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Striking high prevalence of non-response in terms of quadriceps strength after pulmonary rehabilitation in COPD

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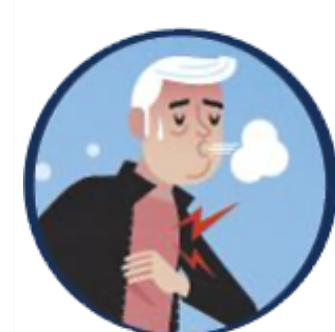
Introduction

On average, pulmonary rehabilitation (PR) in patients with chronic obstructive pulmonary disease (COPD) improves quality of life, dyspnea, and exercise tolerance (grade A). However, some patients show no improvement and are considered "non-responders" (NR). NR are found for all types of variables (biological, psychosocial..) and represent a worrying number of patients (30 to 50% depending on the variables considered)¹. Despite its major importance (major predictor of survival in particular)², the existence of NR on muscle strength after RP has never been specifically studied. Thus, our objectives were 1) **to assess the prevalence of non responders in terms of quadriceps muscle strength (NR-QMS)**, and if so, 2) to **define the characteristics of NR-QMS** and 3) to **identify the predictors of non response**.

Methods

Retrospective study :

- COPD patients (Tiffeneau index <0.70)
- Admitted for a pulmonary rehabilitation program (PR) between **May 2019 and December 2020**.
- **Quadriceps maximal voluntary isometric contraction (QMVC)** assessed before and after PR
- Complying with RGPD ethic rules



Outcomes:

Before PR (T1):

- Anthropometric characteristics: Age, body mass, height, body mass index (BMI) and muscle mass index (MMI)
- Disease severity: BODE index
- Respiratory function: FEV₁
- Blood gases: PaO₂, PaCO₂

Before (T1) and after (T2) PR:

- Exercise tolerance (6MWT) and quality of life (VQ11)
- Quadriceps maximal voluntary isometric contraction

Statistical analyses:

Identification of NR-QMS:

- NR-QMS if QMVC improvement after PR < MCID* (7.5 N.m)³

Prediction of nonresponse to PR :

- Logistic regression analysis (stepwise)
 - *Dependent variable* : Non-response
 - *Independant variables*: Pre PR anthropometric characteristics, disease severity, blood gases, pulmonary function, exercise tolerance, quality of life and muscle strength.

*MCID = Minimum clinically relevant difference

Participants (n=62) :



34%



64.1 ± 7.9 years

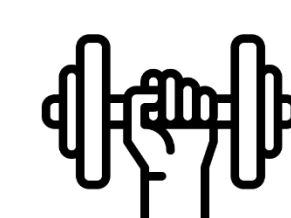


93.4 ± 34.6 N.m



- **Inpatient stay** at the Clinique du souffle « Les Clarines »

- **4-weeks program** including muscle strenghtening 5 days a week



- Resistance training consisted of a minimum of **8 sessions of 45 minutes** at 65-75% of maximal strength assessed with a one-repetition maximum test

Conclusions

50% of patients are **non-responders** !

Efficacy assesment of PR on muscle strength **cannot be based on mean values**
Their **identification** is therefore **essential** !

Should we talk about **non-responders** or **inappropriate programs**?



Results

1 PR effects on quadriceps muscle strength

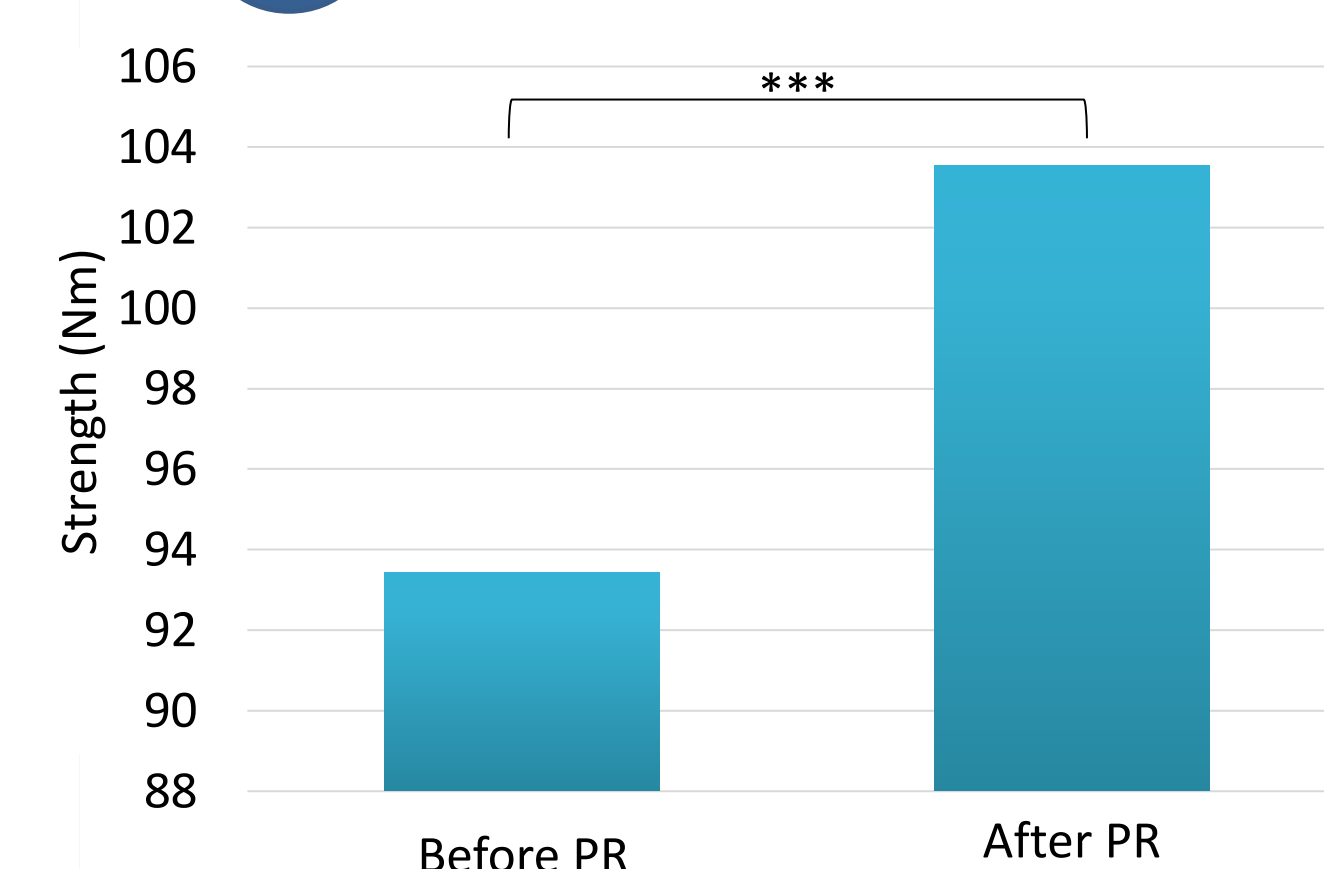


Figure 1. QMVC before and after PR

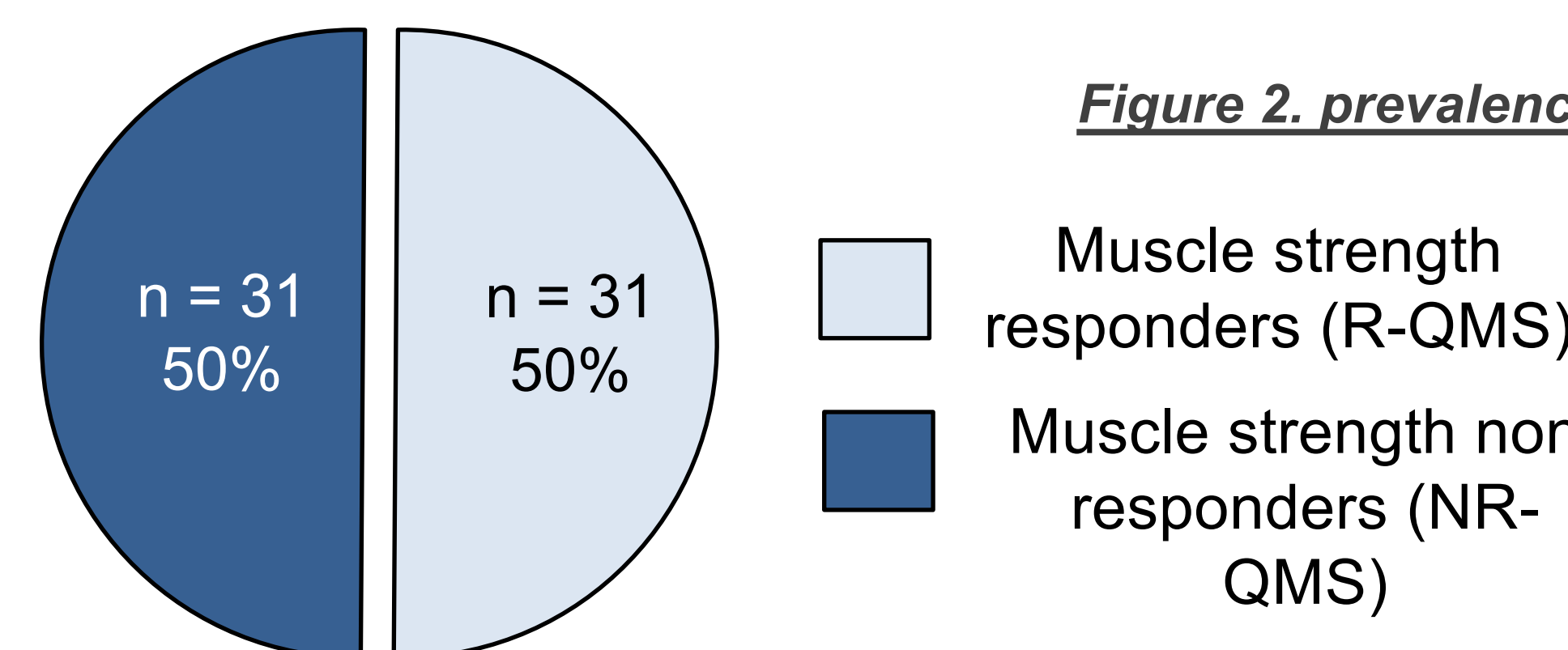


Figure 2. prevalence of NR-QMS

➔ Patients show a mean increase in strength (+10 ± 13 N.m) however
50% of the patients have a force evolution lower than the MCID and are non-responders

3 PREDICTION OF NON-RESPONSE

	Estimate	Odds Ratio [95% IC]	p-value
Muscle strength	-0.03	0.97 [0.95 : 0.99]	< 0.01
PaCO ₂	0.07	1.07 [1.00 : 1.15]	0.05
Gender	0.77	2.16 [0.50 : 9.44]	0.30

Table 2. Results of stepwise logistic regression

➔ **Low pre PR QMVC and high PaCO₂** are significant predictors of non-response.
➔ **Gender** was added to the model because it substantially improved the prediction performance

2 CHARACTERISTICS OF NR-QMS vs R-QMS

	NR-QMS (n = 31)	R-QMS (n = 31)	p-value
Anthropometry			
Gender (M/F)	19/12	22/9	/
Age (years)	64 ± 8	64 ± 8	0.86
Body mass (kg)	66 ± 21	79 ± 15	< 0.01
Height (cm)	165 ± 7	169 ± 7	< 0.05
BMI (kg/m ²)	24 ± 6	28 ± 5	< 0.05
MMI (kg/m ²)	17 ± 3	18 ± 2	0.16
Spirometry			
VEMS (L)	1.25 ± 0.64	1.56 ± 0.60	0.05
Gasometry			
PaO ₂ (mmHg)	60 ± 13	66 ± 9	< 0.05
PaCO ₂ (mmHg)	40 ± 11	38 ± 4	0.24
Muscle strength			
QMVC (N.m)	83 ± 38	103 ± 27	< 0.05

Table 1. Comparison of characteristics of R-QMS vs. NR-QMS COPD patients

➔ NR-QMS had significantly lower height, body mass, and PaO₂ than QMS-R

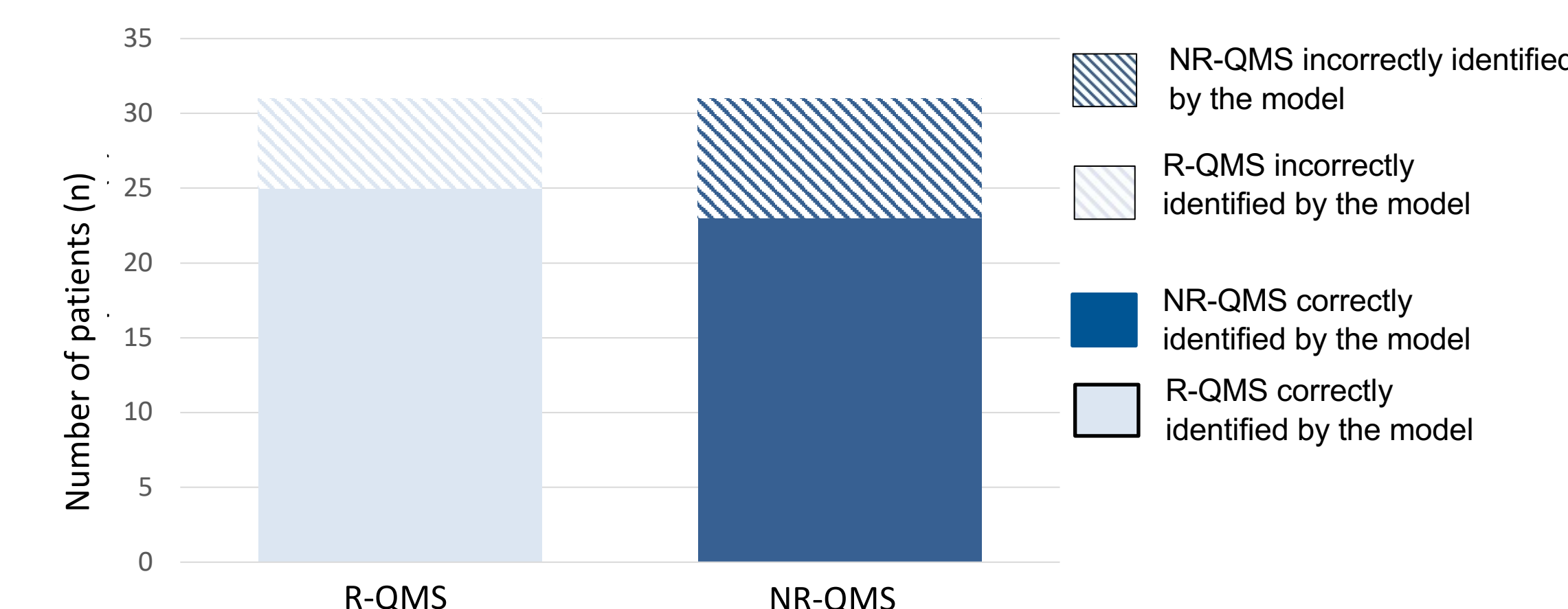


Figure 3: Quality of model prediction

➔ This model has a **specificity of 81%** and a **sensitivity of 74%**.