

Characteristics of pulmonary rehabilitation programmes in New Zealand: a survey of practice prior to and during COVID-19

Sarah Candy, Julie Reeve, Rosie Dobson, Denise Taylor

ABSTRACT

BACKGROUND: Pulmonary rehabilitation (PR) is a core component in the management of symptoms for people living with chronic lung disease. Access to PR is a barrier for many people, which results in low uptake and completion. Differences exist in the structure, organisation and content of PR services both nationally and internationally. Developing an understanding of service provision in Aotearoa New Zealand is important for future developments which aim to reduce barriers to access.

AIM: The primary aim of this survey was to develop an understanding of current pulmonary rehabilitation practices in New Zealand. The onset of a COVID-19 lockdown in New Zealand in March 2020, shortly after completion of the initial survey, enabled a follow-up survey to determine how services had adapted in response to the global pandemic.

METHODS: A cross-sectional observational design using two sequential purpose designed online surveys administered before (Survey 1) and after COVID-19 lockdowns (Survey 2) in New Zealand.

RESULTS: Survey 1 was completed by 36 PR services across New Zealand and showed homogeneity in the content and structure of services provided. PR was primarily funded by district health boards, run by a multi-disciplinary team of health professionals and included participants with a range of chronic respiratory conditions. All programmes completed pre- and post-PR assessments, were a minimum of eight weeks in duration and included exercise and education. Survey 2 showed that, during level 4 and level 3 COVID-19 restrictions, 11 (40.7%) of services paused PR programmes, with 16 (59%) adapting the service to provide home-based rehabilitation via telephone or teleconference facilities.

CONCLUSION: PR programmes in New Zealand report following Australian and New Zealand PR best practice guidelines and are homogenous in content and structure, but COVID-19 restrictions highlighted the need for services to provide more diverse options for service delivery. Future service development should focus on providing a range of delivery options allowing increased access to PR, tailoring therapy to meet individual needs and ensuring services are engaging for all participants to optimise participation.

Pulmonary rehabilitation (PR) is an evidence-based, multidisciplinary intervention that is a key component in the management of people living with a chronic respiratory disease, including COPD.¹ PR is a formalised, highly structured programme that includes exercise, self-management, education and behaviour-change support with health professional supervision. PR has been clearly demonstrated to improve breathlessness and health-related quality of life (HRQoL) and to reduce hospital admissions for exacerbations of COPD.^{2,3} Clinical guidelines strongly recommend the uptake of PR by all people with COPD, particularly following hospital admissions.¹ Despite this, the uptake of, and sustained engagement with, PR programmes in New

Zealand is poor, with estimates that less than 1% of all people with COPD participate in PR, and that only 38% of participants referred to PR complete the programme.^{4,5} Reasons for low attendance and adherence include transportation difficulties, lack of perceived benefit, depression and the interruption to the patient's daily routines.^{4,6-8}

The structure and organisation of PR services has been shown to influence attendance and completion rates.⁹ Several international PR programme surveys published in recent years¹⁰⁻¹⁴ have shown variability in the organisation, structure and content of programmes both within and across different countries.

The primary aim of this study was to develop an understanding of what PR service provision

looks like across New Zealand, and how this complied with best practice guidelines. The initial survey (Survey 1) sought to describe the characteristics, organisation, structure and content of PR programmes across the country. In March and August 2020, the global COVID-19 pandemic prompted significant changes in the way healthcare was being delivered in New Zealand, resulting in PR services needing to adapt in order to meet the needs of their population. Therefore, a second survey (Survey 2) was conducted following the level 4 and level 3 COVID-19 restrictions to (1) determine the impact of COVID-19 restrictions on PR services in New Zealand and (2) assess differences in pre- and post-COVID-19 PR programme delivery and content in New Zealand. Furthermore, both Survey 1 and Survey 2 aimed to identify any gaps in PR service provision and areas for development to enhance accessibility and uptake of PR for people living with a chronic respiratory condition in New Zealand.

Methods

Study design

A cross-sectional observational design, including two sequential purpose designed surveys administered online, was utilised. Ethics approval was granted from Auckland University of Technology Ethics Committee (AUTEK) on 21 May 2019, and an amendment was granted for Survey 2 on 21 August 2020. Data for Survey 1 were collected between July and September 2019 and for Survey 2 between August and September 2020.

Inclusion criteria

Programmes met the inclusion criteria if their service was consistent with the American Thoracic Society (ATS) (2016) definition for PR. See Box 1.

Box 1: PR services must include the following:

1. Programme delivered by exercise physiologist or physiotherapist
2. Minimum duration of six weeks
3. Included functional assessment (eg, six minute walk test (6MWT))
4. Included a measure of health-related quality of life
5. Included a measure of health-related quality of life

For Survey 1, programmes were required to have had a PR programme operating within the last six months. Only services which responded to Survey 1 were invited to participate in Survey 2. Respiratory support groups or maintenance groups were excluded.

Survey tool

The two surveys used a purposefully designed instrument developed by SC, JR, RD and DT. The survey was uploaded to REDcap software for administration. The survey was designed to represent the New Zealand context. Questions were developed based on other PR surveys conducted internationally^{10,12-14} and adapted to the New Zealand context, which includes questions specific to the New Zealand district health board (DHB) structure, the healthcare professionals delivering PR in New Zealand and the different cultural groups seen across the country. Secondly, taking knowledge already known about PR programmes in New Zealand from previous studies,¹ and updating and extending this knowledge. Both surveys were piloted with two clinicians working in PR to enhance content validity; neither was included in the final administration of the study, but their PR services were included. Feedback from pilot was minor and the survey was modified to improve readability. Survey 1 consisted of 72 questions over five sections, taking approximately 30 minutes to complete. Survey 2 involved 25 questions over three sections and took ten minutes to complete.

Procedures

Potential PR programmes throughout New Zealand were identified through:

1. Invitations posted in physiotherapy respiratory special interest group newsletters.
2. Contacting physiotherapy professional leads at each New Zealand DHB and requesting forwarding the survey invitation to clinicians coordinating the PR programme.
3. Internet searches for PR programmes in New Zealand.
4. Utilising professional networks.

Only one respondent per service was invited to take part in the survey.

All identified PR programme co-ordinators were sent an email inviting them to participate and outlining the aims of the survey along with

a participant information sheet. Interested participants were asked to return a written consent form via email prior to being sent the online survey link via the REDcap. One automatic reminder email and survey link was sent to all participants who did not respond within 14 days.

The second survey was administered by emailing all participants who completed the first survey and inviting them to complete Survey 2.

Data analysis

All data provided was de-identified and analysed by aggregation. A simple descriptive statistical analysis was completed. The qualitative data collated from open-ended questions were analysed using a simple general inductive thematic approach to identify common themes and meanings from the data.¹⁵

Results

Responses

Initial searches and advertisements identified 41 potential participants for Survey 1, who were sent participant information sheets. Two respondents did not meet the inclusion criteria. Thirty-nine survey links were sent out and 38 responses were received. Two services duplicated their responses which were checked for inter-rater reliability before duplicates were removed. Responses were analysed from 36 programmes (97.3%) for Survey 1. Survey 2 was sent to all respondents of Survey 1 and 27/36 (75.0%) responded. Response rates can be seen in Figure 1. Respondents to Survey 1 were physiotherapists (n=27; 75.0%), nurses (n=7; 19.4%) and exercise physiologists (n=2; 5.5%).

Geographical distribution

New Zealand is currently divided into 16 regions for local government purposes, and 15 regions had a minimum of one respondent to Survey 1. Survey 1 was completed by 28 PR services (77.7%) in the North Island (NI), and eight (22.2%) in the South Island (SI). Survey 2 was completed by 19 PR services (70.3%) in NI and five SI (18.5%), with three respondents (11.1%) not stipulating their region.

Programme setting

The majority of respondents provided PR at one site only (n=23; 63.9%), with 13 (36.1%) offering programmes across multiple sites. The setting of the programmes surveyed can be seen in Table 1.

Of note, four services (10.8%) offered home based rehabilitation prior to COVID-19 restrictions in Survey 1.

Programme organisation

The programmes surveyed reported delivery by a multi-disciplinary team with 27 programmes (75.0%) reporting that they utilised four or more different healthcare professionals directly in the delivery of the programme. The disciplines reported to be involved are listed in Table 2. The majority of programmes were funded by the public health services: 26 (72.2%) by DHBs, four (11.1%) by primary healthcare organisations (PHOs) and four (11.1%) by combined DHB/PHO funding. Two programmes (5.5%) were reported to be self-funded by participants and one service (2.8%) was funded by a combination of self-funding/insurance. Referrals to the PR services came from a variety of healthcare professionals (Table 3). Sixteen services (44.4%) undertook an annual service audit of the programme. A further four services (11.1%) reported having undertaken service audits, but not on a regular basis. A service audit had never been completed by n=16 of respondents (44.4%).

Programme structure

PR programmes were mostly eight weeks in duration and predominantly utilised group-based exercise and education classes. Respondents were asked about the format of their PR programme and the majority (69.4%) used a block/cohort programme. Block programmes require that all participants start PR on the same day, whereas a rolling programme allows participants to enrol at any time. An individual (1:1) programme was reported to be offered by one (2.7%) respondent. Twenty-four (66.7%) respondents reported having a waitlist to start the programme, with eight (22.2%) reporting the wait time for PR to be up to six months, the majority of which followed a block format programme (n=6; 75.0%). Only two services (5.5%) offered PR outside of normal working hours, with the remainder of services provided only within 9am to 5pm Monday to Friday.

Programme content

The inclusion of a pre and post programme assessment was reported by all respondents, with further follow-up assessment (>3 months post completion) included by 10 programmes (27.7%). All services included measures of exercise capacity and health-related quality of life,

Figure 1: Flow chart showing the number of participants invited and the number who completed Survey 1 and Survey 2.

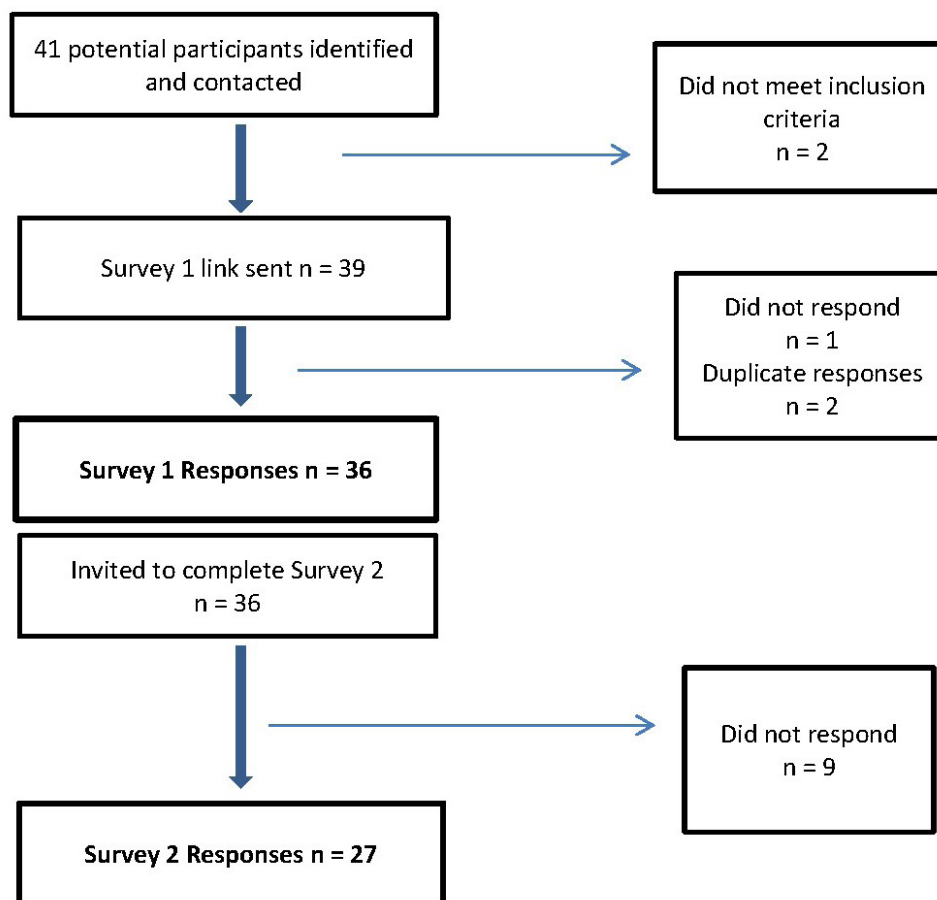


Table 1: PR programme setting (n=36).

Setting	n (%)
Hospital outpatient	19 (52.7)
Community venue	15 (41.6)
Home-based	4 (11.1)
Hospital inpatient	1 (2.7)
Church	3 (8.3)
Private facilities	3 (8.3)
Marae	2 (5.5)
Water-based	1 (2.7)
Telerehabilitation	0 (0.0)

with the different measures used shown in Table 3. Programmes included patients with a range of chronic respiratory conditions (Table 3). Only one programme (2.7%) offered multi-morbidity rehabilitation programme (ie, included participants living with multi-morbid long-term health conditions).

Respondents were asked whether they offered any adaptations to the programme for participants of different cultural backgrounds, with 22 (61.1%) reporting making adaptations to the service including: moving the location of PR to a marae (n=3; 8.3%), recruitment of healthcare professionals to reflect the different cultures in the classes (n=5; 13.8%), provision of an interpreting service (n=10; 27.7%), and provision of written material translated to different languages (n=6; 16.6%).

At the time of data collection for Survey 1, none of the services included a telerehabilitation component in their PR service. Respondents reported using digital technologies to assist in the delivery of centre-based programmes via appointment reminders through email (n=16; 44%) and/or text messaging (n=22; 61.6%). Technology was also used for delivering self-management education (n=13; 36%) in the form of videos and Microsoft PowerPoint presentations.

Survey two

Of the 27 completed Survey 2 responses, 11 centres (40.7%) stopped their PR programmes completely during the COVID-associated lockdowns (New Zealand level 3 and 4 restrictions). In the programmes that continued to operate during COVID-19 restrictions, the telephone was the most frequent modality used for completing PR assessments, delivering exercise prescription and self-management education. Some respondents utilised video-conference facilities (n =7; 25.9%) and/or text messaging (n =2; 7.4%). The content of the programmes and modalities used during the COVID-19 lockdowns is shown in Table 4. Ten services (37.0%) reported that, following COVID-19 restrictions being lifted, they planned to recommence services with the addition of telehealth options for participants, whereas five services (18.5%) reported that they would likely resume the same services as prior to COVID-19 lockdowns. Twelve services (44.4%) remained unsure of their future structure at the time of the survey.

Respondents were asked to describe the most significant barrier when trying to deliver PR during COVID-19 restrictions. The most common themes included not being able to assess participants in person (n=16; 59.2%), not being able to complete objective measures (n=15; 55.5%), a lack

Table 2: Disciplines directly involved in the delivery of PR.

Healthcare Profession	n (%)
Physiotherapist	32 (88.8)
Nurse	29 (80.5)
Dietician	21 (58.3)
Occupational therapist	15 (41.7)
Healthcare assistant	15 (41.7)
Health psychologist	10 (27.8)
Peer support / volunteer	7 (19.4)
Social worker	7 (19.4)
Pharmacist	6 (16.6)
Exercise Physiologist	5 (13.8)
Doctor (primary or secondary care)	5 (13.8)
Other *	3 (8.3)

*Others included smoke-free specialists and green prescription providers.

Table 3: Structure and content of New Zealand PR programmes (n=36).

	n (%)
Programme format	
Block programme	25 (69.4)
Rolling programme	10 (27.8)
Other (mixed n=1, individualised n=1)	1 (2.8)
Programme component	
Exercise, group education	33 (91.6)
Exercise, individual education	2 (5.5)
Other	1 (2.7)
Referrals from	
Respiratory physician	34 (94.4)
General practitioner (GP)	33 (91.6)
Physiotherapist	31 (86.1)
Nurse	31 (86.1)
Other physician	23 (63.8)
Other healthcare professional	18 (50.0)
Self-referral	12 (33.3)
Other	1 (2.7)
Participant diagnosis	
COPD	36 (100)
Interstitial lung disease	34 (94.4)
Bronchiectasis	33 (91.6)
Asthma	26 (72.2)
Post thoracic surgery	23 (63.8)
Lung cancer	19 (52.7)
Prehabilitation	18 (50.0)
Obstructive sleep apnoea	14 (28.8)
Cystic fibrosis	1 (2.8)
Breathing pattern disorders	1 (2.8)
Programme length	
<8 weeks	1 (2.8)
8 weeks	25 (69.4)
>8 weeks	10 (27.8)

Table 3 (continued): Structure and content of New Zealand PR programmes (n=36).

	n (%)
Exercise test	
6MWT	30 (83.3)
1 min STS	8 (22.2)
5 rep STS	6 (16.6)
ISWT	3 (8.3)
Other (30 second sit to stand, two-minute step test, CPET)	3 (8.3)
Health-related quality of life measure	
CAT	24(66.6)
CRDQ	7(19.4)
SGRQ	5(13.8)
CCQ	3(8.3)
SF36	2(5.5)
Other (Leischer cough (2), LINQ (1),HADS (1), WHO QOL(1), EQ-5D (1))	7(19.4)
None	1(2.7)

GP: General practitioner; 6MWT: six-minute walk test; 1 min STS: 1 min sit to stand; 5 rep STS: 5 repetition sit to stand; ISWT: incremental shuttle walk test; CAT: COPD Assessment Tool; CRDQ: chronic respiratory disease questionnaire; SGRQ: St George questionnaire; CCQ: chronic COPD questionnaire; SF36: short form 36; LINQ: lung information needs questionnaire; HADS: hospital anxiety and depression index; WHO QOL: World Health Organization quality of life.

Table 4: Delivery of PR during COVID-19 restrictions (n=27).

Component of PR	Delivery modality	n (%)
Assessment	Did not complete assessment during lockdown	16 (59.2)
	Telephone	9 (33.3)
	Video conference	1 (3.7)
Exercise prescription + progression	Telephone	15 (55.5)
	Video Conference	7 (25.9)
	Paper	7 (25.9)
	Email	5 (18.5)
	Mobile apps	2 (7.4)
	Home booklet	1 (3.7)
	Not described	1 (3.7)
Self-management education	Telephone	11 (40.7)
	Paper	8 (29.6)
	Video conference	6 (22.2)
	Email	6 (22.2)
	Text messaging	3 (11.1)
	Mobile apps	3 (11.1)
	Other (web-based resources)	1 (3.7)

of digital access for participants (n= 15; 55.5%) and low digital literacy for participants and staff (n=13; 48.1%). Respondents also reported not being prepared for the restrictions, and not having the time and resources to develop alternative methods for delivering PR.

Respondents were asked whether access to national PR resources would have been helpful to the delivery of PR during COVID-19 restrictions. Twenty-one (77.8%) responded they would have liked access to resources, especially New Zealand specific exercise and self-management educational videos. Other resources respondents would have found helpful during COVID-19 restrictions are shown in Table 5.

Discussion

This study has provided valuable information on the provision of PR services in Aotearoa New Zealand and updates knowledge gained from a previous national PR survey.⁵ Importantly, the study offered an opportunity to examine the impact of COVID-19 on service provision and how PR services adapted to the national restrictions and the perceived importance of maintaining this momentum in advancing the flexibility of PR service delivery.

Characteristics of PR in New Zealand

The main findings from Survey 1 showed that PR programmes demonstrate considerable homogeneity in their organisational aspects: they are largely funded by the public health system, delivered by a multidisciplinary team of healthcare professionals, and the majority include people across a range of chronic respiratory conditions. The content of PR programmes was also consistent across the regions and, importantly, mirrors best practice guidelines.^{1,17} The British Thoracic

Society (BTS) PR guidelines¹⁷ recommend services complete an annual review of individual outcomes and progress. Yet our survey found this was not completed in 53% of New Zealand PR services. Developing a framework for a national audit programme, similar to that in the UK,¹⁸ may assist smaller services to meet this recommendation and provide valuable information on service provision across New Zealand.

Provision of evidence-based PR is only part of the picture. Ensuring participants attend and complete the intervention is challenging.⁴ Contributing factors have previously been identified that relate to both patient characteristics and how the service is delivered.^{4,7-9,19} The current study showed New Zealand PR services have responded to some of the known barriers with the setting of PR services moving away from hospital outpatient settings and into community settings. Currently, 52.7% of PR programmes are in hospital outpatient clinics compared to 71% in 2009.⁵ New Zealand has one of the highest rates of community-based programmes in the world, following Ireland, where 65% of programmes are in community venues.²⁰ Community-based programmes have been shown to achieve equivalent health outcomes to hospital outpatient services if delivered with a consistent format.¹ The increase in community-based services in New Zealand is an important initiative to make programmes more accessible to participants and overcome barriers associated with travel and transport. In addition, the move to community centres with cultural importance, such as marae and church facilities, demonstrate novel ways to improve engagement through making programmes more culturally engaging and meaningful to participants. Ethnicity is an important predictor of non-completion of PR.^{4,18} Strategies that have been shown to assist with engagement include: the setting for PR,^{21,22}

Table 5: Resources respondents reported would be helpful to deliver PR via telehealth in New Zealand (n=27).

Resources	n (%)
New Zealand-specific exercise and education videos	19 (70.3)
Televised PR programme	17 (62.9)
National telerehabilitation service	13 (48.1)
Text messaging programme	11 (40.7)
Mobile PR app	10 (37.0)
Other (written material which could be supported with telephone calls)	1 (3.7)

the staff delivering rehabilitation services,^{21,23} and the use of interpreters.²⁴ Survey 1 demonstrated PR services in New Zealand are working towards improving cultural participation through a variety of these strategies.

Although patient barriers to uptake may have been considered, there remain several organisational and structural components of PR in New Zealand which may potentially contribute to the poor uptake and completion of PR. Most services offered only one location for PR and operated only during work hours, which limits access for people who may be unable to attend during the day. The block-style programmes were utilised by nearly 70% of the respondents, and although these programmes have been shown to be associated with improved completion rates,⁹ they can also be associated with a longer waiting time to start PR. Waiting time to commencement of PR is reported as a predictor of uptake.²⁵ People waiting longer than 90 days are less likely to complete PR.⁹ The length of waiting time is also an important consideration for people following an acute exacerbation, who are recommended to start PR promptly following discharge from hospital.²⁶ Survey 1 found that there were waiting lists for most PR services in NZ, which increased following the COVID-19 restrictions. Services should examine their population needs in order to determine the optimal structure to balance uptake and completion rates.

Survey 1 found the number of PR services in New Zealand offering home-based rehabilitation was low. Clinical guidelines recommend home-based PR, with regular contact, should be offered as an alternative to hospital-based PR.¹ However, it is estimated that this is offered in less than 5% of centres worldwide,¹⁴ with Survey 1 echoing this finding for New Zealand. Emerging models to support home-based rehabilitation have been trialled internationally, including telephone support,²⁷ video-conferencing^{28,29} and web- and mobile-based applications.³⁰⁻³³ These have shown promising results. For the purposes of these surveys, home-based rehabilitation was defined as PR delivered within the participant's home with or without supervision, and telerehabilitation was defined as using information and communication technology to deliver PR from a distance.³⁴ Survey 1 found four services in New Zealand were using home-based rehabilitation, but no services in New Zealand were using telerehabilitation as a mode of delivery for home-based PR services prior to the emergence of COVID-19 in New Zealand.

Impact of COVID 19 restrictions on PR services

Survey 2 showed the challenge of accessing PR services was intensified with the implementation of national restrictions in response to the COVID-19 pandemic. During this time, centre-based programmes were suspended, and delivery of PR services needed to be taken to the participant in new and novel ways. Considering the low number of services offering home-based rehabilitation prior to COVID 19 lockdown, it is perhaps understandable that many services were unable to transition to new models of delivery and instead ceased services during this time. Of the services identified as offering home-based rehabilitation in Survey 1 (n=4), all continued to operate during COVID-19 restrictions.

Telephone was the PR delivery modality used most frequently by respondents who continued to provide PR throughout the lockdown periods (n= 16; 59.2%). Respondents reported the low digital literacy and access to devices for participants as one of the most challenging aspects of trying to deliver alternative PR services. Digital access and literacy have previously been reported as potential barriers to remote delivery of PR in a New Zealand study that investigated the potential for the development of technology-based PR programme.³⁵ Previous reports in New Zealand have shown digital exclusion can occur across all age demographics but is particularly prevalent in Māori and Pacific people,³⁶ who have lower access to PR programmes and poorer outcomes from chronic respiratory conditions.³⁷ Furthermore, international audits have shown associations between deprivation and participation in PR with people from lowest socioeconomic status having lower odds of receiving PR³⁸ and reduced rates of completing PR.^{4,18} An Australian survey investigated computer and internet access in patients admitted to hospital with COPD in an area of high poverty, and found only 16% of patients had computer and 14% had internet access.³⁹ It is therefore vital that the development of alternative delivery methods for PR ensures they do not further increase inequities.

Other challenges identified in this study involved the extra staffing time required in setting up and delivering alternative programmes, such as telerehabilitation. Almost all respondents reported that having access to national resources would have assisted them in continuing to deliver PR services during the lockdown period. There are currently no evidence-based guidelines for alternative delivery methods of PR to guide clinicians. The develop-

ment of New Zealand-tailored and robustly tested resources for alternative methods of delivering PR could be helpful for overcoming known barriers to accessing traditional centre-based services by allowing rapid response to future pandemics.

Limitations

Although every effort was made to ensure all PR programmes in New Zealand were identified and included in the study, there is a possibility a programme may have been missed. A strength of Survey 1 was the high response rate. However, this was lower than expected for Survey 2, which impacts the results and may reflect the busyness of clinicians during lockdowns. Another limitation of the current surveys is that we are unable to determine capacity of PR programmes across New Zealand. Nor can we estimate the uptake of PR services for people with COPD. This survey also did not aim to look at discrepancies regarding availability of PR services across different communities, ethnicities or socioeconomic status. We realise this may influence the uptake and adherence to PR and warrants further investigation. In the future, this information may be beneficial for understanding the discrepancy between PR service referrals, uptake and completion.

Conclusion

Our study has provided important information on the structure, content, and organisation

of PR services in New Zealand, and how services responded to COVID-19 lockdown restrictions. The surveys highlighted several factors which limit widespread access to PR services in New Zealand and demonstrate the potential, and the necessity, of expanding and adapting the current provision of services. PR services need to increase flexibility in the delivery options for participants, including timing, venues and modes of delivery of PR.

COVID-19 restrictions imposed in 2020 provided an unprecedented opportunity to compare how services adapted to the pandemic in New Zealand. Our surveys demonstrated that the number of home-based PR services tripled during COVID-19 restrictions, and how tele-rehabilitation programmes emerged around the country as a result. This demonstrates different models of PR can be delivered in New Zealand and shows the ability of services to be flexible in their provision of PR and to respond and rapidly adapt, but we need to maintain this momentum.

Increasing the capacity and diversity of PR options is essential to address the lack of access to programmes in New Zealand. But it is essential that these services are designed with key stakeholders to ensure they are accessible and engaging for all participants and do not increase existing disparities. Consideration in the design of services must be given to digital divide, equity and culturally engaging models. Finally, ensuring new models of care still adhere to best practice guidelines and are safe and effective is essential.

COMPETING INTERESTS

Nil.

AUTHOR INFORMATION

Sarah Candy: Pulmonary Rehabilitation Coordinator, Respiratory Services, Counties Manukau Health, Auckland.

Julie Reeve: Senior Lecturer, School of Clinical Sciences, Auckland University of Technology, Auckland.

Rosie Dobson: Senior Research Fellow, National Institute for Health Innovation, University of Auckland, Auckland.

Denise Taylor: Professor, School of Clinical Sciences, Auckland University of Technology, Auckland.

CORRESPONDING AUTHOR

Sarah Candy, Pulmonary Rehabilitation Coordinator, Respiratory Service, Counties Manukau Health, Private Bag 93311, Otahuhu, Auckland 1640, 0274363116, scandy@middlemore.co.nz

URL

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