# CURSO DE VMNI

## NIPPON 2026

### Telemonitorização do doente ventilado: indicações e protocolos

João Carlos Winck
*Professor Catedrático Convidado*
*FMUP*

NIPPON GASES Healthcare

# Agenda

Introdução
Telemonitorização na DPOC
Telemonitorização em doentes com DNM
Conclusões

# CONFLICTS OF INTEREST

- **Linde (fees for lecturing and participation in advisory board; ex-employee)**
- **Philips-Respironics (fees for lecturing and participation in advisory board and reimbursement for Congress)**
- **ResMed (fees for lecturing, reimbursement for Congress)**
- **Ultraponto-Vitalmobile (loan of telemedicine equipment)**

# AGENDA

- **Introdução**
- **Telemonitorização na DPOC**
- **Telemonotorização em doentes com DNM**
- **Conclusões**

# INTRODUCTION

*ERJ Express*. Published on July 7, 2016 as doi: 10.1183/13993003.01721-2015

TASK FORCE REPORT
IN PRESS | CORRECTED PROOF

# Tele-monitoring of ventilator-dependent patients: a European Respiratory Society Statement

Nicolino Ambrosino[1], Michele Vitacca[2], Michael Dreher[3], Valentina Isetta[4,5], Josep M. Montserrat[6,5], Thomy Tonia[7], Giuseppe Turchetti[8], Joao Carlos Winck[9], Felip Burgos[10], Michael Kampelmacher[11] and Guido Vagheggini[1] on behalf of the ERS Tele-Monitoring of Ventilator-Dependent Patients Task Force

RATIONALE:

Increased healthcare consumption and the need to cut costs

The increasing number of HMV patients across Europe

Difficulties associated with hospital discharge

Possibility of remote detection of signs and symptoms of decompensation

At-distance tailoring and monitoring of mechanical ventilation and

Education reinforcement for the patient and caregiver.

Eur Respir J 2025; 66: 2500557

EUROPEAN RESPIRATORY JOURNAL
ERS OFFICIAL DOCUMENTS
J. VERBRAECKEN ET AL.

## European Respiratory Society statement on advanced telemedicine for obstructive sleep apnoea (e-Sleep)

Johan Verbraecken[1,26], Emanuele Amodio[2], Ozen K. Basoglu[3], Riccardo Bellazzi[4,5], Matteo Bradicich[6], Marie Bruyneel[7], Refika Hamutcu Ersu[8], Francesco Fanfulla[9], Brigitte Fauroux[10], Ludger Grote[11], Carolina Lombardi[12,13], Walter T. McNicholas[14], Carla Miltz[15], Yüksel Peker[11,16,17,18], Sofia Schiza[19], Monique Carolina Suarez[20], Renaud Tamisier[21], Hui-Leng Tan[22], Dries Testelmans[23], Thomy Tonia[24], Piet-Heijn van Mechelen[15], Bart Vrijsen[23] and Maria R. Bonsignore[2,25,26]

Telemedicine results in similar or improved compliance when compared with traditional face-to-face encounters. Telemedicine-based targeted troubleshooting and support based on individual patient data, and a combination via smartphone apps or coaching websites, are feasible and effective. Expanding evidence suggests that telemedicine is probably cost-effective.

EUROPEAN RESPIRATORY JOURNAL
ERS OFFICIAL DOCUMENTS
M.L. DUIVERMAN ET AL.

Eur Respir J 2025; 66: 2500094

## European Respiratory Society clinical practice guideline on telemedicine in home mechanical ventilation

Marieke L. Duiverman[1,2], Carla Ribeiro[3,4], Thomy Tonia[5], Anda Hazenberg[1,2], Stien van Meerloo[6], Hans van Meerloo[6], Stefanie Werther[7], Christoph Schöbel[7], Aylin Özsancak Uğurlu[8], Jean-Christian Borel[9,10], Cristina Jácome[4], Maxime Patout[11,12], Karen Ward[13], Clare Williams[14], Begum Ergan[15], Christopher Carlin[16], Patrick Murphy[17,18], Raffaela Dellacà[19], Michele Vitacca[20] and Claudia Crimi[21,22]

Despite a growing body of research published since the last ERS statement on telemonitoring of ventilator-dependent patients, the added value of telemedicine in managing patients with chronic respiratory failure on HMV remains controversial as the evidence was still very low. Building upon the 2016 ERS statement, new RCTs comparing telemedicine-guided titration and follow-up with standard care (without telemedicine) were included, providing evidence on tele-titration and tele-follow-up of patients on HMV.

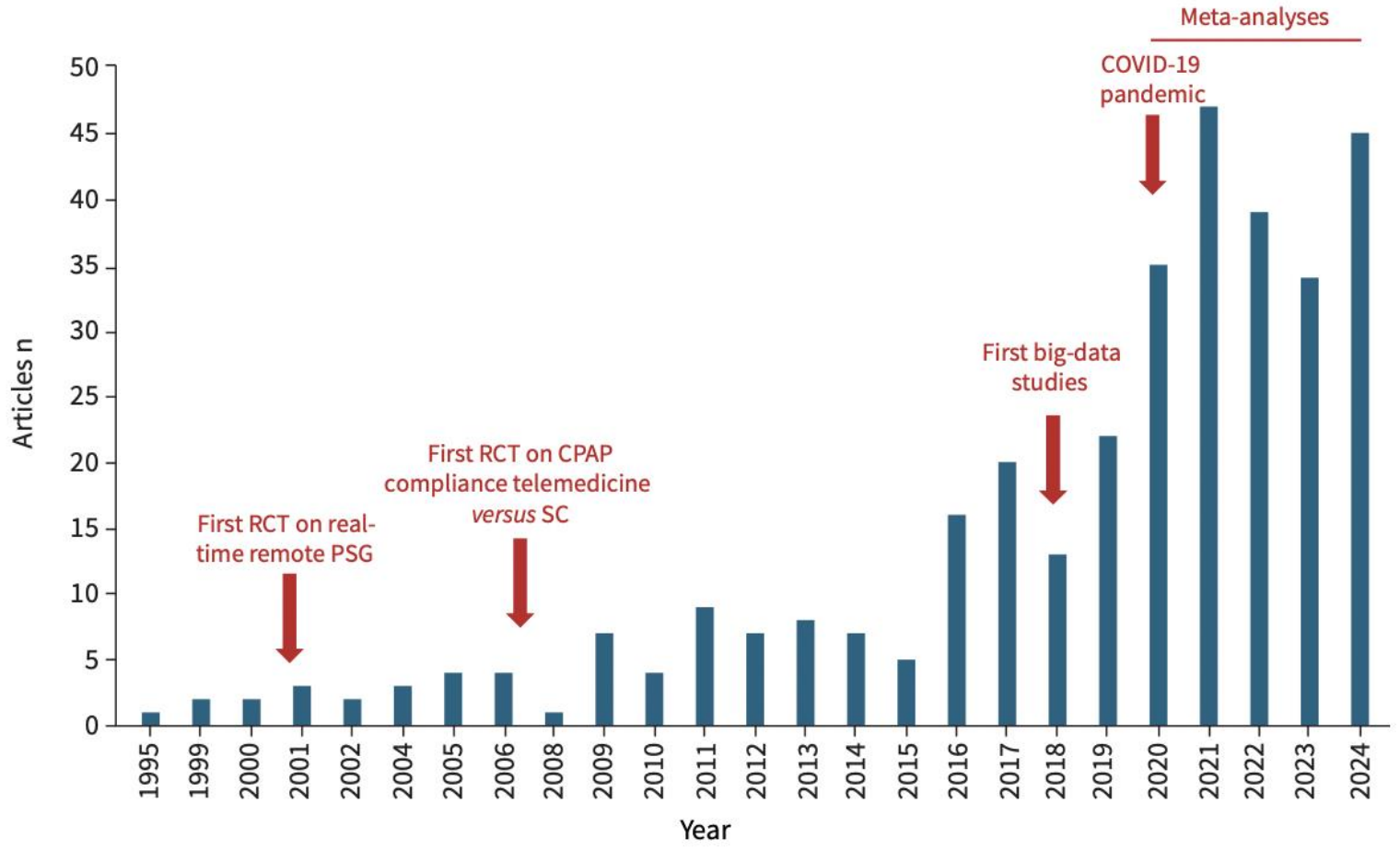



**FIGURE 1** Telemedicine and sleep apnoea: 304 articles published from 1995 to November 2024. RCT: randomised controlled trial; CPAP: continuous positive airway pressure; SC: standard care; COVID-19: coronavirus disease 2019.

# TELEMONITORIZAÇÃO NA DPOC

# EVIDENCE OF TELE-HEALTH IN COPD

Respiratory Medicine (2015) 109, 11–26

Available online at www.sciencedirect.com

ScienceDirect

journal homepage: www.elsevier.com/locate/rmed

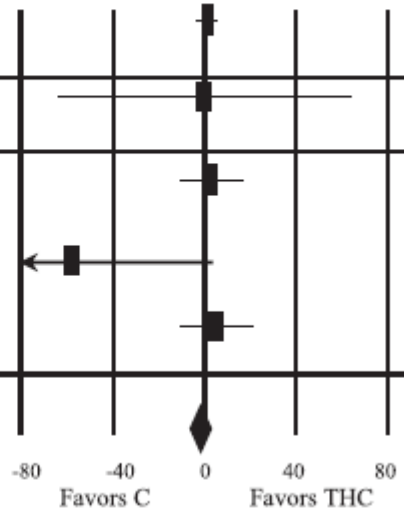
REVIEW

## Telehealthcare in COPD: A systematic review and meta-analysis on physical outcomes and dyspnea☆

Sara Lundell [a,*], Åsa Holmner [b], Börje Rehn [a], Andre Nyberg [a], Karin Wadell [a]

Interventions: **phone calls**, **websites** or **mobile phones**, combined with **education** and/or **exercise training**

| Study | Comparison | Duration | Outcome | Statistics for each study: MD (m) | Lower limit | Upper limit | P-value | Weight | Comparator |
|---|---|---|---|---|---|---|---|---|---|
| Bourbeau, 2003[27] | THC vs C | 12 months | 6MWT | -3.0 | -8.1 | 2.1 | 0.248 | 66.16% | Ordinary care |
| Nield, 2012[32] | THC vs C | 4 weeks | 6MWT | 0.1 | -62.8 | 63.0 | 0.997 | 1.15% | Less than telehealthcare |
| Carrieri-Kohlman, 1996[28] | THC vs C | 8 weeks | 6MWT | 4.0 | -11.2 | 19.1 | 0.609 | 16.79% | Equal to telehealthcare |
| Nguyen 2009[30] | THC vs C | 6 months | 6MWT | -57.4 | -118.0 | 3.2 | 0.064 | 1.24% | |
| Maltais, 2008[35] | THC vs C | 12 months | 6MWT | 5.0 | -11.4 | 21.4 | 0.551 | 14.67% | |
| **Overall** | | | | **-1.3** | **-8.1** | **5.5** | **0.708** | **100%** | |



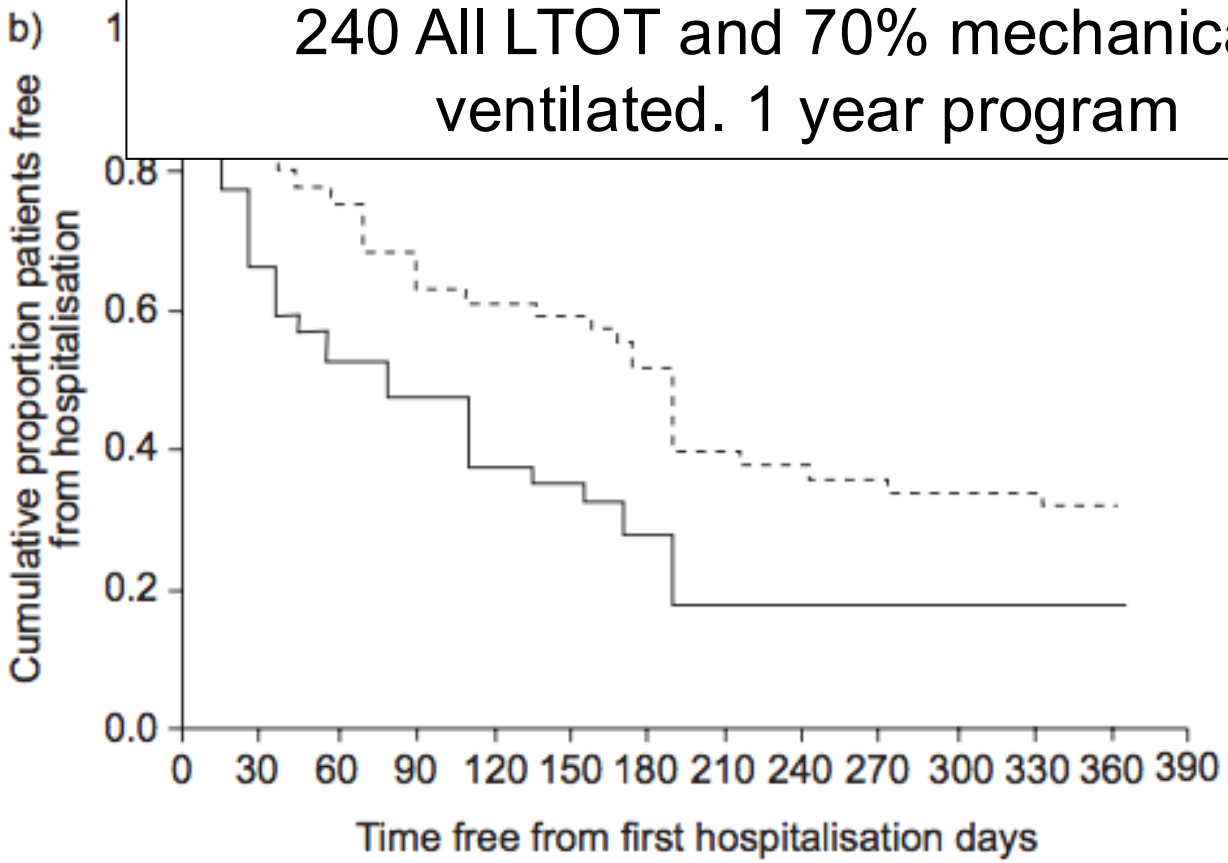

Heterogenity: Q = 4.65, df (Q) = 4; $I^2$ = 14% (p = 0.325), Eggers = -0.21 (p = 0.813)

Eur Respir J 2009; 33: 411–418
DOI: 10.1183/09031936.00005608


# Tele-assistance in chronic respiratory failure patients: a randomised clinical trial

**M. Vitacca*, L. Bianchi*, A. Guerra*, C. Fracchia#, A. Spanevello¶, B. Balbi+ and S. Scalvini§**

240 All LTOT and 70% mechanically ventilated. 1 year program



Respiratory Medicine (2013) xx, 1–10

Available online at www.sciencedirect.com

ScienceDirect

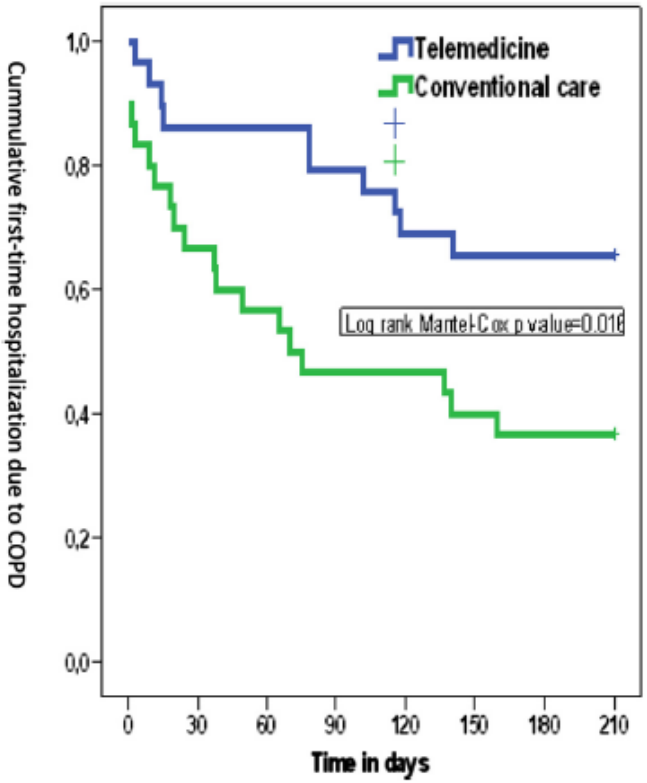
journal homepage: www.elsevier.com/locate/rmed

# A home telehealth program for patients with severe COPD: The PROMETE study

G. Segrelles Calvo [a,*], C. Gómez-Suárez [b], J.B.
E. Zamora [a], A. Gónzalez-Gamarra [d], M. Gonzá
A. Jordán [b], E. Tadeo [b], A. Sebastián [f], G. Ferr
J. Ancochea [a]

Patient performed daily measurements at the home

Parameters were transmitted via the telephone line through a modem




60 LTOT (None under NIV)

# Randomised crossover trial of telemonitoring in chronic respiratory patients (TeleCRAFT trial)

M Chatwin,[1] G Hawkins,[1] L Panicchia,[1] A Woods,[1] A Hanak,[1] R Lucas,[1] E Baker,[2] E Ramhamdany,[3] B Mann,[3] J Riley,[1] M R Cowie,[1] A K Simonds[1]

**Philips Motiva system** :heart rate monitoring, finger pulse oximeter, weight scales and blood pressure monitor.

**2nd generation system**

*Thorax* 2016;**00**:1–7.

# METHODS: TELEMONITORING

## Patients Home

**Philips Motiva system** (modified)


Daily: $SpO_2$, HR and symptom questionnaire
Weekly: Weight and BP
Monthly: Healthcare visits
Data to be inputted by 12.00

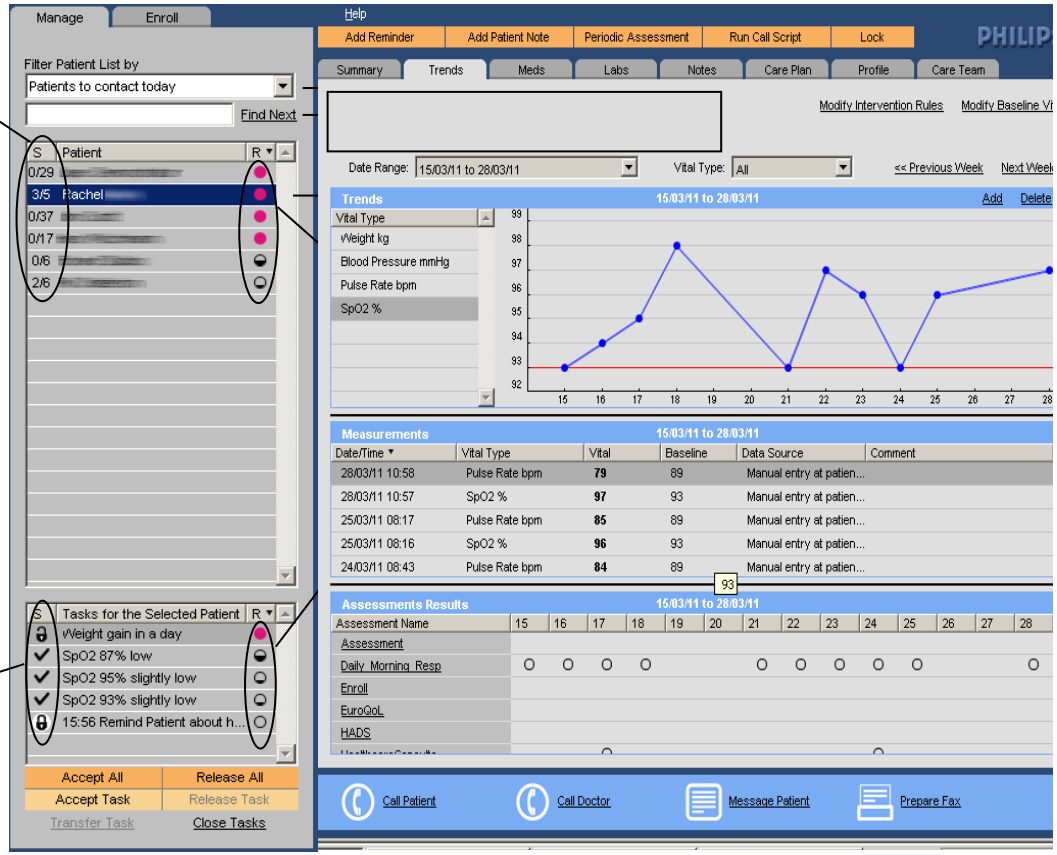
## Hospital Interface

***Courtesy of Michelle Chatwin***

atus

List

icators




Data was reviewed by healthcare team member on daily basis (Mon-Fri) by approximately 14.00 hours

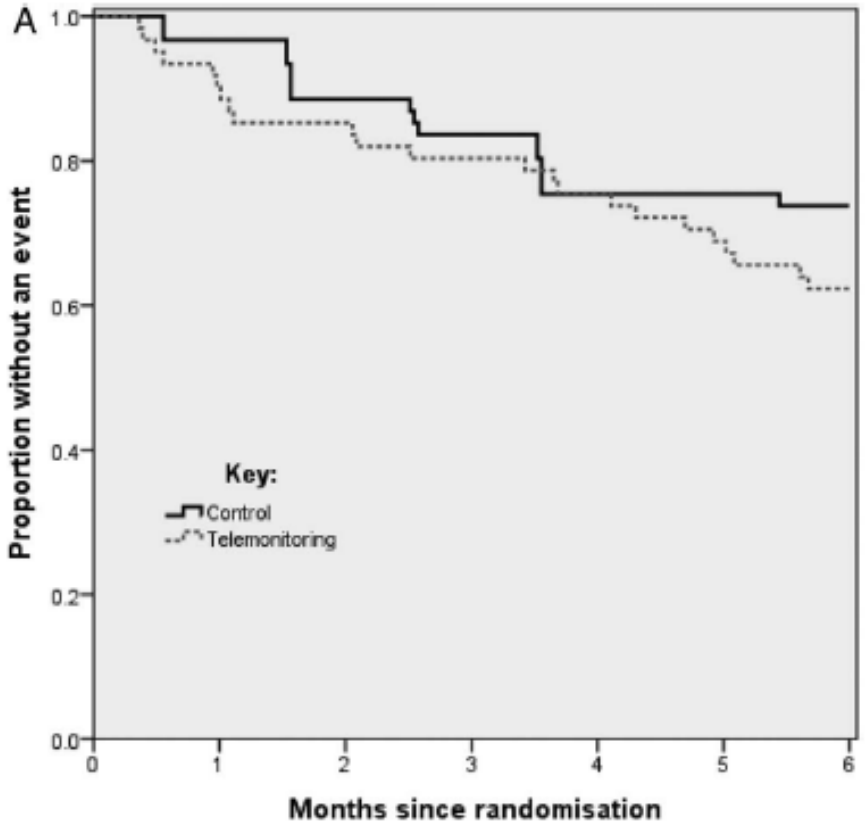
# Randomised crossover trial of telemonitoring in chronic respiratory patients (TeleCRAFT trial)

M Chatwin,[1] G Hawkins,[1] L Panicchia,[1] A Woods,[1] A Hanak,[1] R Lucas,[1] E Baker,[2] E Ramhamdany,[3] B Mann,[3] J Riley,[1] M R Cowie,[1] A K Simonds[1]

**Table 1** Baseline demographics

| | COPD Mean (SD) | Non-COPD Mean (SD) | All Mean (SD) |
|---|---|---|---|
| Age (years) | 65.3 (7.6) | 58 (14.4) | 61.8 (11.9) |
| FEV1 (L) | 0.9 (0.5) | 0.7 (0.5) | 0.9 (0.5) |
| FVC (L) | 2.1 (0.9) | 1.1 (0.6) | 1.7 (1) |
| $PaO_2$ (kPa) | 8.4 (1.2) | 8.2 (1.4) | 8.3 (1.3) |
| $PaCO_2$ (kPa) | 6.4 (1.3) | 6.9 (1.3) | 6.7 (1.3) |
| $SpO_2$ (%) | 92 (3) | 89 (6) | 90.4 (4.9) |
| MRC dyspnoea scale | 4 (1) | 4 (1) | 4 (1) |
| Gold (stage) | 3 (1) | NA (NA) | NA (NA) |
| Height (cm) | 167 (8) | 160 (12) | 164 (11) |
| Weight (kg) | 85 (26) | 83.1 (38.2) | 84.4 (31.9) |
| BMI ($kg/m^2$) | 31 (9) | 33.9 (14.3) | 32 (11.5) |
| HADS anxiety score | 8 (4) | 10 (4) | 9 (4) |
| HADS depression score | 7 (4) | 8 (4) | 8 (1) |
| EQ-5D scale score | 57 (16) | 57 (21) | 57 (18) |
| | **N (%)** | **N (%)** | **N (%)** |
| Males | 20 (63) | 9 (32) | 29 (48) |
| NIV | 27 (84) | 25 (89) | 52 (87) |
| LTOT | 19 (59) | 19 (68) | 38 (63) |
| Lives alone | 9 (28) | 10 (36) | 19 (32) |

BMI, body mass index; HADS, hospital anxiety and depression score; LTOT, long-term oxygen therapy; MRC, Medical Research Council; NIV, non-invasive ventilation.




*Thorax* 2016;**00**:1–7.

Manuela Zamith[1]
Teresa Cardoso[2]
Isabel Matias[3]
Maria João Marques Gomes[4]

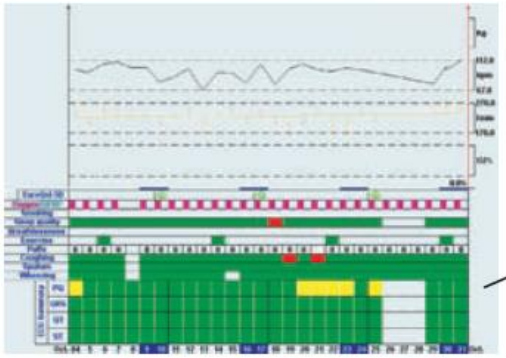
# Telemonitorização domiciliária de insuficientes respiratórios crónicos graves e de doentes asmáticos

## *Home telemonitoring of severe chronic respiratory insufficient and asthmatic patients*

**Quadro IV** – Características dos insuficientes respiratórios

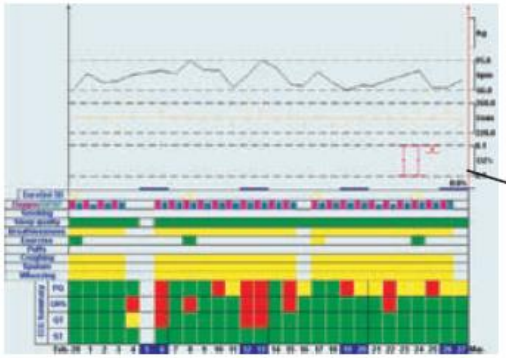
| **Diagnósticos** | |
|---|---|
| DPOC | 21 |
| Sequelas de TP | 12 |
| Cifoscoliose | 6 |
| Fibrose pulmonar | 4 |
| S. obesidade-hipoventilação | 1 |

NIV: 32 (71%)

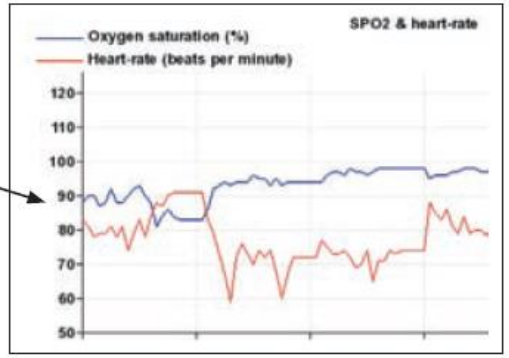


Dados recebidos diariamente, doente 1/Daily data, patient 1

Electrocardiograma/Electrocardiogram

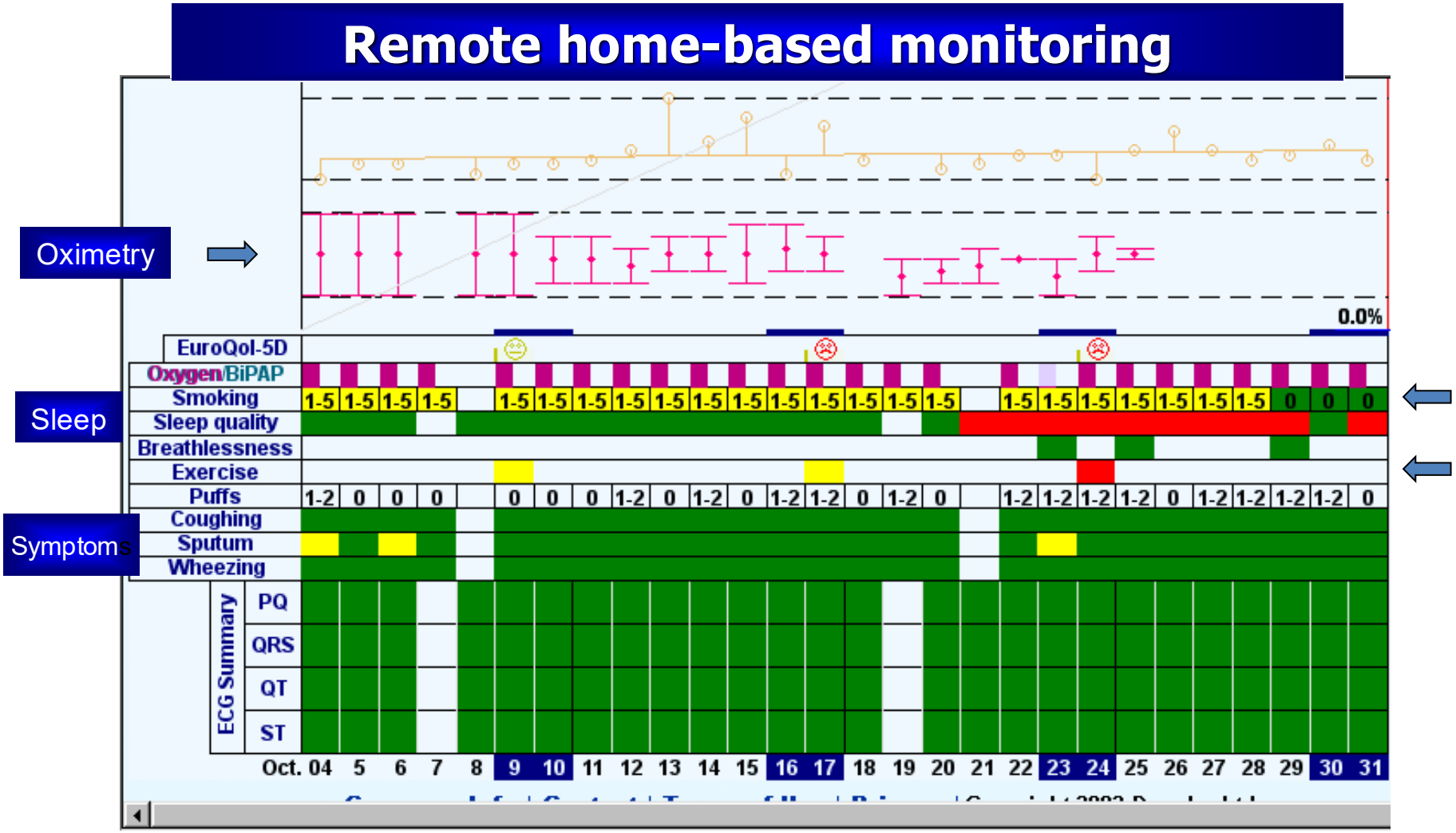


Dados recebidos diariamente, doente 2/Daily Data, patient 2




Oximetria/Oximetry

# MONITORING HOME NONINVASIVELY VENTILATED PATIENTS




*Zamith M, Rev Port Pneumol 2005*

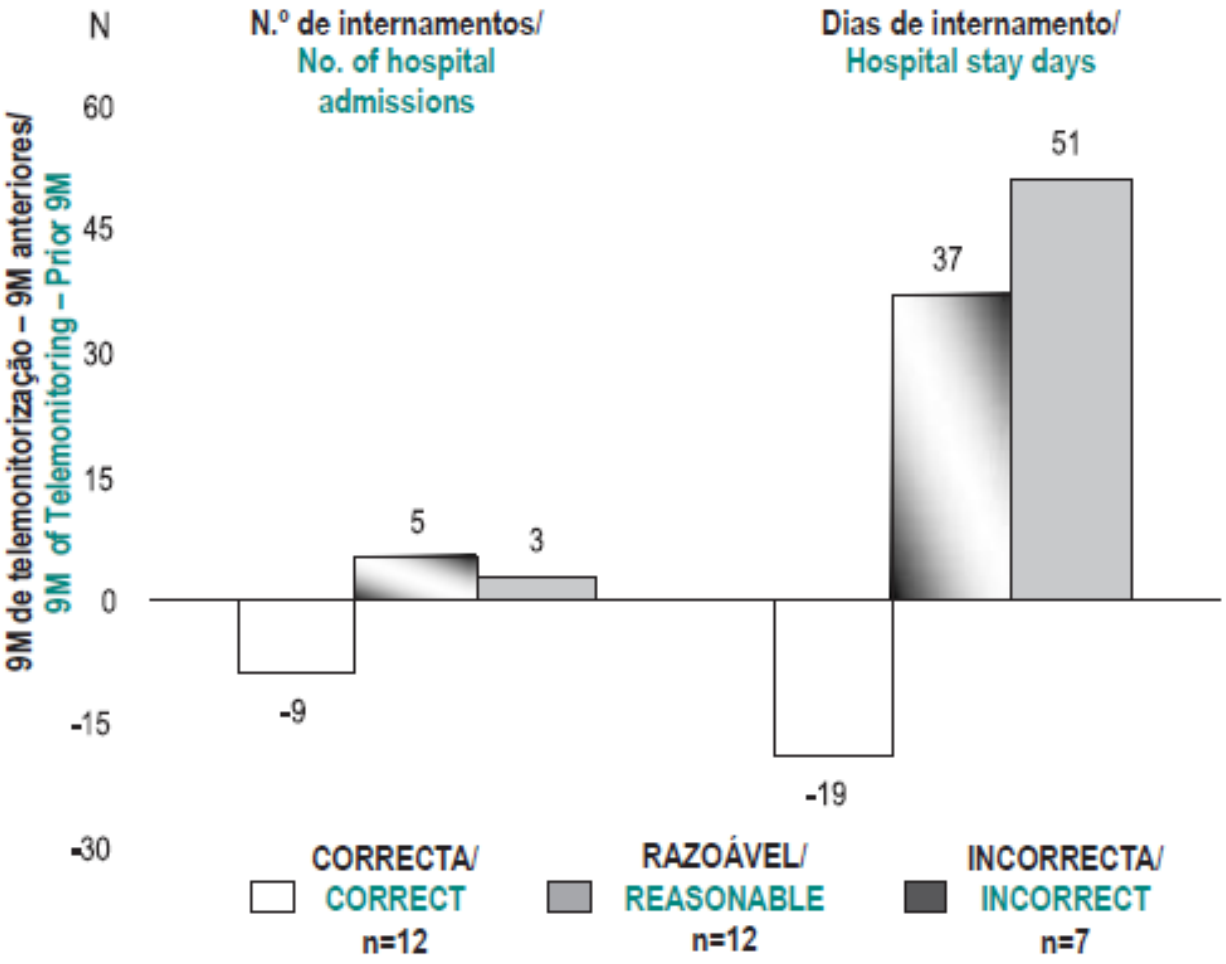



**Fig. 3** – Comparação do número e duração dos internamentos no grupo de insuficientes respiratórios seguidos pela equipa de Lisboa, durante os nove meses de telemonitorização e os nove meses anteriores a este programa, segundo a utilização que foi dada ao equipamento: correcta, razoável ou incorrecta.

# TELEMONITORIZAÇÃO DE DOENTES COM INSUFICIÊNCIA RESPIRATÓRIA CRÓNICA

## Remote home-based monitoring


Dificuldades na transmissão dos dados da oximetria

*Zamith M, Rev Port Pneumol 2005*

Reality project funded by EU

# TELEMONITORIZAÇÃO NAS DNM

# Videophone system improves pediatric Home Respiratory Assistance-*Miyasaka K, Pediatrics 1997*

Figure. Videophone system used in this study. A camera for remote operation (at the right side of the videophone) was used in addition to the fixed-focus camera right above the liquid crystal display screen. The same setup was used in the patient's home. A separate monitor (on top of the personal computer) is used at the hospital for additional viewers. The picture being transmitted is the front panel of a home care ventilator (Puppy 2; Origin Medical Inc, Tokyo, Japan).

# Trial of telemedicine for patients on home ventilator support: feasibility, confidence in clinical management and use in medical decision-making

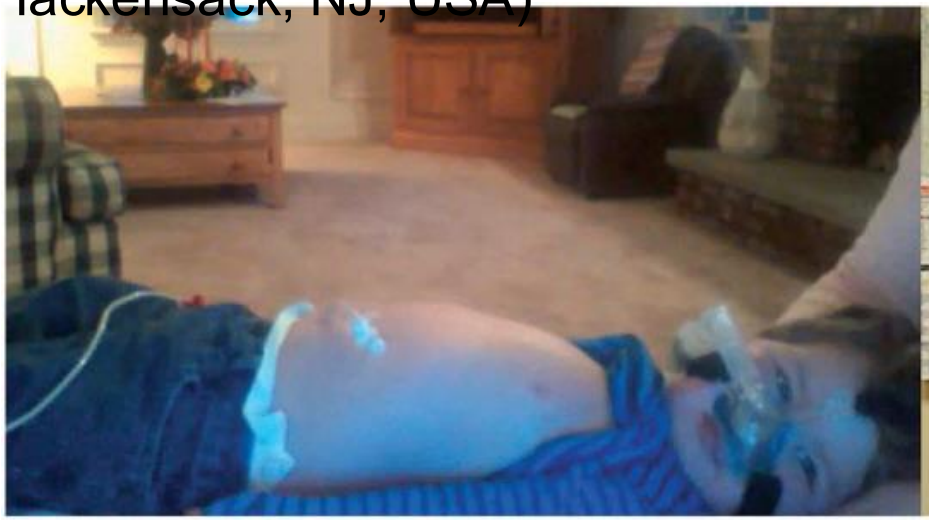
*Journal of Telemedicine and Telecare*
2014, Vol. 20(8) 441–449

DOI: 10.1177/1357633X14555620
jtt.sagepub.com
SAGE

David W Casavant[1], Michael L McManus[1], Susan K Parsons[2], David Zurakowski[3] and Robert J Graham[1]

Web Based Videoconferencing software (Vidyo Corporation, Hackensack, NJ, USA)

N= 14 (8 NMD; 5 adults; 7 invasive MV)
**Results**: Telemedicine encounters supported clinical decision-making, especially in patients with active clinical problems or when the patient was acutely ill.



# Pulmonary rehabilitation at home guided by telemonitoring and access to healthcare facilities for respiratory complications in patients with neuromuscular disease

G. GARUTI [1], S. BAGATTI [1], E. VERUCCHI [2], M. MASSOBRIO [1], L. SPAGNOLATTI [1], G. VEZZANI [3], M. LUSUARDI [1]

Parameters: **SpO2+Modem** (check points twice daily and full night weekly), RR, HR, Symptoms (**Respicard**)

Intervention: PR on demand

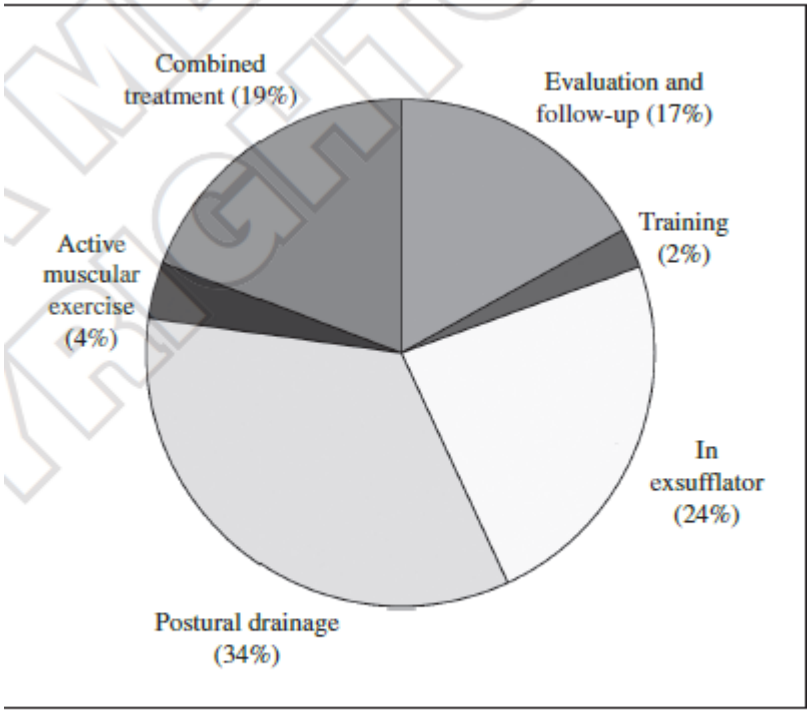



Figure 1.—Respiratory therapist's interventions divided by percentage.

N= 13
**10 on MV** (5 invasive)
8 MD, 1 Pompe, 1 Post-Polio, etc
NO ALS

**Results**: Significant reduction in Hospital admissions

Eur J Phys Rehabil Med 2013: 51-7

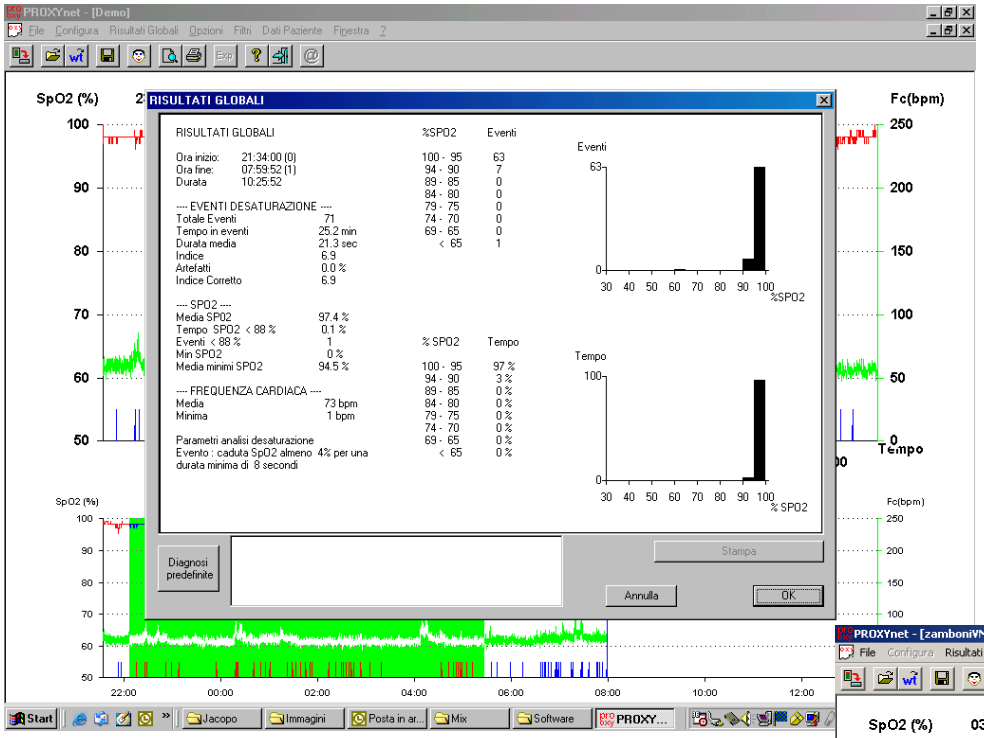
# A pilot study of nurse-led, home monitoring for patients with chronic respiratory failure and with mechanical ventilation assistance

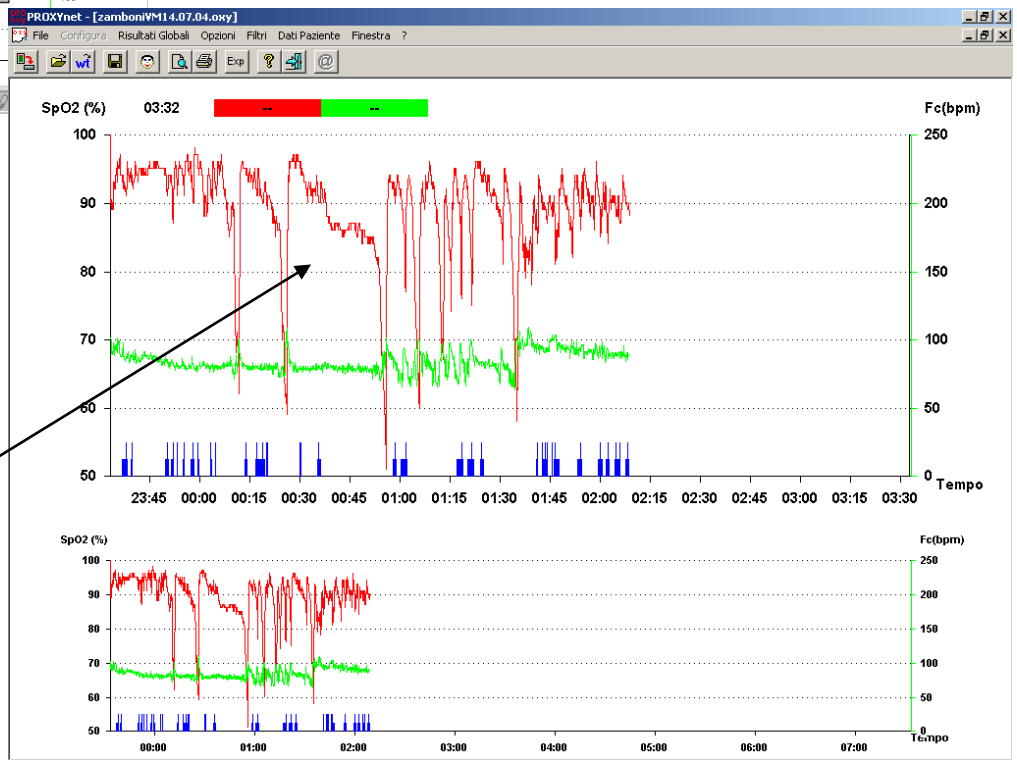
M Vitacca*, G Assoni†, P Pizzocaro*, A Guerra*, L Marchina†, S Scalvini†, F Glisenti†, A Spanevello‡, L Bianchi*, L Barbano*, A Giordano† and B Balbi**

Utilidade da oximetria para titulação da OLT, VMD e estabilização de exacerbações

**Figure 1** Patient at home with the portable pulse oximeter (left) and care-giver sending a recording by modem (right)

Journal of Telemedicine and Telecare 2006; **12**: 337–342




Nocturnal report of a
ALS patient under NMV

Monaldi Arch Chest Dis
2012; 77: 2, 57-66

ORIGINAL ARTICLE

# Telemonitoring in chronic ventilatory failure: a new model of survellaince, a pilot study

S. Bertini, M. Picariello, M. Gorini, T. Renda, A. Augustynen, G. Villella, G. Misuri, N.M. Maluccio, R. Ginanni, D. Tozzi, A. Corrado

NMD (7 in 16) MD n=4 (2 IMV, 2 NIV) ALS n=3 (2 IMV, 1 NIV)

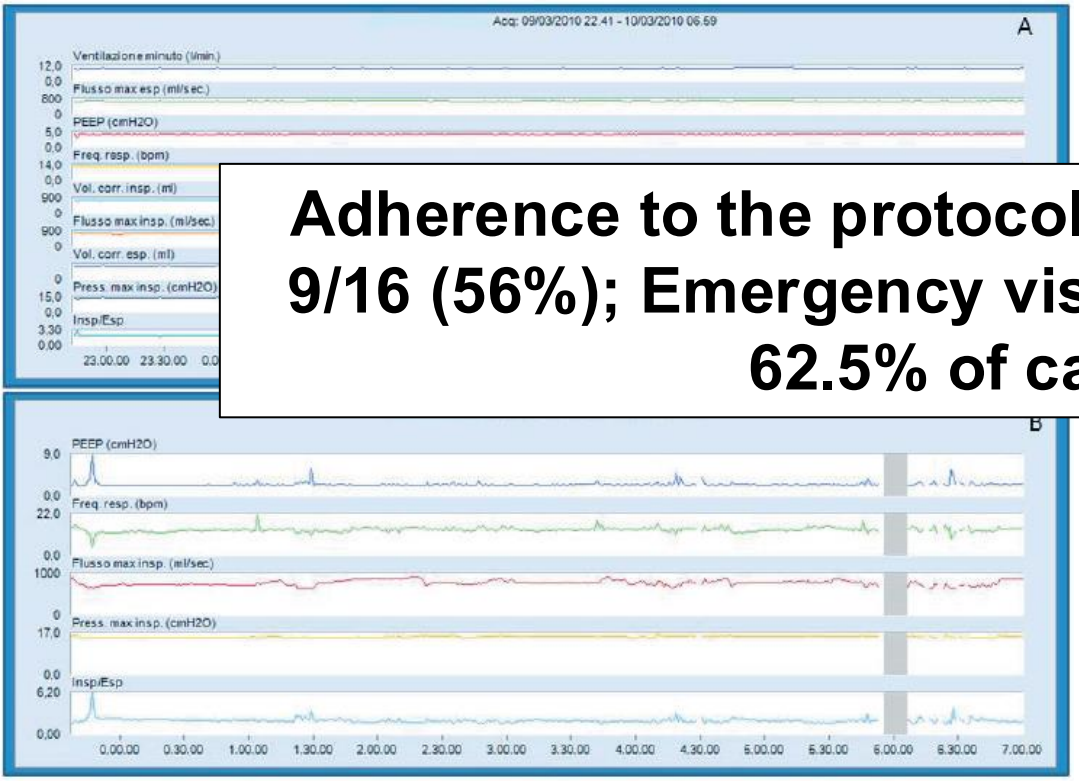


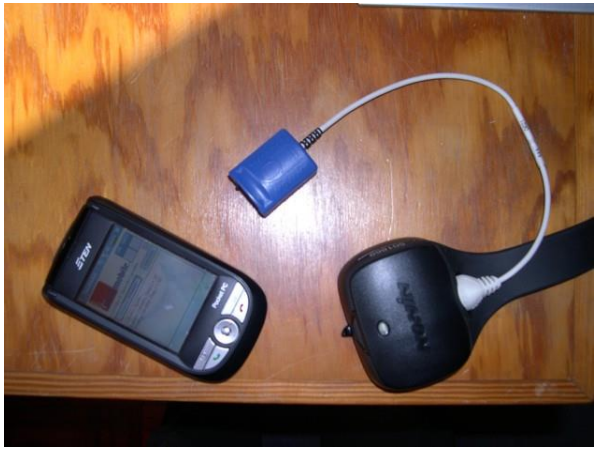

Fig. 4. - Examples of the recorded traces with the Sally System: in panel A traces of patient in Invasive Mechanical Ventilation, in panel B traces of patient in Noninvasive Mechanical Ventilation.

**Adherence to the protocol study was good in 9/16 (56%); Emergency visits were avoided in 62.5% of cases**

# WIRELESS REAL TIME OXIMETRY TELEMONITORING- PILOT STUDY 2006

vitalmobile.net

FACULDADE DE MEDICINA DA UNIVERSIDADE DO PORTO



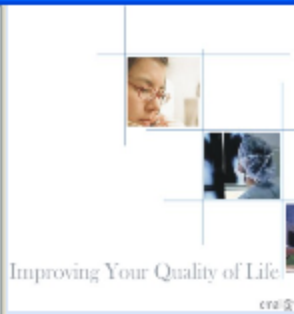

Linde Sogás, Lda.

atient: Joaquim F. (49)

im F. *

| Timespan:19:29:40 | SpO2 (%) | HR (bpm) |
|---|---|---|
| Total episodes | 0 | 0 |
| Episodes time(min) | 0 | 0 |
| Episode Avrg(sec) | 0 | 0 |
| Index(1/hr) (ODI) | 0 | 0 |

| | SpO2 (%) | HR (bpm) |
|---|---|---|
| Average | 91 | 81 |
| Minimum | 84 | 49 |
| Maximum | 98 | 113 |
| Minutes<90% | 452.7 | |

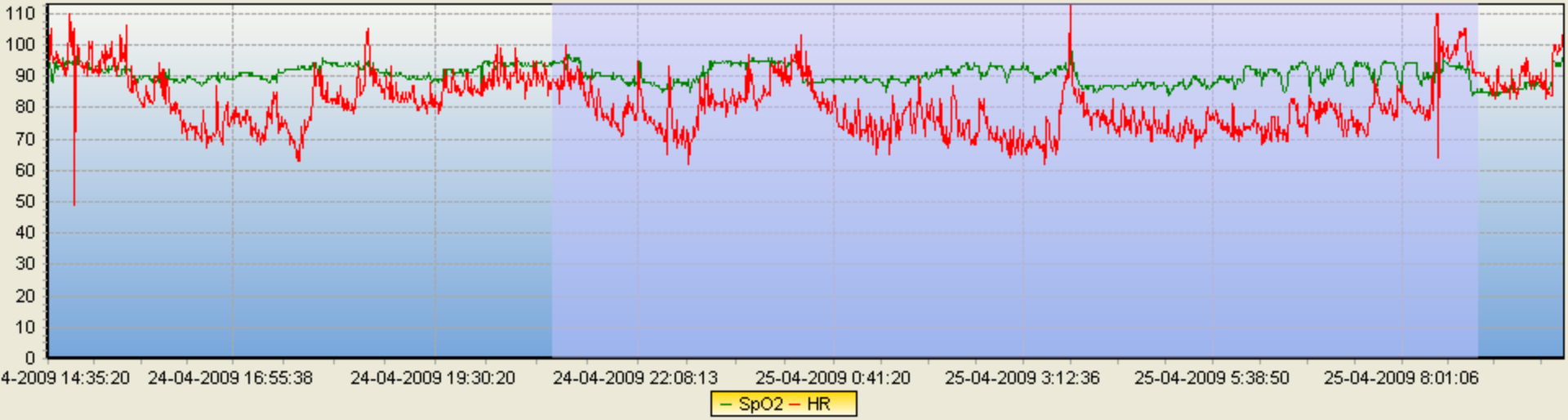



Stat | Gen.Info | Public Notes | Private Notes

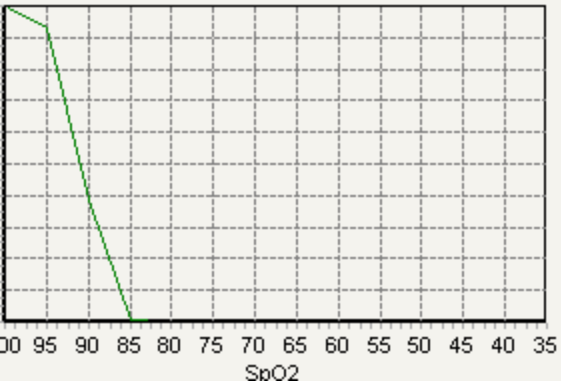
eter | Ventilator | O2 Regul. | Cough Assist

To ZOOM, select graph area (left mouse button)

Readings Date: 2009-04-25 Refresh

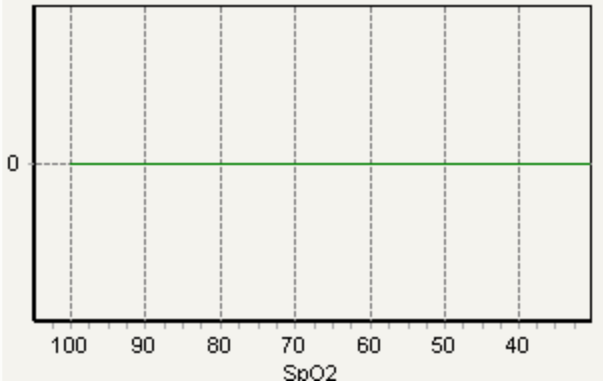



Hour - Distribution




| Under(%) | Time(%) |
|---|---|
| 100 | 100 |
| 95 | 93 |
| 90 | 38.7 |
| 85 | 0.6 |
| 80 | 0 |
| 75 | 0 |
| 70 | 0 |
| 65 | 0 |
| 60 | 0 |
| 55 | 0 |
| 50 | 0 |
| 45 | 0 |
| 40 | 0 |
| 35 | 0 |

# Episodes




| %SpO2 | Episodes |
|---|---|
| 99 - 95 | 0 |
| 94 - 90 | 0 |
| 89 - 85 | 0 |
| 84 - 80 | 0 |
| 79 - 75 | 0 |
| 74 - 70 | 0 |
| 69 - 65 | 0 |
| 64 - 60 | 0 |
| 59 - 55 | 0 |
| 54 - 50 | 0 |
| 49 - 45 | 0 |
| 44 - 40 | 0 |
| 39 - 35 | 0 |
| 34 - 30 | 0 |


VM MultiPatient - Visualizador de imagens e de fax do Windows
VitalMobile Health - Ver: 3.1 (tm) VitalMobile
General
View PATIENT
Pacient: A. (19)
Pacient: P. (9)
Pacient: Hermengarda (10)
Stat
Gen.Info
Public Notes
Private Notes
Analitical Graph
O2 Regul.
Ventilator Regul.
Cough Assist
To ZOOM, select graph area (left mouse button)
Readings Date:
2008-11-02
2008-11-03
Refresh
SpO2 – HR
(%) Hour - Distribution
# Episodes
SpO2
Date of Birth: 01-01-0001
Identif: 10
Doctor:
Height: 0
Weight: 11
HEALTH

# Wireless home oximetry monitoring in patients with high ventilatory dependence

João Carlos Winck [1,2] Miguel R Gonçalves[1,2], Nuno Silva[3], Tiago Pinto[1]
Gonçalo Belo [4], José Belo [4]

1-Serviço de Pneumologia, HSJ EPE; 2-Serviço de Pneumologia, FMUP; 3-Linde Home Care; 4-Vitalmobile – UltraPonto Porto, PORTUGAL

FACULDADE DE MEDICINA DA UNIVERSIDADE DO PORTO

SÃO JOÃO

Linde Sogás, Lda.

vitalmobile HEALTH

For the whole population, cumulative mean spO2 was 93.9%± 2.6%, with 12.1%± 15% of the time spent under 90% (T90) of spO2. Four patients had T90>20% (one bulbar ALS, one MAS, one non-compliant transverse myelitis and one cerebral palsy. Progressive decreases in spO2 urged increases/changes in ventilatory support (Fig 5 and 6): 2 ALS patients under 24 h/day NIV had to be tracheostmized due to progressive bulbar dysfunction.

We included 26 patients; 20 under continuous non-invasive ventilation and 6 under invasive ventilation. Mean age was 55.7±15.3 years, and

Progressive decreases in spO2 urged increases/changes in ventilatory support (like 2 ALS patients that had to be tracheostomized due to progressive bulbar dysfunction). Severe desaturation (due to secretion encumbrance) activated home mechanical in-exsufflation in 4 patients under continuous NIV avoiding hospitalization.

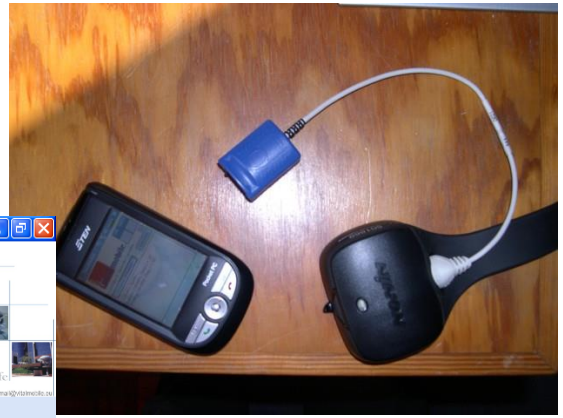

Profound dessaturations with secretion encumbrance activated home MI-E in 4 patients under continuous NIV, avoiding hopsitalization (Fig 7).

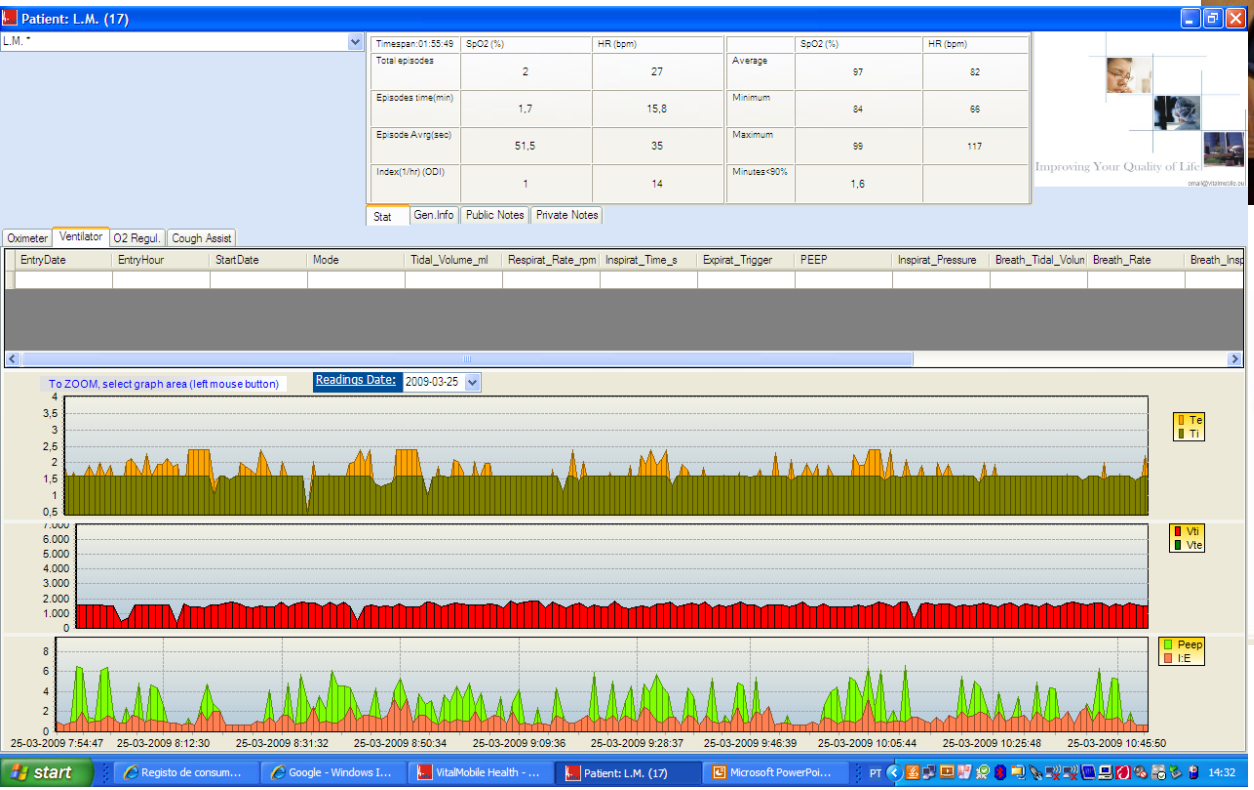
Figure 4-12 hour graph in an ALS patient under 24 h/day NIV (volume ventilator, with mouthpiece

Our telemanagement system gives a more precise picture of the spO2 profile in these patients, permits an earlier detection of respiratory complications and monitors interventions in real-time.

**Winck JC et al ERJ 2009; 34 (suppl 53): 131s**

# WIRELESS VENTILATORY MONITORING SYSTEM (VITALMOBILE® AVM) FOR LONG-TERM MECHANICAL VENTILATION: AN IN-FLIGHT PILOT STUDY





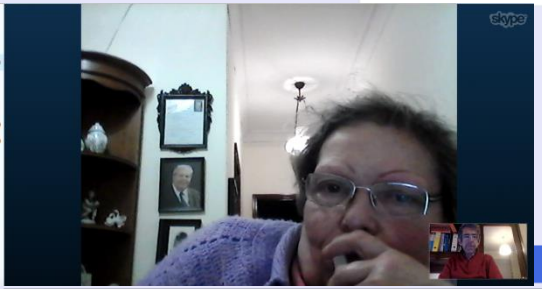

**Rev Port Pneumol 2010; 16 (supl 2): S8**


Check-In
Balcões
16 a 30
THORAX
Oxygen or ventilation during flight for patients with neuromuscular disease?
J C Winck, M R Gonçalves and N Silva
Thorax 2010 65: 370-371

< Patient: Albert >

Albert *

Read Profile



| TimeS: 00:11 | SpO2 (%) | HR (bpm) | Resp.Rate | Activity |
|---|---|---|---|---|
| Average | 0 | 0 | 16,6 | 0,09 |
| Minimum | 0 | 0 | 2,6 | 0,01 |
| Maximum | 0 | 0 | 31,4 | 0,44 |

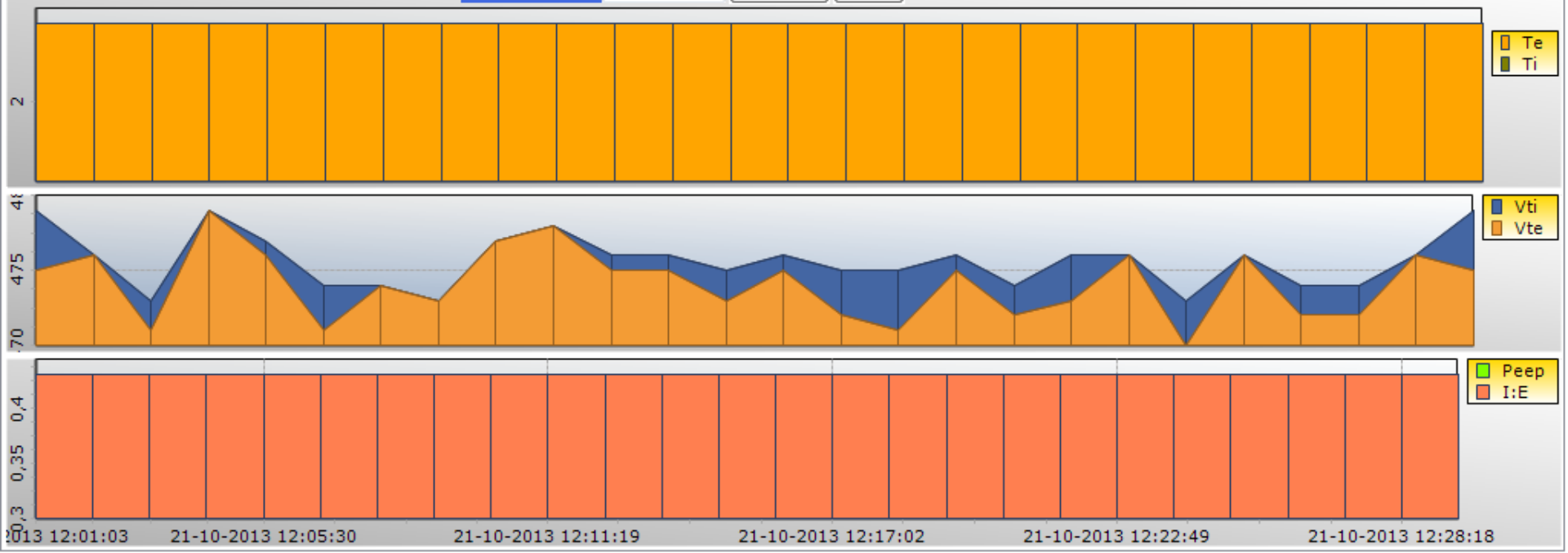
Stat.Oxim | Stat | Gen.Info | Diary | Private Notes | Stat.Pedom.

Oximeter | Motion | Glucose | Manual Inp.M. | Blood Pressure | Pedometer | Weight | Enquiries | Ventilator | ECG

| EntryDate | EntryHour | StartDate | Mode | Tidal_Volume_ml | Respirat_Rate_rpm | Inspirat_Time_s | Expirat_Trigger | PEEP | Inspirat_Pressure |
|---|---|---|---|---|---|---|---|---|---|
| 14-10-2008 | 29-02-2016 5:26 | 15-10-2008 | ACV | 850 | 15 | - | - | 0 | 18 |

To ZOOM, select graph area

Readings Date: 2013-10-22 | Chart Config | Save



# TELEMONITORING IN ALS

## Home telemonitoring of non-invasive ventilation decreases healthcare utilisation in a prospective controlled trial of patients with amyotrophic lateral sclerosis

Anabela Pinto,[1,2] José Pedro Almeida,[1,2] Susana Pinto,[2] João Pereira,[3] António Gouveia Oliveira,[4] Mamede de Carvalho[2,5]

*J Neurol Neurosurg Psychiatry* 2010;**81**:1238–1242.

N=40

**Table 3** Results of the primary outcome—healthcare utilisation

| | Incidence density (% person days) | | Incidence rate ratio | 95% CI | p Value |
|---|---|---|---|---|---|
| | Group 1 | Group 2 | | | |
| Office visits | 9.01 | 3.02 | 0.336 | 0.293 to 0.384 | <0.0001 |
| Emergency room visits | 0.58 | 0.11 | 0.194 | 0.099 to 0.373 | <0.0001 |
| Hospital admissions | 0.37 | 0.06 | 0.173 | 0.066 to 0.407 | <0.001 |

CIs and p values were calculated by applying exact Poisson statistics.

**Table 5** Survival analysis

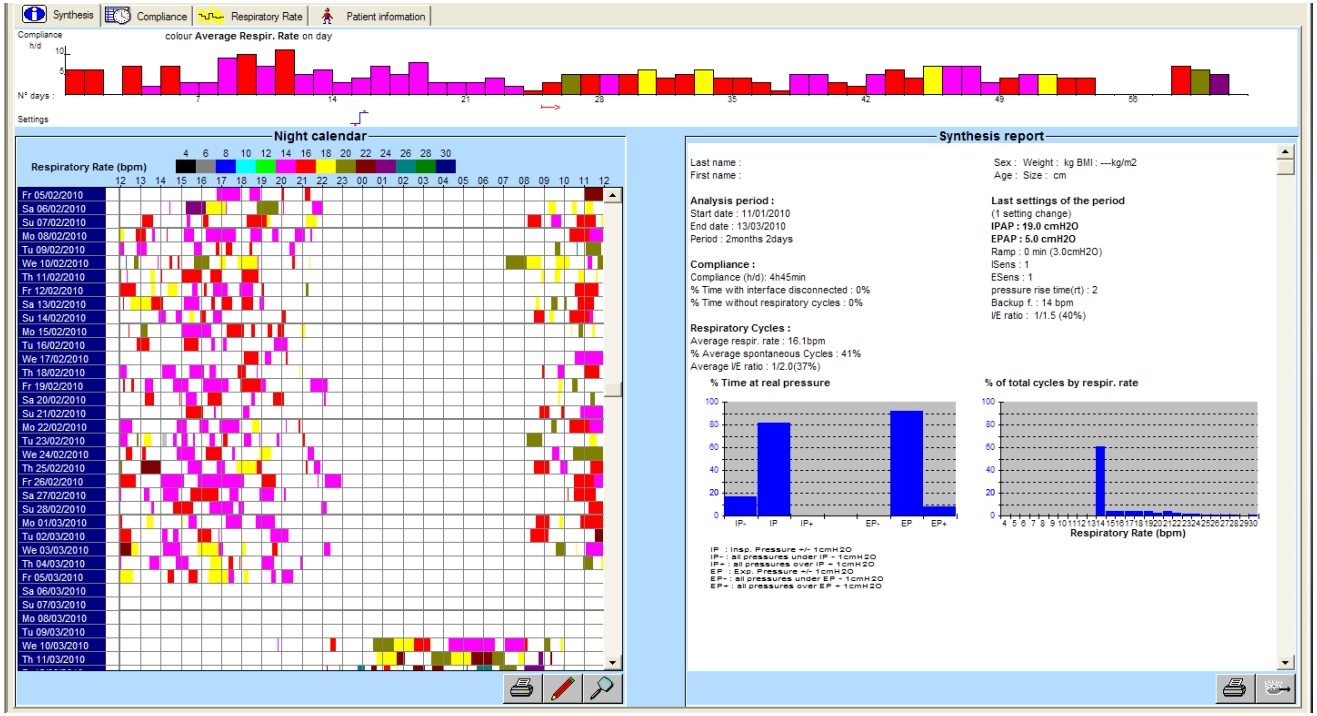
| | Group 1 (n=20) | Group 2 (n=19) | p Value |
|---|---|---|---|
| Survival with NIV | 334 | 865 | 0.13 |
| Survival from onset | 1457 | >3108 | 0.14 |
| Survival from 1st visit | 1092 | 1645 | 0.13 |

Values are median days.
Survival with NIV is the number of days from NIV adaptation to death; Survival from onset is the number of days from symptom onset to death; Survival from first visit is the number of days from diagnosis to death.
NIV, non-invasive ventilation.

# BI-LEVEL GK425 ST (COVIDIEN)

—Bi-direccional comunication

— Visualization pressure/flow waveforms



Respiratory Medicine (2014) 108, 1387–1395

Available online at www.sciencedirect.com

ScienceDirect

journal homepage: www.elsevier.com/locate/rmed

# Initiation of home mechanical ventilation at home: A randomised controlled trial of efficacy, feasibility and costs

A. Hazenberg [a,b,*], H.A.M. Kerstjens [a,b], S.C.L. Prins [c], K.M. Vermeulen [d], P.J. Wijkstra [a,b]

Figure 1 Setup of the telemonitoring equipment at home

**Table 1** Baseline characteristics.

| | Home group ($n = 38$) | Hospital group ($n = 39$) |
|---|---|---|
| Male | 20 | 25 |

**Single centre**

Largest group (35%): ALS (4 bulbar)

Home Initiation of HMV: improves ABG and QoL not inferior to in-hospital initiation. Start of HMV at home, with telemonitoring: safe, feasible and cheaper.

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adjusted (patient or care giver). Transcutaneous monitor 6 h on HMV. The next day the measurements of the transcutaneous monitor and ventilator were evaluated (telemonitoring)

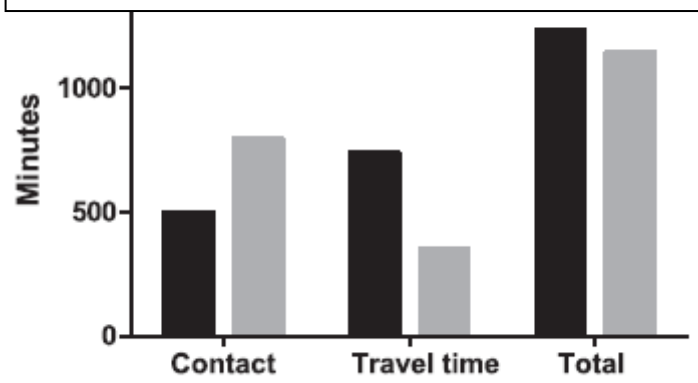



Figure 4 Time spent during initiation of home mechanical

# Telemedicine and Ventilator Titration in Chronic Respiratory Patients Initiating Non-invasive Ventilation (TeleMotiNIV)

**This study is currently recruiting participants.**

*Verified October 2012 by Hospital Sao Joao*

**Sponsor:**
Hospital Sao Joao

**ClinicalTrials.gov Identifier:**
NCT01560741

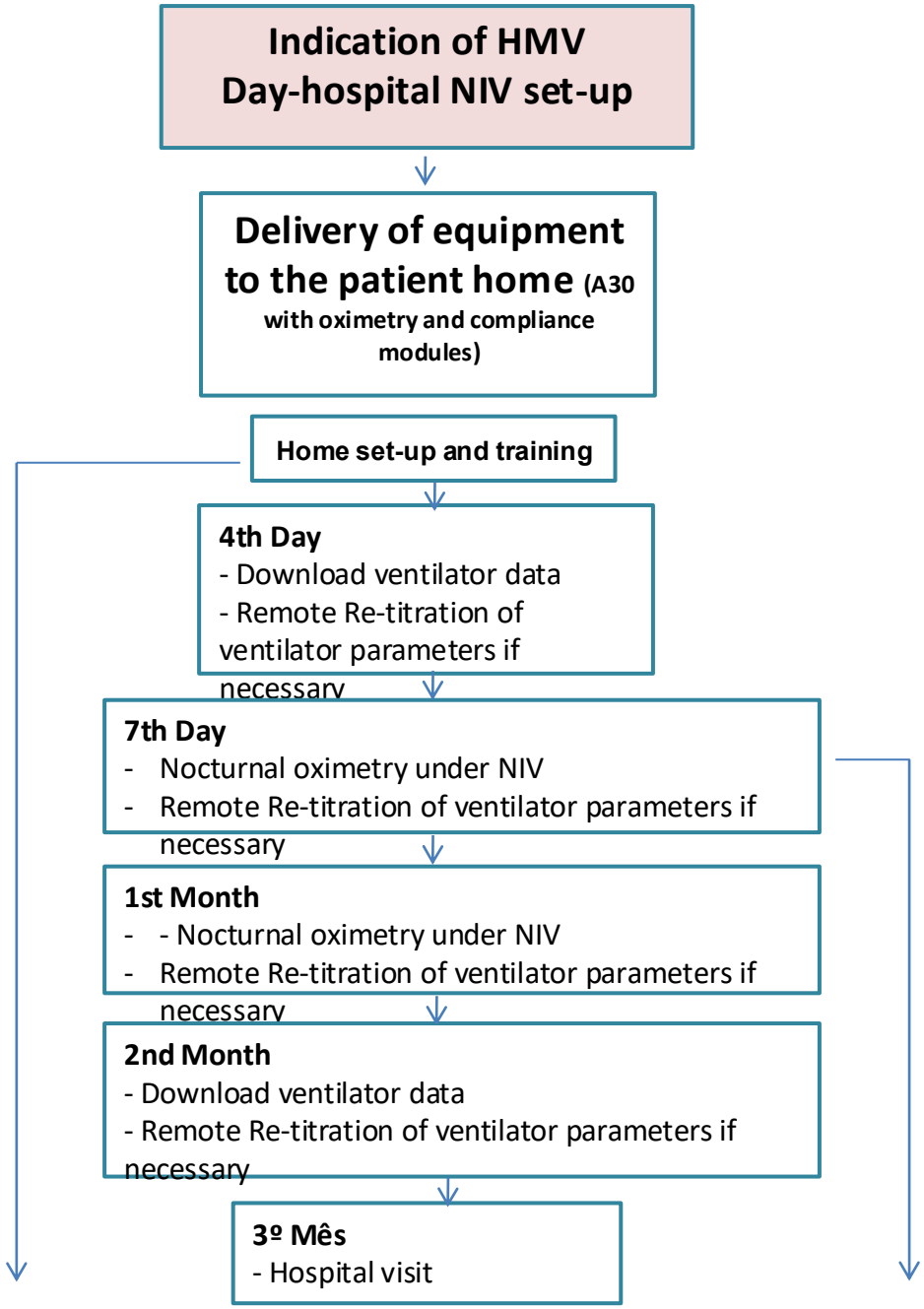
First received: March 20, 2012
Last updated: October 3, 2012
Last verified: October 2012

PHILIPS

# TeleMotiNIV set-up

EncoreAnywhere

4 Patient record


Contact was health care professional initiated or patient initiative

Average Time needed

Total time for Home stet-up & training: 48min per patient
Total download time: 7min per patient
Total Phone call time: 23min per patient
Total remote retitration time: 1,6 min per patient
MD analysis time: 10min per patient

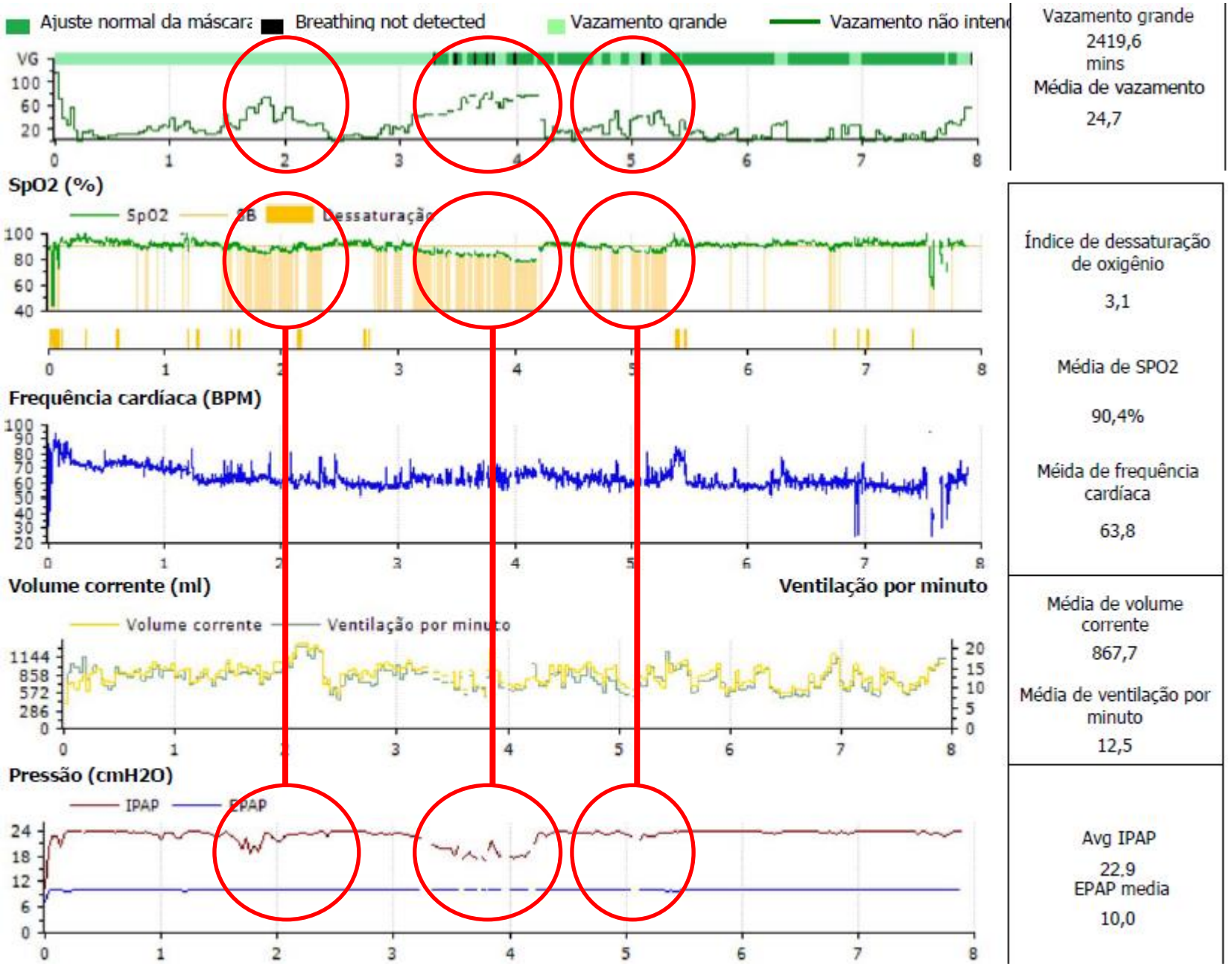
If ventilation efficacy criteria were not met remote titration of ventilator was made coupled with compliance/oximetry download with the same periodicity until 3M
(1 week)

**Telemonitoring**

- **Patient compliant (>=6h) and well adapted** → **Positive feed-back telephone call**
- **High leakage*** (visual inspection of leakage trends; high leakage for > 20% of time) → **Contact patient Consider home visit**
- **Patient complain :High Pressures** → **Check leakage Consider home visit**
- **Patient complain Difficulty getting into sleep** → **Use ramp**
- **Mask discomfort Leakage** → **Check leakage Correct adjustment Consider changing mask**


*High-leakage (“vazamento grande”)

# Multiparameter analysis (including integrated oximetry with ventilator data)

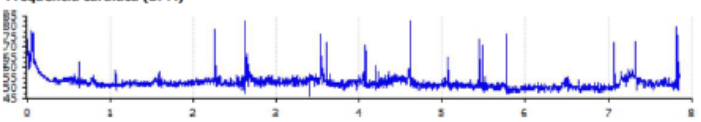


## Detalhes diários do ventilador

10/10/2012 1:31

**SpO2 (%)**


**Frequência cardíaca (BPM)**




| |
|---|
| Índice de dessaturação de oxigênio |
| 0,1 |
| Média de SPO2 |
| 93,5% |
| Média de frequência cardíaca |
| 52,7 |

Tempo passado na faixa de oximetria


| | Alto | Média | Baixo |
|---|---|---|---|
| SpO2 | 98,0% | 93,5% | 89,0% |
| Frequência cardíaca (batimentos por minuto) | 83,0 | 52,7 | 46,0 |

| | >95% | 90-95% | 85-89% | 80-84% | <80% |
|---|---|---|---|---|---|
| % do tempo | 5,8% | 94,2% | 0,0% | 0,0% | 0,0% |
| Tempo real (hh:mm:ss) | 00:27:10 | 07:23:40 | 00:00:10 | 00:00:00 | 00:00:00 |

| | |
|---|---|
| Nível de saturação baixa (SB) | 90% |
| % do tempo < SB(90%) | 0,0% |
| Tempo real < SB(90%) (hh:mm:ss) | 00:00:10 |
| Número de eventos de dessaturação | 1 |
| Índice de dessaturação de oxigênio | 0,1 |
| Tempo real <= 88% (hh:mm:ss) | 00:00:00 |

Patient Summary | Prescription

## DEVICE PRESCRIPTION

› Sleep

⌄ Vent Therapy

| | |
|---|---|
| Mode * | S/T |
| Device * | BiPAP A30 |
| Mode Attribute * | Nenhum |
| Serial Number | N04924518DA44 |
| Issued On * | 24/10/2013 |

Configurações do dispositivo

| | |
|---|---|
| Pressão IPAP | 27,0 |
| Pressão EPAP | |
| Taxa respiratória | |
| Inspiração cronometrada | |
| Configuração do umidificador | |
| Humidificação do System One do desvio | |
| Definição do tempo de elevação | |
| Bloqueio da definição do tempo de elevação | |
| Rampa | |
| Tempo de rampa | |
| Pressão inicial de rampa | |

24,0
24,5
25,0
25,5
26,0
26,5
27,0
27,5
28,0
28,5
29,0
29,5
30,0

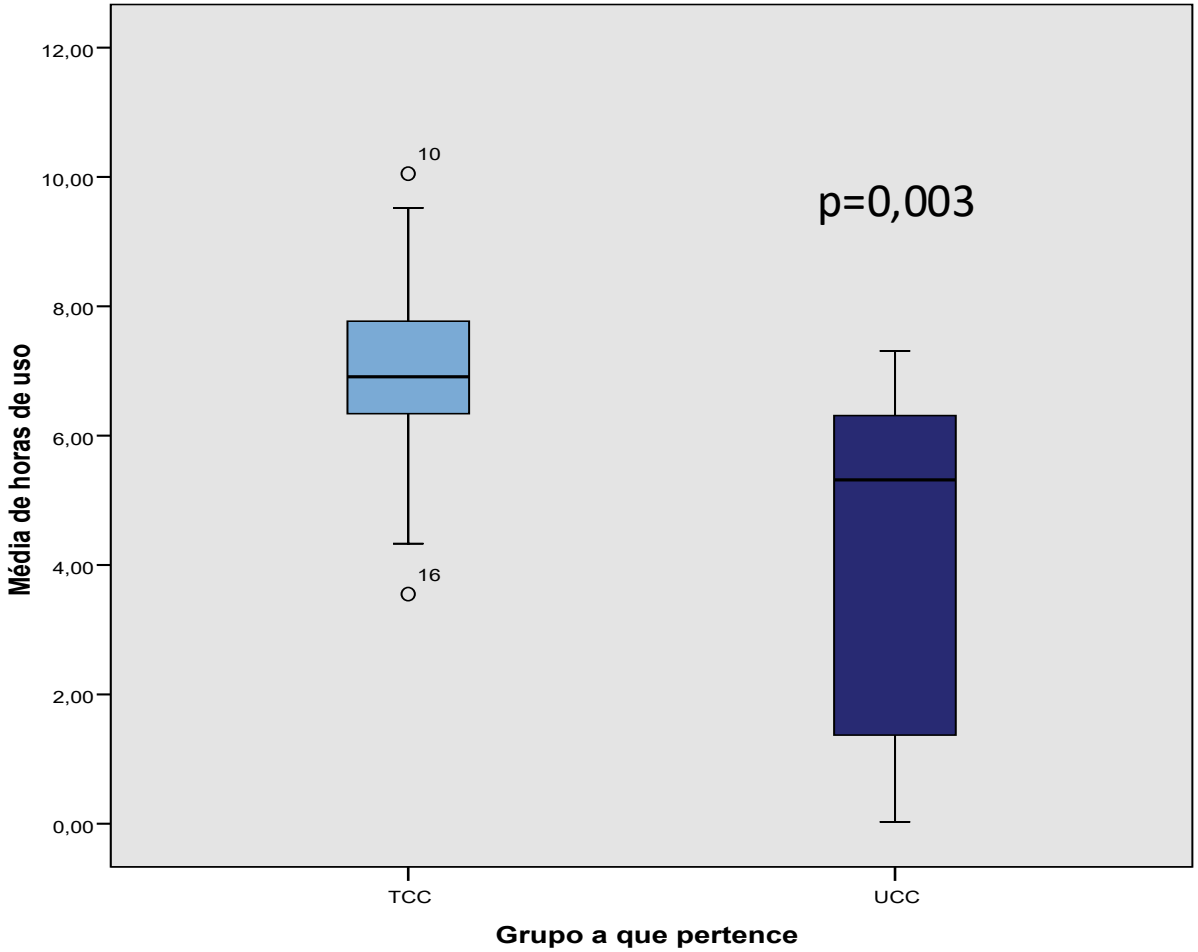
* Required Fields

Cancel



With parameter adjustment nocturnal awakenings are reduced

# Compliance at 3 Months (n=31)




TCC (Telemonitoring) :
mean hours of usage 6,91h
UCC (Usual care) :
mean hours of usage 5,53h

Moreira J et al, Rev Port Pneumol 2014; 20 Suppl 1: 110

# WHEN TO START TELE-MONITORING IN VENTILATED DEPENDENT PATIENTS

- **During initiation/implementation (***Harzenberg A et al Respir Med 2014; Moreira J et al ERJ 2014 Abstract )*
- **To modify/retitrate therapy** *(Harzenberg A et al Respir Med 2014; Moreira J et al ERJ 2014 Abstract e Borel JC Thorax 2015)*
- **To detect earlier exacerbations (***Vitacca M, ERJ 2009***,** *Zamith RPP 2009, Borel JC Thorax 2015)*
- **For weaning** *(Case report: Vitacca M et al TeleMed J E Health 2007)*
- **To monitor travel** *(Winck JC Thorax 2010)*
- **To support palliative care** *(Vitacca M et al, J Med Pers 2009)*

# WHEN TO START TELE-MONITORING IN VENTILATED DEPENDENT PATIENTS

- **To avoid hospitalizations** (*Winck JC, ERJ 2009, Miyasaka K, Pediatrics 1997, Casavant JTT 2014*)

# BASIC PROTOCOLS

- **Initiation/titration: Oximetry, capnography, Thoracic belts, Built-in software**
- **Detection of exacerbations: Built-in software, ?**
- **To modify/retitrate therapy: Bi-directional communication**
- **Follow-up: Oximetry, capnography, Thoracic belts, Built-in software**

Imperial College London

THE LANCET

# Technologies for global health

Peter Howitt, Ara Darzi, Guang-Zhong Yang, Hutan Ashrafian, Rifat Atun, James Barlow, Alex Blakemore, Anthony M J Bull, Josip Car, Lesong Conteh, Graham S Cooke, Nathan Ford, Simon A J Gregson, Karen Kerr, Dominic King, Myutan Kulendran, Robert A Malkin, Azeem Majeed, Stephen Matlin, Robert Merrifield, Hugh A Penfold, Steven D Reid, Peter C Smith, Molly M Stevens, Michael R Templeton, Charles Vincent, Elizabeth Wilson


Technology alone is not enough—it needs to be combined with innovations in processes to have the greatest effect.

*Lancet* 2012; 380: 507–35

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# Are we ready for Europe's e-health revolution?