



WHITE PAPER

Pioneers in Telehealth Based Pulmonary Rehabilitation



Improving Accessibility, Patient Satisfaction,
and Reducing Health Care Costs





Home Rehab Network (HRN) Pioneers in Remote Care

Improving Accessibility, Patient Satisfaction, and Reducing Health Care Costs Through a Telehealth Team-Based Approach

Table of Contents

Drivers of Change and Expansion of the Telehealth Industry	3
Introduction	5
Pulmonary Rehabilitation: Benefits and Utilization	6
What is HRN?	7
Program Criteria and Methods.....	8
Program Success: Health Quality Measures	9
Program Success: Patient Satisfaction and 30D Readmission Reduction	10
The Cost of COPD and Other Chronic Conditions	11
Cost Effectiveness of HRN	12
Future Perspectives.....	13
References	14

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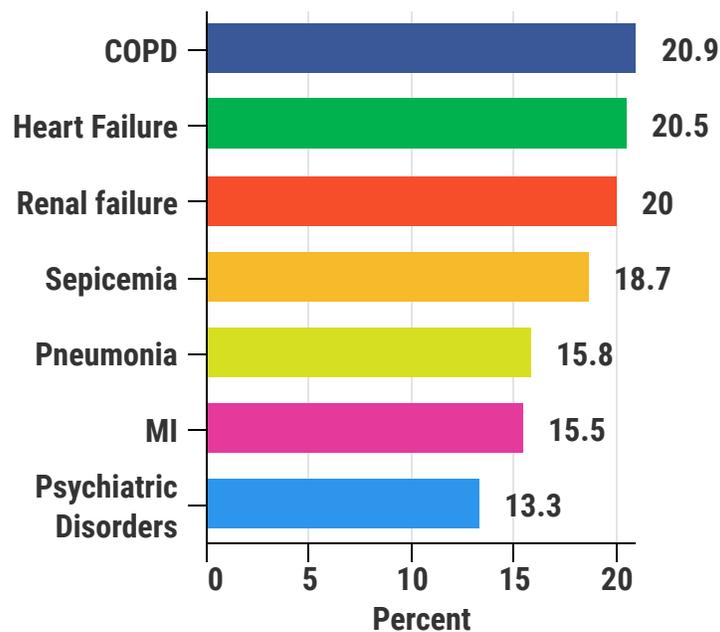


Drivers of Change and Expansion of the Telehealth Industry

Healthcare is transitioning from a system of payment based on volume for services provided (fee for service) to payment based on the value of those services (value-based bundle). Hospitals, post-acute care, and outpatient providers have large amounts of pressure on them to find more efficient routes of delivering care while improving patient outcomes as Medicare and other healthcare payers' experiment with new policies and payment models. Health systems must begin to determine how they will take financial accountability for the quality and costs of an entire episode of care or attributed population, such as under the Hospital Readmissions Reduction Program (HRRP). The percentage of penalized hospitals and the amount of penalties have increased since the implementation of the HRRP. In fiscal year 2020, 82% of 3046 HRRP eligible hospitals were penalized an estimated \$521 million reduction in Medicare payments (1).

Hospital readmissions are one of the most prominent issues associated with alternative payment models as they are expensive, a metric of poor quality of care, and often a sign of poor downstream functional outcomes. A large number of readmissions could be preventable. Studies have shown that there is a direct relationship between poor care communications and readmission rates (2). An indirect factor of hospital readmissions includes patient's physical function, co-morbidities, and socioeconomic status which often goes unrecognized and unaddressed during care transitions. Telehealth programs have shown to be a cost-effective approach to reduce hospital readmissions by providing interventions customized for different patients based on their specific clinical and social factors.

Top Diagnoses for 30 Day Hospital Readmission Rates*

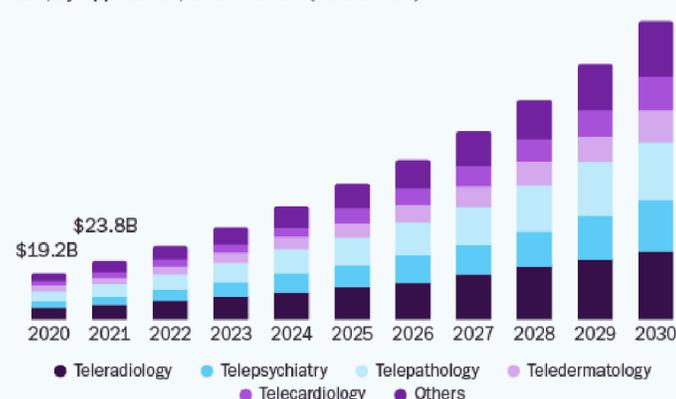


*Hospital inpatient conditions with high frequency of readmissions among adults by expected payer using the 2018 Nationwide Readmissions Database (3)

Expansion of the telemedicine industry has been fueled by rising consumer demand & patient acceptance, need to reduce the cost of care, and enhanced quality of care. Further, legislative provisions under consideration and expansion of broadband to rural and low-income communities addressing health care inequalities will further increase telehealth adoption in the future. The telehealth market size is estimated to grow at a compound annual growth rate of 19.5% from 2022 to 2030 (4).

North America Telemedicine Market

size, by application, 2020 - 2030 (USD Billion)





Drivers of Change and Expansion of the Telehealth Industry COVID-19 Pandemic

The COVID-19 pandemic has had a major impact on our public health and the delivery of healthcare services globally. Overall, approximately 42% of U.S. adults reported having delayed or avoided seeking care during the pandemic because of concerns about COVID-19, including 12% who reported having avoided seeking urgent or emergency care (5). In response, the CDC issued guidance in February 2020 advising health care providers and facilities to offer clinical reimbursed services through virtual means such as telehealth and as a result served as a bridge of care while reducing disease exposure and lessening the patient demand on hospitals (6). Prior to the onset of the pandemic telehealth services were not commonly used, but research has indicated that usage skyrocketed from less than 1% of visits to as much as 80% in areas with a high prevalence of COVID-19 cases (7). This expansion in the use of telehealth borne out of necessity has led to an increased willingness and adoption by patients, providers, and health systems. The telehealth industry now offers a chance to reinvent virtual and hybrid virtual/in-person care models, with a goal of improved healthcare access, outcomes, and affordability.

Pulmonary Telerehabilitation and COVID-19

Early evidence suggests that some complications, such as heart or lung damage, may improve with time, particularly if they receive prompt rehabilitative care. Pulmonary telerehabilitation has played a vital role in restoring function and limiting disability in patients recovering from COVID-19. Evidence shows that COVID-19 patients enrolled early in a PR program have improved QOL measures, a large and rapid recovery in exercise capacity, and improvement in psychosocial status (8,9). Unfortunately, even before this pandemic, most patients needing rehabilitation did not receive it. Furthermore, there were very few established PR programs besides HRN with the experience and technology to provide support for all aspects necessary for recovery from home. Unless there is dramatic change, many people with residual problems after COVID-19 are unlikely to receive expert rehabilitation assessment, advice, and treatments.

Factors Influencing Continued Telehealth Use and Expansion Since COVID-19 (10)

Regulatory changes that facilitated expanded use of telehealth during the pandemic have been made permanent.

Consumer and provider attitudes toward telehealth have improved since the pre-COVID-19 era.

Investment in virtual care and digital health more broadly has skyrocketed, fueling further innovation

Virtual healthcare models have shown to improve patient access, clinical outcomes, and reduce healthcare costs.

HRN, Leaders in the Field of Telehealth Based COVID-19 Rehabilitation

HRN was at the forefront of home-based pulmonary telehealth prior to the pandemic and increased its services to successfully treat hundreds of COVID-19 patients. A major success of HRN's program is attributed to the personalization of the process to the patient's individual needs, providing evidence-based interventions, and setting achievable goals aimed at short and long-term recovery.

The major aims of HRN's program for post COVID-19 management include:

- Reducing shortness of breath, improving lung capacity, and managing any respiratory complications
- Reducing the impact of respiratory symptoms on mental health
- Improve muscle strength and endurance to get their patients back to a more active lifestyle
- Additional support and training related to management of medications, oxygen supplementation, and nutritional support are also provided



Introduction

Telehealth technologies and virtual care programs are gaining recognition by major health systems and providers for their role in improving access to health care and improving short and long-term health outcomes. In many cases, telehealth and virtual care can keep people safely at home and out of hospitals, doctors' offices and urgent care centers by triaging those who have questions and need medical care, providing timely access to diagnosis and treatment, and monitoring patients with chronic conditions such as Chronic Obstructive Pulmonary Disease (COPD). There is no better example of the importance of these remote programs whereby hospitals and health systems leverage telehealth and online tools in many ways to combat the novel COVID-19 pandemic. Telehealth has also been an important strategy to reduce health care costs. As a result, the Centers for Medicare & Medicaid Services (CMS) and other payees continue to amend their coverage and reimbursement guidelines to cover the costs associated with this maturing mode for delivering health care, health education, and health information services.

Pulmonary rehabilitation (PR) is an important part of the management and health maintenance of people with chronic respiratory disease who remain symptomatic or continue to have decreased function despite standard medical treatment. Pulmonary rehabilitation is an evidence-based, multidisciplinary approach that uses patient education, health behavior modification, and exercise training to improve patient outcomes. Center based rehabilitation programs (CBR) have shown to reduce morbidity and mortality rates, and re-hospitalizations. However, many of CBR programs are underused or unavailable for a myriad of reasons in the U.S. Despite extensive global guidelines endorsing pulmonary rehabilitation referral, a recent study in the United States revealed that only approximately 1.2% of patients with chronic obstructive pulmonary disease (COPD) have access to pulmonary rehabilitation services (11). New delivery strategies are urgently needed to improve participation. One potential strategy is telehealth-based rehabilitation programs such as the Home Rehab Network (HRN) that relies on remote coaching with a team of licensed practitioners who provide comprehensive medical assessments and personalized therapy programs entirely outside of the traditional setting.

Benefits of Home-Based Rehab

-  Accessibility
-  Utilization
-  Compliance
-  Patient Satisfaction
-  Patient Costs
-  Health System Costs
-  Rehospitalizations



Pulmonary Rehabilitation: Benefits and Utilization

Benefits

There is **level 1 evidence** supporting the benefits of PR for treatment of chronic pulmonary diseases including improved exercise capacity, emotional function, and health related quality of life (HRQoL) (11). Furthermore, PR results in substantial cost savings in the US healthcare system through the prevention of readmissions. Studies in patients with acute exacerbation in chronic obstructive pulmonary disease (AECOPD) have shown that early supervised PR initiated prior to or within one-month of hospital discharge significantly improves health outcomes such as 6-minute walk, and the St. George's Respiratory Questionnaire (SGRQ) (scale from 0 to 100, lower is better) (13-15). In a pooled meta-analysis evaluating HRQoL directly after end of early PR showed a statistically and clinically significant improvement of 19.43 units on the SGRQ scale (95% CI: [- 29.09 to - 9.77]). Data from same metanalysis yielded a statistically significant mean difference in walking distance (6MWT) of 76.89 m, favoring early PR (95% CI: [21.34 to 132.45]) (13,14).

PR has also shown to significantly reduce rehospitalization rates (30 and 90 Day), and 1-year mortality (Table); providing similar benefits when delivered using an inpatient or outpatient center (15). Similarly, randomized studies utilizing a home-based PR program have shown to be effective intervention in COPD with improvement in lung function (FEV1), HRQoL (SGRQ, Borg, and CAT) scores, and physical capacity (16). Whether in a resource limited setting, home-based PR program shows promise to replace the hospital-based PR program, as a safer option in the era of COVID-19. There is also evidence for the efficacy of PR to improve similar outcomes in other conditions besides COPD including bronchiectasis, pulmonary hypertension, pulmonary and cystic fibrosis, asthma, lung cancer, and post-acute care pneumonia/COVID/exacerbations (16)

	No PR	PR
30D Rehospitalization	147 /658 (22.3%)	53/435 (12.18%)
90D Rehospitalization	286/658 (43.8%)	57/435 (13.13%)
1-Year Mortality	173/1000 (1.73%)	100/1000 (1.0%)

p<0.001 between groups for all measures

Utilization

Despite the documented benefits of these programs and recommendations for their use in clinical guidelines, rates of use are extremely low. A study published in 2018, for example, investigated rates of use in 223,832 Medicare beneficiaries who had been hospitalized for COPD within the 2 years after Medicare began providing reimbursement for pulmonary rehabilitation (17). Their findings showed use rates of only 2.7% within 12 months of hospitalization. Older age (≥ 75 years) and lower socioeconomic status were 2 factors associated with nonuse, and patients living >10 miles away, from a pulmonary rehabilitation facility were also less likely to initiate the service (odds ratio, 0.42; 95% CI, 0.39-0.46). Among the various reasons for underuse, professional organizations have identified a lack of awareness and knowledge of this resource among providers, patients, payers, and lack of access to such programs (17).

Reasons for Under-Utilization



Lack of Awareness/Adherence

- Limited education/resources
- 20% referral rate
- 20% program completion rate



Lack of Transportation

- Difficult for pulmonary pts
- Cost (gas and parking)
- Most pts live in rural area



Lack of Access

- 831 PR programs of 6,093 hospitals in the U.S (13.6%)

AMERICAN THORACIC SOCIETY

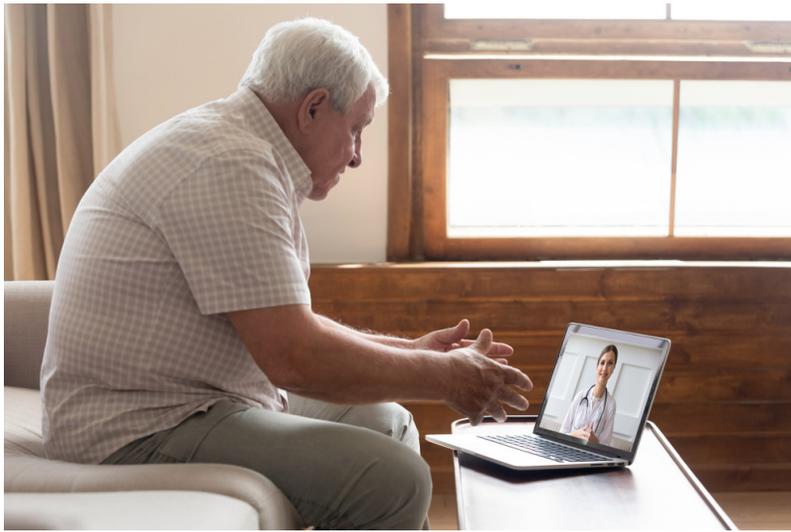
Defining Modern Pulmonary Rehabilitation

" A comprehensive intervention based on a thorough patient assessment followed by patient-tailored therapies that include, but are not limited to, exercise training, education, and behavior change, designed to improve the physical and psychological condition of people with chronic respiratory disease and to promote the long-term adherence to health-enhancing behaviors"



What is Home Rehab Network?

The Home Rehab Network is Maryland-based Telehealth rehabilitation company founded in 2017 with the goal of making rehabilitation more accessible and improving health outcomes in patients with pulmonary disease from the comfort of their own home. Guided by practitioners that are well known in their field of practice, no other program offered in the United States can compete with HRN's experience and success rates in the industry.



Multidisciplinary Team

HRN is composed of physicians, respiratory/occupational therapists, clinical care coordinators, personal trainer, dietician, telehealth IT specialists, account manager, data manager, and external programs/ consultants to enhance program.



Naveed Shah, MD (CMO) has served as Chief of Pulmonary and Director of Sleep Services for a large Maryland based health care system. His medical background with internal medicine along with specialties in critical care and pulmonary medicine make him more than capable to oversee the medical accuracy of the HRN.



Alexander Grichuhin, RRT-RCP (CEO) is highly regarded in the industry with over 20 yrs of experience as a respiratory therapist, pulmonary rehab program director, and college professor. Alex has won several awards in the field including top respiratory therapist by the Worldwide Leaders in Healthcare.

Program Options

Patients are referred from hospitals and physicians. Frequent communication with the patient and the practitioner via phone or video chat are used to monitor your progress and our practitioners will report to the patients' primary doctor on a routine basis. The program also includes therapy schedules, journals, and many other necessary program documentations. There are 2 options below depending on your preference.

1 Telerehabilitation

You interact with the practitioner in real time, and he/she sees you through your TV or Mobile Devices (Phone, Tablet, Laptop Computer). It's just like having the practitioner there with you in your presence! In this program, since the practitioner can see you, he or she can visually see if any complications or concerns may need to be reported to your doctor.

2 MyNewLungs.com

This self-paced, interactive and educational program is made for those that don't want to be in a group session or/and does not have insurance. All HRN patients, though optional, can utilize this platform to do "Extra Therapy" to add more exercises to a patients plan of care.

The video platform is updated and refreshed monthly with new content. Even though a patient might not have insurance, he or she can still participate in therapy using MyNewLungs as an alternative option to help improve their life.

What Do the Programs Provide?

- **Respiratory/ Pulmonary Therapy**
- **Physical Therapy**
- **Occupational Therapy**
- **An assigned Cardiologist/Pulmonologist**
- **Stress Management**
- **Yoga**
- **Educational Classes**



Program Criteria and Methods

Program Inclusion Criteria

Patients meeting the diagnosis criteria below referred by the hospital or healthcare provider may be included into the program (18).

- **COPD:** Moderate, severe, very severe obstruction according to GOLD Guidelines.
- **Non-COPD Moderate lung diseases:** Asthma, bronchiectasis
- **Post-COVID-19:** Pulmonary complications or long-haul respiratory symptoms.

Easy Steps to Join HRN Program and Enrollment

- 1) The patient or treating clinician will call **1(800)-341-5838** or email hrn@hrn.center to set up free consultation.
or
complete HRN referral form on website: homerehabnetwork.com
- 2) The HRN Coordinator will schedule a tele-rehab appointment for the physician initial evaluation and assessment with the HRN board certified pulmonologist.
- 3) A registered respiratory therapist also conducts an evaluative assessment.
- 4) Once approved and enrolled, a program equipment kit will be shipped to the patient and an HRN coordinator will schedule the weekly pulmonary tele-rehab visits.

Standard Customized Kit Includes:

- | | |
|------------------------|------------------|
| - Incentive Spirometer | - Pulse Oximeter |
| - Delta-V | - Nebulizer |
| - Spacer | -Therapy Bands |
| - Pedometer | - Harmonica |
| - Hand & Foot bike | - Nasal Cannula |

Up to \$200 for complete kit

Initial Evaluation, Training, and Reporting "A multidisciplinary tele rehab approach"

1. **Initial assessment conducted by board certified HRN pulmonologist to determine eligibility.**
2. **Customized patient care plan provided including:**
 - Exercise training
 - Healthy eating/smoking cessation support
 - Psychological support
 - Medication training- nebs/inhalers
 - Proper use of O2 and portable concentrators
 - Breathing/coughing techniques
 - Music therapy with harmonica
3. **This is a collaborative collegial relationship between HRN and the referring physician with progress reports sent during and at the end of the program that include multiple health assessments.**
 - 6 Minute Walk Test (*every 2 weeks*)
 - CAT score (*every session*)
 - Incentive spirometry (*every session*)
 - Pulse Oximetry (*every session*)
 - Borg Dyspnea (*every session*)

Additional HRN Program Details

- **Program:** 12-week Live Interactive Pulmonary Rehab Course. Additional maintenance sessions are covered by insurance.
- **Platform:** Secured Zoom
- **Sessions:** 36 sessions, 1.5 hour each MWF, group setting, avg. 5 patients
- **Practitioner:** RT or equal, with MD oversight



Covered by all Insurance carriers



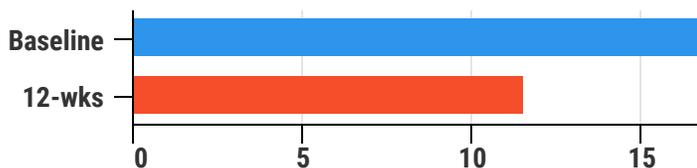
Program Success: Health Quality Measures

Methods

A total 100 stable COPD patients (GOLD stages II-IV, and <4L/min oxygen) between the age of 50-85 were randomly selected from chart review. COPD health quality metrics including COPD assessment test (CAT), 6-minute walk test (6MWT), incentive spirometry, and BORG scale were analyzed prior to, during, and at the completion of the program. Measures were compared using paired t-test and Chi-squared test with $p < 0.05$ considered a statistically significant.

COPD Assessment Test (CAT)

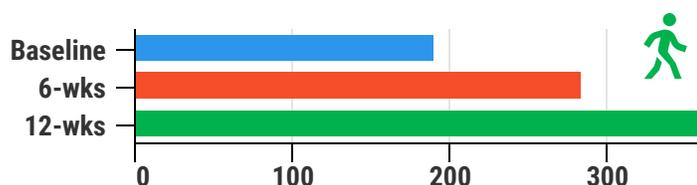
Universally accepted questionnaire-based scoring system used to assess progression of lung disease, decline in functional status, and gauge effectiveness of pulmonary rehabilitation. Range of CAT scores from 0-40 with higher scores denote a more severe impact of COPD on a patient's life. A score >10, and >20 indicates medium and high impact level on health status, respectively. Patients enrolled in HRN showed a significant reduction in CAT scores demonstrating less of an impact of their lifestyle as a result of COPD.



Mean score: 16.8 ± 5.9 vs. 11.5 ± 5.1 , $p < 0.0001$
CAT score >10: 87% vs. 62%, $p < 0.01$
CAT score >20: 24% vs. 1%, $p < 0.0001$

6-Minute Walk Test (6MWT)

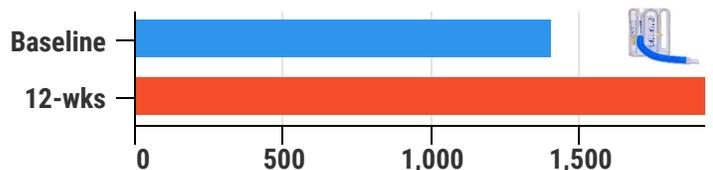
The 6MWT is a commonly used test for the objective assessment of functional exercise capacity for the management of patients with moderate-to-severe pulmonary disease. Unlike pulmonary function testing, the 6MWT captures often coexisting extrapulmonary manifestations of chronic respiratory disease and does not require complex equipment or technical expertise. Poor performance in the 6-min walk test (6MWT < 350 m or 1050ft) is an important prognostic indicator of mortality and risk of exacerbations in COPD patients. Patients enrolled in HRN showed a significant improvement in 6MWT midway and at the completion of the 12-wk program.



Distance (m): 190 ± 119 vs. 284 ± 95 vs. 362 ± 120 , $p < 0.0001$
Improvement: 44% at 6-wks., and 90% at 12-wks

Incentive Spirometry

The incentive spirometer is a commonly used tool in pulmonary rehab to measure lung capacity, promote deep breathing, and strengthen respiratory muscles. COPD patients enrolled in HRN showed a significant improvement in lung capacity midway and at the completion of the 12-wk program.



Lung Capacity (ml): 1400 ± 643 vs. 1921 ± 632 , $p < 0.0001$

BORG Scale

Borg's CR10 scale is the most widely used instrument to assess the intensity of breathlessness during exercise in people with COPD; its non-linear scaling properties were designed for consideration of the non-linear physiological and perceptual responses to exercise. A score of 0 indicates least exertion whereas 10 indicates maximum exertion. At the end of the 12-wk program COPD patients showed an improvement in BORG scale after their 6MWT and at rest suggesting improved conditioning.

Improvement at 12-wks



Post-6MWT

↓ 2.5 pts



At Rest

↓ 4.0 pts

"Over 99% of our patients report improvement in their breathing post-rehabilitation"



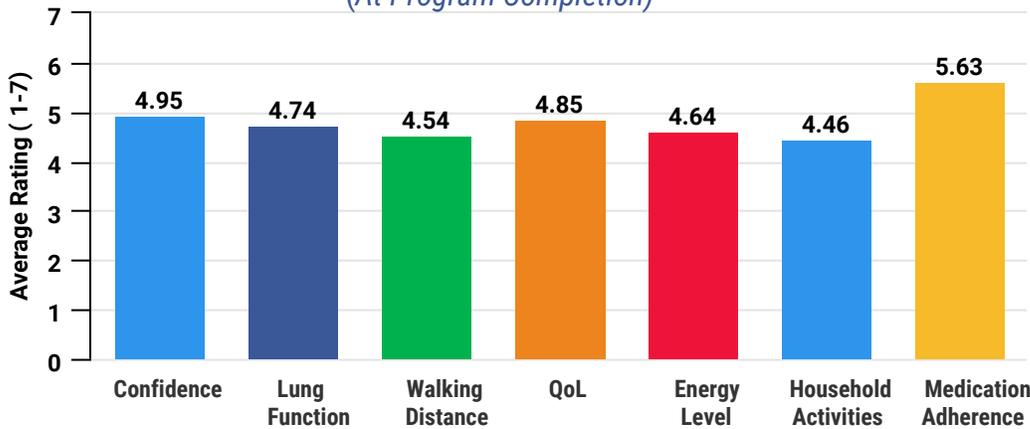
Program Success: Patient Satisfaction and 30-Day Readmission Reduction

Program Satisfaction

HRN have been pioneers in the field, developing the first successful virtual PR model program which include all the components of a traditional center-based program but delivered at home. Since 2018, over 3000 patients in the U.S. have completed the 12-wk program for COPD, heart failure, COVID-19, and other indications requiring pulmonary or cardiovascular rehabilitation. The service has also expanded globally.

The quality of a PR program is reflected in its process and performance metrics with proven improvement in clinical outcomes and low costs. HRN holds one of the highest success rates in patient care with a **program completion rate of 98.7%** compared to 26-36% in published studies. Furthermore, the program has a **patient satisfaction rating of 98%**. A chronic respiratory questionnaire, and daily therapy journal ratings were analyzed in 654 AECOPD patients before and after HRN program completion. Significant improvements were seen in all parameters detailed below.

Chronic Respiratory Questionnaire (At Program Completion)



Baltimore, Maryland



"Wonderful. Highly recommend the program! I have been in zoom classes for the past 2- months and my daily responsibilities are easier to accomplish. Due to the fun harmonica and breathing exercises, walking, and weight training I am able to do so much more. I've learned so much about COPD that I didn't know, and I am grateful!!

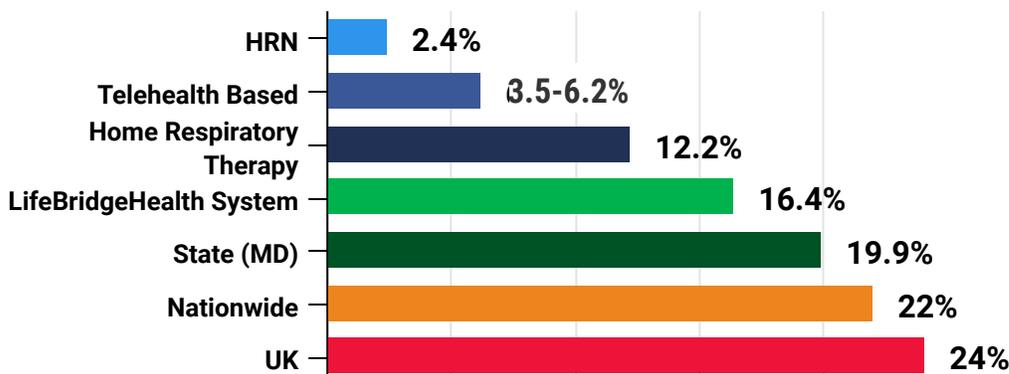


99.1%
Has your breathing improved since starting HRN program?

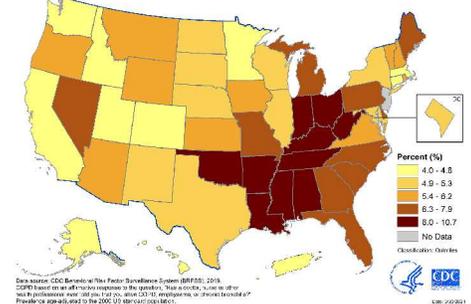
30 Day Rehospitalization

Providers understand that high hospital readmission rates are related to increased morbidity/mortality, whereas excessive rates threaten a hospital's financial health in a value-based reimbursement environment.

Comparison of 30-day Readmission Rates (%) for AECOPD



Prevalence of Chronic Obstructive Pulmonary Disease (COPD) for Adults Aged ≥18 Years by State, United States, BRFSS 2019



It is estimated that 15.7 million Americans (6.4%) have been diagnosed with COPD with prevalence varying considerably by state and country.

Thirty-day readmission rates were compared between out-patient PR programs and health system, statewide, nationwide, and country-based readmission data (19-22). Telehealth-based PR resulted in a drastic reduction in rehospitalization with HRN demonstrating the lowest rates at 2.4%. The impact of a comprehensive telehealth PR program has also resulted in a readmission reduction up to 3-months. However, future research including randomized trials and registries will be required to further validate program success for hospital wide adoption.



The Cost of COPD and Other Chronic Conditions

Introduction

Approximately 50 billion dollars in direct costs and another 15 billion for hospital readmissions is spent annually for the treatment of AECOPD as reported by the Agency for Healthcare Research and Quality (21). These related readmissions are one of the costliest episodes to treat and are frequently avoidable with early adoption of a quality PR program. With hospital and federal dollars going to hospital readmissions, CMS created a value-based reimbursement program that penalizes hospitals for excessive 30-day readmissions rates for 6 conditions or procedure specific 30-day risk-standardized unplanned readmissions including: COPD, pneumonia, HF, AMI, CABG, and elective hip/knee replacements. Furthermore, there are many additional direct and in-direct non-medical costs that place a burden on the patient, their family, and society that are a challenge to calculate. One study showed that patients often felt an emotional cost of their hospital readmission that in most cases could have been preventable with improved education, follow-up, and home health care.

Patient satisfaction has been a priority in healthcare. The quality of patient care is measured by The Healthcare Effectiveness Data and Information Set, which measures different domains of quality, including effectiveness, access, availability, and experience of care (23). Patient satisfaction is also associated with reimbursements from the Center for Medicare and Medicaid. Overall, there have been studies that show a high level of satisfaction with telemedicine. Gustke et al. evaluated patient satisfaction of 495 patient appointments and found that overall patient satisfaction was 98.3% (23).

Costs Associated with COPD and other Chronic Diseases

Direct (Medical)	Direct and Indirect (Non-Medical)
Diagnostic tests, medications, and medical supplies	Travel, Parking, and other out-of-pocket expenses
Inpatient/outpatient care, and professional fees	Social and psychological support
Emergency Department and EMS	Productivity loss
HRRP (penalty/savings)	Informal caregiving

Calculating Hospital Costs Attributed to 30D COPD Readmission Costs

Traditionally, Medicare and other payers make separate payments to providers for each individual service (fee-for service) for a single illness over the course of treatment. Payment rewards the quantity of services offered by providers rather than the quality-of-care which has driven healthcare cost up. In contrast, bundled payments provide incentives for a team approach setting across all healthcare settings and specialties leaving health systems doing more with less. Furthermore, there are several hybrid models of reimbursement combining both payment systems. As a result, there is a wide range in calculated loss to the hospital for 30D readmissions costing hospitals participating in **Fee-for-Service an average of \$19,954** and for **Bundled Payment models \$7,652** per patient. Across all expected payers in 2018 the **average readmission cost was \$15,200** ranging from \$10,900 for self-pay/no charge stays to \$16,400 for privately insured stays. (21). Similar readmission costs have been observed across all targeted chronic diseases included in the HRRP program.

Calculating Hospital Readmission Reduction Program (HRRP) Penalties

Hospital readmission is an important outcome for patients, as it is disruptive to patients and caregivers, costly to the healthcare system, and puts patients at additional risk of hospital-acquired infections and complications. As a result, the HRRP program provides a means to ensure hospitals are accountable for excess readmissions. The Excess Readmission Ratio (ERR) is used to assign penalties to hospitals, adjusts for variation in hospitals' volume and case mix (24). CMS reduces all of a hospital's payments for Medicare admissions based on its ERR, not just payments for readmissions, and not just for the six targeted conditions. Hospitals with an ERR of one or less are not penalized. For hospitals with ERRs greater than one, the higher the ERR, the greater the rate of penalty. HRRP penalties range from 0% to 3% during a performance period. In FY2022, 2,500 hospitals will face HRRP penalty reductions and around 18% of hospitals will be penalized more than 1% of their reimbursements (25). The latest CMS data showed 2,545 hospitals will face FY21 HRRP penalties, with 41 facing the maximum 3% cut in Medicare payments (26). The HRRP produced \$553 million in hospital cuts for FY21, CMS estimated. Despite, HRRP efforts only a modest decrease in all-cause readmissions of the targeted diagnosis's including AECOPD and pneumonia have been reported suggesting greater efforts focused on post discharge management are required (26). More research is required to determine the cost effectiveness of comprehensive telerehabilitation programs such as **HRN to reduce 30D readmission costs and HRRP penalties.**



Costs Effectiveness of HRN

Potential Cost Saving in US, Statewide, and Health System with HRN

Below is a comparison of estimated costs calculated from reported readmission rates (RR) for COPD and bronchiectasis nationwide, state of Maryland, and the LifeBridge Health System who recently implemented the HRN program to improve outcomes and RR. Cost savings vary dependent on payment models and 30-day RR by state. Readmission was defined as a subsequent hospital admission for any cause within 30 days following an initial stay (index admission) for COPD and bronchiectasis. Total patients and RR were obtained from the Healthcare Cost and Utilization Project (HCUP) Statistical Brief by expected payer using the 2018 Nationwide Readmissions Database (NRD). Whereas state and LifeBridge Health system data (all payors) for FY2021 in non-HRN participants was collected through Chesapeake Regional Information System (CRISP) Reporting Services.

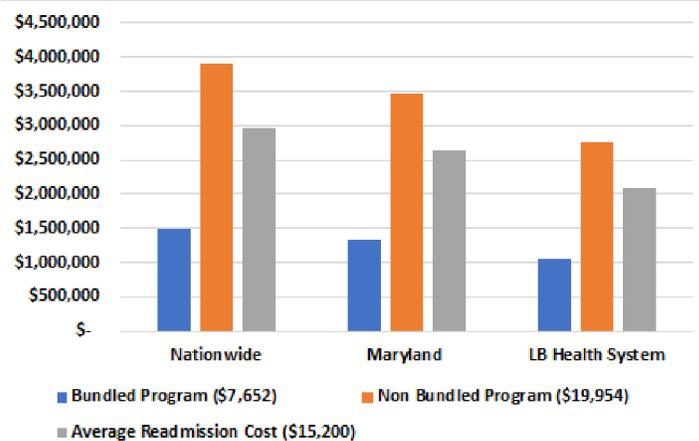
	Total (n=483,000)	Total (n=5,315)	Total (n=456)
Total Cost without HRN	Nationwide (30D RR=22%)	Maryland (30D RR=19.9%)	LB Health System (30D RR, 16.4%)
Bundled Payment	\$ 813,407,600.00	\$ 8,095,816.00	\$ 573,900.00
Fee-for-Service	\$ 2,121,110,200.00	\$ 21,111,332.00	\$ 1,496,550.00
Average Readmission Cost (all payers)	\$ 1,615,760,000.00	\$ 16,081,600.00	\$ 1,140,000.00
Cost with HRN	Nationwide (30D RR=2.5%)	Maryland (30D RR=2.5%)	LB Health System (30D RR=2.5%)
Bundled Payment	\$ 92,397,900.00	\$ 1,017,716.00	\$ 91,824.00
Fee-for-Service	\$ 240,944,550.00	\$ 2,633,928.00	\$ 239,448.00
Average Readmission Cost (all payers)	\$ 183,540,000.00	\$ 2,021,600.00	\$ 182,400.00
Total Potential Savings with HRN	Nationwide	Maryland	LB Health System
Bundled Payment	\$ 721,009,700.00	\$ 7,078,100.00	\$ 482,076.00
Fee- for-Service	\$ 1,880,165,650.00	\$ 18,477,404.00	\$ 1,257,102.00
Average Readmission Cost (all payers)	\$ 1,432,220,000.00	\$ 14,060,000.00	\$ 957,600.00

The potential cost savings is enormous saving over a billion dollars nationwide just accounting for hospital costs. In addition, each state and hospital could save millions per 1000 index visits for COPD and bronchiectasis. The same savings could be applied to other chronic conditions that **HRN** manages such as heart failure.

HRRP Penalty Reduction with HRN

Under programs set up by the Affordable Care Act, the federal government cuts payments to hospitals that have high rates of readmissions and those with the highest numbers of infections and patient injuries. The most recent data on HRRP penalties by hospital is available @ <https://khn.org/news/hospital-penalties>. According to Congress' Medicare Payment Advisory Commission the average penalty is a 0.64% reduction in payment for each Medicare patient stay with fines averaging \$217,000 per penalized hospital (25). Implementation of **HRN** program with low RR rates have the potential of drastically cutting or preventing all penalties by lowering Excess Readmission Ratio (ERR).

Hospital Savings (per/1000 hospitalized patients)



There is critical need for more research and data analytics demonstrating the cost effectiveness of **HRN's** program by region, and payment models. Given the improvement in accessibility, health outcomes, patient satisfaction, and cost reduction it only makes sense for hospitals to provide this proven and one-of-a-kind program to all their patients that meet the criteria.



Future Perspectives

There is considerable evidence supporting the role of pulmonary telehealth rehab as a safe and cost-effective component of integrated management in patients with chronic respiratory illness. We are living through and watching in real-time how telehealth programs are improving the face and future of healthcare as a result of the COVID-19 pandemic. As a leader in the field, **Home Rehab Network** aims to serve as a model in the tele-rehabilitation field and will strive to expand the adoption to meet the needs of a growing population who require comprehensive pulmonary and cardiovascular care for the treatment of chronic or post-surgical conditions requiring at home care. providing future research to advance evidence-based PR.

Future Research

Tele-rehabilitation is a relatively new delivery method, there is critical need for more research demonstrating the efficacy of this method and, particularly, a comparison of telehealth between center-based approaches and in-home models of care. **HRN** is working hard to advance evidence-based practices in remote PR through research utilizing an ongoing registry and partnering with health systems such as LifeBridge Health (Baltimore, MD) to determine the impact of HRN on health outcomes, cost savings, and the future of rehabilitation medicine.

Pulmonary	Cardiovascular
Interstitial lung disease	Congestive Heart Failure
Asthma	Myocardial Infarction
Cystic Fibrosis	CABG
Lung transplantation	
Lung Cancer	
Pulmonary hypertension	

Benefits of Adoption of Tele-Rehabilitation Model for the Use in Clinical Trials

As a result of the pandemic leading to lockdown restrictions and social distancing norms being strictly enforced, there was a drastic reduction in the number of clinical trials that could be conducted, impacting the execution of ongoing trials or the initiation of new ones affecting the rollout of critical drugs and medicines. In response, the pharmaceutical and other industries began incorporating telemedicine modalities when possible, including remote patient recruiting, remote consenting, video conference assessments, and scheduling in home services for sample collection. Benefits of adoption of the Tele-rehabilitation model include:

- Increase research participation, especially for patients from diverse rural areas
- Improved compliance in study patients
- Improved safety and adverse event reporting
- Advance remote diagnostic technologies for early intervention
- Reduce the high cost of conducting research
- Improved accessibility/participation for patients with several medical co-morbidities
- Improved subject understanding of study through electronic documents and recordings/videos

As a leader in the field of telerehabilitation, **HRN** has the ability to provide valuable consultation and services to improve and continue expansion for the use in clinical trials.



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