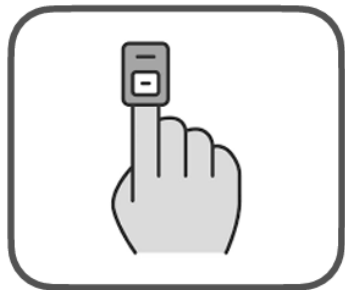


在宅急症居家呼吸困難及喘的評估及處理

呼吸治療師在宅急症照護實務應用
及運作培訓課程

張庭嘉 醫師/成大環境醫學研究所博士班
台南永康奇美醫院 胸腔內科 專任主治醫師

居家呼吸困難及喘的評估



缺氧



喘

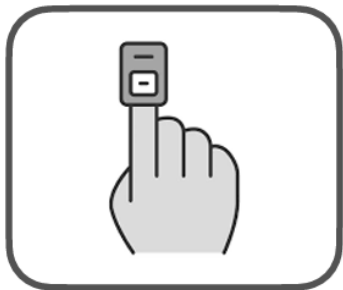


多痰



咳嗽

居家呼吸困難及喘的評估



缺氧



喘



多痰



咳嗽

HYPOXIA

**"Respiratory"
Hypoxic Hypoxia**

↓ P_aO_2

Response to
100% FiO_2

Yes

V/Q mismatch
Diffusion
impairment
↓ FiO_2
Hypoventilation

Oxygen,
Effective

No

Shunt (large)

Oxygen,
Not effective

**"Cardiac"
Stagnant Hypoxia**

normal P_aO_2

Related to ↓ CO
Results in ↓ S_vO_2 and P_vO_2
from increased tissue
extraction of O_2

Response to
100% FiO_2

No

Shock
LV failure
Hypovolemia
Hypothermia

Oxygen,
Not effective

**"Blood and tissue"
Hypoxia**

normal P_aO_2

Anemic Hypoxia

↓ in amount of
functioning Hgb

Histotoxic Hypoxia

Poisoning of cellular
machinery that uses O_2

Response to 100% FiO_2

Yes

CO
poisoning

Oxygen,
Effective

No

Anemia
Methemo-
globinemia

Oxygen,
Not effective

No

Cyanide
poisoning

Oxygen,
Not effective

HYPOXIA

"Respiratory" Hypoxic Hypoxia

↓ P_aO_2

Response to
100% FiO_2

Yes

No

V/Q mismatch
Diffusion
impairment
↓ FiO_2
Hypoventilation

Oxygen,
Effective

Shunt (large)

Oxygen,
Not effective

**Hypoxemia,
Hypoxic hypoxia**

"Cardiac" Stagnant Hypoxia

normal P_aO_2

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Effective

Anemia
Methemo-
globinemia

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Not effective

Cyanide
poisoning

Oxygen,
Not effective

Figure 2-6 Workup of acute hypoxemia

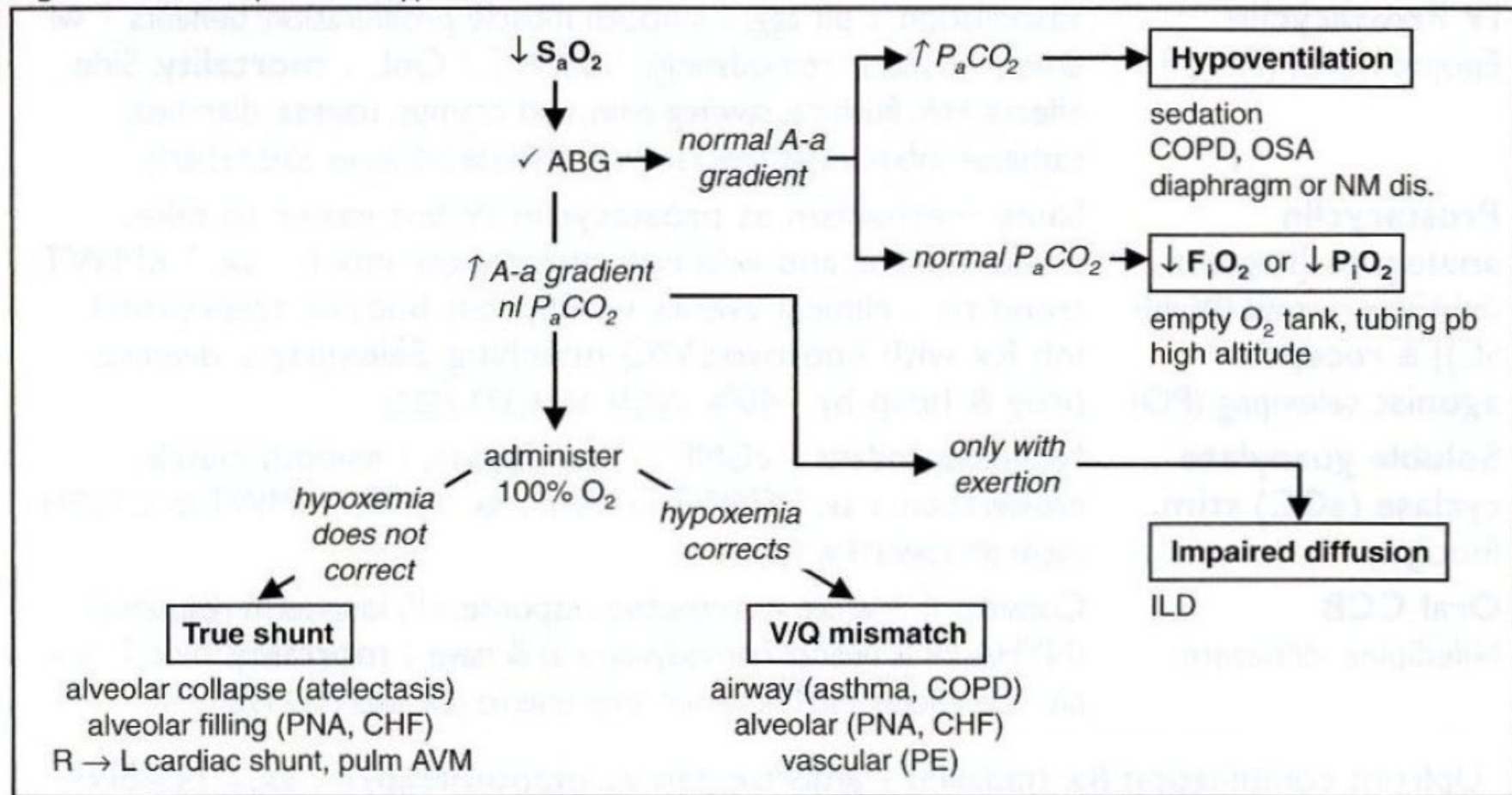
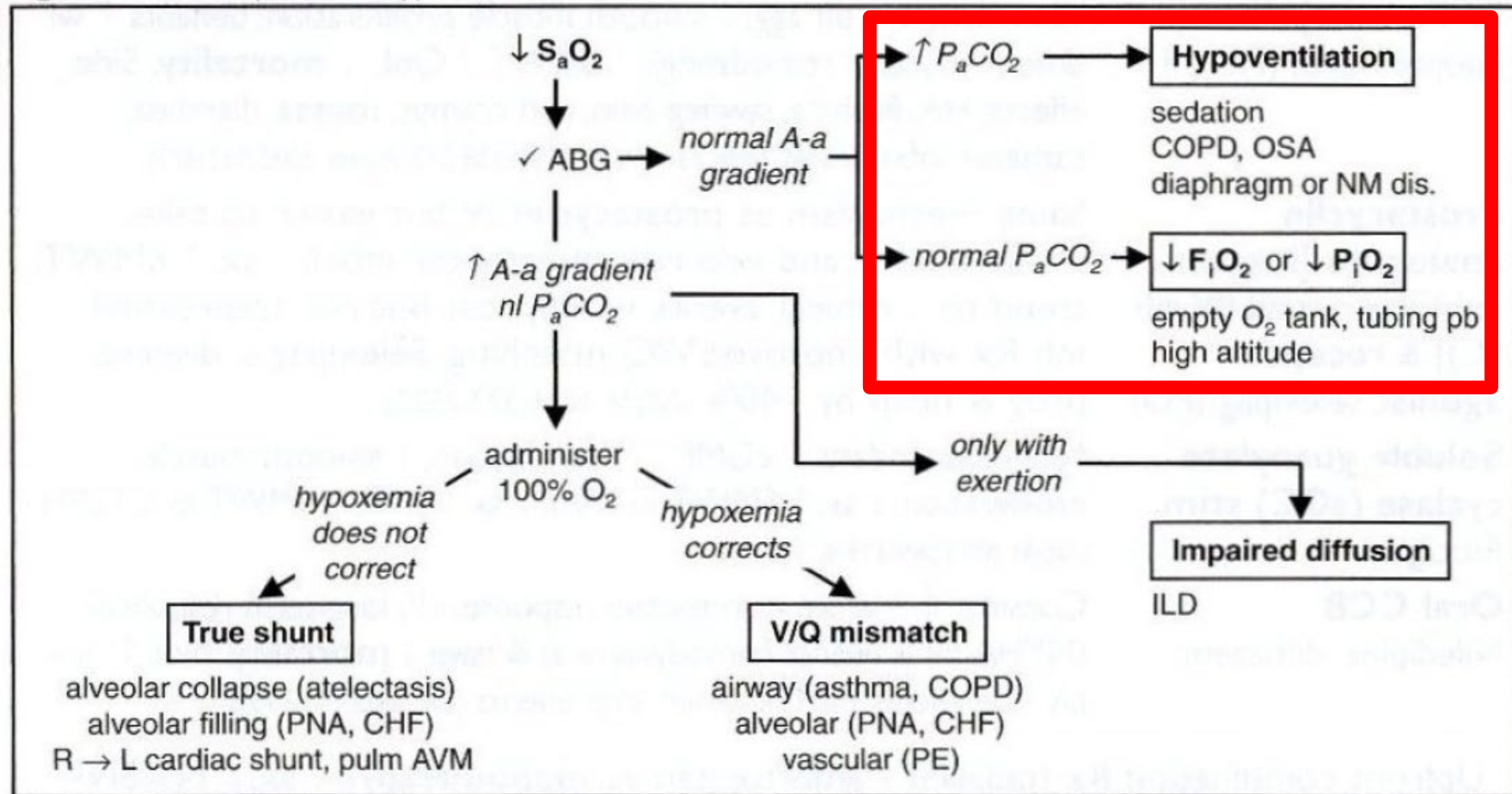


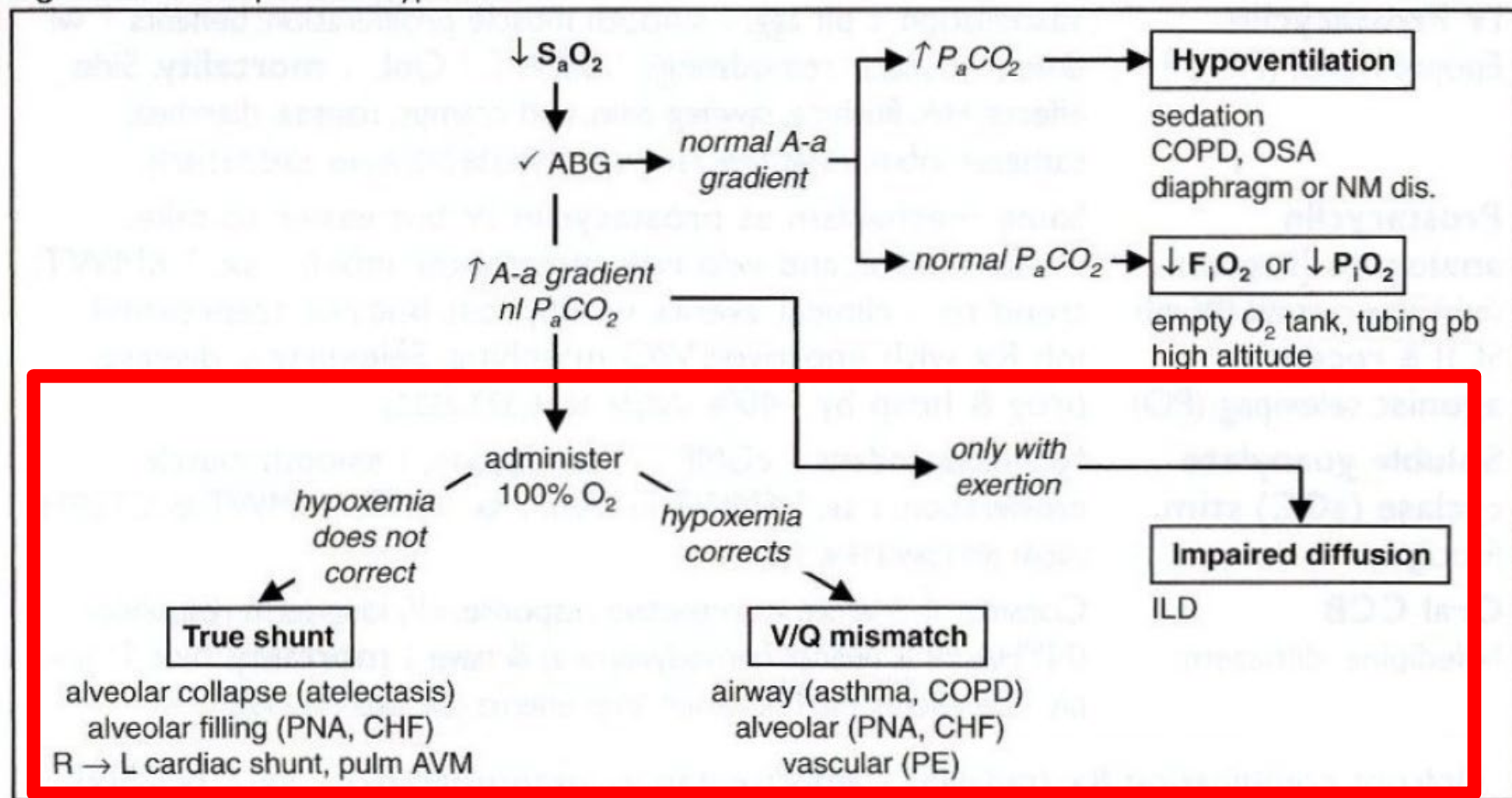
Figure 2-6 Workup of acute hypoxemia



Etiologies of High $\uparrow P_aCO_2$

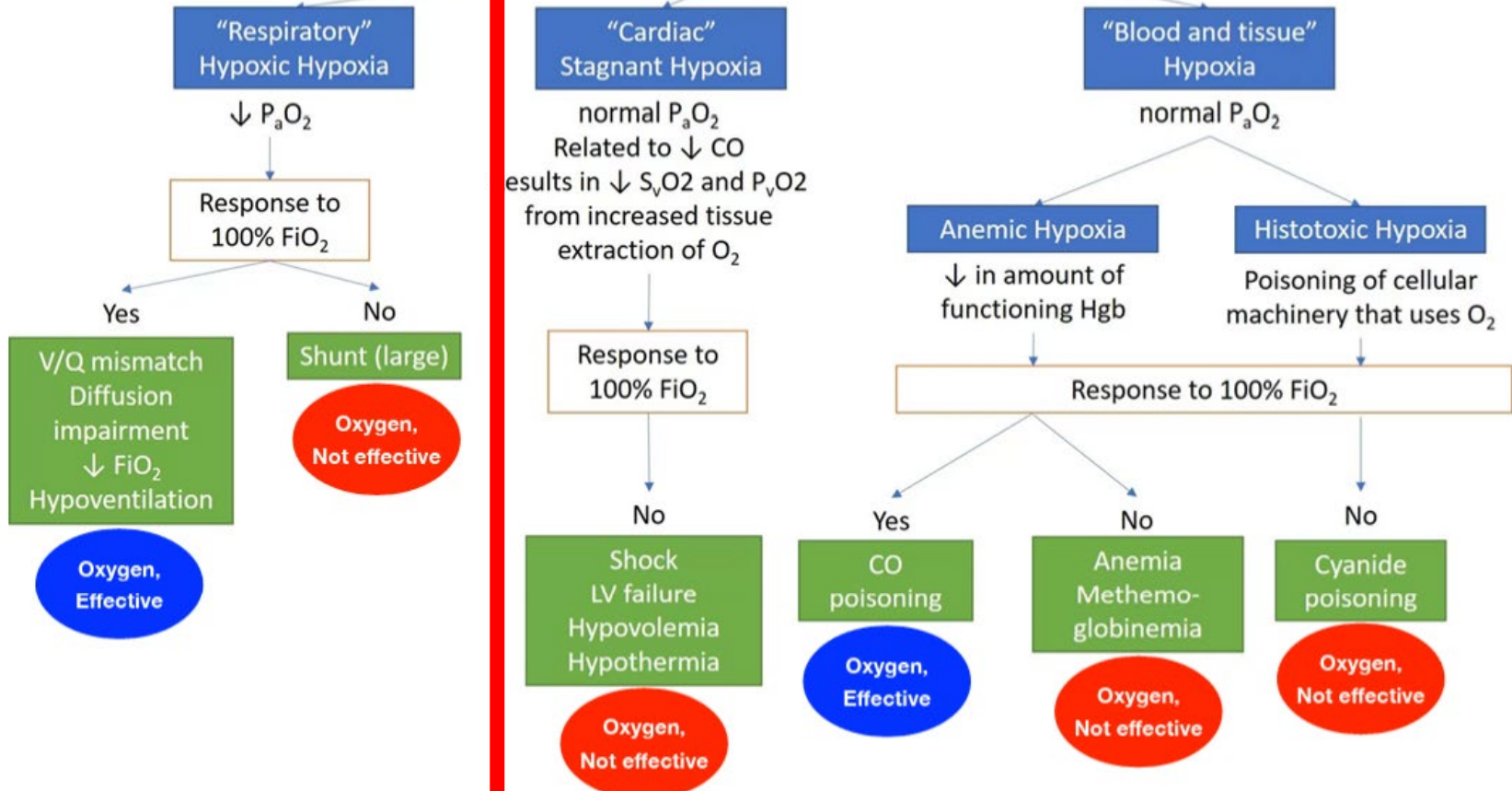
“Won’t Breathe”	“Can’t Breathe”		
$\downarrow RR$	$\downarrow V_T$		$\uparrow V_D$ and/or $\downarrow V_T$
Respiratory Drive	NM System	CW/Pleura	Lung/Airways
Voluntary hypervent. NI PI_{max} & A-a grad.	$\downarrow PI_{max}$ $\downarrow PE_{max}$	Abnl PEx Abnl CT	Abnl PFTs \downarrow End Tidal CO_2
Metabolic alkalosis 1° neurologic: brainstem stroke, tumor, 1° alveolar hypovent 2° neurologic: sedatives, CNS infxn, hypothyroidism	Neuropathies: cervical spine, phrenic nerve, GBS, ALS, polio NMJ: MG, LE Myopathies: diaphragm PM/DM; $\downarrow PO_4$ musc dystrophies	Chest wall: obesity, kyphosis, scoliosis Pleura: fibrosis effusion	Lung parench.: emphysema, ILD/fibrosis, CHF, PNA Airways: asthma, COPD, OSA, bronchiect., CF

Figure 2-6 Workup of acute hypoxemia



HYPOXIA

Hypoxia



Chemical Causes of Cellular Hypoxia

Condition	Causes	Classic features	P_aO_2	Pulse Ox sat	CO- Ox sat	Treatment (+ 100% O_2)
Carbon monoxide	Fires, portable heaters, auto exhaust	Cherry-red skin (COHb color)	nl	nl	↓	Hyperbaric O_2
Methemoglobinemia	Nitrates, sulfonamide, benzocaine, dapsone	Chocolate brown blood	nl	mild ↓	↓	Methylene blue
Cyanide	Nitroprusside, fires, industrial	Bitter almond odor; pink skin	nl	nl (↑ S_vO_2)	nl	Hydroxycobalamin





6號前最高回饋\$1200618
特惠 家用TFT液晶指夾式
脈搏血氧儀 血氧機 血...

\$424.00

momo購物網



人因科技 MWB252 心率
智慧監測運動手錶 血氧
飽和度偵測 手錶

\$700.00

蝦皮購物



手指型血氧濃度計
ROSSMAX SB100 血氧
機 血氧計 網路不販售...

\$3,500.00

來而康長照輔具市集



6號前最高回饋\$1200日
本規格 指夾式家用血氧
機(血氧偵測儀、健康...

\$880.00

momo購物網



【618最低4折起】 Sily
618年中慶 指夾式血氧脈
搏機 指尖血氧偵測儀 ...

\$499.00

PChome 24h購物
7 天內可免費退貨



LED指夾式居家運動血氧
測量儀 血氧測量儀 一鍵
測量 非醫療器材

\$199.00

ch-protection.com



6號前最高回饋\$1200
【自我管理】家用TFT液
晶面板指尖血氧機-2入...

\$449.00

momo購物網



Rossmax 血氧濃度計
SA120 血氧計 血氧機 血
氧濃度機 血氧飽和監...

\$11,000.00

順康醫療



【618最低4折起】 支援
血氧偵測 【DPECO】 迷
你版可愛熊 幼童專用...

\$499.00

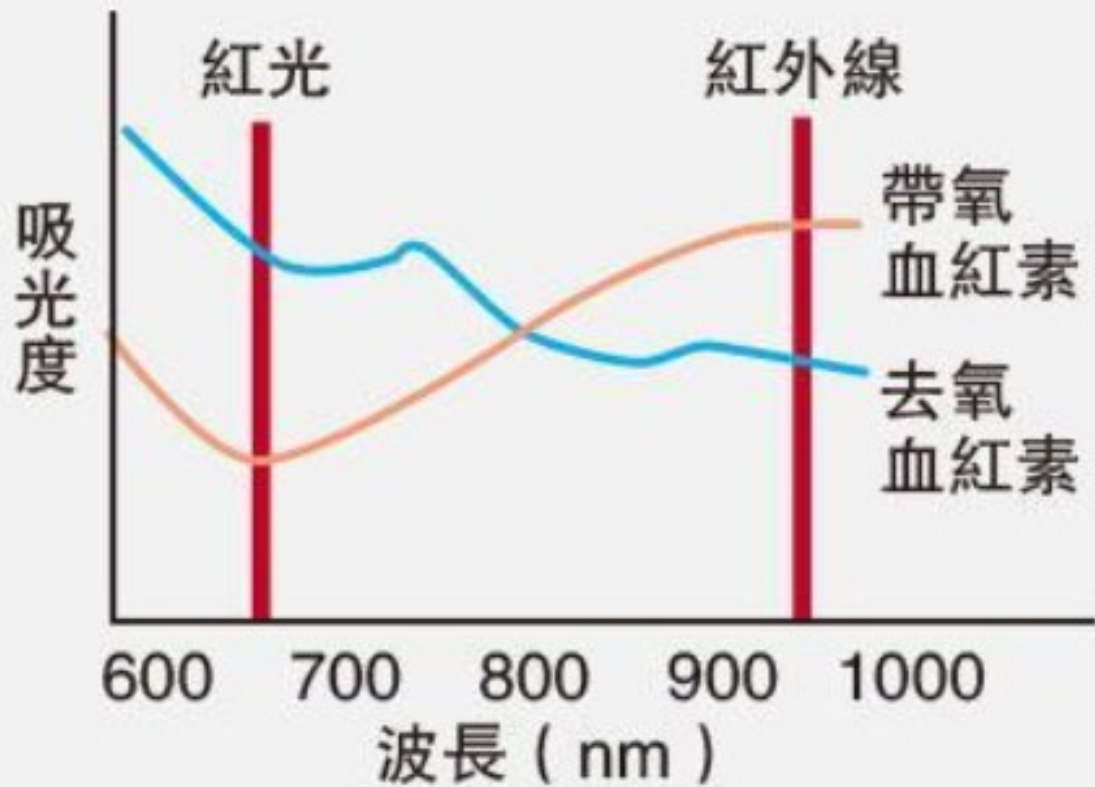
PChome 24h購物



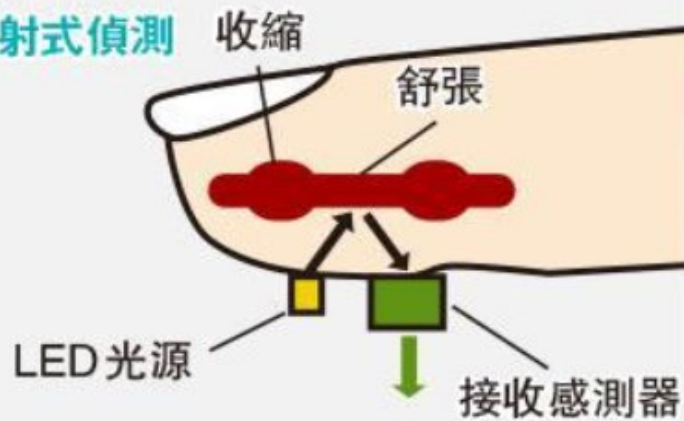
旺北 脈搏血氧濃度計
PRINCE 100B 血氧機 色
彩隨機出貨 網路不販...

\$3,500.00

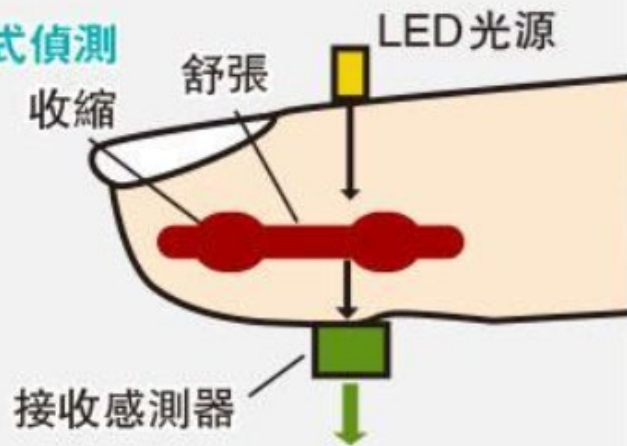
來而康長照輔具市集



反射式偵測



穿透式偵測



**What is an
OXIMETER
and how do
you read it?**



Chemical Causes of Cellular Hypoxia

Condition	Causes	Classic features	P_aO_2	Pulse Ox sat	CO- Ox sat	Treatment (+ 100% O_2)
Carbon monoxide	Fires, portable heaters, auto exhaust	Cherry-red skin (COHb color)	nl	nl	↓	Hyperbaric O_2
Methemoglobinemia	Nitrates, sulfonamide, benzocaine, dapsone	Chocolate brown blood	nl	mild ↓	↓	Methylene blue
Cyanide	Nitroprusside, fires, industrial	Bitter almond odor; pink skin	nl	nl (↑ S_vO_2)	nl	Hydroxycobalamin

Pulse Oximeter (一般血氧機)

一般血氧機只用兩種波長：

- 660 nm (紅光)
- 940 nm (紅外光)

它只能區分：

- OxyHb (HbO₂)
- DeoxyHb (HHb)

無法區分：

- COHb
- MetHb

因此在 CO 中毒時：

COHb 會被誤認成 HbO₂

例如：

Hb種類	百分比
HbO ₂	60%
COHb	35%
HHb	5%

血氧機可能顯示：

SpO₂ ≈ 95%

看起來正常。

Chemical Causes of Cellular Hypoxia

Condition	Causes	Classic features	P_aO_2	Pulse Ox sat	CO- Ox sat	Treatment (+ 100% O_2)
Carbon monoxide	Fires, portable heaters, auto exhaust	Cherry-red skin (COHb color)	nl	nl	↓	Hyperbaric O_2
Methemoglobinemia	Nitrates, sulfonamide, benzocaine, dapsone	Chocolate brown blood	nl	mild ↓	↓	Methylene blue
Cyanide	Nitroprusside, fires, industrial	Bitter almond odor; pink skin	nl	nl (↑ S_vO_2)	nl	Hydroxycobalamin

Co-oximetry 是什麼？

Co-oximeter (血氣分析儀中的特殊測量)

使用多種波長 (4~128種以上)

可直接分辨：

- HbO₂
- HHb
- COHb
- MetHb

因此能真正測出：

Fractional O₂ saturation

公式：

$$SaO_2 = \frac{HbO_2}{HbO_2 + HHb + COHb + MetHb}$$

舉例

假設：

Hb型態	百分比
HbO ₂	60
COHb	35
HHb	5

則：

$$SaO_2 = \frac{60}{100} = 60\%$$

因此：

Co-ox sat = 60% ↓

但

Pulse Ox ≈ 95%

Chemical Causes of Cellular Hypoxia

Condition	Causes	Classic features	P_aO_2	Pulse Ox sat	CO- Ox sat	Treatment (+ 100% O_2)
Carbon monoxide	Fires, portable heaters, auto exhaust	Cherry-red skin (COHb color)	nl	nl	↓	Hyperbaric O_2
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Cyanide	Nitroprusside, fires, industrial	Bitter almond odor; pink skin	nl	nl (↑ S_vO_2)	nl	Hydroxycobalamin

Oxygen Saturation (SpO₂)

Percent of hemoglobin saturated with oxygen

Acoustic Respiration Rate (RRa®)

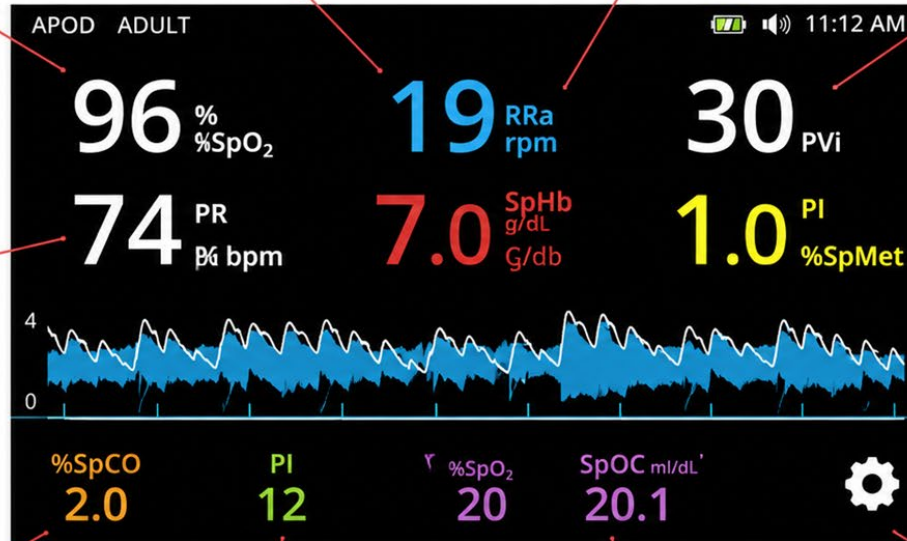
Breaths per minute measured via sound

Total Hemoglobin (SpHb®)

Total hemoglobin concentration

Pleth Variability Index (PVi®)

Indicator of fluid responsiveness (relative change in pleth)



Pulse Rate (PR)
Beats per minute

Carboxyhemoglobin (SpCO®)

Percent of hemoglobin bound with carbon monoxide

Perfusion Index (PI)

Strength of pulse signal at the sensor site

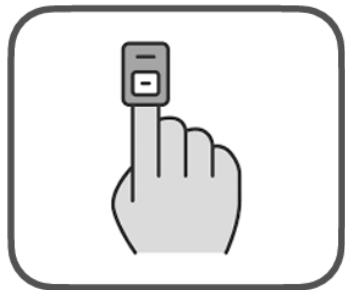
Total Oxygen Content (SpOC®)

Total amount of oxygen in the blood

Methemoglobin (SpMet®)

Percent of hemoglobin in methemoglobin form

居家呼吸困難及喘的評估



缺氧



喘

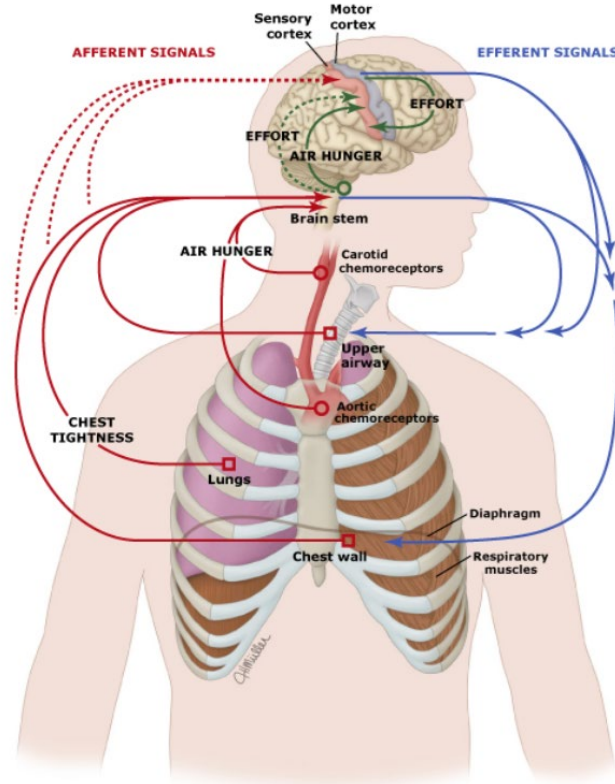


多痰

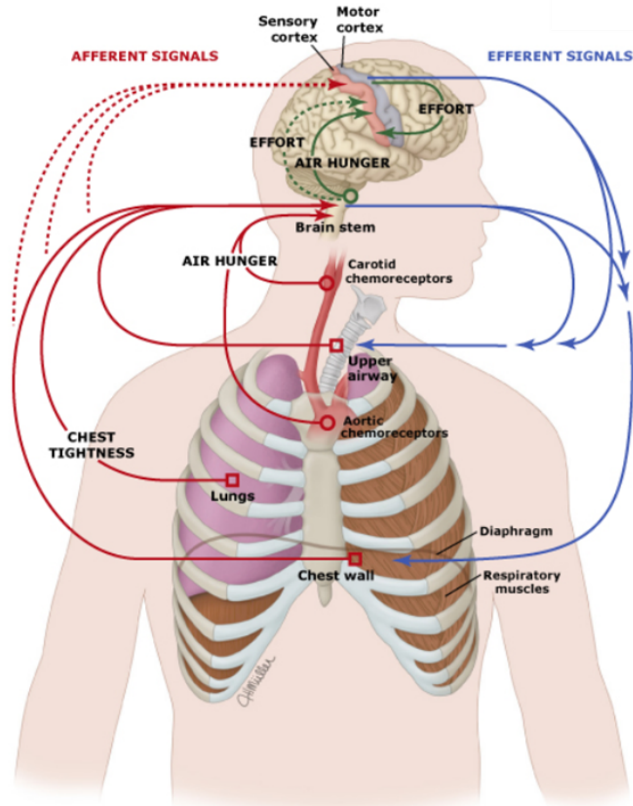


咳嗽

Efferent and Afferent signals that contribute to the sensation of dyspnea

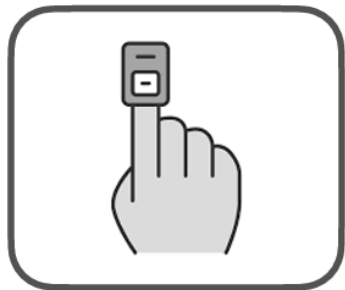


Dyspnea



- **Respiratory centers: increased output**
 - Chemoreceptor: PO_2 , PCO_2
- **Stimulation of mechanoreceptors:**
 - Upper airway receptors: Trigeminal nerve (CN5)
 - Pulmonary receptors: Stretch, Irritant, C-fibers
 - Chest wall receptors: M. spindles
- **Mechanical loading of the respiratory system: dyspnea vs. effort**
- **Neuromechanical dissociation**
- **Impaired oxygen delivery or utilization**
 - Anemia
 - Cardiovascular deconditioning
- **Neural activation associated with breathing discomfort**
 - Sensory dimension: intensity, quality, time course
 - Affective dimension: immediate unpleasantness, evaluative and emotional response

居家呼吸困難及喘的評估



缺氧



喘

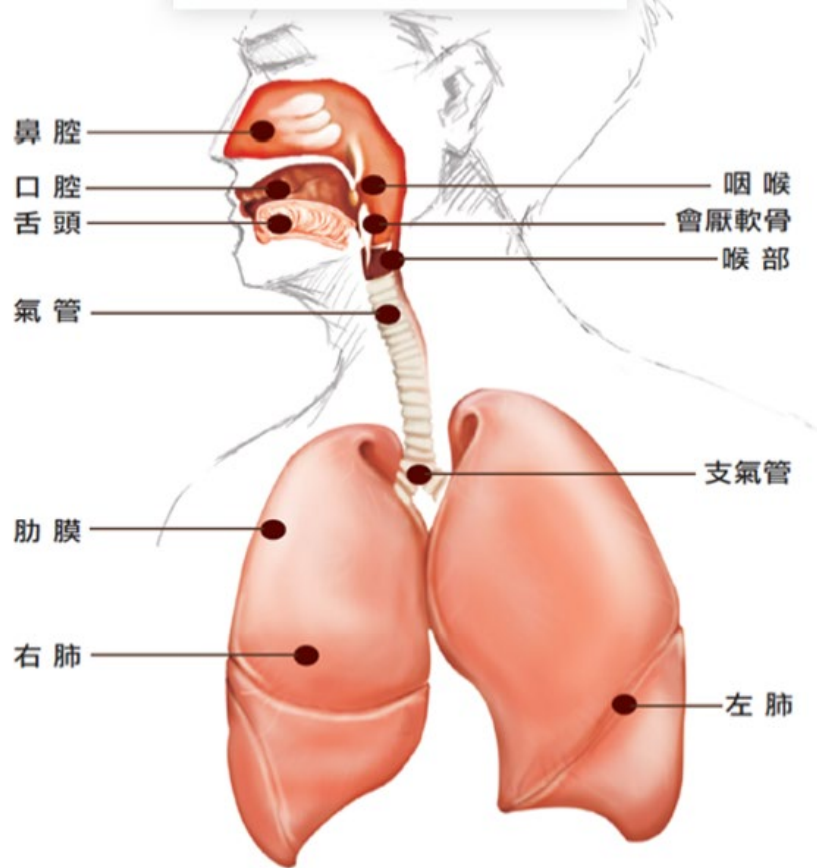


多痰



咳嗽

身體的咳嗽接受器

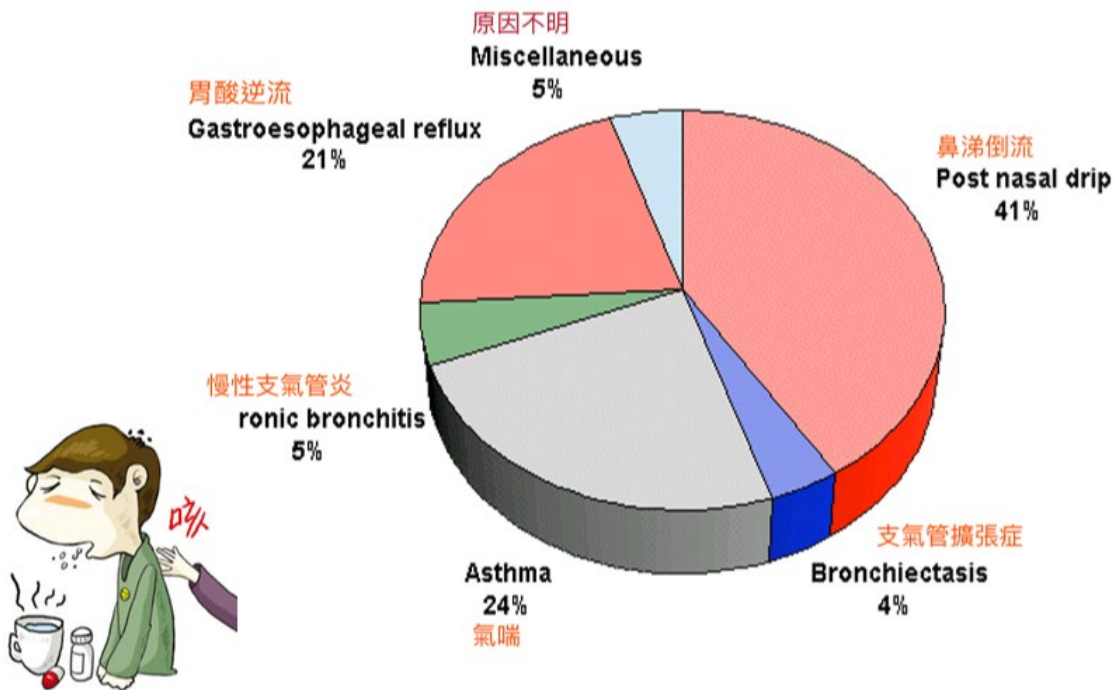


慢性咳嗽:
>8 weeks

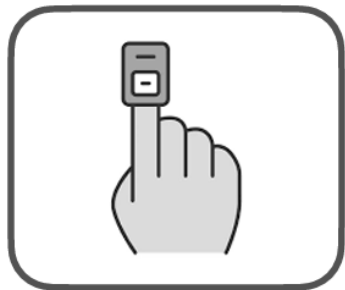
亞急性咳嗽:
3~8 weeks

急性咳嗽:
< 3 weeks

成年人常見慢性咳嗽的原因



居家呼吸困難及喘的評估



缺氧



喘

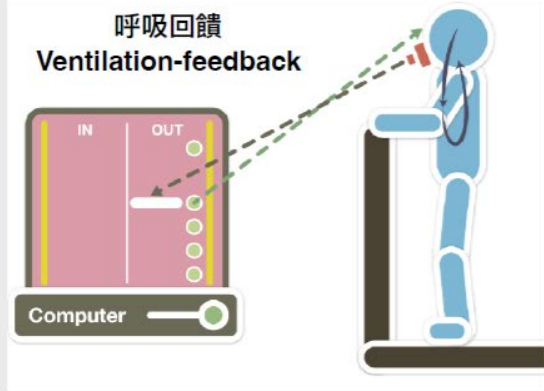
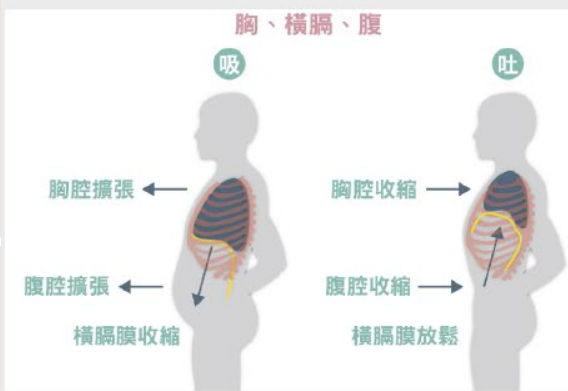
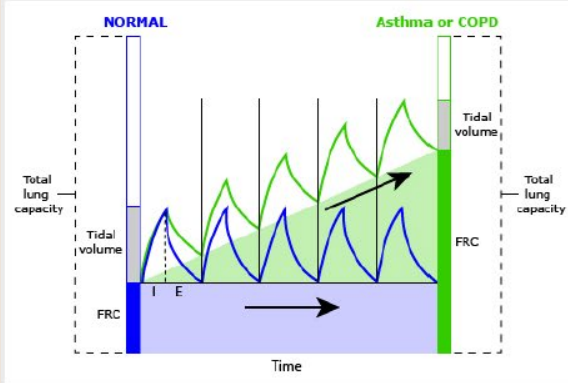


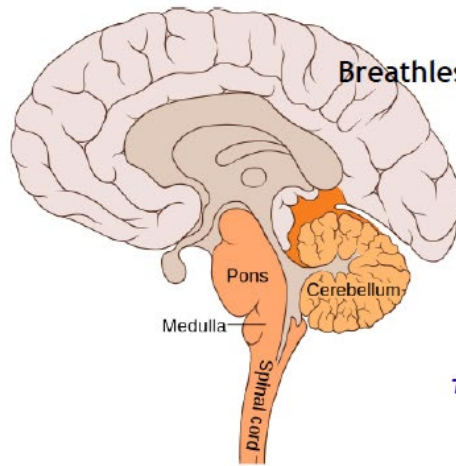
多痰



咳嗽

Dynamic Hyperinflation (air - trapping)





Breathless sensation

(+)

Proprioceptor in skeletal muscle

(+)

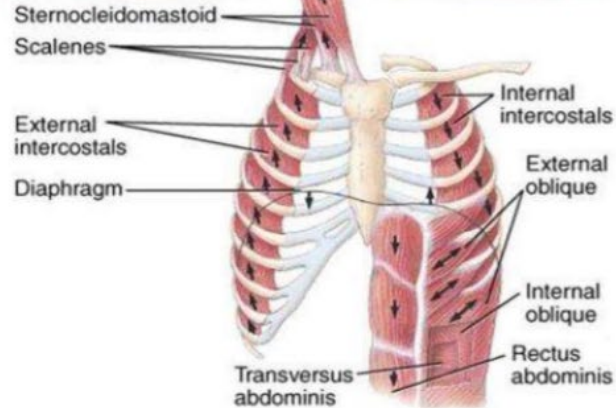
Proprioceptor in chest wall
(Intercostal muscle)

Tension, Stretch



MUSCLES OF INSPIRATION

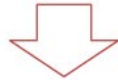
MUSCLES OF EXPIRATION



Tonic contraction of
Accessory Muscle

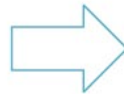


Impeded descent of diaphragm



Fail to recruit IRV & ERV

Paradoxical Abdominal Movement



Relaxation First!



Heat packing



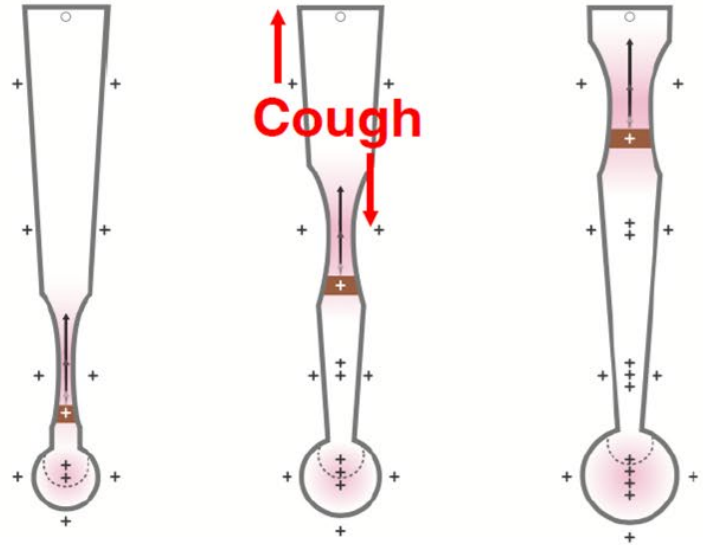
Massage

Airway Clearance Techniques

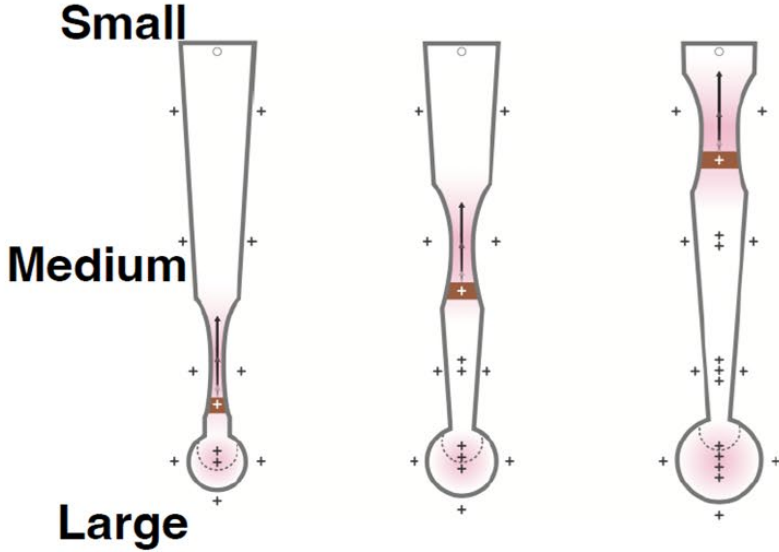
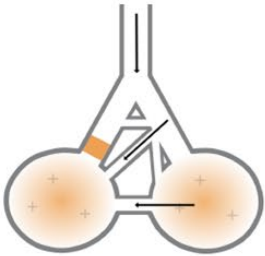
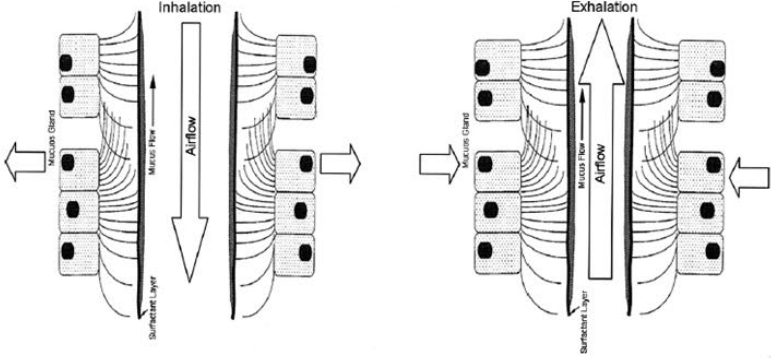
Pressure
Volume \rightarrow Airflow



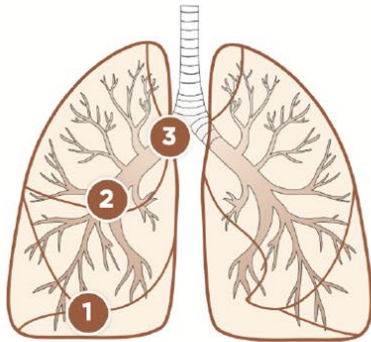
Clearance \neq Cough



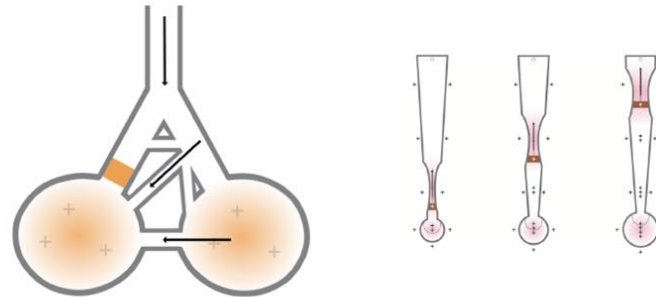
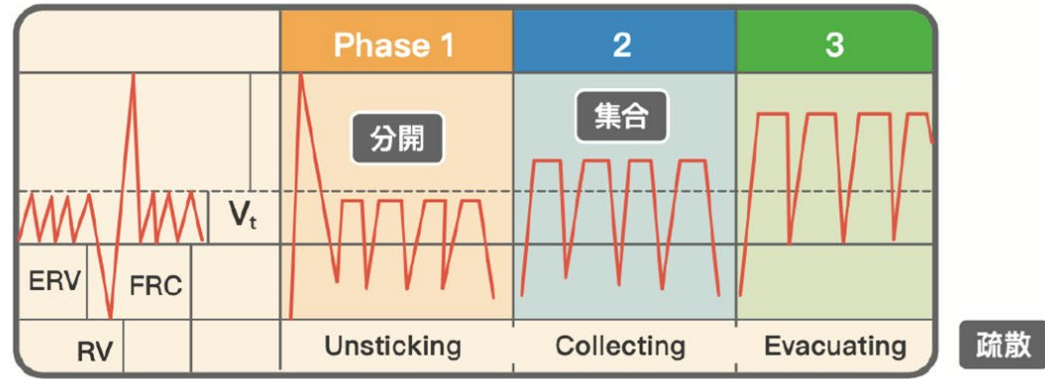
Forced Expiratory Technique



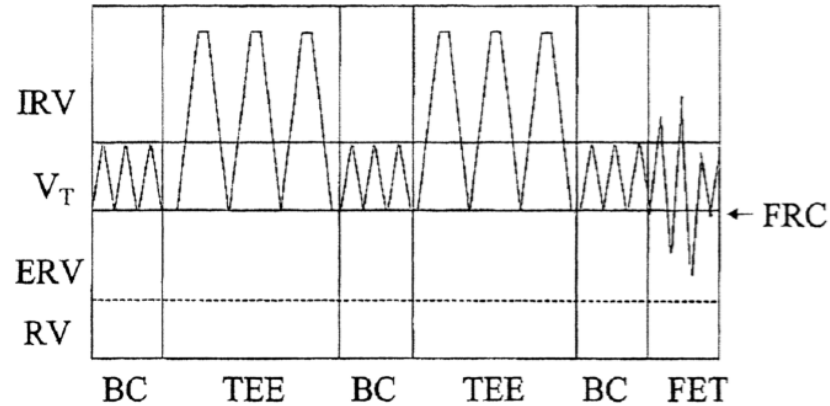
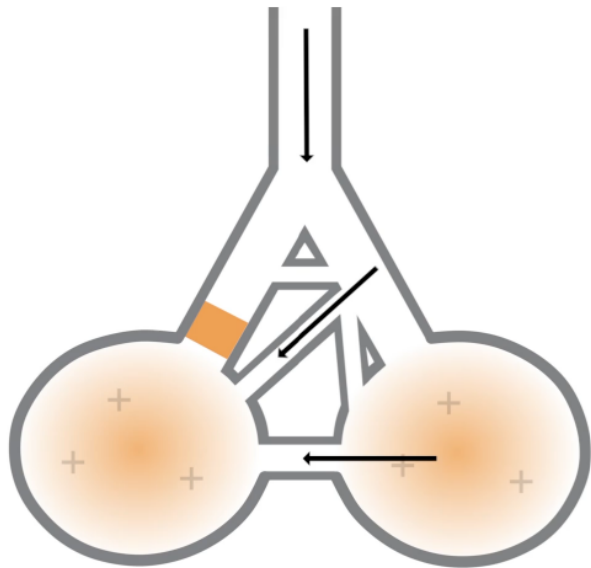
Autogenic Drainage



Hold 2-3 seconds before exhalation

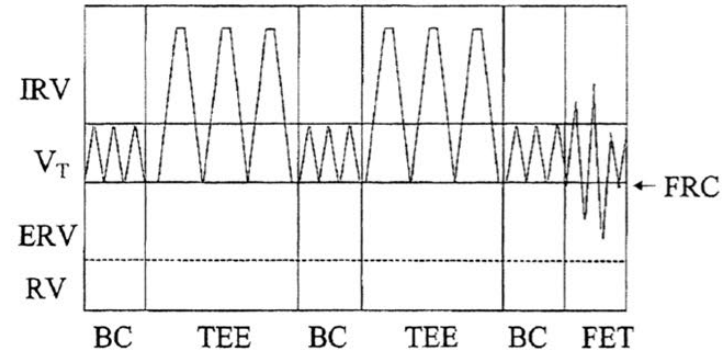
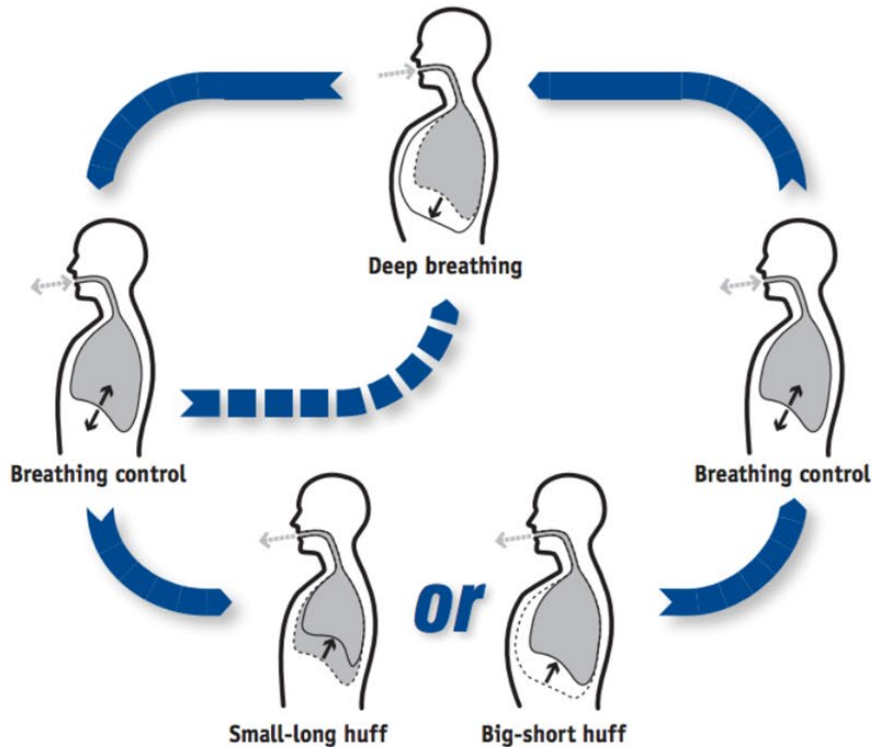


Active Cycle of Breathing Techniques



- **Breathing Control**
- **Thoracic Expansion Exercise**
- **Forced Expiration - Huff**

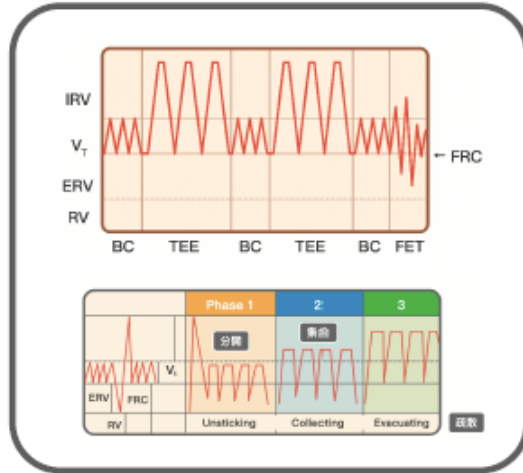
Active Cycle of Breathing Techniques



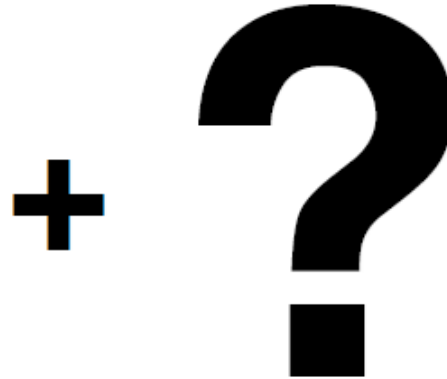
- **Breathing Control**
- **Thoracic Expansion Exercise**
- **Forced Expiration - Huff**

Airway Clearance Techniques

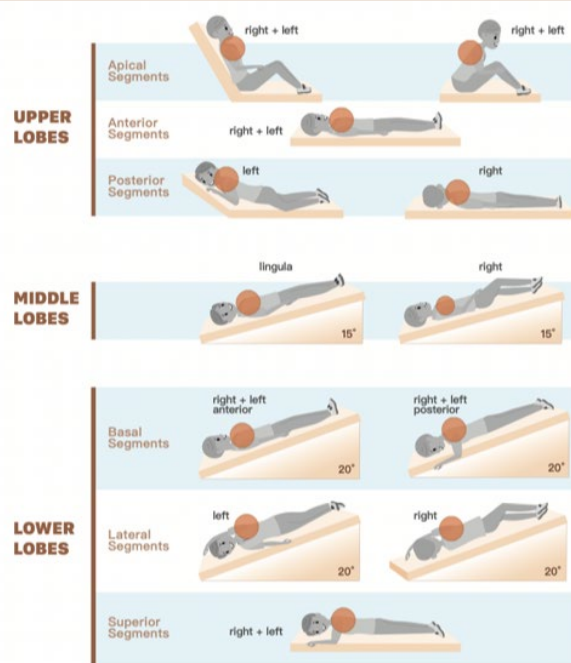
Active Cycle of Breathing Techniques



FET, Autogenic Drainage



Postural Drainage

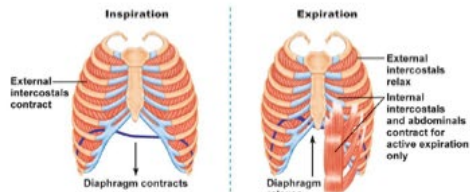


- 10-15m, 3-4/day
- 0.5-1h / eating / 1-1.5h
- Upper then Lower lobes
- 痰液允許吞嚥或抽吸

Clapping, Vibration, Shaking



- **Manual: 3-5 /s**
 - **拍痰機: 20-50 /s**
 - **3-5m each part**
 - **Avoid:**
 - Wound, Catheters
 - **Breasts, Spine,**
- Abdomen**
- **Stomach, Liver, Kidney**
- **Should be painless**
 - **In-phase vibration**



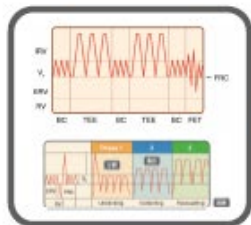
High frequency chest wall oscillation HFCWO



- 30m, 1-6 /day
- COPD: 10-15Hz
- Bronchiectasis: 12-25Hz
- **Absolute contraindication:**
 - Head & neck injured
 - **Hemodynamic unstable**

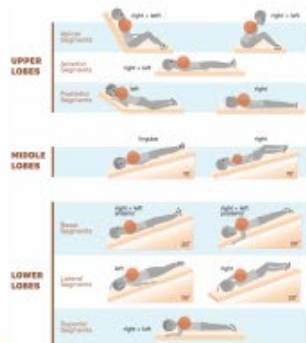
Positive Expiratory Pressure (PEP)





+

Postural Drainage



Clapping, Vibration, Shaking



Oxygen



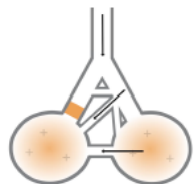
HFCWO (oscillation)



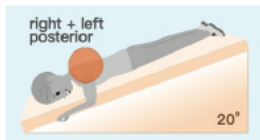
Positive Expiratory Pressure (& Oscillation)



Airway clearance techniques



Volume, Airflow

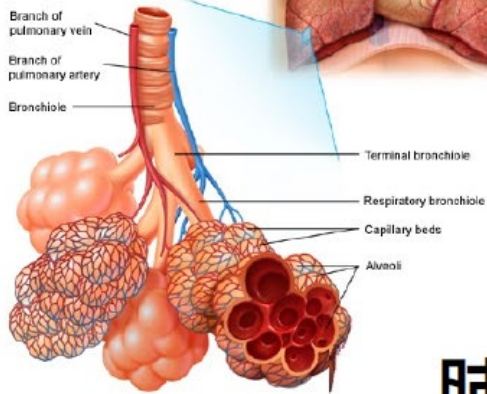


Gravity

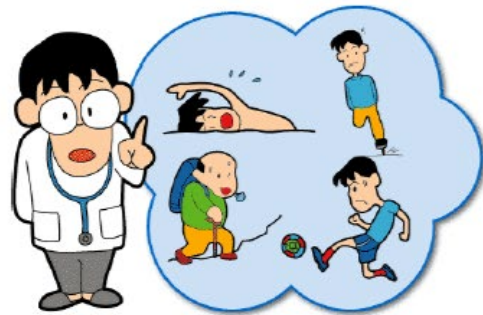


Oscillation, Vibration

GRADE 建議等級	臨床建議內容
1B 強建議 證據等級中	<ul style="list-style-type: none">利用呼吸咳痰技巧可以改善支氣管擴張症或囊性纖維化病人痰液清除，促進痰液清除能力。
	<ul style="list-style-type: none">支氣管擴張症或囊性纖維化病人執行胸腔物理治療對痰液的排除成效皆優於不使用胸腔物理治療或自發性咳嗽方式。
	<ul style="list-style-type: none">支氣管擴張症或囊性纖維化病人執行姿位引流配合震顫、背部扣擊及呼吸咳痰技巧，操作方便不需器材，是臨床上較適合的選擇。
1C 強建議 證據等級低	<ul style="list-style-type: none">採用姿位引流能顯著改善支氣管擴張症病人咳痰困難度、增進肺瀰散量及增加六分鐘走路距離。
2C 弱建議 證據等級低	<ul style="list-style-type: none">使用高頻胸腔振動可幫助痰液清除，進而可能進一步改善肺功能及生活品質，對於痰液較多之肺阻塞、支氣管擴張症的效果較為顯著。
	<ul style="list-style-type: none">使用震動吐氣末正壓裝置對肺阻塞及支氣管擴張症，可幫助痰液清除，進而可能進一步改善肺功能及生活品質。若合併吸入性支氣管擴張劑使用，可增加支氣管擴張的效果。



肺復原相關運動



要持續運動多久呢



約持續八至十二週

至少二十回



每週至少兩回於監控下運動

April 2006						
Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			



每週至少訓練三回 (3~5/週)

間隔多久需運動呢？





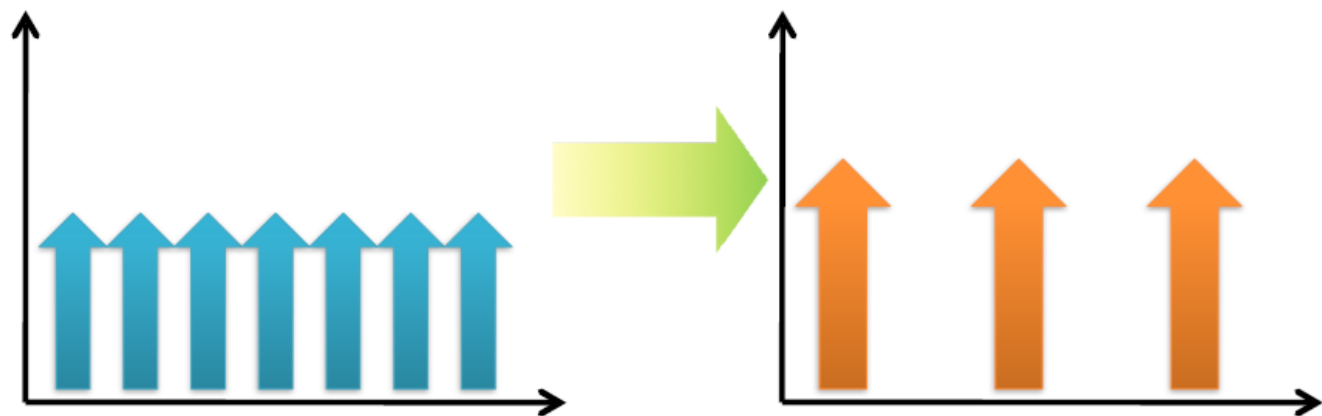
最大運動強度40-85%

55~90% 最大心跳

Borg scale: 4~6 分

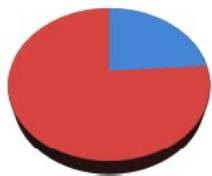
運動訓練的強度如何？

訓練時間：20~60 分鐘



採用間歇式運動訓練可減少症狀

大於60%
運動強度



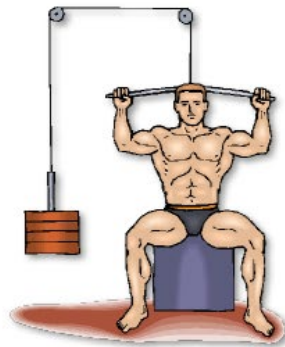
步行



騎腳踏車



每次至少30
分鐘



增強肌力(阻力訓練):

2-3 回/週

50-85%
最大肌力

×

8-15 下

×

1-3 次

每一回肌力訓練



除了運動，其他有哪些要注意的？



藥物治療已達到
最佳效果！

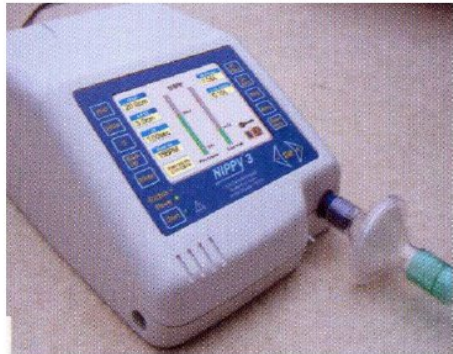


供給氧氣，可提高訓練成果，減輕呼吸症狀

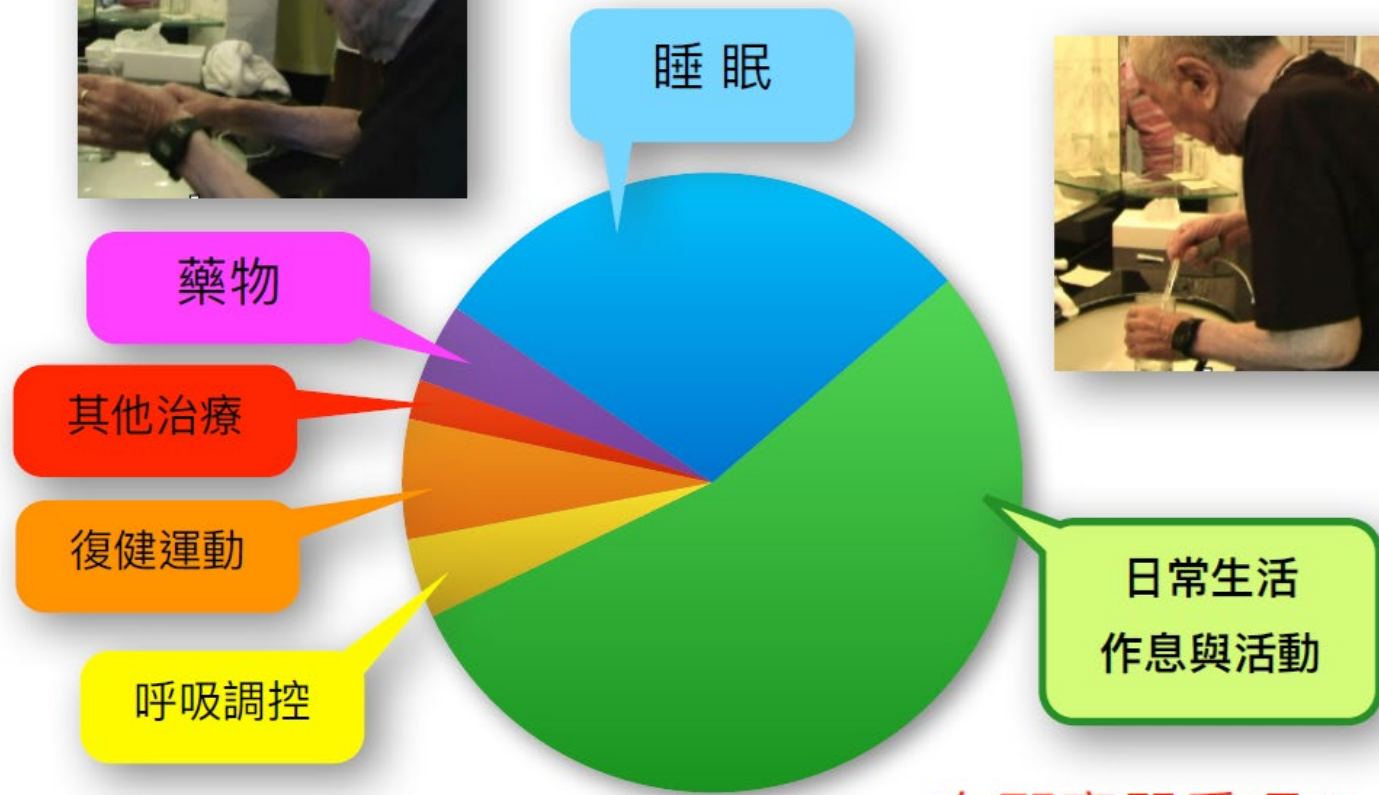
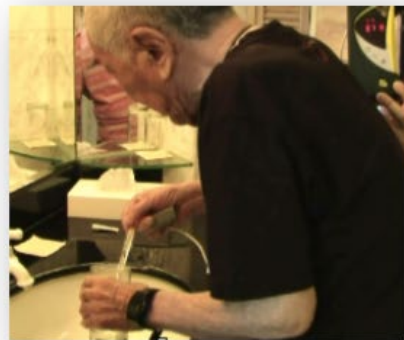




特殊情況下，可
使用非侵襲性正
壓呼吸器



不同的刷牙、漱洗方式



有那麼嚴重嗎？

COPD居家節能技巧 一般原則

- **事先計畫**並盡量簡化生活上必須勞動的事務，**避免重複**費體力的事情
- 將需要體力活動的事務**分散**在一整天，分數次休息的間隔以避免過度消耗體力
- 在每次耗費體力的活動前後均需要**休息**一段時間
- **避免在用餐後**立即從事體力活動，最好休息20~30分鐘後才進行
- 充足的**睡眠**
- 日常生活的收拾工作、衛生盥洗等盡量採用**坐姿**以及**輔助器具**（如拐杖、助行器、浴室座椅等），避免久站
- **避免瞬間**劇烈活動或搬移重物等

