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## Healthcare Providers' Attitudes, Beliefs and Barriers to Pulmonary Rehabilitation for COPD Patients in Saudi Arabia: A National Survey

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# Healthcare Providers' Attitudes, Beliefs and Barriers to Pulmonary Rehabilitation for COPD Patients in Saudi Arabia: A National Survey

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## Abstract

**Objectives:** this study are aimed to assess Healthcare Providers (HCPs) attitudes toward delivering PR to COPD patients and identify factors and barriers that might influence referral.

**Design:** A cross-sectional online survey consisting of nine multiple-choice questions.

**Settings:** Kingdom of Saudi Arabia

**Participants:** 980 HCPs included nurses, respiratory therapists, and physiotherapists.

**Primary outcome measures:** to explore HCPs attitudes and expectations toward delivering a PR program to patients with COPD and identify factors and barriers that might influence referral in Saudi Arabia

**Results:** Overall, 980 HCPs, 520 of them male (53.1%), completed the online survey. Nurses accounted for 40.1% of the total sample size, while respiratory therapists and physiotherapists accounted for 32.1% and 16.5%, respectively. Most HCPs strongly agreed that PR would improve COPD patients' exercise capacity 589 (60.1%), improve patients' health-related quality of life 571 (58.3%), and improve disease self-management in COPD patients 589 (60.1%). Moreover, an in-hospital supervised PR program was the preferred way to deliver PR for 748 (76.3%) HCPs, and 832 (84.9%) perceived information about COPD disease as an essential component of PR, followed by smoking cessation 787 (80.3%). The most common patient-related factor that strongly influenced referral decisions was "mobility affected by breathlessness" (64%), while "availability of PR centres" (61%), "lack of trained HCPs" (52%) and "lack of authority to refer patients" (44%) were the most common barriers for referring.

**Conclusion:** PR is an effective management strategy for COPD patients, but sufficient PR centres, trained staff, and the authority to refer patients are lacking. An in-hospital supervised PR program is the preferred method of delivering PR, with information about COPD disease and smoking cessation being considered essential components of PR. Further research is needed to address physicians' and patients' attitudes and expectations toward delivering a PR program and identify factors and barriers of referring.

Keywords: PR, COPD, pulmonary rehabilitation, Saudi Arabia

### - Strengths and limitations of this study

1. To our knowledge, this is the first national study that explores HCPs' attitudes and beliefs toward delivering PR to COPD patients and identify factors and barriers that might influence referral in Saudi Arabia
2. Availability of PR centres, lack of trained HCPs and lack of authority to refer patients were the most common barriers for referring COPD patients to PR program

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- 4 3. The study was conducted during the COVID-19 pandemic, which may have impacted
- 5 respondents' opinions.
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## 1. Introduction

COPD is a common, preventable, and treatable disease characterized by airway and/or alveolar abnormalities, leading to airflow limitation and persistent pulmonary symptoms<sup>1</sup>. Patients with COPD are susceptible to daily symptoms, reduced exercise capacity and frequent chest infections that could result in deterioration of lung function and acceleration of disease progression, subsequently leading to emergency hospital admissions<sup>1 2</sup>. The prevalence of COPD in Saudi Arabia is ranging from 2.4% to 17.2% among adult who are 45years old and older<sup>3 4</sup>. In addition to pharmacologic approaches, the International Global Initiative for Obstructive Lung Disease (GOLD) stresses the importance of including non-pharmacologic interventions such as PR in the management of COPD symptoms as PR provides symptomatic improvement<sup>5 6</sup>, thereby reducing unnecessary hospital admissions.

PR is a comprehensive, multidisciplinary, non-pharmacologic intervention aimed at improving quality of life and exercise performance in patients with COPD<sup>6-8</sup>. PR usually consists of patient assessment, exercise training, and health education and is administered by a group of multidisciplinary healthcare providers. In Saudi Arabia, PR programs are often unavailable or underutilized<sup>9</sup>, likely due to the lack of trained staff who can manage patients with COPD<sup>10</sup>. In addition, PR services across the country must be conducted under close supervision by pulmonologists or internists with an interest in pulmonary medicine, although the number of chest physicians in Saudi Arabia is relatively low<sup>11 12</sup>. Consequently, an inadequate number of services are provided to meet the needs of patients with COPD.

International and national COPD management guidelines recommend increasing the implementation of PR programs worldwide by involving well-trained healthcare providers in the PR team<sup>7 11 12</sup>, considering that COPD is now perceived as a heterogeneous disease with multisystem manifestation that causes systemic consequences<sup>12</sup>. Despite the current contribution and involvement of experienced healthcare providers (e.g., nurses, respiratory

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3 therapists, physiotherapists, psychologists, occupational therapists, and dietitians) in Saudi PR  
4 programs, awareness of and barriers to healthcare professionals in delivering PR programs in  
5 Saudi Arabia are largely unknown. Therefore, this study aims to explore healthcare  
6 professionals' attitudes and expectations toward delivering a PR program to patients with  
7 COPD in Saudi Arabia.  
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## 17 **2. Methods**

### 18 *2.1. Study design*

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20 A cross-sectional survey was conducted through an online platform (Survey Monkey) between  
21 September 15, 2021, and January 19, 2022.  
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### 30 *2.2. Questionnaire tool*

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32 The survey was composed of nine multiple-choice closed questions and free text fields for  
33 additional comments; it was structured, formulated, and validated by multidisciplinary experts  
34 including nursing, respiratory therapy, physiotherapy, and nutrition in the field of PR based on  
35 the currently available literature<sup>7 13 14</sup>. Before the initial distribution, content and face validity  
36 were assessed after piloting the survey with ten healthcare professionals with a clinical  
37 background in COPD management.  
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46 Before participants started to answer the questionnaire, the aim of the study was provided,  
47 together with information about the lead investigator. Additionally, no personal information  
48 was recorded; voluntary participation was ensured by asking if participants were happy to  
49 complete the survey or not. An additional statement was provided in the survey: "By answering  
50 'yes' in completing the survey question, you voluntarily agree to participate in this study and  
51 give your consent to use your anonymous data for research purposes." The time required to  
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3 complete the survey was approximately three to five minutes. The questionnaire consisted of  
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5 two pages of structured responses that involved multiple-choice answers in three sections.  
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7 Section 1 requested the respondents' demographic information, including gender, profession,  
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9 years of experience and responsibilities in the management of COPD. Section 2 consisted of  
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11 three questions asking about healthcare providers' perceptions of PR. The first question had  
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13 six statements regarding the effectiveness of PR with COPD patients and used a 5-point Likert  
14  
15 scale ranging from 1 = strongly disagree to 5 = strongly agree. The second question asked about  
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17 additional components of PR aside from the exercise component, and the third question was  
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19 about the best way to deliver PR for COPD patients. Section 3 included two questions regarding  
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21 patient-related factors that influence referral decisions and process-related factors that  
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23 influence the decision not to refer COPD patients. These questions used influence as a grading  
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25 tool: no influence, some influence and strong influence.  
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### 33 2.3. *Study population and sampling strategy*

34  
35 Convenience sampling techniques were used to recruit the study participants. nurses,  
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37 respiratory therapists, physiotherapists, psychologists, occupational therapists, and nutritionists  
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39 involved in managing COPD patients or having potential contact with this population were the  
40  
41 main targets. Professional committees managing respiratory diseases and social networks  
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43 (Twitter, WhatsApp, and Telegram) were used to distribute the survey to reach a greater  
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45 number of HCPs working in Saudi Arabia.  
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### 51 2.4. *Patient and Public Involvement statement*

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53 Patients were not involved.  
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### 59 2.5. *Sample size*

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3 Assuming a response distribution of 50%, the minimum sample size to conduct this research is  
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5 377, with a 5% margin of error and a 95% confidence level.  
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## 10 2.6. *Ethical approval*

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12 Institutional Review Board approval for the study was obtained from Jazan University,  
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14 reference number (HAPO-10-Z-001).  
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## 18 2.7. *Statistical analysis*

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20 Data were collected and analysed using the Statistical Package for Social Sciences (SPSS  
21  
22 software, Version 25). The categorical variables were reported and presented in percentages  
23  
24 and frequencies. A Chi-square ( $\chi^2$ ) test was used to assess the statistically significant difference  
25  
26 and frequencies. A Chi-square ( $\chi^2$ ) test was used to assess the statistically significant difference  
27  
28 between categorical variables. Statistical significance was considered if the  $p < 0.05$ .  
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## 32 3. Results

33  
34 Overall, 980 HCPs (520, or 53.1%, male and 460, or 46.9%, female) participated in the online  
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36 survey between September 9, 2021, and January 19, 2022. Nurses accounted for 40.1% of the  
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38 participants, followed by respiratory therapists (32.1%), physiotherapists (16.5%) and other  
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40 healthcare specialties (11.2%) such as nutritionists and occupational therapists. Most  
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42 respondents had one to two years of clinical experience in caring for COPD patients, while  
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44 26% had three to four years and 15.2% had five to six years. Oxygen therapy (57%), inpatient  
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46 treatment (47.1%), ongoing management (42.1%), diagnosis (38.9%), and outpatient clinics  
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48 (38.1%) were the main responsibilities for managing COPD patients (Table1).  
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**Table 1:** Demographic data and characteristics of all study respondents (n= 980).

Demographic variables	Frequency (%)
Gender	
Male	520 (53.1%)
Female	460 (46.9%)
Profession	
Nursing	393 (40.1%)
Respiratory therapy	315 (32.1%)
Physiotherapy	162 (16.5%)
Others	110 (11.2%)
Year of experience with COPD patients	
< 1 year	96 (9.8%)
1-2 years	294 (30%)
3-4 years	255 (26%)
5-6 years	149 (15.2%)
7-8 years	75 (7.7%)
9-10 years	47 (6.5%)
>10 years	47 (4.8%)
Responsibilities for care with COPD patients	
Diagnosis	381 (38.9%)
Urgent assessments	350 (35.7%)
Non-urgent care	360 (36.7%)
Ongoing management	413 (42.1%)
Admission prevention	227 (23.2%)
Medication check	360 (36.7%)
Prescribing	106 (10.8%)
Oxygen therapy	559 (57%)
In patient treatment	462 (47.1%)
Outpatient clinics	373 (38.1%)
Primary care	282 (28.8%)

Data are presented as frequencies and percentages.

### 3.1. HCPs' opinions on referring COPD patients

Most HCPs strongly agreed that PR would improve COPD patients' exercise capacity (589, or 60.1%), and they strongly believed that PR would reduce symptoms of dyspnoea and fatigue (545, or 55.6%). In addition, most HCPs strongly agreed that PR would reduce levels of anxiety and depression (479, or 48.9%), and 571 (58.3%) strongly agreed that PR would improve patients' health-related quality of life. Moreover, 517 (52.8%) strongly agreed that PR would reduce hospital readmission, and 528 (53.9%) strongly agreed that PR would reduce the risk of future COPD exacerbation. Moreover, 440 HCPs (44.9%) strongly agreed that PR would

improve patients' nutritional status, and the majority strongly agreed that PR would improve disease self-management in COPD patients (589, or 60.1%) (Table 2).

### 3.2. Mode of delivery and components of PR

When asked about the preferred way to deliver a PR program for COPD patients, most HCPs believed that in-hospital supervised PR was the preferred method (748, or 76.3%), followed by delivering the PR at home (557, or 56.8%). However, only 275 (28.1%) believed that tailored PR with healthcare provider support over the phone would be the preferred method. Most HCPs believed that the essential components of PR include information about COPD (832, or 84.9%), followed by smoking cessation (787, or 80.3%) and COPD symptoms management (749, or 76.4%), aside from the exercise component (Table 3).

**Table 2:** Healthcare providers' perception on referring COPD patients to PR (n=980).

Item	Frequency (%)
<b>Perception on referring COPD patients to PR</b>	
<i>I believe PR will improve patients' exercise capacity</i>	
Strongly agree	589 (60.1%)
Agree	260 (26.5%)
Neutral	32 (3.3%)
Disagree	8 (0.8%)
Strongly disagree	91 (9.3%)
<i>I believe PR would reduce dyspnoea and fatigue</i>	
Strongly agree	545 (55.6%)
Agree	297 (30.3%)
Neutral	62 (6.3%)
Disagree	25 (2.6%)
Strongly disagree	51 (5.2%)
<i>I believe PR will improve patients' anxiety and depression</i>	
Strongly agree	479 (48.9%)
Agree	320 (32.7%)
Neutral	105 (10.7%)
Disagree	29 (3%)
Strongly disagree	47 (4.8%)
<i>I believe PR will improve patients' health-related quality of life</i>	
Strongly agree	571 (58.3%)
Agree	283 (28.9%)
Neutral	57 (5.8%)
Disagree	19 (1.9%)
Strongly disagree	50 (5.1%)
<i>I believe PR will reduce the risk hospital readmission</i>	
Strongly agree	517 (52.8%)

Agree	317 (32.3%)
Neutral	70 (7.1%)
Disagree	28 (2.9%)
Strongly disagree	48 (4.9%)
<i>I believe PR will reduce the risk of future COPD exacerbation</i>	
Strongly agree	528 (53.9%)
Agree	305 (31.1%)
Neutral	78 (8%)
Disagree	18 (1.8%)
Strongly disagree	51 (5.2%)
<i>I believe PR will improve patients' nutritional status</i>	
Strongly agree	440 (44.9%)
Agree	341 (34.8%)
Neutral	117 (11.9%)
Disagree	28 (2.9%)
Strongly disagree	54 (5.5%)
<i>I believe PR will improve patients' disease self-management</i>	
Strongly agree	589 (60.1%)
Agree	260 (26.5%)
Neutral	32 (3.3%)
Disagree	8 (0.8%)
Strongly disagree	91 (9.3%)

Data are presented as frequencies and percentages.

**Table 3:** Mode of delivery and component of PR (n=980).

Item	Frequency (%)
<b>The best way to deliver PR program for COPD patients</b>	
In hospital supervised program	748 (76.3%)
At home	557 (56.8%)
Online program with healthcare provider support	404 (41.2%)
Tailored program with healthcare provider support through phone	275 (28.1%)
<b>Component of PR program aside from exercise component</b>	
Information about COPD disease	832 (84.9%)
Smoking cessation	787 (80.3%)
Symptoms management	749 (76.4%)
Psychological support	671 (68.5%)
Information about medications	648 (66.1%)
Nutritional counselling	526 (53.7%)

Data are presented as frequencies and percentages.

### 3.3. Patient-related factors that influence referral decisions to PR

The main factors that strongly influenced the decision to refer COPD patients to PR from the HCPs' perspective included mobility affected by patients' breathlessness (64.10%), followed by low activity levels (61.60%), low exercise tolerance (58.20%), patient fatigue related to COPD (52.90%), and patient anxiety related to COPD (50.70%) (Figure 1).

### 3.4. PR referral barriers

From the HCPs' perspective, the main barriers that strongly affect the referral process for COPD patients included a lack of available PR centres (61.80%), followed by a lack of trained HCPs who could manage COPD patients (52.70%) and the lack of authority to refer a patient (44.30%). In addition, 43% reported that patients might refuse the referral process (Figure 2).

## 4. Discussion

To the best of our knowledge, this is the first national study that explores HCPs' attitudes and beliefs about PR programs in Saudi Arabia. Findings show a consensus on the benefits of PR in improving clinical outcomes in COPD. While a supervised hospital-based program was seen as the preferred mode of delivery, the lack of PR centres, well-trained staff, and the authority to refer posed significant barriers to PR referrals. HCPs perceived patients' education about COPD and smoking cessation as the most essential components to be incorporated into a PR program.

PR has established a solid position as the cornerstone of the management of patients with COPD. Indeed, current evidence shows that PR alleviates exercise limitations and dyspnoea, improves nutritional status and psychological well-being, and reduces hospitalizations, future COPD exacerbations, and mortality rates<sup>7 15 16</sup>. Despite this, the global referral rate is currently suboptimal<sup>17 18</sup>. Current international COPD guidelines recommend the involvement of HCPs in the referral of COPD patients; however, referral to PR is solely undertaken by physicians in Saudi Arabia<sup>18-22</sup>. In the current study, nearly half of the participants believed that a lack of authority to refer posed a significant barrier to PR referral. Empowering HCPs who are part of the PR team and COPD management to refer patients in need of PR treatment may increase the referral rate and thus improve clinical outcomes.

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3 Reasons for not referring patients with COPD to PR programs are likely to be multifactorial;  
4 lack of available PR centres is at top of the list, as shown in this study. Saudi Arabia has a  
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6 limited number of PR centres, and the number of people who can access these centres is  
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8 extremely low<sup>9</sup>. This contrasts, for instance, with the situation in the UK, which has 228 PR  
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10 services. The gap in the current practice is therefore clear, and the establishment of new PR  
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12 programs needs to be facilitated across the country. It is however important to mention that PR  
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14 programs can be offered within the existing infrastructure using the incumbent HCPs in the  
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16 hospitals<sup>23</sup>. It has been previously demonstrated that an outpatient PR program offered at a  
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18 small hospital is as effective as a program offered in a large hospital<sup>24</sup>. Current evidence also  
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20 suggests that PR can be effectively offered using different modalities, including inpatient,  
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22 community-based, home settings or online<sup>24 25</sup>. Thus, any of these modes of delivery can be  
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24 adopted according to the hospital's available resources.  
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30 Participants in this study also perceived the lack of well-trained staff as a major barrier to PR  
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32 referral, in concordance with the current literature<sup>18 19</sup>. Studies show that Saudi Arabia suffers  
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34 from a severe shortage of healthcare professionals and that only limited specialties participate  
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36 in the management of COPD<sup>26 27</sup>. Evidence suggests that COPD management is much better if  
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38 performed by a multidisciplinary team<sup>27 28</sup>, highlighting the need for an integrated approach. It  
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40 is however important to mention that the number of specialized physicians and healthcare  
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42 professionals (e.g., respiratory nurses and respiratory physiotherapists) is, overall, low<sup>26 27</sup>,  
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44 which could affect the quality of COPD care in the country. Therefore, the healthcare authority  
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46 in Saudi Arabia should take action to reduce the current shortage by providing training  
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48 incentives to people willing to specialize in respiratory medicine and encouraging the  
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50 upskilling of current healthcare workers. In addition, offering high-quality education either  
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52 inside or outside the country could be a useful approach to stimulate this change.  
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3 Almost 80% of HCPs in this study considered supervised hospital-based programs the  
4 preferred mode of PR delivery, despite the limited number of PR centres in the country. This  
5 is likely because of a lack of knowledge about PR services in Saudi Arabia, as only a small  
6 proportion of HCPs know what PR is<sup>10</sup>. However, utilizing the available resources within the  
7 infrastructure of the hospital remains possible for setting up and delivering a PR program.  
8 Alternatively, home settings, which are as effective as conventional PR programs in improving  
9 exercise capacity and respiratory symptoms<sup>29</sup>, could be considered a viable option.

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11 In this study, most HCPs believed that information about COPD and smoking cessation are the  
12 most important components of a PR program. Indeed, disease-related education contributes to  
13 patients' recognition of their symptoms and worsening disease<sup>30</sup>. However, the content of the  
14 PR educational program, who delivers it, and how it is delivered remain unclear. According to  
15 the ATS/ERS official consensus, smoking cessation is a major component of a PR program<sup>13</sup>  
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14. It is the primary cause of COPD, with the prevalence of COPD smokers ranging from 38%  
to 77%<sup>31</sup>. In addition, smoking contributes to 73% of COPD-related deaths worldwide<sup>32</sup>.  
Smoking is also associated with accelerated lung function declines, higher COPD  
exacerbations<sup>33 34</sup>, and increased dropout rates from PR. Therefore, support for smoking  
cessation should be offered throughout the PR program.

#### 4.1. *Strengths and limitations*

Convenience sample techniques were used in the study, which may impose a selection bias,  
although *a priori* desired level of power was met. In this study, we did not survey or  
interview physicians who are part of COPD management. Finally, the study was conducted  
during the COVID-19 pandemic, which may have impacted respondents' opinions.



## 5. Conclusion

HCPs across specialties agreed on the effectiveness of PR. A supervised hospital-based program was the preferred mode of PR delivery although limited PR services existed. Lack of PR centres, well-trained staff, and the authority to refer were major barriers to referring COPD patients. Patients' education and smoking cessation were perceived as essential components of the PR program, in addition to the exercise component.

### Contributors

The study was designed by A.M.A., M.A., and J.S.A. Data collection was performed by A.A.A, I.A.A, H.W, and A.S.A, statistical methodology was performed by A.M.A, and formal analysis was performed by A.H, Y.S.A and S.M.A. The draft of the manuscript was written by A.M.A, A.A.A, I.A.A, R.A.S, and M.A, and reviewed and revised by J.S.A, H.W and S.M.A. All authors approved the paper for publication.

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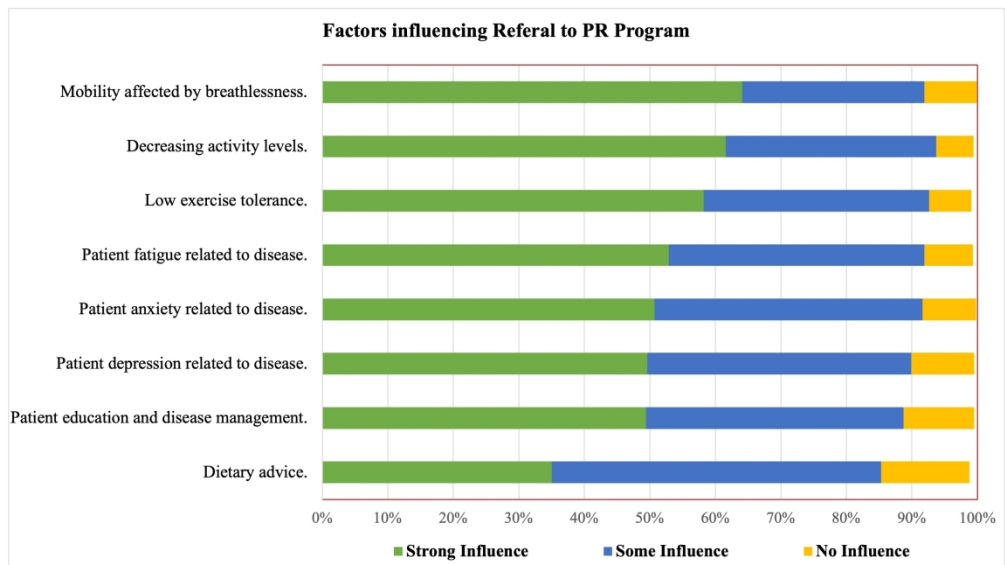
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### Figure legend:

**Figure 1:** Patient-related factors that influence referral decision to PR, using strong, some or no influence grading.

**Figure 2:** Barriers to referring COPD patients to PR from HCPs perspective, using strong, some or no influence grading.

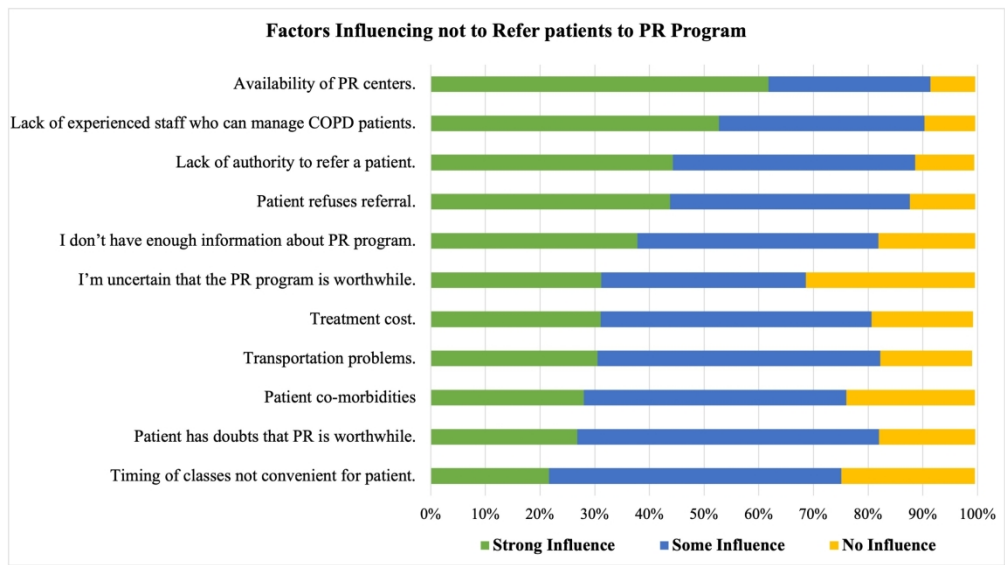
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Patient-related factors that influence referral decision to PR, using strong, some or no influence grading.

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Barriers to referring COPD patients to PR from HCPs perspective, using strong, some or no influence grading.

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# BMJ Open

## Healthcare Providers' Attitudes, Beliefs and Barriers to Pulmonary Rehabilitation for Chronic Obstructive Pulmonary Disease Patients in Saudi Arabia: A Cross-Sectional Study

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<b>Primary Subject Heading</b>:	Rehabilitation medicine
Secondary Subject Heading:	Rehabilitation medicine
Keywords:	REHABILITATION MEDICINE, RESPIRATORY MEDICINE (see Thoracic Medicine), Chronic airways disease < THORACIC MEDICINE

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3 **1 Healthcare Providers' Attitudes, Beliefs and Barriers to Pulmonary**  
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## 46 Abstract

47 **Objectives:** To assess Healthcare Providers (HCPs) attitudes toward delivering Pulmonary  
48 rehabilitation (PR) to Chronic obstructive pulmonary disease (COPD) patients, and identify  
49 factors and barriers that might influence referral.

50 **Design:** A cross-sectional online survey consisted of nine multiple-choice questions.

51 **Settings:** Kingdom of Saudi Arabia.

52 **Participants:** 980 HCPs included nurses, respiratory therapists, and physiotherapists.

53 **Primary outcome measures:** HCPs attitudes and expectations toward delivering PR to COPD  
54 patients and identify factors and barriers that might influence referral in Saudi Arabia

55 **Results:** Overall, 980 HCPs, (53.1%) male, completed the online survey. Nurses accounted for  
56 40.1% of the total sample size, respiratory therapists and physiotherapists accounted for 32.1%  
57 and 16.5%, respectively. The majority of HCPs strongly agreed that PR would improve  
58 exercise capacity 589 (60.1%), health-related quality of life 571 (58.3%), and disease self-  
59 management in COPD patients 589 (60.1%). Moreover, in-hospital supervised PR program  
60 was the preferred method of delivering PR according to 374 (38.16%) HCPs. Around 85% of  
61 HCPs perceived information about COPD disease, followed by smoking cessation 787 (80.3%)  
62 and symptoms management 749 (76.4%) as essential components of PR next to exercise  
63 component. The most common patient-related factor that strongly influenced referral decisions  
64 was "mobility affected by breathlessness" (64%), while "availability of PR centres" (61%),  
65 "lack of trained HCPs" (52%) and "lack of authority to refer patients" (44%) were the most  
66 common barriers for referring.

67 **Conclusion:** PR is an effective management strategy for COPD patients, but sufficient PR  
68 centres, trained staff, and the authority to refer patients are lacking. An in-hospital supervised  
69 PR program is the preferred method of delivering PR, with information about COPD disease,  
70 smoking cessation and symptoms management being considered essential components of PR  
71 in addition to exercise component. Further research is needed to address patients' attitudes and  
72 expectations toward delivering PR program and identify factors and barriers of referring.

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75 **Keywords:** PR, COPD, pulmonary rehabilitation, Saudi Arabia

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4 79 - **Strengths and limitations of this study**  
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- 6 80 1. To our knowledge, this is the first national study that explores HCPs' attitudes and beliefs  
7 81 toward delivering PR to COPD patients and identify factors and barriers that might  
8 82 influence referral in Saudi Arabia  
9 83 2. Availability of PR centres, lack of trained HCPs and lack of authority to refer patients were  
10 84 the most common barriers for referring COPD patients to PR program  
11 85 3. The study was conducted during the COVID-19 pandemic, which may have impacted  
12 86 respondents' opinions.  
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For peer review only

## 1. Introduction

COPD is a common, preventable, and treatable disease characterized by airway and/or alveolar abnormalities, leading to airflow limitation and persistent pulmonary symptoms[1]. Patients with COPD are susceptible to daily symptoms, reduced exercise capacity and frequent chest infections that could result in deterioration of lung function and acceleration of disease progression, subsequently leading to emergency hospital admissions[1, 2]. In addition to pharmacologic approaches, the International Global Initiative for Obstructive Lung Disease (GOLD) stresses the importance of including non-pharmacologic interventions such as PR in the management of COPD symptoms as PR provides symptomatic improvement[3, 4], thereby reducing unnecessary hospital admissions.

PR is a comprehensive, multidisciplinary, non-pharmacologic intervention aimed at improving quality of life and exercise performance in patients with COPD[4-6]. PR usually consists of patient assessment with an exercise test and dyspnoea assessment, exercise training that includes endurance and resistance training, quality of life measure, nutritional with occupational evaluation and health education and is administered by a group of multidisciplinary healthcare providers[7].

There has been an increasing trend in Saudi Arabia's prevalence and incidence of COPD from 1990 to 2019 [8]. In 2019, it has been estimated that around 434,560 people had COPD in the Kingdom of Saudi Arabia[8]. This study shows that the burden of COPD is increasing, and public health policy is necessary to offset this trend. PR programs are an example of community-based primary care management that must be implemented to lessen such a burden [8]. However, in Saudi Arabia, PR programs are often unavailable or underutilized [9], likely due to the lack of trained staff who can manage patients with COPD[10]. In addition, PR services across the country must be conducted under close supervision by pulmonologists or internists with an interest in pulmonary medicine, although the number of chest physicians in

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3 112 Saudi Arabia is relatively low[11, 12]. Consequently, an inadequate number of services are  
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5 113 provided to meet the needs of patients with COPD.  
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8 114 International and national COPD management guidelines recommend increasing the  
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10 115 implementation of PR programs worldwide by involving well-trained healthcare providers in  
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12 116 the PR team[5, 11, 12], considering that COPD is now perceived as a heterogeneous disease  
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14 117 with multisystem manifestation that causes systemic consequences[12]. Despite the current  
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16 118 contribution and involvement of experienced healthcare providers (e.g., nurses, respiratory  
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18 119 therapists, physiotherapists, psychologists, occupational therapists, and dietitians) in Saudi PR  
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20 120 programs, awareness of and barriers to healthcare professionals in delivering PR programs in  
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22 121 Saudi Arabia are limited. Recently, we have conducted a study to assess pulmonologists',  
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24 122 internal medicine', general physicians' attitudes toward delivering PR to COPD patients and  
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26 123 to identify factors and barriers that might influence PR referral decisions. Our findings showed  
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28 124 that referral rate was low among all physicians, due to a lack of PR centres and trained staff.  
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30 125 Giving the fact that our previous study did not assess non-physicians' health care providers  
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32 126 attitudes, beliefs, and barriers to PR even though they are part of the referring process.  
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34 127 Therefore, this study aims to explore healthcare professionals' attitudes and expectations  
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36 128 toward delivering a PR program and identify factors and barriers that might influence referral  
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38 129 of COPD patients in Saudi Arabia.  
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## 131 **2. Methods**

### 132 *2.1. Study design*

133 A cross-sectional survey was conducted through an online platform (Survey Monkey) between  
134 September 15, 2021, and January 19, 2022.

### 135 136 *2.2. Questionnaire tool*

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3 137 The survey was composed of nine multiple-choice closed questions and free text fields for  
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5 138 additional comments; it was structured, formulated, and validated by multidisciplinary experts  
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7 139 including nursing, respiratory therapy, physiotherapy, and nutrition in the field of PR based on  
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9 140 the currently available literature[5, 7, 13]. Before the initial distribution, content and face  
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11 141 validity were assessed after piloting the survey with ten healthcare professionals with a clinical  
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13 142 background in COPD management.  
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17 143 Before participants started to answer the questionnaire, the aim of the study was provided,  
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19 144 together with information about the lead investigator. Additionally, no personal information  
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21 145 was recorded; voluntary participation was ensured by asking if participants were happy to  
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23 146 complete the survey or not. An additional statement was provided in the survey: “By answering  
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25 147 ‘yes’ in completing the survey question, you voluntarily agree to participate in this study and  
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27 148 give your consent to use your anonymous data for research purposes.” The time required to  
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29 149 complete the survey was approximately three to five minutes. The questionnaire consisted of  
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31 150 two pages of structured responses that involved multiple-choice answers in three sections.  
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33 151 Section 1 requested the respondents' demographic information, including gender, profession,  
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35 152 years of experience and responsibilities in the management of COPD. Section 2 consisted of  
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37 153 three questions asking about healthcare providers' perceptions of PR. The first question had  
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39 154 six statements regarding the effectiveness of PR with COPD patients and used a 5-point Likert  
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41 155 scale ranging from 1 = strongly disagree to 5 = strongly agree. The second question asked about  
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43 156 additional components of PR aside from the exercise component, and the third question was  
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45 157 about the best way to deliver PR for COPD patients. Section 3 included two questions regarding  
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47 158 patient-related factors that influence referral decisions and process-related factors that  
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49 159 influence the decision not to refer COPD patients. These questions used influence as a grading  
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51 160 tool: no influence, some influence and strong influence. (See Appendix 1)  
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### 162 2.3. *Study population and sampling strategy*

163 Convenience sampling techniques were used to recruit the study participants. nurses,  
164 respiratory therapists, physiotherapists, psychologists, occupational therapists, and nutritionists  
165 involved in managing COPD patients or having potential contact with this population were the  
166 main targets. Professional committees managing respiratory diseases such as Saudi Society of  
167 Respiratory Care, Saudi Physical Therapy Association and Saudi Nurses Association, and  
168 social networks (Twitter, WhatsApp, and Telegram) were used to distribute the survey to reach  
169 a greater number of HCPs working in Saudi Arabia.

### 171 2.4. *Patient and Public Involvement statement*

172 Patients were not involved.

### 174 2.5. *Sample size*

175 Sample size calculation was not required, as this was an exploratory study designed.

### 177 2.6. *Ethical approval*

178 Institutional Review Board approval for the study was obtained from Jazan University,  
179 reference number (HAPO-10-Z-001).

### 181 2.7. *Statistical analysis*

182 Data were collected and analysed using the Statistical Package for Social Sciences (SPSS  
183 software, Version 25). The categorical variables were reported and presented in percentages  
184 and frequencies. A Chi-square ( $\chi^2$ ) test was used to assess the statistically significant difference  
185 between categorical variables. Statistical significance was considered if the  $p < 0.05$ .



### 3. Results

Overall, 980 HCPs (53.1% male) participated in the online survey between September 9, 2021, and January 19, 2022. Nurses accounted for 40.1% of the participants, followed by respiratory therapists (32.1%), physiotherapists (16.5%) and other healthcare specialties (11.2%) such as nutritionists and occupational therapists. The majority of respondents had one to two (30%) or three to four (26%) years of clinical experience in caring for COPD patients, while 15.2% had five to six years. Oxygen therapy (57%), inpatient treatment (47.1%), ongoing management (42.1%), diagnosis (38.9%), and outpatient clinics (38.1%) were the main responsibilities for managing COPD patients (Table 1).

**Table 1:** Demographic data and characteristics of all study respondents (n= 980).

Demographic variables	Frequency (%)
Gender	
Male	520 (53.1%)
Female	460 (46.9%)
Profession	
Nursing	393 (40.1%)
Respiratory therapy	315 (32.1%)
Physiotherapy	162 (16.5%)
Others	110 (11.2%)
Year of experience with COPD patients	
< 1 year	96 (9.8%)
1-2 years	294 (30%)
3-4 years	255 (26%)
5-6 years	149 (15.2%)
7-8 years	75 (7.7%)
9-10 years	47 (6.5%)
>10 years	47 (4.8%)
Responsibilities for care with COPD patients	
Diagnosis	381 (38.9%)
Urgent assessments	350 (35.7%)
Non-urgent care	360 (36.7%)
Ongoing management	413 (42.1%)
Admission prevention	227 (23.2%)
Medication check	360 (36.7%)
Prescribing	106 (10.8%)
Oxygen therapy	559 (57%)
In patient treatment	462 (47.1%)
Outpatient clinics	373 (38.1%)
Primary care	282 (28.8%)

Data are presented as frequencies and percentages.

### 3.1. HCPs' opinions on referring COPD patients

Most HCPs strongly agreed that PR would improve COPD patients' exercise capacity (589, or 60.1%), and they strongly believed that PR would reduce symptoms of dyspnoea and fatigue (545, or 55.6%). In addition, most HCPs strongly agreed that PR would reduce levels of anxiety and depression (479, or 48.9%), and 571 (58.3%) strongly agreed that PR would improve patients' health-related quality of life. Moreover, 517 (52.8%) strongly agreed that PR would reduce hospital readmission, and 528 (53.9%) strongly agreed that PR would reduce the risk of future COPD exacerbation. Moreover, 440 HCPs (44.9%) strongly agreed that PR would improve patients' nutritional status, and the majority strongly agreed that PR would improve disease self-management in COPD patients (589, or 60.1%) (Table 2).

### 3.2. Mode of delivery and components of PR

When asked about the preferred way to deliver a PR program for COPD patients, most HCPs believed that in-hospital supervised PR was the preferred method (748, or 76.3%), followed by delivering the PR at home (557, or 56.8%). However, only 275 (28.1%) believed that tailored PR with healthcare provider support over the phone would be the preferred method. Most HCPs believed that the essential components of PR include information about COPD disease (832, or 84.9%), followed by smoking cessation (787, or 80.3%) and COPD symptoms management (749, or 76.4%), aside from the exercise component (Table 3).

**Table 2:** Healthcare providers' perception on referring COPD patients to PR (n=980).

Item	Frequency (%)
<b>Perception on referring COPD patients to PR</b>	
<i>I believe PR will improve patients' exercise capacity</i>	
Strongly agree	589 (60.1%)
Agree	260 (26.5%)
Neutral	32 (3.3%)
Disagree	8 (0.8%)
Strongly disagree	91 (9.3%)
<i>I believe PR would reduce dyspnoea and fatigue</i>	
Strongly agree	545 (55.6%)

3	Agree	297 (30.3%)
4	Neutral	62 (6.3%)
5	Disagree	25 (2.6%)
6	Strongly disagree	51 (5.2%)
7	<i>I believe PR will improve patients' anxiety and depression</i>	
8	Strongly agree	479 (48.9%)
9	Agree	320 (32.7%)
10	Neutral	105 (10.7%)
11	Disagree	29 (3%)
12	Strongly disagree	47 (4.8%)
13	<i>I believe PR will improve patients' health-related quality of life</i>	
14	Strongly agree	571 (58.3%)
15	Agree	283 (28.9%)
16	Neutral	57 (5.8%)
17	Disagree	19 (1.9%)
18	Strongly disagree	50 (5.1%)
19	<i>I believe PR will reduce the risk hospital readmission</i>	
20	Strongly agree	517 (52.8%)
21	Agree	317 (32.3%)
22	Neutral	70 (7.1%)
23	Disagree	28 (2.9%)
24	Strongly disagree	48 (4.9%)
25	<i>I believe PR will reduce the risk of future COPD exacerbation</i>	
26	Strongly agree	528 (53.9%)
27	Agree	305 (31.1%)
28	Neutral	78 (8%)
29	Disagree	18 (1.8%)
30	Strongly disagree	51 (5.2%)
31	<i>I believe PR will improve patients' nutritional status</i>	
32	Strongly agree	440 (44.9%)
33	Agree	341 (34.8%)
34	Neutral	117 (11.9%)
35	Disagree	28 (2.9%)
36	Strongly disagree	54 (5.5%)
37	<i>I believe PR will improve patients' disease self-management</i>	
38	Strongly agree	589 (60.1%)
39	Agree	260 (26.5%)
40	Neutral	32 (3.3%)
41	Disagree	8 (0.8%)
42	Strongly disagree	91 (9.3%)

220 Data are presented as frequencies and percentages.

221

222 **Table 3:** Mode of delivery and component of PR (n=980).

Item	Frequency (%)
<b>The best way to deliver PR program for COPD patients</b>	
In hospital supervised program	374 (38.16%)
At home	276 (28.16%)
Online program with healthcare provider support	192 (19.59%)
Tailored program with healthcare provider support through phone	138 (14.08%)

<b>Component of PR program aside from exercise component</b>	
Information about COPD disease	832 (84.9%)
Smoking cessation	787 (80.3%)
Symptoms management	749 (76.4%)
Psychological support	671 (68.5%)
Information about medications	648 (66.1%)
Nutritional counselling	526 (53.7%)

223 Data are presented as frequencies and percentages.

### 225 3.3. *Patient-related factors that influence referral decisions to PR*

226 The main factors that strongly influenced the decision to refer COPD patients to PR from the  
 227 HCPs' perspective included mobility affected by patients' breathlessness (64.10%), followed  
 228 by low activity levels (61.60%), low exercise tolerance (58.20%), patient fatigue related to  
 229 COPD (52.90%), and patient anxiety related to COPD (50.70%) (Figure 1).

### 231 3.4. *PR referral barriers*

232 From the HCPs' perspective, the main barriers that strongly affect the referral process for  
 233 COPD patients included a lack of available PR centres (61.80%), followed by a lack of trained  
 234 HCPs who could manage COPD patients (52.70%) and the lack of authority to refer a patient  
 235 (44.30%). In addition, 43% reported that patients might refuse the referral process (Figure 2).

## 237 4. Discussion

238 To the best of our knowledge, this is the first national study that explores assess non physician  
 239 HCPs attitudes and expectation toward delivering PR to COPD patients and identify factors  
 240 and barriers that might influence referral in Saudi Arabia. Findings show that HCPs perceived  
 241 PR as an effective management strategy in improving clinical outcomes in COPD. While a  
 242 supervised hospital-based program was seen as the preferred mode of delivery, the lack of PR  
 243 centres, well-trained staff, and the authority to refer posed significant barriers to PR referrals.

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3 244 HCPs perceived patients' education about COPD disease, smoking cessation and symptoms  
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5 245 management as the most essential components of PR program next to exercise component.  
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8 246 PR has established a solid position as the cornerstone of the management of patients with  
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10 247 COPD. Indeed, current evidence shows that PR alleviates exercise limitations and dyspnoea,  
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12 248 improves nutritional status and psychological well-being, and reduces hospitalizations, future  
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14 249 COPD exacerbations, and mortality rates[5, 14, 15]. In our study, HCPs perceived mobility  
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16 250 affected by breathlessness, low activity levels, and low exercise tolerance as the most common  
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18 251 factors that influence referral decision which are in accordance with current international  
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20 252 guidelines [16, 17]. According to National Institute for Health and Care Excellence (NICE)  
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22 253 and British Thoracic Society (BTS) PR should be offer to patients who are dyspeptic and  
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24 254 functionally limited due to breathlessness [16, 17]. All these reported factors that influence  
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26 255 referral have been showed to effectively improved in COPD patients who were enrolled in  
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28 256 PR[18].  
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33 257 Despite the current evidence of PR effectiveness, the global referral rate is currently  
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35 258 suboptimal[19-21]. Current international COPD guidelines recommend the involvement of  
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37 259 HCPs in the referral of COPD patients; however, referral to PR cannot be performed without  
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39 260 physicians' permission in Saudi Arabia[16, 18, 20, 22, 23]. In the current study, nearly half of  
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41 261 the participants believed that a lack of authority to refer posed a significant barrier to PR  
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43 262 referral. Empowering HCPs who are part of the PR team and COPD management to refer  
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45 263 patients in need of PR treatment may increase the referral rate and thus improve clinical  
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47 264 outcomes.  
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51 265 Reasons for not referring patients with COPD to PR programs are likely to be multifactorial;  
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53 266 lack of available PR centres is at top of the list, as shown in this study which is in accordance  
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55 267 with recent study included physicians and concluded that limited PR centres was the cause of  
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57 268 low PR referral[21]. Saudi Arabia has a limited number of PR centres, and the number of people  
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3 269 who can access these centres is extremely low[9]. This contrasts, for instance, with the situation  
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5 270 in the UK, which has 228 PR services. The gap in the current practice is therefore clear, and  
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8 271 the establishment of new PR programs needs to be facilitated across the country. It is however  
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10 272 important to mention that PR programs can be offered within the existing infrastructure using  
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12 273 the incumbent HCPs in the hospitals[24]. It has been previously demonstrated that an outpatient  
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14 274 PR program offered at a small hospital is as effective as a program offered in a large  
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17 275 hospital[25]. Current evidence also suggests that PR can be effectively offered using different  
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19 276 modalities, including inpatient, community-based, home settings or online[25, 26]. Thus, any  
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21 277 of these modes of delivery can be adopted according to the hospital's available resources.

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24 278 Participants in this study also perceived the lack of well-trained staff as a major barrier to PR  
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26 279 referral, in concordance with the current literature[18, 20, 21]. Studies show that Saudi Arabia  
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28 280 suffers from a severe shortage of healthcare professionals and that only limited specialties  
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30 281 participate in the management of COPD[27, 28]. Evidence suggests that COPD management  
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32 282 is much better if performed by a multidisciplinary team[28, 29], highlighting the need for an  
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35 283 integrated approach. It is however important to mention that the number of specialized  
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37 284 physicians and healthcare professionals (e.g., respiratory nurses and respiratory  
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39 285 physiotherapists) is, overall, low[27, 28], which could affect the quality of COPD care in the  
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41 286 country. Therefore, the healthcare authority in Saudi Arabia should take action to reduce the  
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44 287 current shortage by providing training incentives to people willing to specialize in respiratory  
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47 288 medicine and encouraging the upskilling of current healthcare workers. In addition, offering  
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49 289 high-quality education either inside or outside the country could be a useful approach to  
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51 290 stimulate this change.

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54 291 Almost half of the study participants perceived "patients might refuse the referral" as a major  
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56 292 barrier to refer COPD patients to PR which is in accordance with recent study included  
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58 293 physicians and concluded that 46% perceived patients refuse referral is a major barrier[21].  
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3 294 This may be due to the lack of patients' knowledge about the PR and its benefit to their  
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5 295 condition as well as travel distance to PR[18, 30, 31]. Therefore, incorporating patients'  
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7 296 preferences of PR delivery mode and increasing awareness of PR and its benefit among COPD  
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9 297 population are needed.

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12 298 Almost 80% of HCPs in this study considered supervised hospital-based programs the  
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14 299 preferred mode of PR delivery, despite the limited number of PR centres in the country. This  
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16 300 is likely because of a lack of knowledge about PR services in Saudi Arabia, as only a small  
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18 301 proportion of HCPs know what PR is[10]. However, utilizing the available resources within  
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20 302 the infrastructure of the hospital remains possible for setting up and delivering a PR program.  
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22 303 Alternatively, home settings, which are as effective as conventional PR programs in improving  
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24 304 exercise capacity and respiratory symptoms[32], could be considered a viable option.

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26 305 In this study, most HCPs believed that information about COPD disease, smoking cessation  
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28 306 and symptoms management are the most important components of a PR program. Indeed,  
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30 307 disease-related education contributes to patients' recognition of their symptoms and worsening  
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32 308 disease[33]. However, the content of the PR educational program, who delivers it, and how it  
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34 309 is delivered remain unclear. According to the ATS/ERS official consensus, smoking cessation  
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36 310 is a major component of a PR program[7, 13]. It is the primary cause of COPD, with the  
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38 311 prevalence of COPD smokers ranging from 38% to 77%[34]. In addition, smoking contributes  
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40 312 to 73% of COPD-related deaths worldwide[35]. Smoking is also associated with accelerated  
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42 313 lung function declines, higher COPD exacerbations[36, 37], and increased dropout rates from  
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44 314 PR. Therefore, support for smoking cessation should be offered throughout the PR program.  
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46 315 Further research is needed to address COPD patients' attitudes and expectations toward  
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48 316 delivering a PR program and identify factors and barriers of referring. Additionally, future  
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50 317 research should also focus on suitable mode of delivering PR as well as essential components  
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52 318 from patients' perspective.  
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#### 4.1. *Strengths and limitations*

Convenience sample techniques were used in the study, which may impose a selection bias.

In this study, we did not survey or interview physicians who are part of COPD management.

Finally, the study was conducted during the COVID-19 pandemic, which may have impacted respondents' opinions.

326

### 5. Conclusion

HCPs across specialties agreed on the effectiveness of PR. A supervised hospital-based program was the preferred mode of PR delivery although limited PR services existed. Lack of PR centres, well-trained staff, and the authority to refer were major barriers to referring COPD patients. Patients' education, smoking cessation and symptoms management were perceived as essential components of the PR program, in addition to the exercise component.

333

#### Contributors

The study was designed by A.A., M.A., and J.S.A. Data collection was performed by A.A.A, I.A.A, H.W, and A.S.A, statistical methodology was performed by A.A, and formal analysis was performed by A.H, Y.S.A and S.M.A. The draft of the manuscript was written by A.M.A, A.A.A, I.A.A, R.A.S, E.M.A and M.A, and reviewed and revised by E.M.A, J.S.A., H.W and S.M.A. All authors approved the paper for publication.

340

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**Competing interests:** None declared.

**Patient consent for publication:** Not required



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3 345 **Ethics approval:** Institutional Review Board approval for the study was obtained from Jazan  
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5 346 University, reference number (HAPO-10-Z-001).  
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8 347 **Provenance and peer review:** Not commissioned; externally peer reviewed.  
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10 348 **Data availability statement:** Data are available on reasonable request.  
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For peer review only

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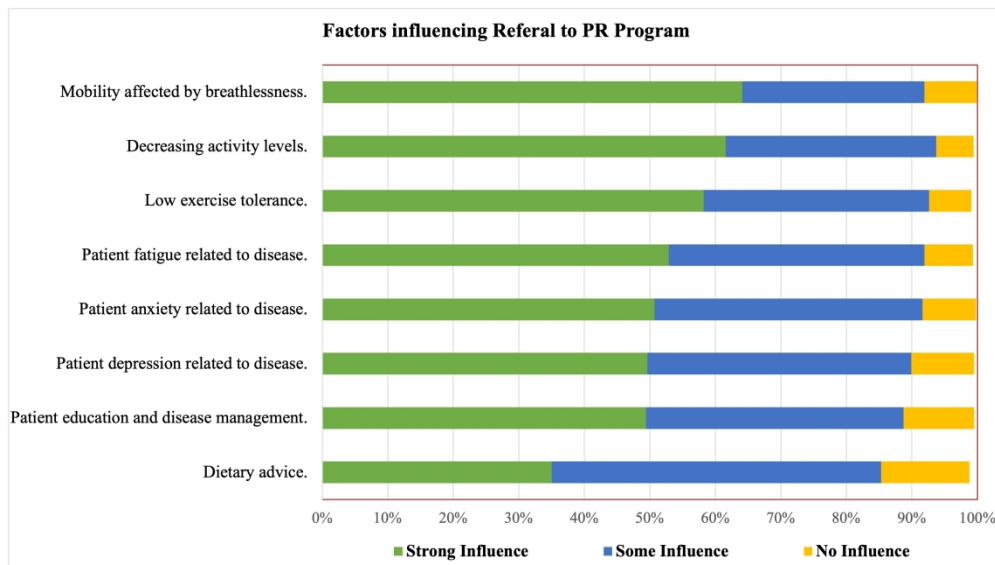
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**Figure 1:** Patient-related factors that influence referral decision to PR, using strong, some or no influence grading.

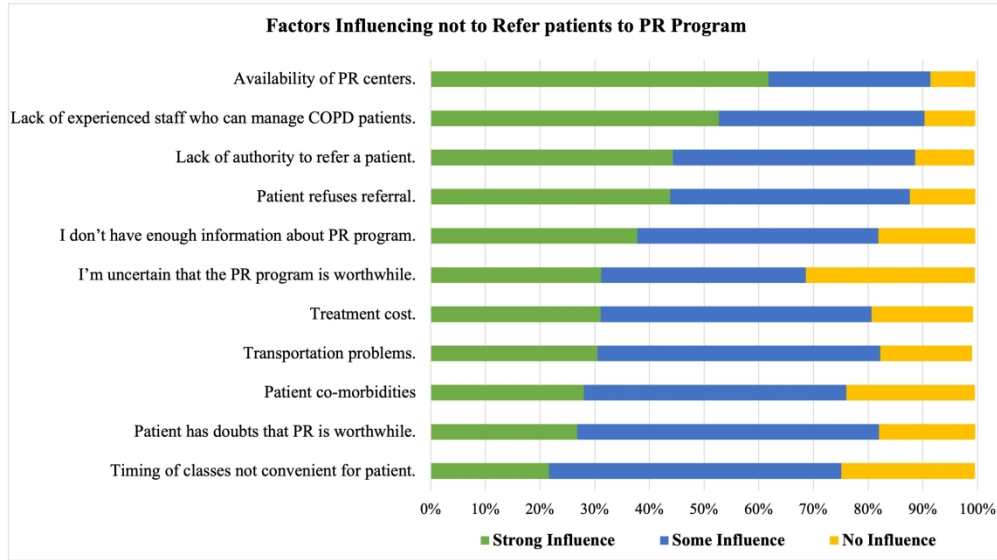
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**Figure 2:** Barriers to referring COPD patients to PR from HCPs perspective, using strong, some or no influence grading.



Patient-related factors that influence referral decision to PR, using strong, some or no influence grading.

247x139mm (330 x 330 DPI)



Barriers to referring COPD patients to PR from HCPs perspective, using strong, some or no influence grading.

247x138mm (330 x 330 DPI)

## Staff Attitudes and Expectations regarding a pulmonary rehabilitation for Chronic obstructive pulmonary disease patients.

We are aiming to understand your attitude and expectations toward delivering a Pulmonary rehabilitation programme for patients with Chronic obstructive pulmonary disease (COPD), and it would be great if you could answer this questionnaire.

Please fill out the survey, be informed that your identity will be completely anonymous and no personal identifying information will be collected and there are no consequences for refusing to participate, your participation is voluntary. This survey will only take 5 minutes to complete.

By answering the first question, you voluntarily agree to participate in this study and give your consent to use your anonymous data for research purposes.

### I. Demographic Information

1. Your Gender?

- A. Male
- B. Female

2. Your Profession?

- A. Nurse
- B. Respiratory therapist
- C. Physiotherapist
- D. Other:

3. What responsibilities do you have for the care of people with COPD? Tick all that apply.

- |   |   |   |
|---|---|---|
| <input type="checkbox"/> Diagnosis          | <input type="checkbox"/> Prescribing          | <input type="checkbox"/> Inpatient treatment        |
| <input type="checkbox"/> Non-urgent care    | <input type="checkbox"/> Ongoing management   | <input type="checkbox"/> Outpatient clinics         |
| <input type="checkbox"/> Urgent assessments | <input type="checkbox"/> Admission prevention | <input type="checkbox"/> Primary care               |
| <input type="checkbox"/> Oxygen therapy     | <input type="checkbox"/> Medication checks    | <input type="checkbox"/> Other: please give details |

4. How many years of experience do you have of caring for people with COPD?

Please enter a whole number.

## II. Perceptions of a rehabilitation programme

5. For each statement please select the answer that best suits your opinion.

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
I believe that pulmonary rehabilitation programme will improve patients exercise capacity.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I believe that pulmonary rehabilitation programme would be beneficial in reducing dyspnea & fatigue.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I believe that pulmonary rehabilitation programme will improve patient anxiety and depression	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I believe that pulmonary rehabilitation programme will improve health-related quality of life.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I believe that pulmonary rehabilitation programme would help in reducing hospital readmission	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I think that pulmonary rehabilitation will reduces the risk of COPD exacerbation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I believe that pulmonary rehabilitation programme will improve patient nutritional status	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I believe that pulmonary rehabilitation programme will improve patient disease self-management	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

6. What do you think that pulmonary rehabilitation programme for individuals with COPD should contain aside from an exercise programme? Tick all that apply.

- |   |  |
|---|--|
| <input type="checkbox"/> Information about COPD disease | <input type="checkbox"/> Symptoms management         |
| <input type="checkbox"/> Nutritional counseling         | <input type="checkbox"/> Smoking cessation           |
| <input type="checkbox"/> Psychological support          | <input type="checkbox"/> Others: please give details |
| <input type="checkbox"/> Information about medications  |  |

If other, please give details



7. **What do you think is the best way to deliver a pulmonary rehabilitation programme for this population.**

- At the hospital. Where they can follow a programme supervised by healthcare professionals.
- By using an online programme with support from a healthcare professional to answer their questions.
- At home. Where they can follow a programme manual with the support of healthcare professionals.
- By following a tailored programme with the support of health care professionals through the phone.

**III. Referral to rehabilitation programme**

8. **In your opinion, what factors might influence decision to refer COPD patients to a pulmonary rehabilitation programme?**

	No influence	Some influence	Strong influence
Mobility, affected by breathlessness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Decreased activity levels	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Low exercise tolerance	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Patient anxiety related to disease	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Depression related to disease	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Patient education and disease management	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Fatigue related to disease	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Dietary advice	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Others please give details			

9. **In your opinion, what factors might influence decision Not to refer COPD patients to a pulmonary rehabilitation programme ?**

	No influence	Some influence	Strong influence
I don't have enough information about pulmonary rehabilitation programme	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I'm uncertain that the programme is worthwhile	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Patient refuses referral	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Patient co-morbidities	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Patient has doubts that rehabilitation is worthwhile	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Transportation problems	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Timing of classes not convenient for patient	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lack of authority to refer patients	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lack of trained staff who can manage COPD patients during pulmonary rehabilitation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Treatment cost	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Availability of pulmonary rehabilitation centers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Others please give details			

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60STROBE Statement—Checklist of items that should be included in reports of *cross-sectional studies*

	<b>Item No</b>	<b>Recommendation</b>	<b>Page number Line number</b>
<b>Title and abstract</b>	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	P: 1, Line: 3
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	P: 2, Lines:46-73
<b>Introduction</b>			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	Pages 4 and 5
Objectives	3	State specific objectives, including any prespecified hypotheses	Page 5, lines:127-129
<b>Methods</b>			
Study design	4	Present key elements of study design early in the paper	Page 5 Lines:133-134
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	Page 7 Lines:163-169
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants	Page 7 Lines:163-169
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	N/A
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	Page 6 Lines:137-160
Bias	9	Describe any efforts to address potential sources of bias	N/A
Study size	10	Explain how the study size was arrived at	Page 7, Line:175
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	N/A
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	Page 7 Lines:182-185
		(b) Describe any methods used to examine subgroups and interactions	N/A
		(c) Explain how missing data were addressed	N/A
		(d) If applicable, describe analytical methods taking account of sampling strategy	N/A
		(e) Describe any sensitivity analyses	N/A
<b>Results</b>			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	Page 8 Lines:187-188
		(b) Give reasons for non-participation at each stage	N/A
		(c) Consider use of a flow diagram	N/A
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	Page 8: Table 1
		(b) Indicate number of participants with missing data for each variable of interest	N/A

Outcome data	15*	Report numbers of outcome events or summary measures	Pages 9-11
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	N/A
		(b) Report category boundaries when continuous variables were categorized	N/A
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	N/A
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	N/A
<b>Discussion</b>			
Key results	18	Summarise key results with reference to study objectives	Pages 11-12 Lines:238-245
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	Page:15 Lines:318-322
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	Pages 11-14 Lines:238-315
Generalisability	21	Discuss the generalisability (external validity) of the study results	N/A
<b>Other information</b>			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	Page 15 Line:338

\*Give information separately for exposed and unexposed groups.

**Note:** An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at [www.strobe-statement.org](http://www.strobe-statement.org).

# BMJ Open

## Healthcare Providers' Attitudes, Beliefs and Barriers to Pulmonary Rehabilitation for Chronic Obstructive Pulmonary Disease Patients in Saudi Arabia: A Cross-Sectional Study

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3 **1 Healthcare Providers' Attitudes, Beliefs and Barriers to Pulmonary**  
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12 **4**

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## Abstract

**Objectives:** To assess Healthcare Providers (HCPs) attitudes toward delivering Pulmonary rehabilitation (PR) to Chronic obstructive pulmonary disease (COPD) patients, and identify factors and barriers that might influence referral.

**Design:** A cross-sectional online survey consisted of nine multiple-choice questions.

**Settings:** Kingdom of Saudi Arabia.

**Participants:** 980 HCPs included nurses, respiratory therapists, and physiotherapists.

**Primary outcome measures:** HCPs attitudes and expectations toward delivering PR to COPD patients and identify factors and barriers that might influence referral in Saudi Arabia

**Results:** Overall, 980 HCPs, (53.1%) male, completed the online survey. Nurses accounted for 40.1% of the total sample size, respiratory therapists and physiotherapists accounted for 32.1% and 16.5%, respectively. The majority of HCPs strongly agreed that PR would improve exercise capacity 589 (60.1%), health-related quality of life 571 (58.3%), and disease self-management in COPD patients 589 (60.1%). Moreover, in-hospital supervised PR program was the preferred method of delivering PR according to 374 (38.16%) HCPs. Around 85% of HCPs perceived information about COPD disease, followed by smoking cessation 787 (80.3%) and symptoms management 749 (76.4%) as essential components of PR next to exercise component. The most common patient-related factor that strongly influenced referral decisions was "mobility affected by breathlessness" (64%), while "availability of PR centres" (61%), "lack of trained HCPs" (52%) and "lack of authority to refer patients" (44%) were the most common barriers for referring.

**Conclusion:** PR is an effective management strategy for COPD patients, but sufficient PR centres, trained staff, and the authority to refer patients are lacking. An in-hospital supervised PR program is the preferred method of delivering PR, with information about COPD disease, smoking cessation and symptoms management being considered essential components of PR in addition to exercise component. Further research is needed to confirm HCP perceptions of patient-related barriers to delivering PR.

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75 Keywords: PR, COPD, pulmonary rehabilitation, Saudi Arabia

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4 79 - **Strengths and limitations of this study**  
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- 6 80 1. To our knowledge, this is the first national study that explores HCPs' attitudes and beliefs  
7 81 toward delivering PR to COPD patients and identify factors and barriers that might  
8 82 influence referral in Saudi Arabia  
9 83 2. Availability of PR centres, lack of trained HCPs and lack of authority to refer patients were  
10 84 the most common barriers for referring COPD patients to PR program  
11 85 3. The study was conducted during the COVID-19 pandemic, which may have impacted  
12 86 respondents' opinions.  
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For peer review only

## 1. Introduction

COPD is a common, preventable, and treatable disease characterized by airway and/or alveolar abnormalities, leading to airflow limitation and persistent pulmonary symptoms[1]. Patients with COPD are susceptible to daily respiratory symptoms, reduced exercise capacity and frequent chest infections that could result in deterioration of lung function and acceleration of disease progression, subsequently leading to emergency hospital admissions[1, 2]. In addition to pharmacologic approaches, the International Global Initiative for Obstructive Lung Disease (GOLD) stresses the importance of including non-pharmacologic interventions such as PR in the management of COPD symptoms as PR provides symptomatic improvement[3, 4], thereby reducing unnecessary hospital admissions.

PR is a comprehensive, multidisciplinary, non-pharmacologic intervention aimed at improving quality of life and exercise performance in patients with COPD[4-6]. PR usually consists of patient assessment with an exercise test and dyspnoea assessment, exercise training that includes endurance and resistance training, quality of life measure, nutritional with occupational evaluation and health education and is administered by a group of multidisciplinary healthcare providers[7].

There has been an increasing trend in Saudi Arabia's prevalence and incidence of COPD from 1990 to 2019 [8]. In 2019, it has been estimated that around 434,560 people had COPD in the Kingdom of Saudi Arabia[8]. This study shows that the burden of COPD is increasing, and public health policy is necessary to offset this trend. PR programs are an example of community-based primary care management that must be implemented to lessen such a burden [8]. However, in Saudi Arabia, PR programs are often unavailable or underutilized [9], ] for multiple reasons, including the lack of trained staff who can manage patients with COPD [10]. In addition, PR services across the country must be conducted under close supervision by pulmonologists or internists with an interest in pulmonary medicine, although the number of

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3 112 chest physicians in Saudi Arabia is relatively low[11, 12]. Consequently, an inadequate number  
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5 113 of services are provided to meet the needs of patients with COPD.  
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8 114 International and national COPD management guidelines recommend increasing the  
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10 115 implementation of PR programs worldwide by involving well-trained healthcare providers in  
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12 116 the PR team[5, 11, 12], considering that COPD is now perceived as a heterogeneous disease  
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14 117 with multisystem manifestation that causes systemic consequences[12]. Despite the current  
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16 118 contribution and involvement of experienced healthcare providers (e.g., nurses, respiratory  
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18 119 therapists, physiotherapists, psychologists, occupational therapists, and dietitians) in Saudi PR  
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20 120 programs, awareness of and barriers to healthcare professionals in delivering PR programs in  
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22 121 Saudi Arabia are limited. Recently, we have conducted a study to assess pulmonologists',  
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24 122 internists', and general practitioners' attitudes toward delivering PR to COPD patients and to  
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26 123 identify factors and barriers that might influence PR referral decisions. Our findings showed  
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28 124 that referral rate was low among all physicians, which was attributed to a lack of PR centres  
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30 125 and trained staff [13]. Giving the fact that our previous study did not survey non-physicians'  
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32 126 health care providers attitudes but they were implicated as a barrier to referral, the present study  
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34 127 aimed to explore allied healthcare professionals' attitudes and expectations toward delivering  
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36 128 a PR program and identify their views on factors and barriers that might influence referral of  
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38 129 COPD patients in Saudi Arabia.  
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## 131 **2. Methods**

### 132 *2.1. Study design*

133 A cross-sectional survey was conducted through an online platform (Survey Monkey) between  
134 September 15, 2021, and January 19, 2022.

### 135 136 *2.2. Questionnaire tool*

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3 137 The survey was composed of nine multiple-choice closed questions and free text fields for  
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5 138 additional comments; it was structured, formulated, and validated by multidisciplinary experts  
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7 139 including nursing, respiratory therapy, physiotherapy, and nutrition in the field of PR based on  
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9 140 the currently available literature[5, 7, 14]. Before the initial distribution, content and face  
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11 141 validity were assessed after piloting the survey with ten healthcare professionals with a clinical  
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13 142 background in COPD management.  
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17 143 Before participants started to answer the questionnaire, the aim of the study was provided,  
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19 144 together with information about the lead investigator. Additionally, no personal information  
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21 145 was recorded; voluntary participation was ensured by asking if participants were happy to  
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23 146 complete the survey or not. An additional statement was provided in the survey: “By answering  
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25 147 ‘yes’ in completing the survey question, you voluntarily agree to participate in this study and  
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27 148 give your consent to use your anonymous data for research purposes.” The time required to  
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29 149 complete the survey was approximately three to five minutes. The questionnaire consisted of  
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31 150 two pages of structured responses that involved multiple-choice answers in three sections.  
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33 151 Section 1 requested the respondents' demographic information, including gender, profession,  
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35 152 years of experience and responsibilities in the management of COPD. Section 2 consisted of  
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37 153 three questions asking about healthcare providers' perceptions of PR. The first question had  
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39 154 six statements regarding the effectiveness of PR with COPD patients and used a 5-point Likert  
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41 155 scale ranging from 1 = strongly disagree to 5 = strongly agree. The second question asked about  
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43 156 additional components of PR aside from the exercise component, and the third question was  
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45 157 about the best way to deliver PR for COPD patients. Section 3 included two questions regarding  
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47 158 patient-related factors that influence referral decisions and process-related factors that  
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49 159 influence the decision not to refer COPD patients. These questions used influence as a grading  
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51 160 tool: no influence, some influence and strong influence. (See Appendix 1)  
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### 162 2.3. *Sampling strategy*

163 Professional committees managing respiratory diseases such as Saudi Society of Respiratory  
164 Care, Saudi Physical Therapy Association and Saudi Nurses Association, and social networks  
165 (Twitter, WhatsApp, and Telegram) were used to distribute the survey to reach a greater  
166 number of HCPs working in Saudi Arabia. Professional committees posted the survey on their  
167 social media as well as sent emails to their members. Additionally, four authors from four  
168 different medical institutions as well as from four different regions of Saudi Arabia have  
169 participated in data collection. Each data collector was responsible for distributing the survey  
170 at his/her region to HCPs to ensure all geographical areas of Saudi Arabia are covered.

### 172 2.4. *Patient and Public Involvement statement*

173 Patients were not involved.

### 175 2.5. *Sample size*

176 Convenience sampling techniques were used to recruit the study participants. nurses,  
177 respiratory therapists, physiotherapists, psychologists, occupational therapists, and nutritionists  
178 involved in managing COPD patients or having potential contact with this population were the  
179 main targets. Sample size calculation was not required, as this was an exploratory study  
180 designed.

### 182 2.6. *Ethical approval*

183 Institutional Review Board approval for the study was obtained from Jazan University,  
184 reference number (HAPO-10-Z-001).

## 186 2.7. Statistical analysis

187 Data were collected and analysed using the Statistical Package for Social Sciences (SPSS  
188 software, Version 25). The categorical variables were reported and presented in percentages  
189 and frequencies. A Chi-square ( $\chi^2$ ) test was used to assess the statistically significant difference  
190 between categorical variables. Statistical significance was considered if the  $p < 0.05$ .

## 191 3. Results

192 Overall, 980 HCPs (53.1% male) participated in the online survey between September 9, 2021,  
193 and January 19, 2022. Nurses accounted for 40.1% of the participants, followed by respiratory  
194 therapists (32.1%), physiotherapists (16.5%) and other healthcare specialties (11.2%) such as  
195 nutritionists and occupational therapists. The majority of respondents had one to two (30%) or  
196 three to four (26%) years of clinical experience in caring for COPD patients, while 15.2% had  
197 five to six years. Oxygen therapy (57%), inpatient treatment (47.1%), ongoing management  
198 (42.1%), diagnosis (38.9%), and outpatient clinics (38.1%) were the main responsibilities for  
199 managing COPD patients (Table 1).

200 **Table 1:** Demographic data and characteristics of all study respondents (n= 980).

Demographic variables	Frequency (%)
Gender	
Male	520 (53.1%)
Female	460 (46.9%)
Profession	
Nursing	393 (40.1%)
Respiratory therapy	315 (32.1%)
Physiotherapy	162 (16.5%)
Others	110 (11.2%)
Year of experience with COPD patients	
< 1 year	96 (9.8%)
1-2 years	294 (30%)
3-4 years	255 (26%)
5-6 years	149 (15.2%)
7-8 years	75 (7.7%)
9-10 years	47 (6.5%)
>10 years	47 (4.8%)

Responsibilities for care with COPD patients	
Diagnosis	381 (38.9%)
Urgent assessments	350 (35.7%)
Non-urgent care	360 (36.7%)
Ongoing management	413 (42.1%)
Admission prevention	227 (23.2%)
Medication check	360 (36.7%)
Prescribing	106 (10.8%)
Oxygen therapy	559 (57%)
In patient treatment	462 (47.1%)
Outpatient clinics	373 (38.1%)
Primary care	282 (28.8%)

Data are presented as frequencies and percentages.

### 3.1. *Healthcare providers' opinions on referring COPD patients*

Most HCPs strongly agreed that PR would improve COPD patients' exercise capacity (589, or 60.1%), and they strongly believed that PR would reduce symptoms of dyspnoea and fatigue (545, or 55.6%). In addition, most HCPs strongly agreed that PR would reduce levels of anxiety and depression (479, or 48.9%), and 571 (58.3%) strongly agreed that PR would improve patients' health-related quality of life. Moreover, 517 (52.8%) strongly agreed that PR would reduce hospital readmission, and 528 (53.9%) strongly agreed that PR would reduce the risk of future COPD exacerbation. Moreover, 440 HCPs (44.9%) strongly agreed that PR would improve patients' nutritional status, and the majority strongly agreed that PR would improve disease self-management in COPD patients (589, or 60.1%) (Table 2).

### 3.2. *Mode of delivery and components of pulmonary rehabilitation*

When asked about the preferred way to deliver a PR program for COPD patients, most HCPs believed that in-hospital supervised PR was the preferred method (748, or 76.3%), followed by delivering the PR at home (557, or 56.8%). However, only 275 (28.1%) believed that tailored PR with healthcare provider support over the phone would be the preferred method. Most HCPs believed that the essential components of PR include information about COPD disease (832,

221 or 84.9%), followed by smoking cessation (787, or 80.3%) and COPD symptoms management  
 222 (749, or 76.4%), aside from the exercise component (Table 3).

223  
 224 **Table 2:** Healthcare providers' perception on referring COPD patients to PR (n=980).

Item	Frequency (%)
<b>Perception on referring COPD patients to PR</b>	
<i>I believe PR will improve patients' exercise capacity</i>	
Strongly agree	589 (60.1%)
Agree	260 (26.5%)
Neutral	32 (3.3%)
Disagree	8 (0.8%)
Strongly disagree	91 (9.3%)
<i>I believe PR would reduce dyspnoea and fatigue</i>	
Strongly agree	545 (55.6%)
Agree	297 (30.3%)
Neutral	62 (6.3%)
Disagree	25 (2.6%)
Strongly disagree	51 (5.2%)
<i>I believe PR will improve patients' anxiety and depression</i>	
Strongly agree	479 (48.9%)
Agree	320 (32.7%)
Neutral	105 (10.7%)
Disagree	29 (3%)
Strongly disagree	47 (4.8%)
<i>I believe PR will improve patients' health-related quality of life</i>	
Strongly agree	571 (58.3%)
Agree	283 (28.9%)
Neutral	57 (5.8%)
Disagree	19 (1.9%)
Strongly disagree	50 (5.1%)
<i>I believe PR will reduce the risk hospital readmission</i>	
Strongly agree	517 (52.8%)
Agree	317 (32.3%)
Neutral	70 (7.1%)
Disagree	28 (2.9%)
Strongly disagree	48 (4.9%)
<i>I believe PR will reduce the risk of future COPD exacerbation</i>	
Strongly agree	528 (53.9%)
Agree	305 (31.1%)
Neutral	78 (8%)
Disagree	18 (1.8%)
Strongly disagree	51 (5.2%)
<i>I believe PR will improve patients' nutritional status</i>	
Strongly agree	440 (44.9%)
Agree	341 (34.8%)
Neutral	117 (11.9%)
Disagree	28 (2.9%)
Strongly disagree	54 (5.5%)
<i>I believe PR will improve patients' disease self-management</i>	
Strongly agree	589 (60.1%)
Agree	260 (26.5%)
Neutral	32 (3.3%)



Disagree	8 (0.8%)
Strongly disagree	91 (9.3%)

Data are presented as frequencies and percentages.

**Table 3:** Mode of delivery and component of PR (n=980).

Item	Frequency (%)
<b>The best way to deliver PR program for COPD patients</b>	
In hospital supervised program	374 (38.16%)
At home	276 (28.16%)
Online program with healthcare provider support	192 (19.59%)
Tailored program with healthcare provider support through phone	138 (14.08%)
<b>Component of PR program aside from exercise component</b>	
Information about COPD disease	832 (84.9%)
Smoking cessation	787 (80.3%)
Symptoms management	749 (76.4%)
Psychological support	671 (68.5%)
Information about medications	648 (66.1%)
Nutritional counselling	526 (53.7%)

Data are presented as frequencies and percentages.

### 3.3. *Patient-related factors that influence referral decisions to pulmonary rehabilitation*

The main factors that strongly influenced the decision to refer COPD patients to PR from the HCPs' perspective included mobility affected by patients' breathlessness (64.10%), followed by low activity levels (61.60%), low exercise tolerance (58.20%), patient fatigue related to COPD (52.90%), and patient anxiety related to COPD (50.70%) (Figure 1).

### 3.4. *Pulmonary rehabilitation referral barriers*

From the HCPs' perspective, the main barriers that strongly affect the referral process for COPD patients included a lack of available PR centres (61.80%), followed by a lack of trained HCPs who could manage COPD patients (52.70%) and the lack of authority to refer a patient (44.30%). In addition, 43% reported that patients might refuse the referral process (Figure 2).

## 4. Discussion

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3 244 To the best of our knowledge, this is the first national study that explores assess non physician  
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5 245 HCPs attitudes and expectation toward delivering PR to COPD patients and identify factors  
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8 246 and barriers that might influence referral in Saudi Arabia. Findings show that HCPs perceived  
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10 247 PR as an effective management strategy in improving clinical outcomes in COPD. While a  
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12 248 supervised hospital-based program was seen as the preferred mode of delivery, the lack of PR  
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14 249 centres, well-trained staff, and the authority to refer posed significant barriers to PR referrals.  
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17 250 HCPs perceived patients' education about COPD disease, smoking cessation and symptoms  
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19 251 management as the most essential components of PR program next to exercise component.  
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21 252 PR has established a solid position as the cornerstone of the management of patients with  
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23 253 COPD. Indeed, current evidence shows that PR alleviates exercise limitations and dyspnoea,  
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25 254 improves nutritional status and psychological well-being, and reduces hospitalizations, future  
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27 255 COPD exacerbations, and mortality rates[5, 15, 16]. In our study, HCPs perceived mobility  
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29 256 affected by breathlessness, low activity levels, and low exercise tolerance as the most common  
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31 257 factors that influence referral decision which are in accordance with current international  
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33 258 guidelines [17, 18]. According to National Institute for Health and Care Excellence (NICE)  
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35 259 and British Thoracic Society (BTS) PR should be offer to patients who are short of breath and  
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37 260 functionally limited due to breathlessness [17, 18]. All these reported factors that influence  
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39 261 referral have been showed to effectively improved in COPD patients who were enrolled in  
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41 262 PR[19].  
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46 263 Despite the current evidence of PR effectiveness, the global referral rate is currently  
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48 264 suboptimal[13, 20, 21]. Current international COPD guidelines recommend the involvement  
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50 265 of experienced HCPs in the referral management of COPD patients; however, referral to PR  
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52 266 cannot be performed without physicians' permission in Saudi Arabia[17, 19, 21-23]. In the  
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54 267 current study, nearly half of the participants believed that a lack of authority to refer posed a  
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56 268 significant barrier to PR referral. Therefore, experienced HCPs who are part of the PR team or  
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3 269 COPD management should promote physicians' knowledge about PR and its benefit to  
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6 270 enhance PR referral rate.  
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8 271 Reasons for not referring patients with COPD to PR programs are likely to be multifactorial;  
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10 272 lack of available PR centres is at top of the list, as shown in this study which is in accordance  
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12 273 with recent study included physicians and concluded that limited PR centres was the cause of  
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14 274 low PR referral[13]. Saudi Arabia has a limited number of PR centres, and the number of people  
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16 275 who can access these centres is extremely low[9]. This contrasts, for instance, with the situation  
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18 276 in the UK, which has 228 PR services. The gap in the current practice is therefore clear, and  
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20 277 the establishment of new PR programs needs to be facilitated across the country. It is however  
21  
22 278 important to mention that PR programs can be offered within the existing infrastructure using  
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24 279 the incumbent HCPs in the hospitals[24]. It has been previously demonstrated that an outpatient  
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26 280 PR program offered at a small hospital is as effective as a program offered in a large  
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28 281 hospital[25]. Current evidence also suggests that PR can be effectively offered using different  
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30 282 modalities, including inpatient, community-based, home settings or online[25, 26]. Thus, any  
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32 283 of these modes of delivery can be adopted according to the hospital's available resources.  
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35 284 Participants in this study also perceived the lack of well-trained staff as a major barrier to PR  
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37 285 referral, in concordance with the current literature[13, 19, 21]. Studies show that Saudi Arabia  
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39 286 suffers from a severe shortage of healthcare professionals and that only limited specialties  
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41 287 participate in the management of COPD[27, 28]. Evidence suggests that COPD management  
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43 288 is much better if performed by a multidisciplinary team[28, 29], highlighting the need for an  
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45 289 integrated approach. It is however important to mention that the number of specialized  
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47 290 physicians and healthcare professionals (e.g., respiratory nurses and respiratory  
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49 291 physiotherapists) is, overall, low[27, 28], which could affect the quality of COPD care in the  
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51 292 country. Therefore, the healthcare authority in Saudi Arabia should take action to reduce the  
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53 293 current shortage by providing training incentives to people willing to specialize in respiratory  
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3 294 medicine and encouraging the upskilling of current healthcare workers. In addition, offering  
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5 295 high-quality education either inside or outside the country could be a useful approach to  
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8 296 stimulate this change.

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10 297 Almost half of the study participants perceived “patients might refuse the referral” as a major  
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12 298 barrier to refer COPD patients to PR which is in accordance with recent study included  
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14 299 physicians and concluded that 46% perceived patients refuse referral is a major barrier[13].  
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17 300 This may be due to the lack of patients’ knowledge about the PR and its benefit to their  
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19 301 condition as well as travel distance to PR[19, 30, 31]. Therefore, incorporating patients’  
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21 302 preferences of PR delivery mode and increasing awareness of PR and its benefit among COPD  
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23 303 population are needed.

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26 304 Almost 80% of HCPs in this study considered supervised hospital-based programs the  
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28 305 preferred mode of PR delivery, despite the limited number of PR centres in the country. This  
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30 306 is likely because of a lack of knowledge about PR services in Saudi Arabia, as only a small  
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32 307 proportion of HCPs know what PR is[10]. However, utilizing the available resources within  
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35 308 the infrastructure of the hospital remains possible for setting up and delivering a PR program.  
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37 309 Alternatively, home settings, which are as effective as conventional PR programs in improving  
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39 310 exercise capacity and respiratory symptoms[32], could be considered a viable option.

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42 311 In this study, most HCPs believed that information about COPD disease, smoking cessation  
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44 312 and symptoms management are the most important components of a PR program. Indeed,  
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46 313 disease-related education contributes to patients’ recognition of their symptoms and worsening  
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48 314 disease[33]. However, the content of the PR educational program, who delivers it, and how it  
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50 315 is delivered remain unclear. According to the ATS/ERS official consensus, smoking cessation  
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52 316 is a major component of a PR program[7, 14]. It is the primary cause of COPD, with the  
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54 317 prevalence of COPD smokers ranging from 38% to 77%[34]. In addition, smoking contributes  
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56 318 to 73% of COPD-related deaths worldwide[35]. Smoking is also associated with accelerated  
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3 319 lung function declines, higher COPD exacerbations[36, 37], and increased dropout rates from  
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6 320 PR. Therefore, support for smoking cessation should be offered throughout the PR program.  
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8 321 Further research is needed to address COPD patients' attitudes and expectations toward  
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10 322 delivering a PR program and identify factors and barriers of referring. Additionally, future  
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12 323 research should also focus on suitable mode of delivering PR as well as essential components  
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15 324 from patients' perspective.  
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#### 22 327 *4.1. limitations*

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24 328 Convenience sample techniques were used in the study, which may impose a selection bias.  
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27 329 In this study, we did not survey or interview physicians who are part of COPD management.  
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29 330 Additionally, we have failed to report the geographic distribution of the respondents.  
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31 331 Moreover, the exact number of HCPs' who involved in PR as well as with COPD patients;  
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33 332 therefore, the sample of our study may not represent the general population of HCPs. Finally,  
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36 333 the study was conducted during the COVID-19 pandemic, which may have impacted  
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38 334 respondents' opinions, especially, 28% of the total respondents reported that home PR is the  
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41 335 prefer method of delivering PR from their perspective.  
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## 45 337 **5. Conclusion**

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48 338 HCPs across specialties agreed on the effectiveness of PR. A supervised hospital-based  
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50 339 program was the preferred mode of PR delivery although limited PR services existed. Lack of  
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52 340 PR centres, well-trained staff, and the authority to refer were major barriers to referring COPD  
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55 341 patients. Patients' education, smoking cessation and symptoms management were perceived as  
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57 342 essential components of the PR program, in addition to the exercise component.  
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3 344 **Contributors**  
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5  
6 345 The study was designed by A.A., M.A., and J.S.A. Data collection was performed by A.A.A,  
7 346 I.A.A, H.W, and A.S.A, statistical methodology was performed by A.A, and formal analysis  
8  
9 347 was performed by A.H, Y.S.A and S.M.A. The draft of the manuscript was written by A.M.A,  
10  
11 348 A.A.A, I.A.A, R.A.S, E.M.A and M.A, and reviewed and revised by E.M.A, J.S.A., H.W and  
12  
13 349 S.M.A. All authors approved the paper for publication.  
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20 352 commercial or not-for-profit sectors

21  
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23  
24 354 **Patient consent for publication:** Not required

25  
26 355 **Ethics approval:** Institutional Review Board approval for the study was obtained from Jazan  
27  
28 356 University, reference number (HAPO-10-Z-001).

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30 357 **Provenance and peer review:** Not commissioned; externally peer reviewed.

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32 358 **Data availability statement:** Data are available upon reasonable request.  
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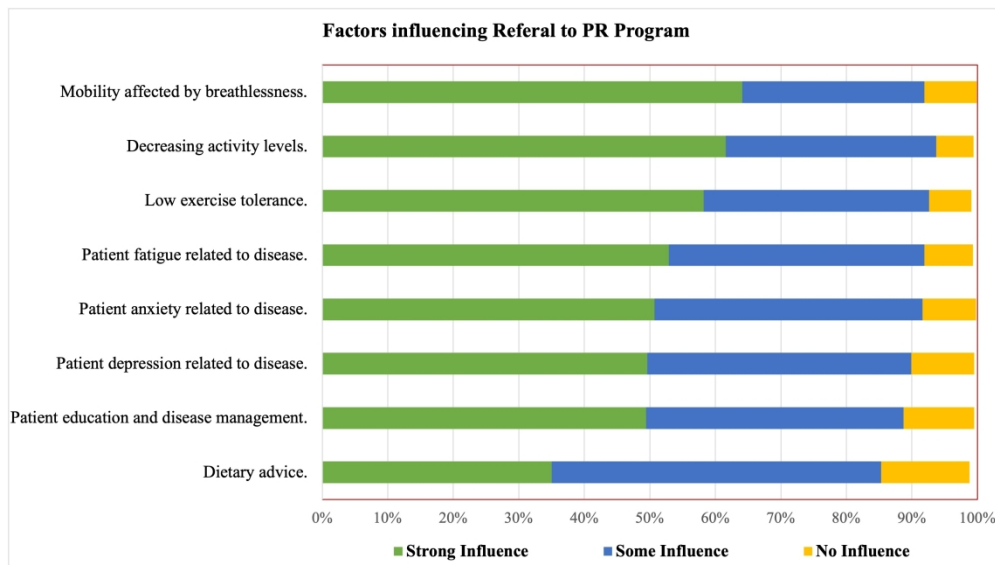
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**Figure 1:** Patient-related factors that influence referral decision to PR, using strong, some or no influence grading.

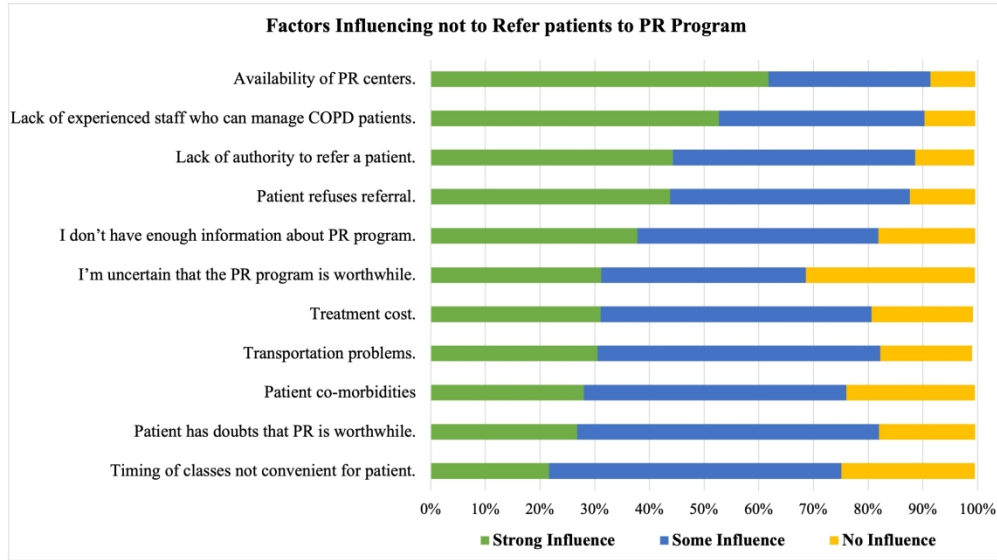
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**Figure 2:** Barriers to referring COPD patients to PR from HCPs perspective, using strong, some or no influence grading.



Patient-related factors that influence referral decision to PR, using strong, some or no influence grading.

247x139mm (330 x 330 DPI)



Barriers to referring COPD patients to PR from HCPs perspective, using strong, some or no influence grading.

247x138mm (330 x 330 DPI)

## Staff Attitudes and Expectations regarding a pulmonary rehabilitation for Chronic obstructive pulmonary disease patients.

We are aiming to understand your attitude and expectations toward delivering a Pulmonary rehabilitation programme for patients with Chronic obstructive pulmonary disease (COPD), and it would be great if you could answer this questionnaire.

Please fill out the survey, be informed that your identity will be completely anonymous and no personal identifying information will be collected and there are no consequences for refusing to participate, your participation is voluntary. This survey will only take 5 minutes to complete.

By answering the first question, you voluntarily agree to participate in this study and give your consent to use your anonymous data for research purposes.

### I. Demographic Information

1. Your Gender?

- A. Male
- B. Female

2. Your Profession?

- A. Nurse
- B. Respiratory therapist
- C. Physiotherapist
- D. Other:

3. What responsibilities do you have for the care of people with COPD? Tick all that apply.

- |   |   |   |
|---|---|---|
| <input type="checkbox"/> Diagnosis          | <input type="checkbox"/> Prescribing          | <input type="checkbox"/> Inpatient treatment        |
| <input type="checkbox"/> Non-urgent care    | <input type="checkbox"/> Ongoing management   | <input type="checkbox"/> Outpatient clinics         |
| <input type="checkbox"/> Urgent assessments | <input type="checkbox"/> Admission prevention | <input type="checkbox"/> Primary care               |
| <input type="checkbox"/> Oxygen therapy     | <input type="checkbox"/> Medication checks    | <input type="checkbox"/> Other: please give details |

4. How many years of experience do you have of caring for people with COPD?

Please enter a whole number.

## II. Perceptions of a rehabilitation programme

5. For each statement please select the answer that best suits your opinion.

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
I believe that pulmonary rehabilitation programme will improve patients exercise capacity.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I believe that pulmonary rehabilitation programme would be beneficial in reducing dyspnea & fatigue.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I believe that pulmonary rehabilitation programme will improve patient anxiety and depression	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I believe that pulmonary rehabilitation programme will improve health-related quality of life.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I believe that pulmonary rehabilitation programme would help in reducing hospital readmission	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I think that pulmonary rehabilitation will reduces the risk of COPD exacerbation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I believe that pulmonary rehabilitation programme will improve patient nutritional status	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I believe that pulmonary rehabilitation programme will improve patient disease self-management	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

6. What do you think that pulmonary rehabilitation programme for individuals with COPD should contain aside from an exercise programme? Tick all that apply.

- |   |  |
|---|--|
| <input type="checkbox"/> Information about COPD disease | <input type="checkbox"/> Symptoms management         |
| <input type="checkbox"/> Nutritional counseling         | <input type="checkbox"/> Smoking cessation           |
| <input type="checkbox"/> Psychological support          | <input type="checkbox"/> Others: please give details |
| <input type="checkbox"/> Information about medications  |  |

If other, please give details

7. **What do you think is the best way to deliver a pulmonary rehabilitation programme for this population.**

- At the hospital. Where they can follow a programme supervised by healthcare professionals.
- By using an online programme with support from a healthcare professional to answer their questions.
- At home. Where they can follow a programme manual with the support of healthcare professionals.
- By following a tailored programme with the support of health care professionals through the phone.

**III. Referral to rehabilitation programme**

8. **In your opinion, what factors might influence decision to refer COPD patients to a pulmonary rehabilitation programme?**

	No influence	Some influence	Strong influence
Mobility, affected by breathlessness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Decreased activity levels	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Low exercise tolerance	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Patient anxiety related to disease	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Depression related to disease	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Patient education and disease management	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Fatigue related to disease	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Dietary advice	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Others please give details			

9. **In your opinion, what factors might influence decision Not to refer COPD patients to a pulmonary rehabilitation programme ?**

	No influence	Some influence	Strong influence
I don't have enough information about pulmonary rehabilitation programme	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I'm uncertain that the programme is worthwhile	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Patient refuses referral	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Patient co-morbidities	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Patient has doubts that rehabilitation is worthwhile	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Transportation problems	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Timing of classes not convenient for patient	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lack of authority to refer patients	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lack of trained staff who can manage COPD patients during pulmonary rehabilitation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Treatment cost	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Availability of pulmonary rehabilitation centers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Others please give details			

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60STROBE Statement—Checklist of items that should be included in reports of *cross-sectional studies*

	<b>Item No</b>	<b>Recommendation</b>	<b>Page number Line number</b>
<b>Title and abstract</b>	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	P: 1, Line: 3
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	P: 2, Lines:46-73
<b>Introduction</b>			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	Pages 4 and 5
Objectives	3	State specific objectives, including any prespecified hypotheses	Page 5, lines:127-129
<b>Methods</b>			
Study design	4	Present key elements of study design early in the paper	Page 5 Lines:133-134
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	Page 7 Lines:163-169
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants	Page 7 Lines:163-169
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	N/A
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	Page 6 Lines:137-160
Bias	9	Describe any efforts to address potential sources of bias	N/A
Study size	10	Explain how the study size was arrived at	Page 7, Line:175
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	N/A
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	Page 7 Lines:182-185
		(b) Describe any methods used to examine subgroups and interactions	N/A
		(c) Explain how missing data were addressed	N/A
		(d) If applicable, describe analytical methods taking account of sampling strategy	N/A
		(e) Describe any sensitivity analyses	N/A
<b>Results</b>			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	Page 8 Lines:187-188
		(b) Give reasons for non-participation at each stage	N/A
		(c) Consider use of a flow diagram	N/A
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	Page 8: Table 1
		(b) Indicate number of participants with missing data for each variable of interest	N/A

Outcome data	15*	Report numbers of outcome events or summary measures	Pages 9-11
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	N/A
		(b) Report category boundaries when continuous variables were categorized	N/A
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	N/A
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	N/A
<b>Discussion</b>			
Key results	18	Summarise key results with reference to study objectives	Pages 11-12 Lines:238-245
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	Page:15 Lines:318-322
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	Pages 11-14 Lines:238-315
Generalisability	21	Discuss the generalisability (external validity) of the study results	N/A
<b>Other information</b>			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	Page 15 Line:338

\*Give information separately for exposed and unexposed groups.

**Note:** An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at [www.strobe-statement.org](http://www.strobe-statement.org).



# BMJ Open

## Healthcare Providers' Attitudes, Beliefs and Barriers to Pulmonary Rehabilitation for Chronic Obstructive Pulmonary Disease Patients in Saudi Arabia: A Cross-Sectional Study

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3 1 **Healthcare Providers' Attitudes, Beliefs and Barriers to Pulmonary**  
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9 3 **Arabia: A Cross-Sectional Study**  
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## Abstract

**Objectives:** To assess the attitude of healthcare Providers (HCPs) towards the delivering of pulmonary rehabilitation (PR) to chronic obstructive pulmonary disease (COPD) patients and identify factors and barriers that might influence referral.

**Design:** A cross-sectional online survey consisting of nine multiple-choice questions.

**Settings:** Saudi Arabia.

**Participants:** 980 HCPs including nurses, respiratory therapists (RT), and physiotherapists.

**Primary outcome measures:** HCPs attitudes towards and expectations of the delivery of PR to COPD patients and the identification of factors and barriers that might influence referral in Saudi Arabia.

**Results:** Overall, 980 HCPs, 53.1% of whom were male, completed the survey. Nurses accounted for 40.1% of the total sample size, and RTs and physiotherapists accounted for 32.1% and 16.5%, respectively. The majority of HCPs strongly agreed that PR would improve exercise capacity 589 (60.1%), health-related quality of life 571 (58.3%), and disease self-management in COPD patients 589 (60.1%). Moreover, the in-hospital supervised PR programme was the preferred method of delivering PR, according to 374 (38.16%) HCPs. Around 85% of HCPs perceived information about COPD, followed by smoking cessation 787 (80.3%) as essential components of PR besides the exercise component. The most common patient-related factor that strongly influenced referral decisions was “mobility affected by breathlessness” (64%), while the “availability of PR centres” (61%), the “lack of trained HCPs” (52%) and the “lack of authority to refer patients” (44%) were the most common barriers to referral.

**Conclusion:** PR is perceived as an effective management strategy for COPD patients. A supervised hospital-based programme is the preferred method of delivering PR, with information about COPD and smoking cessation considered essential components of PR besides the exercise component. A lack of PR centres, well-trained staff, and the authority to refer patients were major barriers to referring COPD patients. Further research is needed to confirm HCP perceptions of patient-related barriers.

Keywords: PR, COPD, pulmonary rehabilitation, Saudi Arabia

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4 79 - **Strengths and limitations of this study**  
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- 6 80 1. To our knowledge, this is the first national study that explores HCPs' attitudes and beliefs  
7 81 about the delivery of PR to COPD patients and identifies factors and barriers that might  
8 82 influence referral in Saudi Arabia  
9 83 2. The availability of PR centres, the lack of trained HCPs and the lack of authority to refer  
10 84 patients were the most common barriers preventing the referral of COPD patients to PR  
11 85 programme  
12 86 3. The study was conducted during the COVID-19 pandemic, which may have impacted the  
13 87 respondents' opinions.  
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For peer review only

## 1. Introduction

COPD is a common, preventable, and treatable disease characterized by airway and/or alveolar abnormalities, leading to airflow limitation and persistent pulmonary symptoms [1]. Patients with COPD are susceptible to daily respiratory symptoms, reduced exercise capacity and frequent chest infections that could result in deterioration of lung function and acceleration of disease progression, subsequently leading to emergency hospital admissions [1, 2]. In addition to pharmacologic approaches, the International Global Initiative for Obstructive Lung Disease (GOLD) stresses the importance of including non-pharmacologic interventions such as PR in the management of COPD symptoms as PR provides symptomatic improvement [3, 4], thereby reducing unnecessary hospital admissions.

PR is a comprehensive, multidisciplinary, non-pharmacologic intervention aimed at improving quality of life and exercise performance in patients with COPD [4-6]. PR usually consists of patient assessment with an exercise test and dyspnoea assessment, exercise training that includes endurance and resistance training, quality of life measure, nutritional with occupational evaluation and health education and is administered by a group of multidisciplinary healthcare providers [7].

There has been an increasing trend in Saudi Arabia's prevalence and incidence of COPD from 1990 to 2019 [8]. In 2019, it has been estimated that around 434,560 people had COPD in the Kingdom of Saudi Arabia [8]. This study shows that the burden of COPD is increasing, and public health policy is necessary to offset this trend. PR programmes are an example of community-based primary care management that must be implemented to lessen such a burden [8]. However, in Saudi Arabia, PR programmes are often unavailable or underutilised [9], ] for multiple reasons, including the lack of trained staff who can manage patients with COPD [10]. In addition, PR services across the country must be conducted under close supervision by pulmonologists or internists with an interest in pulmonary medicine, although the number of

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3 113 chest physicians in Saudi Arabia is relatively low [11, 12]. Consequently, an inadequate  
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5 114 number of services are provided to meet the needs of patients with COPD.  
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8 115 International and national COPD management guidelines recommend increasing the  
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10 116 implementation of PR programmes worldwide by involving well-trained healthcare providers  
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12 117 in the PR team [5, 11, 12], considering that COPD is now perceived as a heterogeneous disease  
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14 118 with multisystem manifestation that causes systemic consequences [12]. Despite the current  
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16 119 contribution and involvement of experienced healthcare providers (e.g., nurses, respiratory  
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18 120 therapists, physiotherapists, psychologists, occupational therapists, and dietitians) in Saudi PR  
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20 121 programmes, awareness of and barriers to healthcare professionals in delivering PR  
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22 122 programmes in Saudi Arabia are limited. Recently, we have conducted a study to assess  
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24 123 pulmonologists', internists', and general practitioners' attitudes towards the delivery of PR to  
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26 124 COPD patients and to identify factors and barriers that might influence PR referral decisions.  
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28 125 Our findings showed that the referral rate was low among all physicians, which was attributed  
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30 126 to a lack of PR centres and trained staff [13]. Given the fact that our previous study did not  
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32 127 survey non-physicians health care providers' attitudes, although they were implicated as a  
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34 128 barrier to referral, the present study aimed to explore allied healthcare professionals' attitudes  
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36 129 and expectations towards delivering a PR programme and identify their views on factors and  
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38 130 barriers that might influence the referral of COPD patients in Saudi Arabia.  
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## 132 **2. Methods**

### 133 *2.1. Study design*

134 A cross-sectional survey was conducted through an online platform (Survey Monkey) between  
135 September 15, 2021, and January 19, 2022.

### 136 137 *2.2. Questionnaire tool*



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3 138 The survey was composed of nine multiple-choice closed questions and free text fields for  
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6 139 additional comments; it was structured, formulated, and validated by multidisciplinary experts  
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8 140 including nursing, respiratory therapy, physiotherapy, and nutrition in the field of PR based on  
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10 141 the currently available literature [5, 7, 14]. Before the initial distribution, content and face  
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12 142 validity were assessed after piloting the survey with ten healthcare professionals with a clinical  
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14 143 background in COPD management.

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17 144 Before participants started to answer the questionnaire, the aim of the study was provided,  
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19 145 together with information about the lead investigator. Additionally, no personal information  
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21 146 was recorded; voluntary participation was ensured by asking if participants were happy to  
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23 147 complete the survey or not. An additional statement was provided in the survey: "By answering  
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25 148 'yes' in completing the survey question, you voluntarily agree to participate in this study and  
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27 149 give your consent to use your anonymous data for research purposes." The time required to  
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29 150 complete the survey was approximately three to five minutes. The questionnaire consisted of  
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31 151 two pages of structured responses that involved multiple-choice answers in three sections.  
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33 152 Section 1 requested the respondents' demographic information, including gender, profession,  
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35 153 years of experience and responsibilities in the management of COPD. Section 2 consisted of  
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37 154 three questions asking about healthcare providers' perceptions of PR. The first question had  
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39 155 six statements regarding the effectiveness of PR with COPD patients and used a 5-point Likert  
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41 156 scale ranging from 1 = strongly disagree to 5 = strongly agree. The second question asked about  
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43 157 additional components of PR aside from the exercise component, and the third question was  
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45 158 about the best way to deliver PR for COPD patients. Section 3 included two questions regarding  
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47 159 patient-related factors that influence referral decisions and process-related factors that  
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49 160 influence the decision not to refer COPD patients. These questions used influence as a grading  
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51 161 tool: no influence, some influence and strong influence. (See Appendix 1)  
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### 163 2.3. *Sampling strategy*

164 Professional committees managing respiratory diseases such as Saudi Society of Respiratory  
165 Care, Saudi Physical Therapy Association and Saudi Nurses Association, and social networks  
166 (Twitter, WhatsApp, and Telegram) were used to distribute the survey to reach a greater  
167 number of HCPs working in Saudi Arabia. Professional committees posted the survey on their  
168 social media pages and sent emails to their members. Additionally, four authors from four  
169 different medical institutions in four different regions of Saudi Arabia have participated in the  
170 data collection. Each data collector was responsible for distributing the survey in his/her region  
171 to HCPs to ensure that all the geographical areas of Saudi Arabia were covered.

### 173 2.4. *Patient and Public Involvement statement*

174 Patients were not involved.

### 176 2.5. *Sample size*

177 Convenience sampling techniques were used to recruit the study participants. Nurses,  
178 respiratory therapists, physiotherapists, psychologists, occupational therapists, and nutritionists  
179 involved in managing COPD patients or who had potential contact with this population were  
180 the main targets. Sample size calculation was not required, as this was an exploratory study  
181 designed.

### 183 2.6. *Ethical approval*

184 Institutional Review Board approval for the study was obtained from Jazan University,  
185 reference number (HAPO-10-Z-001).

186

## 187 2.7. Statistical analysis

188 Data were collected and analysed using the Statistical Package for Social Sciences (SPSS  
189 software, Version 25). The categorical variables were reported and presented in percentages  
190 and frequencies. A Chi-square ( $\chi^2$ ) test was used to assess the statistically significant difference  
191 between categorical variables. Statistical significance was considered if the  $p < 0.05$ .

## 193 3. Results

194 Overall, 980 HCPs (53.1% male) participated in the online survey between September 9, 2021,  
195 and January 19, 2022. Nurses accounted for 40.1% of the participants, followed by respiratory  
196 therapists (32.1%), physiotherapists (16.5%) and other healthcare specialties (11.2%) such as  
197 nutritionists and occupational therapists. The majority of respondents had one to two (30%) or  
198 three to four (26%) years of clinical experience in caring for COPD patients, while 15.2% had  
199 five to six years. Oxygen therapy (57%), inpatient treatment (47.1%), ongoing management  
200 (42.1%), diagnosis (38.9%), and outpatient clinics (38.1%) were the main responsibilities for  
201 managing COPD patients (Table 1).

202 **Table 1:** Demographic data and characteristics of all study respondents (n= 980).

Demographic variables	Frequency (%)
Gender	
Male	520 (53.1%)
Female	460 (46.9%)
Profession	
Nursing	393 (40.1%)
Respiratory therapy	315 (32.1%)
Physiotherapy	162 (16.5%)
Others	110 (11.2%)
Year of experience with COPD patients	
< 1 year	96 (9.8%)
1-2 years	294 (30%)
3-4 years	255 (26%)
5-6 years	149 (15.2%)
7-8 years	75 (7.7%)
9-10 years	47 (6.5%)
>10 years	47 (4.8%)

Responsibilities for care with COPD patients	
Diagnosis	381 (38.9%)
Urgent assessments	350 (35.7%)
Non-urgent care	360 (36.7%)
Ongoing management	413 (42.1%)
Admission prevention	227 (23.2%)
Medication check	360 (36.7%)
Prescribing	106 (10.8%)
Oxygen therapy	559 (57%)
In patient treatment	462 (47.1%)
Outpatient clinics	373 (38.1%)
Primary care	282 (28.8%)

204 Data are presented as frequencies and percentages.

205

### 206 3.1. *Healthcare providers' opinions on referring COPD patients*

207 Most HCPs strongly agreed that PR would improve COPD patients' exercise capacity (589, or  
 208 60.1%), and they strongly believed that PR would reduce symptoms of dyspnoea and fatigue  
 209 (545, or 55.6%). In addition, most HCPs strongly agreed that PR would reduce levels of anxiety  
 210 and depression (479, or 48.9%), and 571 (58.3%) strongly agreed that PR would improve  
 211 patients' health-related quality of life. Moreover, 517 (52.8%) strongly agreed that PR would  
 212 reduce hospital readmission, and 528 (53.9%) strongly agreed that PR would reduce the risk  
 213 of future COPD exacerbation. Moreover, 440 HCPs (44.9%) strongly agreed that PR would  
 214 improve patients' nutritional status, and the majority strongly agreed that PR would improve  
 215 disease self-management in COPD patients (589, or 60.1%) (Table 2).

216

### 217 3.2. *Mode of delivery and components of pulmonary rehabilitation*

218 When asked about the preferred way to deliver a PR programme for COPD patients, most HCPs  
 219 believed that in-hospital supervised PR was the preferred method (748, or 76.3%), followed by  
 220 delivering the PR at home (557, or 56.8%). However, only 275 (28.1%) believed that tailored  
 221 PR with healthcare provider support over the phone would be the preferred method. Most HCPs  
 222 believed that the essential components of PR include information about COPD disease (832,

223 or 84.9%), followed by smoking cessation (787, or 80.3%) and COPD symptoms management  
 224 (749, or 76.4%), aside from the exercise component (Table 3).

225  
 226 **Table 2:** Healthcare providers' perception on referring COPD patients to pulmonary  
 227 rehabilitation (n=980).

Item	Frequency (%)
<b>Perception on referring COPD patients to PR</b>	
<i>I believe PR will improve patients' exercise capacity</i>	
Strongly agree	589 (60.1%)
Agree	260 (26.5%)
Neutral	32 (3.3%)
Disagree	8 (0.8%)
Strongly disagree	91 (9.3%)
<i>I believe PR would reduce dyspnoea and fatigue</i>	
Strongly agree	545 (55.6%)
Agree	297 (30.3%)
Neutral	62 (6.3%)
Disagree	25 (2.6%)
Strongly disagree	51 (5.2%)
<i>I believe PR will improve patients' anxiety and depression</i>	
Strongly agree	479 (48.9%)
Agree	320 (32.7%)
Neutral	105 (10.7%)
Disagree	29 (3%)
Strongly disagree	47 (4.8%)
<i>I believe PR will improve patients' health-related quality of life</i>	
Strongly agree	571 (58.3%)
Agree	283 (28.9%)
Neutral	57 (5.8%)
Disagree	19 (1.9%)
Strongly disagree	50 (5.1%)
<i>I believe PR will reduce the risk hospital readmission</i>	
Strongly agree	517 (52.8%)
Agree	317 (32.3%)
Neutral	70 (7.1%)
Disagree	28 (2.9%)
Strongly disagree	48 (4.9%)
<i>I believe PR will reduce the risk of future COPD exacerbation</i>	
Strongly agree	528 (53.9%)
Agree	305 (31.1%)
Neutral	78 (8%)
Disagree	18 (1.8%)
Strongly disagree	51 (5.2%)
<i>I believe PR will improve patients' nutritional status</i>	
Strongly agree	440 (44.9%)
Agree	341 (34.8%)
Neutral	117 (11.9%)
Disagree	28 (2.9%)
Strongly disagree	54 (5.5%)
<i>I believe PR will improve patients' disease self-management</i>	
Strongly agree	589 (60.1%)
Agree	260 (26.5%)

Neutral	32 (3.3%)
Disagree	8 (0.8%)
Strongly disagree	91 (9.3%)

228 Data are presented as frequencies and percentages.

229

230 **Table 3:** Mode of delivery and component of pulmonary rehabilitation programme (n=980).

Item	Frequency (%)
<b>The best way to deliver PR programme for COPD patients</b>	
In hospital supervised programme	374 (38.16%)
At home	276 (28.16%)
Online programme with healthcare provider support	192 (19.59%)
Tailored programme with healthcare provider support through phone	138 (14.08%)
<b>Component of PR programme aside from exercise component</b>	
Information about COPD disease	832 (84.9%)
Smoking cessation	787 (80.3%)
Symptoms management	749 (76.4%)
Psychological support	671 (68.5%)
Information about medications	648 (66.1%)
Nutritional counselling	526 (53.7%)

231 Data are presented as frequencies and percentages.

232

### 233 3.3. *Patient-related factors that influence referral decisions to pulmonary* 234 *rehabilitation*

235 The main factors that strongly influenced the decision to refer COPD patients to PR from the  
236 HCPs' perspective included mobility affected by patients' breathlessness (64.10%), followed  
237 by low activity levels (61.60%), low exercise tolerance (58.20%), patient fatigue related to  
238 COPD (52.90%), and patient anxiety related to COPD (50.70%) (Figure 1).

239

### 240 3.4. *Pulmonary rehabilitation referral barriers*

241 From the HCPs' perspective, the main barriers that strongly affect the referral process for  
242 COPD patients included a lack of available PR centres (61.80%), followed by a lack of trained  
243 HCPs who could manage COPD patients (52.70%) and the lack of authority to refer a patient  
244 (44.30%). In addition, 43% reported that patients might refuse the referral process (Figure 2).

245

## 246 4. Discussion

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3 247 To the best of our knowledge, this is the first national study that explores assess non physician  
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5 248 HCPs attitudes and expectation toward delivering PR to COPD patients and identify factors  
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8 249 and barriers that might influence referral in Saudi Arabia. Findings show that HCPs perceived  
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10 250 PR as an effective management strategy in improving clinical outcomes in COPD. While a  
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12 251 supervised hospital-based programme was seen as the preferred mode of delivery, the lack of  
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14 252 PR centres, well-trained staff, and the authority to refer posed significant barriers to PR  
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16 253 referrals. HCPs perceived patients' education about COPD disease, smoking cessation and  
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18 254 symptoms management as the most essential components of PR programme next to exercise  
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20 255 component.

23  
24 256 PR has established a solid position as the cornerstone of the management of patients with  
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26 257 COPD. Indeed, current evidence shows that PR alleviates exercise limitations and dyspnoea,  
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28 258 improves nutritional status and psychological well-being, and reduces hospitalizations, future  
29  
30 259 COPD exacerbations, and mortality rates [5, 15, 16]. In our study, HCPs perceived mobility  
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32 260 affected by breathlessness, low activity levels, and low exercise tolerance as the most common  
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34 261 factors that influence referral decision which are in accordance with current international  
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36 262 guidelines [17, 18]. According to National Institute for Health and Care Excellence (NICE)  
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38 263 and British Thoracic Society (BTS) PR should be offer to patients who are short of breath and  
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40 264 functionally limited due to breathlessness [17, 18]. All these reported factors that influence  
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42 265 referral have been showed to effectively improved in COPD patients who were enrolled in PR  
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44 266 [19].

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49 267 Despite the current evidence of PR effectiveness, the global referral rate is currently suboptimal  
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51 268 [13, 20, 21]. Current international COPD guidelines recommend the involvement of  
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53 269 experienced HCPs in the referral management of COPD patients; however, referral to PR  
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55 270 cannot be performed without physicians' permission in Saudi Arabia [17, 19, 21-23]. In the  
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57 271 current study, nearly half of the participants believed that a lack of authority to refer posed a  
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3 272 significant barrier to PR referral. Therefore, experienced HCPs who are part of the PR team or  
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5 273 COPD management should promote physicians' knowledge about PR and its potential to  
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8 274 enhance the PR referral rate.

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10 275 Reasons for not referring patients with COPD to PR programmes are likely to be multifactorial;  
11  
12 276 lack of available PR centres is at top of the list, as shown in this study which is in accordance  
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14 277 with recent study included physicians and concluded that limited PR centres was the cause of  
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17 278 low PR referral [13]. Saudi Arabia has a limited number of PR centres, and the number of  
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19 279 people who can access these centres is extremely low [9]. This contrasts, for instance, with the  
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21 280 situation in the UK, which has 228 PR services. The gap in the current practice is therefore  
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23 281 clear, and the establishment of new PR programmes needs to be facilitated across the country.

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26 282 It is however important to mention that PR programs can be offered within the existing  
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28 283 infrastructure using the incumbent HCPs in the hospitals [24]. It has been previously  
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30 284 demonstrated that an outpatient PR programme offered at a small hospital is as effective as a  
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32  
33 285 programme offered in a large hospital [25]. Current evidence also suggests that PR can be  
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35 286 effectively offered using different modalities, including inpatient, community-based, home  
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37 287 settings or online [25, 26]. Thus, any of these modes of delivery can be adopted according to  
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39 288 the hospital's available resources.

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42 289 Participants in this study also perceived the lack of well-trained staff as a major barrier to PR  
43  
44 290 referral, in concordance with the current literature [13, 19, 21]. Studies show that Saudi Arabia  
45  
46 291 suffers from a severe shortage of healthcare professionals and that only limited specialties  
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48 292 participate in the management of COPD [27, 28]. Evidence suggests that COPD management  
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50 293 is much better if performed by a multidisciplinary team [28, 29], highlighting the need for an  
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53 294 integrated approach. It is however important to mention that the number of specialized  
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55 295 physicians and healthcare professionals (e.g., respiratory nurses and respiratory  
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57 296 physiotherapists) is, overall, low [27, 28], which could affect the quality of COPD care in the  
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3 297 country. Therefore, the healthcare authority in Saudi Arabia should take action to reduce the  
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5 298 current shortage by providing training incentives to people willing to specialize in respiratory  
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7 299 medicine and encouraging the upskilling of current healthcare workers. In addition, offering  
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10 300 high-quality education either inside or outside the country could be a useful approach to  
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12 301 stimulate this change.

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14 302 Almost half of the study participants perceived “patients might refuse the referral” as a major  
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16 303 barrier to refer COPD patients to PR which is in accordance with recent study included  
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18 304 physicians and concluded that 46% perceived patients refuse referral is a major barrier [13].  
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20 305 This may be due to the lack of patients’ knowledge about the PR and its benefit to their  
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22 306 condition as well as travel distance to PR [19, 30, 31]. Therefore, incorporating patients’  
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24 307 preferences of PR delivery mode and increasing awareness of PR and its benefit among COPD  
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26 308 population are needed.

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29 309 Almost 80% of HCPs in this study considered supervised hospital-based programmes the  
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31 310 preferred mode of PR delivery, despite the limited number of PR centres in the country. This  
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33 311 is likely because of a lack of knowledge about PR services in Saudi Arabia, as only a small  
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35 312 proportion of HCPs know what PR is [10]. However, utilizing the available resources within  
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37 313 the infrastructure of the hospital remains possible for setting up and delivering a PR  
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39 314 programme. Alternatively, home settings, which are as effective as conventional PR  
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41 315 programmes in improving exercise capacity and respiratory symptoms [32], could be  
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43 316 considered a viable option.

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46 317 In this study, most HCPs believed that information about COPD disease, smoking cessation  
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48 318 and symptoms management are the most important components of a PR programme. Indeed,  
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50 319 disease-related education contributes to patients’ recognition of their symptoms and worsening  
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52 320 disease [33]. However, the content of the PR educational programme, who delivers it, and how  
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54 321 it is delivered remain unclear. According to the ATS/ERS official consensus, smoking  
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3 322 cessation is a major component of a PR programme [7, 14]. It is the primary cause of COPD,  
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6 323 with the prevalence of COPD smokers ranging from 38% to 77% [34]. In addition, smoking  
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8 324 contributes to 73% of COPD-related deaths worldwide[35]. Smoking is also associated with  
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11 325 accelerated lung function declines, higher COPD exacerbations [36, 37], and increased dropout  
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13 326 rates from PR. Therefore, support for smoking cessation should be offered throughout the PR  
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15 327 programme.

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17 328 Further research is needed to address COPD patients' attitudes and expectations toward  
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19 329 delivering a PR programme and identify factors and barriers of referring. Additionally, future  
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21 330 research should also focus on suitable mode of delivering PR as well as essential components  
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23 331 from patients' perspective.  
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#### 30 31 334 *4.1. limitations*

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33 335 Convenience sample techniques were used in the study, which may impose a selection bias.  
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35 336 In this study, we did not survey or interview physicians who are part of COPD management.  
36  
37 337 Additionally, we have failed to report the geographic distribution of the respondents.  
38  
39 338 Moreover, the exact number of HCPs who involved in PR and with COPD patients is unclear;  
40  
41 339 therefore, the sample of our study may not represent the general population of HCPs. Finally,  
42  
43 340 the study was conducted during the COVID-19 pandemic, which may have impacted  
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45 341 respondents' opinions, especially given that 28% of the total number of respondents reported  
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47 342 that home PR is their preferred method of PR delivery.  
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## 52 53 54 344 **5. Conclusion**

55  
56 345 HCPs across specialties agreed on the effectiveness of PR for COPD patients. A supervised  
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58 346 hospital-based programme is the preferred mode of PR delivery, with information about  
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3 347 COPD disease and smoking cessation being considered essential components of PR in  
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5 348 addition to the exercise component. The lack of PR centres and well-trained staff and the lack  
6  
7 349 of authority to refer patients were major barriers to the referral of COPD patients.  
8  
9

10 350

### 11 351 **Contributors**

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14  
15 352 The study was designed by A.A., M.A., and J.S.A. Data collection was performed by A.A.A,  
16  
17 353 I.A.A, H.W, and A.S.A, statistical methodology was performed by A.A, and formal analysis  
18  
19 354 was performed by A.H, Y.S.A and S.M.A. The draft of the manuscript was written by A.M.A,  
20  
21 355 A.A.A, I.A.A, R.A.S, E.M.A and M.A, and reviewed and revised by E.M.A, J.S.A., H.W and  
22  
23 356 S.M.A. All authors approved the paper for publication.  
24

25 357

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27  
28 359 commercial or not-for-profit sectors

29  
30 360 **Competing interests:** No, there are no competing interests for any author.

31  
32 361 **Patient consent for publication:** Not required

33  
34 362 **Ethics approval:** Institutional Review Board approval for the study was obtained from Jazan  
35  
36 363 University, reference number (HAPO-10-Z-001).

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39 364 **Provenance and peer review:** Not commissioned; externally peer reviewed.

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41 365 **Data availability statement:** Data are available upon reasonable request.  
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### Figure legend:

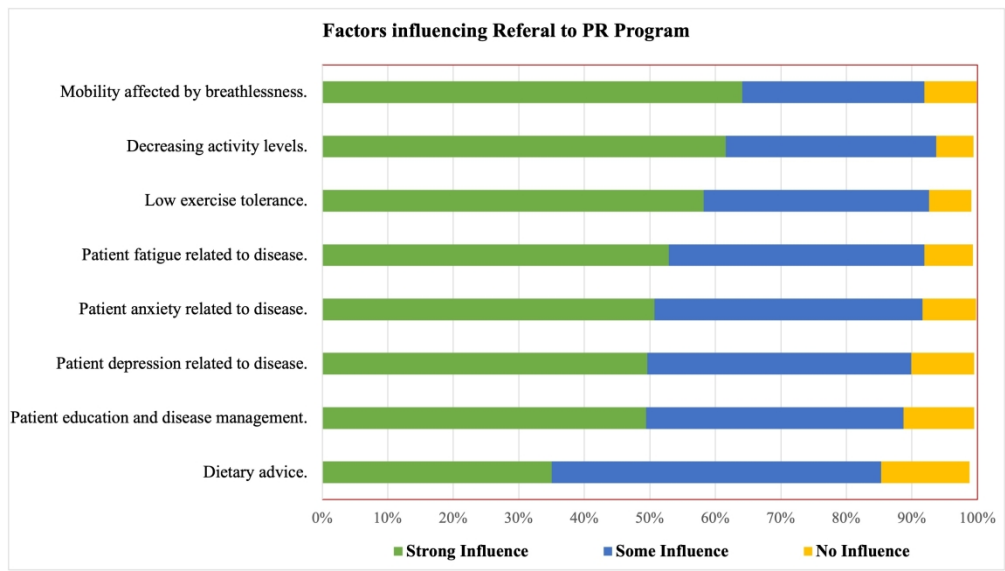
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**Figure 1:** Patient-related factors that influence referral decision to PR, using strong, some or no influence grading (n=980).

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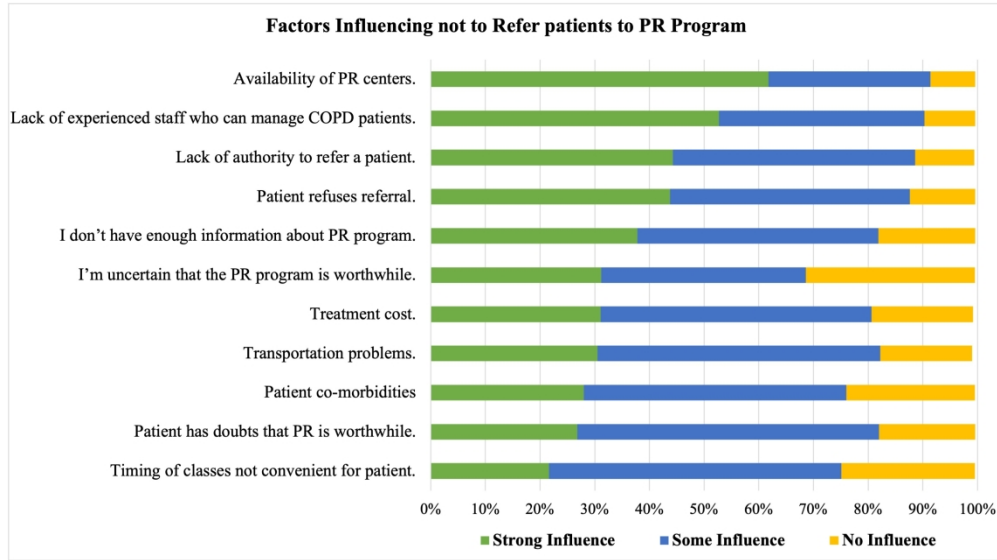
**Figure 2:** Barriers to referring COPD patients to PR from HCPs perspective, using strong, some or no influence grading (n=980).

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Patient-related factors that influence referral decision to PR, using strong, some or no influence grading.

247x139mm (330 x 330 DPI)



Barriers to referring COPD patients to PR from HCPs perspective, using strong, some or no influence grading.

247x138mm (330 x 330 DPI)



## Staff Attitudes and Expectations regarding a pulmonary rehabilitation for Chronic obstructive pulmonary disease patients.

We are aiming to understand your attitude and expectations toward delivering a Pulmonary rehabilitation programme for patients with Chronic obstructive pulmonary disease (COPD), and it would be great if you could answer this questionnaire.

Please fill out the survey, be informed that your identity will be completely anonymous and no personal identifying information will be collected and there are no consequences for refusing to participate, your participation is voluntary. This survey will only take 5 minutes to complete.

By answering the first question, you voluntarily agree to participate in this study and give your consent to use your anonymous data for research purposes.

### I. Demographic Information

1. Your Gender?

- A. Male
- B. Female

2. Your Profession?

- A. Nurse
- B. Respiratory therapist
- C. Physiotherapist
- D. Other:

3. What responsibilities do you have for the care of people with COPD? Tick all that apply.

- |   |   |   |
|---|---|---|
| <input type="checkbox"/> Diagnosis          | <input type="checkbox"/> Prescribing          | <input type="checkbox"/> Inpatient treatment        |
| <input type="checkbox"/> Non-urgent care    | <input type="checkbox"/> Ongoing management   | <input type="checkbox"/> Outpatient clinics         |
| <input type="checkbox"/> Urgent assessments | <input type="checkbox"/> Admission prevention | <input type="checkbox"/> Primary care               |
| <input type="checkbox"/> Oxygen therapy     | <input type="checkbox"/> Medication checks    | <input type="checkbox"/> Other: please give details |

4. How many years of experience do you have of caring for people with COPD?

Please enter a whole number.

## II. Perceptions of a rehabilitation programme

5. For each statement please select the answer that best suits your opinion.

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
I believe that pulmonary rehabilitation programme will improve patients exercise capacity.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I believe that pulmonary rehabilitation programme would be beneficial in reducing dyspnea & fatigue.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I believe that pulmonary rehabilitation programme will improve patient anxiety and depression	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I believe that pulmonary rehabilitation programme will improve health-related quality of life.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I believe that pulmonary rehabilitation programme would help in reducing hospital readmission	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I think that pulmonary rehabilitation will reduces the risk of COPD exacerbation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I believe that pulmonary rehabilitation programme will improve patient nutritional status	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I believe that pulmonary rehabilitation programme will improve patient disease self-management	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

6. What do you think that pulmonary rehabilitation programme for individuals with COPD should contain aside from an exercise programme? Tick all that apply.

- |   |  |
|---|--|
| <input type="checkbox"/> Information about COPD disease | <input type="checkbox"/> Symptoms management         |
| <input type="checkbox"/> Nutritional counseling         | <input type="checkbox"/> Smoking cessation           |
| <input type="checkbox"/> Psychological support          | <input type="checkbox"/> Others: please give details |
| <input type="checkbox"/> Information about medications  |  |

If other, please give details

7. **What do you think is the best way to deliver a pulmonary rehabilitation programme for this population.**

- At the hospital. Where they can follow a programme supervised by healthcare professionals.
- By using an online programme with support from a healthcare professional to answer their questions.
- At home. Where they can follow a programme manual with the support of healthcare professionals.
- By following a tailored programme with the support of health care professionals through the phone.

**III. Referral to rehabilitation programme**

8. **In your opinion, what factors might influence decision to refer COPD patients to a pulmonary rehabilitation programme?**

	No influence	Some influence	Strong influence
Mobility, affected by breathlessness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Decreased activity levels	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Low exercise tolerance	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Patient anxiety related to disease	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Depression related to disease	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Patient education and disease management	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Fatigue related to disease	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Dietary advice	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Others please give details			

9. **In your opinion, what factors might influence decision Not to refer COPD patients to a pulmonary rehabilitation programme ?**

	No influence	Some influence	Strong influence
I don't have enough information about pulmonary rehabilitation programme	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I'm uncertain that the programme is worthwhile	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Patient refuses referral	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Patient co-morbidities	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Patient has doubts that rehabilitation is worthwhile	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Transportation problems	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Timing of classes not convenient for patient	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lack of authority to refer patients	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lack of trained staff who can manage COPD patients during pulmonary rehabilitation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Treatment cost	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Availability of pulmonary rehabilitation centers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Others please give details			

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60STROBE Statement—Checklist of items that should be included in reports of *cross-sectional studies*

	<b>Item No</b>	<b>Recommendation</b>	<b>Page number Line number</b>
<b>Title and abstract</b>	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	P: 1, Line: 3
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	P: 2, Lines:46-73
<b>Introduction</b>			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	Pages 4 and 5
Objectives	3	State specific objectives, including any prespecified hypotheses	Page 5, lines:127-129
<b>Methods</b>			
Study design	4	Present key elements of study design early in the paper	Page 5 Lines:133-134
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	Page 7 Lines:163-169
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants	Page 7 Lines:163-169
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	N/A
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	Page 6 Lines:137-160
Bias	9	Describe any efforts to address potential sources of bias	N/A
Study size	10	Explain how the study size was arrived at	Page 7, Line:175
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	N/A
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	Page 7 Lines:182-185
		(b) Describe any methods used to examine subgroups and interactions	N/A
		(c) Explain how missing data were addressed	N/A
		(d) If applicable, describe analytical methods taking account of sampling strategy	N/A
		(e) Describe any sensitivity analyses	N/A
<b>Results</b>			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	Page 8 Lines:187-188
		(b) Give reasons for non-participation at each stage	N/A
		(c) Consider use of a flow diagram	N/A
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	Page 8: Table 1
		(b) Indicate number of participants with missing data for each variable of interest	N/A

Outcome data	15*	Report numbers of outcome events or summary measures	Pages 9-11
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	N/A
		(b) Report category boundaries when continuous variables were categorized	N/A
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	N/A
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	N/A
<b>Discussion</b>			
Key results	18	Summarise key results with reference to study objectives	Pages 11-12 Lines:238-245
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	Page:15 Lines:318-322
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	Pages 11-14 Lines:238-315
Generalisability	21	Discuss the generalisability (external validity) of the study results	N/A
<b>Other information</b>			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	Page 15 Line:338

\*Give information separately for exposed and unexposed groups.

**Note:** An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at [www.strobe-statement.org](http://www.strobe-statement.org).