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Hospital at Home for Elderly Patients with Acute Exacerbation of Chronic Obstructive Pulmonary Disease

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1. Introduction

Demographic, epidemiological, social, and cultural trends in European countries are changing the traditional patterns of care. The next decades will see increasing rates of care-dependent older people and non communicable diseases as the leading cause of chronic illness and disability. The break-up of the traditional large family group and urbanization will also lead to gaps in the care of older or disabled family members. These changes in needs and social structure require a different approach to health and social sector policy and services since a disease-oriented approach, alone, is no longer appropriate. An answer to these issues could be home care, a sustainable approach to prevent the need for unnecessary acute or long-term institutionalization and maintain individuals in their home and community as long as possible providing diagnostic, therapeutic and social support (Tarricone & Tsouros, 2008).

Home is a place of emotional and physical associations, memories and comfort. Although many people can be happy in assisted-living facilities, retirement communities or nursing homes – and for many people these are better options – leaving home can be disruptive and depressing for some people. Recent trends in health care favour alternatives to traditional hospital care for patients with acute or chronic diseases. Home care used appropriately decreases hospitalization and nursing home use without compromising medical outcomes. Moreover, patients generally prefer to remain in familiar surroundings. Physician support of home care services honors that preference (Levine et al., 2003).

Chronic Obstructive Pulmonary Disease (COPD) has been the focus of several hospital at home studies, however, most models studied have been early-discharge schemes that employed nursing care, without physician care in the home. There have been fewer studies of substitutive physician-led clinical unit model of hospital at home.

2. Ageing population: Demographics trends

Population ageing is progressing rapidly in many industrialized countries. For the world as a whole, the elderly will grow from 6.9% of the population in 2000 to a projected 19.3% in 2050 (Gavrilov & Heuveline, 2003).

Population ageing is a great challenge for the health care systems. As nations age, the prevalence of disability, frailty, and chronic diseases (Alzheimer's disease, cancer, cardiovascular and cerebrovascular diseases, COPD, etc.) is expected to increase dramatically.

Frailty is gaining attention in many fields because it increases the risk of hospitalization, falls, mortality and institutionalization. Geriatricians, gerontologists, and social scientists study frailty to better understand its impacts on health, individuals, and society. Frailty has been considered synonymous of disability or co-morbidity, but it is recognized that it is a biological syndrome identified by decreased reserves in multiple organ systems. The incidence of frailty increases with age, reaching more than 32% in those older than 90 years (Fried et al., 2001). Frailty can be a primary diagnosis, when the state is not associated directly with a specific disease, or a secondary diagnosis when the syndrome occur as a result of an acute event or the end stage of many chronic conditions, including severe congestive heart failure, stroke, chronic inflammatory diseases and dementia. The hospital, which is the "gold standard" for the delivery of acute medical care, is not an ideal environment for frail elderly patients. A new functional impairment and iatrogenic events such as nosocomial infections, pressure sores, falls and delirium are common during hospital stay.

Chronic obstructive pulmonary disease is a major cause of chronic morbidity and mortality. Patients with COPD usually have progressive airflow obstruction that is not fully reversible, which leads to a history of progressive, worsening breathlessness that can impact on daily activities and health-related quality of life. Winter outbreaks of COPD exacerbations, mostly occurring in elderly people with concurrent chronic co-morbidities, often generate dramatic increases in hospital emergency room admission. Such admissions have increased substantially over the past decade, comprising a significant proportion of all hospital admissions, and are associated with a high rate of readmission contributing to the high costs of care for COPD.

3. Chronic obstructive pulmonary disease: Epidemiological data

Chronic obstructive pulmonary disease is a leading cause of mortality and morbidity worldwide, affecting approximately 210 million people and leading to 3 million deaths annually (WHO, 2011).

The prevalence and morbidity data greatly understimate the total burden of COPD because the disease is usually not diagnosed until it is clinically apparent and moderately advanced. Furthermore, population-based estimates of COPD prevalence by region are problematic since the disease is progressive, measurement tools and definitions still vary among studies, and implementation of spirometry is often not feasible in developing regions (Lopez et al., 2006a).

A recent systematic review and meta-analysis on global burden of COPD reported a prevalence of physiologically defined COPD of 9-10% in adults (Halbert et al., 2006). These

data agree with results from the BOLD study, a population-based prevalence study including participants from 12 sites worldwide (n=9425), reporting a prevalence of COPD stage II or higher of 10.1% overall, 11.8% for men and 8.5% for women (Buist et al., 2007).

In England the rate of COPD in the population is estimated at between 2% and 4%, representing between 982.000 and 1.96 million people. The diagnosed prevalence of COPD was 1.5% of the population in 2007/08 according to the Quality Outcome Framework (QOF) statistical bulletin. Approximately 835.000 people in England have been diagnosed with COPD in 2008/09. However, it is currently estimated that over 3 million people have the disease and that an estimated 2 million have undiagnosed COPD, among whom it is considered that 5.5% will have COPD at the mild end of the spectrum (NICE guidelines, update 2010).

Recent available data suggest that a pooled prevalence on spirometric basis is about 9% in European adults, with 4-6% of them suffering from a relevant clinical form of the disease. In Italy, prevalence of COPD is 4.5%, on average.

The reported total prevalence of chronic bronchitis in U.S. adults ranged from a high of 55 (2001) cases per 1.000 to a low of 34 (2007). The prevalence of chronic bronchitis appears to have peaked in 2001, followed by a subsequent decline from 2001 to 2007. In 2008, however, there was an increase in the prevalence (44 case per 1.000) compared to the previous year, and this prevalence was the same in 2009 (data from the U.S. National Health Interview Survey-NHIS, 1999-2009).

The epidemiology of COPD in five major Latin American cities (São Paulo, Santiago, Mexico city, Montevideo and Caracas) has been provided by the PLATINO project , launched in 2002: rates of COPD range from 7.8% in Mexico city to 19.7% in Montevideo, suggesting that COPD is a greater health problem in Latin America than previously realized (Menezes et al., 2005). COPD is emerging as public health problem also in the Middle Est and North Africa countries. In 2001, the prevalence of COPD in Africa was estimated 179/100.000 and 301/100.000 in eastern Mediterranean countries (Lopez et al., 2006b).

Currently, in the European Union COPD and asthma, together with pneumonia, are the third most common cause of death, while in North America COPD represents the fourth leading cause of death. Five year survival from diagnosis is 78% in men and 72% in women with clinically mild disease, but falls to 30% in men and 24% in women with severe disease. (NICE guidelines, update 2010). Due to an aging population, increase in COPD prevalence and mortality are expected in the coming decades. The World Health Organization (WHO) has estimated that COPD will be the third leading cause of death for both males and females worldwide by the year 2030, surpassed only by heart disease and stroke (WHO, 2011).

Burden of COPD can also be measured in disability-adjusted life years (DALYs). Worldwide, COPD is expected to move up from the 12th leading cause of DALYs in 1990 to the 5th leading cause in 2020 (Lopez et al., 2006 b).

In the United States COPD accounts for 15.4 million physician visits, 1.5 million emergency department visits and 636.000 hospitalizations each year (Dalal et al., 2011). In Italy, COPD is the fourth highest cause of hospital admission (130.000 admissions every year). In the UK COPD is the second largest cause of emergency admission and the most common cause for emergency admission to hospital due to respiratory disease. One fifth (21%) of bed days

used for respiratory disease treatment are due to COPD, such that COPD accounts for more than one million "bed days" each year in hospitals in the UK (NICE guidelines, update 2010).

The impact of hospitalization for acute exacerbations is significant; mortality during admission is > 10% and mortality during the year after discharge following treatment for acute COPD exacerbation is 25-40% (Escarrabill, 2009).

An acute exacerbation of COPD is not an exceptional or unique event. The Risk Factors of COPD Exacerbation Study (EFRAM) found that 63% of patients were readmitted during the year following an exacerbation (Garcia-Aymerich et al., 2003). Patients with COPD experience exacerbations one to three times a year, with treatment often requiring emergency room care or hospitalization, which contributes substantially to the financial burden of the disease (Dalal et al., 2011).

Various observational studies have found that inpatient care accounts for 50-75% of the direct medical costs of COPD. This cost increases with disease severity: inpatient costs of patients with stage III (severe) disease are double those of patients with stage II (moderate) disease and 6.5 times greater than those of patients with stage I (mild) disease (Dalal et al., 2011).

The indirect cost of COPD are substantial with an impact on annual productivity amounting to an estimated 24 million lost working days per annum. There is little data available to quantify other indirect costs such as carer time and inability to carry out non-occupationally related activity (NICE guidelines, update 2010).

There continues to be high demand for acute care hospital beds for patients with an exacerbation of COPD. Recent reports highlight the fact that although the acute hospital is the standard venue for providing acute medical care, it may be hazardous for older persons, who commonly experience iatrogenic illness, functional decline, and other adverse events. One way to decrease or avoid admissions to hospital is to provide people with acute care treatment at home.

4. Current knowledge on home care for COPD exacerbations

COPD is often associated with exacerbations of symptoms. Exacerbations, particularly that result in admission to hospital, are significant events in the natural history of the disease. They are disruptive and distressing for patients, and account for a significant proportion of the total costs of caring for patients with COPD.

There is no generally agreed definition for an exacerbation of COPD. Definitions currently rely on clinical empiricism with little evidence-based scientific support (Caramori et al., 2009). Most common international guidelines and working groups provide very similar definition of a COPD exacerbation: "*an event in the natural course of the disease characterized by a change in the patient's baseline dyspnea, cough and/or sputum that is beyond normal day-to-day variations, is acute in onset, and may warrant a change in regular medication in a patient with underlying COPD*" (ATS/ERS guidelines, Celli et al., 2004; GOLD, 2009; BTS guidelines, 2007; CTS guidelines, O'Donnel et al., 2008; SEPAR/ALAT joint guidelines, Peces-Barba et al., 2008; Rodriguez-Roisin, 2000).

When an exacerbation of COPD has been diagnosed, to define its severity is essential. Quantification of severity is important in medical management as well as in determing the setting of care (Celli et al., 2004). At present, there is not a validated method for quantifying the severity of exacerbation. Generally, the intensity of the underlying COPD must be considered, as well as comorbidity and a history of previous exacerbations. In addition to these factors, the progression of the symptoms, response to therapy, and availability of adequate home care must be considered in order to decide whether hospitalization is necessary. However, grading of the severity of mild to moderate exacerbations remains contentious since they can be categorised either on clinical presentation (essentially symptoms) or healthcare use resources (Rodriguez-Roisin, 2006).

The most recent position paper of the American Thoracic Society and the European Respiratory Society (ATS/ERS task force) provide a three levels operational classification of severity of COPD exacerbations which allows to identify the best setting of care according to specific elements of clinical evaluation and diagnostic procedures. Level I: patient can be treated at home, Level II: requires hospitalization, Level III: leads to respiratory failure (Celli et al., 2004).

In the National Institute for Clinical Excellence (NICE) guidelines (update 2010), hospital-at-home and assisted-discharge schemes are recommended as a safe and effective alternative to conventional hospitalization (Grade A), particularly for patients with less severe exacerbations. The same authors admit that, currently, there are insufficient data to make firm recommendations about which patients with an exacerbation are most suitable for hospital-at-home or early discharge, and patient selection should depend on the resources available, absence of factors associated with worse prognosis and patient's preference (NICE guidelines, update 2010).

The joint guidelines of the Spanish Society of Pulmonology and Thoracic Surgery (SEPAR) and the Latin American Thoracic Society (ALAT) indicate home hospitalization only for patient without signs of severity such as diminished level of consciouness, abnormal chest radiograph, hypercapnia with acidosis, significant comorbidities, need of ventilatory support (Peces-Barba et al., 2008).

The Global Initiative for Chronic Obstructive Lung Disease (GOLD) guidelines (update 2009) state that "admission of patient with severe COPD exacerbations to intermediate or special respiratory care units may be appropriate if personnel, skills, and equipment exist to identify and manage acute respiratory failure successfully" (GOLD, 2009).

A first feasibility analysis of home-based services to prevent conventional hospitalization of COPD exacerbations was reported in 1999 by Gravil and collegues (Gravil et al., 1998). Subsequent controlled trials confirmed both safety and cost reduction when these types of services were applied to selected COPD patients (Cotton et al., 2000; Davies et al., 2000; Hernandez et al., 2003; Ojoo et al., 2002; Skwarska et al., 2000).

In a review and a meta-analysis including 7 robust RCTs (n=754 patients) Ram and collegues evaluated the overall efficacy of hospital at home schemes, showing that selected patients presenting to hospital emergency departments with acute exacerbation of COPD can be successfully treated at home when supported by visiting respiratory nurses at home. Authors suggested that approximately 25% of the patients with COPD who presented at the

emergency department with acute exacerbations would be suitable for home treatment (Ram et al., 2003, 2004).

In conclusion, there is an international consensus on home care for COPD exacerbations, especially for less severe episodes, although data on specific characteristics of patients suitable for this form of care are currently insufficient. In addition, the confusion on definition of "home hospitalization" and "hospital at home" can make difficult to clear up this problem.

Intermediate care is a treatment model which bridges the interface between hospital and community care. A specific subtype of intermediate care is Hospital-at-Home. There is a consensus on defining "Hospital-at-Home" a model of care where "active treatment is provided by healthcare professionals in the patient's home for a condition that otherwise would require hospital care, always for a limited period" (Cochrane Database of Systematic Review, Shepperd et al., 2001). Many disparate models exist with the general nomenclature of "Hospital at Home", "Home hospitalization". These include usual community-based care, outpatient infusion centre, nurse-only outpatient care and the direct clinical unit model of care. These models have distinct features.

Established models for delivering hospital-level care in the home setting exist internationally, including United States, Canada, Israel, Australia, New Zeland, Spain, United Kingdom, Italy, France (Leff et al., 2005; Lemelin et al., 2007; Stessman et al., 1996; Caplan et al., 1999; Montalto, 2002; Richards et al., 2005; Cerrillo –Rodriguez et al., 2009; Pérez-Lopez et al., 2008; Kalra et al., 2008; Wilson et al., 1999; Myles et al., 1996; Aimonino Ricauda et al., 2008).

For patients with exacerbations of COPD, over the last few years there has been considerable interest especially in hospital-based rapid assessment units and early discharge or admission avoidance hospital at home schemes.

Rapid assessment units aim to identify those patients that can be safely be managed at home. These units generally involve a full assessment of the patient in the hospital by a multidisciplinary team and discharge to the community with appropriate support (e.g. nebuliser and compressor or oxygen concentrator, nursing and medical supervision from respiratory specialists, increased social support). Patients remains under the care of the hospital but General Pratictioners are made aware of the fact that their patients are receiving home care.

Early or assisted or supported discharge schemes aim to identify patients in hospital who could be discharge before they have fully recovered by providing increased support in their homes. These schemes involve getting people out of hospital as quickly as possible. In a recent review Shepperd and collegues have demonstrated that mortality and disability for patients recovering from stroke, COPD or surgical interventions are similar in hospital and in early/supported discharge services. Patients may also be more satisfied with their care at home, and at the same time their cares, in most cases, do not report additional burden. However, authors concluded that there is little evidence of cost savings to the health care system (Shepperd et al., 2009a).

The **admission avoidance schemes** provide active treatment by hospital health care professionals (doctors, nurses and other professional figures) in the patient's home, always

for a limited time period. The key is that if the hospital at home service was not available, then the patient would need to be admitted to an acute hospital ward. In a systematic review of avoidance of admission through the provision of hospital care at home, 10 randomized trials involving elderly patients with medical condition were included (with a total of 1327 patients). For 5 of these trials individual patient data were obtained for meta-analysis, representing 87% of potentially eligible patients. Authors reported a significantly lower mortality at 6 months for patients who received hospital care at home, greater satisfaction and lower costs (if costs of informal care are excluded). (Shepperd et al., 2008; Shepperd et al., 2009b).

5. The Hospital at Home Service of Torino

In October 1984, with Resolution N. 1134/41/84, the Management Committee of the Local Health Unit 1/23 of Turin set up the 'Experimental Project of Home Hospitalisation'.

In October 1985 a team of doctors and nurses of the Turin Department of Geriatrics started an experiment that was unique in Italy at that time: medical treatment (including examinations and related medical and nursing services) at home rather than in hospital for patients with severe chronic or relapsing illnesses.

The Hospital at Home Service (HHS) is operating in Torino at S. Giovanni Battista Hospital, a large urban University teaching and tertiary-care hospital (Aimonino Ricauda et al., 2004, 2005, 2008; Tibaldi et al., 2004, 2009).

The HHS is a service that provides diagnostic and therapeutic treatments by health care professionals, in the patient's home, of a condition that otherwise would require acute hospital in-patient care. A quick admission to hospital is possible for examinations or interventions that cannot be carried out at home. Transport and acceptance are free for these patients, as part of the HHS service.

The HHS normally operates 12 hours a day (from 8 am to 8 pm), seven day a week. At night our Regional Emergency Unit ("118") can be contacted. For selected patients, medical staff is on-call 24 hours a day. Caregivers are instructed in the emergency plan and encouraged to telephone if problems arise.

The HHS team, equipped with 7 cars, is multidisciplinary and consists of 4 geriatricians, 13 nurses, 1 nurse coordinator, 2 physiotherapists, 1 social worker, 1 counsellor.

The main feature of HHS is that physicians and nurses work together as a team (Figure 1), with daily meeting to discuss the needs of each patient and to organize individualized medical care plans and day-to-day work. The three most important aspects of the nursing activity are:

- home visits to outpatients to give medical care as agreed with the doctors
- daily team meeting
- secretarial work, receiving applications for hospitalization, stocking pharmaceuticals and sanitary material, sending and collecting laboratory analysis, transporting patients for specialistic consultations or exams which can be done only in hospital

The team looks after 25 patients per day and 500 patients per year, on average. The most common diseases treated at home are cardiac, respiratory, cerebrovascular, metabolic and neoplastic diseases.



Fig. 1. Hospital at Home Service: doctor and nurse at patient's home

The HHS can be activated by a direct request of the general physician of the patient as an alternative to traditional hospital care, or by a request from hospital wards doctors to allow early and protected discharge from hospital.

Since 2001, a close collaboration has been started between the HHS and the Emergency Department (ED) of San Giovanni Battista Hospital, to propose, where possible, home care as an alternative to the traditional admission to hospital.

Now, approximately 60% of our patients are referred by the ED, 25% by hospital wards and 15% by specialist or general physicians in the community.

The relationship between the ED team and the "HHS mobile team" made up of 1 geriatrician and 1 nurse is very important. By using a multidimensional case sheet, the "HHS mobile team" carries out an assessment of the patient and his caregiver to evaluate the possibility of hospitalization at home and in order to give information on the service.

A "Module of interview with the family" was conceived and implemented to discover the willingness of the family to work together with HHS team, as a part of the patient's healthcare system.

When the availability is established, an "Informative Card" with information on the service has been given to the patient and his caregiver.

Then, the "HHS mobile team" together with the ED doctor writes a rough copy of patient's case sheet, which will be completed at home during the first HHS visit. In the ED all the

necessary diagnostic tests (e.g., blood tests, radiography, ECG) are provided and then the patient moves home by ambulance, usually within a few hours.

Entry criteria for home hospitalization are: informed consent of patient and caregiver; stable, diagnosed medical conditions needing hospitalization but not expected to require emergency intervention; appropriate care supervision; telephone connection; living in the hospital catchment area (all the southern part of the city).

Exclusion criteria are: need of intensive monitoring or mechanical ventilation, a monitoring more frequent than every 2 hours of blood pressure or haemogasanalysis, patients with an heart attack or with very low levels of oxygen in the blood or with a serious acidosis or alkalosis or with a suspect of pulmonary embolism.

Many services or treatments can be provided at home, as shown in Table 1.

Assessment in Emergency Department and transport home via ambulance
Services and treatment provided:
Physician and nursing visits
Standard blood tests
Pulse oximetry
Electrocardiogram
Spirometry
Echocardiogram
Internistic ecographies and Doppler ultrasonographies
Oral and intravenous medication administration, including antimicrobials and cytotoxic drugs
Oxygen therapy
Blood product transfusion
Central venous access (PICC, Midline)
Surgical treatment of pressure sores
X rays
Telemonitoring
Physical therapy
Occupational therapy
Counselling
Hospital-at-home patients are considered hospital patients, and all services are provided by the hospital, which retains legal and financial responsibility for care.

Table 1. Features of the Hospital at Home Service

A case history is made up for each patient and is always available at the patient's home, with an updated report available in the HHS office.

Medical consultation with other hospital specialists is possible in the hospital or at the home of the patient.

HHS has continued to increase its activity since its inception in 1985. Until now about 11000 admissions have been recorded. In 2010, 550 admissions were recorded, 9113 nursing visits

and 4317 medical visits were conducted. The mean age of our patients was 80 years (range 30-101). Mean length of stay was 14 days.

In 2010 the Piedmont Region issued a decree to regulate this HHS model and acknowledged a refund of 165 Euros/day for DRG included in MDC number 1, 4, 5, 16, 17 (neurological, respiratory, cardiovascular, haematologic and neoplastic diseases), and 145 Euros for the other diseases.

6. The Hospital at Home approach to elderly patients with COPD exacerbation: Principles for patient selection and management

About 20% of patients admitted to the Emergency Department and referred to the HHS of Torino are affected by an exacerbation of COPD.

From an operational point of view, an acute exacerbation of COPD is defined on the basis of Anthonisen criteria as an increase in breathlessness, sputum volume, or purulence for at least 24 hours requiring acute hospitalization (Anthonisen et al., 1987).

Patients that can't be safely managed at home by HHS are those without a family or social support, with severe hypoxemia (PO_2 < 50 mmHg), severe acidosis or alkalosis (pH < 7.35 or > 7.55), suspected pulmonary embolism, suspected myocardial infarction.

In the ED all COPD patients undergo baseline standard clinical evaluation; blood tests (blood cell count, routine biochemical tests and arterial blood gas tensions); pulse oximetry; 12-lead electrocardiography; chest radiographs and hand-held spirometry. Further investigations (including pneumologist's assessment) are performed when required, according to the clinical judgement of the ED physician. Patients eligible for HHS are immediately transferred home by ambulance.

HHS patients receive hospital-level treatments and services at home as dictated by their condition. Treatment of COPD exacerbations is based on the optimized use of bronchodilators as well as the administration of systemic corticosteroids and antibiotics, when requested, administered intravenously in about 90% of patients, and oxygen therapy by nasal cannula or Venturi mask. Non-invasive mechanical ventilation is administered at home in collaboration with pneumologists. Acute administration of nutritional support is possible at home, if requested.

The home care program emphasize patient and caregiver education on the knowledge of the disease giving advices about smoking cessation, nutrition, management of activities of daily living and energy conservation, understanding and use of drugs, health maintenance and early recognition of triggers of exacerbation that required medical intervention. Protocols for prevention of nosocomial infections, bed sores, immobilization, dysphagia are routinely adopted for frail patients. Moreover, a counselling service is offered to the most frail patients and caregivers . Aim of the counselling process is to offer to users the opportunity of exploring, discovering and clarify thought and action patterns, thus enabling them to make a better use of their resources in that specific situation of need. Within a situation of crisis and complexity, the counsellor aims at obtaining a safe, confident and cooperative environment capable of transmitting information, implementing support, modifying

attitudes, promoting health education to the patient and the family and finally enabling them to better cope with the situation. The counsellor do not provide standardized information to increase the caregiver's skill in caregiving; rather, counselors focused on helping caregivers understand and resolve their reactions to caregiving process.

In the first days after admission in HHS each patient is visited at home on a daily basis by physicians and nurses. In the following days the patients is seen every day by a nurse and at intervals of 2-3 days or less by the doctor, as required by the patient's clinical condition. Hospital at home staff is available at all times for urgent home visits, which occur within 20-30 minutes by the telephone call. Home visit include: physical examination, measurement of vital signs (pulse, blood pressure, respiratory rate, temperature, oxygen saturation), administration and revision of therapy, if necessary. Essential skills for members of the HHS team are the ability to take a comprehensive clinical history and assess clinical condition, familiarity with pharmacological and non-pharmacological approaches, good communication skills, understanding of airway clearance techniques.

Upon admission, for each patients are recorded: blood pressure, spirometric parameters (FEV_1, FVC, FEV_1/FVC%), hematocrit, blood glucose, serum creatinine concentration, serum hepatic enzymes, serum nutritional parameters (e.g, total proteins, albumin, transferrin, lymphocytes) and electrolytes, arterial blood gas levels (pH, partial pressure of oxygen, partial pressure of carbon dioxide, bicarbonate, pulse oximetry), sputum culture if possible. During the HHS admission clinical assessment and routine observations are useful in assessing the rate of recovery from an exacerbation. Blood tests, including arterial blood gases measurement and spirometry are repeated according to the clinical condition of the patient. A chest X ray at home is possible, if necessary.

At home, a multidimensional geriatric assessment is conducted using validated instruments. The multidimensional geriatric assessment include the evaluation of comorbidity using the Cumulative Illness Rating Scale (Conwell et al., 1993), severity of illness using the Acute Physiology And Chronic Health Evaluation (Knaus et al., 1985), depression status using the Geriatric Depression Scale (Yesavage et al., 1982), functional status using Katz Activities of Daily Living and Lawton Instrumental Activities of Daily Living (Katz et al., 1963; Lawton & Brody, 1969), cognitive status using the Mini-Mental State Examination (Folstein et al., 1975), quality of life using the Nottingham Health Profile (Hunt et al., 1985), nutritional status using the Mini Nutritional Assessment (Guigoz et al., 1997), characteristics of caregiver with special attention to the level of stress using the Relatives' Stress Scale (Greene et al., 1982), and satisfaction using an "ad hoc" questionnaire for customer satisfaction (Figure 2).

The HHS patients undergo acute rehabilitative care at home, including pulmonary rehabilitation when needed, and their caregivers are encouraged to actively participate in the rehabilitation process. Education and psychological support are important for the overall success of rehabilitation. Education improves knowledge, coping and self-management, actively engaging patients to maintain strategies that reduce dyspnoea, maintain good lifestyle habits and participate in decision-making when acute exacerbation occur.

When patients recover from an acute exacerbation of COPD the dimission is planned, making arrangements with General Pratictioner. District Health Services are activated if required.

Recently, two papers on hospital- at-home treatment of elderly patients with an acute exacerbation of COPD have been published by HHS of San Giovanni Battista Hospital of Torino (Aimonino Ricauda et al., 2007, 2008). Between April 2004 and April 2005 a prospective randomized controlled single-blind trial was conducted to evaluate hospital readmission rates and mortality at 6 month follow up in selected elderly patients with acute exacerbation of COPD. One hundred and four elderly patients admitted to hospital for acute exacerbation of COPD were randomly assigned to General Medical Ward (GMW, n=52) or to Hospital at Home Service (HHS, n=52). Baseline sociodemographic information, clinical data, functional, cognitive, nutritional status, depression and quality of life were obtained (Table 2). All patients were elderly, multimorbid, and functionally and cognitively impaired.

Characteristic	Geriatric Home Hospitalization Service (n=52)	General Medical Ward (n=52)	P-Value
Age, mean ± SD	80.1± 3.2	79.2± 3.1	.20
Male, n (%)	29 (56)	39 (75)	.06
Married, n (%)	27 (52)	29 (56)	.84
Family support at home, n (%)	52 (100)	52 (100)	.89
Smoking history, n (%)			
Current smoker, n (%)	7 (13)	6 (11)	.97
Ex-smoker, n (%)	34 (65)	35 (67)	.95
Nonsmoker, n (%)	11 (21)	11 (21)	.81
Number of cigarettes/d ± SD	20 ± 11	21 ± 15	.83
FEV1, mean ± SD	0.92 ± 0.4	1.04 ± 0.5	.18
Percentage of predicted FEV1	38	47	
Respiratory rate, mean ± SD	24 ± 5	25 ± 7	.32
Home oxygen use before admission, n (%)	18 (35)	12 (23)	.45
Arterial blood gas, mean ± SD			
pH	7.40 ± 0.04	7.41 ± 0.03	.19
Partial pressure of oxygen	69 ± 19	65 ± 14	.23
Partial pressure of carbon dioxide	44 ± 12	46 ± 12	.47
Activities of Daily Living score, mean ± SD*	2.3 ± 2.2	1.9 ± 2.2	.36
Instrumental Activities of Daily Living score, mean ± SD†	7.1 ± 4.9	8.1 ± 4.2	.27
Geriatric Depression Scale score, mean ± SD‡	16.1 ± 6.1	17.2 ± 6.8	.45
Mini Nutritional Assessment, mean ± SD§	17.1 ± 6.5	18.3 ± 6.2	.37
Mini-Mental State Examination score, mean ± SD‖	21.8 ± 6.9	21.8 ± 6.3	.89
Cumulative Illness Rating Scale score, mean ± SD			
Comorbidity index#	2.6 ± 1.5	3.0 ± 1.8	.24
Severity index**	2.5 ± 0.5	2.6 ± 0.5	.19
Acute Physiology and Chronic Health Examination II score, mean ± SD††	9.5 ± 4.0	10.3 ± 4.0	.29
Nottingham Health Profile score, mean ± SD‡‡	20.6± 9.6	19.3± 8.2	.46

Normal range * 0-6, † 0-14, ‡ 0-30, § 0-30, ‖0-30, # 0-14, **1-5, †† 0-100, ‡‡ 0-38.
SD = standard deviation; FEV1 = forced expiratory volume in 1 second.

Table 2. Baseline Characteristics of the Study Populations

QUESTIONNAIRE ON CUSTOMER'S SATISFACTION

Please, answer to the following questions.
Your answers will enable us to improve the quality of our care.
The questionnaire is anonimous and will be processed in a sealed envelope.
You may be helped by a family member or a friend.
Thank you for your comments on the back side of this sheet.

What I think about:

	Excellent	**Very good**	**Poor**	**Unsatisfactory**
1. Medical care				
2. Nursing care				
3. Medical explanations on diagnosis				
4. Medical explanations on disease course and treatment				
5. Nursing advice				
6. Medical and nurses attitudes				
7. Feeling of safety and protection about home hospital/inpatient treatment				
8. Satisfaction about your home hospital/inpatient treatment				

Detailed comments

Positive aspects

.....
.....

Issues to be improved

.....
.....

Date,...../...../.....

Fig. 2. Questionnaire on customer's satisfaction

Patients in both groups received COPD-related treatment at similar rates. The incidence of selected medical complications did not differ between the two setting of care, with the exception of urinary tract infections, which were observed in about 6% of GMW patients and only in 1% of HHS patients (p=.049). There was a lower incidence of hospital readmission for HHS patients compared with GMW patients at 6-month follow-up (42% versus 87%, p<0.001). Cumulative mortality at six months was 20.2% in the total sample, without significant differences between the two study groups. Patients managed in HHS had a longer mean length of stay than those cared for in GMW (15.5 $\pm$ 9.5 v 11.0 $\pm$ 7.9 days, p = 0.010). It is important to highlight that all patients discharged from HHS had completed the care program at home, whereas 11.5% of GMW patients continued their care in long-term facility after hospital discharge, with an average daily cost of $ 174.7 for a mean period

of 25 + 8.7 days. Only HHS patients experienced improvements in depression and quality of life scores. Satisfaction at discharge was very good or excellent for 94% of HHS patients and 88% of acute hospital patients (p=0.83). On a cost per patient per day basis, HHS costs were lower than costs in GMW ($ 101.4 ± 61.3 versus $ 151.7 ± 96.4, p=0.002). Analysis of costs for hospital-at-home patients revealed that 79% of costs were due to drugs, durable medical equipment, diagnostic procedures, medications, and other nonstaff costs.

7. New key aspects of COPD management at home: Telemonitoring and teleradiology

The challenges that are posed to the health care sector in terms of using innovative tools and methods are relevant. Issues like the growing of ageing population and of citizens in chronic conditions are the focus of the last medical progress, which offer new and better treatments.

Telecare and telemedicine are promising if considered as solutions for different particular conditions, such as rural regions and all the situations where the healthcare services could cope with a shortage of specialists or equipments.

Telemedicine, moreover, connecting hospital and homes could - in some cases - contribute to avoiding the traditional hospital admission, resulting less stressful for patients, and money saving as well. Technology can also improve the quality of life by supporting informal carers, making it more likely that people receiving care and their informal carers can continue to stay active at home and in the community instead of being institutionalized. With developments in medical and other technologies, people with very complex conditions may increasingly be treated at home rather than in hospital or institutional care. In San Diego, California, physicians arrive at patients' homes with a new version of the black bag that includes a mobile x-ray machine and a device that can perform more than 20 laboratory tests at the point of care. Landers recent opinion is that "the venue of care for the future is the patient's home, where clinicians can combine old-fashioned sensibilities and caring with the application of new technologies to respond to major demographic, epidemiologic, and health care trends. Five major forces are driving health care into the home: the aging population, epidemics of chronic diseases, technological advances, health care consumerism, and rapidly escalating health care costs" (Landers, 2010).

Telemonitoring devices have been tested on an elderly HHS population in Torino. In November 2008 Telecom Italia (TI), "San Giovanni Battista" Hospital and "Mario Boella" Institute (ISMB) of Torino started a project called *MyDoctor@Home*, for telemonitoring patients affected by an acute exacerbation of COPD or acute heart failure, managed at home by the HHS of "San Giovanni Battista" Hospital.

MyDoctor@Home (Figure 3) is an e-health service that enables the patient to measure at home, with portable and Bluetooth connected medical devices, his own physiological parameters and to transmit them in real time, through a mobile phone, to a platform operating in a TI data center, accessed by the sanitary structure. The patients use the mobile phone in order to transmit the measures, and they may also receive messages reminding them to take measurements and/or to follow their medication schedule.

Through the web platform "MyDoctor@Home", physicians or nurses can monitor in real time or from remote the received measures and can interact with the patient in different modalities (telephone, video-calling, visit at home) (Figure 4).

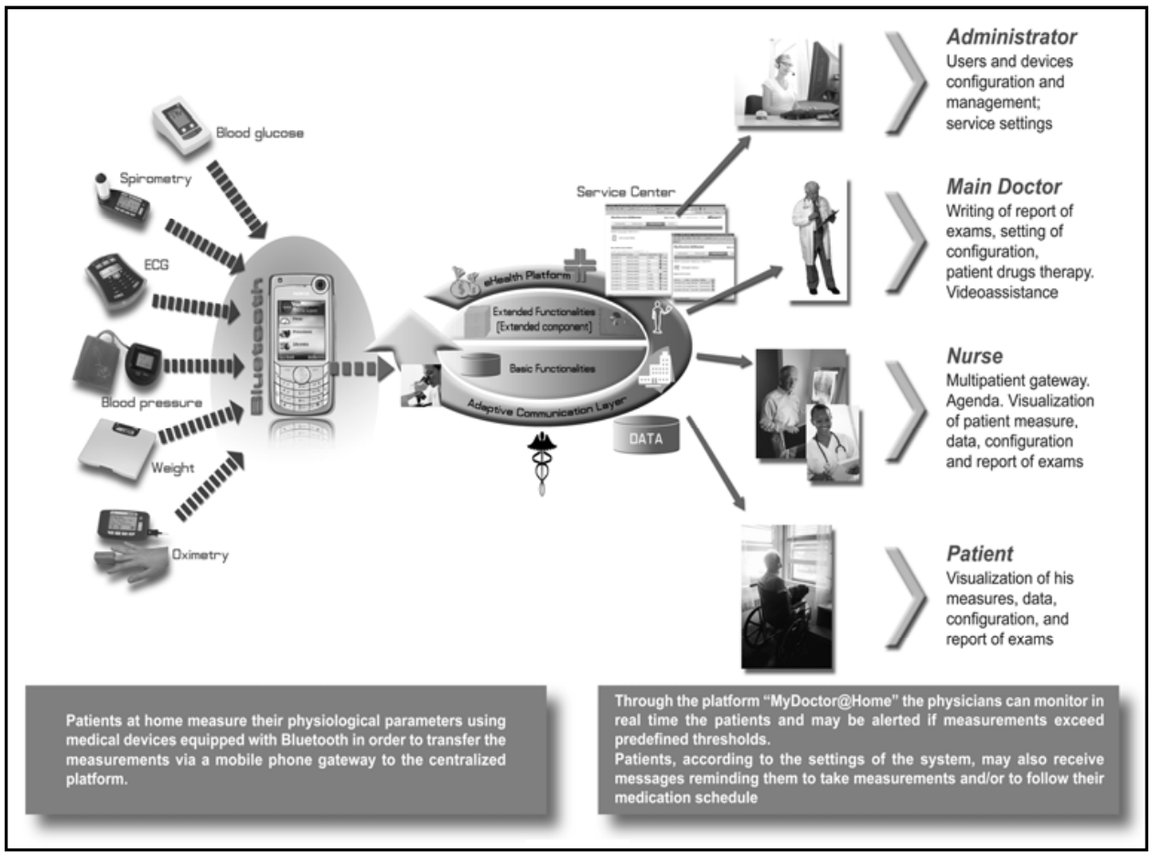


Fig. 3. The MyDoctor@Home Platform



Fig. 4. MyDoctor@Home: Computer work station at HHS office

The system enables the physician to the definition of value thresholds that can be personalized on the basis of single clinical situations. The platform informs the physician on recent measures by sending an SMS so that he can activate quickly the appropriate actions. There is a reduction of reaction times also when the nurse, during the visit at home, sends to the doctor measures performed with professional devices, like for example the ECG or the spyrometer, receiving, quickly, the feedback of the exams and instructions such as for example the variation of the therapy.

Eighteen patients have been involved in the study between June 2009 and June 2010 (27% with a COPD exacerbation), with a mean age of 86 years. All patients were functionally and cognitively impaired, with a poor quality of life. Instruments for telemonitoring resulted easy to use. The use of the equipment of telemonitoring had the benefit to avoid 24 visits by nurses and doctors on the sample in exam. Of them, 15 were substitued by phone contacts on therapy adjustments due to clinical parameter alterations registered by telemonitoring and 9 were substitued by phone counselling. Our preliminary data suggest that the use of our devises could have a reassuring role on the caregivers. Moreover, it has been demonstrated a significantly progressive reduction in the stress levels of caregivers from the baseline to the discharge (Aimonino Ricauda et al., 2011). Nevertheless, the sample size was small and the findings may not be generalizable, given that the study was conducted at only one centre and by an operationally mature hospital-at-home unit. There is the need for better quality studies in the future that can establish a clear role for telemonitoring as an adjunct to intermediate care.

Transporting radiology to the patient's home is challenging. Preliminary experiences indicate that the coupling of simple, light-weight X-ray equipment with an advanced CR-detector system proves effective for externalization of radiographic service. The image and examination quality has been proved to be the same or insignificantly lower than those performed with a stationary equipment and analysis on safety of radio-protection systems show a very low risk exposure for health staff as well as for the general population.

The study of Laerum and collegues showed that mobile, digital radiography service prove better for the nursing home patients at a compatible examination and imagine quality, and a substantially reduced cost for society (Laerum et al., 2005). The study of Sawyer concluded that domiciliary radiography services could be suitable for selected groups of patients (Sawyer et al., 1995).

A pilot study on domiciliary teleradiology service has been conducted at the HHS of Torino between June 2008 and June 2009. Acutely ill HHS patients in need of a radiological examination were randomly assigned to perform imaging at home (Intervention group, n=34) or in hospital (Control group, n=35). Inclusion criteria were: immobilization or chairbound, need for chest, pelvis/hips, joints, upper and lower limbs, hands and feet, abdomen X-rays, absence of definite delirium at enrollment according to the Confusion Assessment Method (CAM) (Inouye et al., 1990) and presence of intermediate or high risk of delirium according to the criteria of Inouye (Inouye et al., 1993), . The radiological examinations were performed at home by two qualified Radiology Technicians (RT) using a portable high frequency X-ray tube, improved cassettes (with imaging plate inside) and a mobile radiological station (Computed Radiography POC 260, Carestream) with visualization and real-time processing of acquired images (Figure 5, Figure 6). Using the Picture Archive and Communication System (PACS) of our hospital acquired images were



Fig. 5. Mobile tele-radiology station: equipment and Radiology Technicians at patient's home



Fig. 6. Mobile tele-radiology station: computed radiography system

transmitted directly via wireless broadband Internet to the radiologists in the hospital who were able to read a radiograph in real time. A firewall hardware has been used in order to protect the confidentiality of patient data. Only one radiography was performed at home in all patients, mainly a chest X-ray. All patients were very old (mean age 78 years in the entire sample), mostly multimorbid, functionally and cognitively impaired, at high risk of developing delirium in 62%. After radiological examinations an acute confusional status, according to the CAM criteria, requiring pharmacological treatment (antipsychotic drugs) appeared in 17% of patients in the Control group, whereas no one in the Intervention group developed delirium. Customer satisfaction for domiciliary X-rays was very good/excellent for 94%. This study demonstrates that a mobile, digital radiography service could be a good option for frail, vulnerable elderly and immobile patients at a compatible examination and image quality, and, due to our analysis, at a substantially reduced cost for the health care system (data in press in Arch Int J, August 2011).

8. Conclusion

Acute exacerbations of COPD are the most common cause of admission to hospital for respiratory illnesses. This causes an increased demand on hospital beds especially during the winter months. Increased provision of services in the community is one proposed method for reducing the pression on acute hospitals.

Intermediate care is a treatment model which bridges the interface between hospital and community care. It often involves cooperation between hospital doctors, general pratictioners, nurses, physioterapists and other healthcare professionals. A specific subtype of intermediate care is Hospital-at-home, were active treatment is provided by healthcare professionals in the patient's home for a condition that otherwise would require hospital care, always for a limited period. Providing acute hospital-level care in a patient's home can be a safe end efficacious alternative to hospital care, especially for frail elderly patients.

The physician-led substitutive "clinical unit" hospital-at home model of Torino provides care that substitutes entirely for an inpatient acute hospital admission; an intensity of care, including medical and nursing care, similar to that provided in the hospital, commensurate with the severity of illness treated; and care that usual community-based home care services cannot provide. Some prior studies of hospital at home for COPD have been of early discharge hospital at home models that treat patients at home with nursing care after they have been admitted to and stabilized in the acute hospital. Davies and collegues in their study of substitutive hospital at home care for COPD employed a nurse-based model that provided only twice daily nursing visits for a period of 3 days and although responsibility for patients rested with hospital physicians, patient's clinical condition did not necessarily require hospital physician's visits at home (Davies et al., 2000). Our intervention targeted very elderly patients with multiple comorbid illnesses, functional impairments and a fairly elevated degree of clinical severity, as shown by the APACHE mean score. These patients need frequent home visits by doctors, nurses and physiotherapists who work together as a team. In our experience HHS care was associated with a reduction in hospital readmission for COPD patients. In addition, HHS care was associated with improvements in quality of life and depression symptoms and a reduction in costs of care. HHS is appropriate for this target population that is especially susceptible to iatrogenic consequences of hospital care and to disruption in their common routines.

The importance of targeting appropriate interventions to appropriate patients has been seen in studies of home care services in which more intensive interventions that included multidimensional assessment were associated with positive outcomes.

Despite the evidence supporting hospital-at-home care, it has had relatively limited dissemination worldwide. Hospital-at-home care is a complex clinical model and, as such, faces substantial dissemination barriers (Leff, 2009).

Our experience suggests that a mature, physician-led, substitutive clinical unit model of hospital-at-home for elderly patients with acute exacerbation of COPD is feasible and is associated with reduction in hospital readmissions and better quality of life.

To date, the evidence base is focused nearly exclusively on patient-related outcomes, rather than on outcomes of interest to potential adopter organizations. There is a need for further studies that include a larger number of patients and an economic evaluation of direct and indirect costs. Moreover, the costs of implementation and the adoption process required within an health organization are to be well delineated.

Hospital at Home of Torino is a part of a comprehensive *continuum of services* at one end of which lies the hospital system and at the other end of which lie community services. Our model is well delineated from an organizational and administrative point of view, and may be considered an example for dissemination.

9. References

Aimonino Ricauda N., Bo M., Molaschi M., Massaia M., Salerno D., Amati D., Tibaldi V. & Fabris F. (2004). Home hospitalization service for acute uncomplicated first ischemic stroke in elderly patients: a randomized trial. *J Am Geriatr Soc* , 52, 278-283.

Aimonino Ricauda N., Isaia G., Rocco M., Tibaldi V., Bergonzini M., Fiorano T., Marinello R., Bertone P. & Isaia G.C. (2011). Il telemonitoraggio in pazienti affetti da BPCO e scompenso cardiaco acuto ospedalizzato a domicilio. *G Gerontol*, 59, 163-166. (Italian)

Aimonino Ricauda N., Isaia G., Tibaldi V., Bestente G., Frisiello A., Sciarappa A., Cavallo S., Ghezzi M. & Larini G. (2010). Telecare and Telemedicine in home care practice: field trial results, In: *Distributed Diagnosis and Home Healthcare*, Rajendra Acharya U, American Scientific Publishers.

Aimonino Ricauda N., Tibaldi V., Barale S., Bardelli B., Pilon S., Marchetto C., Zanocchi M. & Molaschi M. (2007). Depressive symptoms and quality of life in elderly patients with exacerbation of chronic obstructive pulmonary disease or cardiac heart failure: prelimunary data of a randomized controlled trial. *Arch Gerontol Geriatr*, Suppl. 1, 7-12.

Aimonino Ricauda N., Tibaldi V., Leff B, Scarafiotti C., Marinello R., Zanocchi M & Molaschi M. (2008). Substitutive "Hospital at Home" versus inpatient care for elderly patients with exacerbations of chronic obstructive pulmonary disease: a prospective randomized, controlled trial. *J Am Geriatr Soc*, 56, 493-500.

Aimonino Ricauda N., Tibaldi V., Marinello R., Bo M., Isaia G., Scarafiotti C. & Molaschi M. (2005). Acute ischemic stroke in elderly patients treated in hospital at home: a cost minimization analysis. *J Am Geriatr Soc,* 53, 1442-1443.

Anthonisen N.R., Manfreda J., Warren C.P.W., Hershfield E.S., Harding G.K.M. & Nelson N.A. (1987). Antibiotic therapy in exacerbations of chronic obstructive pulmonary disease. *Ann Intern Med*, 106, 196-204.

British Thoracic Society Guideline Development Group. (2007). Intermediate care –Hospital-at-Home in chronic obstructive pulmonary disease: British Thoracic Society guideline. *Thorax*, 62, 200-210.

Buist A.S., McBurnie M.A., Vollmer W.M., Gillespie S., Burney P., Mannino D.M., Menezes A.M.B., Sullivan S.D., Lee T.A., Weiss K.B., Jensen R.L., Marks G.B., Gulsvik A. & Nizankowska-Mogilnicka E., on behalf of the BOLD Collaborative Research Group. (2007). International variation in the prevalence of COPD (the BOLD Study): a population-based prevalence study. *Lancet*, 370, 741-750.

Burge S. & Wedzicha J.A. (2003). COPD exacerbations: definitions and classifications. *Eur Respir J*, 21, suppl. 41, 46s-53s.

Caplan G.A., Ward J.A., Brennan N.J., Coconis J., Board N. & Brown A. (1999). Hospital in the home: a randomised controlled trial. *Med J Aust,* 170, 156-160.

Caramori G. Adcock I.M. & Papi A. (2009). Clinical definition of COPD exacerbations and classification of their severity. *South Med J*, 102, 3, 277-282.

Celli B.R., , MacNee W. & committee members ATS/ERS Task Force. (2004). Standards for the diagnosis and treatment of patients with COPD: a summary of the ATS/ERS position paper. *Eur Respir J*, 23, 932-946.

Cerrillo-Rodríguez M., Alvarez-Arcaya A., Fernández-Díaz E,.& Fernández-Cruz A. (2009). A prospective study of the management of non-massive pulmonary embolism in the home. *Eur J Intern Med*, 20, 598-600.

Conwell Y., Forbes N.T., Cox C. & Caine E.D. (1993). Validation of a measure of physical illness burden at autopsy: the Cumulative Illness Rating Scale. *J Am Geriatr Soc*, 41, 38-41.

Cotton M.M., Bucknall C.E., Dagg K.D., Johnson M.K., MacGregor G., Stewart C. & Stevenson R.D. (2000). Early discharge for patients with exacerbations of chronic obstructive pulmonary disease: a randomised controlled trial. *Thorax,* 55, 902-906.

Dalal A.A., Shah M., D'Souza A.O. & Rane P. (2011). Costs of COPD exacerbations in the emergency department and inpatient setting. *Respir Med*, 105, 454-460.

Davies L., Wilkinson M., Bonner S., Calverley P.M.A. & Angus R.M . (2000). "Hospital at home" versus hospital care in patients with exacerbations of chronic obstructive pulmonary disease: a prospective randomised controlled trial. *BMJ* 321, 1265-1268.

Escarrabill J. (2009). Discharge planning and home care for end-stage COPD patients. *Eur Respir J*, 34, 507-512.

Folstein M.F., Folstein S.E. & McHugh P.R. (1975). "Mini Mental State". A practical method for grading the cognitive state of patients for the clinician. *J Psychiatr Res*, 12, 189-198.

Fried L.P., Tangen C.M., Walston J., Newman A.B., Hirsch C., Gottdiener J., Seeman T., Tracy R., Kop W.J., Burke G. & McBurnie M.A.; Cardiovascular Health Study Collaborative Research. (2001). Frailty in older adults: evidence for a phenotype. *J Gerontol A Biol Sci Med Sci,* 56, M146-M156.

Garcia-Aymerich J., Farrero E., Félez M.A., Izquierdo J., Marrades R.M. & Antò J.M., on behalf of the EFRAM investigators. (2003). Risk factors of readmission to hospital for a COPD exacerbation: a prospective study. *Thorax*, 58, 100-105.

Gavrilov L.A., Heuveline P. (2003). Aging of population, In: *The encyclopedia of population,* Paul Demeny and Geoffrey McNicoll (Eds), Macmillian Reference USA, New York.

Global strategy for the diagnosis, management, and prevention of COPD. Global Initiative for Chronic Obstructive Lung Disease (GOLD), 2009. Available at: www.goldcopd.org.

Gravil J.H., Al-Rawas O.A., Cotton M.M., Flanigan U., Irwin A. & Stevenson R.D. (1998). Home treatment of exacerbations of chronic obstructive pulmonary disease by an acute respiratory assessment service. *Lancet,* 351, 1853-1855.

Greene J.G., Smith R., Gardiner M. & Timbury G.C. (1982). Measuring behavioral disturbance of elderly demented patients in the community and its effects on relatives: a factor analytic study. *Age Ageing*, 11, 121-126.

Guigoz Y., Vellas B. & Garry P.J. (1997). Mini Nutritional Assessment: a practical assessment tool for grading the nutritional state of elderly patients. *Facts, Researche and Intervention in Geriatrics*, Suppl, 15-32.

Halbert R.J., Natoli J.L., Gano A., Badamgarav E., Buist A.S. & Mannino D.M. (2006). Global burden of COPD: systematic review and meta-analysis. *Eur Respir J*, 28, 523-532.

Hernandez C., Casas A., Escarrabill J., Alonso J., Puig-Junoy J., Farrero E., Vilagut G., Collvinent B., Rodriguez-Roisin R., Roca J. & partners of the CHRONIC project. (2003). Home hospitalisation of exacerbated chronic obstructive pulmonary disease patients. *Eur Respir J*, 21, 58-67.

Hunt S.M., McEwen J. & McKenna S.P. (1985). Measuring health status: a new tool for clinicians and epidemilogists. *J Royal Coll Gen Pract*, 35, 185-188.

Inouye S.K., van Dyck C.H,. Alessi C.A., Balkin S., Siegal A.P. & Horwitz R.I. (1990). Clarifying confusion: the confusion assessment method: a new method for detecting delirium. *Ann Intern Med,* 113, 941-948.

Inouye S.K., Viscoli C.M., Horwitz R.I., Hurst L.D. & Tinetti M.E. (1993). A predictive model for delirium in hospitalized elderly medical patients based on admission characteristics. *Ann Intern Med,* 119, 474-481.

Kalra L., Evans A., Perez I., Knapp M., Donaldson N., Swift C.G. (2000). Alternative strategies for stroke care: a prospective randomised controlled trial. *Lancet,* 356, 894-899.

Katz S., Ford A.B., Moskowitz R.W., Jackson B.A. & Jaffe M.W. (1963). Studies of illness in the aged. The index of ADL: a standardized measure of biological and psychosocial function. *JAMA*, 185, 914-919.

Knaus W.A., Draper E.A., Wagner D.P. & Zimmerman J.E. (1985). APACHE II: a severity disease classification system. *Crit Care Med*, 13, 818-829.

Laerum F., Amdal T., Kirkevold M. Kirkevold M., Engedal K., Hellund J.C., Oswold S., Borthne K., Sager E.M. & Randers J. (2005). Moving equipment, not patients: mobile, net-based digital radiography to nursing home patients. *Int Congr,* 1281, 922-925.

Landers S.H. (2010). Why health care is going home. *N Engl J Med* 363, 18, 1690-1691.

Lawton M.P. & Brody E.M. (1969). Assessment of older people: self-maintaining and instrumental activities of daily living. *Gerontologist*, 9, 179-186.

Leff B. (2009). Defining and disseminating the hospital-at-home model. *CMAJ*, 180, 2, 156-157.

Leff B., Burton L., Mader S.L., Naughton B., Burl J., Inouye S.K., Greenough W.B., Guido S., Langston C., Frick K.D., Steinwachs D. & Burton J.R. (2005). Hospital at home: feasibility and outcomes of a program to provide hospital-level care at home for acutely ill older patients. *Ann Intern Med,* 143, 798-808.

Lemelin J., Hogg W.E., Dahrouge S., Armstrong C.D., Martin C.M., Zhang W., Dusseault J.A., Parsons-Nicota J., Saginur R. & Viner G. (2007). Patient, informal caregiver and care-provider acceptance of a hospital in the home program in Ontario, Canada. *BMC Health Services Research,* 7, 130.

Levine S.A., Boal J. & Boling P.A. (2003). Home care. *JAMA*, 290, 9, 1203-1207.

Lopez A.D., Mathers C.D., Ezzati M., Jamison D.T. & Murray C.G. Global and regional burden of disease and risk factors, 2001: systematic analysis of population health data. (2006b). *Lancet*, 367, 9524, 1747-1757.

Lopez A.D., Shibuya K., Rao C., Mathers C.D., Hansell A.L., Held L.S., Schmid V. & Buist S. (2006a). Chronic Obstructive Pulmonary Disease: current burden and future projection. *Eur Respir J*, 27, 397-412.

Menezes A.M.B., Perez-Padilla R., Jardim J.R., Muino A., Lopez M.V., Valdivia G., Montes de Oca M., Talamo C., Hallal P.C. & Victora C.G., for the PLATINO Team. (2005). Chronic obstructive pulmonary disease in five Latin American cities (the PLATINO study): a prevalence study. *Lancet*, 366, 1875-1881.

Montalto M. (2002). *Hospital in the Home: Principles and Practice*. ArtWords Publishing, Melbourne.

Myles J.W., Pryor G.A., Parker M. & Anand JK. (1996). Hospital at home. Scheme in Peterborough is expanding. *BMJ,* 313, 232-233.

National Clinical Guideline Centre. (2010). Chronic obstructive pulmonary disease: management of chronic obstructive pulmonary disease in adults in primari and secondary care. London: National Clinical Guideline Centre. Available at: http://guidance.nice.org.uk/CG101/Guidance/pdf/English.

O'Donnel D.E., Hernandez P., Kaplan A., Aaron S., Bourbeau J., Marciniuk D., Balter M., Ford G., Gervais A., Lacasse Y., Maltais F., Road J., Rocker G., Sin D., Sinuff T. & Voduc N. (2008). Canadian Thoracic Society recommendations for management of chronic obstructive pulmonary disease – 2008 update – highlights for primary care. *Can Respir J,* 15 (SupplA), 1A-8A.

Ojoo J.C., Moon T., McGlone S., Martin K., Gardiner E.D., Greenstone M.A. & Morice A.H. (2002). Patients' and cares' preferences in two models of care for acute exacerbations of COPD: results of a randomised controlled trial. *Thorax,* 57, 167-169.

Peces-Barba G., Barbera J.A., Agustì À., Casanova C., Casas A., Izquierdo J.L., Jardim J., Varela V.L., Monsò E., Montemayor T. & Viejo J.L. (2008). Joint guidelines of the Spanish Society of Pulmonology and Thoracic Surgery (SEPAR) and the Latin American Thoracic Society (ALAT) on the diagnosis and management of chronic obstructive pulmonary disease. *Arch Bronconeumol*, 44, 5, 271-281.

Pérez-López J., San Josè Laporte A., Pardos-Gea J., Tapia Melenchón E., Lozano Ortín E., Barrio Guirado A. & Vilardell Tarrés M. (2008). Safety and efficacy of home intravenous antimicrobial infusion therapy in older patients: a comparative study with younger patients. I*nt J Clin Pract* , 62, 1188-1192.

Ram F.S.F., Wedzicha J.A., Wright J. & Greenstone M. (2004). Hospital at home for patients with acute exacerbations of chronic obstructive pulmonary disease: systematic review of evidence. *BMJ,* 329, 315-319.

Ram F.S.F., Wedzicha J.A., Wright J.J. & Greenstone M. (2003). Hospital at home for acute exacerbations of chronic obstructive pulmonary disease. *Cochrane Database of Systematic Reviews,* Issue 4, Art. No.: CD003573. DOI: 10.1002/14651858.CD003573.

Richards D.A., Toop L.J., Epton M.J., McGeoch R.B., Town G.I., Wynn-Thomas S.M., Dawson R.D., Hlavac M.C., Werno A.M. & Abernethy P.D. (2005). Home management of mild to moderately severe community-acquired pneumonia: a randomised controlled trial. *Med J Aust,* 183, 235-238.

Rodriguez-Roisin R. (2000). Toward a consensus definition for COPD exacerbations. *Chest* , 117, 398s-401s.

Rodriguez-Roisin R. (2006). Review Series. COPD exacerbations. 5: Management. *Thorax*, 61, 535-544.

Sawyer R.H., Patel U. & Horrocks W. (1995). Domiciliary radiography: an important service? *Clin Radiol*, 50, 51-55.

Shepperd S., Doll H., Angus M.R. Clarke M.J., Iliffe S., Kalra L., Aimonino Ricauda N., Tibaldi V. & Wilson A.D. (2009b). Avoiding hospital admission through provision of hospital care at home: a systematic review and meta-analysis of individual patient data. *CMAJ*, 180, 175-82.

Shepperd S., Doll H., Angus R.M., Clarke M.J., Iliffe S., Ricauda N. & Wilson A.D. (2008). Hospital at home admission avoidance. *Cochrane Database of Systematic Reviews,* Issue 4, Art. No.: CD007491. DOI: 10.1002/14651858.CD007491.

Shepperd S., Doll H., Broad J., Gladman J., Iliffe S., Langhorne P., Richards S., Martin F. & Harris R. (2009a). Early discharge hospital at home. *Cochrane Database of Systematic Reviews,* Issue 1, Art. No.: CD000356. DOI: 10.1002/14651858.CD000356.pub3.

Shepperd S., Iliffe S. (2001). Hospital at home versus in-patient hospital care. *The Cochrane Database of Systematic Reviews.* Issue 2. Art. No.: CD000356. DOI: 10.1002/14651858.CD000356.

Skwarska E., Cohen G., Skwarski K.M., Lamb C., Bushnell D., Parker S. & MacNee W. (2000). Randomised controlled trial of supported discharge in patients with exacerbations of chronic obstructive pulmonary disease. *Thorax*, 55, 907-912.

Smith S.M., Brame A., Kulinskaya E. & Elkin S.L. (2011). Telemonitoring and Intermediate care. *Chest*, 139, 731-732.

Stessman J., Ginsberg G., Hammerman-Rozenberg R., Friedman R., Ronen D., Israeli A. & Cohen A. (1996). Decreased hospital utilization by older adults attributable to a home hospitalisation program. *J Am Geriatr Soc*, 44, 591-598.

Tarricone R. & Tsouros A.D. (2008). *Home care in Europe. The solid facts*. Bocconi University. ISBN 978 92 890 4281 9. Milano, Italy.

Tibaldi V., Aimonino N., Ponzetto M., Stasi M.F., Amati D., Raspo S,. Roglia D., Molaschi M. & Fabris F. (2004). A randomized controlled trial of a home hospital interventions for frail elderly demented patients: behavioral disturbances and caregiver's stress. *Arch Gerontol Geriatr*, (9), 431-436.

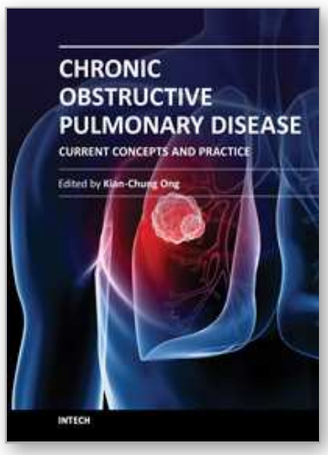
Tibaldi V., Aimonino Ricauda N., Costamagna C., Obialero R., Ruatta C., Stasi M.F. & Molaschi M. (2007). Clinical outcomes in elderly demented patients and caregiver's stress: a 2-year follow-up study. *Arch Gerontol Geriatr,* 44 (Suppl.1), 401-406.

Tibaldi V., Isaia G., Scarafiotti C., Gariglio F., Zanocchi M., Bo M., Bergerone S. & Aimonino Ricauda N. (2009). Hospital at home for elderly patients with acute decompensation of chronic heart failure. A prospective randomized controlled trial. *Arch Intern Med*, 169, 17, 1569-1575.

Wilson A., Parker H., Wynn A., Jagger C., Spiers N., Jones J. & Parker G. (1999). Randomised controlled trial of effectiveness of Leicester hospital at home scheme compared with hospital care. *BMJ*, 319, 1542-1546.

World Health Organization (WHO). (2011). Chronic obstructive pulmonary disease (COPD). Fact sheet no. 315. Available at: www.who.int/mediacentre/factsheets/fs315/en/index.html

Yesavage J.A., Brink T.L., Rose T.L., Lum O., Huang V., Adey M. & Leirer V.O. (1982). Development and validation of a geriatric depression screening scale: a preliminary report. *J Psychiatr Res*, 17, 37-49.



Chronic Obstructive Pulmonary Disease - Current Concepts and Practice

Edited by Dr. Kian-Chung Ong

ISBN 978-953-51-0163-5
Hard cover, 474 pages
Publisher InTech
Published online 02, March, 2012
Published in print edition March, 2012

A decade or so ago, many clinicians were described as having an unnecessarily 'nihilistic' view of COPD. This has certainly changed over the years... This open access book on COPD provides a platform for scientists and clinicians from around the world to present their knowledge of the disease and up-to-date scientific findings, and avails the reader to a multitude of topics: from recent discoveries in the basic sciences to state-of-the-art interventions on COPD. Management of patients with COPD challenges the whole gamut of Respiratory Medicine - necessarily pushing frontiers in pulmonary function (and exercise) testing, radiologic imaging, pharmaceuticals, chest physiotherapy, intensive care with respiratory therapy, bronchology and thoracic surgery. In addition, multi-disciplinary inputs from other specialty fields such as cardiology, neuro-psychiatry, geriatric medicine and palliative care are often necessary for the comprehensive management of COPD. The recent progress and a multi-disciplinary approach in dealing with COPD certainly bode well for the future. Nonetheless, the final goal and ultimate outcome is in improving the health status and survival of patients with COPD.

How to reference

In order to correctly reference this scholarly work, feel free to copy and paste the following:

Aimonino Ricauda Nicoletta, Tibaldi Vittoria, Bertone Paola and Isaia Giovanni Carlo (2012). Hospital at Home for Elderly Patients with Acute Exacerbation of Chronic Obstructive Pulmonary Disease, Chronic Obstructive Pulmonary Disease - Current Concepts and Practice, Dr. Kian-Chung Ong (Ed.), ISBN: 978-953-51-0163-5, InTech, Available from: http://www.intechopen.com/books/chronic-obstructive-pulmonary-disease-current-concepts-and-practice/hospital-at-home-for-elderly-patients-with-acute-exacerbation-of-chronic-obstructive-pulmonary-disea

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