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Rana Abed Alhelali Date

Evaluation of Home Respiratory Therapy Delivered to Patients in the Ministry of Health's Home Medical Program (HMP) and Administered through the Madinah HMP Center, Kingdom of Saudi Arabia, 2013

by

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MPH

Hubert Department of Global Health

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Scott JN McNabb, PhD, MS
Committee Chair

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An abstract of
A thesis submitted to the Faculty of the
Rollins School of Public Health of Emory University
in partial fulfillment of the requirements for the degree of
Master of Public Health
in Hubert Department of Global Health
2014

Abstract

Objective:

To evaluate home respiratory therapy (HRT) administered through the Madinah Home Medical Program (MHMP) Center in the Ministry of Health's (MoH) Home Medical Program (HMP), Kingdom of Saudi Arabia (KSA)

Methods:

Using a retrospective design and descriptive analyses, we evaluated HRT delivered through the MHMP Center. We analyzed the characteristics of patients enrolled (N = 83), including clinical care received and outcomes. From an economic perspective, we also assessed a 30-patient subset for cost.

Results:

Population: Among the 83 patient-records evaluated, 72% were > 60 years of age. Most were female (80%) and of Saudi nationality (90%), and 56% percent were not married.

Clinical diagnosis: Asthma accounted for 34% of diagnosed respiratory disease; other diagnoses included chronic obstructive pulmonary disease (COPD) (11%), respiratory failure (10%), and lung fibrosis (8%).

HMP: Eighty-three of 574 (14%) MHMP Center patients received HRT. Among them, 59 of 83 (71%) required two or three respiratory modalities, and seven of 83 (8%) required four. Most HRT patients (78 of 83, 94%) used respiratory treatment modalities like oxygen therapy; while only 12 of 83 (14%) were on mechanical ventilation.

Outcomes: Patients (or their caregivers) had a high level of satisfaction regarding HRT services provided through the MHMP Center (37 of 41,90%). Almost half (36 of 83, 43%) of patients enrolled receiving HRT through the MHMP Center saw an improvement in their condition; 48% remained clinically static (i.e., neither improvement nor deterioration), and 8% (7 of 83) deteriorated or died. Costs savings were achieved in delivery of HRT through the MHMP Center as measured by reduced emergency room and outpatient department visits after HRT enrollment compared to before HRT enrollment.

Conclusion:

HRT administered through the MHMP Center improved clinical outcomes and increased patient satisfaction while reducing hospital utilization and associated costs. While this evaluation was just descriptive, prospective studies (i.e., a randomized trial, cost-effective study) seem well-justified to carefully assess MHMP services in comparison to hospitalization.

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Acknowledgements

Before and above all, I want to thank the Almighty Allah, the Most Merciful and the Most Gracious for giving me the strength to complete this piece of work.

I would like to express my thanks, gratitude, and appreciation to my thesis advisor, Prof. Scott McNabb, for his guidance and valuable advice throughout this study and for his help and love as our advisor during my two years in the King Abdullah Fellowship Program.

I would like to thank Natalie Schulhofer for her guidance as my ESL instructor on this thesis and for her valuable advice through the whole two years.

Also, I would like to express my thanks to King Abdullah Fellowship Program staff who supported us from the start, from before we arrived to Atlanta up to our final moments here.

I would like to thank Prabhjyot Singh for his support on the technical aspects of this study.

Special thanks to Dr. Aisha Alsagheer, Dr. Nevien Awad, Dr. Salem Aldahi and Mr. Ahmed Maseheli for their support and guidance when I started working on and formulating this thesis.

I wish to thank the whole Home Medical Program staff, those who were involved directly or indirectly, for helping me carry out this study. Their support and cooperation were integral to the completion of this research.

Lastly, I would like to dedicate this work to my family. To my parents for their continuous love and support over my entire life; to my brothers for their belief in me and continuous encouragement, for leaving everything and coming here just to support me in my new life; to my sisters for always being next to me; and to my nieces and nephews for keeping me laughing and smiling all the time.

Abbreviations

MoH…….. Ministry of Health

HHC…… Home Health Care

HMP…….. Home Medical Program

MHMP……Madinah Home Medical Program

ER ……Emergency Room

OPD ……Outpatient Department

ICD-10……10^{th} International Classification of Diseases

GCS……Glasgow Coma Scale

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Chapter One

Introduction

As improvement of healthcare services advances, costs continue to increase globally. In the United States, healthcare costs in 2009 were more than triple those of 1999, and the rate of health expenditures continues to increase as the economy grows (1). This increase in healthcare costs is an especially serious challenge for countries like the Kingdom of Saudi Arabia (KSA), where there has been an epidemiologic transition of health burdens toward non-communicable diseases, whose treatment is more costly. The KSA government's spending on the Ministry of Health (MoH) increased from 2.8% in 1970 to 6.2% in 2009 (MoH, 2011), and the per capita government expenditure on health (PPP int. $) rose from $375 to $430 in just one year, from 2011 to 2012 (2). These higher costs are associated with spending on advanced technologies and pharmaceuticals, higher salaries for health professionals, and more training to strengthen staff capacity and meet the demand of the population's growth (3).

There has been great improvement in healthcare for the KSA population; by 2000, it was ranked 26th in health system performance out of 190 countries according to the WHO (4). Primary, secondary, and tertiary healthcare is free for all citizens. Care is provided through well-established primary health centers, secondary hospitals and tertiary specialist centers (5). Private sector health care is an option patients can now also choose. The MoH regulates both sectors, governmental and private, by developing and implementing legislation (6).

Despite continuous improvement in the KSA MoH health system**,** many factors could interfere with its progress: shortage of professional staff, increase in the prevalence of chronic diseases (which are more costly to treat); the burden of financing and cost on the MoH (the major governmental provider of healthcare services); and the excessive demand of patients for the free services (7). The private sector funds only 22% of healthcare services, a "very low" rate, much lower than in some developed countries (like the United States) and developing countries (e.g., India) (3). This has led to strained resources in the MoH resulting in bed shortages and long waiting lists (7). According to the MoH's 2012 Health Statistics Year Book, the total number of inpatients of MoH hospitals has been increasing, and the lengths of stay increased by 34% in psychiatric and fever and chest hospitals between 2008 and 2012 (2). Each hospital stay for a

patient can lead to an increase in the cost at the hospital, even with no intervention apart from the standard hospital attendance and medical observation.

Several attempts have been made to address the increasing costs and the problem of high bed occupancy while providing better quality services and more effective utilization of resources. These programs include the one-day operation program, more participation from the private sector in funding healthcare services, and the establishment of home healthcare (HHC) facilities.

One of the most cost-effective ways to lower the hospital occupancy rate is by providing HHC services, like having a hospital at home (8). HHC is a comprehensive, regulated program operated by a multidisciplinary team of health care professionals in the patient's home (9). It involves a range of medical activities and services (i.e., curative, preventive, educational, rehabilitative, and social) provided for certain patients in their homes according to specific criteria set by a qualified medical team for that purpose (10). Taking care of patients at home is regarded as one of the best alternatives to inpatient care and the best approach to reducing the burden on hospitals while maintaining similar or better outcomes without additional resources. Besides that, it reduces the risk of one of the biggest health threats to patients and something that they fear, hospital-acquired infections (11). Infections not only affect patients' health but also increase the cost to hospitals trying to control them.

HHC in KSA

Increasing health costs and limited bed capacity led to establishment of HHC services through the MoH in KSA. The first phase occurred in Madinah city in 2005. Called the Home Medical Program (HMP), it was started as a small project by an enthusiastic group working in the MoH, with two mobile teams accepting patients referred from the all the hospitals in Madinah city. In 2007, Princess Adela Bint Abdullah Bin Abdulaziz, president of the National Home Health Care Foundation in the Western Region, officially launched the HMP Center as the first home health care center operating under the umbrella of the MoH. At the same time, an agreement was signed between that foundation and the MoH in Madinah to establish this Center and support patients of low socioeconomic status socially and medically. In March 2009, after the achievement and success of the home care experience provided by this center, the

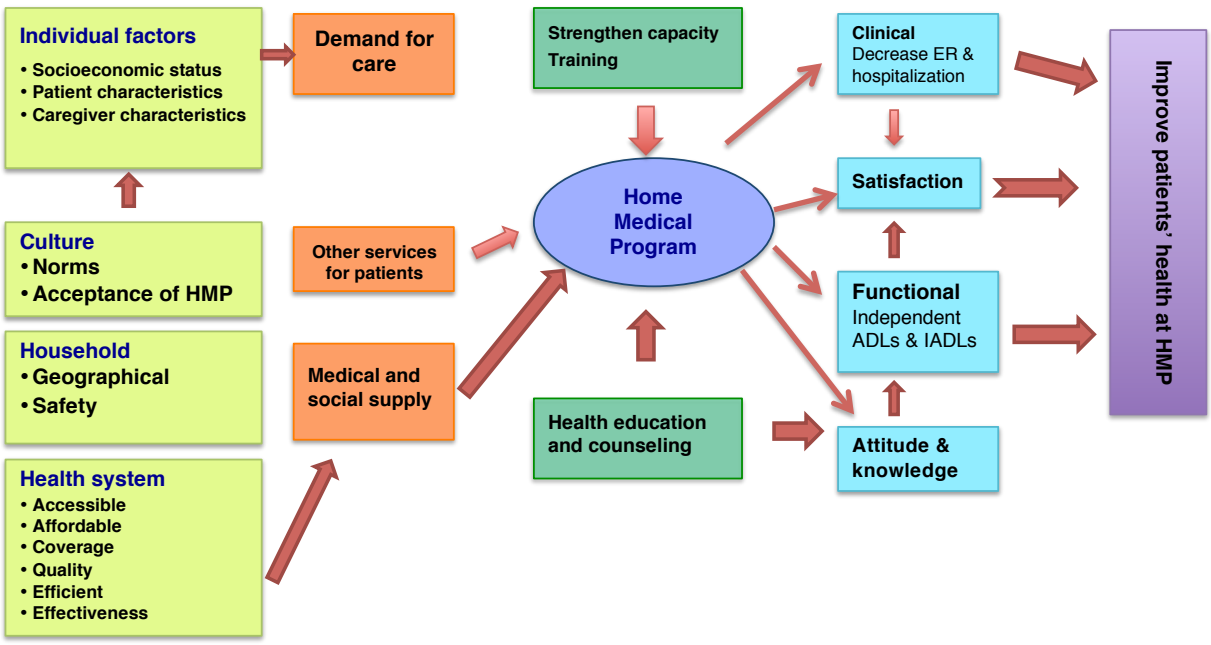
Minister of Health, Dr. Abdullah Bin Abdul Aziz Al-Rabia, launched a General Administration of HMP in MoH which would operate all over the Kingdom (12) .

Currently, the MoH operates home medical programs in each region of the Kingdom; the Madinah center, which is the focus of this study, was the original center and remains a unique home health center. Madinah is an Islamic holy city; because of this and because the center there has a well-developed program with a highly professional staff, the policies and practices implemented through this center are also adopted in other HMPs throughout the entire Kingdom.

Conceptual framework of the HMP

The conceptual framework shows how many factors interact and affect HMP care; these include individual and cultural factors, the conditions of houses where the patients live, and the accessibility and quality of the health system. Improvement of patient health through HMP care depends on strengthening the capacity, educating patients and caregivers, and having the required medical supplies and social supports (Figure 1).

Figure 1. Conceptual Framework of the Home Medical Program in Madinah, Kingdom of Saudi Arabia, 2013



Eligibility for the Program

HMP patients are generally referred 72 hours before being discharged from a hospital. The criteria for referral are that they are stable adult patients with chronic disabilities requiring skilled long-term management and that they live within 50 km of the hospital**.** A hospital's senior physician completes the referral form and notifies the HMP department. After approval by the HMP team, a care plan and strategies are developed on the day of the patient's enrollment and updated every three months. The orders and recommendations of the senior physician are carried out by an HMP team for continuity of care at home (10).

Care can be categorized into four types: acute, chronic, palliative, and transitional. The services utilized through the HMP include but are not limited to post-op patient care, bedsore and wound care, post intensive care services, palliative care for terminally-ill cancer patients, nutritional services, support and education of patients and family caregivers to preserve the health of patient, and the provision of medical equipment as necessary (10).

Is the HMP an effective approach?

There is evidence that HHC services relieve bed over-occupancy and offer a reasonable alternative to hospitals stays (8), but 6 years after the establishment of the HMP Center in KSA, it remains unclear if the program is achieving its aims of reducing hospital admissions, lowering bed occupancy rates, and promoting a patient-centered treatment by maintaining the same or better level of care with more satisfaction and better health outcomes.

The cost of a hospital stay in the main ward is about $400 per day, and in the ICU it is $800 per day. The MoH can save at each hospital if more patients are discharged and treated in HHC. Some of the most costly cases are those with respiratory illness or those who need respiratory therapy. These patients will have frequent hospital stays and emergency room visits, will need more specialized care, and could need respiratory equipment such as invasive or non-invasive mechanical ventilators. In addition, most of these patients need extensive follow-up care by a specially trained team.

The respiratory diseases that often result in hospital admissions and stays of long duration are asthma, chronic obstructive pulmonary disease (COPD), sleep apnea, respiratory failure or any cases requiring respiratory therapy such as a congenital, cardiac or central

nervous system problems or a trauma that compromises respiratory function. Patients with respiratory diseases like COPD are usually required to be admitted to the hospital several times due to the acute exacerbations of the condition and may stay for up to nine days per admission. As a result, hospital costs increase even with no intervention apart from the hospital stay and medical observation (8).

Moreover, respiratory inpatients are at increased risk of acquiring hospital infections, which affect patient health and necessitate hospital spending for infection control. Besides the tangible costs (i.e., bed, cleaning, food), there are non-tangible costs such as patients' comfort and satisfaction and the effect that patients' separation from their loved ones has on the family unit. From the patients' side, there is the importance of restoring the home routine and the issue of transportation costs.

Analyzing effectiveness in health from economic prospective

These elements are used to analyze cost-effectiveness in health: health interventions with the most benefits measured by outcome, competing alternative, and health state (e.g., shortness of breath) or health status (which include all health states)(13). The elements we used in determining cost among HMP patients with respiratory illness or needing respiratory therapy are health intervention (the HMP); the alternative intervention, (hospital care); health state (e.g., difficulties in breathing); and health status (e.g., improvement in the overall health with improvement in the quality of life). We estimated the total costs of both interventions. This will be the economic analysis as part of economic evaluation.

For assessment the achievement of HMP's goals in patients needing respiratory therapy through Madinah HMP (MHMP) Center, we have to evaluate the performance and impact measures for HRT administered through the center. In his study we will use impact evaluation to assess the outcome measures.

Aim

Evaluate respiratory services given through HHC versus hospital care.

Objectives

- Describe the demographic characteristics, diagnoses, and services utilized by patients enrolled for home respiratory therapy (HRT) through the HMP Center of the MoH, Madinah, KSA;
- Assess the outcome measures for MHMP Center; and
- Compare the patient costs and benefits of the HMP and hospital care for respiratory services.

Research question

Is HRT delivered to patients through the MoH's HMP, specifically the MHMP Center, effective?

Significance

The various benefits of incorporating HHC in the health system are known worldwide. The services provided through HHC programs are different from country to country, but most programs are community-based, staffed mainly by professional nurses, and regulated by Medicare guidelines, which reflect the standard of care for all home health agency interactions, even if the patient does not have Medicare insurance (9). KSA's HMP, launched by the Ministry of Health (MoH) in 2009, is government-run, and healthcare services are provided by a multidisciplinary team of professionals working in the patient's home.

Internationally, respiratory therapy is considered one of the most important HHC services, thought to be more cost-effective than hospital care. Despite the importance of this subject and the need to study it, there are no previous studies that estimate and analyzed the costs of respiratory therapy or any other HMP service in KSA.

Chapter Two
Literature Review

The studies on HHC are many and varied. In the last three decades, research has assessed its benefits and whether it has resulted in cost savings. HHC studies vary in the strength of their methodologies, which services are examined, which population is served, and how the impact is assessed (14).

Importance of HHC

The need for HHC programs can be summarized by several points that explain its importance in the health system, as shown in the literature. The population is aging, and there are more people living longer; alongside this, the prevalence of chronic diseases is higher, and hospital costs have increased. Research reveals that HHC has a role in improving the clinical outcomes of patients, that it is cost-effective, and that it is an excellent solution for the bed occupancy issue, freeing hospital beds for acute cases while ensuring quality care for stable patients with chronic health issues (9).

Health System Outcomes

Candidates for HMP services are those inpatients who still need medical care for their condition. A critical period – especially for elderly – is the transitional time when patients are discharged from the hospital to their homes; during this time, they need to be observed regularly to make sure they are in their health care plan. A study was conducted over 12 months by the Amedisys Initiative, a home health and hospice organization, to assess the impact of transitional home health care on patients' quality of life and avoidable re-hospitalizations. The study found that the transitional care played a critical role in the home health industry due to its reduction of hospital readmissions, improved patient outcomes, and cutting of costs (15).

Success stories can also be found under conditions of emergency. In Libya, during the liberation war, three patients on mechanical ventilation were discharged early from the hospital due to the war. They managed well at home for eight months; the family was given caregiver training and had an electric generator at home. This experience proves how possible it is to administer ventilation at home, especially if there is good training of the caregivers and

the existence of a spare electric generator at home (16).

Clinical Outcomes

A randomized trial was conducted in 16 Veterans Affairs (VA) medical centers between 1994 and 1998 to assess the outcome of Team-Managed Home-Based Primary Care (TM/HBPC) among elderly patients (70 years of age) who were homebound with a terminal illness, CHF, or COPD. The outcome measures were patients' functional status, hospitalizations, quality of life, satisfaction, and cost of the care. This study revealed that patients receiving TM/HBPC, especially those who were terminal ill, had a better quality of life—and so did their caregivers. In addition, there were improvements in the satisfaction surveys and a decreased burden on the caregivers with the decline in hospitalizations. TM/HBPC was costly, but it was worth it for the benefits gained (17).

This finding was supported by a systematic review conducted by Health Quality Ontario in 2012. The evidence-based analysis looked at "in-home care for optimizing chronic disease management in the community." The researchers performed an extensive review of the best available evidence comparing the effectiveness of care among patients enrolled in home care and those with no care or under conventional medical care. Patient health conditions included heart failure, atrial fibrillation, coronary heart diseases, cerebrovascular diseases, COPD, diabetes, chronic wounds, and chronic disease / co-morbidity. In both groups, the researchers examined mortality rate, hospitalization, quality of life, functional status, and specific clinical outcome measures. Researchers concluded that there were reductions in all causes of mortality and hospitalization among those under home care. In addition to that, patients had better measures regarding quality of life and daily living activities, especially if they were treated by professional staff who modified their tasks according to the patients needs (18).

In the U.K. in 2012, researchers conducted a systematic review to assess the clinical effectiveness and cost-effectiveness of a home-based, nurse-led health promotion intervention for older patients. Researchers showed that there were better clinical outcomes associated with home-based, nurse-led health promotion, but that results were unclear for the elderly because of the complexity of the intervention (19).

Respiratory disease outcomes

HRC is a necessary alternative solution for those in need of mechanical ventilation for patients such as those with idiopathic inflammatory myopathies who present with respiratory failure, especially if they do not respond to immunosuppressive therapy. In 2000, researchers in one study revealed that there were promising results in improving chronic hypoventilation and quality of life when home mechanical ventilation with nasal or tracheal intermittent positive pressure was administered, especially at night. This was lifesaving approach for most cases that present with respiratory failure (20).

The use of home mechanical ventilation is growing and has rapidly expanded, especially in European countries, for patients of a variety of ages and different types of medical conditions. Home mechanical ventilation started in 1990s with noninvasive ventilation (NIV), especially among those with respiratory failure in neuromuscular illness; it helped to prolong and improve the quality of life. Moreover, home ventilation worked better for children with congenital neuromuscular disease than being hospitalized for long period, according to European practice. Despite of the success of home ventilation modalities still it was unclear whether long-term oxygen therapy (LTOT) or NIV with LTOT was the best treatment for COPD cases. (21).

Many studies have addressed the importance of home integration in management of bronchial asthma for all ages. Home integration has been determined to be more effective for children. These programs included home visits for environmental assessment and providing the patients with required health education, in addition to monitoring the patients' peak flow rate. This conclusion was supported by an observational study conducted in 2005; researchers assessed 18 asthmatic children before and after participation in an in-home asthma disease management program for one year to evaluate the clinical outcomes and the cost. They found that there were significant improvements to patient health, with a decrease in hospitalizations (both ICU and non-ICU), duration of hospitalization, and ER or OPD visits. This resulted in reduced costs and a lower number of school absences (22).

A 2011 Cochrane review found that educating children about asthma is a vital element in its management, but there was variable evidence for home-based asthma education when compared to standard care (23).

Satisfaction Outcomes

Client satisfaction is considered an important measure in assessing quality of life (24). Different satisfaction surveys vary in validity and reliability. The level of satisfaction depends on how much the services meet the clients' expectations and understanding of home care. There were inconsistencies in the patients' responses; some studies did not establish that home care patients were well-satisfied, and other studies revealed a high level of patient satisfaction for overall care or certain elements of it.

One Canadian study consisting of face-to-face surveys examined the patients' perception of satisfaction with home care services. Researchers found that there was a high level of satisfaction regarding the personal character of home care and lower satisfaction levels due to inappropriate visiting timing and lack of availability of services elements (25).

According to two national surveys, one conducted in Madinah (26) and the other one in Tabuk (27), overall levels of patient satisfaction were high. The one conducted at the HMP Center in Madinah in 2008 assessed client satisfaction towards HMP services using a validated questionnaire. That study revealed a high level of satisfaction for overall care and less satisfaction towards the timing of visits (26). The other one was conducted in the home health care program run through a military hospital in Tabuk, among patients needing respiratory services. In this study, satisfaction was 90% out of total 112 patients (27).

Economic Benefits

Regarding the economic outcomes, there were many studies that discussed the cost savings and cost-effectiveness for both the providers and patients, but the evidence for this is controversial. HHC services have direct and indirect effects on the reduction of health system costs. This was shown in a Canadian study conducted in 1995 in Brunswick's Extra-Mural Hospital (EMH). Researchers found that the reduction in health system costs was due to a decrease in physician services brought about by home care services (28).

In 1999, there was a review study that examined the evidence collected on the effects of substituting home care for inpatient acute care. As result of this review, there were no significance difference in the health outcomes and the social and cost effects were changing according to the clinical conditions(29). In contrast, there was a promising study conducted in Canada by Marcus Hollander in 2000. He compared the costs incurred by patients who received treatment at home to those incurred in nursing facilities. This study found that home care cost significantly less, saving an average of 25% to 60% (30).

Patients with respiratory diseases such as COPD are usually required to be admitted to the hospital several times due to the acute exacerbations of the condition and may stay for up to 9 days per admission. As a result, hospital costs increase even with no intervention apart from the hospital stay and medical observation (8).

However, the cost-effectiveness of home care over hospital care has not been conclusively established. A multicenter randomized controlled assessment was conducted between 2007 and 2011 in the Netherlands to compare early discharged COPD patients who received nursing follow up with similar patients who continued under hospital care. Researchers found that those under hospital care had more improvement in their clinical assessment, but the finding was not statistically significantly ($P > 0.2$), and the cost savings were higher for the group discharged early (31).

Home-based services were documented to be cost-effective for many medical conditions besides respiratory diseases. Children with special needs (32) and patients needing percutaneous endoscopic gastrostomy (PEG) have also been shown to benefit from home healthcare (33).

Chapter 3
Manuscript

Abstract

Objective:

To evaluate home respiratory therapy (HRT) administered through the Madinah Home Medical Program (MHMP) Center in the Ministry of Health's (MoH) Home Medical Program (HMP), Kingdom of Saudi Arabia (KSA)

Methods:

Using a retrospective design and descriptive analyses, we evaluated HRT delivered through the MHMP Center. We analyzed the characteristics of patients enrolled (N = 83), including clinical care received and outcomes. From an economic perspective, we also assessed a 30-patient subset for cost.

Results:

Population: Among the 83 patient-records evaluated, 72% were > 60 years of age. Most were female (80%) and of Saudi nationality (90%), and 56% percent were not married.

Clinical diagnosis: Asthma accounted for 34% of diagnosed respiratory disease; other diagnoses included chronic obstructive pulmonary disease (COPD) (11%), respiratory failure (10%), and lung fibrosis (8%).

HMP: Eighty-three of 574 (14%) MHMP Center patients received HRT. Among them, 59 of 83 (71%) required two or three respiratory modalities, and seven of 83 (8%) required four. Most HRT patients (78 of 83, 94%) used respiratory treatment modalities like oxygen therapy; while only 12 of 83 (14%) were on mechanical ventilation.

Outcomes: Patients (or their caregivers) had a high level of satisfaction regarding HRT services provided through the MHMP Center (37 of 41,90%). Almost half (36 of 83, 43%) of patients enrolled receiving HRT through the MHMP Center saw an improvement in their condition; 48% remained clinically static (i.e., neither improvement nor deterioration), and 8% (7 of 83) deteriorated or died. Costs savings were achieved in delivery of HRT through the MHMP Center as measured by reduced emergency room and outpatient department visits after HRT enrollment compared to before HRT enrollment.

Conclusion:

HRT administered through the MHMP Center improved clinical outcomes and increased patient satisfaction while reducing hospital utilization and associated costs. While this evaluation was just descriptive, prospective studies (i.e., a randomized trial, cost-effective study) seem well-justified to carefully assess MHMP services in comparison to hospitalization.

Introduction

The Ministry of Health (MoH) of the Kingdom of Saudi Arabia (KSA) has made several attempts to address the increasing costs and the problem of high bed occupancy while providing better quality services and more effective utilization of resources. These programs include the one-day operation program, more participation from the private sector in funding healthcare services, and the establishment of home healthcare (HHC) facilities.

One of the most cost-effective ways to lower the hospital occupancy rate is by providing HHC services, which is like having a hospital at home (8). HHC is a comprehensive, regulated program operated by a multidisciplinary team of health care professionals in the patient's home (9).

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In March 2009, the Minister of Health, Dr. Abdullah Bin Abdul Aziz Al-Rabia, launched a General Administration of Home Medical Program in MoH which would operate all over the Kingdom (12). KSA's Home Medical Program (HMP) is government-run, and health care services are provided by a multidisciplinary team of professionals working in a patient's home.

Currently, the MoH operates the HMP in each region of the Kingdom; the Madinah HMP Center, which is the focus of this study, was the kingdom's original HHC center and remains unique, handling the majority of home health patients in Madinah.

There is evidence that HHC services relieve bed over-occupancy and offer a reasonable alternative to hospitals stays (8), but 6 years after the establishment of the HMP Center in KSA, it remains unclear if the program is achieving its aims of reducing hospital admissions, lowering bed occupancy rates, and promoting a patient-centered treatment by maintaining the same or better level of care with more satisfaction and better health outcomes.

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services, thought to be more cost-effective than hospital care. Despite the importance of this subject and the need to study it, there are no previous studies that estimate the costs of respiratory therapy or any other HMP service in KSA.

To assess the achievement of the HMP's goals for patients needing respiratory therapy through Madinah HMP (MHMP) Center, we have to evaluate the performance and impact measures for HRT in the center. In his study, we will use impact evaluation to assess the outcome measures.

As part of the evaluation, we will perform an economic evaluation. The elements we will use in determining whether the HMP is the most cost-effective approach among patients with respiratory illness or needing respiratory therapy are:

(1) The health intervention, identified here as the HMP;
(2) The alternative intervention, identified as hospital care;
(3) The patient's health state, which includes conditions such as difficulty with breathing;
(4) The patient's health status, which includes improvements in overall health and in quality of life.

The costs of both interventions will be compared to determine which intervention is more cost-effective.

Methods

Using a retrospective design and descriptive analyses, we evaluated HRT delivered through the MHMP Center. First, this study describes the characteristics of patients who were enrolled through the MHMP Center HRT, and second, it describes the clinical care they received through the HMP and the outcomes. Finally, we present a cost assessment of a 30-patient subset for the economic evaluation.

Study area

The study was conducted in Al Madinah Al Munawarh, which is the second holiest Islamic city. It is situated in the Hejaz region in western KSA, with a population of 870,000 (2003 estimate). As mentioned earlier, Madinah is home to the kingdom's first HMP Center, one which remains unique. At the time of this study, the MHMP Center served around 500 patients referred from different hospitals and other health facilities inside the city. Madinah is a model for the home care program in KSA, and the HMP Center is the KSA's main training center; whatever is implemented at this center is disseminated throughout the KSA.

Study population

In our study, we included any patients with respiratory diseases or needing respiratory therapy enrolled through the HMP Center in Madinah, KSA, in July 2013.

At this time, there were a total of 574 patients actively enrolled in the MHMP Center, according to data taken from Directorate of Health Affairs in Madinah.

Sample size

A total of 83 patients with respiratory diseases or needing respiratory therapy were enrolled in MHMP Center. These were all included in this study. This study has two parts. The first part assesses 83 patients in regard to the their characteristics, the clinical care they received through HMP Center, and the outcome measures. The second part examines 30 of these patients as a pilot study of the a cost evaluation of HRT and medical services utilization prior to

and subsequent enrollment in the HMP program, whose clinical and medical care data prior to HMP enrollment was available.

Sampling technique

For part one, the necessary data was taken from files of all 83 patients. For the second part, selection was based on the completeness of the patients' files: the first 30 randomly selected patients with complete medical records were included.

Study Tool

The researcher created and used a database to collect information and the desired data from the groups' medical records, consisting of the variables below.

Dependent Variables

Outcome measures

Many outcome measures could have been used to assess the effectiveness of HMP (figure conceptual framework): clinical evaluation, satisfaction surveys, functional evaluation, cost analysis, and others. We chose to use the following in this study:

- **Patients/caregivers' overall satisfaction**: in an annual survey conducted since 2008 (26), this part assesses the overall satisfaction towards HMP services.
- **Hospital utilization**: the total of each of the 3 categories—Emergency room (ER) visits, Outpatient department (OPD) visits and readmission after enrollment to HMP—ranging between 0 visits to the maximum number the individual needed.
- **Clinical progress while enrolled in the HMP**: includes the final outcome after enrollment and Glasgow Coma Scale (GCS).

Independent Variables

- **Patient demographic data:** age, gender, marital status, and nationality.
- **Clinical diagnosis:** based on the 10^{th} international classification of diseases.
- **Severity score:** a scale of the severity of patients overall condition based on the rank of selected variables.

- **Clinical care utilized through HMP:** types of care, services utilized and respiratory modalities used.

Dependent Variable	Description
Outcome measures	
Clinical progress	Evaluated the following variables as nominal categories: 0) Improved 1) Static (not improved) 2) Deterioration or death
GCS	Glasgow Coma Scale is a discrete numerical variable from 3-15.
ER visits	Discrete number of ER visits
OPD visits	Discrete number of OPD visits
Patient Satisfaction	Evaluated the following as a categorical variable for this question "How satisfied you were with your overall care?" 0) Very dissatisfied / Dissatisfied 1) Very satisfied /Satisfied 2) Uncertain 3) Not available
Independent Variable	**Description**
Demographics	
Age	Evaluated as a categorical variable: 0) 18 – 60 Years of Age 1) 61 – 80 Years of Age 2) > 80 years of Age
Gender	Evaluated as a binary variable: 0) Male 1) Female
Marital status	Evaluated as a binary variable: 0) Married 1) Non-married
Nationality	Evaluated as a binary variable: 0) Saudi 1) Non Saudi
Clinical diagnosis	
Patients diagnoses	Evaluated the diagnosis according to ICD-10 as categorical variables
Diagnosis counts	Evaluated the number of diagnoses per patients as: 1: number of the patients who have one diagnosis 2: number of the patients who have two diagnoses 3: number of the patients who have three diagnoses 4: number of the patients who have four diagnoses 5: number of the patients who have five diagnoses
Specific system diagnosis	Evaluated each specific organ system diagnosis as categorical variables

Clinical care at HMP	
Duration in HMP	Evaluated the duration in HMP as a categorical variable: 0) Less than 1.5 years 1) 1.5-3 years 2) Over 3 years
Types of care	Evaluated the types of care delivered through HMP: 0) Chronic 1) Acute 2) Palliative 3) Transitional
HMP Services utilized	Evaluated the services utilized in HMP as: 0) Nursing services 1) Advanced Respiratory services 2) Social services 3) Physiotherapy services 4) Nutritional services 5) Health education
Respiratory modalities	Evaluated the respiratory modalities utilized in HMP as: 0) Measurement modalities (Pulse oximetry, Spirometer) 1) Treatment modalities (Tracheostomy, MDI, Nebulizers, Oxygen cylinder) 2) Mechanical ventilation (invasive and non-invasive) 3) Supportive modalities (Oxygen concentrator, Suction machine, Bag valve mask and Chest physiotherapy)

Severity Score

The severity score was developed to rank specific variables. The score is the sum total of each subcategory, as shown in the following table. The maximum score is 65 and the minimum score is 6.

Variable	Score	Details	Comment
Age	1	18 – 60 Years of Age	Ordinal according to the categories
	2	61 – 80 Years of Age	
	3	> 80 years of Age	
Type of referral	1	PHC &other	Ordinal according to the categories
	2	Secondary Hospital care (governmental +private)	
	3	Tertiary or specialized center	
Diagnosis counts	Continuous number	1-11	
Specific organ diagnosis	1	Mental Dermatology Gastrointestinal Musculoskeletal	Any patient having one of these diagnoses will score 1 for each
	2	Endocrine Genitourinary Injury	Any patient having one of these diagnoses will score 1 for each
	5	Respiratory Cardiovascular Central nervous Neoplasm	Any patient having one of these diagnoses will score 1 for each
Services	1	Nursing Health education	Any patient using one of these services will score 1 for each
	2	Physiotherapy Dietitian	Any patient using one of these services

			will score 2 for each
	3	Respiratory Social	Any patient using one of these services will score 3 for each
Respiratory Modalities	1	Measurement modalities Supportive modalities	Any patient using one of these modalities will score 1 for each
	2	Treatment modalities	Any patient using one of these modalities will score 2 for each
	3	Mechanical Ventilation modalities	Any patient using one of these modalities will score 3 for each

Data entry and analysis

In this secondary data analysis, data were collected from MHMP Center records and coded to facilitate data entry. Collected data was analyzed using SPSS v.20 and SAS v.9.3. Percentages, mean, and SD were used as descriptive statistics. Categorical variables were presented as frequency and percentage. The result is considered statistically significant when the P value is < 0.05. Associations between the demographic variables, clinical diagnosis, HMP medical care and outcome measures were operated statistically using chi-square or two sample t-test. For the 30 patients, we used the paired t-test with variance before and after variables (ER visits, OPD visits, and GCS).

Ethical considerations

This analysis was determined by the Emory review board to be IRB exempt because it is an analysis of secondary data and all data were de-identified prior to analysis. A permission letter from the general director of the HMP was given to facilitate the researcher's work at the different health facilities. Permission from the General Director of Health at the Directorate of Health in Madinah was given to facilitate the work. Written consent permitting the use of patients' information was given by the patients at their time of enrollment at the MHMP Center.

Results

Part I: Patient characteristics

A total of 83 (14%) patients had respiratory illness or needed respiratory services out of the 574 patients enrolled in MHMP Center at the time of this study. A pilot group of 30 patients was selected out of these 83 patients to assess the differences in outcome prior to and after enrollment at the MHMP Center and to estimate the cost saving per patient.

Demographic data

Out of 83 patients studied, about three-quarters (72%) were over 60 years old. Most of them were female (80%) and of Saudi nationality (90%), and over half (56%) were not married (single, divorced, or widowed) (Table 1).

Table 1: Characteristics of patients needing respiratory therapy enrolled in the Home Medical Program (HMP), Madinah HMP Center, Kingdom of Saudi Arabia, 2013

Characteristics		N (%)
Age		
	18 – 60 years of age	18 (22)
	61 – 80 years of age	37 (45)
	> 80 years of age	27 (32)
	Missing	1 (1)
Gender		
	Female	66 (80)
	Male	17 (20)
Nationality		
	Saudi	74 (90)
	Non-Saudi	8 (9)
	Missing	1 (1)
Marital status		
	Non-married	46 (56)
	Married	26 (31)
	Missing	11 (13)
Total		83 (100)

Patient diagnosis

Those receiving HMP respiratory services enrolled with multiple clinical diagnoses. The top three clinical diagnoses among this study's patients were respiratory diseases (91.6%), followed by cardiovascular diseases (89.2%) and endocrine diseases (65.1%) (Figures 2 and 3).

Figure 2. Diagnoses by Organ System in Patients Enrolled through the Madinah Home Medical Program Center, Kingdom of Saudi Arabia, 2013

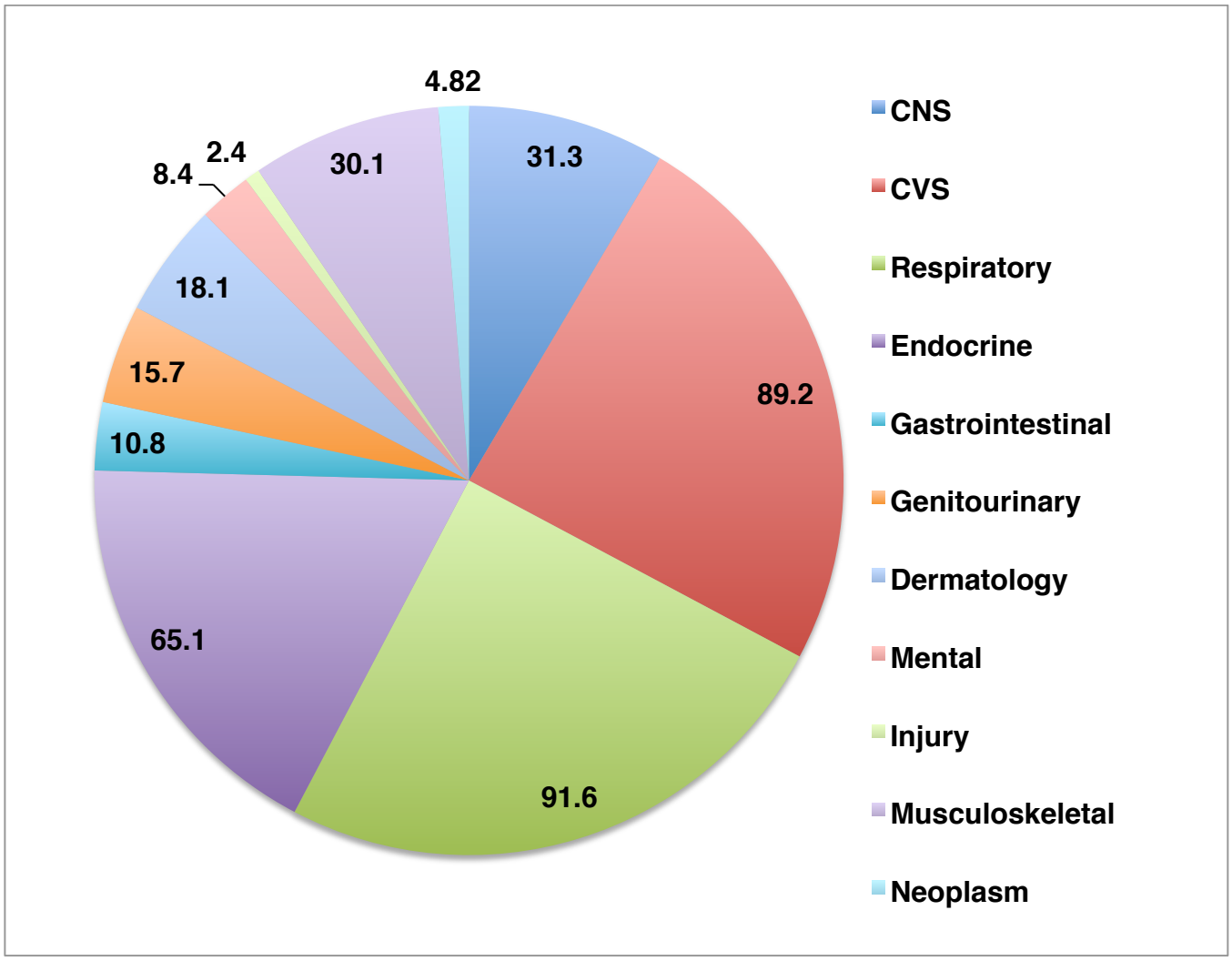
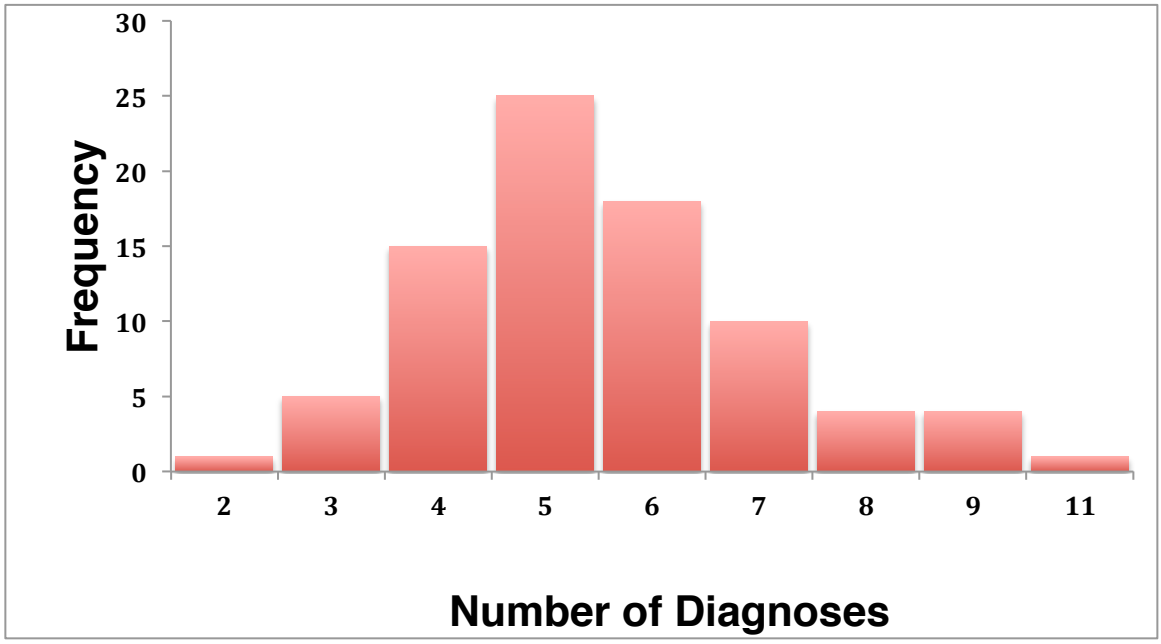


Figure 3. Frequency of Diagnoses Counts among 83 Patients Enrolled in the Madinah Home Medical Program Center, Kingdom of Saudi Arabia, 2013



Asthma accounted for about a third of respiratory disease diagnoses (33.7%). Other diagnoses included COPD (10.8%), respiratory failure (9.6%) and lung fibrosis (8.4%) (Table 2). Most respiratory diagnosis patients had a single respiratory diagnosis (65.1%), but a sizable minority had two (22.9%).

Table 2: Respiratory diagnoses* of patients needing respiratory therapy ° enrolled in the Home Medical Program (HMP), Madinah HMP Center, Kingdom of Saudi Arabia, 2013

Respiratory Diagnosis	N (%)
Asthma	28 (33.7)
COPD	9 (10.8)
Respiratory failure	8 (9.6)
Lung fibrosis	7 (8.4)
Pulmonary edema	3 (3.7)
TB	2 (2.5)
Others	19 (22.9)
Total	76 (91.6)

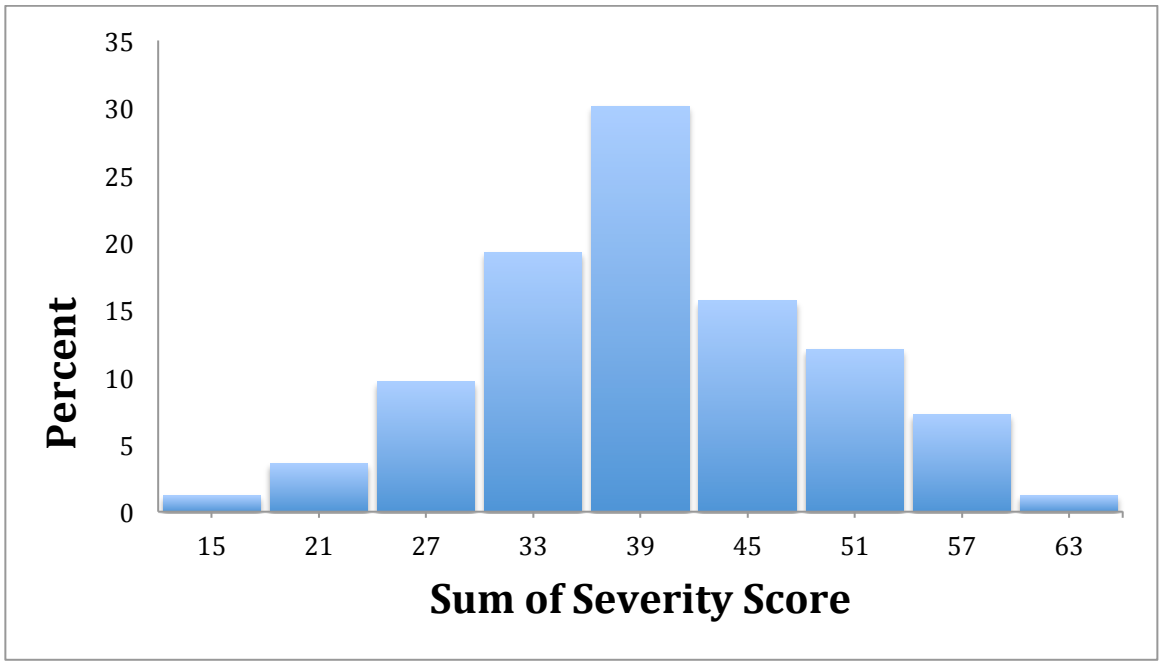
*** Based on ICD-10**
° N – 83

In addition to respiratory diseases, a number of these patients also had non-communicable diseases: 31.3% had hypertension, 42.2% had diabetes, and 15.7% were obese.

Certain conditions in these respiratory patients affected their mobility: 19.3% had cerebrovascular accidents before enrollment, 14.5% were hemi- or quadriplegic, and 15.7% had bedsores.

The severity score had a normal distribution of all patients: the upper tertile had a low severity score, the second tertile had moderate severity, and the bottom tertile had high severity scores (Figure 4).

Figure 4. Distribution of the Severity Score of Patients Needing Respiratory Therapy in Madinah Home Medical Program Center, Kingdom of Saudi Arabia, 2013



Patient profiles

About one-third (37.3%) of these patients had been enrolled in the HMP less than 1.5 years, 21.7% had been enrolled from 1.5 years to 3 years, and 14.5% had been enrolled for more than 3 years (Table 3). Most of them were enrolled for chronic care (92.9%), and all 83 patients needed nursing services and health education; in addition, most needed advanced respiratory services (69.9%). Regarding the respiratory modalities, the majority of patients required either two or three modalities, and 8% of them required four. Almost all of the patients (94%) used treatment respiratory modalities like oxygen therapy, and 14% were on mechanical ventilation.

Table 3: Profiles of patients needing respiratory therapy in the Home Medical Program (HMP), Madinah HMP Center, Kingdom of Saudi Arabia, 2013

Patient Profile	N (%)
Time spent in HMP	
Less than 1.5 years in HMP	31 (37.3)
1.5 to 3 years in HMP	18 (21.7)
Over 3 years in HMP	12 (14.5)
Services provided	
Nursing	83 (100)
Health education	82 (98.8)
Respiratory	58 (69.9)
Physiotherapy	33 (39.8)
Social	20 (24.1)
Dietary	18 (21.7)
Respiratory modalities per patient	
One	17 (20.5)
Two	28 (33.7)
Three	31 (37.4)
Four	7 (8.4)
Respiratory modalities administered	
Treatment	78 (94)
Supportive	58 (70)
Measurement	46 (55)
Mechanical Ventilation	12 (14)

Outcomes

Overall patient satisfaction

Annual satisfaction surveys are distributed to all HMP patients served through the MHMP Center. Data from this survey was available for 41 patients in this study. According to

these survey results, overall patient (or caregiver) satisfaction towards the HMP Center's services was high; 90.2% of patients were either satisfied or very satisfied, only 4.9% were either dissatisfied or very dissatisfied; and 4.9% were uncertain about their response (Table 4).

Patients' progress through HMP

Regarding patient progress through HMP Center, 43.4% were improved, 48.2% remained static without any improvement or deterioration, and 8.4% deteriorated or died (Table 4).

Hospital utilization during HMP enrollment

Regarding the hospital utilization (the sum of ER, OPD, and readmissions), half of the patients had 0 to 2 visits, and 33% had more than 2 visits (Table 4).

Logistic regression

Logistic regression between demographics, clinical and medical care, and outcomes was conducted, but the results were not statistically significant.

Table 4: Outcomes of patients needing respiratory therapy in the Home Medical Program, Madinah HMP Center, Kingdom of Saudi Arabia, 2013

Outcomes		N (%)
Patient satisfaction		
	Very Satisfied/Satisfied	37 (90.2)
	Very Dissatisfied/Dissatisfied	2 (4.9)
	Uncertain	2 (4.9)
	Total	**41 (100)**
Patient progress		
	Not improved/Static	40 (48.2)
	Improved	36 (43.4)
	Deterioration or died	7 (8.4)
	Total	**83 (100)**
Hospital utilization		
	0-2 Visits	50 (60.2)
	More than 2 Visits	33 (39.8)
	Total	**83 (100)**

Part II: Cost Savings Assessment

Pilot study

The second part of this study examined 30 out of 83 patients to evaluate the effectiveness of home respiratory care by comparing the clinical changes in hospital utilization and GCS before and after enrollment through MHMP Center and estimated the cost savings.

Demographic characteristics of this population

Out of the 30 patients in the pilot group, 79.5% were female, 86.7% were Saudi citizens, and 46.7% were married. The demographic of this random subgroup is similar to the

demographic of entire study population and this shows us how it is very reprehensive of the 83 patients.

Hospital stays prior to enrollment to HMP

Prior to enrollment in MHMP, patients had an average hospital stay of 36 days (SD ± 69.6). One-third of the patients (28.9%) had stayed in the main ward between 1 and 30 days, while 3.6% had stayed between 30 and 60 days, and 2.4% had stayed more than 60 days. A sizable minority also had been in the ICU: 14.5% had stayed there between 1 and 60 days, and 4.8% had stayed more than 60 days (Table 5).

Comparative analysis of hospital utilization

ER visits

Patients had a total of 30 ER visits before enrollment in the HMP, which decreased to 13 visits after HMP enrollment (Table 5). Using a paired t-test for the number of ER visits before and after, the average reduction of 1.3 visits (SD ± 0.5, $p < 0.0001$) was statistically significant.

OPD visits

Patients had a total of 29 OPD visits before enrollment in the HMP, which decreased to 17 visits after HMP enrollment (Table 5). Using a paired t-test for the number of OPD visits before and after, the average reduction of 1.5 (SD ± 1.1$p < 0.0001$) was statistically significant.

GCS

The mean GCS at the hospital prior to HMP enrollment was 13 (SD ± 1.1), with a range between 5 and 15; the mean of the last GCS done at HMP was 13.6 (SD ±2.4), with a range between 9 and 15 (Table 5). The mean increase in GCS after enrollment to HMP was 0.6 (SD ±

1.9), with the paired T-test; the difference of GCS at hospital's discharge and the last one done at HMP was not statistically significant ($p < 0.08$).

Patient satisfaction

Regarding the patient satisfaction comparison, satisfaction improved after enrollment through MHMP Center, but there was no statistical test applicable to satisfaction ratings.

Cost savings through HMP

The estimated cost for each ER visit was SR 300 SR ($80), so enrollment in the HMP resulted in savings of $1,440. HMP enrollment resulted in $800 in savings for OPD visits for this study population (Tables 5). The average hospital stay of these patients was 36 days ± 69.6 days; the cost of each day was estimated to be $400 in the main ward and $800 in the ICU. The maximum hospital stay was 365 days in one of the cases.

Table 5: Clinical assessment of 30 random patients needing respiratory therapy in the Home Medical Program prior to enrollment in Madinah HMP Center, Kingdom of Saudi Arabia, 2013

Medical Care		**N (%)**
Hospital stay		
	1 to 30 days in General Ward	24 (28.9)
	30 to 60 days in General Ward	3 (3.6)
	Over 60 days in General Ward	2 (2.4)
	0 to 30 days in ICU	12 (14.5)
	Over 60 days in ICU	4 (4.8)
Hospital Utilization		
Before Enrollment		
	Number of ER visits	30
	Cost of ER visits	$2400
	Number of OPD visits	29
	Cost of OPD visits	$1933
	Total	**$4333**
After Enrollment		
	Number of ER visits	13
	Cost of ER visits	$1040
	Number of OPD visits	17
	Cost of OPD visits	$1133
	Total	**$2173**
Clinical Care		
Glasgow Coma Scale		**Mean (SD)**
	Before enrollment	13.0 (1.1)
	After enrollment	13.6 (2.4)
	Mean difference	0.6 *(1.9)

* **P>0.5**

Discussion

This study assessed respiratory therapy delivered through the MHMP Center in Madinah and revealed many positive findings. It provided clinical and financial evidence supporting the provision of HMP respiratory services, which resulted in a high level of overall patient satisfaction, better or stable patient progress, and less hospital utilization, leading to cost savings.

The outcome findings were similar to what was seen in the most of the literature. For clinical improvement, the study showed lower hospital utilization, ER, OPD, and readmissions for all kinds of patients, especially those requiring home respiratory therapy (17, 18, 22). In this study, besides hospital utilization, we used the GCS as one of the objective clinical measures to assess patient health improvement, and these figures reflected improvement in the score but were not statistically significant ($p < 0.08$). For clinical assessment, other studies used many indicators and measures, such as using a scale for assessing the patients' functional status, especially among the elderly at home (17).

In terms of quality of life and patient satisfaction, the study revealed a high level of overall satisfaction, which was also seen in other studies nationally and internationally (25-27).

The cost benefits of HHC were controversial in the literature; many studies showed it to be one of the most effective cost-saving approaches, but some research revealed there to be inconsistent results (31). This study found cost benefits among the pilot group (8, 30).

The pilot group's results comparing variables before and after HMP enrollment indicated improvement clinically (ER, OPD, GCS), in quality of life (satisfaction), and also economically, through savings achieved though reduced hospital utilization. This shows the

value of respiratory services delivered through the HMP. This pilot group sample was different from the other 53 patients only in their severity scores; otherwise, they were similar (e.g., in amount of prior hospital utilization). In essence, the findings related to this pilot group could be applicable to the rest of the patients.

Though small, the 83-patient sample was not biased and served as a good representation of the population, as seen by the normal distribution of the number of diagnoses counts and of severity score. This strengthened the study and proved there was no bias. The patients were equally distributed (Figures 3 and 4). Also, the normal distribution of the severity score revealed that the HMP could handle patients with different severity scores; even with the variation, most patients had high levels of satisfaction, with stable or improved health outcomes.

As mentioned earlier, despite there being evidence of the various benefits of incorporating home health care in the health system, this evidence was not derived from KSA. The services provided through the HMP are different from other countries, so this pilot was the first study that assessed the effectiveness of home health care in KSA, and the first that has provided evidence of its cost-effectiveness.

This study had several limitations. The lack of sufficient objective clinical measures was a limitation. The use of additional objective clinical indicators is recommended for future studies. Another limitation of this study was the small sample size, though it was the total number of patients enrolled in the HMP who had a respiratory diagnosis or needed respiratory care. Having a larger sample size will increase the power of the study, and the association and variance between variables could be estimated more accurately. Another limitation was that it

was a secondary data analysis from medical records, and this could have meant information bias. A prospective study that regularly monitors patient changes would produce more valid data and reduce instances of when data was unavailable. Assessing elderly persons with co-morbidities is challenging, and in such cases it is difficult to control the confounders that could have affected the patients' health due the complexity of the interventions for elderly (19).

We now have a better view of the HMP's achievements and its contribution to reducing hospital utilization and consequently saving money, while maintaining the same or better level of care compared to hospitals, with more satisfaction and better health outcomes. Evidence provided here and in previous studies supports the effectiveness of the HMP and justifies the need for more funding from the MoH, especially for patients who have respiratory illness or need respiratory care. A study encompassing more HMP patients using prospective performance and the impact evaluation measures is the next step.

Chapter 4

Conclusion and Recommendations

Conclusion

This study revealed that respiratory therapy delivered through the MHMP Center was a valuable approach both clinically and economically. There were decreases in hospital utilization, improvements in overall patient satisfaction, and cost savings when patients with respiratory illness or patients needing respiratory care were treated at home.

Recommendations

We recommend broadening this study to include more patients in the future. We also recommend conducting a prospective study to ensure the accuracy of collected data and to better evaluate the patient outcomes. Since insufficient data was an obstacle, keeping better records or using an electronic filing system would be advisable. There were limitations in the clinical outcomes indicators, objective, measurable indicators should be included in subsequent studies. In evaluating the cost-effectiveness of any health intervention, we should have data such as DALYs that help us estimate the cost in the equation of health cost-effectiveness. Additional prospective studies or randomized trials are advisable for better evaluation and cost analysis comparison outcomes.

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