Delay Time:	20 Minutes
SmartFlex:	OFF	SmartFlex Mode:	Full-time
SmartFlex IRnd:	2	SmartFlex ERnd:	0

Usage Statistics

Total Hours Used:	1875 Hours 30 Minutes	Days Not Used:	4.0 days
Days Used at least 4 hours:	280.0 days	% Days with any usage:	98.9%
Possible Usage Days in Range:	364.0 days	Days with any usage:	360.0 days
Usage Index:	77.0%	Average Usage Duration:	5 Hours 12 Minutes
Standard Deviation:	1 Hours 36 Minutes		

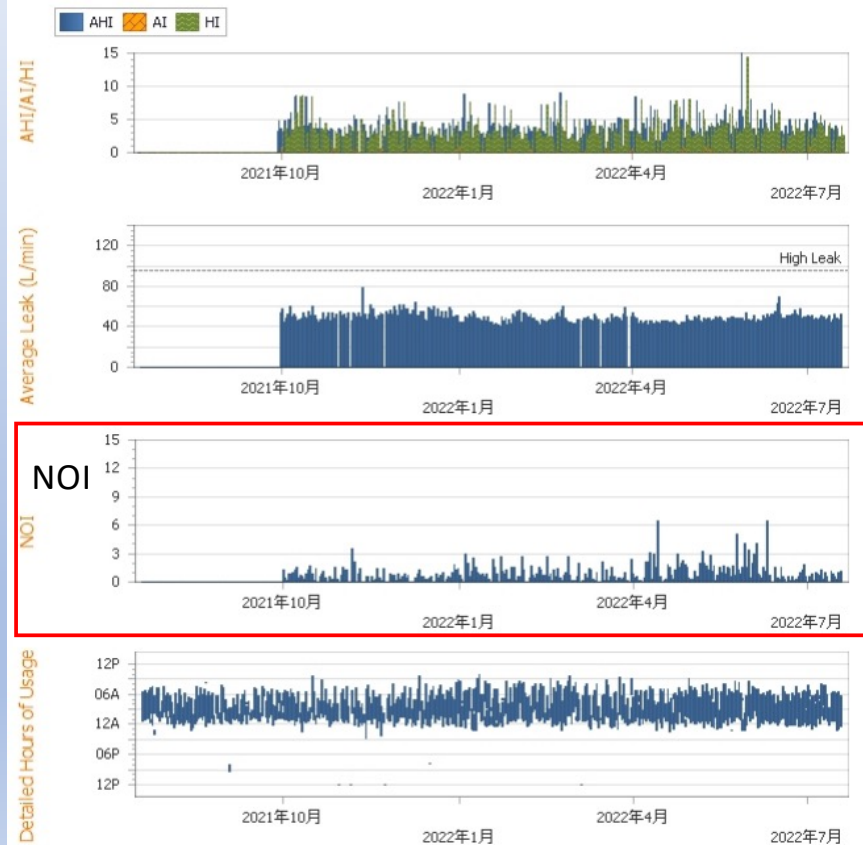
Event Statistics (Averages)

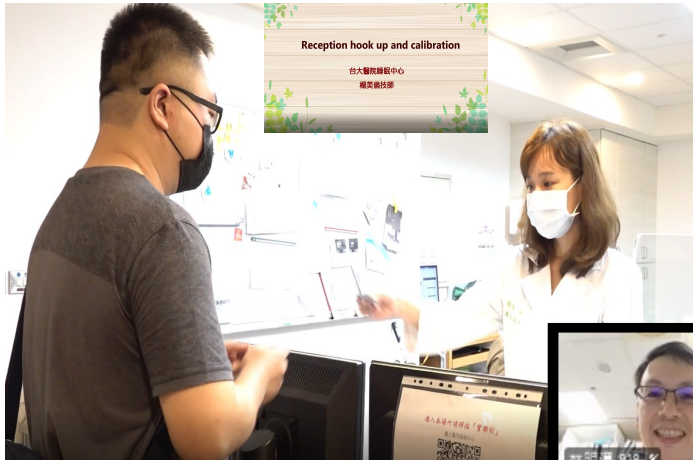
Apnea/Hypopnea Index:	3.8 Per hour	Apnea Index:	0.3 Per hour
Hypopnea Index:	3.5 Per hour	Non-Obstructive Index:	1.0 Per hour
Exhale Puff Index:	3.4 Per hour		

Leak Statistics

Average Leak:	49.5 L/Min	Standard Deviation:	±8.8 L/Min
95th Percentile Leakage:	68.0 L/Min		

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台大醫院 睡眠中心

