

# Performance of pulmonary rehabilitation in a national severe asthma cohort

I. Jarosch<sup>1,2</sup>, A. Nussbaumer<sup>1</sup>, A. Holtdirk<sup>3</sup>, M. Seefeldt<sup>4</sup>, T. Schneeberger<sup>1,2</sup>, R. Gloeckl<sup>1,2</sup>, D. Leitl<sup>1,2</sup>, R. Buhl<sup>5</sup>, E. Hamelmann<sup>6</sup>, M. Idzko<sup>7</sup>, S. Korn<sup>8</sup>, C. Taube<sup>9</sup>, K. Milger<sup>10</sup>, D. Skowasch<sup>11</sup>, C. Schulz<sup>12</sup>, M. Jandl<sup>13</sup>, R. Ehmann<sup>14</sup>, O. Schmidt<sup>15</sup>, A. Koczulla<sup>1,2,16</sup>.

<sup>1</sup>Schoen Klinik Berchtesgadener Land, Institute for Pulmonary Rehabilitation Research, Schoenau am Koenigssee, <sup>2</sup>Philipps University Marburg, Pulmonary rehabilitation, German Center for Lung Research (DZL), University Giessen/Marburg Lung Center, (UGMLC), Marburg, <sup>3</sup>CRO Dr. med. Kottmann GmbH & Co. KG, Hamm, Germany, <sup>4</sup>German Asthma Net e.V., Bochum, Germany, <sup>5</sup>Pulmonary Department, Johannes-Gutenberg University Mainz, Mainz, Germany, <sup>6</sup>Universitätsmedizin Mainz, Mainz, Germany, <sup>7</sup>Pneumology, University Hospital Vienna AKH, Vienna, Austria, <sup>8</sup>IKF Pneumologie Mainz, Mainz, Germany, <sup>9</sup>Department of Pulmonology, University of Essen, Essen, Germany, <sup>10</sup>LMU Klinikum, Munich, Germany, <sup>11</sup>Internal Med. II, UKB, Bonn, Germany, <sup>12</sup>Universitätsklinik Regensburg, Regensburg, Germany, <sup>13</sup>Hamburger Institut für Therapieforchung, Hamburg, Germany, <sup>14</sup>Lungenfacharztpraxis Stuttgart, Stuttgart, Germany, <sup>15</sup>Pneumologische Gemeinschaftspraxis Koblenz, Koblenz, Germany, <sup>16</sup>Teaching Hospital Paracelsus Medical University Salzburg, Austria

## Background

Although pulmonary rehabilitation (PR) in adults with asthma is associated with various clinically meaningful improvements, PR is not yet a widespread standard of clinical practice for people with asthma.

This analysis aimed to determine the characteristics of asthma patients who were referred to a PR program compared to those, who never participated in a PR program.

## Methods

Adults with severe asthma (GINA step 5) who were registered in the German Asthma Net Registry between 2011 and Oct 2022 were included in this retrospective analysis. During the annual registry visits, patients were asked if they performed a PR in the previous 12 months. Patients who answered with 'yes' at any visit were used as the PR-group (PRG), whereas patients never attended a PR in the history were used as a control group (CON).

The most recent visit (CON) or the visit after PR (PRG) were used for retrospective, cross-sectional analysis. Potential predictors of PR attendance for multivariate logistic regression analysis were chosen based on clinical judgement and data availability: Age, GINA control status, Asthma Control Test (ACT), incapacity for work, exacerbation rate, symptoms (resting/exertional dyspnoea, chest tightness, cough, rhonchus, prolonged expiration, deconditioning, depression).

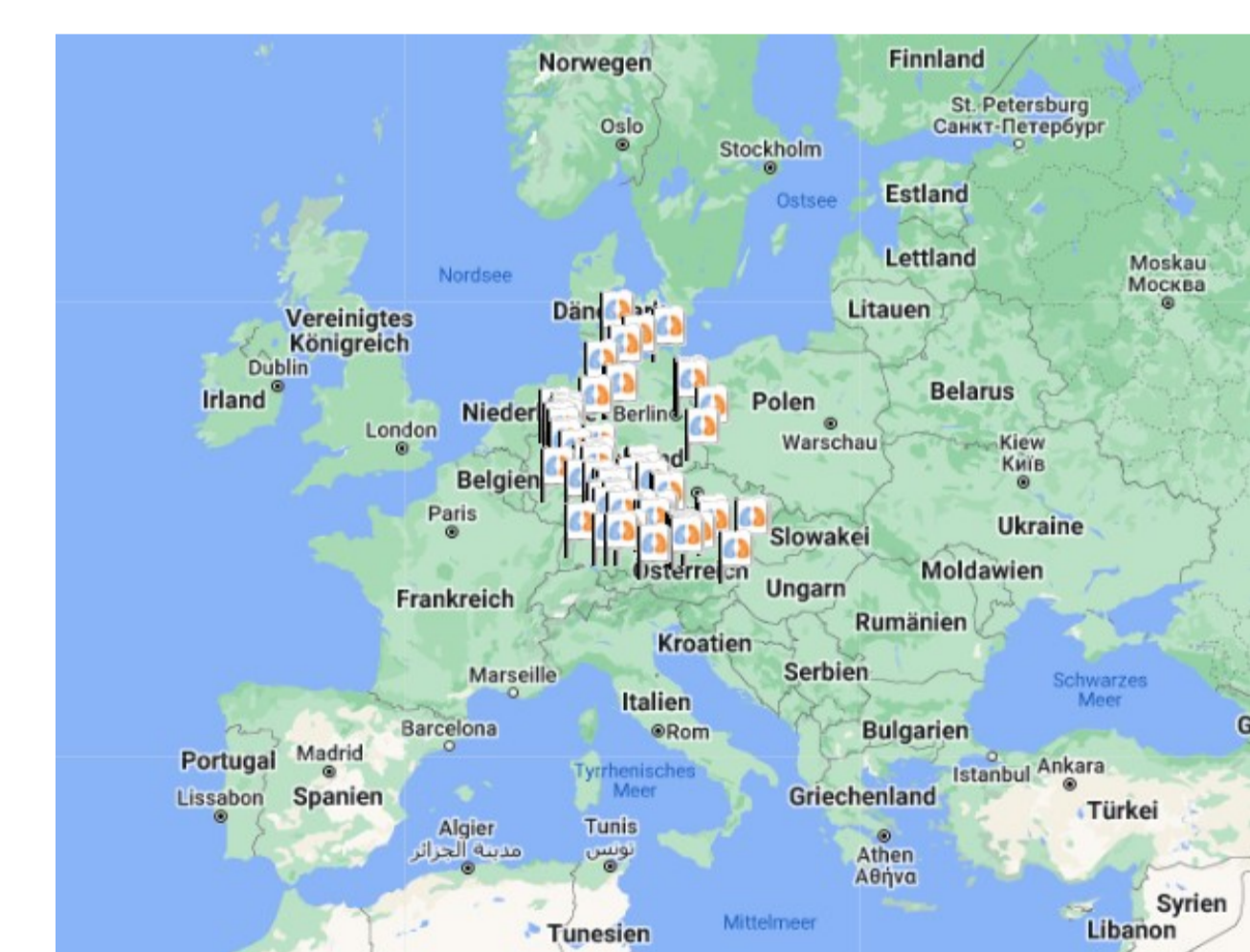


Table 1. Baseline characteristics.

Parameters	N=2170
Age, yrs	54±14
Gender (male), %	41
FEV1, % pred.	75.5 (321.2)
DLCO, % pred.	71.6 (16.8)
<b>Pulmonary rehabilitation</b>	
Pulmonary rehabilitation participation, n (%)	456 (21)
1 Rehabilitation in the last 12 months, n (%)	442 (20)
> 1 Rehabilitation in the last 12 months, n (%)	14 (0.6)

Abbreviations: FEV<sub>1</sub>: Forced expiratory volume in one second; DLCO: Diffusion capacity of the lung for CO.

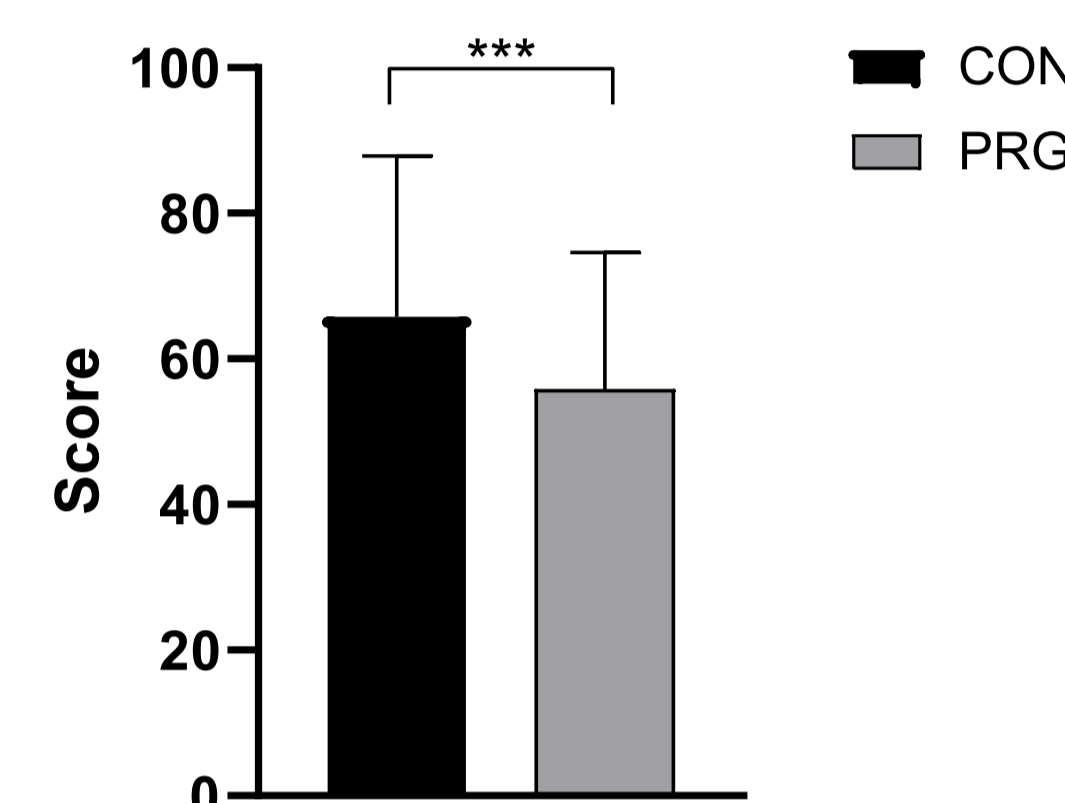
Figure 1. German Asthma Net Centers, who included patients into the severe asthma registry. The German Asthma Net e.V. was founded 2011 for conception and phenotyping of patients with severe asthma and for evaluating the medical treatment.

## Results

During the observation period, a total of 456 patients (21%) performed a PR in the past. As inpatient PR with a duration of 3 weeks is the most common setting in Germany, it was used in 80% of cases (outpatient: 6.3%, unknown: 13.7%). 42.8% of PRG subjects compared to 20% of CON subjects were not able to go to work due to asthma.

## Results

### A. Asthma Quality of Life Questionnaire



### B. Reported symptoms

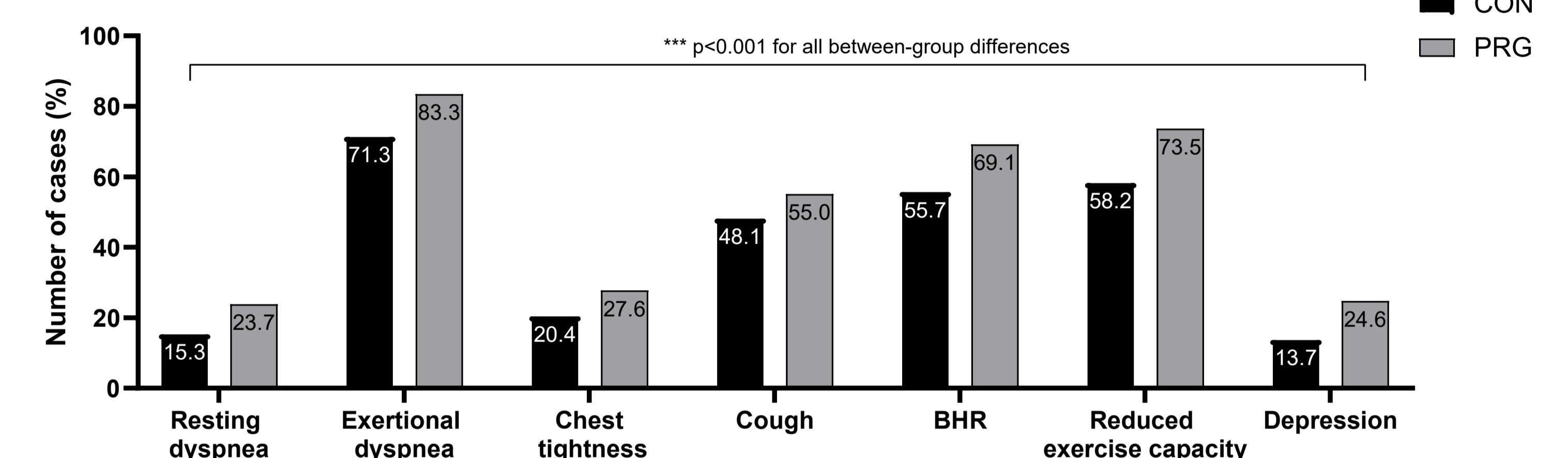


Figure 2. Asthma Quality of Life Questionnaire (AQLQ)(A) and symptoms (B) in control group (CON) versus pulmonary rehabilitation group (PRG).

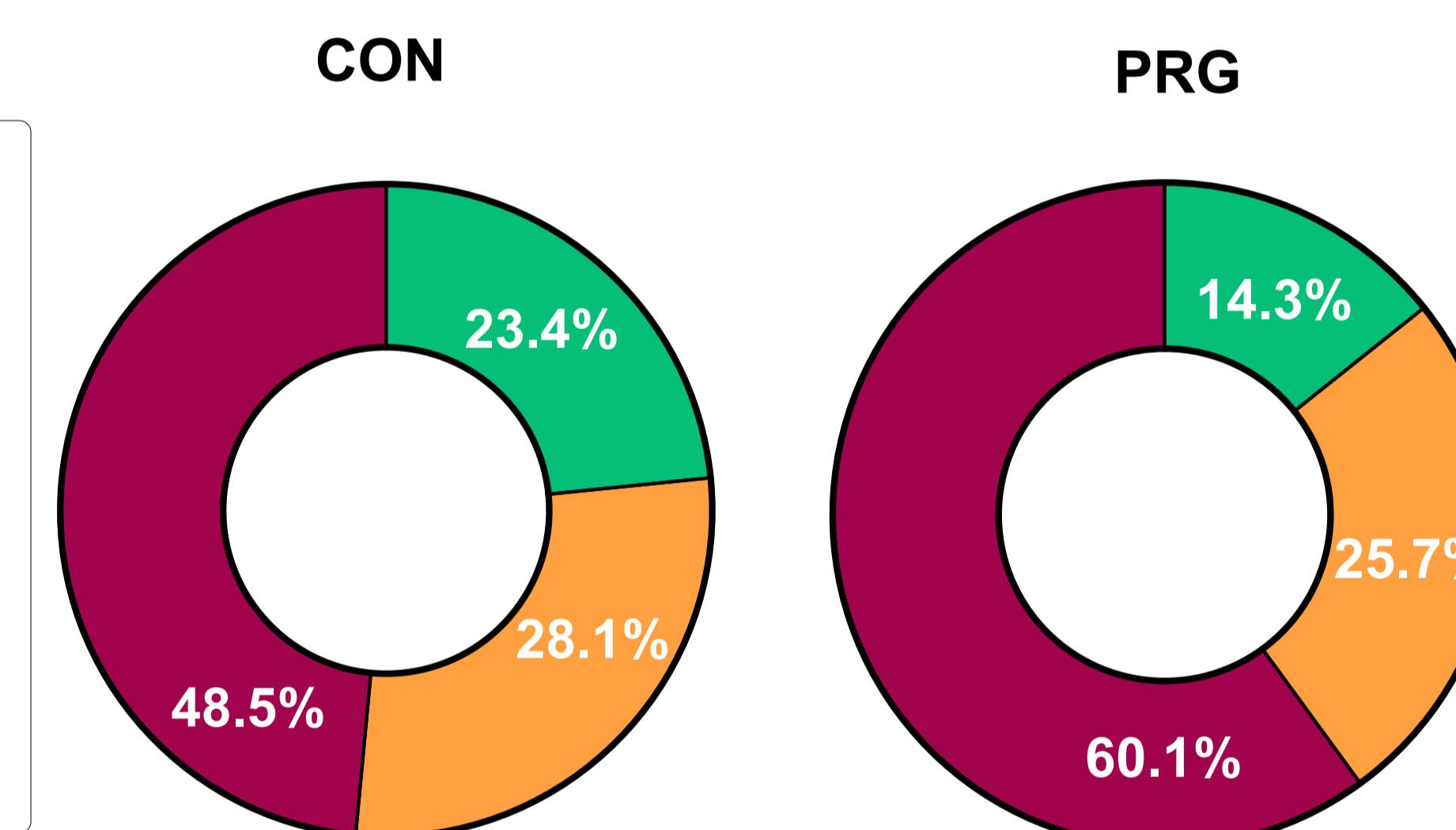
### A. GINA control status

#### Assessment of GINA symptom control

In the past 4 weeks, has the patient had:

- Daytime symptoms >2x/ week?
- Any night waking due to asthma?
- Reliever needed more than 2x/week?
- Any activity limitation due to asthma?

→ 0 = Controlled  
→ 1-2 = Partly controlled  
→ 3-4 = Uncontrolled



### B. Asthma control test

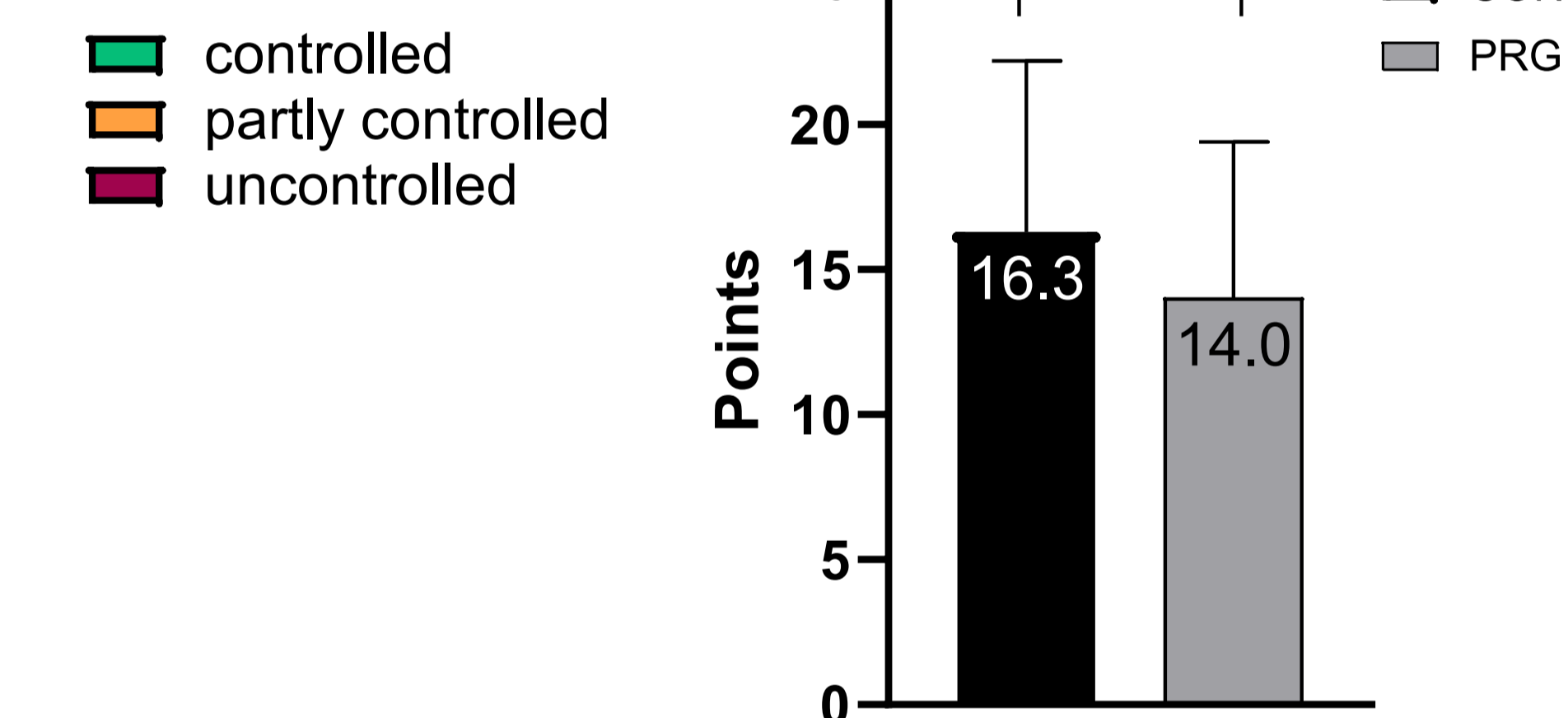


Figure 3. GINA control status (A) and Asthma control test (B) in control group (CON) versus pulmonary rehabilitation group (PRG). The between-group differences for GINA control status and Asthma control test were significant (p<0.0001).

### 4. Frequency of exacerbations

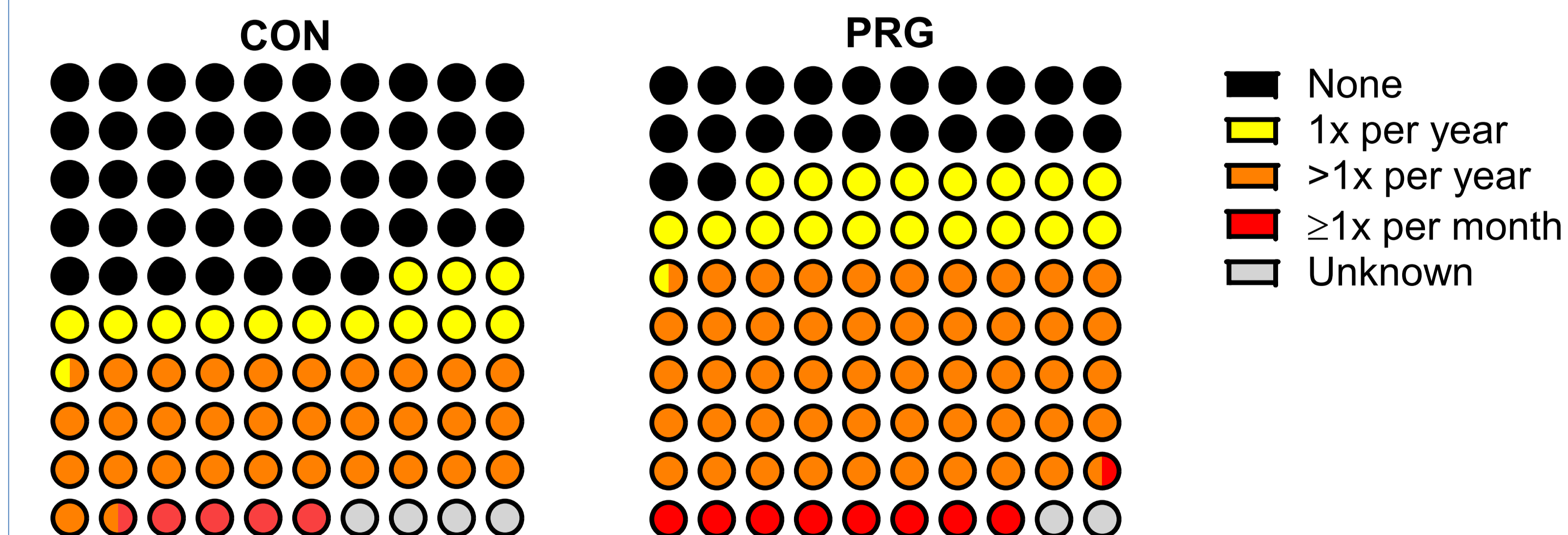


Figure 4. Frequency of exacerbations in number of cases (%) in control group (CON) versus the pulmonary rehabilitation group (PRG). p<0.001 for between-group difference.

### 5. Predictors for PR attendance

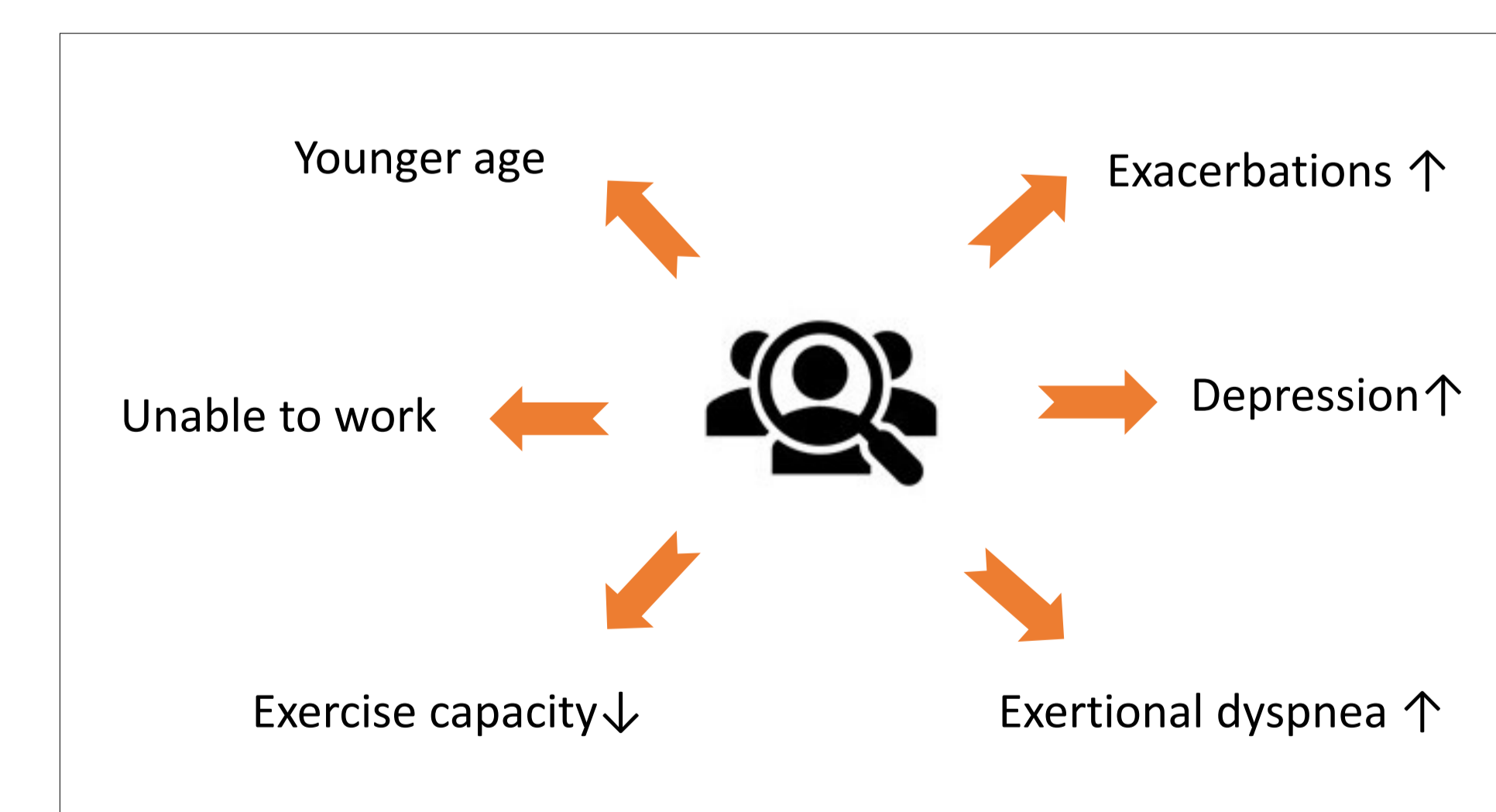


Figure 5. Predictors for PR attendance. Multivariate regression analysis revealed predictors for higher odds of PR attendance.

## Conclusions

Data from this large, national cohort showed that only a minority of severe asthma patients (21%) performed a PR program, although its effectiveness is proven for several outcomes and different stages of disease. The likelihood of PR-referral seems to be higher in more impaired asthma patients which are also limited in their capacity to work.