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**Investigating primary health care practitioners' barriers and enablers to referral of COPD patients to Pulmonary Rehabilitation: an exploratory sequential mixed methods study using the Theoretical Domains Framework.**

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## Title

# Investigating primary health care practitioners' barriers and enablers to referral of COPD patients to Pulmonary Rehabilitation: an exploratory sequential mixed methods study using the Theoretical Domains Framework.

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## Key words

Chronic Obstructive Pulmonary Disease (COPD), Pulmonary Rehabilitation (PR), Primary Care, Theoretical Domains Framework (TDF). Mixed methods research.

## List of Abbreviations

PR – Pulmonary Rehabilitation  
COPD – Chronic Obstructive Pulmonary Disease  
PHCP – Primary Health Care Practitioner  
TDF – Theoretical Domains Framework

**Word Count 4179**

## Abstract

### Objectives

Pulmonary rehabilitation is a highly effective, recommended intervention for patients with COPD. Using behavioural theory to understand why referral remains low enables the development of targeted interventions in order to improve future PR referral.

### Methods

We undertook an exploratory sequential mixed methods study to investigate referral practices of Primary Health Care Practitioners (PHCPs) in the United Kingdom (UK). In phase 1 semi-structured interviews were undertaken. Content analysis was used to map themes to the Theoretical Domains Framework (TDF) and a 54-item TDF based questionnaire was developed.

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2  
3 48

4 49 In Phase 2 we distributed the questionnaire to a larger PHCP population. We used descriptive  
5 50 analyses to identify barriers and enablers, and key TDF domains. Mixing of data occurred at  
6 51 2 points; instrument design and interpretation.  
7 52

### 9 53 **Results**

10 54 19 PHCP took part in interviews and 233 responded to the survey. Integrated results revealed  
11 55 that PHCPs with a post qualifying respiratory qualification (154/241; 63.9%) referred more  
12 56 frequently (91/154; 59.1%) than those without (28/87; 32.2%).  
13 57

14 58 There were more barriers than enablers for referral in all 13 TDF domains. Key barriers  
15 59 included: infrequent engagement from PR provider to referrer, concern around patient's  
16 60 physical ability and access to PR (particularly for those in work), assumed poor patient  
17 61 motivation, no clear practice referrer and few referral opportunities. These mapped to  
18 62 domains: belief about capabilities, social influences, environment, optimism, skills and social  
19 63 and professional role.  
20 64

21 65 Enablers to referral were observed in knowledge, social influences memory and environment  
22 66 domains. Many PHCPs believed in the physical and psychological value of PR. Helpful  
23 67 enablers were out-of-practice support from respiratory interested colleagues, dedicated  
24 68 referral time (annual review) and on-screen referral prompts.  
25 69

### 26 70 **Conclusions**

27 71 Referral to PR is complex. Barriers outweighed enablers. Aligning these findings to  
28 72 behaviour change techniques will identify interventions to overcome barriers and strengthen  
29 73 enablers, thereby increasing referral of COPD patients to PR.  
30 74

### 31 75 32 76 **Strengths and limitations of this study**

33 77  
34 78 1: This is the first mixed methods study to use the Theoretical Domains Framework to  
35 79 identify barriers and enablers to pulmonary rehabilitation referral from a primary health care  
36 80 practitioner perspective.  
37 81

38 82 2: The utilisation and combination of two differing research paradigms in this exploratory  
39 83 sequential approach offers novel and detailed insights through combined research lenses  
40 84 which encompass multiple perspectives.  
41 85

42 86 3: Many geographical regions across the United Kingdom are represented and include a  
43 87 diverse range of primary healthcare practitioners.  
44 88

1  
2  
3 89 4: A combination of participant recruitment approaches have been used to reduce potential  
4 90 sample and selection biases.

5  
6 91

7  
8 92 5: Generalisability of the overall findings are limited by the inability to calculate distribution  
9 93 and therefore response rates.

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13 95

## 14 96 **Background**

15  
16 97

17  
18 98 Pulmonary Rehabilitation (PR) is a low cost, high value, internationally recommended  
19 99 intervention for COPD patients which is effective in improving exercise capacity, reducing  
20 100 the impact of symptoms and improving prognosis (1) (1) (2) (3) (4). It is a structured  
21 101 multidisciplinary intervention combining individualised exercise with disease-related  
22 102 education (4). Despite the clear evidence of its effectiveness, the proportion of COPD  
23 103 patients receiving PR is persistently low worldwide (5) (6). Our previously published  
24 104 inductive qualitative paper presented the experiences of primary health care practitioners  
25 105 (PHCPs) as key potential referrers to PR (7). We found that there was a generalised  
26 106 awareness of PR, but little detailed knowledge of either the programme or the clinical  
27 107 benefits. Relationships with PR providers were limited, but considered important. Patient  
28 108 characteristics, rather than clinical need, influenced referral offers and referrers frequently  
29 109 believed patients to be poorly motivated. PR was most commonly offered during times of  
30 110 disease stability (usually at COPD annual review) and ease of the referral process and  
31 111 financial incentives positively influenced referral. In summary, referrers reported many  
32 112 barriers but few enablers, which collectively resulted in infrequent discussions about PR and  
33 113 associated referrals.

34  
35 114

36 115 However, in order to aid the development of appropriate interventions to improve referral  
37 116 rates it is important to establish the generalisability and relative importance of these findings  
38 117 within a broader population of PHCPs. Furthermore, applying theory to identify the  
39 118 psychological and structural drivers that influence behaviour (8, 9) may offer new insights to  
40 119 shape interventions (10).

41  
42 120

43 121 The Theoretical Domains Framework (TDF) is a well-recognised approach which was  
44 122 derived from a synthesis of behaviour change theories (11, 12), and examines the processes

1  
2  
3 123 that influence behaviour (11). When applied, it offers explanations for behaviours,  
4  
5 124 highlighting reasons that may inhibit or promote (13, 14) implementation of practice-based  
6  
7 125 change (15).

8  
9 126

10 127 Using mixed methods, and applying the TDF we sought to assess and explain the reasons for  
11  
12 128 low PR referral by primary health care professionals (PHCPs) for patients with COPD. Our  
13  
14 129 aim was to inform the development of theory informed interventions to improve PR referral  
15  
16 130 rates from primary care in future.

17 131

## 18 132 **Methods**

19 133

20  
21 134 We used an exploratory sequential design defined by two separate phases (figure 1). The  
22  
23 135 cognitive and practical experiences of PHCP when considering and undertaking referral for  
24  
25 136 patients with COPD were initially explored using a deductive approach by applying the TDF  
26  
27 137 to data from our previously collected qualitative interviews. These findings informed a  
28  
29 138 second quantitative phase, where we tested themes for generalisability using a nationwide  
30  
31 139 survey of PHCP, to highlight the most relevant factors influencing referral. (16) (17) (18).

32 140

33 141

### 34 142 Figure 1 Sequential exploratory research design

35 143

36 144

37  
38  
39 145 Both data sets retained independent value and meaning, but were connected at two time  
40  
41 146 points: 1) where the qualitative data was used to construct the questionnaire and 2) where  
42  
43 147 phase 1 and 2 results were integrated to inform interpretation. The exploratory sequential  
44  
45 148 mixed methods design therefore achieves both methodological and content integration (17,  
46  
47 149 18).

48 150

## 49 151 **Patient and Public Involvement**

50 152

51 153 There has been no public and/or patient involvement in this study.

52 154

## 53 155 **Phase 1 Application of TDF to qualitative interview data.**

54 156

1  
2  
3 157 We re-analysed data from our previously published inductive qualitative study (7) in which  
4  
5 158 19 PHCPs from two differing geographical regions across Central and East of England were  
6  
7 159 recruited and interviewed to thematic saturation using a pre-designed topic guide. A  
8  
9 160 deductive approach using content analysis was used for re-analysis of the data in order to  
10  
11 161 align the results to the TDF and to offer new insights.  
12

13  
14 163 The interview topic guide (Additional file 1) was mapped to the Capability Opportunity  
15  
16 164 Motivation-Behaviour model (COM-B), a model that highlights three critical prerequisites  
17  
18 165 for behaviour change (19). This model was adopted rather than the TDF to guide interviews  
19  
20 166 primarily because of the practical need to reduce interview length without compromising its  
21  
22 167 aim. COM-B is very closely aligned to the TDF and has been utilised as a topic guide and  
23  
24 168 mapped to the TDF in a similar health care professional study (20). The topic guide allowed  
25  
26 169 the researcher (JW) to ensure theoretical informed components were covered including  
27  
28 170 prompts allowing deeper understanding relative to the target behaviour, referral to PR.  
29  
30 171 Photographic images of individuals depicting differing stages of COPD were also used to  
31  
32 172 elicit associative visual responses and to enrich behavioural understanding.  
33

## 34 173

### 35 174 **Analysis**

36 175

36 176 All interview transcripts were managed using NVivo v12. Barriers and enablers emerging  
37  
38 177 from the interviews via content analysis were mapped to the relevant TDF domain, initially  
39  
40 178 using construct labelling (11) (Additional File 2). Utterances were coded once and to only  
41  
42 179 one TDF domain to reduce duplication. JW undertook the initial coding then 5 transcripts  
43  
44 180 were randomly allocated and distributed throughout the team (RJ, PA, and SG) and  
45  
46 181 independent TDF coding occurred, followed by collaborative team discussion to ensure  
47  
48 182 agreement with the coding. Queries were discussed with a behavioural expert (IV).  
49

## 50 183

### 51 184 **Phase 2 Quantitative Methodology**

52 185 Study Design – Cross sectional survey.  
53

54 186

55 187 PHCPs were recruited via two main methods. Initially an invitation was included in a  
56  
57 188 fortnightly newsletter emailed to members of the Primary Care Respiratory Society (PCRS).  
58  
59 189 The survey was additionally distributed and shared by PCRS via their organisational Twitter  
60  
190 and Facebook accounts. Social media distribution of the survey was further increased by



1  
2  
3 191 individual and other organisational sharing, including the Facebook accounts of Advanced  
4  
5 192 Practice UK and General Practice Nurse UK. A link for questionnaire completion was  
6  
7 193 provided to the platform 'Online Survey' (21). This was open between April and December  
8  
9 194 2019. To increase participation, responders were invited to opt in to a prize draw to win an I-  
10 195 pad.

11 196

12  
13 197 Simultaneously, paper versions of the questionnaire were distributed at 6 UK conferences  
14  
15 198 between March and November 2019 to attending PHCPs (predominately by hand by JW, and  
16  
17 199 using 'in-conference bag' distribution at one event). Upon self-completion, questionnaires  
18  
19 200 were placed by participants in a locked ballot box and an optional token of appreciation was  
20  
21 201 offered. Paper questionnaires were manually entered onto 'Online survey' by JW.

22 202

23  
24 203 As this was exploratory research, no *a priori* sample size calculations were performed. A  
25  
26 204 pragmatic approach to study closure was adopted, this being online availability for a period  
27  
28 205 of 8 months, distribution of the questionnaire at several appropriate PHCP targeted events,  
29  
30 206 and that a representative range of PHCP had responded.

31 207

### 32 208 **Methodology– Instrument Design**

33 209

34  
35  
36 210 The cross-sectional survey (Additional file 3), collected (1) individual socio-demographic  
37  
38 211 data, (2) current referral experiences, using TDF-based Likert scale questions (n=54) and (3)  
39  
40 212 any new or complementary issues which may not have been previously mentioned, using an  
41  
42 213 optional open question (22).

43 214

#### 44 215 Socio-demographic data

45 216

46  
47  
48 217 These included questions on geographical location of practice, job title, post-qualifying  
49  
50 218 respiratory education and estimated frequency of PR referrals, using questions with pre-  
51  
52 219 specified options.

53 220

#### 54 221 Psychometric data

55 222

56  
57  
58 223 Barriers and enablers for PR referral identified from the phase 1 qualitative findings were  
59  
60 224 converted into belief statements (11), including some that sought to test direct understanding.

225 All questions were generated and aligned to the TDF by the coder (JW) and validated by  
 226 other team coders (RJ), including a TDF expert (IV). 54 closed, fully labelled 5-point, Likert  
 227 scale questions/belief statements were included with responses ranging from ‘strongly  
 228 disagree’ to ‘strongly agree’ and a mid-point rating. Some statements were reversed as an  
 229 opposite belief to that frequently reported in the phase 1 data. These design elements were  
 230 purposely selected to improve reliability and validity (23).

231

232 The final survey mapped the 54 belief statements and open question section to 12 out of 14  
 233 theoretical domains (‘emotion’ and ‘behavioural regulation’ was excluded, given its low  
 234 mapping in phase 1 results). Two rounds of survey piloting were undertaken with five  
 235 practice nurses and the questionnaire refined to ensure question clarity and clearer  
 236 completion instructions.

237

## 238 **Analysis**

239

240 All data were exported into an excel spreadsheet and STATAv16 used to conduct simple  
 241 descriptive statistics (frequencies and percentages), dichotomising into Agree/Strongly Agree  
 242 vs the remaining options. Free text that directly related to barriers and enablers of referral  
 243 practice was content-mapped to the TDF and thematic analysis applied (24).

244

## 245 **Results**

### 246 **Response rates.**

247

248 Table 1 shows paper survey distribution (>1100 across 6 events) and return rates for phase 2.  
 249 154 questionnaires were returned and 134 (83%) had completed the survey sufficiently and  
 250 were included. Online, it is unknown how many potential practitioners read the survey  
 251 invitation, therefore participation rates could not be calculated. 123 participants started the  
 252 online survey, but only 99 (80.5%) completed it and were included in the analysis.

253

### 254 Table 1 Paper survey distribution

Conference	Attendee number and profile	Number distributed	Number Returned
------------	-----------------------------	--------------------	-----------------

Conference 1 – GPN	Unable to obtain attendance number (Community & general practice nurses) @ 170	117	33 (28%)
Conference 2 - RCGP	141 (68 GPs inc registrars)	48	24 (50%)
Conference 3 - NIP-N	171 (Community & general practice nurses)	47	26 (55%)
Conference 4 - NIP-M*	382 (Community & general practice nurses)	382 - 400	36 (9.4-9%)
Conference 5 – NIP-C	236 (Community & general practice nurses)	51	31 (61%)
Workshop – PCRS	27 (Community & general practice nurses, 4 GP's, pharmacist x2)	8	4 (50%)
Total	@ 1,127	653-671	154 (23-23.6%)

\*Surveys placed in conference bags

GPN = General Practice Nurses, RCGP = Royal College of General Practitioners, NIP = Nursing in Practice (N=Northampton, M =Manchester, C =Cardiff), PCRS = Primary Care Respiratory Society.

## Description of participants

Table 2 presents the socio-demographic characteristics for all participants in the phase 1 qualitative (n=19) and phase 2 quantitative (n=233) studies.

The qualitative study included a greater proportion of GPs (6/19, 32%) compared with the survey respondents (29/233, 12.5%), who were also predominantly female, and nurses. Nurse respondents were similarly distributed across both conference and online groups (110/134, 82.1%; and 76/99, 76.9% respectively) and responders from both sources had similar time working in practice. However, respondents recruited through conferences, compared to those who responded online, tended to be younger (28% < 40 years of age), more likely to be practice nurses rather than other types of professionals, but were less likely to have respiratory qualifications, to see COPD patients or to refer them to PR.

Table 2 Baseline demographics of all participants

		Phase 1 Interviews (n=19) (%)	Phase 2 Survey (n=233)		Total (n=233)
			Conference (n=134) (%)	Online (n=99) (%)	
<b>Primary Health Care Practitioner Role</b>	General Practitioner (GP)	6 (32)	18 (13.4)	11 (11.1)	29 (12.5)
	Advanced Nurse Practitioner (ANP)	4 (21)	25 (18.7)	32 (32.3)	57 (24.5)
	Practice Nurse (PN)	7 (37)	85 (63.4)	44 (44.5)	129 (55.4)
	Emergency Care Practitioner (ECP)	-	1 (0.8)	1 (1)	2(0.9)
	Pharmacist	-	-	4 (4)	4 (1.7)
	Health Care Assistant (HCA)	1 (5)	-	1 (1)	1 (0.4)
	Other	1 (5)	5 (3.7)	6 (6.1)	11 (4.7)

	<b>Total responses</b>	19 (100)	134/134 (100)	99/99 (100)	233/233 (100)
<b>Sex</b>	Female	14 (74)	115 (91.3)	92 (92.9)	207 (92)
	Male	5 (26)	11 (8.7)	7 (7.1)	18 (8)
	<b>Total responses</b>	19	126/134 (94)	99/99 (100)	225/233 (96.6)
<b>Age (years)</b>	18-29	Data not collected	5 (3.8)	2 (2)	7 (3.0)
	30-39		32 (24)	11 (11.1)	43 (18.5)
	40-49		36 (27.1)	40 (40.4)	76 (32.8)
	50-59		49 (36.8)	40 (40.4)	89 (38.4)
	60 +		11 (8.3)	6 (6.1)	17 (7.3)
	<b>Total responses</b>		133/134 (99.3)	99/99 (100)	232/233 (99.6)
<b>Ethnicity</b>	White British	Data not collected	112 (84.2)	87 (87.9)	199 (85.7)
	White other		8 (6)	4 (4.1)	12 (5.2)
	Asian/Asian British		7 (5.3)	3 (3)	10 (4.3)
	Mixed Multiple Ethnic Groups		1 (0.7)	2 (2)	3 (1.3)
	Black/African/Caribbean/Black British		2 (1.4)	-	2 (0.9)
	Other ethnic group		3 (2.4)	3 (3)	6 (2.6)
	<b>Total responses</b>		133/134 (99.3)	99/99 (100)	232/233 (99.6)
<b>Practice Geographical Location</b>	Scotland	-	1 (0.8)	3 (3)	4 (1.7)
	England North East and West	-	31 (23.6)	15 (15.1)	46 (20)
	Yorkshire and the Humber	-	8 (6.1)	6 (6.1)	14 (6)
	Midlands (East and West)	9 (45)	20 (15.3)	16 (16.1)	36 (15.8)
	East of England	10 (55)	23 (17.5)	18 (18.2)	41 (17.8)
	Wales	-	31 (23.6)	-	31 (13.5)
	London	-	3 (2.4)	6 (6.1)	9 (3.9)
	South (East and West)	-	14 (10.7)	35 (35.4)	49 (21.3)
	<b>Total responses</b>	19 (100)	131/134 (97.8)	99/99 (100)	230/233 (98.7)
	<b>Years in General Practice</b>	< 5	Data not collected	39 (29.9)	23 (23.2)
6- 10			26 (19.8)	25 (25.3)	51 (22.2)
11-15			18 (13.7)	18 (18.2)	36 (15.7)
16-20			22 (16.8)	14 (14.1)	36 (15.7)
21 +			26 (19.8)	19 (19.2)	45 (19.4)
<b>Total responses</b>			131/134 (97.8)	99/99 (100)	230/233 (98.7)
<b>Currently see COPD patients</b>	Acute Management	Data not collected	9 (6.7)	5 (5)	14 (6)
	Chronic Management		30 (22.6)	26 (26.3)	56 (24)
	Acute and Chronic management		81 (60.9)	67 (67.6)	148 (64)
	Don't see COPD patients		13 (9.8)	1 (1)	14 (6)
	<b>Total responses</b>		133/134 (99.3)	99/99 (100)	232/233 (99.6)
<b>CPD Respiratory Qualifications*</b>	None	7 (36.8)	62 (46.3)	19 (19.2)	81 (34.8)
	COPD Diploma	-	28 (20.9)	50 (50.5)	78 (33.5)
	Asthma Diploma	-	38 (28.4)	52 (50.5)	90 (38.6)
	ARTP Spiro	-	34 (25.4)	40 (40.4)	74 (31.8)
	Other	12 (63.2)**	16 (11.9)	26 (26.3)	42 (18)
	> one qualification	-	32 (23.9)	51 (51.5)	83 (35.6)
	<b>Total responses</b>	19	210	238	448
<b>Reported PR referral practice</b>	Yes (frequency not specified)	-	-	11 (11.1)	11 (4.7)
	Weekly	1 (5.3)	16 (12)	32 (32.3)	48 (20.7)
	Monthly	10 (52.6)	40 (30.1)	21 (21.2)	61 (26.3)
	< Monthly	9 (47.4)	43 (32.3)	29 (29.3)	72 (31)
	None	0	34 (25.6)	6 (6.1)	40 (17.3)
	<b>Total</b>	19	133/134 (99.3)	99/99 (100)	232/233 (99.6)

274

## 275 Referral to PR by type of healthcare professional

276

277 Overall, 109 (49.1%) reported being frequent referrers to PR, with GPs being less likely to  
 278 refer and other professions including emergency care practitioners and nurse practitioners and  
 279 ANPs more likely to refer. Referral was also higher among those with one or more

280 continuous practice development (CPD) respiratory qualifications. However, this may be  
 281 partly related to such qualification being higher among ANPs (82.5% (47/57)) and other  
 282 grouped professions (58.8% (10/17)) than among GPs (17.9% (5/28)). More than 10 years  
 283 spent in general practice appeared to marginally increase referral frequency (60.7%; 51.8%).

284

285 Table 3 PHCP referral practice\*

	Frequent Referral n (%) (weekly or monthly) Total n=109	Infrequent referral n (%) (>monthly or no referral) Total n=113
Staff type		
GP (n=28)	10 (35.7)	18 (64.3)
PN (n=120)	57 (47.5)	63 (52.5)
ANP (n=57)	32 (56.1)	25 (43.9)
Other (ECP/NP/Pharm/HCA) (n=17)	10 (58.8)	7 (41.2)
CPD Respiratory Qualification	84 (77.1)	59 (52.2)
Years in Practice > 10 years**	65/107 (60.7)	58/112 (51.8)

286 \*11/99 online PHCPs specified that they referred to PR but did not specify referral frequency and were removed  
 287 from this analysis.

288 \*\* 107/109 and 112/113 reported time spent in general practice

289

290 40/233 (17.2%) responding PHCPs reported never referring to PR, with the largest group  
 291 being practice nurses (29/40; 72.5%). 33 of 40 PHCPs offered a variety of reasons for non-  
 292 referral including; not considering it to be part of their role, not seeing COPD patients or not  
 293 knowing they could refer (12/33; 36.4%). Others reported it was undertaken by other  
 294 respiratory specialist/interested health care professionals across primary and secondary care  
 295 settings (12/33; 36.4%). Further reported reasons were unsure how to and/or a lack of  
 296 training (5/33; 15.1%), uncertainty about local service provision (3/33; 9.1%) and 1/33  
 297 (3.0%) reported belief that patients were not interested.

298

### 299 **Phase 1 Results: TDF analysis of the qualitative interviews**

300 Table 4 shows the referral behaviour of PHCPs mapped to all 14 TDF domains. The most  
 301 frequently mapped domain was social and professional role (n=287 times) whilst the least  
 302 mapped was behavioural regulation (n=4).

303

304

305

306

307

308 Table 4: Phase 1 Mapping of barriers and enablers for referral to TDF domains

309

TDF Domain (construct mapping frequency)	Content mapping (n)	Key points	Evidence supporting
<b>1.Social and Professional Role</b> (A coherent set of behaviours and displayed personal qualities of an individual in a social or work setting)	(n=289)	<p>Referral was considered everyone's role, however it was considered best undertaken by the PHCP during disease stability and at annual review. It was often considered to be the practice nurses' role, but also respiratory-interested others.</p> <p>Most PHCPs considered it their duty of care to motivate patients.</p> <p>Only 1 of 19 PHCPs described implementing practice leadership to improve PR awareness and/or referral.</p>	<p><i>It is largely the nurses' job to see stable COPD patients at an annual review and that is the most appropriate time to refer to pulmonary rehabilitation, not during an acute exacerbation' –GP5</i></p> <p><i>No, I think it's everybody's role, I mean I'm not sure about my non-respiratory colleagues. PN2</i></p> <p><i>So we've put forward a proper business case for it. (Local PR service). GP4</i></p>
<b>2.Knowledge</b> (An awareness of the existence of something)	(n=256)	<p>17 of 19 PHCPs knew of the existence of PR and a generalised understanding of its purpose. PR Knowledge was reported to be gained through post qualification education and networking events.</p> <p>Local PR knowledge such as programme timing, waiting list (if any), and availability of patient transport, was often unknown and were described as inhibitors to referral discussions.</p> <p>The referral criteria Medical Research Council (MRC) dyspnoea Score <math>\geq 3</math> was frequently cited as a referral prompt, although some PHCPs wanted to refer patients with MRC scores of 2 and felt unable to.</p>	<p><i>I think it's a fundamental treatment and I think it's better than drugs. PN7</i></p> <p><i>Do you currently refer to PR? P -I wouldn't know where. GP2</i></p> <p><i>I don't know how to describe pulmonary rehab to a patient. GP3</i></p> <p><i>I just feel that we don't know enough about the program to confidently hand on your heart sell it. PN1</i></p> <p><i>'We've also got the barrier of we can only refer if their MRC is 3 or 4 or 5' PN5</i></p>
<b>3. Environment</b> (Any circumstance of a person's situation or environment that discourages or encourages the development of skills and abilities,	(n=195)	<p>PR referral was often considered inappropriate in non-COPD focused consultations or when a patient was consulting for an acute exacerbation. Clinical time constraints were often described as inhibiting referral, although annual review considered appropriate time</p>	<p><i>I think in our role when you're treating potentially acutely unwell people in a really limited time span then it's, it is realistically going to be hard to cover everything, really hard. ANP2</i></p>

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<p>independence, social competence, and adaptive behaviour)</p>		<p>because of its clinical focus, template design and longer consultation time.</p> <p>PHCPs often stated little PR promotional material was available in practice for patients or staff; there were however mixed views on the potential value of this.</p> <p>3 practices had initiated an in-practice 12 weekly, 1 hour generic exercise group, this appeared to be seen as equivalent to PR by 1 PN.</p>	<p><i>On the annual review well I follow the template and when I get to the pulmonary rehab I mention it then and I say, 'Would you like to go?' PN3</i></p> <p><i>It would be useful for our local organisation I think to give us some little leaflets about what they do so we can give that to patients about the local service ANP4</i></p> <p><i>I'm not against a leaflet but have you seen how many posters and leaflets we have on our walls? GP2</i></p>
<p><b>4. Belief about capabilities</b> (Acceptance of the truth, reality, or validity about an ability, talent, or facility that a person can put to constructive use)</p>	<p>(n=141)</p>	<p>Individual PHCP PR referral confidence varied, with particular uncertainty expressed in how to best 'sell PR' and how to motivate un-motivated patients. Although most were confident in reassuring patients that PR would improve breathlessness.</p> <p>PHCPs with positive non-pharmacological and exercise beliefs appeared to have greater confidence in PR benefit and patients' abilities</p> <p>A number of PHCPs described COPD patients as uninterested in improving their health and some PHCPs emphasised patients needed to be committed to PR. Whilst some PHCPs described 'knowing' which patients would accept referral, others described undertaking subjective patient assessment and expressed concerns about patients' exercise capability in the presence of breathlessness.</p> <p>For patients receiving oxygen therapy there was much uncertainty of the benefit of PR and an assumption that Oxygen/secondary care teams would have previously offered this.</p> <p>Most PHCPs considered key environmental factors such as session timing, venue accessibility, patient financial hardship, as barriers for most patients. Patients in work, or</p>	<p><i>I would need to feel confident, before I speak to this patient about it. ANP4</i></p> <p><i>I quite like... Non-medicinal treatment...think if you're excited by it then it's easier for patients to get excited by it as well. GP4</i></p> <p><i>They are also very very clear that there not going to take anyone on their course unless there is 100% commitment at the beginning that they are going to complete the course. ANP1</i></p> <p><i>You look at the ones that you think would more likely go. ANP4</i></p> <p><i>It's really basically where I see a need, where I see they can benefit – ANP1</i></p> <p><i>If the patients already on oxygen therapy, then it's likely that they've already been seen by them. HCA</i></p> <p><i>The main stumbling block is that you come across is " I'm not going every week for x number of weeks, I can't afford it, I haven't got that much time, how do you expect me to get there ....not a huge number of our patients drive. GP4</i></p>

		those able to take the dog for a walk/wearing walking boots were considered 'too well' for PR.	<i>There's some patients that I would like to refer but they can't go because of work commitments. PN3</i> <i>'It's quite surprising that some patients are still working at odd jobs and things like that and keep them very active. So, for those patients it's not so important.'</i> PN3
<b>5.Memory (Inc: Decision making)</b> (The ability to retain information, focus selectively on aspects of the environment and choose between two or more alternatives)	(n= 118)	Some PHCPs reported forgetting to refer patients to PR, however, embedded system reminders often found in COPD review templates or on-screen prompts were cited as important for most PHCPs.  Patient behaviour and clinical presentation altered decision making processes for some PHCPs for example not referring current smokers, or remembering PR in light of increasing COPD symptom burden and disease deterioration, whilst earlier concerns for patient capability and commitment became less apparent.	<i>I do need a reminders because my head's full, so as I say, I don't want to tick boxes but I do need a prompt.'</i> PN7  <i>That's something that we do, so we have a prompt that pops up saying has this patient been referred to pulmonary rehab. GP5</i>  <i>I think I go through phases, I'll do it really well for a while and somebody has motivated me and then I'll forget that and do something else. PN7</i>  <i>Breathlessness and exacerbations, I think, would be the key factors. GP3</i>
<b>6.Optimism</b> (The confidence that things will happen for the best or that desired goals will be attained)	(n=110)	PHCPs frequently reported that patients did not want to attend PR, citing disease stigma and lack of activation as underlying reasons.  Negative patient responses appeared to dampen PHCPs optimism and reduce subsequent referral offers. Positive patient experience however had the opposite effect.  Positive and negative perceptions of PR providers were also reported on the basis of service quality and frequency of referral acceptance, this appeared to influence referral behaviour.	<i>The first thing you think, 'Are they going to do it?'</i> ANP4  <i>Patients don't want it. PN5</i>  <i>Even if you then said what the evidence was and how you could improve, it's – I think that group of people are really difficult to engage .GP3</i>  <i>If they're negative anyway everything you suggest they sort of have an answer, 'Oh no that won't work. PN4</i>  <i>The longer the wait time, the less likely they are to turn up. HCA</i>  <i>I don't think it's the greatest service, it does have an impact because I'm not going to tell my patients to go. PN7</i>



<p><b>7. Belief about consequences</b> (Acceptance of the truth, reality, or validity about outcomes of a behaviour in a given situation)</p>	<p>(n=107)</p>	<p>There was a general sense that PR is positive with many health and psychological benefits, but beliefs captured in other domains impacted on PHCP belief about consequences of referral offer. A small number of PHCPs expressed concern that PR might worsen patient’s depression and/or anxiety, particularly for those socially isolated.</p>	<p><i>I’ve seen patients that have been... their lives have been transformed in the first year. PN7</i></p> <p><i>Might have prevented the exacerbation if they’d gone PN5</i></p> <p><i>I will say that when I’m talking to patients, say it’s better than drugs, but I still get a closed reaction. PN7</i></p> <p><i>If we can improve patient’s breathing they’re less likely to get anxious, that makes them less likely to dial 999 or likely to do something about it. And perhaps use their rescue packs more appropriately. ANP4</i></p> <p><i>I wouldn’t want to mention it if it ended up being that I’m saying there’s this really good helpful programme but actually if she’s so effected by her disease that she doesn’t leave the house then I wouldn’t want to have mentioned it and then not for her not to be able to go. ANP2</i></p>
<p><b>8. Social Influences</b> (Those interpersonal processes that can cause individuals to change their thoughts, feelings, or behaviours)</p>	<p>(n=84)</p>	<p>Out of practice engagement from PR providers and PR advocates were important in increasing overall awareness and positively influencing referral behaviour.</p> <p>Almost all PHCPs described little to no engagement from providers themselves, and described not knowing what had happened to completed referrals.</p> <p>PHCPs also reported that positive patient PR experiences positively influenced PHCPs referral behaviour and that family can be influential, yet patients rarely ask for PR.</p> <p>PHCPs described a need to increase PR’s profile publicly and for it to be marketed similarly to pharmacological treatments. The name PR itself was considered by some PHCPs to be a negative influence as ‘rehab’ was deemed to have undesirable connotations.</p>	<p><i>Our referral rate has gone up a lot since the respiratory MDT’s because every single one of those patients has subsequently had a referral. GP4</i></p> <p><i>At the moment I wouldn’t know how many people we refer, is that referral going up, Nobodies giving us feedback from the rehab team about how we are doing as a surgery. PN1</i></p> <p><i>If patients that have been to it you know express a positive experience that is something you can share with other people that you are trying to refer. GP1</i></p> <p><i>I asked him to talk to his wife, because I knew she’d want him to go, because I know her through a different channel, and erm... he’s come back and said ‘Ooo I’ll give it a shot. PN5</i></p>

			<i>Nobody has picked up a leaflet and walked in with it and said can you refer me, nobody has. ANP1</i>
<b>9.Skills</b> (An ability or proficiency acquired through practice)	(n=79)	<p>The physical act of referring patients to PR were described as largely straightforward by most PHCPs, although there was no standardised process across the 2 regions.</p> <p>Most undertook this action independently, although there were descriptions of practice administrators helping.</p> <p>However, frequency of referral to PR when described in interviews, was far lower than that which was documented on the returned research interest form.</p>	<p><i>Do you currently refer people to pulmonary rehab? Some, some. PN7</i></p> <p><i>I've been at this practice for nearly three years now and it's sort of something that falls really far down on your list of things that you do on your COPD review, so it's always the last thing that you come to. GP4</i></p> <p><i>It's very easy. It's a form erm it's a just a single sheet. PN2</i></p> <p><i>Quicker, easier referral, much easier referral method PN7</i></p>
<b>10.Reinforcement</b> (Increasing the probability of a response by arranging a dependent relationship, or contingency, between the response and a given stimulus)	(n=59)	<p>There appeared to be no direct sanctions for non-referral of patients, although practice financial rewards in one region appeared to enhance awareness and referral.</p> <p>Outside of these practices there was a suggestion that financial incentives would be advantageous, additionally calculating health cost benefit for PR attendance was suggested as potential enabler.</p> <p>Additionally reinforcements such as those offered by social influences and patients were also described to be valuable.</p>	<p><i>We've got this thing called A** that we're doing for, you know it was the QOF before, so like A** has taken over that so I think because of the A** the doctor who is the lead A** leader he discusses that a lot because of course you get points, you still get the points for it like QOF. So the more we refer is the more points we get so there's an incentive there for the practice. PN6</i></p> <p><i>Yeah if they did something on the BBC or something they might all be in the next day saying, 'Oh I wanna do that'. PN4</i></p> <p><i>If you spent 5 minutes with somebody then at the end of that they agreed to go and then they attended, then you would be motivated to do it again. GP5</i></p>
<b>11.Goals</b> (Mental representations of outcomes or 'end states' that an individual wants to achieve)	(n=47)	<p>Referral to PR was a low-level goal for most PHCPs, but one that varied by consultation type and was not considered during an acute exacerbation review. However, referral appeared to become a goal in the presence of worsening patient symptoms.</p>	<p><i>As a practice, when we do the acute exacerbation we're pretty much focus on the acute exacerbation. GP4</i></p> <p><i>I refer a few to pulmonary rehab but I don't do as many as I feel I should. PN7</i></p>

		<p>Some PHCPs described wanting to refer more patients and learning strategies to improve patient acceptance, but described frequent discord between PHCP and patient goals which PHCPs found challenging.</p> <p>No PHCPs discussed set practice PR referral targets although one GP reported plans to set up a programme geographically closer to practice (captured as leadership in the domain social &amp; professional.)</p>	<p><i>She was more receptive because she'd had a few flares up, not after the first one but because she's had a few. And I think that makes them more receptive to doing that sort of thing. ANP4</i></p> <p><i>One hand I'm wanting them to engage with the disease process so that actually they've got more skills to self-manage and that's going to actually keep them much better for the rest of their life, on the other hand they don't want to be classified as ill. ANP1</i></p> <p><i>It would help me in trying to find out why she didn't go because I would challenge her on it and try and get her to go again and give it another go and that would help me in. ANP4</i></p>
<p><b>12.Intentions</b> (A conscious decision to perform a behaviour or a resolve to act in a certain way)</p>	(n=39)	<p>Some PHCPs have described adopting patient-aimed strategies that included persistence and warnings against overreliance and/or possible reduced effectiveness of pharmacological treatments in an effort to move patients to a state ready for PR referral.</p> <p>There also appeared to be an understanding that acceptance for many patients takes time.</p>	<p><i>I said you know you've used those rescue packs a lot you know if we could get your breathing a bit better, perhaps you wouldn't be so bad...., and she said, alright then I'll see, do the referral. ANP4</i></p> <p><i>How would you feel about something that's not medicine based but will probably help you as much as the inhalers that we've put you on, she was suddenly very interested in. GP4</i></p> <p><i>I look for that chink of interest and then I'll try and worm my way in then. PN7</i></p> <p><i>He was very adamant that he didn't want to go, then I gave him the booklet. PN5</i></p>
<p><b>13.Emotion</b> (A complex reaction pattern, involving experiential, behavioural, and physiological elements, by which the individual attempts to deal with a personally significant matter or event)</p>	(n=6)	<p>PHCPs emotion was rarely discussed although some said they felt annoyed with providers if a referral had been rejected.</p> <p>There were high levels of empathy towards patients particularly amongst nurses; a small number described not</p>	<p><i>Most of our patients are reasonably trusting and say well you seem quite excited by it so shall we give it a try. GP4</i></p> <p><i>They're gonna meet all these people they don't know and be told to lift this walk here, do that and they're frightened, its... I'd be terrified. PN5</i></p>

		<p>wanting to offer the hope of PR to patients and for PR providers to reject referral, this appeared to be a particular concern for patients with high disease burden.</p>	<p><i>I just don't want to raise – if you raise patients' hopes and say – and offer it, then it can make them – you know, if they're already depressed because of the COPD, it could just make the depression worse you know, so I don't want to impact on their mental wellbeing. ANP1</i></p>
<p><b>14. Behavioural regulation</b> (Anything aimed at managing or changing objectively observed or measured actions)</p>	<p>(n=4)</p>	<p>Some PHCPs saw events such as hospital admissions/out-patient appointments as good opportunities for patients to change behaviours but for staff in those settings to instigate referral.</p> <p>PHCP personal behavioural regulation was low, many did not know how any they had referred or what, post referral, the patient's journey had become. One participant described the research interview as helpful in allowing them to consider how to change their referral approach, but most PHCPs did not vocalise intentions to change or modify current or future PR referral behaviours.</p>	<p><i>I don't know how much is done in secondary care, but very often when stuff, when you've been in anywhere near secondary care people really its often quite a sit up moment, gosh this is serious enough for me to have to go to hospital, even if it an outpatient appointment. ANP1</i></p> <p><i>This is one of your treatment choices' and perhaps I need to change, thinking about it, my approach in – er, how I word it. ANP4</i></p> <p><i>It's trying to make it a priority. ANP4</i></p>

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312 **Phase 2. Questionnaire results: Referral practice beliefs.**

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314 Table 5 presents the number and proportion of PHCPs that agreed or strongly agreed with each belief statement by frequency of referral.

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320 Table 5 Results of TDF belief statements by referral frequency

TDF Domain	TDF Questions (n=54)	Frequent referral n=109 (%) (weekly/monthly)	Infrequent referral n=113(%) (>monthly or no referral)	Total n=222(%)
1.Knowledge	I am aware of the content of Pulmonary Rehabilitation (PR) Programmes	97/109 (89.0)	72/113(63.7)	169/222 (76.1)
	I am aware of PR programme objectives.	99/109 (90.8)	75/113 (66.4)	174/222 (78.4)
	I am unsure of the evidence base for PR	18/109(16.5)	30/113 (26.5)	49/222(21.6)
	I know where geographically my local PR programme is delivered	92/109 (84.4)	70/113(61.9)	162/222 (73.0)
	I know when it is appropriate to refer a patient with COPD to PR	106/109 (97.3)	74/113 (65.5)	180/222 (81.1)
	I can answer questions patients have about PR	88/109 (80.7)	60/113 (53.1)	148/222 (66.7)
	I know how to contact my local PR provider	91/109(83.2)	68/113 (60.2)	159/222 (71.6)
2.Skill	It is easy to refer a patient to PR	87/109 (80.0)	48/113 (42.5)	135/222 (60.8)
3.Social & Professional Role	Referral to PR is the practice nurse role	63/109 (57.8)	45/113 (39.8)	108/222(48.6)
	Other General Practice staff in my practice (excluding Practice Nurse) refer patients to PR	52/109(47.7)	63/113(55.8)	115/222 (51.8)
	I believe in encouraging patients to attend PR	109/109 (100)	104/112 (92.9)	213/221 (96.4)
4.Environment	Resources about PR (i.e written information) are readily available	39/109 (35.7)	25/112 (22.3)	64/221 (29.0)
	There is not enough time in practice to refer	12/109 (11.0)	22/113 (19.5)	34/222(15.3)
5.Social Influences	My local PR providers regularly engage with me	31/109 (28.4)	17/113 (15.0)	48/222 (22.6)

	PR is something that patients ask for	3/109 (2.8)	8/112 (7.1)	11/221 (5.0)
	There are good relationships in practice with PR providers	44/109 (40.4)	28/112 (25.0)	72/221 (32.6)
	PR providers are good at communicating outcomes of referrals I have made	39/109 (35.8)	25/112 (22.3)	64/221 (29.0)
6.Optimism (including pessimism)	I am confident my local PR provider offers a good service for my patients.	81/109 (74.3)	52/113 (46.0)	135/222 (60.8)
	I don't believe patients will attend PR after I have referred	16/109 (14.7)	16/113(14.2)	32/222(14.4)
	Patients who smoke are not motivated to take part in PR	7/109 (6.4)	7/113 (6.2)	14/222 (6.3)
	Patients who live alone won't like to take part in group PR	5/109 (4.6)	2/113 (1.8)	7/222 (3.2)
	Patients are motivated to attend PR	23/109 (21.6)	30/111 (27.0)	53/219 (24.2)
7.Belief about Capabilities (self)	I am confident in my ability to encourage patients to attend PR, even when they are not motivated	91/109(83.5)	73/113 (67.6)	164/222 (73.9)
	I do not find it easy to discuss PR with patients.	8/109(7.3)	25/113 (22.1)	36/222(16.2)
Belief about capabilities (patients)	Patients without their own transport won't be able to get to PR	40/109(36.7)	26/113 (23.0)	66/222 (29.7)
	Patients in work are not able to attend PR	62/109 (56.9)	35/113 (31.0)	97/222 (43.7)
	Patients who use home oxygen are unable to take part in PR	4/109(3.7)	6/113 (5.3)	10/222 (4.5)
8.Belief about consequences	If I keep pushing patients to attend PR this will disadvantage my relationship with them.	10/109 (9.2)	10/112 (8.9)	20/221 (9.0)
	I believe patients may be harmed by taking part In PR	1/109 (0.9)	1/113 (0.9)	2/222(0.9)
	I believe most patients will attend and complete PR following my referral	55/109 (50.4)	47/112 (42.0)	102/221 (46.2)
	PR is not beneficial to patients who are breathless	3/109(2.8)	3/113(2.7)	6/222 (2.7)

	PR is best suited to those patients with worsening breathlessness	29/109 (26.6)	29/112 (25.9)	58/221 (26.2)
	PR is <b>best</b> suited to those who have frequent exacerbations	27/109 (24.8)	28/112 (25.0)	55/221 (24.9)
	PR reduces hospital admissions	101/109 (92.7)	97/112 (86.6)	198/221 (89.6)
	PR reduces risk of mortality	85/109 (78.0)	82/112 (73.2)	167/221 (75.6)
	If patients attend PR this will reduce their general practice visits	73/109 (67.0)	78/112 (69.6)	151/221 (68.3)
	PR reduces exacerbations	88/109 (80.7)	84/112 (75.0)	172/221 (77.8)
	PR improves breathlessness	103/109 (94.5)	100/112 (89.3)	203/221 (91.9)
	PR reduces a patient's anxiety and/or depression.	97/108 (89.8)	96/112 (85.7)	193/220 (87.7)
9..Goals	Referring patients to PR is something I have been advised to do	95/107(88.8)	57/112(50.9)	152/219 (69.4)
	My practice regularly reviews COPD registers to ensure eligible COPD patients are offered PR	51/109 (46.8)	40/113 (35.4))	91/222 (41.0)
	There are set targets within the practice to improve PR referral rates	23/109 (21.1)	21/113 (18.6)	44/222 (19.8)
10. Memory (Inc.Decision Making)	I often forget to refer patients with COPD to PR	3/109 (2.8)	23/113 (20.4)	26/222 (11.7)
	Prompts to refer patients to PR within annual review templates are important reminders for me	72/109 (66.1)	69/112 (61.6)	141/221 (63.8)
	I only refer patients if they have quit smoking	1/109 (0.9)	3/113 (2.7)	4/222 (1.8)
	I only refer patients if they are optimised on their respiratory medication	17/109 (15.6)	12/113 (10.6)	29/222 (13.1)
	PR is most suited to COPD patients who have frequent exacerbations	20/109 (18.3)	20/113 (17.7)	40/221 (18.1)

	The best time to discuss PR referral with patients is when they are stable.	32/109 (29.4)	25/112 (22.3)	57/221 (25.8)
11.Reinforcement	More health care practitioners will discuss PR with patients because of the QoF incentive.	75/109 (68.8)	73/112 (65.2)	148/221 (67.0)
	My practice receives financial incentives for referral to PR (Before April 2019)	6/108 (5.6)	5/113 (4.4)	11/221 (5.0)
	I believe patient attendance to PR will increase because of the QoF Incentive.	41/109 (37.6)	58/112 (51.8)	99/221 (44.8)
	I believe the QoF incentive will not increase patients PR attendance	29/109 (26.6)	25/112 (2.3)	54/221 (24.4)
	There will be greater awareness of PR within practices because of the new QoF incentives.	84/109 (77.1)	71/112 (63.4)	155/221 (70.1)
12.Intentions	I will refer more patients to PR now there are practice QoF incentives (from April 2019)	30/109 (27.5)	42/112 (37.5)	72/221 (32.6)



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3 322 In general, most PHCPs had some PR knowledge (especially the frequent referrers) and  
4 323 understood the beneficial consequences of PR. However, resources, social influences (such as  
5 324 relationship with PR providers) and pessimism about patient motivations were perceived  
6 325 barriers by a high proportion of PHCPs, irrespective of their referral practice.  
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11 327 There were however, differences in domains between frequent and infrequent PR referrers.  
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14 329 The greatest differences were within the 'Knowledge' domain. Frequent referrers most  
15 330 commonly reported agreement with all 7 statements, when compared to the infrequent  
16 331 referrers. For example, 97.3% reported knowing when to refer to PR and 80.7% being able to  
17 332 answer patients' questions versus 65.5% and 53.3% of infrequent referrers.  
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23 334 Further group differences were demonstrated in the 'Skills' domain and 'Beliefs about  
24 335 (PHCP) capabilities', which showed that infrequent referrers were less confident in  
25 336 encouraging unmotivated patients to attend PR (67.6% versus 83.5% of frequent referrers).  
26 337 Reduced confidence amongst infrequent referrers was further reflected within the 'Optimism'  
27 338 domain and belief statement 'I am confident my local provider offers a good service' (46%  
28 339 against 74.3% of frequent referrers). However, over half (56.9%) of frequent referrers felt  
29 340 that patients in work were not able to attend PR, compared to less than a third (31%) of those  
30 341 who referred infrequently.  
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39 343 The remaining belief statements demonstrated greater group similarities than differences.  
40 344 Environment, Social and Professional role: Most respondents felt that there was enough time  
41 345 in practice to refer (84.7%) and believed in encouraging PR attendance (96.4%). Yet  
42 346 promotional information on PR was rarely available in practices (29%). There was no clearly  
43 347 identified PR referrer; less than half (48.6%) felt it was the practice nurse's role and (51.8%)  
44 348 reported other practice staff refer.  
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51 350 Social influences: Frequent referrers were slightly more likely to agree with 3 of the 4  
52 351 domain belief statements than infrequent referrers. Although, collectively the groups reported  
53 352 both PR provider engagement and referral outcome reporting as low at only 22.6% and 29%  
54 353 respectively. PHCPs also reported patients rarely request referral to PR (5%).  
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3 355 Belief about consequences and Optimism: Most PHCPs agreed that PR offers physical health  
4 356 benefits, including improving breathlessness and reducing hospital admissions (91.9%,  
5 357 89.6%) respectively. Yet far fewer PHCPs believed patients would attend and complete PR  
6 358 (46.2%), with fewer still agreeing that patients are PR motivated (24.2%).  
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10 359  
11 360 Memory (decision-making): Only a small number of PHCPs reported forgetting to refer  
12 361 patients to PR (11.7%). COPD annual review templates were reported as helpful referral  
13 362 reminders (63.8%) and 25.8% reported the best time to discuss referral with patients was  
14 363 during COPD stability. Patient characteristics such as disease stability and smoking status do  
15 364 not appear to impede PHCP referral decisions as 98.2% reported referring smokers.  
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20 365  
21 366 Goals, Reinforcement and Intention: in-practice review of eligible patients was not  
22 367 commonly reported (41%) and only (19.8%) reported in-practice targets to improve referral  
23 368 rates. Practice financial reward for referral (pre April 2019) was rarely reported (5%); indeed  
24 369 the implementation of financial reward via national QoF incentives (post April 2019) was  
25 370 considered unlikely to greatly improve referral behaviours, with less than a third (32.6%)  
26 371 stating they would refer more. However, there was general agreement that this incentive  
27 372 would increase practice awareness of PR (70.1%).  
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## 35 374 **Phase 2. Questionnaire: Open questions.**

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37 376 A third of PHCPs (33.8%) responded to the open question at the end of the survey including  
38 377 5/11 PHCPs who reported referral, but did not specify frequency, (answer length 3-167  
39 378 words, mean 35). Non-frequent referrers reported more open comments (43/113 38.1%) than  
40 379 frequent referrers (33/109 30.3%)  
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47 381 This gave an additional 94 comments that related directly to PR referral. These were content  
48 382 mapped to all 12 relevant TDF domains. The comments predominately cited referral barriers.  
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53 384 Belief about capabilities had the highest number of comments 36/94 (38.3%) with many  
54 385 encompassing concerns about PR accessibility, particularly transport challenges for patients.

55 386 For example, '*Location of PR too far for patients to travel and too much commitment. Patients tend to be*  
56 387 *older adults on generally low incomes. A number of my patients would attend if it was close by with no*  
57 388 *expense*'. A small number of PHCPs (3.2%) considered a patient's inability to complete pre-

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3 389 PR spirometry as a referral barrier, and 10.6% of comments related to referral processes,  
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5 390 which were reported to be lengthy and as such '*easier simpler*' processes were requested.  
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## 8 392 **Connected results**

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11 394 In order to identify the key factors that inhibit and/or enable PHCP referral to PR, Phase 1  
12  
13 395 and phase 2 results were merged to allow for data contrast and meta-inference (18) (Table 5).  
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16  
17 397 Most PHCPs believed in PR and encouraging patients to attend. Referral is most likely to be  
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19 398 considered at annual review (indeed referral is rarely offered to patients outside of this  
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21 399 consultation). On-screen prompts are helpful reminders, but in practice material promoting  
22  
23 400 PR is rare. PHCP PR knowledge is largely gained from networking with other respiratory  
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25 401 interested health professionals and/or CPD education. PHCPs report patients have little  
26  
27 402 motivation for PR, rarely ask for referral to PR and view that patients in work are unlikely to  
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29 403 be able to attend.

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31 405 Some findings of the qualitative study were not clearly replicated in the survey results. For  
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33 406 example, phase one qualitative data highlighted that some GPs and ANPs felt the practice  
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35 407 nurse was best placed to undertake PR referral at the time of annual review, yet respiratory  
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37 408 interested GPs and those undertaking annual review did not share this view. The phase two  
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39 409 survey data supported the latter position, where 29/129 (22.5%) of practice nurses reported  
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41 410 never referring. Therefore responsibility of PR referral is not based on profession, but is  
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43 411 undertaken by PHCPs who are respiratory interested and/or conducting the patient's annual  
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45 412 review.  
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47 414 Qualitative generalisable findings were limited in a number of areas meaning clear  
48  
49 415 conclusion cannot be drawn, these included; time available to undertake referral, ease of  
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51 416 referral process, perceptions of quality of PR programme, referral of patients when COPD  
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53 417 symptom burden is increasing and non-referral in order to protect patient relationship.  
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57 420 Where generalisability is clear, a summary of the key behavioural barriers and enablers by  
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59 421 TDF domain are shown in figure 2, demonstrating a greater number of barriers than enablers  
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422 to referral. However, it is also important to report that barriers and enablers most commonly  
 423 co-exist within the same domains.

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425 Table 6 Integrated results matrix

426 ✓ Enabler and agreement with Phase 1 data.

427 ✗ Barrier and agreement with Phase 1 data.

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TDF Domain	Phase 1 Qualitative study Main Factors	Phase 2 Survey Main Factors	Barrier - ✗ / Enabler - ✓
Social and Professional Role	It is largely seen as the practice nurse role, or staff undertaking COPD review.	Not clearly PNs role, but PHCP doing annual review is most likely referrer.	PHCP undertaking annual review (not necessarily the PN)- ✓
	The best time to refer a patient is when they are stable	Disagree	Not generalizable in quantitative data.
	Most PHCPs believe in encouraging patients to attend.	Agree	✓
Knowledge	Generally a good basic knowledge	Agree (Generally higher in frequent referrers)	Enabler – but room for improvement
	Little detailed local programme knowledge	Disagree (Higher local knowledge in frequent referrers)	✓
	Knowledge is largely gained from CPD/networking	Agree	✓
Environment	There is a lack of time in practice.	Disagree	Not generalizable in the quantitative data.
	Referral is only considered during non-acute COPD focused consultations.	Agreed (some infrequent referrers reported not to see COPD patients)	✗
	There is a lack of PR promotional material available in practices.	Agree	✗
Memory	On screen reminders are important	Agree	✓
	Referral prompted when patients have symptoms that are worsening	Disagree	Not generalizable in the quantitative data.
Optimism	Patients do not want PR/are not motivated	Agree	✗
	PR providers do not offer a good service.	Some agreement more so with infrequent referrers	✗
Belief about consequences	PR is good for patient's physical and psychological health.	Agree	✓
	PR may harm patients (psychologically)	Disagree	Not generalizable in the quantitative data.
		Disagree	

	Pushing PR might harm my relationship. Patients will not always attend and complete post referral.	General agreement.	Not generalizable in the quantitative data. ✗
Belief about capability	Talking to patients about PR is challenging.  Patients in work are unable to attend PR  Transport is a barrier  Not for patients with oxygen  Not for patients who smoke  Best suited to those who have frequent exacerbations	Some agreement more so with infrequent referrers.  Agree  Agree (Open question)  Disagree  Disagree  Disagree	✗  ✗  ✗  Not generalizable in the quantitative data. Not generalizable in the quantitative data. Not generalizable in the quantitative data.
Social influences	Lack of PR provider engagement and feedback to referrer  Patients do not ask for PR	Agree  Agree	✗  ✗
Skills	Referral to PR by PHCP is low  Referral process is relatively easy	Agree  Disagreement, particularly by infrequent referrers.	✗  Likely barrier
Reinforcement	Financial reward increases referral rates  Patients decline PR  Financial reward increases practice awareness	Most don't think this would change behaviour.  Not captured explicitly  Agree	Not generalizable in the quantitative data  Likely barrier  ✓
Goals	No set in-practice process to improve or review referral rates.	Agree	✗
Intentions	Referral acceptance takes time  General desire to refer more patients.	Not captured explicitly  Not captured explicitly	Likely barrier  Likely enabler
Emotion	PHCPs are fearful on behalf of patients  Frustration with PR providers	Concern over access abilities (expressed in free text, may capture PHCP fear)  Not captured explicitly.	✗  ✗
Behavioural Regulation	PHCPs do not know how many patients they have referred.  PHCPs have no planned intentions to change behaviour	Agree  Largely agree, although some emerging interventions (free text)	✗  Likely barrier

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3 429 Figure 2 Key barriers and enablers by TDF domain.

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8 432 **Discussion:**

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11 434 Referral to PR from primary care remains poor. This is the first time the Theoretical Domains  
12 Framework has been applied to a mixed-methods study to understand the key factors that  
13 435 determine referral to PR by PHCPs. Results highlighted multiple intertwined barriers and few  
14 436 enablers. Many (although not all) of the findings from the qualitative study were affirmed by  
15 437 the more generalisable survey.  
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20 440 Although Cox et al (25) retrospectively applied the TDF to primary studies in order to  
21 441 identify the barriers and enablers to PR, the review only included a small number (n=2) of  
22 442 UK based HCP qualitative referrer studies. Reported referral facilitators were PR programme  
23 443 knowledge, successful HCP prior referral and patient PR accessibility. These mapping to two  
24 444 domains, knowledge and beliefs about consequences. Our study finds referral facilitators in  
25 445 an additional five TDF domains (as shown in figure 2). PHCPs reported believing that PR  
26 446 was beneficial for patients and wanting to refer more. They have however, requested greater  
27 447 engagement from providers, better knowledge of local programmes and improvements in PR  
28 448 promotion. They also reported in-practice goals and/or monitoring of referrals to address the  
29 449 shortfall in patients referred are rare.  
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33 452 However, PHCPs collectively reported low confidence in patients' abilities and motivations  
34 453 to attend PR, a belief likely to be strengthened by reports of few patients requesting referral.  
35 454 Beliefs about low uptake, may explain why referral is commonly offered at times of  
36 455 increasing COPD symptoms, thus acting as a lever to referral acceptance. Infrequent referrers  
37 456 reported reduced confidence in encouraging un-motivated patients to attend, with similar  
38 457 findings reported in phase 1 data as PHCPs expressed concerns around the protection of  
39 458 relationships with patients. Venue accessibility also appears to be a barrier and whilst the  
40 459 direct survey question (question 21) appeared not to overtly agree with this, both phase 1 and  
41 460 the phase 2 open question results highlighted transport a practical and cost barrier, affirmed  
42 461 by patient studies (25). Variability in referral rate by PHCP profession was an unexpected  
43 462 finding and offers insights that (1) few PNs refer and (2) where it is considered to be the  
44 'respiratory nurse' role, referral opportunities may become reduced. Associative referral

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3 463 frequency and respiratory qualification is also a new finding. ANPs were those most likely to  
4 464 refer and to have respiratory qualifications. This may reflect current nationwide upscaling of  
5 465 the nursing workforce and Master's educational requirements of ANPs (26).  
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## 10 467 **Strengths and Limitations**

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13 469 Combining qualitative and quantitative methods in a mixed method research approach  
14 470 offered valuable insight into PHCP referral practices and is a key strength of this research.  
15 471 The range and number of PHCPs included from across the UK were broadly representative of  
16 472 the general practice workforce (27). We recognise that predominately respiratory interested  
17 473 participants may have taken part in this study which may skew results, and it is noted that  
18 474 online participants reported higher referral practice and respiratory qualification(s) than their  
19 475 counterparts, which may be a study limitation, suggesting that more emphasis should be  
20 476 placed on the perspective of the infrequent referrers. Adopting additional recruitment  
21 477 strategies such as via general practice-based conferences is seen as a study strength which  
22 478 sought to capture a range of PHCPs views. Demographic similarities across all 3 recruitment  
23 479 streams highlight study design attempts to reduce participation and sample selection biases.  
24 480 Questionnaire specific biases relating to self-reporting response is a source of potential  
25 481 weakness, specifically where responses maybe perceived to be 'socially acceptable',  
26 482 otherwise known as social desirability (28). This may offer some explanation around the  
27 483 variation observed in the belief about capabilities domain of the integrated results matrix  
28 484 (Table 6). Grouping participants by reported referral frequency is a study strength,  
29 485 particularly as the aim is to understand both what supports and inhibits referral.  
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44 487 Much of the validity of the TDF is gained from its direct application with HCPs, as utilised  
45 488 here. However transcript content mapping to 84 constructs is complex and time consuming as  
46 489 also described by others (29). Additionally, aligning content to a key domain was  
47 490 challenging, particularly where content could be mapped to more than one domain, for  
48 491 example patients declining PR impacted on belief about consequences, optimism and  
49 492 reinforcement domains. This has been previously reported as a TDF weakness (14), but its  
50 493 potential impact unclear. Mapping content to all relevant domains is an alternative approach  
51 494 (11), but was discounted on the basis of practicality and interpretation complexity. The TDF  
52 495 offers a functional approach to behavioural data analysis, most likely to be helpful when there  
53 496 is little to no underlying knowledge of the investigating phenomenon. However, the

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3 497 interrelations between referrer, patient and provider have previously been reported to be  
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5 498 important factors in the referral journey (7). Yet, the TDF does not offer causal determinants  
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7 499 of behaviour (11) and alignment to predetermined domains reduces the ability to consider any  
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9 500 phenomena falling outside those domains and the likely connecting relations, meaning the  
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11 501 whole picture maybe missed and is a potential limitation.

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13 503 One researcher (JW) is an experienced respiratory nurse specialist which may have altered  
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15 504 analysis, although transparency and team analysis sought to reduce potential bias.

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### 17 506 **Relation to other studies.**

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22 508 This mixed methods TDF based study finds agreement with many key referral factors  
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24 509 presented in our previous inductive qualitative study using the same data (7). However, it  
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26 510 disputes that the PN is the main referrer to PR within primary care, and questions the value of  
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28 511 practice based financial reward as a referral incentive. It also highlights that the referral  
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30 512 process itself is not straightforward and there are no sanctions for non-referral, but there is  
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32 513 time in practice to refer. Increasing the population sample and geographical reach in this  
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34 514 study strengthens current known practice referral barriers including, poor patient motivation,  
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36 515 few in-practice resources, perceived venue access difficulties and little awareness of local PR  
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38 516 provision (25, 30-33). Subjective patient assessments including PHCPs perceptions of  
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40 517 patients capabilities and motivations have been described as influencing PHCP referral  
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42 518 decisions here and previously published (7). This is a novel finding in relation to PR referral,  
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44 519 yet similar HCP pessimistic attitudes, relating to a patient's capability and motivation to  
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46 520 access services and change behaviours to improve health outcomes have been reported in the  
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48 521 primary healthcare management of reducing cardiovascular disease risk in people with  
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50 522 serious mental illness (34, 35).

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52 524 Phase one and inductive data analysis (7) suggested that offering PR at COPD symptom  
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54 525 increase was common yet this was unconfirmed in the survey results. This may demonstrate  
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56 526 further social desirability reporting as previous analyses have demonstrated patients attending  
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58 527 PR to have 1.24 hospitalisations per patient-year 95% CI (0.66-2.34) suggesting sicker  
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60 528 patients are those most likely to be offered PR (36). However, referral at this time supports  
529 both PHCP and patients' concerns about patient's capabilities (7, 25, 37), meaning lower  
530 acceptance and adherence to PR is probable, and negative PHCP beliefs about outcomes are



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3 531 likely to perpetuate. An alternative approach and one that appears not to be currently  
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5 532 undertaken is to refer at the point of an acute exacerbation of COPD, which maybe a referral  
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7 533 lever (11, 37).  
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10 535 In our original inductive analysis (7), we reported that financial incentives may be important,  
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12 536 yet results in this current study are mixed and PHCPs appear uncertain of their value. It will  
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14 537 be interesting to observe the impact of the newly implemented financial rewards for PR  
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16 538 referral in England, but where similar QoF rewards were implemented for referral to diabetes  
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18 539 programmes, uptake did not greatly improve (38). Given positive correlations between  
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20 540 referral rates and CPD education, efforts to increase the number and education of the primary  
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22 541 care workforce by Health Education England (39) is encouraging. The literature also supports  
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24 542 a general consensus that for patients in employment, PR is largely considered inaccessible  
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26 543 (7)(28). This was reported as a barrier by the frequent referrers more than the infrequent  
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28 544 referrers, which questions whether PR knowledge itself is a potential barrier as previously  
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30 545 reported (7) and that PHCP beliefs influence subsequent referral behaviours.  
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### 31 547 **Conclusions**

32 548 This is the first mixed methods research study to examine the factors that inhibit and enable  
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34 549 referral to PR for patients with COPD from a primary care perspective. Whilst knowledge  
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36 550 and respiratory qualification appear to be enablers, many barriers persist which must be  
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38 551 overcome to increase referral opportunities for all eligible patients. The most important  
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40 552 aspects to address are to increase PR provider engagement with referrers, increase PR  
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42 553 awareness and support for potential patients and all PHCPs, including those with respiratory  
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44 554 qualifications and to increase PHCP internal motivation for PR referral, particularly for those  
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46 555 patients in work and those with less symptom burden. These suggestions are likely to require  
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48 556 multi-system changes. Mapping these TDF findings to behaviour change techniques (BCT)  
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50 557 are important next steps which will enable clear targeted interventions to be identified and  
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52 558 tested in clinical practice, which will ultimately increase referral to PR, thereby improving  
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54 559 COPD patients' health outcomes and reducing health service utilization.  
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#### 22 23 24 674 **Ethics approval and consent to participate**

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26 675 Ethical Approvals: Phase 1 approval granted by Health Research Authority: Project ID:  
27 676 213367. Phase 2 approval granted by University of Birmingham: ERN\_19-0439. All  
28 677 participants in phase 1 and phase 2 studies gave consent.

#### 29 30 678 **Consent for publication**

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33 679 Not Applicable

#### 34 35 680 **Availability of data and material**

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38 681 The datasets during and/or analysed during the current study available from the  
39 682 corresponding author on reasonable request.

#### 40 41 683 **Competing interests**

42  
43 684 The authors declare that they have no competing interests"

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46  
47  
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49 687 or not-for-profit sectors'.

#### 50 51 688 **Authors' contributions**

52  
53  
54 689 JW collected, analysed and interpreted phase 1 and phase 2 data and was a major contributor  
55 690 in writing the manuscript. RJ, PA, SG and AE contributed to study design, data analysis and  
56 691 interpretation of phase 1 and 2 data. RJ, PA and SG all contributed to the writing of the  
57 692 manuscript. IV supported phase 1 topic guide development, phase 1 data alignment to the  
58 693 TDF and the formulation of the phase 2 questionnaire where behavioural expert consensus  
59 694 was sought. All authors read and approved the final manuscript.

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695 **Acknowledgements**

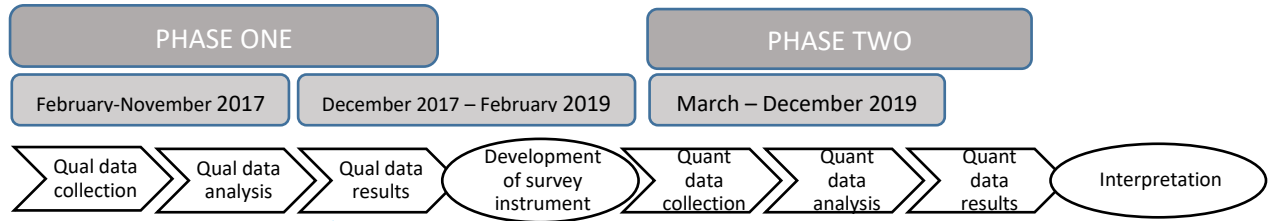
696 The authors thank all participating primary healthcare practitioners for giving up their time,  
697 providing the data, and contributing to this study.

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Figure 1

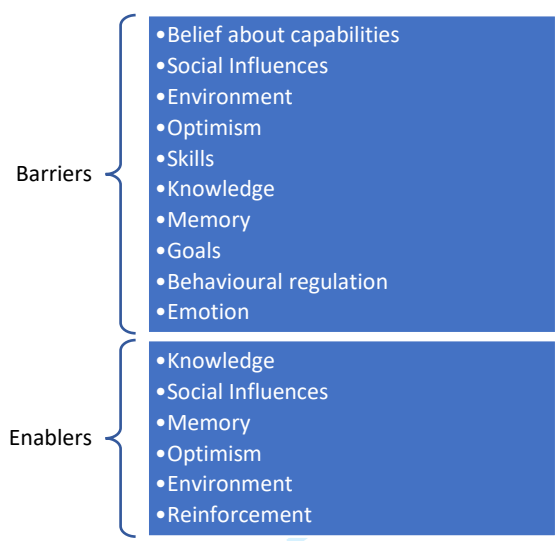
Figure 1: Exploratory sequential design



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Figure 2: Key barriers and enablers by TDF domain.



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## Additional File 2: Phase 1 interview guide

### **Understanding barriers and enablers for primary care health staff when referring patients with Chronic Obstructive Pulmonary Disease (COPD) to Pulmonary Rehabilitation: a qualitative study. Topic Guide for Interviews.**

#### **Interview Objectives:**

- To explore the experience of primary care practitioners in relation to referral of patients with COPD to pulmonary rehabilitation.
- To gain an understanding of the main perceived barriers and enablers for referring COPD patients for pulmonary rehabilitation.
- To gain insight into whether any patient characteristics influence whether or not people with COPD are referred for pulmonary rehabilitation.

#### Understanding current behaviour

To start the discussion, participants will be asked to talk about their experiences of managing patients with COPD in primary care and any experience of referral for pulmonary rehabilitation

1/ Could you tell me in what context do you currently see COPD patients? (Exposure to population/target intervention within working role e.g. planned – annual review/flu jab or unplanned - exacerbation)

2/ On average how many COPD patients do you think you see per week?

3/ Do you currently refer to PR programmes?

#### Capability, Opportunity, Motivation – including External Context

4/ What is your understanding/view surrounding Pulmonary Rehabilitation programs in general? And in relation to your local provider?....

5/ Do you think pulmonary rehabilitation is beneficial for patients? In what ways? Or why not?

6/ How easy or difficult is it for you to refer to your local PR provider?

(Eg. Is it your role to refer? When is it appropriate to refer COPD patients to PR?)

7/ What motivates you to refer patients to PR ?

(Eg. Do patients/carers ever ask you about pulmonary rehabilitation? Does the post PR patient summary motivate you, are you reminded by prompts or other guidance?)

8/ What do you think stops you from referring patients to pulmonary rehabilitation?

#### Images Alternating images (between 1-4)

9/ If this person was in your COPD patient, would you consider discussing PR with them? Why? Why not?



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Future

10/ Is there anything that you think could improve the primary care discussion surrounding PR and/or encourage you to make referrals to PR?

Possible prompts: Do you think a short video clip would help you motivate patients? Or computerised prompts to follow? Or a further telephone call to encourage patients? Or a firm appointment slot to discuss PR with them?

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Additional file 3 TDF domain alignment using construct labelling (1)

Domain	Constructs
1. Knowledge (An awareness of the existence of something)	Knowledge (including knowledge of condition /scientific rationale) Procedural knowledge Knowledge of task environment
2. Skills (An ability or proficiency acquired through practice)	Skills Skills development Competence Ability Interpersonal skills Practice Skill assessment
3. Social/Professional Role and Identity (A coherent set of behaviours and displayed personal qualities of an individual in a social or work setting)	Professional identity Professional role Social identity Identity Professional boundaries Professional confidence Group identity Leadership Organisational commitment
4. Beliefs about Capabilities (Acceptance of the truth, reality, or validity about an ability, talent, or facility that a person can put to constructive use)	Self-confidence Perceived competence Self-efficacy Perceived behavioural control Beliefs Self-esteem Empowerment Professional confidence
5. Optimism (The confidence that things will happen for the best or that desired goals will be attained)	Optimism Pessimism Unrealistic optimism Identity
6. Beliefs about Consequences (Acceptance of the truth, reality, or validity about outcomes of a behaviour in a given situation)	Beliefs Outcome expectancies Characteristics of outcome expectancies Anticipated regret Consequents

<p>7. Reinforcement</p> <p>(Increasing the probability of a response by arranging a dependent relationship, or contingency, between the response and a given stimulus)</p>	<p>Rewards (proximal / distal, valued / not valued, probable / improbable)</p> <p>Incentives</p> <p>Punishment</p> <p>Consequents</p> <p>Reinforcement</p> <p>Contingencies</p> <p>Sanctions</p>
<p>8. Intentions</p> <p>(A conscious decision to perform a behaviour or a resolve to act in a certain way)</p>	<p>Stability of intentions</p> <p>Stages of change model</p> <p>Transtheoretical model and stages of change</p>
<p>9. Goals</p> <p>(Mental representations of outcomes or end states that an individual wants to achieve)</p>	<p>Goals (distal / proximal)</p> <p>Goal priority</p> <p>Goal / target setting</p> <p>Goals (autonomous / controlled)</p> <p>Action planning</p> <p>Implementation intention</p>
<p>10. Memory, Attention and Decision Processes</p> <p>(The ability to retain information, focus selectively on aspects of the environment and choose between two or more alternatives)</p>	<p>Memory</p> <p>Attention</p> <p>Attention control</p> <p>Decision making</p> <p>Cognitive overload / tiredness</p>
<p>11. Environmental Context and Resources</p> <p>(Any circumstance of a person's situation or environment that discourages or encourages the development of skills and abilities, independence, social competence, and adaptive behaviour)</p>	<p>Environmental stressors</p> <p>Organisational culture /climate</p> <p>Resources / material resources</p> <p>Salient events / critical incidents</p> <p>Person x environment interaction</p> <p>Barriers and facilitators</p>
<p>12. Social influences</p> <p>(Those interpersonal processes that can cause individuals to change their thoughts, feelings, or behaviours)</p>	<p>Social pressure</p> <p>Social norms</p> <p>Group conformity</p> <p>Social comparisons</p> <p>Group norms</p> <p>Social support</p> <p>Power</p> <p>Intergroup conflict</p> <p>Alienation</p> <p>Group identity</p> <p>Modelling</p>
<p>13. Emotion</p>	<p>Fear</p> <p>Anxiety</p>

(A complex reaction pattern, involving experiential, behavioural, and physiological elements, by which the individual attempts to deal with a personally significant matter or event)	Affect Stress Depression Positive / negative affect Burn-out
14. Behavioural Regulation  (Anything aimed at managing or changing objectively observed or measured actions)	Self-monitoring Breaking habit Action planning

1. Cane J, O'Connor D, Michie S. Validation of the theoretical domains framework for use in behaviour change and implementation research. *Implementation Science*. 2012;7(37).

### **Additional File 4: General Practice Staff experiences of referring patients with COPD to PR**

Thank you for taking the time to complete this questionnaire, which aims to gather perspectives from staff working in primary care. This survey is designed for us to find out some of the barriers staff face when considering referring a patient with COPD to PR so please answer the questions as honestly as you can. This should only take you around 15 minutes to complete. First, please complete the following information

	England
Geographical location of practice (please circle)	North East    North West    Yorkshire and the Humber    East Midlands    West Midlands East of England    London    South East    South West Scotland    Wales    NI
Profession (please circle)	GP/Trainer    Practice Nurse    ANP    Other (ECP/HCP/Pharmacist)
Age (years)	18-29    30- 39    40 – 49    50- 59    60 +
Gender	Female    Male
What is your ethnic group? Please circle one option that best describes your ethnic group or background	<p><b>White</b> English    Welsh    Scottish    Northern Irish British Irish Gypsy, Traveller or Irish Traveller Any other White background:</p> <p><b>Mixed/ Multiple ethnic groups</b> White and Black Caribbean White and Black African White and Asian Any other Mixed/ Multiple ethnic background:</p> <p><b>Black/ African/ Caribbean/Black British</b> African Caribbean Any other Black/ African/ Caribbean background</p> <p><b>Asian/ Asian British</b> Indian Pakistani Bangladeshi Chinese Any other Asian background:</p> <p><b>Other ethnic group</b> Arab Any other ethnic group:</p>
Do you see patients with COPD for (please circle as many as relevant)	Acute management    Chronic management    Both    Neither
No. of years in general practice	Years: .....    Months: .....
Respiratory Qualifications	None    COPD Diploma    Asthma Diploma    ARTP Spirometry    Other
Do you currently refer patients with COPD to pulmonary Rehabilitation?	Yes - If yes -    Weekly    Monthly    Less than monthly No - if no please explain why .....

This questionnaire is designed to ask you about your experiences with referring (or considering referring) patients with COPD to Pulmonary Rehabilitation and should take no more than **15 minutes** to complete. Please don't spend too long thinking about each question.

The questionnaire is made up of 4 elements. When rating your level of agreement with each phrase, please think about **all the things that might affect you being able to discuss pulmonary rehabilitation with your patients as well as refer.**

**Please indicate your level of agreement with the following statements:**

Question list	Strongly Disagree	Disagree	Neither disagree nor agree	Agree	Strongly Agree
1. I am aware of the content of Pulmonary Rehabilitation (PR) Programmes	1	2	3	4	5
2. I am aware of PR programme objectives.	1	2	3	4	5
3. I am unsure of the evidence base for PR	1	2	3	4	5
4. I know where geographically my local PR programme is delivered	1	2	3	4	5
5. I know when it is appropriate to refer a patient with COPD to PR	1	2	3	4	5
6. I can answer questions patients have about PR	1	2	3	4	5
7. I know how to contact my local PR provider	1	2	3	4	5
8. My local PR providers regularly engage with me	1	2	3	4	5
9. It is easy to refer a patient to PR	1	2	3	4	5
10. I am confident my local PR provider offers a good service for my patients.	1	2	3	4	5
11. Referral to PR is the practice nurse role	1	2	3	4	5
12. Other General Practice staff in my practice (excluding Practice Nurse) refer patients to PR	1	2	3	4	5
13. Referring patients to PR is something I have been advised to do	1	2	3	4	5
14. I am confident in my ability to encourage patients to attend PR, even when they are not motivated	1	2	3	4	5
15. I do not find it easy to discuss PR with patients.	1	2	3	4	5
16. I don't believe patients will attend PR after I have referred	1	2	3	4	5
17. Patients in work are not able to attend PR	1	2	3	4	5
18. PR is not beneficial to patients who are breathless	1	2	3	4	5
19. Patients who use home oxygen are unable to take part in PR	1	2	3	4	5
20. Patients who smoke are not motivated to take part in PR	1	2	3	4	5
21. Patients without their own transport won't be able to get to PR	1	2	3	4	5
22. Patients who live alone won't like to take part in group PR	1	2	3	4	5
23. I only refer patients if they have quit smoking	1	2	3	4	5
24. I only refer patients if they are optimised on their respiratory medication	1	2	3	4	5

Question list	Strongly Disagree	Disagree	Neither disagree nor agree	Agree	Strongly Agree
25. PR is most suited to COPD patients who have frequent exacerbations	1	2	3	4	5
26. My practice receives financial incentives for referral to PR (Before April 2019)	1	2	3	4	5
27. My practice regularly reviews COPD registers to ensure eligible COPD patients are offered PR	1	2	3	4	5
28. There are set targets within the practice to improve PR referral rates	1	2	3	4	5
29. I often forget to refer patients with COPD to PR	1	2	3	4	5
30. There is not enough time in practice to refer	1	2	3	4	5
31. I believe patients may be harmed by taking part in PR	1	2	3	4	5
32. Prompts to refer patients to PR within annual review templates are important reminders for me	1	2	3	4	5
33. The best time to discuss PR referral with patients is when they are stable.	1	2	3	4	5
34. Patients are motivated to attend PR	1	2	3	4	5
35. PR is best suited to those patients with worsening breathlessness	1	2	3	4	5
36. PR is best suited to those who have frequent exacerbations	1	2	3	4	5
37. I believe in encouraging patients to attend PR	1	2	3	4	5
38. PR reduces hospital admissions	1	2	3	4	5
39. I believe most patients will attend and complete PR following my referral	1	2	3	4	5
40. PR reduces risk of mortality	1	2	3	4	5
41. If patients attend PR this will reduce their general practice visits	1	2	3	4	5
42. PR reduces exacerbations	1	2	3	4	5
43. PR improves breathlessness	1	2	3	4	5
44. PR reduces a patient's anxiety and/or depression.	1	2	3	4	5
45. If I keep pushing patients to attend PR this will disadvantage my relationship with them.	1	2	3	4	5
46. There are good relationships in practice with PR providers	1	2	3	4	5
47. PR providers are good at communicating outcomes of referrals I have made	1	2	3	4	5
48. Resources about PR (i.e written information) are readily available	1	2	3	4	5
49. PR is something that patients ask for	1	2	3	4	5

Question list	Strongly Disagree	Disagree	Neither disagree nor agree	Agree	Strongly Agree
50. I will refer more patients to PR now there are practice QoF incentives (from April 2019)	1	2	3	4	5
51. There will be greater awareness of PR within practices because of the new QoF incentives.	1	2	3	4	5
52. More health care practitioners will discuss PR with patients because of the QoF incentive.	1	2	3	4	5
53. I believe patient attendance to PR will increase because of the QoF Incentive.	1	2	3	4	5
54. I believe the QoF incentive will not increase patients PR attendance	1	2	3	4	5

2/Please consider the interventions below. Please rate each possible intervention based on which you think would be the most helpful in improving your rates of referral to PR?

3/ Then please indicate the top 5 that you think will be the most effective in increasing PR referral within your practice. Please rank them in order 1 (highest) – 5 (lowest) in the 'Rank' column.

Question list	Strongly Disagree	Disagree	Neither disagree nor agree	Agree	Strongly Agree	Rank (1-5)
1. Health Care Professional (HCP) referring patients to PR at the time of COPD diagnosis.	1	2	3	4	5	
2. HCP prescribing PR at the time of COPD acute exacerbation.	1	2	3	4	4	
3. A standardised summary (i.e: a 2 sentences) that describes PR succinctly for HCP to recite to eligible patients.	1	2	3	4	5	
4. Face to face educational sessions for general practice staff.	1	2	3	4	5	
5. Online educational sessions for general practice staff.	1	2	3	4	5	
6. Face to face educational sessions for potential patients, carers and family.	1	2	3	4	5	
7. Online educational sessions for patients, carers & family.	1	2	3	4	5	
8. Practice staff loaning DVDs which demonstrate PR to patients.	1	2	3	4	5	
9. HCP showing patients PR recording within practice or consultation ie on a tablet device.	1	2	3	4	5	
10. Past PR patient attenders directly engage with eligible patients to highlight benefits.	1	2	3	4	5	
11. PR providers directly contacting eligible practice patients.	1	2	3	4	5	



Question list	Strongly Disagree	Disagree	Neither disagree nor agree	Agree	Strongly Agree	Rank
12. PR providers engaging with practice staff by coming into surgeries.	1	2	3	4	5	
13. Personalised letters to eligible patients from general practice advocating PR.	1	2	3	4	5	
14. Group consultations with patients, general practice staff and PR provider.	1	2	3	4	5	
15. Patients being able to refer themselves to PR.	1	2	3	4	5	
16. Patients having their own COPD health care record, similar to a COPD passport, meaning they are prompted to ask for PR.	1	2	3	4	5	
17. PR promotional material within patient pharmacy medication packs	1	2	3	4	5	
18. Greater awareness of PR in practice. i.e Posters highlighting local PR provider, benefits, etc.	1	2	3	4	5	
19. General practice staff being able to refer patients by telephone rather than manually completing referral form.	1	2	3	4	5	
20. If my practice referred more COPD patients this would increase my own referral numbers.	1	2	3	4	5	
21. Changing the name of PR to something more user friendly.	1	2	3	4	5	
22. General practice staff being taught motivational interviewing techniques would improve referral to PR.	1	2	3	4	5	
23. Lead practice PR referrer to educate and show PR video to other practice staff at practice meetings, to encourage a whole practice approach.	1	2	3	4	5	

4/ Please add any further comments/suggestions you may have.....

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Many thanks for completing this questionnaire. Please return to the return box to collect your chocolate(s).

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Additional file 1

Guidelines for Conducting and Reporting Mixed Research for Counselor Researchers (1)

<p><b>Research Formulation</b></p> <p>1.1.1. Treat each relevant article as data that generate both qualitative (e.g., qualitative findings, literature review of source article, source article author’s conclusion) and quantitative (e.g., p values, effect sizes, sample size score reliability, quantitative results) information that yield a mixed research synthesis.</p> <p>1.1.2. Subject each document selected as part of the literature review to summarization, analysis, evaluation, and synthesis.</p> <p>1.1.3. Provide literature reviews that are comprehensive, current, and rigorous; that have been compared and contrasted adequately; and that contain primary sources that are relevant to the research problem under investigation, with clear connections being made between the sources presented and the present study.</p> <p>1.1.4. Present clearly the theoretical/conceptual framework.</p> <p>1.1.5. Assess the findings stemming from each individual study and the emergent synthesis for trustworthiness, credibility, dependability, legitimation, validity, plausibility, applicability, consistency, neutrality, reliability, objectivity, confirmability, and/or transferability.</p> <p>1.1.6. Present the goal of the study (i.e., predict; add to the knowledge base; have a personal, social, institutional, and/or organizational impact; measure change; understand complex phenomena; test new ideas; generate new ideas; inform constituencies; and examine the past).</p> <p>1.2.1. Specify the objective(s) of the study (i.e., exploration, description, explanation, prediction, and influence).</p> <p>1.3.1. Specify the rationale of the study.</p> <p>1.3.2. Specify the rationale for combining qualitative and quantitative approaches (i.e., participant enrichment, instrument fidelity, treatment integrity, and significance enhancement).</p> <p>1.4.1. Specify the purpose of the study.</p> <p>1.4.2. Specify the purpose for combining qualitative and quantitative approaches (e.g., identify representative sample members, conduct member check, validate individual scores on outcome measures, develop items for an instrument, identify barriers and/or facilitators within intervention condition,</p>	<p>Pages 3/4/5</p> <p>Title &amp; pages 3 &amp; 4</p>
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<p>evaluate the fidelity of implementing the intervention and how it worked, enhance findings that are not significant, compare results from the quantitative data with the qualitative findings).</p> <p>1.5.1. Avoid asking research questions that lend themselves to yes/no responses.</p> <p>1.5.2. Present mixed research questions (i.e., questions that embed both a quantitative research question and a qualitative research question within the same question) when possible.</p>	As above
<p><b>Research Planning</b></p> <p>2.1.1. Specify the initial and final sample sizes for all quantitative and qualitative phases of the study.</p> <p>2.1.2. Present all sample size considerations made for the quantitative phase(s) (i.e., a priori power) and qualitative phases (e.g., information-rich cases).</p> <p>2.1.3. Present the sampling scheme for both the quantitative and qualitative phases of the study.</p> <p>2.1.4. Describe the mixed sampling scheme (i.e., concurrent–identical, concurrent–parallel, concurrent–nested, concurrent–multilevel, sequential–identical, sequential–parallel, sequential–nested, and sequential–multilevel).</p> <p>2.1.5. Clarify the type of generalization to be made (i.e., statistical generalization, analytic generalization, and case-to-case transfer) and link it to the selected sampling design, sampling scheme, and sample size(s).</p> <p>2.2.1. Outline the mixed research design.</p> <p>2.2.2. Specify the quantitative research design (i.e., historical, descriptive, correlational, causal–comparative/quasi-experimental, and experimental).</p> <p>2.2.3. Specify the qualitative research design (e.g., biography, ethnographic, auto-ethnography, oral history, phenomenological, case study, grounded theory)</p>	Pages 4-5
<p><b>Research Implementation</b></p> <p>3.1.1. Outline the mixed data collection strategy.</p> <p>3.1.2. Present information about all quantitative and qualitative instruments and the process of administration.</p> <p>3.2.1. Outline the mixed data collection strategy (i.e., data reduction, data display, data transformation, data correlation, data consolidation, data comparison, and data integration).</p>	<p>Pages 5.6.7</p> <p>Pages 24-26</p>

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<p>3.2.2. Provide relevant descriptive and inferential statistics for each statistical analysis.</p> <p>3.2.3. Discuss the extent to which the assumptions (e.g., normality, independence, equality of variances) that underlie the analyses were met, as well as any observations that might have distorted the findings (e.g., missing data, outliers).</p> <p>3.2.4. Specify the statistical software used.</p> <p>3.2.5. Specify where the responsibility or authority for the creation of categories resided (i.e., participants, programs, investigative, literature, or interpretive), what the grounds were on which one could justify the existence of a given set of categories (i.e., external, rational, referential, empirical, technical, or participative), what was the source of the name used to identify a given category (i.e., participants, programs, investigative, literature, or interpretive), and at what point during the research process the categories were specified (i.e., a priori, a posteriori, or iterative)</p>	<p>Page 5.7</p>
<p>3.2.6. Specify the name of the technique used to analyze the qualitative data (e.g., content analysis method of constant comparison, discourse analysis, componential analysis, keywords in context, analytic induction, word count, domain analysis, taxonomic analysis).</p> <p>3.2.7. Specify the qualitative software used.</p> <p>3.3.1. Discuss the threats to internal validity, external validity, and measurement validity and outline the steps taken to address each of these threats to internal validity, external validity, and measurement validity.</p> <p>3.3.2. Discuss the threats to trustworthiness, credibility, dependability, authenticity, verification, plausibility, applicability, confirmability, and/or transferability of data and outline all verification procedures used.</p> <p>3.3.3. Discuss mixed research legitimation types (i.e., sample integration legitimation, insider–outsider legitimation, weakness minimization legitimation, sequential legitimation, conversion legitimation, paradigmatic mixing legitimation, commensurability legitimation, multiple validities legitimation, and political legitimation).</p>	<p>Page 5-7, 28-29</p>
<p>3.4.1. Interpret relevant types of significance of the quantitative findings (i.e., statistical significance, practical significance, clinical significance, and economic significance).</p> <p>3.4.2. Conduct post hoc power analysis for all statistically non-significant findings.</p> <p>3.4.3. Interpret the significance (i.e., meaning) of qualitative findings.</p>	<p>Page 18-23,  Not applicable. Page 10-17,</p>

3.4.4. Discuss criteria for evaluating findings in mixed research studies (e.g., within-design consistency, conceptual consistency, interpretive agreement, interpretive distinctiveness, design suitability, design fidelity, analytic adequacy, interpretive consistency, theoretical consistency, integrative efficacy).	Page 25-26
3.5.1. Describe all steps of the mixed research process.	Throughout paper.
3.5.2. Describe the context in which the mixed research study took place.	Page 5-6
3.5.3. Ensure that the mixed research report is accurate and complete; does not distort differences within and among individuals and groups; is free from plagiarism or misrepresentation of the ideas and conceptualizations of other scholars; and contains findings that are adequately accessible for reanalysis, further analysis, verification, or replication.	Throughout paper.
3.5.4. Present all ethical considerations that were addressed in the study (e.g., informed consent, confidentiality, incentives, funding sources, potential conflicts of interest, biases).	Page 5-6 and page 33
3.5.5. Specify study approval in accordance with an institutional review board either in the report or in the cover letter submitted to the editor.	Covering letter to the editor
3.5.3. Present recommendations for future research that culminate in a validation, replication, or extension of the underlying study.	Page 30

1. Leech NL, Onwuegbuzi AJ. Guidelines for Conducting and Reporting Mixed Research in the Field of Counseling and Beyond. *Journal of Counseling & Development*. 2010;88:61-9.

# BMJ Open

## Investigating primary health care practitioners' barriers and enablers to referral of patients with COPD to Pulmonary Rehabilitation: a mixed methods study using the Theoretical Domains Framework.

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## Title

# Investigating primary health care practitioners' barriers and enablers to referral of patients with COPD to Pulmonary Rehabilitation: a mixed methods study using the Theoretical Domains Framework.

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## Key words

Chronic Obstructive Pulmonary Disease (COPD), Pulmonary Rehabilitation (PR), Primary Care, Theoretical Domains Framework (TDF). Mixed methods research.

## List of Abbreviations

PR – Pulmonary Rehabilitation  
COPD – Chronic Obstructive Pulmonary Disease  
PHCP – Primary Health Care Practitioner  
TDF – Theoretical Domains Framework

**Word Count 4,268**

## Abstract

### Objectives

Pulmonary rehabilitation is a highly effective, recommended intervention for patients with COPD. Using behavioural theory to understand why referral remains low enables the development of targeted interventions in order to improve future PR referral.

### Methods

We undertook a multiphase sequential mixed methods study to investigate referral practices of Primary Health Care Practitioners (PHCPs) in the United Kingdom (UK). In phase 1, semi-structured interviews were undertaken. Content analysis was used to map themes to the Theoretical Domains Framework (TDF) and a 54-item TDF-based questionnaire was developed.

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3 48

4 49 In Phase 2 we distributed the questionnaire to a larger PHCP population. We used descriptive  
5 50 analyses to identify barriers and enablers, and key TDF domains. Mixing of data occurred at  
6 51 two points; instrument design and interpretation.  
7 52

### 9 53 **Results**

10 54 19 PHCP took part in interviews and 233 responded to the survey. Integrated results revealed  
11 55 that PHCPs with a post qualifying respiratory qualification (154/241; 63.9%) referred more  
12 56 frequently (91/154; 59.1%) than those without (28/87; 32.2%).  
13 57

14 58 There were more barriers than enablers for referral in all 13 TDF domains. Key barriers  
15 59 included: infrequent engagement from PR provider to referrer, concern around patient's  
16 60 physical ability and access to PR (particularly for those in work), assumed poor patient  
17 61 motivation, no clear practice referrer and few referral opportunities. These mapped to  
18 62 domains: belief about capabilities, social influences, environment, optimism, skills and social  
19 63 and professional role.  
20 64

21 65 Enablers to referral were observed in knowledge, social influences memory and environment  
22 66 domains. Many PHCPs believed in the physical and psychological value of PR. Helpful  
23 67 enablers were out-of-practice support from respiratory interested colleagues, dedicated  
24 68 referral time (annual review) and on-screen referral prompts.  
25 69

### 26 70 **Conclusions**

27 71 Referral to PR is complex. Barriers outweighed enablers. Aligning these findings to  
28 72 behaviour change techniques will identify interventions to overcome barriers and strengthen  
29 73 enablers, thereby increasing referral of COPD patients to PR.  
30 74

### 31 75 32 76 **Strengths and limitations of this study**

33 77  
34 78 1: This is the first mixed methods study to use the Theoretical Domains Framework to  
35 79 identify barriers and enablers to pulmonary rehabilitation referral from a primary health care  
36 80 practitioner perspective.  
37 81

38 82 2: The utilisation and combination of two differing research paradigms in this exploratory  
39 83 sequential approach offers novel and detailed insights through combined research lenses  
40 84 which encompass multiple perspectives.  
41 85

42 86 3: Many geographical regions across the United Kingdom are represented and include a  
43 87 diverse range of primary healthcare practitioners.  
44 88

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3 89 4: A combination of participant recruitment approaches have been used to reduce potential  
4 90 sample and selection biases.

5 91  
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8 92 5: Generalisability of the overall findings are limited by the inability to calculate distribution  
9 93 and therefore response rates.

10 94

11 95

## 12 96 **Background**

13 97

14 98 Pulmonary Rehabilitation (PR) is a low cost, high value, internationally recommended  
15 99 intervention for COPD patients which is effective in improving exercise capacity, reducing  
16 100 the impact of symptoms and improving prognosis (1, 2) . It is a structured multidisciplinary  
17 101 intervention combining individualised exercise with disease-related education (3). Despite  
18 102 the clear evidence of its effectiveness, the proportion of COPD patients receiving PR is  
19 103 persistently low worldwide (4, 5). Our previously published inductive qualitative paper  
20 104 presented the experiences of primary health care practitioners (PHCPs) as key potential  
21 105 referrers to PR (6). We found that there was a generalised awareness of PR, but little detailed  
22 106 knowledge of either the programme or the clinical benefits. Relationships with PR providers  
23 107 were limited, but considered important. Patient characteristics, rather than clinical need,  
24 108 influenced referral offers and referrers frequently believed patients to be poorly motivated.  
25 109 PR was most commonly offered during times of disease stability (usually at COPD annual  
26 110 review) and ease of the referral process and financial incentives positively influenced referral.  
27 111 In summary, referrers reported many barriers but few enablers, which collectively resulted in  
28 112 infrequent discussions about PR and associated referrals.

29 113

30 114 However, in order to aid the development of appropriate interventions to improve referral  
31 115 rates it is important to establish the generalisability and relative importance of these findings  
32 116 within a broader population of PHCPs. Furthermore, applying theory to identify the  
33 117 psychological and structural drivers that influence behaviour (7, 8) may offer new insights to  
34 118 shape interventions (9).

35 119

36 120 The Theoretical Domains Framework (TDF) is a well-recognised approach which was  
37 121 derived from a synthesis of behaviour change theories (10), and examines the processes that

1  
2  
3 122 influence behaviour (11). When applied, it offers explanations for behaviours, highlighting  
4 123 reasons that may inhibit or promote (12, 13) implementation of practice-based change (12).

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7 124

8 125 Using mixed methods, and applying the TDF we sought to assess and explain the reasons for  
9 126 low PR referral by primary health care professionals (PHCPs) for patients with COPD. The  
10 127 aim of our multiphase design was to inform the development of theory informed  
11 128 interventions to improve PR referral rates from primary care in future.

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## 16 130 **Methods**

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20 132 We used a multiphase sequential design defined by two separate phases (figure 1). The  
21 133 cognitive and practical experiences of PHCP when considering and undertaking referral for  
22 134 patients with COPD were initially explored using a deductive approach by applying the TDF  
23 135 to data from our previously collected qualitative interviews. These findings informed a  
24 136 second quantitative phase, where we tested themes for generalisability using a nationwide  
25 137 survey of PHCP, to highlight the most relevant factors influencing referral. (14-16).

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### 32 139 Figure 1 Multiphase sequential research design

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37 142 Both data sets retained independent value and meaning, but were connected at two time  
38 143 points: 1) where the qualitative data was used to construct the questionnaire and 2) where  
39 144 phase 1 and 2 results were integrated to inform interpretation. The multiphase sequential  
40 145 mixed methods design therefore achieves both methodological and content integration (15,  
41 146 16).

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## 47 148 **Patient and Public Involvement**

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50 150 There has been no public and/or patient involvement in this study.

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53 151

### 54 152 **Phase 1 Application of TDF to qualitative interview data.**

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56 153

57 154 We re-analysed data from our previously published inductive qualitative study (6) in which  
58 155 19 PHCPs from two differing geographical regions across Central and East of England were

1  
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3 156 recruited and interviewed to thematic saturation using a pre-designed topic guide. A  
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5 157 deductive approach using content analysis (17) was used for re-analysis of the data in order to  
6  
7 158 align the results to the TDF and to offer new insights.

8  
9 159

10 160 The interview topic guide (Additional file 1) was mapped to the Capability Opportunity  
11  
12 161 Motivation-Behaviour model (COM-B), a model that highlights three critical prerequisites  
13  
14 162 for behaviour change (18). This model was adopted rather than the TDF to guide interviews  
15  
16 163 primarily because of the practical need to reduce interview length without compromising its  
17  
18 164 aim. COM-B is very closely aligned to the TDF and has been utilised as a topic guide and  
19 165 mapped to the TDF in a similar health care professional study (19).

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## 22 167 **Analysis**

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24 168

25 169 All interview transcripts were managed using NVivo v12. Barriers and enablers emerging  
26  
27 170 from the interviews via content analysis were mapped to the relevant TDF domain, initially  
28  
29 171 using construct labelling (10, 20) (Additional File 2). Utterances were coded once to the key  
30  
31 172 TDF construct which then determined TDF domain alignment. JW undertook the initial  
32  
33 173 coding then 5 transcripts were randomly allocated and distributed throughout the team (RJ,  
34  
35 174 PA, and SG) and independent TDF coding occurred, followed by frequent collaborative team  
36  
37 175 discussion to ensure agreement with the coding. Queries were discussed with a behavioural  
38 176 expert (IV).

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## 41 178 **Phase 2 Quantitative Methodology**

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43 179 Study Design – Cross sectional survey.

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45 180

46 181 PHCPs were recruited via two main methods. Initially an invitation was included in a  
47  
48 182 fortnightly newsletter emailed to members of the Primary Care Respiratory Society (PCRS).  
49  
50 183 The survey was additionally distributed and shared by PCRS via their organisational Twitter  
51  
52 184 and Facebook accounts. Social media distribution of the survey was further increased by  
53  
54 185 individual and other organisational sharing, including the Facebook accounts of Advanced  
55  
56 186 Practice UK and General Practice Nurse UK. A link for questionnaire completion was  
57  
58 187 provided to the platform 'Online Survey' (21). This was open between April and December  
59  
60 188 2019. To increase participation, responders were invited to opt in to a prize draw to win an I-  
189 pad.

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2  
3 190 Simultaneously, paper versions of the questionnaire were distributed at 6 UK conferences  
4  
5 191 between March and November 2019 to attending PHCPs (predominately by hand by JW, and  
6  
7 192 using ‘in-conference bag’ distribution at one event). Upon self-completion, questionnaires  
8  
9 193 were placed by participants in a locked ballot box and an optional token of appreciation was  
10  
11 194 offered. Paper questionnaires were manually entered onto ‘Online survey’ by JW.

12 195

13 196 As this was exploratory research, no *a priori* sample size calculations were performed. A  
14  
15 197 pragmatic approach to study closure was adopted, this being online availability for a period  
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17 198 of 8 months, distribution of the questionnaire at several appropriate PHCP targeted events,  
18  
19 199 and that a reasonable range of PHCP had responded.

20 200

## 21 201 **Methodology– Instrument Design**

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25 203 The cross-sectional survey (Additional file 3), collected (1) individual socio-demographic  
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27 204 data, (2) current referral experiences, using TDF-based Likert scale questions (n=54) and (3)  
28  
29 205 any new or complementary issues which may not have been previously mentioned, using an  
30  
31 206 optional open question (22).

32 207

### 33 208 Socio-demographic data

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37 210 These included questions on geographical location of practice, job title, post-qualifying  
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39 211 respiratory education and estimated frequency of PR referrals, using questions with pre-  
40  
41 212 specified options.

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### 43 214 Psychometric data

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47 216 Barriers and enablers for PR referral identified from the phase 1 qualitative findings were  
48  
49 217 converted into belief statements (20), including some that sought to test direct understanding.  
50  
51 218 All questions were generated and aligned to the TDF by the coder (JW) and validated by  
52  
53 219 other team coders (RJ), including a TDF expert (IV). 54 closed, fully labelled 5-point, Likert  
54  
55 220 scale questions/belief statements were included with responses ranging from ‘strongly  
56  
57 221 disagree’ to ‘strongly agree’ and a mid-point rating. Some statements were reversed as an  
58  
59 222 opposite belief to that frequently reported in the phase 1 data. These design elements were  
60  
223 purposely selected to improve reliability and validity (23).

1  
2  
3 224 The final survey mapped the 54 belief statements and open question section to 12 out of 14  
4  
5 225 theoretical domains ('emotion' and 'behavioural regulation' was excluded, given its low  
6  
7 226 mapping in phase 1 results). Two rounds of survey piloting were undertaken with five  
8  
9 227 practice nurses and the questionnaire refined to ensure question clarity and clearer  
10  
11 228 completion instructions.  
12

12 229

### 13 230 **Analysis**

15 231

17 232 All data were exported into an excel spreadsheet and STATAv16 used to conduct simple  
18  
19 233 descriptive statistics (frequencies and percentages), dichotomising into Agree/Strongly Agree  
20  
21 234 vs the remaining options. Free text that directly related to barriers and enablers of referral  
22  
23 235 practice was content-mapped to the TDF and thematic analysis applied (24).  
24

24 236

### 25 237 **Results: Phase 2**

#### 26 238 **Response rates.**

27 239

29 240 Paper surveys (>1100) were distributed across 6 UK primary care focused events which were  
30  
31 241 attended by a variety of PHCPs. 154 (~14%) were returned and 134/154 (83%) completed the  
32  
33 242 survey sufficiently and were included. Online, it is unknown how many potential  
34  
35 243 practitioners read the survey invitation, therefore participation rates could not be calculated.  
36  
37 244 123 participants started the online survey, but only 99 (80.5%) completed it and were  
38  
39 245 included in the analysis.  
40

41 246

42  
43 247 Full details of the paper survey distribution and return rates can be found in additional file 1.  
44

44 248

#### 45 249 **Description of participants**

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47  
48 251 Table 1 presents the socio-demographic characteristics for participants in the phase 2  
49  
50 252 quantitative (n=233) studies. Participants characteristics for phase 1 (qualitative) are available  
51  
52 253 in the previously published paper (6)  
53

53 254

54  
55 255 In contrast to the qualitative study where 6/19 (32%) were GPs, the survey respondents were  
56  
57 256 predominantly female nurses. Nurse respondents were similarly distributed across both  
58  
59 257 conference and online groups (110/134, 82.1%; and 76/99, 76.9% respectively) and  
60

258 responders from both sources had similar time working in practice. However, respondents  
 259 recruited through conferences, compared to those who responded online, tended to be  
 260 younger (28% < 40 years of age), more likely to be practice nurses rather than other types of  
 261 professionals, but were less likely to have respiratory qualifications, to see COPD patients or  
 262 to refer them to PR.

263

264 Table 1 Baseline demographics of phase 2 participants

		Phase 2 Survey (n=233)		
		Conference (n=134) (%)	Online (n=99) (%)	Total (n=233)
<b>Primary Health Care Practitioner Role</b>	General Practitioner (GP)	18 (13.4)	11 (11.1)	29 (12.5)
	Advanced Nurse Practitioner (ANP)	25 (18.7)	32 (32.3)	57 (24.5)
	Practice Nurse (PN)	85 (63.4)	44 (44.5)	129 (55.4)
	Emergency Care Practitioner (ECP)	1 (0.8)	1 (1)	2(0.9)
	Pharmacist	-	4 (4)	4 (1.7)
	Health Care Assistant (HCA)	-	1 (1)	1 (0.4)
	Other	5 (3.7)	6 (6.1)	11 (4.7)
	<b>Total responses</b>	134/134 (100)	99/99 (100)	233/233 (100)
<b>Sex</b>	Female	115 (91.3)	92 (92.9)	207 (92)
	Male	11 (8.7)	7 (7.1)	18 (8)
	<b>Total responses</b>	126/134 (94)	99/99 (100)	225/233 (96.6)
<b>Age (years)</b>	18-29	5 (3.8)	2 (2)	7 (3.0)
	30-39	32 (24)	11 (11.1)	43 (18.5)
	40-49	36 (27.1)	40 (40.4)	76 (32.8)
	50-59	49 (36.8)	40 (40.4)	89 (38.4)
	60 +	11 (8.3)	6 (6.1)	17(7.3)
	<b>Total responses</b>	133/134 (99.3)	99/99 (100)	232/233(99.6)
<b>Ethnicity</b>	White British	112 (84.2)	87 (87.9)	199 (85.7)
	White other	8 (6)	4 (4.1)	12 (5.2)
	Asian/Asian British	7 (5.3)	3 (3)	10 (4.3)
	Mixed Multiple Ethnic Groups	1 (0.7)	2 (2)	3 (1.3)
	Black/African/Caribbean/Black British	2 (1.4)	-	2 (0.9)
	Other ethnic group	3 (2.4)	3 (3)	6 (2.6)
	<b>Total responses</b>	133/134 (99.3)	99/99 (100)	232/233(99.6)
<b>Practice Geographical Location</b>	Scotland	1 (0.8)	3 (3)	4 (1.7)
	England North East and West	31 (23.6)	15 (15.1)	46 (20)
	Yorkshire and the Humber	8 (6.1)	6 (6.1)	14 (6)
	Midlands (East and West)	20 (15.3)	16 (16.1)	36 (15.8)
	East of England	23 (17.5)	18 (18.2)	41 (17.8)
	Wales	31 (23.6)	-	31 (13.5)
	London	3 (2.4)	6 (6.1)	9 (3.9)
	South (East and West)	14 (10.7)	35 (35.4)	49 (21.3)
	<b>Total responses</b>	131/134 (97.8)	99/99 (100)	230/233(98.7)
<b>Years in General Practice</b>	< 5	39 (29.9)	23 (23.2)	62 (27)
	6- 10	26 (19.8)	25 (25.3)	51 (22.2)
	11-15	18 (13.7)	18 (18.2)	36 (15.7)
	16-20	22 (16.8)	14 (14.1)	36 (15.7)
	21 +	26 (19.8)	19 (19.2)	45 (19.4)
	<b>Total responses</b>	131/134 (97.8)	99/99 (100)	230/233(98.7)
<b>Currently see COPD patients</b>	Acute Management	9 (6.7)	5 (5)	14 (6)
	Chronic Management	30 (22.6)	26 (26.3)	56 (24)
	Acute and Chronic management	81 (60.9)	67 (67.6)	148 (64)
	Don't see COPD patients	13 (9.8)	1 (1)	14 (6)



	<b>Total responses</b>	133/134 (99.3)	99/99 (100)	232/233(99.6)
<b>CPD Respiratory Qualifications*</b>	None	62 (46.3)	19 (19.2)	81 (34.8)
	COPD Diploma	28 (20.9)	50 (50.5)	78 (33.5)
	Asthma Diploma	38 (28.4)	52 (50.5)	90 (38.6)
	ARTP Spiro	34 (25.4)	40 (40.4)	74 (31.8)
	Other	16 (11.9)	26 (26.3)	42 (18)
	> one qualification	32 (23.9)	51 (51.5)	83 (35.6)
	<b>Total responses</b>	210	238	448
<b>Reported PR referral practice</b>	Yes (frequency not specified)	-	11 (11.1)	11 (4.7)
	Weekly	16 (12)	32 (32.3)	48 (20.7)
	Monthly	40 (30.1)	21 (21.2)	61 (26.3)
	< Monthly	43 (32.3)	29 (29.3)	72 (31)
	None	34 (25.6)	6 (6.1)	40 (17.3)
	<b>Total</b>	133/134 (99.3)	99/99 (100)	232/233(99.6)

265

266 **Referral to PR by type of healthcare professional**

267

268 Overall, 109 (49.1%) reported being frequent referrers to PR, with GPs being less likely to  
 269 refer and other professions including emergency care practitioners and nurse practitioners and  
 270 ANPs more likely to refer. Referral was also higher among those with one or more  
 271 continuous practice development (CPD) respiratory qualifications. However, this may be  
 272 partly related to such qualification being higher among ANPs (82.5% (47/57)) and other  
 273 grouped professions (58.8% (10/17)) than among GPs (17.9% (5/28)). More than 10 years  
 274 spent in general practice appeared to marginally increase referral frequency (60.7%; 51.8%).

275

276 **Table 2 PHCP referral practice\***

	<b>Frequent Referral n (%) (weekly or monthly) Total n=109</b>	<b>Infrequent referral n (%) (&gt;monthly or no referral) Total n=113</b>
Staff type		
GP (n=28)	10 (35.7)	18 (64.3)
PN (n=120)	57 (47.5)	63 (52.5)
ANP (n=57)	32 (56.1)	25 (43.9)
Other (ECP/NP/Pharm/HCA) (n=17)	10 (58.8)	7 (41.2)
CPD Respiratory Qualification	84 (77.1)	59 (52.2)
Years in Practice > 10 years**	65/107 (60.7)	58/112 (51.8)

277 \*11/99 online PHCPs specified that they referred to PR but did not specify referral frequency and were removed  
 278 from this analysis.

279 \*\* 107/109 and 112/113 reported time spent in general practice

280

281 40/233 (17.2%) responding PHCPs reported never referring to PR, with the largest group  
 282 being practice nurses (29/40; 72.5%). 33 of 40 PHCPs offered a variety of reasons for non-  
 283 referral including; not considering it to be part of their role, not seeing COPD patients or not  
 284 knowing they could refer (12/33; 36.4%). Others reported it was undertaken by other  
 285 respiratory specialist/interested health care professionals across primary and secondary care

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2  
3 286 settings (12/33; 36.4%). Further reported reasons were unsure how to and/or a lack of  
4  
5 287 training (5/33; 15.1%), uncertainty about local service provision (3/33; 9.1%) and 1/33  
6  
7 288 (3.0%) reported belief that patients were not interested.  
8  
9 289

10 290 **Phase 1 Results: TDF analysis of the qualitative interviews**

11 291 Table 3 shows the referral behaviour of PHCPs mapped to all 14 TDF domains. The most  
12  
13 292 frequently mapped domain was social and professional role (n=287 times) whilst the least  
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15 293 mapped was behavioural regulation (n=4).  
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For peer review only

299 Table 3: Phase 1 Mapping of barriers and enablers for referral to TDF domains

300

TDF Domain (construct mapping frequency)	Content mapping (n)	Key points	Evidence supporting
<b>1.Social and Professional Role</b> (A coherent set of behaviours and displayed personal qualities of an individual in a social or work setting)	(n=289)	<p>Referral was considered everyone's role, however it was considered best undertaken by the PHCP during disease stability and at annual review. It was often considered to be the practice nurses' role, but also respiratory-interested others.</p> <p>Most PHCPs considered it their duty of care to motivate patients.</p> <p>Only 1 of 19 PHCPs described implementing practice leadership to improve PR awareness and/or referral.</p>	<p><i>It is largely the nurses' job to see stable COPD patients at an annual review and that is the most appropriate time to refer to pulmonary rehabilitation, not during an acute exacerbation' –GP5</i></p> <p><i>No, I think it's everybody's role, I mean I'm not sure about my non-respiratory colleagues. PN2</i></p> <p><i>So we've put forward a proper business case for it. (Local PR service). GP4</i></p>
<b>2.Knowledge</b> (An awareness of the existence of something)	(n=256)	<p>17 of 19 PHCPs knew of the existence of PR and a generalised understanding of its purpose. PR Knowledge was reported to be gained through post qualification education and networking events.</p> <p>Local PR knowledge such as programme timing, waiting list (if any), and availability of patient transport, was often unknown and were described as inhibitors to referral discussions.</p> <p>The referral criteria Medical Research Council (MRC) dyspnoea Score <math>\geq 3</math> was frequently cited as a referral prompt, although some PHCPs wanted to refer patients with MRC scores of 2 and felt unable to.</p>	<p><i>I think it's a fundamental treatment and I think it's better than drugs. PN7</i></p> <p><i>Do you currently refer to PR? P -I wouldn't know where. GP2</i></p> <p><i>I don't know how to describe pulmonary rehab to a patient. GP3</i></p> <p><i>I just feel that we don't know enough about the program to confidently hand on your heart sell it. PN1</i></p> <p><i>'We've also got the barrier of we can only refer if their MRC is 3 or 4 or 5' PN5</i></p>
<b>3. Environment</b> (Any circumstance of a person's situation or environment that discourages or encourages the development of skills and abilities,	(n=195)	<p>PR referral was often considered inappropriate in non-COPD focused consultations or when a patient was consulting for an acute exacerbation. Clinical time constraints were often described as inhibiting referral, although annual review considered appropriate time</p>	<p><i>I think in our role when you're treating potentially acutely unwell people in a really limited time span then it's, it is realistically going to be hard to cover everything, really hard. ANP2</i></p>

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<p>independence, social competence, and adaptive behaviour)</p>		<p>because of its clinical focus, template design and longer consultation time.</p> <p>PHCPs often stated little PR promotional material was available in practice for patients or staff; there were however mixed views on the potential value of this.</p> <p>3 practices had initiated an in-practice 12 weekly, 1 hour generic exercise group, this appeared to be seen as equivalent to PR by 1 PN.</p>	<p><i>On the annual review well I follow the template and when I get to the pulmonary rehab I mention it then and I say, 'Would you like to go?' PN3</i></p> <p><i>It would be useful for our local organisation I think to give us some little leaflets about what they do so we can give that to patients about the local service ANP4</i></p> <p><i>I'm not against a leaflet but have you seen how many posters and leaflets we have on our walls? GP2</i></p>
<p><b>4. Belief about capabilities</b> (Acceptance of the truth, reality, or validity about an ability, talent, or facility that a person can put to constructive use)</p>	<p>(n=141)</p>	<p>Individual PHCP PR referral confidence varied, with particular uncertainty expressed in how to best 'sell PR' and how to motivate un-motivated patients. Although most were confident in reassuring patients that PR would improve breathlessness.</p> <p>PHCPs with positive non-pharmacological and exercise beliefs appeared to have greater confidence in PR benefit and patients' abilities</p> <p>A number of PHCPs described COPD patients as uninterested in improving their health and some PHCPs emphasised patients needed to be committed to PR. Whilst some PHCPs described 'knowing' which patients would accept referral, others described undertaking subjective patient assessment and expressed concerns about patients' exercise capability in the presence of breathlessness.</p> <p>For patients receiving oxygen therapy there was much uncertainty of the benefit of PR and an assumption that Oxygen/secondary care teams would have previously offered this.</p> <p>Most PHCPs considered key environmental factors such as session timing, venue accessibility, patient financial hardship, as barriers for most patients. Patients in work, or</p>	<p><i>I would need to feel confident, before I speak to this patient about it. ANP4</i></p> <p><i>I quite like... Non-medicinal treatment...think if you're excited by it then it's easier for patients to get excited by it as well. GP4</i></p> <p><i>They are also very very clear that there not going to take anyone on their course unless there is 100% commitment at the beginning that they are going to complete the course. ANP1</i></p> <p><i>You look at the ones that you think would more likely go. ANP4</i></p> <p><i>It's really basically where I see a need, where I see they can benefit – ANP1</i></p> <p><i>If the patients already on oxygen therapy, then it's likely that they've already been seen by them. HCA</i></p> <p><i>The main stumbling block is that you come across is " I'm not going every week for x number of weeks, I can't afford it, I haven't got that much time, how do you expect me to get there ....not a huge number of our patients drive. GP4</i></p>

		those able to take the dog for a walk/wearing walking boots were considered 'too well' for PR.	<i>There's some patients that I would like to refer but they can't go because of work commitments. PN3</i> <i>'It's quite surprising that some patients are still working at odd jobs and things like that and keep them very active. So, for those patients it's not so important.'</i> PN3
<b>5.Memory (Inc: Decision making)</b> (The ability to retain information, focus selectively on aspects of the environment and choose between two or more alternatives)	(n= 118)	Some PHCPs reported forgetting to refer patients to PR, however, embedded system reminders often found in COPD review templates or on-screen prompts were cited as important for most PHCPs.  Patient behaviour and clinical presentation altered decision making processes for some PHCPs for example not referring current smokers, or remembering PR in light of increasing COPD symptom burden and disease deterioration, whilst earlier concerns for patient capability and commitment became less apparent.	<i>I do need a reminders because my head's full, so as I say, I don't want to tick boxes but I do need a prompt.'</i> PN7  <i>That's something that we do, so we have a prompt that pops up saying has this patient been referred to pulmonary rehab. GP5</i>  <i>I think I go through phases, I'll do it really well for a while and somebody has motivated me and then I'll forget that and do something else. PN7</i>  <i>Breathlessness and exacerbations, I think, would be the key factors. GP3</i>
<b>6.Optimism</b> (The confidence that things will happen for the best or that desired goals will be attained)	(n=110)	PHCPs frequently reported that patients did not want to attend PR, citing disease stigma and lack of activation as underlying reasons.  Negative patient responses appeared to dampen PHCPs optimism and reduce subsequent referral offers. Positive patient experience however had the opposite effect.  Positive and negative perceptions of PR providers were also reported on the basis of service quality and frequency of referral acceptance, this appeared to influence referral behaviour.	<i>The first thing you think, 'Are they going to do it? ANP4</i>  <i>Patients don't want it. PN5</i>  <i>Even if you then said what the evidence was and how you could improve, it's – I think that group of people are really difficult to engage .GP3</i>  <i>If they're negative anyway everything you suggest they sort of have an answer, 'Oh no that won't work. PN4</i>  <i>The longer the wait time, the less likely they are to turn up. HCA</i>  <i>I don't think it's the greatest service, it does have an impact because I'm not going to tell my patients to go. PN7</i>

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<p><b>7. Belief about consequences</b> (Acceptance of the truth, reality, or validity about outcomes of a behaviour in a given situation)</p>	<p>(n=107)</p>	<p>There was a general sense that PR is positive with many health and psychological benefits, but beliefs captured in other domains impacted on PHCP belief about consequences of referral offer. A small number of PHCPs expressed concern that PR might worsen patient’s depression and/or anxiety, particularly for those socially isolated.</p>	<p><i>I’ve seen patients that have been... their lives have been transformed in the first year. PN7</i></p> <p><i>Might have prevented the exacerbation if they’d gone PN5</i></p> <p><i>I will say that when I’m talking to patients, say it’s better than drugs, but I still get a closed reaction. PN7</i></p> <p><i>If we can improve patient’s breathing they’re less likely to get anxious, that makes them less likely to dial 999 or likely to do something about it. And perhaps use their rescue packs more appropriately. ANP4</i></p> <p><i>I wouldn’t want to mention it if it ended up being that I’m saying there’s this really good helpful programme but actually if she’s so effected by her disease that she doesn’t leave the house then I wouldn’t want to have mentioned it and then not for her not to be able to go. ANP2</i></p>
<p><b>8. Social Influences</b> (Those interpersonal processes that can cause individuals to change their thoughts, feelings, or behaviours)</p>	<p>(n=84)</p>	<p>Out of practice engagement from PR providers and PR advocates were important in increasing overall awareness and positively influencing referral behaviour.</p> <p>Almost all PHCPs described little to no engagement from providers themselves, and described not knowing what had happened to completed referrals.</p> <p>PHCPs also reported that positive patient PR experiences positively influenced PHCPs referral behaviour and that family can be influential, yet patients rarely ask for PR.</p> <p>PHCPs described a need to increase PR’s profile publicly and for it to be marketed similarly to pharmacological treatments. The name PR itself was considered by some PHCPs to be a negative influence as ‘rehab’ was deemed to have undesirable connotations.</p>	<p><i>Our referral rate has gone up a lot since the respiratory MDT’s because every single one of those patients has subsequently had a referral. GP4</i></p> <p><i>At the moment I wouldn’t know how many people we refer, is that referral going up, Nobodies giving us feedback from the rehab team about how we are doing as a surgery. PN1</i></p> <p><i>If patients that have been to it you know express a positive experience that is something you can share with other people that you are trying to refer. GP1</i></p> <p><i>I asked him to talk to his wife, because I knew she’d want him to go, because I know her through a different channel, and erm... he’s come back and said ‘Ooo I’ll give it a shot. PN5</i></p>

			<i>Nobody has picked up a leaflet and walked in with it and said can you refer me, nobody has. ANP1</i>
<b>9.Skills</b> (An ability or proficiency acquired through practice)	(n=79)	<p>The physical act of referring patients to PR were described as largely straightforward by most PHCPs, although there was no standardised process across the 2 regions.</p> <p>Most undertook this action independently, although there were descriptions of practice administrators helping.</p> <p>However, frequency of referral to PR when described in interviews, was far lower than that which was documented on the returned research interest form.</p>	<p><i>Do you currently refer people to pulmonary rehab? Some, some. PN7</i></p> <p><i>I've been at this practice for nearly three years now and it's sort of something that falls really far down on your list of things that you do on your COPD review, so it's always the last thing that you come to. GP4</i></p> <p><i>It's very easy. It's a form erm it's a just a single sheet. PN2</i></p> <p><i>Quicker, easier referral, much easier referral method PN7</i></p>
<b>10.Reinforcement</b> (Increasing the probability of a response by arranging a dependent relationship, or contingency, between the response and a given stimulus)	(n=59)	<p>There appeared to be no direct sanctions for non-referral of patients, although practice financial rewards in one region appeared to enhance awareness and referral.</p> <p>Outside of these practices there was a suggestion that financial incentives would be advantageous, additionally calculating health cost benefit for PR attendance was suggested as potential enabler.</p> <p>Additionally reinforcements such as those offered by social influences and patients were also described to be valuable.</p>	<p><i>We've got this thing called A** that we're doing for, you know it was the QOF before, so like A** has taken over that so I think because of the A** the doctor who is the lead A** leader he discusses that a lot because of course you get points, you still get the points for it like QOF. So the more we refer is the more points we get so there's an incentive there for the practice. PN6</i></p> <p><i>Yeah if they did something on the BBC or something they might all be in the next day saying, 'Oh I wanna do that'. PN4</i></p> <p><i>If you spent 5 minutes with somebody then at the end of that they agreed to go and then they attended, then you would be motivated to do it again. GP5</i></p>
<b>11.Goals</b> (Mental representations of outcomes or 'end states' that an individual wants to achieve)	(n=47)	<p>Referral to PR was a low-level goal for most PHCPs, but one that varied by consultation type and was not considered during an acute exacerbation review. However, referral appeared to become a goal in the presence of worsening patient symptoms.</p>	<p><i>As a practice, when we do the acute exacerbation we're pretty much focus on the acute exacerbation. GP4</i></p> <p><i>I refer a few to pulmonary rehab but I don't do as many as I feel I should. PN7</i></p>

		<p>Some PHCPs described wanting to refer more patients and learning strategies to improve patient acceptance, but described frequent discord between PHCP and patient goals which PHCPs found challenging.</p> <p>No PHCPs discussed set practice PR referral targets although one GP reported plans to set up a programme geographically closer to practice (captured as leadership in the domain social &amp; professional.)</p>	<p><i>She was more receptive because she'd had a few flares up, not after the first one but because she's had a few. And I think that makes them more receptive to doing that sort of thing. ANP4</i></p> <p><i>One hand I'm wanting them to engage with the disease process so that actually they've got more skills to self-manage and that's going to actually keep them much better for the rest of their life, on the other hand they don't want to be classified as ill. ANP1</i></p> <p><i>It would help me in trying to find out why she didn't go because I would challenge her on it and try and get her to go again and give it another go and that would help me in. ANP4</i></p>
<p><b>12.Intentions</b> (A conscious decision to perform a behaviour or a resolve to act in a certain way)</p>	(n=39)	<p>Some PHCPs have described adopting patient-aimed strategies that included persistence and warnings against overreliance and/or possible reduced effectiveness of pharmacological treatments in an effort to move patients to a state ready for PR referral.</p> <p>There also appeared to be an understanding that acceptance for many patients takes time.</p>	<p><i>I said you know you've used those rescue packs a lot you know if we could get your breathing a bit better, perhaps you wouldn't be so bad...., and she said, alright then I'll see, do the referral. ANP4</i></p> <p><i>How would you feel about something that's not medicine based but will probably help you as much as the inhalers that we've put you on, she was suddenly very interested in. GP4</i></p> <p><i>I look for that chink of interest and then I'll try and worm my way in then. PN7</i></p> <p><i>He was very adamant that he didn't want to go, then I gave him the booklet. PN5</i></p>
<p><b>13.Emotion</b> (A complex reaction pattern, involving experiential, behavioural, and physiological elements, by which the individual attempts to deal with a personally significant matter or event)</p>	(n=6)	<p>PHCPs emotion was rarely discussed although some said they felt annoyed with providers if a referral had been rejected.</p> <p>There were high levels of empathy towards patients particularly amongst nurses; a small number described not</p>	<p><i>Most of our patients are reasonably trusting and say well you seem quite excited by it so shall we give it a try. GP4</i></p> <p><i>They're gonna meet all these people they don't know and be told to lift this walk here, do that and they're frightened, its... I'd be terrified. PN5</i></p>



		wanting to offer the hope of PR to patients and for PR providers to reject referral, this appeared to be a particular concern for patients with high disease burden.	<i>I just don't want to raise – if you raise patients' hopes and say – and offer it, then it can make them – you know, if they're already depressed because of the COPD, it could just make the depression worse you know, so I don't want to impact on their mental wellbeing. ANP1</i>
<b>14. Behavioural regulation</b> (Anything aimed at managing or changing objectively observed or measured actions)	(n=4)	Some PHCPs saw events such as hospital admissions/out-patient appointments as good opportunities for patients to change behaviours but for staff in those settings to instigate referral.  PHCP personal behavioural regulation was low, many did not know how any they had referred or what, post referral, the patient's journey had become. One participant described the research interview as helpful in allowing them to consider how to change their referral approach, but most PHCPs did not vocalise intentions to change or modify current or future PR referral behaviours.	<i>I don't know how much is done in secondary care, but very often when stuff, when you've been in anywhere near secondary care people really its often quite a sit up moment, gosh this is serious enough for me to have to go to hospital, even if it an outpatient appointment. ANP1</i>  <i>This is one of your treatment choices' and perhaps I need to change, thinking about it, my approach in – er, how I word it. ANP4</i>  <i>It's trying to make it a priority. ANP4</i>

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### 303 Phase 2. Questionnaire results: Referral practice beliefs.

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305 Table 4 presents the number and proportion of PHCPs that agreed or strongly agreed with each belief statement by frequency of referral.

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311 Table 4 Results of TDF belief statements by referral frequency

TDF Domain	TDF Questions (n=54)	Frequent referral n=109 (%) (weekly/monthly)	Infrequent referral n=113(%) (>monthly or no referral)	Total n=222(%)
1.Knowledge	I am aware of the content of Pulmonary Rehabilitation (PR) Programmes *	97/109 (89.0)	72/113(63.7)	169/222 (76.1)
	I am aware of PR programme objectives. *	99/109 (90.8)	75/113 (66.4)	174/222 (78.4)
	I am unsure of the evidence base for PR	18/109(16.5)	30/113 (26.5)	49/222(21.6)
	I know where geographically my local PR programme is delivered*	92/109 (84.4)	70/113(61.9)	162/222 (73.0)
	I know when it is appropriate to refer a patient with COPD to PR *	106/109 (97.3)	74/113 (65.5)	180/222 (81.1)
	I can answer questions patients have about PR*	88/109 (80.7)	60/113 (53.1)	148/222 (66.7)
	I know how to contact my local PR provider *	91/109(83.2)	68/113 (60.2)	159/222 (71.6)
2.Skill	It is easy to refer a patient to PR*	87/109 (80.0)	48/113 (42.5)	135/222 (60.8)
3.Social & Professional Role	Referral to PR is the practice nurse role	63/109 (57.8)	45/113 (39.8)	108/222(48.6)
	Other General Practice staff in my practice (excluding Practice Nurse) refer patients to PR	52/109(47.7)	63/113(55.8)	115/222 (51.8)
	I believe in encouraging patients to attend PR	109/109 (100)	104/112 (92.9)	213/221 (96.4)
4.Environment	Resources about PR i.e written information) are readily available	39/109 (35.7)	25/112 (22.3)	64/221 (29.0)
	There is not enough time in practice to refer	12/109 (11.0)	22/113 (19.5)	34/222(15.3)
5.Social Influences	My local PR providers regularly engage with me	31/109 (28.4)	17/113 (15.0)	48/222 (22.6)

	PR is something that patients ask for	3/109 (2.8)	8/112 (7.1)	11/221 (5.0)
	There are good relationships in practice with PR providers	44/109 (40.4)	28/112 (25.0)	72/221 (32.6)
	PR providers are good at communicating outcomes of referrals I have made	39/109 (35.8)	25/112 (22.3)	64/221 (29.0)
6.Optimism (including pessimism)	I am confident my local PR provider offers a good service for my patients.*	81/109 (74.3)	52/113 (46.0)	135/222 (60.8)
	I don't believe patients will attend PR after I have referred	16/109 (14.7)	16/113(14.2)	32/222(14.4)
	Patients who smoke are not motivated to take part in PR	7/109 (6.4)	7/113 (6.2)	14/222 (6.3)
	Patients who live alone won't like to take part in group PR	5/109 (4.6)	2/113 (1.8)	7/222 (3.2)
	Patients are motivated to attend PR	23/109 (21.6)	30/111 (27.0)	53/219 (24.2)
7.Belief about Capabilities (self)	I am confident in my ability to encourage patients to attend PR, even when they are not motivated	91/109(83.5)	73/113 (67.6)	164/222 (73.9)
	I do not find it easy to discuss PR with patients.	8/109(7.3)	25/113 (22.1)	36/222(16.2)
Belief about capabilities (patients)	Patients without their own transport won't be able to get to PR	40/109(36.7)	26/113 (23.0)	66/222 (29.7)
	Patients in work are not able to attend PR *	62/109 (56.9)	35/113 (31.0)	97/222 (43.7)
	Patients who use home oxygen are unable to take part in PR	4/109(3.7)	6/113 (5.3)	10/222 (4.5)
8.Belief about consequences	If I keep pushing patients to attend PR this will disadvantage my relationship with them.	10/109 (9.2)	10/112 (8.9)	20/221 (9.0)
	I believe patients may be harmed by taking part In PR	1/109 (0.9)	1/113 (0.9)	2/222(0.9)
	I believe most patients will attend and complete PR following my referral	55/109 (50.4)	47/112 (42.0)	102/221 (46.2)
	PR is not beneficial to patients who are breathless	3/109(2.8)	3/113(2.7)	6/222 (2.7)

	PR is best suited to those patients with worsening breathlessness	29/109 (26.6)	29/112 (25.9)	58/221 (26.2)
	PR is <b>best</b> suited to those who have frequent exacerbations	27/109 (24.8)	28/112 (25.0)	55/221 (24.9)
	PR reduces hospital admissions	101/109 (92.7)	97/112 (86.6)	198/221 (89.6)
	PR reduces risk of mortality	85/109 (78.0)	82/112 (73.2)	167/221 (75.6)
	If patients attend PR this will reduce their general practice visits	73/109 (67.0)	78/112 (69.6)	151/221 (68.3)
	PR reduces exacerbations	88/109 (80.7)	84/112 (75.0)	172/221 (77.8)
	PR improves breathlessness	103/109 (94.5)	100/112 (89.3)	203/221 (91.9)
	PR reduces a patient's anxiety and/or depression.	97/108 (89.8)	96/112 (85.7)	193/220 (87.7)
9..Goals	Referring patients to PR is something I have been advised to do*	95/107(88.8)	57/112(50.9)	152/219 (69.4)
	My practice regularly reviews COPD registers to ensure eligible COPD patients are offered PR	51/109 (46.8)	40/113 (35.4)	91/222 (41.0)
	There are set targets within the practice to improve PR referral rates	23/109 (21.1)	21/113 (18.6)	44/222 (19.8)
10. Memory (Inc.Decision Making)	I often forget to refer patients with COPD to PR	3/109 (2.8)	23/113 (20.4)	26/222 (11.7)
	Prompts to refer patients to PR within annual review templates are important reminders for me	72/109 (66.1)	69/112 (61.6)	141/221 (63.8)
	I only refer patients if they have quit smoking	1/109 (0.9)	3/113 (2.7)	4/222 (1.8)
	I only refer patients if they are optimised on their respiratory medication	17/109 (15.6)	12/113 (10.6)	29/222 (13.1)
	PR is most suited to COPD patients who have frequent exacerbations	20/109 (18.3)	20/113 (17.7)	40/221 (18.1)

	The best time to discuss PR referral with patients is when they are stable.	32/109 (29.4)	25/112 (22.3)	57/221 (25.8)
11.Reinforcement	More health care practitioners will discuss PR with patients because of the QoF incentive.	75/109 (68.8)	73/112 (65.2)	148/221 (67.0)
	My practice receives financial incentives for referral to PR (Before April 2019)	6/108 (5.6)	5/113 (4.4)	11/221 (5.0)
	I believe patient attendance to PR will increase because of the QoF Incentive.	41/109 (37.6)	58/112 (51.8)	99/221 (44.8)
	I believe the QoF incentive will not increase patients PR attendance *	29/109 (26.6)	25/112 (2.3)	54/221 (24.4)
	There will be greater awareness of PR within practices because of the new QoF incentives.	84/109 (77.1)	71/112 (63.4)	155/221 (70.1)
12.Intentions	I will refer more patients to PR now there are practice QoF incentives (from April 2019)	30/109 (27.5)	42/112 (37.5)	72/221 (32.6)

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\*differences in results of >20% between frequent and infrequent referrer

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3 314 In general, most PHCPs had some PR knowledge (especially the frequent referrers) and  
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5 315 understood the beneficial consequences of PR. However, resources, social influences (such as  
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7 316 relationship with PR providers) and pessimism about patient motivations were perceived  
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9 317 barriers by a high proportion of PHCPs, irrespective of their referral practice.

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12 319 There were however, differences in domains between frequent and infrequent PR referrers.

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15 321 The greatest differences were within the 'Knowledge' domain. Frequent referrers most  
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17 322 commonly reported agreement with all 7 statements, when compared to the infrequent  
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19 323 referrers. For example, 97.3% reported knowing when to refer to PR and 80.7% being able to  
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21 324 answer patients' questions versus 65.5% and 53.1% of infrequent referrers.

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24 326 Further group differences were demonstrated in the 'Skills' domain and 'Beliefs about  
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26 327 (PHCP) capabilities', which showed that infrequent referrers were less confident in  
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28 328 encouraging unmotivated patients to attend PR (67.6% versus 83.5% of frequent referrers).  
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30 329 Reduced confidence amongst infrequent referrers was further reflected within the 'Optimism'  
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32 330 domain and belief statement 'I am confident my local provider offers a good service' (46%  
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34 331 against 74.3% of frequent referrers). However, over half (56.9%) of frequent referrers felt  
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36 332 that patients in work were not able to attend PR, compared to less than a third (31%) of those  
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38 333 who referred infrequently.

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41 335 The remaining belief statements demonstrated greater group similarities than differences.  
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43 336 Environment, Social and Professional role: Most respondents felt that there was enough time  
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45 337 in practice to refer (84.7%) and believed in encouraging PR attendance (96.4%). Yet  
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47 338 promotional information on PR was rarely available in practices (29%). There was no clearly  
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49 339 identified PR referrer; less than half (48.6%) felt it was the practice nurse's role and (51.8%)  
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51 340 reported other practice staff refer.

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54 342 Social influences: Frequent referrers were slightly more likely to agree with 3 of the 4  
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56 343 domain belief statements than infrequent referrers. Although, collectively the groups reported  
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58 344 both PR provider engagement and referral outcome reporting as low at only 22.6% and 29%  
59  
60 345 respectively. PHCPs also reported patients rarely request referral to PR (5%).

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3 347 Belief about consequences and Optimism: Most PHCPs agreed that PR offers physical health  
4 348 benefits, including improving breathlessness and reducing hospital admissions (91.9%,  
5 349 89.6%) respectively. Yet far fewer PHCPs believed patients would attend and complete PR  
6 350 (46.2%), with fewer still agreeing that patients are PR motivated (24.2%).  
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10 351  
11 352 Memory (decision-making): Only a small number of PHCPs reported forgetting to refer  
12 353 patients to PR (11.7%). COPD annual review templates were reported as helpful referral  
13 354 reminders (63.8%) and 25.8% reported the best time to discuss referral with patients was  
14 355 during COPD stability. Patient characteristics such as disease stability and smoking status do  
15 356 not appear to impede PHCP referral decisions as 98.2% reported referring smokers.  
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21 358 Goals, Reinforcement and Intention: in-practice review of eligible patients was not  
22 359 commonly reported (41%) and only (19.8%) reported in-practice targets to improve referral  
23 360 rates. Practice financial reward for referral (pre April 2019) was rarely reported (5%); indeed  
24 361 the implementation of financial reward via national QoF incentives (post April 2019) was  
25 362 considered unlikely to greatly improve referral behaviours, with less than a third (32.6%)  
26 363 stating they would refer more. However, there was general agreement that this incentive  
27 364 would increase practice awareness of PR (70.1%).  
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## 36 366 **Phase 2. Questionnaire: Open questions.**

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38 368 A third of PHCPs (33.8%) responded to the open question at the end of the survey including  
39 369 5/11 PHCPs who reported referral, but did not specify frequency, (answer length 3-167  
40 370 words, mean 35). Non-frequent referrers reported more open comments (43/113 38.1%) than  
41 371 frequent referrers (33/109 30.3%)  
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47 373 This gave an additional 94 comments that related directly to PR referral. These were content  
48 374 mapped to all 12 relevant TDF domains. The comments predominately cited referral barriers.  
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53 376 Belief about capabilities had the highest number of comments 36/94 (38.3%) with many  
54 377 encompassing concerns about PR accessibility, particularly transport challenges for patients.

55 378 For example, '*Location of PR too far for patients to travel and too much commitment. Patients tend to be*  
56 379 *older adults on generally low incomes. A number of my patients would attend if it was close by with no*  
57 380 *expense*'. A small number of PHCPs (3.2%) considered a patient's inability to complete pre-

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3 381 PR spirometry as a referral barrier, and 10.6% of comments related to referral processes,  
4 382 which were reported to be lengthy and as such '*easier simpler*' processes were requested.

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8 384 **Connected results**

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11 386 In order to identify the key factors that inhibit and/or enable PHCP referral to PR, Phase 1  
12 387 and phase 2 results were merged to allow for data contrast and meta-inference (16) (Table 5).

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16 389 Most PHCPs believed in PR and encouraging patients to attend. Referral is most likely to be  
17 390 considered at annual review (indeed referral is rarely offered to patients outside of this  
18 391 consultation). On-screen prompts are helpful reminders, but in practice material promoting  
19 392 PR is rare. PHCP PR knowledge is largely gained from networking with other respiratory  
20 393 interested health professionals and/or CPD education. PHCPs report patients have little  
21 394 motivation for PR, rarely ask for referral to PR and view that patients in work are unlikely to  
22 395 be able to attend.

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26 397 Some findings of the qualitative study were not clearly replicated in the survey results. For  
27 398 example, phase one qualitative data highlighted that some GPs and ANPs felt the practice  
28 399 nurse was best placed to undertake PR referral at the time of annual review, yet respiratory  
29 400 interested GPs and those undertaking annual review did not share this view. The phase two  
30 401 survey data supported the latter position, where 29/129 (22.5%) of practice nurses reported  
31 402 never referring. Therefore responsibility of PR referral is not based on profession, but is  
32 403 undertaken by PHCPs who are respiratory interested and/or conducting the patient's annual  
33 404 review.

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36 406 Qualitative generalisable findings were limited in a number of areas meaning clear  
37 407 conclusion cannot be drawn, these included; time available to undertake referral, ease of  
38 408 referral process, perceptions of quality of PR programme, referral of patients when COPD  
39 409 symptom burden is increasing and non-referral in order to protect patient relationship.

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42 411 Where generalisability is clear, a summary of the key behavioural barriers and enablers by  
43 412 TDF domain are shown in Table 5, demonstrating a greater number of barriers than enablers  
44 413 to referral. However, it is also important to report that barriers and enablers most commonly  
45 414 co-exist within the same domains.



415 Table 5 Matrix of Integrated results

416 ✓ Enabler and agreement with Phase 1 data.

417 ✗ Barrier and agreement with Phase 1 data.

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TDF Domain	Phase 1 Qualitative study Main Factors	Phase 2 Survey Main Factors	Barrier - ✗ / Enabler - ✓
Social and Professional Role	It is largely seen as the practice nurse role, or staff undertaking COPD review.	Not clearly PNs role, but PHCP doing annual review is most likely referrer.	PHCP undertaking annual review (not necessarily the PN)- ✓
	The best time to refer a patient is when they are stable	Disagree	Not generalizable in quantitative data.
	Most PHCPs believe in encouraging patients to attend.	Agree	✓
Knowledge	Generally a good basic knowledge	Agree (Generally higher in frequent referrers)	Enabler – but room for improvement
	Little detailed local programme knowledge	Disagree (Higher local knowledge in frequent referrers)	✓
	Knowledge is largely gained from CPD/networking	Agree	✓
Environment	There is a lack of time in practice.	Disagree	Not generalizable in the quantitative data.
	Referral is only considered during non-acute COPD focused consultations.	Agreed (some infrequent referrers reported not to see COPD patients)	✗
	There is a lack of PR promotional material available in practices.	Agree	✗
Memory	On screen reminders are important	Agree	✓
	Referral prompted when patients have symptoms that are worsening	Disagree	Not generalizable in the quantitative data.
Optimism	Patients do not want PR/are not motivated	Agree	✗
	PR providers do not offer a good service.	Some agreement more so with infrequent referrers	✗
Belief about consequences	PR is good for patient's physical and psychological health.	Agree	✓
	PR may harm patients (psychologically)	Disagree	Not generalizable in the quantitative data.
	Pushing PR might harm my relationship.	Disagree	Not generalizable in the quantitative data.
	Patients will not always attend and complete post referral.	General agreement.	✗

Belief about capability	Talking to patients about PR is challenging.	Some agreement more so with infrequent referrers.	✗
	Patients in work are unable to attend PR	Agree	✗
	Transport is a barrier	Agree (Open question)	✗
	Not for patients with oxygen	Disagree	Not generalizable in the quantitative data. Not generalizable in the quantitative data. Not generalizable in the quantitative data
	Not for patients who smoke	Disagree	
	Best suited to those who have frequent exacerbations	Disagree	
Social influences	Lack of PR provider engagement and feedback to referrer	Agree	✗
	Patients do not ask for PR	Agree	✗
Skills	Referral to PR by PHCP is low	Agree	✗
	Referral process is relatively easy	Disagreement, particularly by infrequent referrers.	Likely barrier
Reinforcement	Financial reward increases referral rates	Most don't think this would change behaviour.	Not generalizable in the quantitative data
	Patients decline PR	Not captured explicitly	Likely barrier
	Financial reward increases practice awareness	Agree	✓
Goals	No set in-practice process to improve or review referral rates.	Agree	✗
Intentions	Referral acceptance takes time	Not captured explicitly	Likely barrier
	General desire to refer more patients.	Not captured explicitly	Likely enabler
Emotion	PHCPs are fearful on behalf of patients	Concern over access abilities (expressed in free text, may capture PHCP fear)	✗
	Frustration with PR providers	Not captured explicitly.	✗
Behavioural Regulation	PHCPs do not know how many patients they have referred.	Agree	✗
	PHCPs have no planned intentions to change behaviour	Largely agree, although some emerging interventions (free text)	Likely barrier

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3 422 **Discussion:**  
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5 423 This is the first time the Theoretical Domains Framework has been applied to a mixed-  
6 424 methods study to understand the key factors that determine referral to PR by PHCPs.  
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10 426 Results highlighted multiple intertwined barriers and few enablers across all TDF domains  
11 427 Many (although not all) of the findings from the qualitative study were affirmed by the more  
12 428 generalisable survey and highlight that referral to PR from primary care remains poor, and  
13 429 that PHCPs believed that PR was beneficial for patients and wanted to refer more. They did  
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15 430 however, request greater engagement from providers, better knowledge of local programmes  
16 431 and improvements in PR promotion. They also reported that in-practice goals and monitoring  
17 432 of referrals to address the shortfall in patients referred were rare.  
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22 434 However, PHCPs collectively reported low confidence in patients' abilities and motivations  
23 435 to attend PR, a belief likely to be strengthened by reports of few patients requesting referral.  
24 436 Beliefs about low uptake may explain why referral is commonly offered at times of  
25 437 increasing COPD symptoms, thus acting as a lever to referral acceptance. Infrequent referrers  
26 438 reported reduced confidence in encouraging un-motivated patients to attend, with similar  
27 439 findings reported in phase 1 data as PHCPs expressed concerns around the protection of  
28 440 relationships with patients. Venue accessibility also appears to be a barrier and whilst the  
29 441 direct survey question (question 21) appeared not to overtly agree with this, both phase 1 and  
30 442 the phase 2 open question results highlighted transport as both a practical and financial  
31 443 barrier.  
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34 445 Variability in referral rate by PHCP profession was an unexpected finding and offers insights  
35 446 that (1) few PNs refer and (2) where it is considered to be the 'respiratory nurse' role, referral  
36 447 opportunities may become reduced. The association between referral frequency and  
37 448 respiratory qualification is also a new finding. ANPs were those most likely to refer and to  
38 449 have respiratory qualifications.  
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41 451 **Relation to other studies.**  
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44 453 This mixed methods TDF based study finds agreement with many key referral factors  
45 454 presented in our previous inductive qualitative study using the same data (6) and  
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3 455 Cox et al's (25) TDF-applied systematic review which included patients and HCPs views on  
4 456 PR barriers and enablers. However this primary mixed methods study reports additional  
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6 457 findings. It disputes that the PN is the main referrer to PR within primary care, and questions  
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8 458 the value of practice based financial reward as a referral incentive. It also highlights that the  
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10 459 referral process itself is not straightforward and there are no sanctions for non-referral, but  
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12 460 that there is time in practice to refer.

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15 462 Increasing the population sample and geographical reach in this study strengthens current  
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17 463 known referral barriers including, poor patient motivation, few in-practice resources,  
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19 464 perceived venue access difficulties and little awareness of local PR provision (26-29).  
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21 465 Subjective patient assessments including PHCPs perceptions of patients capabilities and  
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23 466 motivations have been described as influencing PHCP referral decisions here and previously  
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25 467 published (6). This is a novel finding in relation to PR referral, yet similar HCP pessimistic  
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27 468 attitudes, relating to a patient's capability and motivation to access services and change  
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29 469 behaviours to improve health outcomes have been reported in the primary healthcare  
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31 470 management of reducing cardiovascular disease risk in people with serious mental illness (30,  
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33 471 31).

34 473 Phase one and inductive data analysis (6) suggested that offering PR at COPD symptom  
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36 474 increase was common yet this was unconfirmed in the survey results. This may demonstrate  
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38 475 further social desirability reporting as previous analyses have demonstrated patients attending  
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40 476 PR to have 1.24 hospitalisations per patient-year 95% CI (0.66-2.34) suggesting sicker  
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42 477 patients are those most likely to be offered PR (32). However, referral at this time supports  
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44 478 both PHCP and patients' concerns about patient's capabilities (6, 25, 33), meaning lower  
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46 479 acceptance and adherence to PR is probable, and negative PHCP beliefs about referral  
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48 480 outcomes are likely to perpetuate. An alternative approach and one that appears not to be  
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50 481 currently undertaken is to refer at the point of an acute exacerbation of COPD, which maybe  
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52 482 a referral lever (33).

53 484 In our original inductive analysis (6), we reported that financial incentives may be important,  
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55 485 yet results in this current study are mixed and PHCPs appear uncertain of their value. It will  
56  
57 486 be interesting to observe the impact of the newly implemented financial rewards for PR  
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59 487 referral in England, but where similar QoF rewards were implemented for referral to diabetes  
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488 programmes, uptake did not greatly improve (34). Given positive correlations between

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3 489 referral rates and CPD education, efforts to increase the number and education of the primary  
4 care workforce by Health Education England (35, 36) is encouraging.  
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8 492 The literature also supports a general consensus that for patients in employment, PR is largely  
9 considered inaccessible (6, 28). This was reported as a barrier by the frequent referrers more  
10 493 than the infrequent referrers, which questions whether PR knowledge itself is a potential  
11 494 barrier as previously reported (6) and that PHCP beliefs influence subsequent referral  
12 495 behaviours.  
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### 18 498 **Strengths and Limitations**

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20 500 Using the previously published qualitative data to inform the questionnaire offered valuable  
21 501 insights into PHCP referral practices and is a key strength of this research.  
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26 503 The range and number of PHCPs included from across the UK were broadly representative of  
27 504 the general practice nursing workforce, whilst less so for others, notably doctors and is a  
28 505 limitation (37). We recognise that predominately respiratory interested participants may have  
29 506 taken part in this study which may skew results, and it is noted that online participants  
30 507 reported higher referral practice and respiratory qualification(s) than their counterparts, which  
31 508 may be a study limitation, suggesting that more emphasis should be placed on the perspective  
32 509 of the infrequent referrers. Adopting additional recruitment strategies such as via general  
33 510 practice-based conferences is seen as a study strength which sought to capture a range of  
34 511 PHCPs views. Demographic similarities across all 3 recruitment streams highlight study  
35 512 design attempts to reduce participation and sample selection biases. Questionnaire specific  
36 513 biases relating to self-reporting response is a source of potential weakness, specifically where  
37 514 responses maybe perceived to be 'socially acceptable', otherwise known as social desirability  
38 515 (38). This may offer some explanation around the variation observed in the belief about  
39 516 capabilities domain of the integrated results matrix (Table 5). Grouping participants by  
40 517 reported referral frequency is a study strength, particularly as the aim is to understand both  
41 518 what supports and inhibits referral. Another limitation is that we are not sure about exact  
42 519 response rates where distribution was unknown.  
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3 522 Much of the validity of the TDF is gained from its direct application with HCPs, as utilised  
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5 523 here. Transcript content mapping to 84 constructs is complex and time consuming as also  
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7 524 described by others (39) but was considered the most comprehensive approach in the absence  
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9 525 of a gold standard approach to TDF application (39). The TDF offers a functional approach  
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11 526 to behavioural data analysis, most likely to be helpful when there is little to no underlying  
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13 527 knowledge of the investigating phenomenon. However, the interrelations between referrer,  
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15 528 patient and provider have previously been reported to be important factors in the referral  
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17 529 journey (6). Yet, the TDF does not offer causal determinants of behaviour (20) and alignment  
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19 530 to predetermined domains reduces the ability to consider any phenomena falling outside  
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21 531 those domains and the likely connecting relations, meaning the whole picture maybe missed  
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23 532 and is a potential limitation.

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24 534 All authors had different professional backgrounds, one of whom (JW) is an experienced  
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26 535 respiratory nurse specialist which may have altered data analysis although transparency and  
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28 536 frequent team analysis sought to reduce potential bias.

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### 539 **Implications for policy and practice**

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36 541 Whilst this paper highlights multiple barriers in referring patients with COPD to PR, barriers  
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38 542 to high quality healthcare for patients with COPD persist across health services, spanning the  
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40 543 disease trajectory (40). It is interesting to note that few participants in our study thought that  
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42 544 a financial incentive was important. It is however difficult to assess this given that face to  
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44 545 face PR programmes were suspended across the country as a result of the COVID-19  
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46 546 pandemic. However, as previously highlighted QOF incentives for referral to diabetes  
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48 547 programmes did not greatly improve uptake. What we need to do now is to design and test an  
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50 548 intervention for improving referral to PR which incorporates multi-system level changes.  
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52 549 Additional intervention considerations will also need to include post COVID-19 infection  
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54 550 control adaptations, as well as managing increases in service demands arising from  
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56 551 programme suspension backlogs and new referrals, including COVID-19 survivors (41).

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## 556 **Conclusions**

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558 This is the first mixed methods research study to examine the factors that inhibit and enable  
559 referral to PR for patients with COPD from a primary care perspective. Whilst knowledge  
560 and respiratory qualification appear to be enablers, many barriers persist which must be  
561 overcome to increase referral opportunities for all eligible patients. The most important  
562 aspects to address are to increase PR provider engagement with referrers, increase PR  
563 awareness and support for potential patients and all PHCPs, including those with respiratory  
564 qualifications and to increase PHCP internal motivation for PR referral, particularly for those  
565 patients in work and those with less symptom burden. Mapping these TDF findings to  
566 behaviour change techniques (BCT) are important next steps which will enable clear targeted  
567 interventions to be identified and tested in clinical practice, which will ultimately increase  
568 referral to PR, thereby improving COPD patients' health outcomes and reducing health  
569 service utilization.

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- 53 685  
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58 **688 Ethics approval and consent to participate**  
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3 689 Ethical Approvals: Phase 1 approval granted by Health Research Authority: Project ID:  
4 690 213367. Phase 2 approval granted by University of Birmingham: ERN\_19-0439. All  
5 691 participants in phase 1 and phase 2 studies gave consent.

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8 692 **Consent for publication**

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10 693 Not Applicable

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12 694 **Availability of data and material**

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15 695 The datasets during and/or analysed during the current study available from the  
16 696 corresponding author on reasonable request.

17  
18 697 **Competing interests**

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20 698 The authors declare that they have no competing interests"

21  
22 699 **Funding**

23  
24  
25 700 'This research received no specific grant from any funding agency in the public, commercial  
26 701 or not-for-profit sectors'.

27  
28 702 **Authors' contributions**

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30  
31 703 JW collected, analysed and interpreted phase 1 and phase 2 data and was a major contributor  
32 704 in writing the manuscript. RJ, PA, SG and AE contributed to study design, data analysis and  
33 705 interpretation of phase 1 and 2 data. RJ, PA and SG all contributed to the writing of the  
34 706 manuscript. IV supported phase 1 topic guide development, phase 1 data alignment to the  
35 707 TDF and the formulation of the phase 2 questionnaire where behavioural expert consensus  
36 708 was sought. All authors read and approved the final manuscript.

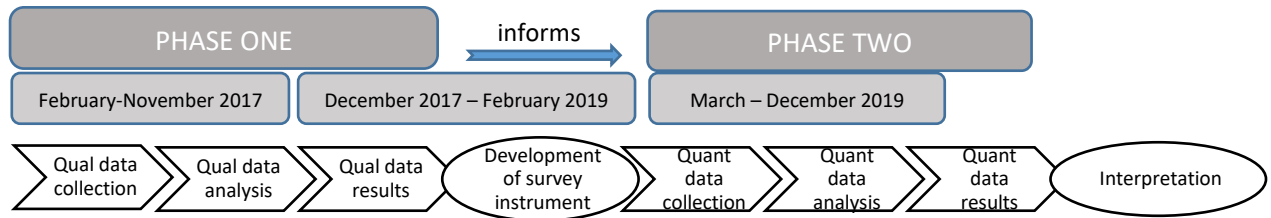
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39 709 **Acknowledgements**

40  
41 710 The authors thank all participating primary healthcare practitioners for giving up their time,  
42 711 providing the data, and contributing to this study.

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Figure 1

Figure 1: Multiphase sequential design



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## **Additional File 1: Phase 1 interview guide**

### **Understanding barriers and enablers for primary care health staff when referring patients with Chronic Obstructive Pulmonary Disease (COPD) to Pulmonary Rehabilitation: a qualitative study. Topic Guide for Interviews.**

#### **Interview Objectives:**

- To explore the experience of primary care practitioners in relation to referral of patients with COPD to pulmonary rehabilitation.
- To gain an understanding of the main perceived barriers and enablers for referring COPD patients for pulmonary rehabilitation.
- To gain insight into whether any patient characteristics influence whether or not people with COPD are referred for pulmonary rehabilitation.

#### Understanding current behaviour

To start the discussion, participants will be asked to talk about their experiences of managing patients with COPD in primary care and any experience of referral for pulmonary rehabilitation

1/ Could you tell me in what context do you currently see COPD patients? (Exposure to population/target intervention within working role e.g. planned – annual review/flu jab or unplanned - exacerbation)

2/ On average how many COPD patients do you think you see per week?

3/ Do you currently refer to PR programmes?

#### Capability, Opportunity, Motivation – including External Context

4/ What is your understanding/view surrounding Pulmonary Rehabilitation programs in general? And in relation to your local provider?....

5/ Do you think pulmonary rehabilitation is beneficial for patients? In what ways? Or why not?

6/ How easy or difficult is it for you to refer to your local PR provider?

(Eg. Is it your role to refer? When is it appropriate to refer COPD patients to PR?)

7/ What motivates you to refer patients to PR ?

(Eg. Do patients/carers ever ask you about pulmonary rehabilitation? Does the post PR patient summary motivate you, are you reminded by prompts or other guidance?)

8/ What do you think stops you from referring patients to pulmonary rehabilitation?

#### Images Alternating images (between 1-4)

9/ If this person was in your COPD patient, would you consider discussing PR with them? Why? Why not?

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5 10/ Is there anything that you think could improve the primary care discussion surrounding  
6 PR and/or encourage you to make referrals to PR?  
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8 Possible prompts: Do you think a short video clip would help you motivate patients? Or  
9 computerised prompts to follow? Or a further telephone call to encourage patients? Or a  
10 firm appointment slot to discuss PR with them?  
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Additional file 2 TDF domain alignment using construct labelling (1)

Domain	Constructs
1. Knowledge (An awareness of the existence of something)	Knowledge (including knowledge of condition /scientific rationale) Procedural knowledge Knowledge of task environment
2. Skills (An ability or proficiency acquired through practice)	Skills Skills development Competence Ability Interpersonal skills Practice Skill assessment
3. Social/Professional Role and Identity (A coherent set of behaviours and displayed personal qualities of an individual in a social or work setting)	Professional identity Professional role Social identity Identity Professional boundaries Professional confidence Group identity Leadership Organisational commitment
4. Beliefs about Capabilities (Acceptance of the truth, reality, or validity about an ability, talent, or facility that a person can put to constructive use)	Self-confidence Perceived competence Self-efficacy Perceived behavioural control Beliefs Self-esteem Empowerment Professional confidence
5. Optimism (The confidence that things will happen for the best or that desired goals will be attained)	Optimism Pessimism Unrealistic optimism Identity
6. Beliefs about Consequences (Acceptance of the truth, reality, or validity about outcomes of a behaviour in a given situation)	Beliefs Outcome expectancies Characteristics of outcome expectancies Anticipated regret Consequents

<p>7. Reinforcement</p> <p>(Increasing the probability of a response by arranging a dependent relationship, or contingency, between the response and a given stimulus)</p>	<p>Rewards (proximal / distal, valued / not valued, probable / improbable)</p> <p>Incentives</p> <p>Punishment</p> <p>Consequents</p> <p>Reinforcement</p> <p>Contingencies</p> <p>Sanctions</p>
<p>8. Intentions</p> <p>(A conscious decision to perform a behaviour or a resolve to act in a certain way)</p>	<p>Stability of intentions</p> <p>Stages of change model</p> <p>Transtheoretical model and stages of change</p>
<p>9. Goals</p> <p>(Mental representations of outcomes or end states that an individual wants to achieve)</p>	<p>Goals (distal / proximal)</p> <p>Goal priority</p> <p>Goal / target setting</p> <p>Goals (autonomous / controlled)</p> <p>Action planning</p> <p>Implementation intention</p>
<p>10. Memory, Attention and Decision Processes</p> <p>(The ability to retain information, focus selectively on aspects of the environment and choose between two or more alternatives)</p>	<p>Memory</p> <p>Attention</p> <p>Attention control</p> <p>Decision making</p> <p>Cognitive overload / tiredness</p>
<p>11. Environmental Context and Resources</p> <p>(Any circumstance of a person's situation or environment that discourages or encourages the development of skills and abilities, independence, social competence, and adaptive behaviour)</p>	<p>Environmental stressors</p> <p>Organisational culture /climate</p> <p>Resources / material resources</p> <p>Salient events / critical incidents</p> <p>Person x environment interaction</p> <p>Barriers and facilitators</p>
<p>12. Social influences</p> <p>(Those interpersonal processes that can cause individuals to change their thoughts, feelings, or behaviours)</p>	<p>Social pressure</p> <p>Social norms</p> <p>Group conformity</p> <p>Social comparisons</p> <p>Group norms</p> <p>Social support</p> <p>Power</p> <p>Intergroup conflict</p> <p>Alienation</p> <p>Group identity</p> <p>Modelling</p>
<p>13. Emotion</p>	<p>Fear</p> <p>Anxiety</p>

<p>(A complex reaction pattern, involving experiential, behavioural, and physiological elements, by which the individual attempts to deal with a personally significant matter or event)</p>	<p>Affect Stress Depression Positive / negative affect Burn-out</p>
<p>14. Behavioural Regulation (Anything aimed at managing or changing objectively observed or measured actions)</p>	<p>Self-monitoring Breaking habit Action planning</p>

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**Additional File 3: General Practice Staff experiences of referring patients with COPD to PR**

Thank you for taking the time to complete this questionnaire, which aims to gather perspectives from staff working in primary care. This survey is designed for us to find out some of the barriers staff face when considering referring a patient with COPD to PR so please answer the questions as honestly as you can. This should only take you around 15 minutes to complete. First, please complete the following information

Geographical location of practice (please circle)	<p style="text-align: center;">England</p> <p>North East    North West    Yorkshire and the Humber    East Midlands    West Midlands</p> <p style="text-align: center;">East of England    London    South East    South West</p> <p style="text-align: center;">Scotland    Wales    NI</p>
Profession (please circle)	GP/Trainer    Practice Nurse    ANP    Other (ECP/HCP/Pharmacist)
Age (years)	18-29    30- 39    40 – 49    50- 59    60 +
Gender	Female    Male
What is your ethnic group? Please circle one option that best describes your ethnic group or background	<p><b>White</b> English    Welsh    Scottish    Northern Irish British Irish Gypsy, Traveller or Irish Traveller Any other White background:</p> <p><b>Mixed/ Multiple ethnic groups</b> White and Black Caribbean White and Black African White and Asian Any other Mixed/ Multiple ethnic background:</p> <p><b>Black/ African/ Caribbean/Black British</b> African Caribbean Any other Black/ African/ Caribbean background</p> <p><b>Asian/ Asian British</b> Indian Pakistani Bangladeshi Chinese Any other Asian background:</p> <p><b>Other ethnic group</b> Arab Any other ethnic group:</p>
Do you see patients with COPD for (please circle as many as relevant)	Acute management    Chronic management    Both    Neither
No. of years in general practice	Years: .....    Months: .....
Respiratory Qualifications	None    COPD Diploma    Asthma Diploma    ARTP Spirometry    Other
Do you currently refer patients with COPD to pulmonary Rehabilitation?	Yes - If yes -    Weekly    Monthly    Less than monthly  No - if no please explain why .....

This questionnaire is designed to ask you about your experiences with referring (or considering referring) patients with COPD to Pulmonary Rehabilitation and should take no more than **15 minutes** to complete. Please don't spend too long thinking about each question.

The questionnaire is made up of 4 elements. When rating your level of agreement with each phrase, please think about **all the things that might affect you being able to discuss pulmonary rehabilitation with your patients as well as refer.**

**Please indicate your level of agreement with the following statements:**

Question list	Strongly Disagree	Disagree	Neither disagree nor agree	Agree	Strongly Agree
1. I am aware of the content of Pulmonary Rehabilitation (PR) Programmes	1	2	3	4	5
2. I am aware of PR programme objectives.	1	2	3	4	5
3. I am unsure of the evidence base for PR	1	2	3	4	5
4. I know where geographically my local PR programme is delivered	1	2	3	4	5
5. I know when it is appropriate to refer a patient with COPD to PR	1	2	3	4	5
6. I can answer questions patients have about PR	1	2	3	4	5
7. I know how to contact my local PR provider	1	2	3	4	5
8. My local PR providers regularly engage with me	1	2	3	4	5
9. It is easy to refer a patient to PR	1	2	3	4	5
10. I am confident my local PR provider offers a good service for my patients.	1	2	3	4	5
11. Referral to PR is the practice nurse role	1	2	3	4	5
12. Other General Practice staff in my practice (excluding Practice Nurse) refer patients to PR	1	2	3	4	5
13. Referring patients to PR is something I have been advised to do	1	2	3	4	5
14. I am confident in my ability to encourage patients to attend PR, even when they are not motivated	1	2	3	4	5
15. I do not find it easy to discuss PR with patients.	1	2	3	4	5
16. I don't believe patients will attend PR after I have referred	1	2	3	4	5
17. Patients in work are not able to attend PR	1	2	3	4	5
18. PR is not beneficial to patients who are breathless	1	2	3	4	5
19. Patients who use home oxygen are unable to take part in PR	1	2	3	4	5
20. Patients who smoke are not motivated to take part in PR	1	2	3	4	5
21. Patients without their own transport won't be able to get to PR	1	2	3	4	5
22. Patients who live alone won't like to take part in group PR	1	2	3	4	5
23. I only refer patients if they have quit smoking	1	2	3	4	5
24. I only refer patients if they are optimised on their respiratory medication	1	2	3	4	5

Question list	Strongly Disagree	Disagree	Neither disagree nor agree	Agree	Strongly Agree
25. PR is most suited to COPD patients who have frequent exacerbations	1	2	3	4	5
26. My practice receives financial incentives for referral to PR (Before April 2019)	1	2	3	4	5
27. My practice regularly reviews COPD registers to ensure eligible COPD patients are offered PR	1	2	3	4	5
28. There are set targets within the practice to improve PR referral rates	1	2	3	4	5
29. I often forget to refer patients with COPD to PR	1	2	3	4	5
30. There is not enough time in practice to refer	1	2	3	4	5
31. I believe patients may be harmed by taking part in PR	1	2	3	4	5
32. Prompts to refer patients to PR within annual review templates are important reminders for me	1	2	3	4	5
33. The best time to discuss PR referral with patients is when they are stable.	1	2	3	4	5
34. Patients are motivated to attend PR	1	2	3	4	5
35. PR is best suited to those patients with worsening breathlessness	1	2	3	4	5
36. PR is best suited to those who have frequent exacerbations	1	2	3	4	5
37. I believe in encouraging patients to attend PR	1	2	3	4	5
38. PR reduces hospital admissions	1	2	3	4	5
39. I believe most patients will attend and complete PR following my referral	1	2	3	4	5
40. PR reduces risk of mortality	1	2	3	4	5
41. If patients attend PR this will reduce their general practice visits	1	2	3	4	5
42. PR reduces exacerbations	1	2	3	4	5
43. PR improves breathlessness	1	2	3	4	5
44. PR reduces a patient's anxiety and/or depression.	1	2	3	4	5
45. If I keep pushing patients to attend PR this will disadvantage my relationship with them.	1	2	3	4	5
46. There are good relationships in practice with PR providers	1	2	3	4	5
47. PR providers are good at communicating outcomes of referrals I have made	1	2	3	4	5
48. Resources about PR (i.e written information) are readily available	1	2	3	4	5
49. PR is something that patients ask for	1	2	3	4	5

Question list	Strongly Disagree	Disagree	Neither disagree nor agree	Agree	Strongly Agree
50. I will refer more patients to PR now there are practice QoF incentives (from April 2019)	1	2	3	4	5
51. There will be greater awareness of PR within practices because of the new QoF incentives.	1	2	3	4	5
52. More health care practitioners will discuss PR with patients because of the QoF incentive.	1	2	3	4	5
53. I believe patient attendance to PR will increase because of the QoF Incentive.	1	2	3	4	5
54. I believe the QoF incentive will not increase patients PR attendance	1	2	3	4	5

2/Please consider the interventions below. Please rate each possible intervention based on which you think would be the most helpful in improving your rates of referral to PR?

3/ Then please indicate the top 5 that you think will be the most effective in increasing PR referral within your practice. Please rank them in order 1 (highest) – 5 (lowest) in the 'Rank' column.

Question list	Strongly Disagree	Disagree	Neither disagree nor agree	Agree	Strongly Agree	Rank (1-5)
1. Health Care Professional (HCP) referring patients to PR at the time of COPD diagnosis.	1	2	3	4	5	
2. HCP prescribing PR at the time of COPD acute exacerbation.	1	2	3	4	4	
3. A standardised summary (i.e: a 2 sentences) that describes PR succinctly for HCP to recite to eligible patients.	1	2	3	4	5	
4. Face to face educational sessions for general practice staff.	1	2	3	4	5	
5. Online educational sessions for general practice staff.	1	2	3	4	5	
6. Face to face educational sessions for potential patients, carers and family.	1	2	3	4	5	
7. Online educational sessions for patients, carers & family.	1	2	3	4	5	
8. Practice staff loaning DVDs which demonstrate PR to patients.	1	2	3	4	5	
9. HCP showing patients PR recording within practice or consultation ie on a tablet device.	1	2	3	4	5	
10. Past PR patient attenders directly engage with eligible patients to highlight benefits.	1	2	3	4	5	
11. PR providers directly contacting eligible practice patients.	1	2	3	4	5	

Question list	Strongly Disagree	Disagree	Neither disagree nor agree	Agree	Strongly Agree	Rank
12. PR providers engaging with practice staff by coming into surgeries.	1	2	3	4	5	
13. Personalised letters to eligible patients from general practice advocating PR.	1	2	3	4	5	
14. Group consultations with patients, general practice staff and PR provider.	1	2	3	4	5	
15. Patients being able to refer themselves to PR.	1	2	3	4	5	
16. Patients having their own COPD health care record, similar to a COPD passport, meaning they are prompted to ask for PR.	1	2	3	4	5	
17. PR promotional material within patient pharmacy medication packs	1	2	3	4	5	
18. Greater awareness of PR in practice. i.e Posters highlighting local PR provider, benefits, etc.	1	2	3	4	5	
19. General practice staff being able to refer patients by telephone rather than manually completing referral form.	1	2	3	4	5	
20. If my practice referred more COPD patients this would increase my own referral numbers.	1	2	3	4	5	
21. Changing the name of PR to something more user friendly.	1	2	3	4	5	
22. General practice staff being taught motivational interviewing techniques would improve referral to PR.	1	2	3	4	5	
23. Lead practice PR referrer to educate and show PR video to other practice staff at practice meetings, to encourage a whole practice approach.	1	2	3	4	5	

4/ Please add any further comments/suggestions you may have.....

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Many thanks for completing this questionnaire. Please return to the return box to collect your chocolate(s).

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For peer review only

Guidelines for Conducting and Reporting Mixed Research for Counselor Researchers (1)

<b>Research Formulation</b>	
<p>1.1.1. Treat each relevant article as data that generate both qualitative (e.g., qualitative findings, literature review of source article, source article author's conclusion) and quantitative (e.g., p values, effect sizes, sample size score reliability, quantitative results) information that yield a mixed research synthesis.</p> <p>1.1.2. Subject each document selected as part of the literature review to summarization, analysis, evaluation, and synthesis.</p> <p>1.1.3. Provide literature reviews that are comprehensive, current, and rigorous; that have been compared and contrasted adequately; and that contain primary sources that are relevant to the research problem under investigation, with clear connections being made between the sources presented and the present study.</p> <p>1.1.4. Present clearly the theoretical/conceptual framework.</p> <p>1.1.5. Assess the findings stemming from each individual study and the emergent synthesis for trustworthiness, credibility, dependability, legitimation, validity, plausibility, applicability, consistency, neutrality, reliability, objectivity, confirmability, and/or transferability.</p> <p>1.1.6. Present the goal of the study (i.e., predict; add to the knowledge base; have a personal, social, institutional, and/or organizational impact; measure change; understand complex phenomena; test new ideas; generate new ideas; inform constituencies; and examine the past).</p>	Pages 3/4/5
<p>1.2.1. Specify the objective(s) of the study (i.e., exploration, description, explanation, prediction, and influence).</p> <p>1.3.1. Specify the rationale of the study.</p> <p>1.3.2. Specify the rationale for combining qualitative and quantitative approaches (i.e., participant enrichment, instrument fidelity, treatment integrity, and significance enhancement).</p> <p>1.4.1. Specify the purpose of the study.</p> <p>1.4.2. Specify the purpose for combining qualitative and quantitative approaches (e.g., identify representative sample members, conduct member check, validate individual scores on outcome measures, develop items for an instrument, identify barriers and/or facilitators within intervention condition, evaluate the fidelity of implementing the intervention and how it worked, enhance findings that are not significant, compare results from the quantitative data with the qualitative findings).</p>	Title & pages 3 & 4
	As above

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<p>1.5.1. Avoid asking research questions that lend themselves to yes/no responses.</p> <p>1.5.2. Present mixed research questions (i.e., questions that embed both a quantitative research question and a qualitative research question within the same question) when possible.</p>	
<p><b>Research Planning</b></p> <p>2.1.1. Specify the initial and final sample sizes for all quantitative and qualitative phases of the study.</p> <p>2.1.2. Present all sample size considerations made for the quantitative phase(s) (i.e., a priori power) and qualitative phases (e.g., information-rich cases).</p> <p>2.1.3. Present the sampling scheme for both the quantitative and qualitative phases of the study.</p> <p>2.1.4. Describe the mixed sampling scheme (i.e., concurrent-identical, concurrent-parallel, concurrent-nested, concurrent-multilevel, sequential-identical, sequential-parallel, sequential-nested, and sequential-multilevel).</p> <p>2.1.5. Clarify the type of generalization to be made (i.e., statistical generalization, analytic generalization, and case-to-case transfer) and link it to the selected sampling design, sampling scheme, and sample size(s).</p> <p>2.2.1. Outline the mixed research design.</p> <p>2.2.2. Specify the quantitative research design (i.e., historical, descriptive, correlational, causal-comparative/quasi-experimental, and experimental).</p> <p>2.2.3. Specify the qualitative research design (e.g., biography, ethnographic, auto-ethnography, oral history, phenomenological, case study, grounded theory)</p>	<p>Pages 4-5</p>
<p><b>Research Implementation</b></p> <p>3.1.1. Outline the mixed data collection strategy.</p> <p>3.1.2. Present information about all quantitative and qualitative instruments and the process of administration.</p> <p>3.2.1. Outline the mixed data collection strategy (i.e., data reduction, data display, data transformation, data correlation, data consolidation, data comparison, and data integration).</p> <p>3.2.2. Provide relevant descriptive and inferential statistics for each statistical analysis.</p>	<p>Pages 5.6.7</p> <p>Pages 24-26</p>



3.2.3. Discuss the extent to which the assumptions (e.g., normality, independence, equality of variances) that underlie the analyses were met, as well as any observations that might have distorted the findings (e.g., missing data, outliers).

3.2.4. Specify the statistical software used.

3.2.5. Specify where the responsibility or authority for the creation of categories resided (i.e., participants, programs, investigative, literature, or interpretive), what the grounds were on which one could justify the existence of a given set of categories (i.e., external, rational, referential, empirical, technical, or participative), what was the source of the name used to identify a given category (i.e., participants, programs, investigative, literature, or interpretive), and at what point during the research process the categories were specified (i.e., a priori, a posteriori, or iterative)

3.2.6. Specify the name of the technique used to analyze the qualitative data (e.g., content analysis method of constant comparison, discourse analysis, componential analysis, keywords in context, analytic induction, word count, domain analysis, taxonomic analysis).

3.2.7. Specify the qualitative software used.

3.3.1. Discuss the threats to internal validity, external validity, and measurement validity and outline the steps taken to address each of these threats to internal validity, external validity, and measurement validity.

3.3.2. Discuss the threats to trustworthiness, credibility, dependability, authenticity, verification, plausibility, applicability, confirmability, and/or transferability of data and outline all verification procedures used.

3.3.3. Discuss mixed research legitimation types (i.e., sample integration legitimation, insider–outsider legitimation, weakness minimization legitimation, sequential legitimation, conversion legitimation, paradigmatic mixing legitimation, commensurability legitimation, multiple validities legitimation, and political legitimation).

3.4.1. Interpret relevant types of significance of the quantitative findings (i.e., statistical significance, practical significance, clinical significance, and economic significance).

3.4.2. Conduct post hoc power analysis for all statistically non-significant findings.

3.4.3. Interpret the significance (i.e., meaning) of qualitative findings.

3.4.4. Discuss criteria for evaluating findings in mixed research studies (e.g., within-design consistency, conceptual consistency, interpretive agreement, interpretive distinctiveness, design suitability, design fidelity, analytic adequacy, interpretive consistency, theoretical consistency, integrative efficacy).

Page 5.7

Page 5-7, 28-29

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Not applicable.

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3.5.1. Describe all steps of the mixed research process.	
3.5.2. Describe the context in which the mixed research study took place.	Throughout paper.
3.5.3. Ensure that the mixed research report is accurate and complete; does not distort differences within and among individuals and groups; is free from plagiarism or misrepresentation of the ideas and conceptualizations of other scholars; and contains findings that are adequately accessible for reanalysis, further analysis, verification, or replication.	Page 5-6
3.5.4. Present all ethical considerations that were addressed in the study (e.g., informed consent, confidentiality, incentives, funding sources, potential conflicts of interest, biases).	Throughout paper.
3.5.5. Specify study approval in accordance with an institutional review board either in the report or in the cover letter submitted to the editor.	Page 5-6 and page 33
3.5.3. Present recommendations for future research that culminate in a validation, replication, or extension of the underlying study.	Covering letter to the editor  Page 30

1. Leech NL, Onwuegbuzi AJ. Guidelines for Conducting and Reporting Mixed Research in the Field of Counseling and Beyond. Journal of Counseling & Development. 2010;88:61-9.

# BMJ Open

## Investigating primary health care practitioners' barriers and enablers to referral of patients with COPD to Pulmonary Rehabilitation: a mixed methods study using the Theoretical Domains Framework.

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2  
3 **Title**

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7 **Investigating primary health care practitioners' barriers and enablers to referral of**  
8 **patients with COPD to Pulmonary Rehabilitation: a mixed methods study using the**  
9 **Theoretical Domains Framework.**  
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28 **Key words**  
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30

31 Chronic Obstructive Pulmonary Disease (COPD), Pulmonary Rehabilitation (PR), Primary  
32 Care, Theoretical Domains Framework (TDF). Mixed methods research.  
33  
34

35 **List of Abbreviations**  
36  
37

38 PR – Pulmonary Rehabilitation  
39 COPD – Chronic Obstructive Pulmonary Disease  
40 PHCP – Primary Health Care Practitioner  
41 TDF – Theoretical Domains Framework  
42  
43

44 **Word Count 4,268**  
45  
46

47 **Abstract**  
48

49 **Objectives**

50 Pulmonary Rehabilitation (PR) is a highly effective, recommended intervention for patients  
51 with Chronic Obstructive Pulmonary Disease (COPD). Using behavioural theory within  
52 mixed methods research to understand why referral remains low enables the development of  
53 targeted interventions in order to improve future PR referral.  
54

55 **Design**

56 A multiphase sequential mixed methods study.  
57

58 **Setting**

59 United Kingdom (UK).  
60

## 48 **Participants**

49 252 multi-professional Primary Health Care Practitioners (PHCPs).

## 51 **Measures**

52 Phase 1: Semi-structured interviews. Phase 2: a 54-item paper and online questionnaire,  
53 based on the Theoretical Domains Framework (TDF). Content and descriptive analysis  
54 utilised. Data mixed at two points; instrument design and interpretation.

## 56 **Results**

57 19 PHCPs took part in interviews and 233 responded to the survey. Integrated results  
58 revealed that PHCPs with a post qualifying respiratory qualification (154/241; 63.9%)  
59 referred more frequently (91/154; 59.1%) than those without (28/87; 32.2%).

60  
61 There were more barriers than enablers for referral in all 13 TDF domains. Key barriers  
62 included: infrequent engagement from PR provider to referrer, concern around patient's  
63 physical ability and access to PR (particularly for those in work), assumed poor patient  
64 motivation, no clear practice referrer and few referral opportunities. These mapped to  
65 domains: belief about capabilities, social influences, environment, optimism, skills and social  
66 and professional role.

67  
68 Enablers to referral were observed in knowledge, social influences memory and environment  
69 domains. Many PHCPs believed in the physical and psychological value of PR. Helpful  
70 enablers were out-of-practice support from respiratory interested colleagues, dedicated  
71 referral time (annual review) and on-screen referral prompts.

## 73 **Conclusions**

74 Referral to PR is complex. Barriers outweighed enablers. Aligning these findings to  
75 behaviour change techniques will identify interventions to overcome barriers and strengthen  
76 enablers, thereby increasing referral of COPD patients to PR.

## 79 **Strengths and limitations of this study**

81 1: This is the first mixed methods study to use the Theoretical Domains Framework to  
82 identify barriers and enablers to pulmonary rehabilitation referral from a primary health care  
83 practitioner perspective.

84  
85 2: The utilisation and combination of two differing research paradigms in this exploratory  
86 sequential approach offers novel and detailed insights through combined research lenses  
87 which encompass multiple perspectives.

88  
89 3: Many geographical regions across the United Kingdom are represented and include a  
90 diverse range of primary healthcare practitioners.

1  
2  
3 91  
4  
5 92 4: A combination of participant recruitment approaches have been used to reduce potential  
6  
7 93 sample and selection biases.  
8  
9 94

10 95 5: Generalisability of the overall findings are limited by the inability to calculate distribution  
11  
12 96 and therefore response rates.  
13  
14 97  
15 98

## 17 99 **Background**

18  
19 100  
20 101 Pulmonary Rehabilitation (PR) is a low cost, high value, internationally recommended  
21  
22 102 intervention for Chronic Obstructive Pulmonary Disease (COPD) patients which is effective  
23  
24 103 in improving exercise capacity, reducing the impact of symptoms and improving prognosis  
25  
26 104 (1, 2) . It is a structured multidisciplinary intervention combining individualised exercise with  
27  
28 105 disease-related education (3). Despite the clear evidence of its effectiveness, the proportion of  
29  
30 106 COPD patients receiving PR is persistently low worldwide (4, 5). Our previously published  
31  
32 107 inductive qualitative paper presented the experiences of primary health care practitioners  
33  
34 108 (PHCPs) as key potential referrers to PR (6). We found that there was a generalised  
35  
36 109 awareness of PR, but little detailed knowledge of either the programme or the clinical  
37  
38 110 benefits. Relationships with PR providers were limited, but considered important. Patient  
39  
40 111 characteristics, rather than clinical need, influenced referral offers and referrers frequently  
41  
42 112 believed patients to be poorly motivated. PR was most commonly offered during times of  
43  
44 113 disease stability (usually at COPD annual review) and ease of the referral process and  
45  
46 114 financial incentives positively influenced referral. In summary, referrers reported many  
47  
48 115 barriers but few enablers, which collectively resulted in infrequent discussions about PR and  
49  
50 116 associated referrals.

51  
52 117  
53 118 However, in order to aid the development of appropriate interventions to improve referral  
54  
55 119 rates it is important to establish the generalisability and relative importance of these findings  
56  
57 120 within a broader population of PHCPs. Furthermore, applying theory to identify the  
58  
59 121 psychological and structural drivers that influence behaviour (7, 8) may offer new insights to  
60  
122 shape interventions (9).

1  
2  
3 124 The Theoretical Domains Framework (TDF) is a well-recognised approach which was  
4  
5 125 derived from a synthesis of behaviour change theories (10), and examines the processes that  
6  
7 126 influence behaviour (11). When applied, it offers explanations for behaviours, highlighting  
8  
9 127 reasons that may inhibit or promote (12, 13) implementation of practice-based change (12).

10 128

11  
12 129 Using mixed methods, and applying the TDF we sought to assess and explain the reasons for  
13  
14 130 low PR referral by primary health care professionals (PHCPs) for patients with COPD. The  
15  
16 131 aim of our multiphase design was to inform the development of theory informed  
17  
18 132 interventions to improve PR referral rates from primary care in future.

19 133

## 20 134 **Methods**

21 135

22  
23  
24 136 We used a multiphase sequential design defined by two separate phases (figure 1). The  
25  
26 137 cognitive and practical experiences of PHCP when considering and undertaking referral for  
27  
28 138 patients with COPD were initially explored using a deductive approach by applying the TDF  
29  
30 139 to data from our previously collected qualitative interviews. These findings informed a  
31  
32 140 second quantitative phase, where we tested themes for generalisability using a nationwide  
33  
34 141 survey of PHCP, to highlight the most relevant factors influencing referral. (14-16).

34 142

### 36 143 Figure 1 Multiphase sequential research design

37 144

38  
39 145

40  
41 146 Both data sets retained independent value and meaning, but were connected at two time  
42  
43 147 points: 1) where the qualitative data was used to construct the questionnaire and 2) where  
44  
45 148 phase 1 and 2 results were integrated to inform interpretation. The multiphase sequential  
46  
47 149 mixed methods design therefore achieves both methodological and content integration (15,  
48  
49 150 16).

49 151

## 51 152 **Patient and Public Involvement**

52 153

54 154 There has been no public and/or patient involvement in this study.

56 155

## 58 156 **Phase 1 Application of TDF to qualitative interview data.**

59 157



1  
2  
3 158 We re-analysed data from our previously published inductive qualitative study (6) in which  
4  
5 159 19 PHCPs from two differing geographical regions across Central and East of England were  
6  
7 160 recruited and interviewed to thematic saturation using a pre-designed topic guide. A  
8  
9 161 deductive approach using content analysis (17) was used for re-analysis of the data in order to  
10  
11 162 align the results to the TDF and to offer new insights.  
12

13  
14 164 The interview topic guide (Additional file 1) was mapped to the Capability Opportunity  
15  
16 165 Motivation-Behaviour model (COM-B), a model that highlights three critical prerequisites  
17  
18 166 for behaviour change (18). This model was adopted rather than the TDF to guide interviews  
19  
20 167 primarily because of the practical need to reduce interview length without compromising its  
21  
22 168 aim. COM-B is very closely aligned to the TDF and has been utilised as a topic guide and  
23  
24 169 mapped to the TDF in a similar health care professional study (19).  
25

26 170

## 27 171 **Analysis**

28 172

29 173 All interview transcripts were managed using NVivo v12. Barriers and enablers emerging  
30  
31 174 from the interviews via content analysis were mapped to the relevant TDF domain, initially  
32  
33 175 using construct labelling (10, 20) (Additional File 2). Utterances were coded once to the key  
34  
35 176 TDF construct which then determined TDF domain alignment. JW undertook the initial  
36  
37 177 coding then 5 transcripts were randomly allocated and distributed throughout the team (RJ,  
38  
39 178 PA, and SG) and independent TDF coding occurred, followed by frequent collaborative team  
40  
41 179 discussion to ensure agreement with the coding. Queries were discussed with a behavioural  
42  
43 180 expert (IV).  
44

45 181

## 46 182 **Phase 2 Quantitative Methodology**

47 183 Study Design – Cross sectional survey.  
48

49 184

50 185 PHCPs were recruited via two main methods. Initially an invitation was included in a  
51  
52 186 fortnightly newsletter emailed to members of the Primary Care Respiratory Society (PCRS).  
53  
54 187 The survey was additionally distributed and shared by PCRS via their organisational Twitter  
55  
56 188 and Facebook accounts. Social media distribution of the survey was further increased by  
57  
58 189 individual and other organisational sharing, including the Facebook accounts of Advanced  
59  
60 190 Practice UK and General Practice Nurse UK. A link for questionnaire completion was  
191 191 provided to the platform ‘Online Survey’ (21). This was open between April and December

1  
2  
3 192 2019. To increase participation, responders were invited to opt in to a prize draw to win an I-  
4 193 pad.

5  
6 194 Simultaneously, paper versions of the questionnaire were distributed at 6 UK conferences  
7  
8 195 between March and November 2019 to attending PHCPs (predominately by hand by JW, and  
9 196 using ‘in-conference bag’ distribution at one event). Upon self-completion, questionnaires  
10 197 were placed by participants in a locked ballot box and an optional token of appreciation was  
11 198 offered. Paper questionnaires were manually entered onto ‘Online survey’ by JW.  
12  
13  
14  
15

16 199

17 200 As this was exploratory research, no *a priori* sample size calculations were performed. A  
18 201 pragmatic approach to study closure was adopted, this being online availability for a period  
19 202 of 8 months, distribution of the questionnaire at several appropriate PHCP targeted events,  
20 203 and that a reasonable range of PHCP had responded.  
21  
22  
23

24 204

## 25 205 **Methodology– Instrument Design**

26 206

27 207 The cross-sectional survey (Additional file 3), collected (1) individual socio-demographic  
28 208 data, (2) current referral experiences, using TDF-based Likert scale questions (n=54) and (3)  
29 209 any new or complementary issues which may not have been previously mentioned, using an  
30 210 optional open question (22).  
31  
32  
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35

36 211

### 37 212 Socio-demographic data

38 213

39 214 These included questions on geographical location of practice, job title, post-qualifying  
40 215 respiratory education and estimated frequency of PR referrals, using questions with pre-  
41 216 specified options.  
42  
43  
44  
45

46 217

### 47 218 Psychometric data

48 219

49 220 Barriers and enablers for PR referral identified from the phase 1 qualitative findings were  
50 221 converted into belief statements (20), including some that sought to test direct understanding.  
51 222 All questions were generated and aligned to the TDF by the coder (JW) and validated by  
52 223 other team coders (RJ), including a TDF expert (IV). 54 closed, fully labelled 5-point, Likert  
53 224 scale questions/belief statements were included with responses ranging from ‘strongly  
54 225 disagree’ to ‘strongly agree’ and a mid-point rating. Some statements were reversed as an  
55  
56  
57  
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59  
60

226 opposite belief to that frequently reported in the phase 1 data. These design elements were  
227 purposely selected to improve reliability and validity (23).

228 The final survey mapped the 54 belief statements and open question section to 12 out of 14  
229 theoretical domains ('emotion' and 'behavioural regulation' was excluded, given its low  
230 mapping in phase 1 results). Two rounds of survey piloting were undertaken with five  
231 practice nurses and the questionnaire refined to ensure question clarity and clearer  
232 completion instructions.

233

### 234 **Analysis**

235

236 All data were exported into an excel spreadsheet and STATAv16 used to conduct simple  
237 descriptive statistics (frequencies and percentages), dichotomising into Agree/Strongly Agree  
238 vs the remaining options. Free text that directly related to barriers and enablers of referral  
239 practice was content-mapped to the TDF and thematic analysis applied (24).

240

### 241 **Results: Phase 2**

#### 242 **Response rates.**

243

244 Paper surveys (>1100) were distributed across 6 UK primary care focused events which were  
245 attended by a variety of PHCPs. 154 (~14%) were returned and 134/154 (83%) completed the  
246 survey sufficiently and were included. Online, it is unknown how many potential  
247 practitioners read the survey invitation, therefore participation rates could not be calculated.  
248 123 participants started the online survey, but only 99 (80.5%) completed it and were  
249 included in the analysis.

250

251 Full details of the paper survey distribution and return rates can be found in additional file 1.

252

#### 253 **Description of participants**

254

255 Table 1 presents the socio-demographic characteristics for participants in the phase 2  
256 quantitative (n=233) studies. Participants characteristics for phase 1 (qualitative) are available  
257 in the previously published paper (6)

258

259

260

259 In contrast to the qualitative study where 6/19 (32%) were GPs, the survey respondents were  
 260 predominantly female nurses. Nurse respondents were similarly distributed across both  
 261 conference and online groups (110/134, 82.1%; and 76/99, 76.9% respectively) and  
 262 responders from both sources had similar time working in practice. However, respondents  
 263 recruited through conferences, compared to those who responded online, tended to be  
 264 younger (28% < 40 years of age), more likely to be practice nurses rather than other types of  
 265 professionals, but were less likely to have respiratory qualifications, to see COPD patients or  
 266 to refer them to PR.

267

268 Table 1 Baseline demographics of phase 2 participants

		Phase 2 Survey (n=233)		
		Conference (n=134) (%)	Online (n=99) (%)	Total (n=233)
<b>Primary Health Care Practitioner Role</b>	General Practitioner (GP)	18 (13.4)	11 (11.1)	29 (12.5)
	Advanced Nurse Practitioner (ANP)	25 (18.7)	32 (32.3)	57 (24.5)
	Practice Nurse (PN)	85 (63.4)	44 (44.5)	129 (55.4)
	Emergency Care Practitioner (ECP)	1 (0.8)	1 (1)	2 (0.9)
	Pharmacist	-	4 (4)	4 (1.7)
	Health Care Assistant (HCA)	-	1 (1)	1 (0.4)
	Other	5 (3.7)	6 (6.1)	11 (4.7)
	<b>Total responses</b>	134/134 (100)	99/99 (100)	233/233 (100)
<b>Sex</b>	Female	115 (91.3)	92 (92.9)	207 (92)
	Male	11 (8.7)	7 (7.1)	18 (8)
	<b>Total responses</b>	126/134 (94)	99/99 (100)	225/233 (96.6)
<b>Age (years)</b>	18-29	5 (3.8)	2 (2)	7 (3.0)
	30-39	32 (24)	11 (11.1)	43 (18.5)
	40-49	36 (27.1)	40 (40.4)	76 (32.8)
	50-59	49 (36.8)	40 (40.4)	89 (38.4)
	60 +	11 (8.3)	6 (6.1)	17 (7.3)
	<b>Total responses</b>	133/134 (99.3)	99/99 (100)	232/233 (99.6)
<b>Ethnicity</b>	White British	112 (84.2)	87 (87.9)	199 (85.7)
	White other	8 (6)	4 (4.1)	12 (5.2)
	Asian/Asian British	7 (5.3)	3 (3)	10 (4.3)
	Mixed Multiple Ethnic Groups	1 (0.7)	2 (2)	3 (1.3)
	Black/African/Caribbean/Black British	2 (1.4)	-	2 (0.9)
	Other ethnic group	3 (2.4)	3 (3)	6 (2.6)
	<b>Total responses</b>	133/134 (99.3)	99/99 (100)	232/233 (99.6)
<b>Practice Geographical Location</b>	Scotland	1 (0.8)	3 (3)	4 (1.7)
	England North East and West	31 (23.6)	15 (15.1)	46 (20)
	Yorkshire and the Humber	8 (6.1)	6 (6.1)	14 (6)
	Midlands (East and West)	20 (15.3)	16 (16.1)	36 (15.8)
	East of England	23 (17.5)	18 (18.2)	41 (17.8)
	Wales	31 (23.6)	-	31 (13.5)
	London	3 (2.4)	6 (6.1)	9 (3.9)
	South (East and West)	14 (10.7)	35 (35.4)	49 (21.3)
	<b>Total responses</b>	131/134 (97.8)	99/99 (100)	230/233 (98.7)

<b>Years in General Practice</b>	< 5	39 (29.9)	23 (23.2)	62 (27)
	6- 10	26 (19.8)	25 (25.3)	51 (22.2)
	11-15	18 (13.7)	18 (18.2)	36 (15.7)
	16-20	22 (16.8)	14 (14.1)	36 (15.7)
	21 +	26 (19.8)	19 (19.2)	45 (19.4)
	<b>Total responses</b>	131/134 (97.8)	99/99 (100)	230/233(98.7)
<b>Currently see COPD patients</b>	Acute Management	9 (6.7)	5 (5)	14 (6)
	Chronic Management	30 (22.6)	26 (26.3)	56 (24)
	Acute and Chronic management	81 (60.9)	67 (67.6)	148 (64)
	Don't see COPD patients	13 (9.8)	1 (1)	14 (6)
	<b>Total responses</b>	133/134 (99.3)	99/99 (100)	232/233(99.6)
<b>CPD Respiratory Qualifications*</b>	None	62 (46.3)	19 (19.2)	81 (34.8)
	COPD Diploma	28 (20.9)	50 (50.5)	78 (33.5)
	Asthma Diploma	38 (28.4)	52 (50.5)	90 (38.6)
	ARTP Spiro	34 (25.4)	40 (40.4)	74 (31.8)
	Other	16 (11.9)	26 (26.3)	42 (18)
	> one qualification	32 (23.9)	51 (51.5)	83 (35.6)
	<b>Total responses</b>	210	238	448
<b>Reported PR referral practice</b>	Yes (frequency not specified)	-	11 (11.1)	11 (4.7)
	Weekly	16 (12)	32 (32.3)	48 (20.7)
	Monthly	40 (30.1)	21 (21.2)	61 (26.3)
	< Monthly	43 (32.3)	29 (29.3)	72 (31)
	None	34 (25.6)	6 (6.1)	40 (17.3)
	<b>Total</b>	133/134 (99.3)	99/99 (100)	232/233(99.6)

269

## 270 Referral to PR by type of healthcare professional

271

272 Overall, 109 (49.1%) reported being frequent referrers to PR, with GPs being less likely to  
 273 refer and other professions including emergency care practitioners and nurse practitioners and  
 274 ANPs more likely to refer. Referral was also higher among those with one or more  
 275 continuous practice development (CPD) respiratory qualifications. However, this may be  
 276 partly related to such qualification being higher among ANPs (82.5% (47/57)) and other  
 277 grouped professions (58.8% (10/17)) than among GPs (17.9% (5/28)). More than 10 years  
 278 spent in general practice appeared to marginally increase referral frequency (60.7%; 51.8%).

279

280 Table 2 PHCP referral practice\*

	<b>Frequent Referral n (%) (weekly or monthly) Total n=109</b>	<b>Infrequent referral n (%) (&gt;monthly or no referral) Total n=113</b>
Staff type		
GP (n=28)	10 (35.7)	18 (64.3)
PN (n=120)	57 (47.5)	63 (52.5)
ANP (n=57)	32 (56.1)	25 (43.9)
Other (ECP/NP/Pharm/HCA) (n=17)	10 (58.8)	7 (41.2)
CPD Respiratory Qualification	84 (77.1)	59 (52.2)
Years in Practice > 10 years**	65/107 (60.7)	58/112 (51.8)

281 \*11/99 online PHCPs specified that they referred to PR but did not specify referral frequency and were removed  
 282 from this analysis.

283 \*\* 107/109 and 112/113 reported time spent in general practice

284

1  
2  
3 285 40/233 (17.2%) responding PHCPs reported never referring to PR, with the largest group  
4  
5 286 being practice nurses (29/40; 72.5%). 33 of 40 PHCPs offered a variety of reasons for non-  
6  
7 287 referral including; not considering it to be part of their role, not seeing COPD patients or not  
8  
9 288 knowing they could refer (12/33; 36.4%). Others reported it was undertaken by other  
10  
11 289 respiratory specialist/interested health care professionals across primary and secondary care  
12  
13 290 settings (12/33; 36.4%). Further reported reasons were unsure how to and/or a lack of  
14  
15 291 training (5/33; 15.1%), uncertainty about local service provision (3/33; 9.1%) and 1/33  
16  
17 292 (3.0%) reported belief that patients were not interested.  
18

293

### 294 **Phase 1 Results: TDF analysis of the qualitative interviews**

295 Table 3 shows the referral behaviour of PHCPs mapped to all 14 TDF domains. The most  
296 frequently mapped domain was social and professional role (n=287 times) whilst the least  
297 mapped was behavioural regulation (n=4).  
298  
299  
300  
301  
302

303 Table 3: Phase 1 Mapping of barriers and enablers for referral to TDF domains

304

TDF Domain (construct mapping frequency)	Content mapping (n)	Key points	Evidence supporting
<b>1.Social and Professional Role</b> (A coherent set of behaviours and displayed personal qualities of an individual in a social or work setting)	(n=289)	<p>Referral was considered everyone's role, however it was considered best undertaken by the PHCP during disease stability and at annual review. It was often considered to be the practice nurses' role, but also respiratory-interested others.</p> <p>Most PHCPs considered it their duty of care to motivate patients.</p> <p>Only 1 of 19 PHCPs described implementing practice leadership to improve PR awareness and/or referral.</p>	<p><i>It is largely the nurses' job to see stable COPD patients at an annual review and that is the most appropriate time to refer to pulmonary rehabilitation, not during an acute exacerbation' –GP5</i></p> <p><i>No, I think it's everybody's role, I mean I'm not sure about my non-respiratory colleagues. PN2</i></p> <p><i>So we've put forward a proper business case for it. (Local PR service). GP4</i></p>
<b>2.Knowledge</b> (An awareness of the existence of something)	(n=256)	<p>17 of 19 PHCPs knew of the existence of PR and a generalised understanding of its purpose. PR Knowledge was reported to be gained through post qualification education and networking events.</p> <p>Local PR knowledge such as programme timing, waiting list (if any), and availability of patient transport, was often unknown and were described as inhibitors to referral discussions.</p> <p>The referral criteria Medical Research Council (MRC) dyspnoea Score <math>\geq 3</math> was frequently cited as a referral prompt, although some PHCPs wanted to refer patients with MRC scores of 2 and felt unable to.</p>	<p><i>I think it's a fundamental treatment and I think it's better than drugs. PN7</i></p> <p><i>Do you currently refer to PR? P -I wouldn't know where. GP2</i></p> <p><i>I don't know how to describe pulmonary rehab to a patient. GP3</i></p> <p><i>I just feel that we don't know enough about the program to confidently hand on your heart sell it. PN1</i></p> <p><i>'We've also got the barrier of we can only refer if their MRC is 3 or 4 or 5' PN5</i></p>
<b>3. Environment</b> (Any circumstance of a person's situation or environment that discourages or encourages the development of skills and abilities,	(n=195)	<p>PR referral was often considered inappropriate in non-COPD focused consultations or when a patient was consulting for an acute exacerbation. Clinical time constraints were often described as inhibiting referral, although annual review considered appropriate time</p>	<p><i>I think in our role when you're treating potentially acutely unwell people in a really limited time span then it's, it is realistically going to be hard to cover everything, really hard. ANP2</i></p>

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<p>independence, social competence, and adaptive behaviour)</p>		<p>because of its clinical focus, template design and longer consultation time.</p> <p>PHCPs often stated little PR promotional material was available in practice for patients or staff; there were however mixed views on the potential value of this.</p> <p>3 practices had initiated an in-practice 12 weekly, 1 hour generic exercise group, this appeared to be seen as equivalent to PR by 1 PN.</p>	<p><i>On the annual review well I follow the template and when I get to the pulmonary rehab I mention it then and I say, 'Would you like to go?' PN3</i></p> <p><i>It would be useful for our local organisation I think to give us some little leaflets about what they do so we can give that to patients about the local service ANP4</i></p> <p><i>I'm not against a leaflet but have you seen how many posters and leaflets we have on our walls? GP2</i></p>
<p><b>4. Belief about capabilities</b> (Acceptance of the truth, reality, or validity about an ability, talent, or facility that a person can put to constructive use)</p>	<p>(n=141)</p>	<p>Individual PHCP PR referral confidence varied, with particular uncertainty expressed in how to best 'sell PR' and how to motivate un-motivated patients. Although most were confident in reassuring patients that PR would improve breathlessness.</p> <p>PHCPs with positive non-pharmacological and exercise beliefs appeared to have greater confidence in PR benefit and patients' abilities</p> <p>A number of PHCPs described COPD patients as uninterested in improving their health and some PHCPs emphasised patients needed to be committed to PR. Whilst some PHCPs described 'knowing' which patients would accept referral, others described undertaking subjective patient assessment and expressed concerns about patients' exercise capability in the presence of breathlessness.</p> <p>For patients receiving oxygen therapy there was much uncertainty of the benefit of PR and an assumption that Oxygen/secondary care teams would have previously offered this.</p> <p>Most PHCPs considered key environmental factors such as session timing, venue accessibility, patient financial hardship, as barriers for most patients. Patients in work, or</p>	<p><i>I would need to feel confident, before I speak to this patient about it. ANP4</i></p> <p><i>I quite like... Non-medicinal treatment...think if you're excited by it then it's easier for patients to get excited by it as well. GP4</i></p> <p><i>They are also very very clear that there not going to take anyone on their course unless there is 100% commitment at the beginning that they are going to complete the course. ANP1</i></p> <p><i>You look at the ones that you think would more likely go. ANP4</i></p> <p><i>It's really basically where I see a need, where I see they can benefit – ANP1</i></p> <p><i>If the patients already on oxygen therapy, then it's likely that they've already been seen by them. HCA</i></p> <p><i>The main stumbling block is that you come across is " I'm not going every week for x number of weeks, I can't afford it, I haven't got that much time, how do you expect me to get there ....not a huge number of our patients drive. GP4</i></p>



		those able to take the dog for a walk/wearing walking boots were considered 'too well' for PR.	<i>There's some patients that I would like to refer but they can't go because of work commitments. PN3</i> <i>'It's quite surprising that some patients are still working at odd jobs and things like that and keep them very active. So, for those patients it's not so important.'</i> PN3
<b>5.Memory (Inc: Decision making)</b> (The ability to retain information, focus selectively on aspects of the environment and choose between two or more alternatives)	(n= 118)	Some PHCPs reported forgetting to refer patients to PR, however, embedded system reminders often found in COPD review templates or on-screen prompts were cited as important for most PHCPs.  Patient behaviour and clinical presentation altered decision making processes for some PHCPs for example not referring current smokers, or remembering PR in light of increasing COPD symptom burden and disease deterioration, whilst earlier concerns for patient capability and commitment became less apparent.	<i>I do need a reminders because my head's full, so as I say, I don't want to tick boxes but I do need a prompt.'</i> PN7  <i>That's something that we do, so we have a prompt that pops up saying has this patient been referred to pulmonary rehab. GP5</i>  <i>I think I go through phases, I'll do it really well for a while and somebody has motivated me and then I'll forget that and do something else. PN7</i>  <i>Breathlessness and exacerbations, I think, would be the key factors. GP3</i>
<b>6.Optimism</b> (The confidence that things will happen for the best or that desired goals will be attained)	(n=110)	PHCPs frequently reported that patients did not want to attend PR, citing disease stigma and lack of activation as underlying reasons.  Negative patient responses appeared to dampen PHCPs optimism and reduce subsequent referral offers. Positive patient experience however had the opposite effect.  Positive and negative perceptions of PR providers were also reported on the basis of service quality and frequency of referral acceptance, this appeared to influence referral behaviour.	<i>The first thing you think, 'Are they going to do it? ANP4</i>  <i>Patients don't want it. PN5</i>  <i>Even if you then said what the evidence was and how you could improve, it's – I think that group of people are really difficult to engage .GP3</i>  <i>If they're negative anyway everything you suggest they sort of have an answer, 'Oh no that won't work. PN4</i>  <i>The longer the wait time, the less likely they are to turn up. HCA</i>  <i>I don't think it's the greatest service, it does have an impact because I'm not going to tell my patients to go. PN7</i>

<p><b>7. Belief about consequences</b> (Acceptance of the truth, reality, or validity about outcomes of a behaviour in a given situation)</p>	<p>(n=107)</p>	<p>There was a general sense that PR is positive with many health and psychological benefits, but beliefs captured in other domains impacted on PHCP belief about consequences of referral offer. A small number of PHCPs expressed concern that PR might worsen patient’s depression and/or anxiety, particularly for those socially isolated.</p>	<p><i>I’ve seen patients that have been... their lives have been transformed in the first year. PN7</i></p> <p><i>Might have prevented the exacerbation if they’d gone PN5</i></p> <p><i>I will say that when I’m talking to patients, say it’s better than drugs, but I still get a closed reaction. PN7</i></p> <p><i>If we can improve patient’s breathing they’re less likely to get anxious, that makes them less likely to dial 999 or likely to do something about it. And perhaps use their rescue packs more appropriately. ANP4</i></p> <p><i>I wouldn’t want to mention it if it ended up being that I’m saying there’s this really good helpful programme but actually if she’s so effected by her disease that she doesn’t leave the house then I wouldn’t want to have mentioned it and then not for her not to be able to go. ANP2</i></p>
<p><b>8. Social Influences</b> (Those interpersonal processes that can cause individuals to change their thoughts, feelings, or behaviours)</p>	<p>(n=84)</p>	<p>Out of practice engagement from PR providers and PR advocates were important in increasing overall awareness and positively influencing referral behaviour.</p> <p>Almost all PHCPs described little to no engagement from providers themselves, and described not knowing what had happened to completed referrals.</p> <p>PHCPs also reported that positive patient PR experiences positively influenced PHCPs referral behaviour and that family can be influential, yet patients rarely ask for PR.</p> <p>PHCPs described a need to increase PR’s profile publicly and for it to be marketed similarly to pharmacological treatments. The name PR itself was considered by some PHCPs to be a negative influence as ‘rehab’ was deemed to have undesirable connotations.</p>	<p><i>Our referral rate has gone up a lot since the respiratory MDT’s because every single one of those patients has subsequently had a referral. GP4</i></p> <p><i>At the moment I wouldn’t know how many people we refer, is that referral going up, Nobodies giving us feedback from the rehab team about how we are doing as a surgery. PN1</i></p> <p><i>If patients that have been to it you know express a positive experience that is something you can share with other people that you are trying to refer. GP1</i></p> <p><i>I asked him to talk to his wife, because I knew she’d want him to go, because I know her through a different channel, and erm... he’s come back and said ‘Ooo I’ll give it a shot. PN5</i></p>

			<i>Nobody has picked up a leaflet and walked in with it and said can you refer me, nobody has. ANP1</i>
<b>9.Skills</b> (An ability or proficiency acquired through practice)	(n=79)	<p>The physical act of referring patients to PR were described as largely straightforward by most PHCPs, although there was no standardised process across the 2 regions.</p> <p>Most undertook this action independently, although there were descriptions of practice administrators helping.</p> <p>However, frequency of referral to PR when described in interviews, was far lower than that which was documented on the returned research interest form.</p>	<p><i>Do you currently refer people to pulmonary rehab? Some, some. PN7</i></p> <p><i>I've been at this practice for nearly three years now and it's sort of something that falls really far down on your list of things that you do on your COPD review, so it's always the last thing that you come to. GP4</i></p> <p><i>It's very easy. It's a form erm it's a just a single sheet. PN2</i></p> <p><i>Quicker, easier referral, much easier referral method PN7</i></p>
<b>10.Reinforcement</b> (Increasing the probability of a response by arranging a dependent relationship, or contingency, between the response and a given stimulus)	(n=59)	<p>There appeared to be no direct sanctions for non-referral of patients, although practice financial rewards in one region appeared to enhance awareness and referral.</p> <p>Outside of these practices there was a suggestion that financial incentives would be advantageous, additionally calculating health cost benefit for PR attendance was suggested as potential enabler.</p> <p>Additionally reinforcements such as those offered by social influences and patients were also described to be valuable.</p>	<p><i>We've got this thing called A** that we're doing for, you know it was the QOF before, so like A** has taken over that so I think because of the A** the doctor who is the lead A** leader he discusses that a lot because of course you get points, you still get the points for it like QOF. So the more we refer is the more points we get so there's an incentive there for the practice. PN6</i></p> <p><i>Yeah if they did something on the BBC or something they might all be in the next day saying, 'Oh I wanna do that'. PN4</i></p> <p><i>If you spent 5 minutes with somebody then at the end of that they agreed to go and then they attended, then you would be motivated to do it again. GP5</i></p>
<b>11.Goals</b> (Mental representations of outcomes or 'end states' that an individual wants to achieve)	(n=47)	<p>Referral to PR was a low-level goal for most PHCPs, but one that varied by consultation type and was not considered during an acute exacerbation review. However, referral appeared to become a goal in the presence of worsening patient symptoms.</p>	<p><i>As a practice, when we do the acute exacerbation we're pretty much focus on the acute exacerbation. GP4</i></p> <p><i>I refer a few to pulmonary rehab but I don't do as many as I feel I should. PN7</i></p>

		<p>Some PHCPs described wanting to refer more patients and learning strategies to improve patient acceptance, but described frequent discord between PHCP and patient goals which PHCPs found challenging.</p> <p>No PHCPs discussed set practice PR referral targets although one GP reported plans to set up a programme geographically closer to practice (captured as leadership in the domain social &amp; professional.)</p>	<p><i>She was more receptive because she'd had a few flares up, not after the first one but because she's had a few. And I think that makes them more receptive to doing that sort of thing. ANP4</i></p> <p><i>One hand I'm wanting them to engage with the disease process so that actually they've got more skills to self-manage and that's going to actually keep them much better for the rest of their life, on the other hand they don't want to be classified as ill. ANP1</i></p> <p><i>It would help me in trying to find out why she didn't go because I would challenge her on it and try and get her to go again and give it another go and that would help me in. ANP4</i></p>
<p><b>12.Intentions</b> (A conscious decision to perform a behaviour or a resolve to act in a certain way)</p>	(n=39)	<p>Some PHCPs have described adopting patient-aimed strategies that included persistence and warnings against overreliance and/or possible reduced effectiveness of pharmacological treatments in an effort to move patients to a state ready for PR referral.</p> <p>There also appeared to be an understanding that acceptance for many patients takes time.</p>	<p><i>I said you know you've used those rescue packs a lot you know if we could get your breathing a bit better, perhaps you wouldn't be so bad...., and she said, alright then I'll see, do the referral. ANP4</i></p> <p><i>How would you feel about something that's not medicine based but will probably help you as much as the inhalers that we've put you on, she was suddenly very interested in. GP4</i></p> <p><i>I look for that chink of interest and then I'll try and worm my way in then. PN7</i></p> <p><i>He was very adamant that he didn't want to go, then I gave him the booklet. PN5</i></p>
<p><b>13.Emotion</b> (A complex reaction pattern, involving experiential, behavioural, and physiological elements, by which the individual attempts to deal with a personally significant matter or event)</p>	(n=6)	<p>PHCPs emotion was rarely discussed although some said they felt annoyed with providers if a referral had been rejected.</p> <p>There were high levels of empathy towards patients particularly amongst nurses; a small number described not</p>	<p><i>Most of our patients are reasonably trusting and say well you seem quite excited by it so shall we give it a try. GP4</i></p> <p><i>They're gonna meet all these people they don't know and be told to lift this walk here, do that and they're frightened, its... I'd be terrified. PN5</i></p>

		wanting to offer the hope of PR to patients and for PR providers to reject referral, this appeared to be a particular concern for patients with high disease burden.	<i>I just don't want to raise – if you raise patients' hopes and say – and offer it, then it can make them – you know, if they're already depressed because of the COPD, it could just make the depression worse you know, so I don't want to impact on their mental wellbeing. ANP1</i>
<b>14. Behavioural regulation</b> (Anything aimed at managing or changing objectively observed or measured actions)	(n=4)	Some PHCPs saw events such as hospital admissions/out-patient appointments as good opportunities for patients to change behaviours but for staff in those settings to instigate referral.  PHCP personal behavioural regulation was low, many did not know how any they had referred or what, post referral, the patient's journey had become. One participant described the research interview as helpful in allowing them to consider how to change their referral approach, but most PHCPs did not vocalise intentions to change or modify current or future PR referral behaviours.	<i>I don't know how much is done in secondary care, but very often when stuff, when you've been in anywhere near secondary care people really its often quite a sit up moment, gosh this is serious enough for me to have to go to hospital, even if it an outpatient appointment. ANP1</i>  <i>This is one of your treatment choices' and perhaps I need to change, thinking about it, my approach in – er, how I word it. ANP4</i>  <i>It's trying to make it a priority. ANP4</i>

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## 307 Phase 2. Questionnaire results: Referral practice beliefs.

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309 Table 4 presents the number and proportion of PHCPs that agreed or strongly agreed with each belief statement by frequency of referral.

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315 Table 4 Results of TDF belief statements by referral frequency

TDF Domain	TDF Questions (n=54)	Frequent referral n=109 (%) (weekly/monthly)	Infrequent referral n=113(%) (>monthly or no referral)	Total n=222(%)
1.Knowledge	I am aware of the content of Pulmonary Rehabilitation (PR) Programmes *	97/109 (89.0)	72/113(63.7)	169/222 (76.1)
	I am aware of PR programme objectives. *	99/109 (90.8)	75/113 (66.4)	174/222 (78.4)
	I am unsure of the evidence base for PR	18/109(16.5)	30/113 (26.5)	49/222(21.6)
	I know where geographically my local PR programme is delivered*	92/109 (84.4)	70/113(61.9)	162/222 (73.0)
	I know when it is appropriate to refer a patient with COPD to PR *	106/109 (97.3)	74/113 (65.5)	180/222 (81.1)
	I can answer questions patients have about PR*	88/109 (80.7)	60/113 (53.1)	148/222 (66.7)
	I know how to contact my local PR provider *	91/109(83.2)	68/113 (60.2)	159/222 (71.6)
2.Skill	It is easy to refer a patient to PR*	87/109 (80.0)	48/113 (42.5)	135/222 (60.8)
3.Social & Professional Role	Referral to PR is the practice nurse role	63/109 (57.8)	45/113 (39.8)	108/222(48.6)
	Other General Practice staff in my practice (excluding Practice Nurse) refer patients to PR	52/109(47.7)	63/113(55.8)	115/222 (51.8)
	I believe in encouraging patients to attend PR	109/109 (100)	104/112 (92.9)	213/221 (96.4)
4.Environment	Resources about PR i.e written information) are readily available	39/109 (35.7)	25/112 (22.3)	64/221 (29.0)
	There is not enough time in practice to refer	12/109 (11.0)	22/113 (19.5)	34/222(15.3)
5.Social Influences	My local PR providers regularly engage with me	31/109 (28.4)	17/113 (15.0)	48/222 (22.6)

	PR is something that patients ask for	3/109 (2.8)	8/112 (7.1)	11/221 (5.0)
	There are good relationships in practice with PR providers	44/109 (40.4)	28/112 (25.0)	72/221 (32.6)
	PR providers are good at communicating outcomes of referrals I have made	39/109 (35.8)	25/112 (22.3)	64/221 (29.0)
6.Optimism (including pessimism)	I am confident my local PR provider offers a good service for my patients.*	81/109 (74.3)	52/113 (46.0)	135/222 (60.8)
	I don't believe patients will attend PR after I have referred	16/109 (14.7)	16/113(14.2)	32/222(14.4)
	Patients who smoke are not motivated to take part in PR	7/109 (6.4)	7/113 (6.2)	14/222 (6.3)
	Patients who live alone won't like to take part in group PR	5/109 (4.6)	2/113 (1.8)	7/222 (3.2)
	Patients are motivated to attend PR	23/109 (21.6)	30/111 (27.0)	53/219 (24.2)
7.Belief about Capabilities (self)	I am confident in my ability to encourage patients to attend PR, even when they are not motivated	91/109(83.5)	73/113 (67.6)	164/222 (73.9)
	I do not find it easy to discuss PR with patients.	8/109(7.3)	25/113 (22.1)	36/222(16.2)
Belief about capabilities (patients)	Patients without their own transport won't be able to get to PR	40/109(36.7)	26/113 (23.0)	66/222 (29.7)
	Patients in work are not able to attend PR *	62/109 (56.9)	35/113 (31.0)	97/222 (43.7)
	Patients who use home oxygen are unable to take part in PR	4/109(3.7)	6/113 (5.3)	10/222 (4.5)
8.Belief about consequences	If I keep pushing patients to attend PR this will disadvantage my relationship with them.	10/109 (9.2)	10/112 (8.9)	20/221 (9.0)
	I believe patients may be harmed by taking part In PR	1/109 (0.9)	1/113 (0.9)	2/222(0.9)
	I believe most patients will attend and complete PR following my referral	55/109 (50.4)	47/112 (42.0)	102/221 (46.2)
	PR is not beneficial to patients who are breathless	3/109(2.8)	3/113(2.7)	6/222 (2.7)

	PR is best suited to those patients with worsening breathlessness	29/109 (26.6)	29/112 (25.9)	58/221 (26.2)
	PR is <b>best</b> suited to those who have frequent exacerbations	27/109 (24.8)	28/112 (25.0)	55/221 (24.9)
	PR reduces hospital admissions	101/109 (92.7)	97/112 (86.6)	198/221 (89.6)
	PR reduces risk of mortality	85/109 (78.0)	82/112 (73.2)	167/221 (75.6)
	If patients attend PR this will reduce their general practice visits	73/109 (67.0)	78/112 (69.6)	151/221 (68.3)
	PR reduces exacerbations	88/109 (80.7)	84/112 (75.0)	172/221 (77.8)
	PR improves breathlessness	103/109 (94.5)	100/112 (89.3)	203/221 (91.9)
	PR reduces a patient's anxiety and/or depression.	97/108 (89.8)	96/112 (85.7)	193/220 (87.7)
9..Goals	Referring patients to PR is something I have been advised to do*	95/107(88.8)	57/112(50.9)	152/219 (69.4)
	My practice regularly reviews COPD registers to ensure eligible COPD patients are offered PR	51/109 (46.8)	40/113 (35.4)	91/222 (41.0)
	There are set targets within the practice to improve PR referral rates	23/109 (21.1)	21/113 (18.6)	44/222 (19.8)
10. Memory (Inc.Decision Making)	I often forget to refer patients with COPD to PR	3/109 (2.8)	23/113 (20.4)	26/222 (11.7)
	Prompts to refer patients to PR within annual review templates are important reminders for me	72/109 (66.1)	69/112 (61.6)	141/221 (63.8)
	I only refer patients if they have quit smoking	1/109 (0.9)	3/113 (2.7)	4/222 (1.8)
	I only refer patients if they are optimised on their respiratory medication	17/109 (15.6)	12/113 (10.6)	29/222 (13.1)
	PR is most suited to COPD patients who have frequent exacerbations	20/109 (18.3)	20/113 (17.7)	40/221 (18.1)



	The best time to discuss PR referral with patients is when they are stable.	32/109 (29.4)	25/112 (22.3)	57/221 (25.8)
11.Reinforcement	More health care practitioners will discuss PR with patients because of the QoF incentive.	75/109 (68.8)	73/112 (65.2)	148/221 (67.0)
	My practice receives financial incentives for referral to PR (Before April 2019)	6/108 (5.6)	5/113 (4.4)	11/221 (5.0)
	I believe patient attendance to PR will increase because of the QoF Incentive.	41/109 (37.6)	58/112 (51.8)	99/221 (44.8)
	I believe the QoF incentive will not increase patients PR attendance *	29/109 (26.6)	25/112 (2.3)	54/221 (24.4)
	There will be greater awareness of PR within practices because of the new QoF incentives.	84/109 (77.1)	71/112 (63.4)	155/221 (70.1)
12.Intentions	I will refer more patients to PR now there are practice QoF incentives (from April 2019)	30/109 (27.5)	42/112 (37.5)	72/221 (32.6)

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317 \*differences in results of &gt;20% between frequent and infrequent referrer

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3 318 In general, most PHCPs had some PR knowledge (especially the frequent referrers) and  
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5 319 understood the beneficial consequences of PR. However, resources, social influences (such as  
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7 320 relationship with PR providers) and pessimism about patient motivations were perceived  
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9 321 barriers by a high proportion of PHCPs, irrespective of their referral practice.

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12 323 There were however, differences in domains between frequent and infrequent PR referrers.

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15 325 The greatest differences were within the 'Knowledge' domain. Frequent referrers most  
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17 326 commonly reported agreement with all 7 statements, when compared to the infrequent  
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19 327 referrers. For example, 97.3% reported knowing when to refer to PR and 80.7% being able to  
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21 328 answer patients' questions versus 65.5% and 53.1% of infrequent referrers.

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24 330 Further group differences were demonstrated in the 'Skills' domain and 'Beliefs about  
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26 331 (PHCP) capabilities', which showed that infrequent referrers were less confident in  
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28 332 encouraging unmotivated patients to attend PR (67.6% versus 83.5% of frequent referrers).  
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30 333 Reduced confidence amongst infrequent referrers was further reflected within the 'Optimism'  
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32 334 domain and belief statement 'I am confident my local provider offers a good service' (46%  
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34 335 against 74.3% of frequent referrers). However, over half (56.9%) of frequent referrers felt  
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36 336 that patients in work were not able to attend PR, compared to less than a third (31%) of those  
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38 337 who referred infrequently.

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41 339 The remaining belief statements demonstrated greater group similarities than differences.  
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43 340 Environment, Social and Professional role: Most respondents felt that there was enough time  
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45 341 in practice to refer (84.7%) and believed in encouraging PR attendance (96.4%). Yet  
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47 342 promotional information on PR was rarely available in practices (29%). There was no clearly  
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49 343 identified PR referrer; less than half (48.6%) felt it was the practice nurse's role and (51.8%)  
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51 344 reported other practice staff refer.

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54 346 Social influences: Frequent referrers were slightly more likely to agree with 3 of the 4  
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56 347 domain belief statements than infrequent referrers. Although, collectively the groups reported  
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58 348 both PR provider engagement and referral outcome reporting as low at only 22.6% and 29%  
59  
60 349 respectively. PHCPs also reported patients rarely request referral to PR (5%).

350

351 Belief about consequences and Optimism: Most PHCPs agreed that PR offers physical health  
352 benefits, including improving breathlessness and reducing hospital admissions (91.9%,  
353 89.6%) respectively. Yet far fewer PHCPs believed patients would attend and complete PR  
354 (46.2%), with fewer still agreeing that patients are PR motivated (24.2%).

355  
356 Memory (decision-making): Only a small number of PHCPs reported forgetting to refer  
357 patients to PR (11.7%). COPD annual review templates were reported as helpful referral  
358 reminders (63.8%) and 25.8% reported the best time to discuss referral with patients was  
359 during COPD stability. Patient characteristics such as disease stability and smoking status do  
360 not appear to impede PHCP referral decisions as 98.2% reported referring smokers.

361  
362 Goals, Reinforcement and Intention: in-practice review of eligible patients was not  
363 commonly reported (41%) and only (19.8%) reported in-practice targets to improve referral  
364 rates. Practice financial reward for referral (pre April 2019) was rarely reported (5%); indeed  
365 the implementation of financial reward via national QoF incentives (post April 2019) was  
366 considered unlikely to greatly improve referral behaviours, with less than a third (32.6%)  
367 stating they would refer more. However, there was general agreement that this incentive  
368 would increase practice awareness of PR (70.1%).

## 369 370 **Phase 2. Questionnaire: Open questions.**

371  
372 A third of PHCPs (33.8%) responded to the open question at the end of the survey including  
373 5/11 PHCPs who reported referral, but did not specify frequency, (answer length 3-167  
374 words, mean 35). Non-frequent referrers reported more open comments (43/113 38.1%) than  
375 frequent referrers (33/109 30.3%)

376  
377 This gave an additional 94 comments that related directly to PR referral. These were content  
378 mapped to all 12 relevant TDF domains. The comments predominately cited referral barriers.

379  
380 Belief about capabilities had the highest number of comments 36/94 (38.3%) with many  
381 encompassing concerns about PR accessibility, particularly transport challenges for patients.  
382 For example, '*Location of PR too far for patients to travel and too much commitment. Patients tend to be*  
383 *older adults on generally low incomes. A number of my patients would attend if it was close by with no*  
384 *expense*'. A small number of PHCPs (3.2%) considered a patient's inability to complete pre-

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3 385 PR spirometry as a referral barrier, and 10.6% of comments related to referral processes,  
4 386 which were reported to be lengthy and as such '*easier simpler*' processes were requested.  
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### 8 388 **Connected results**

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11 390 In order to identify the key factors that inhibit and/or enable PHCP referral to PR, Phase 1  
12 391 and phase 2 results were merged to allow for data contrast and meta-inference (16) (Table 5).  
13  
14 392

15  
16 393 Most PHCPs believed in PR and encouraging patients to attend. Referral is most likely to be  
17 394 considered at annual review (indeed referral is rarely offered to patients outside of this  
18 395 consultation). On-screen prompts are helpful reminders, but in practice material promoting  
19 396 PR is rare. PHCP PR knowledge is largely gained from networking with other respiratory  
20 397 interested health professionals and/or CPD education. PHCPs report patients have little  
21 398 motivation for PR, rarely ask for referral to PR and view that patients in work are unlikely to  
22 399 be able to attend.  
23  
24 400

25  
26 401 Some findings of the qualitative study were not clearly replicated in the survey results. For  
27 402 example, phase one qualitative data highlighted that some GPs and ANPs felt the practice  
28 403 nurse was best placed to undertake PR referral at the time of annual review, yet respiratory  
29 404 interested GPs and those undertaking annual review did not share this view. The phase two  
30 405 survey data supported the latter position, where 29/129 (22.5%) of practice nurses reported  
31 406 never referring. Therefore responsibility of PR referral is not based on profession, but is  
32 407 undertaken by PHCPs who are respiratory interested and/or conducting the patient's annual  
33 408 review.  
34  
35 409

36 410 Qualitative generalisable findings were limited in a number of areas meaning clear  
37 411 conclusion cannot be drawn, these included; time available to undertake referral, ease of  
38 412 referral process, perceptions of quality of PR programme, referral of patients when COPD  
39 413 symptom burden is increasing and non-referral in order to protect patient relationship.  
40  
41 414

42  
43 415 Where generalisability is clear, a summary of the key behavioural barriers and enablers by  
44 416 TDF domain are shown in Table 5, demonstrating a greater number of barriers than enablers  
45 417 to referral. However, it is also important to report that barriers and enablers most commonly  
46 418 co-exist within the same domains.

419 Table 5 Matrix of Integrated results

420 ✓ Enabler and agreement with Phase 1 data.

421 ✗ Barrier and agreement with Phase 1 data.

422

TDF Domain	Phase 1 Qualitative study Main Factors	Phase 2 Survey Main Factors	Barrier - ✗ / Enabler - ✓
Social and Professional Role	It is largely seen as the practice nurse role, or staff undertaking COPD review.	Not clearly PNs role, but PHCP doing annual review is most likely referrer.	PHCP undertaking annual review (not necessarily the PN)- ✓
	The best time to refer a patient is when they are stable	Disagree	Not generalizable in quantitative data.
	Most PHCPs believe in encouraging patients to attend.	Agree	✓
Knowledge	Generally a good basic knowledge	Agree (Generally higher in frequent referrers)	Enabler – but room for improvement
	Little detailed local programme knowledge	Disagree (Higher local knowledge in frequent referrers)	✓
	Knowledge is largely gained from CPD/networking	Agree	✓
Environment	There is a lack of time in practice.	Disagree	Not generalizable in the quantitative data.
	Referral is only considered during non-acute COPD focused consultations.	Agreed (some infrequent referrers reported not to see COPD patients)	✗
	There is a lack of PR promotional material available in practices.	Agree	✗
Memory	On screen reminders are important	Agree	✓
	Referral prompted when patients have symptoms that are worsening	Disagree	Not generalizable in the quantitative data.
Optimism	Patients do not want PR/are not motivated	Agree	✗
	PR providers do not offer a good service.	Some agreement more so with infrequent referrers	✗
Belief about consequences	PR is good for patient's physical and psychological health.	Agree	✓
	PR may harm patients (psychologically)	Disagree	Not generalizable in the quantitative data.
	Pushing PR might harm my relationship.	Disagree	Not generalizable in the quantitative data.
	Patients will not always attend and complete post referral.	General agreement.	✗

Belief about capability	Talking to patients about PR is challenging.	Some agreement more so with infrequent referrers.	✗
	Patients in work are unable to attend PR	Agree	✗
	Transport is a barrier	Agree (Open question)	✗
	Not for patients with oxygen	Disagree	Not generalizable in the quantitative data. Not generalizable in the quantitative data. Not generalizable in the quantitative data
	Not for patients who smoke	Disagree	
	Best suited to those who have frequent exacerbations	Disagree	
Social influences	Lack of PR provider engagement and feedback to referrer	Agree	✗
	Patients do not ask for PR	Agree	✗
Skills	Referral to PR by PHCP is low	Agree	✗
	Referral process is relatively easy	Disagreement, particularly by infrequent referrers.	Likely barrier
Reinforcement	Financial reward increases referral rates	Most don't think this would change behaviour.	Not generalizable in the quantitative data
	Patients decline PR	Not captured explicitly	Likely barrier
	Financial reward increases practice awareness	Agree	✓
Goals	No set in-practice process to improve or review referral rates.	Agree	✗
Intentions	Referral acceptance takes time	Not captured explicitly	Likely barrier
	General desire to refer more patients.	Not captured explicitly	Likely enabler
Emotion	PHCPs are fearful on behalf of patients	Concern over access abilities (expressed in free text, may capture PHCP fear)	✗
	Frustration with PR providers	Not captured explicitly.	✗
Behavioural Regulation	PHCPs do not know how many patients they have referred.	Agree	✗
	PHCPs have no planned intentions to change behaviour	Largely agree, although some emerging interventions (free text)	Likely barrier

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3 426 **Discussion:**

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5 427 This is the first time the Theoretical Domains Framework has been applied to a mixed-  
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7 428 methods study to understand the key factors that determine referral to PR by PHCPs.

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9 429  
10 430 Results highlighted multiple intertwined barriers and few enablers across all TDF domains  
11  
12 431 Many (although not all) of the findings from the qualitative study were affirmed by the more  
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14 432 generalisable survey and highlight that referral to PR from primary care remains poor, and  
15  
16 433 that PHCPs believed that PR was beneficial for patients and wanted to refer more. They did  
17  
18 434 however, request greater engagement from providers, better knowledge of local programmes  
19  
20 435 and improvements in PR promotion. They also reported that in-practice goals and monitoring  
21  
22 436 of referrals to address the shortfall in patients referred were rare.

23  
24 438 However, PHCPs collectively reported low confidence in patients' abilities and motivations  
25  
26 439 to attend PR, a belief likely to be strengthened by reports of few patients requesting referral.  
27  
28 440 Beliefs about low uptake may explain why referral is commonly offered at times of  
29  
30 441 increasing COPD symptoms, thus acting as a lever to referral acceptance. Infrequent referrers  
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32 442 reported reduced confidence in encouraging un-motivated patients to attend, with similar  
33  
34 443 findings reported in phase 1 data as PHCPs expressed concerns around the protection of  
35  
36 444 relationships with patients. Venue accessibility also appears to be a barrier and whilst the  
37  
38 445 direct survey question (question 21) appeared not to overtly agree with this, both phase 1 and  
39  
40 446 the phase 2 open question results highlighted transport as both a practical and financial  
41  
42 447 barrier.

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44 448  
45 449 Variability in referral rate by PHCP profession was an unexpected finding and offers insights  
46  
47 450 that (1) few PNs refer and (2) where it is considered to be the 'respiratory nurse' role, referral  
48  
49 451 opportunities may become reduced. The association between referral frequency and  
50  
51 452 respiratory qualification is also a new finding. ANPs were those most likely to refer and to  
52  
53 453 have respiratory qualifications.

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55 454  
56 455 **Relation to other studies.**

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58 457 This mixed methods TDF based study finds agreement with many key referral factors  
59  
60 458 presented in our previous inductive qualitative study using the same data (6) and

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3 459 Cox et al's (25) TDF-applied systematic review which included patients and HCPs views on  
4 460 PR barriers and enablers. However this primary mixed methods study reports additional  
5 461 findings. It disputes that the PN is the main referrer to PR within primary care, and questions  
6 462 the value of practice based financial reward as a referral incentive. It also highlights that the  
7 463 referral process itself is not straightforward and there are no sanctions for non-referral, but  
8 464 that there is time in practice to refer.  
9

10 465  
11 466 Increasing the population sample and geographical reach in this study strengthens current  
12 467 known referral barriers including, poor patient motivation, few in-practice resources,  
13 468 perceived venue access difficulties and little awareness of local PR provision (26-29).  
14 469 Subjective patient assessments including PHCPs perceptions of patients capabilities and  
15 470 motivations have been described as influencing PHCP referral decisions here and previously  
16 471 published (6). This is a novel finding in relation to PR referral, yet similar HCP pessimistic  
17 472 attitudes, relating to a patient's capability and motivation to access services and change  
18 473 behaviours to improve health outcomes have been reported in the primary healthcare  
19 474 management of reducing cardiovascular disease risk in people with serious mental illness (30,  
20 475 31).  
21

22 476  
23 477 Phase one and inductive data analysis (6) suggested that offering PR at COPD symptom  
24 478 increase was common yet this was unconfirmed in the survey results. This may demonstrate  
25 479 further social desirability reporting as previous analyses have demonstrated patients attending  
26 480 PR to have 1.24 hospitalisations per patient-year 95% CI (0.66-2.34) suggesting sicker  
27 481 patients are those most likely to be offered PR (32). However, referral at this time supports  
28 482 both PHCP and patients' concerns about patient's capabilities (6, 25, 33), meaning lower  
29 483 acceptance and adherence to PR is probable, and negative PHCP beliefs about referral  
30 484 outcomes are likely to perpetuate. An alternative approach and one that appears not to be  
31 485 currently undertaken is to refer at the point of an acute exacerbation of COPD, which maybe  
32 486 a referral lever (33).  
33

34 487  
35 488 In our original inductive analysis (6), we reported that financial incentives may be important,  
36 489 yet results in this current study are mixed and PHCPs appear uncertain of their value. It will  
37 490 be interesting to observe the impact of the newly implemented financial rewards for PR  
38 491 referral in England, but where similar QoF rewards were implemented for referral to diabetes  
39 492 programmes, uptake did not greatly improve (34). Given positive correlations between



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3 493 referral rates and CPD education, efforts to increase the number and education of the primary  
4 care workforce by Health Education England (35, 36) is encouraging.

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8 496 The literature also supports a general consensus that for patients in employment, PR is largely  
9 considered inaccessible (6, 28). This was reported as a barrier by the frequent referrers more  
10 497 than the infrequent referrers, which questions whether PR knowledge itself is a potential  
11 498 barrier as previously reported (6) and that PHCP beliefs influence subsequent referral  
12 499 behaviours.  
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## 16 17 502 **Strengths and Limitations**

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20 504 Using the previously published qualitative data to inform the questionnaire offered valuable  
21 505 insights into PHCP referral practices and is a key strength of this research.  
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25 508 The range and number of PHCPs included from across the UK were broadly representative of  
26 509 the general practice nursing workforce, whilst less so for others, notably doctors and is a  
27 510 limitation (37). We recognise that predominately respiratory interested participants may have  
28 511 taken part in this study which may skew results, and it is noted that online participants  
29 512 reported higher referral practice and respiratory qualification(s) than their counterparts, which  
30 513 may be a study limitation, suggesting that more emphasis should be placed on the perspective  
31 514 of the infrequent referrers. Adopting additional recruitment strategies such as via general  
32 515 practice-based conferences is seen as a study strength which sought to capture a range of  
33 516 PHCPs views. Demographic similarities across all 3 recruitment streams highlight study  
34 517 design attempts to reduce participation and sample selection biases. Questionnaire specific  
35 518 biases relating to self-reporting response is a source of potential weakness, specifically where  
36 519 responses maybe perceived to be 'socially acceptable', otherwise known as social desirability  
37 520 (38). This may offer some explanation around the variation observed in the belief about  
38 521 capabilities domain of the integrated results matrix (Table 5). Grouping participants by  
39 522 reported referral frequency is a study strength, particularly as the aim is to understand both  
40 523 what supports and inhibits referral. Another limitation is that we are not sure about exact  
41 524 response rates where distribution was unknown.  
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3 526 Much of the validity of the TDF is gained from its direct application with HCPs, as utilised  
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5 527 here. Transcript content mapping to 84 constructs is complex and time consuming as also  
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7 528 described by others (39) but was considered the most comprehensive approach in the absence  
8  
9 529 of a gold standard approach to TDF application (39). The TDF offers a functional approach  
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11 530 to behavioural data analysis, most likely to be helpful when there is little to no underlying  
12  
13 531 knowledge of the investigating phenomenon. However, the interrelations between referrer,  
14  
15 532 patient and provider have previously been reported to be important factors in the referral  
16  
17 533 journey (6). Yet, the TDF does not offer causal determinants of behaviour (20) and alignment  
18  
19 534 to predetermined domains reduces the ability to consider any phenomena falling outside  
20  
21 535 those domains and the likely connecting relations, meaning the whole picture maybe missed  
22  
23 536 and is a potential limitation.

24 537

25 538 All authors had different professional backgrounds, one of whom (JW) is an experienced  
26  
27 539 respiratory nurse specialist which may have altered data analysis although transparency and  
28  
29 540 frequent team analysis sought to reduce potential bias.

30 541

31 542

### 32 543 **Implications for policy and practice**

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36 545 Whilst this paper highlights multiple barriers in referring patients with COPD to PR, barriers  
37  
38 546 to high quality healthcare for patients with COPD span throughout the disease trajectory and  
39  
40 547 persist across health service provisions worldwide (40-42). It is interesting to note that few  
41  
42 548 participants in our study thought that a financial incentive was important. It is however  
43  
44 549 difficult to assess this given that face to face PR programmes were suspended across the  
45  
46 550 country as a result of the COVID-19 pandemic. However, as previously highlighted QOF  
47  
48 551 incentives for referral to diabetes programmes did not greatly improve uptake. What we need  
49  
50 552 to do now is to design and test an intervention for improving referral to PR which  
51  
52 553 incorporates multi-system level changes. Additional intervention considerations will also  
53  
54 554 need to include post COVID-19 infection control adaptations, as well as managing increases  
55  
56 555 in service demands arising from programme suspension backlogs and new referrals,  
57  
58 556 including COVID-19 survivors (43).

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## 560 **Conclusions**

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562 This is the first mixed methods research study to examine the factors that inhibit and enable  
563 referral to PR for patients with COPD from a primary care perspective. Whilst knowledge  
564 and respiratory qualification appear to be enablers, many barriers persist which must be  
565 overcome to increase referral opportunities for all eligible patients. The most important  
566 aspects to address are to increase PR provider engagement with referrers, increase PR  
567 awareness and support for potential patients and all PHCPs, including those with respiratory  
568 qualifications and to increase PHCP internal motivation for PR referral, particularly for those  
569 patients in work and those with less symptom burden. Mapping these TDF findings to  
570 behaviour change techniques (BCT) are important next steps which will enable clear targeted  
571 interventions to be identified and tested in clinical practice, which will ultimately increase  
572 referral to PR, thereby improving COPD patients' health outcomes and reducing health  
573 service utilization.

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11 699 **Ethics approval and consent to participate**

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14 700 Ethical Approvals: Phase 1 approval granted by Health Research Authority: Project ID:  
15 701 213367. Phase 2 approval granted by University of Birmingham: ERN\_19-0439. All  
16 702 participants in phase 1 and phase 2 studies gave consent.

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18 703 **Consent for publication**

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21 704 Not Applicable

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23 705 **Availability of data and material**

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25 706 The datasets during and/or analysed during the current study available from the  
26 707 corresponding author on reasonable request.

27  
28  
29 708 **Competing interests**

30  
31 709 The authors declare that they have no competing interests"

32  
33 710 **Funding**

34  
35  
36 711 ‘This research received no specific grant from any funding agency in the public, commercial  
37 712 or not-for-profit sectors’.

38  
39 713 **Authors' contributions**

40  
41 714 JW collected, analysed and interpreted phase 1 and phase 2 data and was a major contributor  
42 715 in writing the manuscript. RJ, PA, SG and AE contributed to study design, data analysis and  
43 716 interpretation of phase 1 and 2 data. RJ, PA and SG all contributed to the writing of the  
44 717 manuscript. IV supported phase 1 topic guide development, phase 1 data alignment to the  
45 718 TDF and the formulation of the phase 2 questionnaire where behavioural expert consensus  
46 719 was sought. All authors read and approved the final manuscript.

47  
48  
49 720 **Acknowledgements**

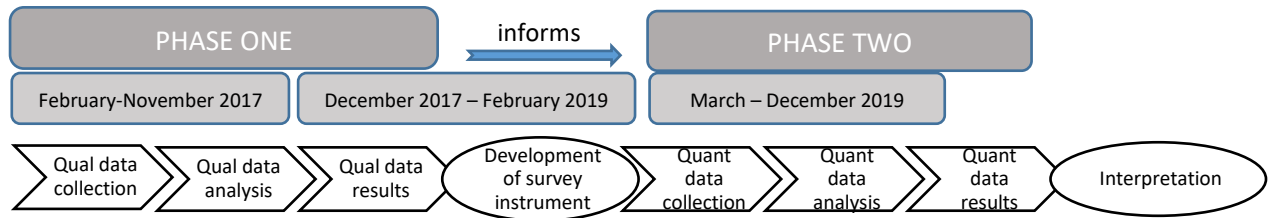
50  
51  
52 721 The authors thank all participating primary healthcare practitioners for giving up their time,  
53 722 providing the data, and contributing to this study.

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Figure 1

Figure 1: Multiphase sequential design



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## **Additional File 1: Phase 1 interview guide**

### **Understanding barriers and enablers for primary care health staff when referring patients with Chronic Obstructive Pulmonary Disease (COPD) to Pulmonary Rehabilitation: a qualitative study. Topic Guide for Interviews.**

#### **Interview Objectives:**

- To explore the experience of primary care practitioners in relation to referral of patients with COPD to pulmonary rehabilitation.
- To gain an understanding of the main perceived barriers and enablers for referring COPD patients for pulmonary rehabilitation.
- To gain insight into whether any patient characteristics influence whether or not people with COPD are referred for pulmonary rehabilitation.

#### Understanding current behaviour

To start the discussion, participants will be asked to talk about their experiences of managing patients with COPD in primary care and any experience of referral for pulmonary rehabilitation

1/ Could you tell me in what context do you currently see COPD patients? (Exposure to population/target intervention within working role e.g. planned – annual review/flu jab or unplanned - exacerbation)

2/ On average how many COPD patients do you think you see per week?

3/ Do you currently refer to PR programmes?

#### Capability, Opportunity, Motivation – including External Context

4/ What is your understanding/view surrounding Pulmonary Rehabilitation programs in general? And in relation to your local provider?....

5/ Do you think pulmonary rehabilitation is beneficial for patients? In what ways? Or why not?

6/ How easy or difficult is it for you to refer to your local PR provider?

(Eg. Is it your role to refer? When is it appropriate to refer COPD patients to PR?)

7/ What motivates you to refer patients to PR ?

(Eg. Do patients/carers ever ask you about pulmonary rehabilitation? Does the post PR patient summary motivate you, are you reminded by prompts or other guidance?)

8/ What do you think stops you from referring patients to pulmonary rehabilitation?

#### Images Alternating images (between 1-4)

9/ If this person was in your COPD patient, would you consider discussing PR with them? Why? Why not?



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5 10/ Is there anything that you think could improve the primary care discussion surrounding  
6 PR and/or encourage you to make referrals to PR?  
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8 Possible prompts: Do you think a short video clip would help you motivate patients? Or  
9 computerised prompts to follow? Or a further telephone call to encourage patients? Or a  
10 firm appointment slot to discuss PR with them?  
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Additional file 2 TDF domain alignment using construct labelling (1)

Domain	Constructs
1. Knowledge (An awareness of the existence of something)	Knowledge (including knowledge of condition /scientific rationale) Procedural knowledge Knowledge of task environment
2. Skills (An ability or proficiency acquired through practice)	Skills Skills development Competence Ability Interpersonal skills Practice Skill assessment
3. Social/Professional Role and Identity (A coherent set of behaviours and displayed personal qualities of an individual in a social or work setting)	Professional identity Professional role Social identity Identity Professional boundaries Professional confidence Group identity Leadership Organisational commitment
4. Beliefs about Capabilities (Acceptance of the truth, reality, or validity about an ability, talent, or facility that a person can put to constructive use)	Self-confidence Perceived competence Self-efficacy Perceived behavioural control Beliefs Self-esteem Empowerment Professional confidence
5. Optimism (The confidence that things will happen for the best or that desired goals will be attained)	Optimism Pessimism Unrealistic optimism Identity
6. Beliefs about Consequences (Acceptance of the truth, reality, or validity about outcomes of a behaviour in a given situation)	Beliefs Outcome expectancies Characteristics of outcome expectancies Anticipated regret Consequents

<p>1 2 3 4 5 6 7 8 9 10 11 12 13</p> <p>7. Reinforcement</p> <p>(Increasing the probability of a response by arranging a dependent relationship, or contingency, between the response and a given stimulus)</p>	<p>Rewards (proximal / distal, valued / not valued, probable / improbable)</p> <p>Incentives</p> <p>Punishment</p> <p>Consequents</p> <p>Reinforcement</p> <p>Contingencies</p> <p>Sanctions</p>
<p>14 15 16 17 18 19</p> <p>8. Intentions</p> <p>(A conscious decision to perform a behaviour or a resolve to act in a certain way)</p>	<p>Stability of intentions</p> <p>Stages of change model</p> <p>Transtheoretical model and stages of change</p>
<p>20 21 22 23 24 25 26 27</p> <p>9. Goals</p> <p>(Mental representations of outcomes or end states that an individual wants to achieve)</p>	<p>Goals (distal / proximal)</p> <p>Goal priority</p> <p>Goal / target setting</p> <p>Goals (autonomous / controlled)</p> <p>Action planning</p> <p>Implementation intention</p>
<p>28 29 30 31 32 33 34</p> <p>10. Memory, Attention and Decision Processes</p> <p>(The ability to retain information, focus selectively on aspects of the environment and choose between two or more alternatives)</p>	<p>Memory</p> <p>Attention</p> <p>Attention control</p> <p>Decision making</p> <p>Cognitive overload / tiredness</p>
<p>35 36 37 38 39 40 41 42 43 44</p> <p>11. Environmental Context and Resources</p> <p>(Any circumstance of a person's situation or environment that discourages or encourages the development of skills and abilities, independence, social competence, and adaptive behaviour)</p>	<p>Environmental stressors</p> <p>Organisational culture /climate</p> <p>Resources / material resources</p> <p>Salient events / critical incidents</p> <p>Person x environment interaction</p> <p>Barriers and facilitators</p>
<p>45 46 47 48 49 50 51 52 53 54 55 56 57</p> <p>12. Social influences</p> <p>(Those interpersonal processes that can cause individuals to change their thoughts, feelings, or behaviours)</p>	<p>Social pressure</p> <p>Social norms</p> <p>Group conformity</p> <p>Social comparisons</p> <p>Group norms</p> <p>Social support</p> <p>Power</p> <p>Intergroup conflict</p> <p>Alienation</p> <p>Group identity</p> <p>Modelling</p>
<p>58 59 60</p> <p>13. Emotion</p>	<p>Fear</p> <p>Anxiety</p>

<p>(A complex reaction pattern, involving experiential, behavioural, and physiological elements, by which the individual attempts to deal with a personally significant matter or event)</p>	<p>Affect Stress Depression Positive / negative affect Burn-out</p>
<p>14. Behavioural Regulation (Anything aimed at managing or changing objectively observed or measured actions)</p>	<p>Self-monitoring Breaking habit Action planning</p>

1. Cane J, O'Connor D, Michie S. Validation of the theoretical domains framework for use in behaviour change and implementation research. *Implementation Science*. 2012;7(37).

**Additional File 3: General Practice Staff experiences of referring patients with COPD to PR**

Thank you for taking the time to complete this questionnaire, which aims to gather perspectives from staff working in primary care. This survey is designed for us to find out some of the barriers staff face when considering referring a patient with COPD to PR so please answer the questions as honestly as you can. This should only take you around 15 minutes to complete. First, please complete the following information

Geographical location of practice (please circle)	<p style="text-align: center;">England</p> <p>North East    North West    Yorkshire and the Humber    East Midlands    West Midlands</p> <p style="text-align: center;">East of England    London    South East    South West</p> <p style="text-align: center;">Scotland    Wales    NI</p>
Profession (please circle)	GP/Trainer    Practice Nurse    ANP    Other (ECP/HCP/Pharmacist)
Age (years)	18-29    30- 39    40 – 49    50- 59    60 +
Gender	Female    Male
What is your ethnic group? Please circle one option that best describes your ethnic group or background	<p><b>White</b> English    Welsh    Scottish    Northern Irish British Irish Gypsy, Traveller or Irish Traveller Any other White background:</p> <p><b>Mixed/ Multiple ethnic groups</b> White and Black Caribbean White and Black African White and Asian Any other Mixed/ Multiple ethnic background:</p> <p><b>Black/ African/ Caribbean/Black British</b> African Caribbean Any other Black/ African/ Caribbean background</p> <p><b>Asian/ Asian British</b> Indian Pakistani Bangladeshi Chinese Any other Asian background:</p> <p><b>Other ethnic group</b> Arab Any other ethnic group:</p>
Do you see patients with COPD for (please circle as many as relevant)	Acute management    Chronic management    Both    Neither
No. of years in general practice	Years: .....    Months: .....
Respiratory Qualifications	None    COPD Diploma    Asthma Diploma    ARTP Spirometry    Other
Do you currently refer patients with COPD to pulmonary Rehabilitation?	Yes    - If yes -    Weekly    Monthly    Less than monthly  No - if no please explain why .....

This questionnaire is designed to ask you about your experiences with referring (or considering referring) patients with COPD to Pulmonary Rehabilitation and should take no more than **15 minutes** to complete. Please don't spend too long thinking about each question.

The questionnaire is made up of 4 elements. When rating your level of agreement with each phrase, please think about **all the things that might affect you being able to discuss pulmonary rehabilitation with your patients as well as refer.**

**Please indicate your level of agreement with the following statements:**

Question list	Strongly Disagree	Disagree	Neither disagree nor agree	Agree	Strongly Agree
1. I am aware of the content of Pulmonary Rehabilitation (PR) Programmes	1	2	3	4	5
2. I am aware of PR programme objectives.	1	2	3	4	5
3. I am unsure of the evidence base for PR	1	2	3	4	5
4. I know where geographically my local PR programme is delivered	1	2	3	4	5
5. I know when it is appropriate to refer a patient with COPD to PR	1	2	3	4	5
6. I can answer questions patients have about PR	1	2	3	4	5
7. I know how to contact my local PR provider	1	2	3	4	5
8. My local PR providers regularly engage with me	1	2	3	4	5
9. It is easy to refer a patient to PR	1	2	3	4	5
10. I am confident my local PR provider offers a good service for my patients.	1	2	3	4	5
11. Referral to PR is the practice nurse role	1	2	3	4	5
12. Other General Practice staff in my practice (excluding Practice Nurse) refer patients to PR	1	2	3	4	5
13. Referring patients to PR is something I have been advised to do	1	2	3	4	5
14. I am confident in my ability to encourage patients to attend PR, even when they are not motivated	1	2	3	4	5
15. I do not find it easy to discuss PR with patients.	1	2	3	4	5
16. I don't believe patients will attend PR after I have referred	1	2	3	4	5
17. Patients in work are not able to attend PR	1	2	3	4	5
18. PR is not beneficial to patients who are breathless	1	2	3	4	5
19. Patients who use home oxygen are unable to take part in PR	1	2	3	4	5
20. Patients who smoke are not motivated to take part in PR	1	2	3	4	5
21. Patients without their own transport won't be able to get to PR	1	2	3	4	5
22. Patients who live alone won't like to take part in group PR	1	2	3	4	5
23. I only refer patients if they have quit smoking	1	2	3	4	5
24. I only refer patients if they are optimised on their respiratory medication	1	2	3	4	5

Question list	Strongly Disagree	Disagree	Neither disagree nor agree	Agree	Strongly Agree
25. PR is most suited to COPD patients who have frequent exacerbations	1	2	3	4	5
26. My practice receives financial incentives for referral to PR (Before April 2019)	1	2	3	4	5
27. My practice regularly reviews COPD registers to ensure eligible COPD patients are offered PR	1	2	3	4	5
28. There are set targets within the practice to improve PR referral rates	1	2	3	4	5
29. I often forget to refer patients with COPD to PR	1	2	3	4	5
30. There is not enough time in practice to refer	1	2	3	4	5
31. I believe patients may be harmed by taking part in PR	1	2	3	4	5
32. Prompts to refer patients to PR within annual review templates are important reminders for me	1	2	3	4	5
33. The best time to discuss PR referral with patients is when they are stable.	1	2	3	4	5
34. Patients are motivated to attend PR	1	2	3	4	5
35. PR is best suited to those patients with worsening breathlessness	1	2	3	4	5
36. PR is best suited to those who have frequent exacerbations	1	2	3	4	5
37. I believe in encouraging patients to attend PR	1	2	3	4	5
38. PR reduces hospital admissions	1	2	3	4	5
39. I believe most patients will attend and complete PR following my referral	1	2	3	4	5
40. PR reduces risk of mortality	1	2	3	4	5
41. If patients attend PR this will reduce their general practice visits	1	2	3	4	5
42. PR reduces exacerbations	1	2	3	4	5
43. PR improves breathlessness	1	2	3	4	5
44. PR reduces a patient's anxiety and/or depression.	1	2	3	4	5
45. If I keep pushing patients to attend PR this will disadvantage my relationship with them.	1	2	3	4	5
46. There are good relationships in practice with PR providers	1	2	3	4	5
47. PR providers are good at communicating outcomes of referrals I have made	1	2	3	4	5
48. Resources about PR (i.e written information) are readily available	1	2	3	4	5
49. PR is something that patients ask for	1	2	3	4	5

Question list	Strongly Disagree	Disagree	Neither disagree nor agree	Agree	Strongly Agree
50. I will refer more patients to PR now there are practice QoF incentives (from April 2019)	1	2	3	4	5
51. There will be greater awareness of PR within practices because of the new QoF incentives.	1	2	3	4	5
52. More health care practitioners will discuss PR with patients because of the QoF incentive.	1	2	3	4	5
53. I believe patient attendance to PR will increase because of the QoF Incentive.	1	2	3	4	5
54. I believe the QoF incentive will not increase patients PR attendance	1	2	3	4	5

2/Please consider the interventions below. Please rate each possible intervention based on which you think would be the most helpful in improving your rates of referral to PR?

3/ Then please indicate the top 5 that you think will be the most effective in increasing PR referral within your practice. Please rank them in order 1 (highest) – 5 (lowest) in the 'Rank' column.

Question list	Strongly Disagree	Disagree	Neither disagree nor agree	Agree	Strongly Agree	Rank (1-5)
1. Health Care Professional (HCP) referring patients to PR at the time of COPD diagnosis.	1	2	3	4	5	
2. HCP prescribing PR at the time of COPD acute exacerbation.	1	2	3	4	4	
3. A standardised summary (i.e: a 2 sentences) that describes PR succinctly for HCP to recite to eligible patients.	1	2	3	4	5	
4. Face to face educational sessions for general practice staff.	1	2	3	4	5	
5. Online educational sessions for general practice staff.	1	2	3	4	5	
6. Face to face educational sessions for potential patients, carers and family.	1	2	3	4	5	
7. Online educational sessions for patients, carers & family.	1	2	3	4	5	
8. Practice staff loaning DVDs which demonstrate PR to patients.	1	2	3	4	5	
9. HCP showing patients PR recording within practice or consultation ie on a tablet device.	1	2	3	4	5	
10. Past PR patient attenders directly engage with eligible patients to highlight benefits.	1	2	3	4	5	
11. PR providers directly contacting eligible practice patients.	1	2	3	4	5	



Question list	Strongly Disagree	Disagree	Neither disagree nor agree	Agree	Strongly Agree	Rank
12. PR providers engaging with practice staff by coming into surgeries.	1	2	3	4	5	
13. Personalised letters to eligible patients from general practice advocating PR.	1	2	3	4	5	
14. Group consultations with patients, general practice staff and PR provider.	1	2	3	4	5	
15. Patients being able to refer themselves to PR.	1	2	3	4	5	
16. Patients having their own COPD health care record, similar to a COPD passport, meaning they are prompted to ask for PR.	1	2	3	4	5	
17. PR promotional material within patient pharmacy medication packs	1	2	3	4	5	
18. Greater awareness of PR in practice. i.e Posters highlighting local PR provider, benefits, etc.	1	2	3	4	5	
19. General practice staff being able to refer patients by telephone rather than manually completing referral form.	1	2	3	4	5	
20. If my practice referred more COPD patients this would increase my own referral numbers.	1	2	3	4	5	
21. Changing the name of PR to something more user friendly.	1	2	3	4	5	
22. General practice staff being taught motivational interviewing techniques would improve referral to PR.	1	2	3	4	5	
23. Lead practice PR referrer to educate and show PR video to other practice staff at practice meetings, to encourage a whole practice approach.	1	2	3	4	5	

4/ Please add any further comments/suggestions you may have.....

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Many thanks for completing this questionnaire. Please return to the return box to collect your chocolate(s).

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For peer review only

Guidelines for Conducting and Reporting Mixed Research for Counselor Researchers (1)

<b>Research Formulation</b>	
<p>1.1.1. Treat each relevant article as data that generate both qualitative (e.g., qualitative findings, literature review of source article, source article author's conclusion) and quantitative (e.g., p values, effect sizes, sample size score reliability, quantitative results) information that yield a mixed research synthesis.</p> <p>1.1.2. Subject each document selected as part of the literature review to summarization, analysis, evaluation, and synthesis.</p> <p>1.1.3. Provide literature reviews that are comprehensive, current, and rigorous; that have been compared and contrasted adequately; and that contain primary sources that are relevant to the research problem under investigation, with clear connections being made between the sources presented and the present study.</p> <p>1.1.4. Present clearly the theoretical/conceptual framework.</p> <p>1.1.5. Assess the findings stemming from each individual study and the emergent synthesis for trustworthiness, credibility, dependability, legitimation, validity, plausibility, applicability, consistency, neutrality, reliability, objectivity, confirmability, and/or transferability.</p> <p>1.1.6. Present the goal of the study (i.e., predict; add to the knowledge base; have a personal, social, institutional, and/or organizational impact; measure change; understand complex phenomena; test new ideas; generate new ideas; inform constituencies; and examine the past).</p>	Pages 3/4/5
<p>1.2.1. Specify the objective(s) of the study (i.e., exploration, description, explanation, prediction, and influence).</p> <p>1.3.1. Specify the rationale of the study.</p> <p>1.3.2. Specify the rationale for combining qualitative and quantitative approaches (i.e., participant enrichment, instrument fidelity, treatment integrity, and significance enhancement).</p> <p>1.4.1. Specify the purpose of the study.</p> <p>1.4.2. Specify the purpose for combining qualitative and quantitative approaches (e.g., identify representative sample members, conduct member check, validate individual scores on outcome measures, develop items for an instrument, identify barriers and/or facilitators within intervention condition, evaluate the fidelity of implementing the intervention and how it worked, enhance findings that are not significant, compare results from the quantitative data with the qualitative findings).</p>	Title & pages 3 & 4
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<p>1.5.1. Avoid asking research questions that lend themselves to yes/no responses.</p> <p>1.5.2. Present mixed research questions (i.e., questions that embed both a quantitative research question and a qualitative research question within the same question) when possible.</p>	
<p><b>Research Planning</b></p> <p>2.1.1. Specify the initial and final sample sizes for all quantitative and qualitative phases of the study.</p> <p>2.1.2. Present all sample size considerations made for the quantitative phase(s) (i.e., a priori power) and qualitative phases (e.g., information-rich cases).</p> <p>2.1.3. Present the sampling scheme for both the quantitative and qualitative phases of the study.</p> <p>2.1.4. Describe the mixed sampling scheme (i.e., concurrent–identical, concurrent–parallel, concurrent–nested, concurrent–multilevel, sequential–identical, sequential–parallel, sequential–nested, and sequential–multilevel).</p> <p>2.1.5. Clarify the type of generalization to be made (i.e., statistical generalization, analytic generalization, and case-to-case transfer) and link it to the selected sampling design, sampling scheme, and sample size(s).</p> <p>2.2.1. Outline the mixed research design.</p> <p>2.2.2. Specify the quantitative research design (i.e., historical, descriptive, correlational, causal–comparative/quasi-experimental, and experimental).</p> <p>2.2.3. Specify the qualitative research design (e.g., biography, ethnographic, auto-ethnography, oral history, phenomenological, case study, grounded theory)</p>	<p>Pages 4-5</p>
<p><b>Research Implementation</b></p> <p>3.1.1. Outline the mixed data collection strategy.</p> <p>3.1.2. Present information about all quantitative and qualitative instruments and the process of administration.</p> <p>3.2.1. Outline the mixed data collection strategy (i.e., data reduction, data display, data transformation, data correlation, data consolidation, data comparison, and data integration).</p> <p>3.2.2. Provide relevant descriptive and inferential statistics for each statistical analysis.</p>	<p>Pages 5.6.7</p> <p>Pages 24-26</p>

3.2.3. Discuss the extent to which the assumptions (e.g., normality, independence, equality of variances) that underlie the analyses were met, as well as any observations that might have distorted the findings (e.g., missing data, outliers).

3.2.4. Specify the statistical software used.

3.2.5. Specify where the responsibility or authority for the creation of categories resided (i.e., participants, programs, investigative, literature, or interpretive), what the grounds were on which one could justify the existence of a given set of categories (i.e., external, rational, referential, empirical, technical, or participative), what was the source of the name used to identify a given category (i.e., participants, programs, investigative, literature, or interpretive), and at what point during the research process the categories were specified (i.e., a priori, a posteriori, or iterative)

3.2.6. Specify the name of the technique used to analyze the qualitative data (e.g., content analysis method of constant comparison, discourse analysis, componential analysis, keywords in context, analytic induction, word count, domain analysis, taxonomic analysis).

3.2.7. Specify the qualitative software used.

3.3.1. Discuss the threats to internal validity, external validity, and measurement validity and outline the steps taken to address each of these threats to internal validity, external validity, and measurement validity.

3.3.2. Discuss the threats to trustworthiness, credibility, dependability, authenticity, verification, plausibility, applicability, confirmability, and/or transferability of data and outline all verification procedures used.

3.3.3. Discuss mixed research legitimation types (i.e., sample integration legitimation, insider–outsider legitimation, weakness minimization legitimation, sequential legitimation, conversion legitimation, paradigmatic mixing legitimation, commensurability legitimation, multiple validities legitimation, and political legitimation).

3.4.1. Interpret relevant types of significance of the quantitative findings (i.e., statistical significance, practical significance, clinical significance, and economic significance).

3.4.2. Conduct post hoc power analysis for all statistically non-significant findings.

3.4.3. Interpret the significance (i.e., meaning) of qualitative findings.

3.4.4. Discuss criteria for evaluating findings in mixed research studies (e.g., within-design consistency, conceptual consistency, interpretive agreement, interpretive distinctiveness, design suitability, design fidelity, analytic adequacy, interpretive consistency, theoretical consistency, integrative efficacy).

Page 5.7

Page 5-7, 28-29

Page 18-23,

Not applicable.

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3.5.1. Describe all steps of the mixed research process.	
3.5.2. Describe the context in which the mixed research study took place.	Throughout paper.
3.5.3. Ensure that the mixed research report is accurate and complete; does not distort differences within and among individuals and groups; is free from plagiarism or misrepresentation of the ideas and conceptualizations of other scholars; and contains findings that are adequately accessible for reanalysis, further analysis, verification, or replication.	Page 5-6
3.5.4. Present all ethical considerations that were addressed in the study (e.g., informed consent, confidentiality, incentives, funding sources, potential conflicts of interest, biases).	Throughout paper.
3.5.5. Specify study approval in accordance with an institutional review board either in the report or in the cover letter submitted to the editor.	Page 5-6 and page 33
3.5.3. Present recommendations for future research that culminate in a validation, replication, or extension of the underlying study.	Covering letter to the editor  Page 30

1. Leech NL, Onwuegbuzi AJ. Guidelines for Conducting and Reporting Mixed Research in the Field of Counseling and Beyond. *Journal of Counseling & Development*. 2010;88:61-9.