2023

An Investigation into Cardiac and Pulmonary Rehabilitation Compliance in Southern Illinois Post-COVID-19

Sarah Vogt
sarah.vogt@siu.edu

AN INVESTIGATION INTO CARDIAC AND PULMONARY REHABILITATION COMPLIANCE IN SOUTHERN ILLINOIS POST COVID-19 PANDEMIC

by

Sarah E. Vogt

B.S., Southern Illinois University, 2022

A Research Paper
Submitted in Partial Fulfillment of the Requirements for the
Master of Science

School of Health and Human Services
in the Graduate School
Southern Illinois University Carbondale
December 2023

RESEARCH PAPER APPROVAL

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Approved by:

Dr. Juliane P. Wallace, Chair

Graduate School
Southern Illinois University Carbondale
November 16, 2023

AN ABSTRACT OF THE RESEARCH PAPER OF

Sarah E. Vogt, for the Master of Human Science degree in Exercise Science, presented on November 16, 2023, at Southern Illinois University Carbondale.

TITLE: AN INVESTIGATION INTO CARDIAC AND PULMONARY REHABILITATION COMPLIANCE IN SOUTHERN ILLINOIS POST COVID-19 PANDEMIC

MAJOR PROFESSOR: Dr. Juliane P. Wallace

Cardiovascular disease and its associated comorbidities are the leading cause of death in the United States. Pulmonary conditions such as COPD, lung cancer, and interstitial lung disease cause impaired functional capacity, dyspnea, and decreased quality of life. Both diseases can be exacerbated by the COVID-19 virus. Cardiac and pulmonary rehabilitation programs have been proven to increase exercise capacity, quality of life, and socialization among compliant participants. In this study, using existing data from Southern Illinois Healthcare from January 2022 to July 2023, the compliance rate for cardiac and pulmonary rehabilitation programs in southern Illinois post-COVID-19 pandemic is compared with national averages pre-COVID. The results show that 55.55% of cardiac patients and 70% of pulmonary patients complied with their physicians' referrals. It is concluded that southern Illinois post-COVID has a higher compliance rate than reported averages pre-COVID.

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CHAPTER 1

INTRODUCTION

CARDIAC REHABILITATION

Cardiovascular disease (CVD) and its associated comorbidities are the leading cause of death in the United States. With a death toll of 173,000 people in 2021, CVD has killed more people than cancer, COVID, and strokes (Xu, et. Al, 2022). Cardiac rehabilitation programs have become increasingly popular to introduce patients to regular exercise to improve health and education. After a cardiac event, a patient's cardiologist or primary care physician may refer them to a rehabilitation program. For most patients in the United States that are referred to cardiac or pulmonary rehabilitation, Medicare/Medicaid will cover 3-45-minute sessions a week for 8-12 weeks with a qualifying diagnosis (Lavie & Milani, 2011).

It has been concluded that every 1 MET increase on a treadmill can result in a 12% decrease in mortality and improved prognosis can be seen for cardiac patients (Myers, et. Al, 2002). Other benefits of regular exercise after a cardiac event include management of blood pressure, lipids levels, diabetes, and psychosocial behaviors (Mampuya, 2012). Myocardial injury can be linked to the COVID-19 virus through increased troponin levels caused by the body's inflammatory response (Chilazi, et. Al, 2021). This causes damage to the cardiac muscle and impairs functional capacity. There is an increased need for rehabilitation in patients that experience myocardial damage due to the COVID-19 virus.

PULMONARY REHABILITATION

With COVID-19 being a respiratory virus, the post infection symptoms are more prevalent and detrimental to individuals with existing lung conditions. In patients with interstitial lung disease, significant new symptoms post-COVID-19 include fatigue, increased coughing,

and sleep disruption with persisting symptoms of decrease oxygen diffusion and desaturation during exertion were reported (Fesu, et. Al, 2023). Similarly, to cardiac rehabilitation, benefits can be seen in pulmonary rehabilitation with the prevalence of lung conditions increasing since the COVID-19 pandemic. Approximately 33.2 million adults were diagnosed with chronic lung disease as of 2021 (ALA, 2023). The most common chronic lung diseases include COPD, interstitial lung disease, and now, long COVID. When exploring the accessibility of pulmonary rehabilitation nationally, it has been found that in a sample of Medicare beneficiaries 40% of adults are diagnosed with COPD and eight in nine of those in rural areas, have poor access to pulmonary rehabilitation (Malla, et. All, 2023). This information shows that populations across the nation are unable to capitalize on the benefits of pulmonary rehabilitation.

Pulmonary rehabilitation benefits can be seen through improved functional capacity and quality of life with decreased dyspnea scores and hospitalization (Hill, 2005). After the completion of the exercise protocol in pulmonary rehabilitation, findings reported that, “an improvement in endurance exercise, a decline in Ve/Vo2 at maximal exercise, and an improvement in the subjective sensation of dyspnea,” can be expected (Niederman et. Al, p. 804, 1991). Thus, the referral process and compliance with a rehabilitation program is essential for patients with decreased lung function due to pulmonary conditions and/or post-COVID-19 symptoms.

COMPLIANCE

There are numerous factors that can influence the utilization of cardiac and pulmonary rehabilitation programs which can be complicated with medical conditions. A 2019 study concluded that the most common reasons for noncompliance with a cardiac rehabilitation referral include, “distance, financial resources, work and other time constraints, gender, age, social

support, illness perceptions, and depression" (Tian, et. Al, p. 31, 2019). But the blame for such a low enforcement of rehabilitation programs cannot be fully placed on patients. Another study investigating cardiac rehabilitation physician referral rates reported that "Over the past decade, inclusion criteria for programs have widened to include a variety of patient groups… Yet only one third to one half of eligible patients are referred to programs." (Clark, et. Al., p. 692, 2012). Alongside a drastically low referral rate, it has been concluded that in the United States, only 14% to 55% of patients comply with their referrals after a hospitalization (Ghisi, et. Al, 2013). A 2013 study concluded that only 90 of the 286 patients that were hospitalized due to COPD exacerbation received referral and only 43 (47.78%) completed pulmonary rehabilitation (Jones, et. All, 2013). This conclusion forces us to ask how patients could be encouraged to increase utilization and why are physicians not referring qualified patients in need.

Since the determination of COVID-19's effects on new and existing conditions, qualifying diagnosis codes have been updated to consider the increased demand for rehabilitation. Effective as of January 1st, 2022, diagnoses that previously did not qualify including chronic respiratory failure, pneumonia, viral cardiomyopathy, shortness of breath, and others (Table #3) that are indicated as post-COVID-19 conditions can now qualify for outpatient rehabilitation programs.

The purpose of this study is to compare the compliance rates to cardiac and pulmonary rehabilitation from before the COVID-19 pandemic to those in rural southern Illinois post-COVID-19. There is a growing body of research on the benefits of complying with a cardiac and pulmonary rehabilitation program but there is a lack of understanding of these in rural areas following COVID-19.

CHAPTER 2

METHODOLOGY

PARTICIPANTS

The participants for this study include all the patients that were referred to cardiac or pulmonary rehabilitation in the Southern Illinois Healthcare system from January 2022 to July 2023. These patients vary in age, sex, insurance plans, diagnoses, and were accumulated to this list solely on their referral from a physician to seek exercise intervention.

INSTRUMENTS

From the physician referral, each patient was contacted about their eligibility into the program based on their diagnosis. The qualifying diagnoses can be seen in Tables #1-2. The patients that qualified for the programs then have the option to accept or decline 36 sessions of rehabilitation after the benefits and structure are discussed. Using existing data, the acceptance rate, ages, and diagnoses were determined.

PROCEDURES

To determine the rate of compliance with each rehabilitation program, we referred to existing data provided by Saint Joseph Hospitals Cardiac and Pulmonary Rehabilitation department on physician referrals to find the descriptive characteristics of the subjects and the decision of compliance.

ANALYSIS

Descriptive statistics were determined for the number of referrals, acceptances, declines, diagnoses, and dates of birth. Percentages of each were calculated through excel formulas to determine the prevalence of each in the region.

CHAPTER 3

RESULTS

From the existing data provided, 829 referrals were submitted by physicians for cardiac and pulmonary rehabilitation from January of 2022 to July of 2023. Of the 829 referrals, 639 were for cardiac diagnoses listed in Table 1. The other 190 referrals were for pulmonary diagnoses listed in Table 2 and Table 3.

Of the 639 patients that were referred to cardiac rehabilitation, 355 patients accepted their referral to take part in 36 sessions of rehabilitation or 55.55%. The remaining 284 patients declined the right to participate or 44.44%. The average age of a patient that was referred to cardiac rehabilitation that accepted the referral was 69.12 years while the average age of a declined referral was 68.63 years.

Of the 190 patients that were referred to pulmonary rehabilitation, 133 patients accepted their referral to participate in 36 sessions of rehabilitation or 70%. The remaining 57 patients declined the right to participate or 30%. The average age of a patient that was referred to pulmonary rehabilitation that accepted the referral was 68.9 while the average age of a declined referral was 67.46.

With the use of existing data, it is assumed that gender and demographic characteristics did not play a role in deciding the acceptance of a referral.

CHAPTER 4

DISCUSSION

When compared to the data reported on referral compliance pre-COVID, the participation from individuals in southern Illinois post-COVID is higher. The percentage of patients following through on referrals for cardiac rehabilitation is slightly above the average range from before the pandemic. The percentage of patients that complied with the referral to pulmonary rehabilitation is 22.22% greater than the average before the COVID-19 pandemic.

The COVID-19 pandemic had drastic effects on every person in the world but especially those in a high-risk population such as those with diagnoses that qualify for cardiac and pulmonary rehabilitation. The average age of those involved in this study are also considered to be at greater risk to succumb to complications from COVID-19. This could be an explanation for more individuals taking advantage of rehabilitation programs post-COVID. In a 2020 study about ageism during the pandemic, it was concluded that COVID-related health worries increased anxiety symptoms in a population of individuals averaging 69.75 years of age (Bergman, et. All, 2020). The event that unfolded over the course of the pandemic forced populations to focus on their health, improve their quality of life, and decrease their mortality and morbidity.

Another conclusion for these results is that because of the lower populations in southern Illinois, the demand for primary care and specialized physicians is also lower. This can allow physicians to take more time to properly care for and research ways to help their patients more effectively. In 2018, a study concluded that the highest reported reasons that doctors do not refer to pulmonary rehabilitation programs was because of low knowledge of the benefits, referral procedures, and patient criteria, or they forgot to complete the referral (Milner, et. All, 2018).

A limitation of this study that should be mentioned includes the lack of specific demographics for the patients that are referred. Factors that could influence the decision-making process for referral compliance such as comorbidities, socioeconomic status, sex, and traveling ability were not excluded in the existing data.

CHAPTER 5

CONCLUSION

Cardiac and pulmonary rehabilitation programs have long been studied for their benefits in improving the exercise capacity and quality of life of those that participate. To reap these benefits, patients must first be referred by a physician and meet qualifying diagnoses. The rate of compliance with these programs from before the COVID-19 pandemic are on average lower than those in rural southern Illinois post-COVID-19. Thus, southern Illinois is taking greater advantage of the benefits of rehabilitation after the pandemic than reported averages before the pandemic. These results show that the pandemic caused greater demand for cardiac and pulmonary rehabilitation programs. The mechanisms of this demand can be explained through an increase in health awareness in the population and increased physician care, but further investigation is required.

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APPENDIX A

Table 1 – Cardiac Rehabilitation Qualifying Diagnoses

	A	B	C	D
1	Source FY2015 ICD-9-CM diagnosis	Source Code/Title ICD-9	Target FY2015 ICD-10-CM diagnosis	Target Code/Title ICD-10
2	410.01	Acute myocardial infarction of anterolateral wall, initial episode of care	I21.09	ST elevation (STEMI) myocardial infarction involving other coronary artery of anterior wall
3	410.01	Acute myocardial infarction of anterolateral wall, initial episode of care	I22.0	Subsequent ST elevation (STEMI) myocardial infarction of anterior wall
4	410.11	Acute myocardial infarction of other anterior wall, initial episode of care	I21.01	ST elevation (STEMI) myocardial infarction involving left main coronary artery
5	410.11	Acute myocardial infarction of other anterior wall, initial episode of care	I21.02	ST elevation (STEMI) myocardial infarction involving left anterior descending coronary artery
6	410.11	Acute myocardial infarction of other anterior wall, initial episode of care	I21.09	ST elevation (STEMI) myocardial infarction involving other coronary artery of anterior wall
7	410.11	Acute myocardial infarction of other anterior wall, initial episode of care	I22.0	Subsequent ST elevation (STEMI) myocardial infarction of anterior wall
8	410.21	Acute myocardial infarction of inferolateral wall, initial episode of care	I21.19	ST elevation (STEMI) myocardial infarction involving other coronary artery of inferior wall
9	410.21	Acute myocardial infarction of inferolateral wall, initial episode of care	I22.1	Subsequent ST elevation (STEMI) myocardial infarction of inferior wall
10	410.31	Acute myocardial infarction of inferoposterior wall, initial episode of care	I21.11	ST elevation (STEMI) myocardial infarction involving right coronary artery
11	410.31	Acute myocardial infarction of inferoposterior wall, initial episode of care	I22.1	Subsequent ST elevation (STEMI) myocardial infarction of inferior wall
12	410.41	Acute myocardial infarction of other inferior wall, initial episode of care	I21.19	ST elevation (STEMI) myocardial infarction involving other coronary artery of inferior wall
13	410.41	Acute myocardial infarction of other inferior wall, initial episode of care	I22.1	Subsequent ST elevation (STEMI) myocardial infarction of inferior wall
14	410.51	Acute myocardial infarction of other lateral wall, initial episode of care	I21.29	ST elevation (STEMI) myocardial infarction involving other sites
15	410.51	Acute myocardial infarction of other lateral wall, initial episode of care	I22.8	Subsequent ST elevation (STEMI) myocardial infarction of other sites
16	410.61	True posterior wall infarction, initial episode of care	I21.29	ST elevation (STEMI) myocardial infarction involving other sites
17	410.61	True posterior wall infarction, initial episode of care	I22.8	Subsequent ST elevation (STEMI) myocardial infarction of other sites
18	410.71	Subendocardial infarction, initial episode of care	I21.4	Non-ST elevation (NSTEMI) myocardial infarction
19	410.71	Subendocardial infarction, initial episode of care	I22.2	Subsequent non-ST elevation (NSTEMI) myocardial infarction
20	410.91	Acute myocardial infarction of unspecified site, initial episode of care	I21.3	ST elevation (STEMI) myocardial infarction of unspecified site
21	410.91	Acute myocardial infarction of unspecified site, initial episode of care	I22.9	Subsequent ST elevation (STEMI) myocardial infarction of unspecified site
22	413.9	Other and unspecified angina pectoris	I20.8	Other forms of angina pectoris
23	413.9	Other and unspecified angina pectoris	I20.9	Angina pectoris, unspecified
24	413.9	Other and unspecified angina pectoris	I25.111	Atherosclerotic heart disease of native coronary artery with angina pectoris with documented spasm
25	413.9	Other and unspecified angina pectoris	I25.118	Atherosclerotic heart disease of native coronary artery with other forms of angina pectoris
26	413.9	Other and unspecified angina pectoris	I25.119	Atherosclerotic heart disease of native coronary artery with unspecified angina pectoris
27	413.9	Other and unspecified angina pectoris	I25.701	Atherosclerosis of coronary artery bypass graft(s), unspecified, with angina pectoris with documented spasm
28	413.9	Other and unspecified angina pectoris	I25.708	Atherosclerosis of coronary artery bypass graft(s), unspecified, with other forms of angina pectoris
29	413.9	Other and unspecified angina pectoris	I25.709	Atherosclerosis of coronary artery bypass graft(s), unspecified, with unspecified angina pectoris
30	413.9	Other and unspecified angina pectoris	I25.711	Atherosclerosis of autologous vein coronary artery bypass graft(s) with angina pectoris with documented spasm
31	413.9	Other and unspecified angina pectoris	I25.718	Atherosclerosis of autologous vein coronary artery bypass graft(s) with other forms of angina pectoris
32	413.9	Other and unspecified angina pectoris	I25.719	Atherosclerosis of autologous vein coronary artery bypass graft(s) with unspecified angina pectoris
33	413.9	Other and unspecified angina pectoris	I25.721	Atherosclerosis of autologous artery coronary artery bypass graft(s) with angina pectoris with documented spasm
34	413.9	Other and unspecified angina pectoris	I25.728	Atherosclerosis of autologous artery coronary artery bypass graft(s) with other forms of angina pectoris
35	413.9	Other and unspecified angina pectoris	I25.729	Atherosclerosis of autologous artery coronary artery bypass graft(s) with unspecified angina pectoris
36	413.9	Other and unspecified angina pectoris	I25.731	Atherosclerosis of nonautologous biological coronary artery bypass graft(s) with angina pectoris with documented spasm
37	413.9	Other and unspecified angina pectoris	I25.738	Atherosclerosis of nonautologous biological coronary artery bypass graft(s) with other forms of angina pectoris
38	413.9	Other and unspecified angina pectoris	I25.739	Atherosclerosis of nonautologous biological coronary artery bypass graft(s) with unspecified angina pectoris
39	413.9	Other and unspecified angina pectoris	I25.751	Atherosclerosis of native coronary artery of transplanted heart with angina pectoris with documented spasm
40	413.9	Other and unspecified angina pectoris	I25.758	Atherosclerosis of native coronary artery of transplanted heart with other forms of angina pectoris
41	413.9	Other and unspecified angina pectoris	I25.759	Atherosclerosis of native coronary artery of transplanted heart with unspecified angina pectoris
42	413.9	Other and unspecified angina pectoris	I25.761	Atherosclerosis of bypass graft of coronary artery of transplanted heart with angina pectoris with documented spasm
43	413.9	Other and unspecified angina pectoris	I25.768	Atherosclerosis of bypass graft of coronary artery of transplanted heart with other forms of angina pectoris
44	413.9	Other and unspecified angina pectoris	I25.769	Atherosclerosis of bypass graft of coronary artery of transplanted heart with unspecified angina pectoris
45	413.9	Other and unspecified angina pectoris	I25.791	Atherosclerosis of other coronary artery bypass graft(s) with angina pectoris with documented spasm
46	413.9	Other and unspecified angina pectoris	I25.798	Atherosclerosis of other coronary artery bypass graft(s) with other forms of angina pectoris
47	413.9	Other and unspecified angina pectoris	I25.799	Atherosclerosis of other coronary artery bypass graft(s) with unspecified angina pectoris
48	428.22	Chronic systolic heart failure	I50.22	Chronic systolic (congestive) heart failure
49	V42.1	Heart replaced by transplant	Z48.21	Encounter for aftercare following heart transplant
50	V42.1	Heart replaced by transplant	Z48.280	Encounter for aftercare following heart-lung transplant
51	V42.1	Heart replaced by transplant	Z94.1	Heart transplant status
52	V42.1	Heart replaced by transplant	Z94.3	Heart and lungs transplant status
53	V43.3	Heart valve replaced by other means	Z95.2	Presence of prosthetic heart valve
54	V45.81	Aortocoronary bypass status	Z95.1	Presence of aortocoronary bypass graft
55	V45.82	Percutaneous transluminal coronary angioplasty status	Z95.5	Presence of coronary angioplasty implant and graft
56	V45.82	Percutaneous transluminal coronary angioplasty status	Z98.61	Coronary angioplasty status

APPENDIX B

Table 2 – Pulmonary Rehabilitation Qualifying Diagnoses

COPD Diagnoses – Pulmonary Rehab Services Procedure/Treatment Codes (HCPCS-G0242)

- ☐ (E84.11) 277.00 -Cystic Fibrosis without mention of meconium ileus
- ☐ (E84.0) 277.02 -Cystic Fibrosis with pulmonary manifestations
- ☐ (J41.0) 491.0 -Simple Chronic Bronchitis
- ☐ (J44.9) 491.20 -Obstructive chronic bronchitis without exacerbation
- ☐ (J44.1) 491.21-Obstructive chronic bronchitis, acute exacerbation
- ☐ (J20.9) 491.22 -Acute bronchitis
- ☐ (J43.9 Emphysema) 492.0 -Emphysematous bleb or 492.8 -Other emphysema
- ☐ (J47.9 Bronchiectasis) 494.0 -Bronchiectasis without acute exacerbation
- ☐ (J47.1) 494.1 -Bronchiectasis with acute exacerbation
- ☐ (J44.9) 496 -Chronic Airway obstruction (COPD)
- ☐ (E88.01 Alpha 1 Antitrypsin Deficiency-use with J44.9 above)

Non-COPD Diagnoses – Use Respiratory Services Procedure/Treatment Codes (HCPCS: G0237, G0238, G0239)

- ☐ (D86.0 Sarcoidosis of Lung) 135 -Sarcoidosis (plus Lung involvement)
- ☐ (J45.909 Unspecified Asthma) 493.82 -Cough variant Asthma or 493.20 -Chronic Obstructive Asthma unspecified
- ☐ (J60) 500 -Coal worker's Pneumoconioses
- ☐ (J61) 501 -Asbestosis
- ☐ (J64) 505 - Pneumoconiosis, unspecified
- ☐ (J68.4) 506.4-Chronic respiratory conditions due to fumes & vapors
- ☐ (J70.1) 508.1-Chronic & other pulmonary manifestations, radiation
- ☐ (J84.10) 515 -Post-inflammatory pulmonary fibrosis
- ☐ (J84.01) 516.0 -Pulmonary alveolar proteinosis
- ☐ (J84.02) 516.2 -Pulmonary alveolar microlithiasis
- ☐ (J84.112) 516.3 -Idiopathic fibrosing alveolitis
- ☐ (J84.9) Interstitial Lung Disease (Diffusion Defect)
- ☐ (C34.90 Lung Cancer)
- ☐ (J96.10 Chronic Respiratory Failure with hypoxia or hypercapnia
- ☐ (Z76.82 Pre Lung Transplant) V49.83 Pre Lung Trasplant
- ☐ (Z94.2 Post Lung Transplant) V42.6 Post Lung Transplant
- ☐ (J98.4 Other Disorders of Lung) 518.89 Other disorders of the lung not elsewhere classified.
- ☐ Note: No ICD10 Code for Restrictive Lung Disease and it is not listed under J98.4 above in the ICD10-CM Book.

APPENDIX C

Table 3 – Qualifying Diagnoses Post-COVID

ICD-10 Codes – Effective 1/1/2022

ICD-10 codes *released* 10/1/2021 and *effective* 1/1/2022:

Code first: the specific condition (or symptom) related to COVID-19 if known, such as:

- **J96.1** – Chronic respiratory failure
- **J12.82** – Pneumonia due to coronavirus disease
- **M35.81** – Multisystem inflammatory syndrome
- **J80** – Acute respiratory distress syndrome
- **B33.24** – Viral cardiomyopathy (?)
- **R06.02** – Shortness of breath (?)

Code second:

- **U09.9** – Post COVID-19 condition

VITA

Graduate School
Southern Illinois University

Sarah E. Vogt

Vogt.sarah880@gmail.com

Southern Illinois University Carbondale
Bachelor of Science, Exercise Science, December 17, 2022

Special Honors and Awards:
Magna Cum Laude, December 17, 2022

Research Paper Title:
An Investigation into Cardiac and Pulmonary Rehabilitation Compliance in Southern Illinois Post Covid-19 Pandemic

Major Professor: Dr. Juliane P. Wallace