School of Public Health

Alcohol consumption, smoking and lifestyle characteristics for Japanese patients with chronic obstructive pulmonary disease

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DECLARATION

To the best of my knowledge and belief this thesis contains no material previously published by any other person except where due acknowledgment has been made.

This thesis contains no material which has been accepted for the award of any other degree or diploma in any university.

Signature: …….

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ABSTRACT

This thesis investigated lifestyle characteristics including cigarette smoking, alcohol consumption, dietary supplements intake, physical activity, and urinary incontinence status for Japanese patients with chronic obstructive pulmonary disease (COPD). Field studies were conducted in the middle of Japan.

The study was conducted using a cross-sectional survey and all patients were recruited from the outpatient departments of six hospitals in three districts/prefectures, namely, Aichi, Gifu, and Kyoto. Three hundred referred COPD patients diagnosed by respiratory physicians were recruited in 2006. Inclusion criteria were (i) aged between 50 and 75 years; and (ii) had COPD as the primary functionally limiting illness which was diagnosed within the past four years.

Diagnosis of COPD was confirmed by spirometry with $FEV_1/FVC < 70\%$, where FEV_1 = forced expiratory volume in one second and FVC = forced vital capacity. A structured questionnaire was administered to collect information on lifestyle characteristics. All interviews, averaging 40 minutes, took place in the hospital outpatient departments. Clinical characteristics, height, weight and presence of any co-morbidity (e.g. diabetes, hypertension, cardiovascular disease), were retrieved from medical records.

A total of 278 eligible participants (244 men and 34 women) were available for analysis. The majority were men (88%) with mean age 66.5 (SD 6.7) years and mean body mass index (BMI) 21.9 (SD 3.6). Most of them were married (84%), had high school or below education (80%) and retired (55%).

In relation to cigarette smoking, 62 (53 male and 9 female) participants (22.5%) were current smokers of whom the great majority (89%) smoked daily. Only six (2.1%) participants were never smokers. The prevalence of smoking by time from diagnosis was: 24.5% (< 1 year), 20.6% (1-2 years), and 18.9% (2-4 years). Continuous smoking was inversely associated with age (odds ratio (OR) = 0.94, 95% confidence interval (CI) 0.90-0.98), BMI (OR = 0.88, 95% CI 0.80-0.97) and disease severity

(OR = 0.29, 95% CI 0.12-0.74 for severe COPD and OR = 0.29, 95% CI 0.09-0.92 for very severe COPD).

For alcohol consumption, 158 (150 male and 8 female) patients (56.8%) drank alcohol regularly on at least a monthly basis, the majority of them (73.4%) being daily drinkers. Beer was the most preferred alcoholic beverage drank (30.9%). Alcohol intake appeared to be positively associated with the habit of adding soy sauce to foods, whereas dyspnoea of patients posed significant limitations for them to drink alcoholic beverages. Also, female patients tended to have lower alcohol consumption levels than male patients.

Regarding dietary supplements, 117 (101 male and 16 female) participants (42.1%) were dietary supplement users, but the prevalence for female patients (47.1%) was higher than male patients (41.4%). Younger patients (≤ 60 years) and those with severe COPD had relatively low proportion of users (27.3% and 28.9%, respectively). Dietary supplementation was found to be affected by age ($p = 0.04$), COPD severity ($p = 0.03$) and presence of co-morbidity ($p = 0.03$). Older patients over 60 years were more likely to take dietary supplements (OR = 2.44, 95% CI 1.03-5.80), whereas severe COPD patients (OR = 0.41, 95% CI 0.18-0.95) and those with a co-morbidity (OR = 0.54, 95% CI 0.32-0.94) tended not to use.

With respect to physical activity of COPD patients, 198 (175 male and 23 female) of them (77%) participated in physical activities on at least weekly basis, but only 22% and 4% engaged in moderate and vigorous activities, respectively. Over 2/3 of them walked at least weekly. Regression analysis showed that perceived life-long physical activity involvement appeared to be positively associated with total physical activity, whereas patients with very severe COPD tended to have significantly lower total physical activity levels. Besides COPD severity, both age and smoking exhibited a negative impact on walking. It is evident that walking activities decreased among very severe patients, current smokers and those in advanced age.

The prevalence of urinary incontinence was 12.6% (10% for men and 32% for women). The most common occurrence of urine loss was before reaching the toilet (54%) followed by coughing/sneezing (23%). While urge incontinence was reported

by 63% of male incontinent patients, 82% of female incontinent patients experienced stress incontinence. Incontinence was more likely among female patients (OR = 8.7, 95% CI 3.2-23.4) and older patients over 70 years (OR = 2.3, 95% CI 1.0-5.2). COPD severity was also found to be a significant factor ($p = 0.007$), with very severe patients at slightly higher risk of urinary incontinence (OR = 1.1, 95% CI 0.3-3.5) than mild COPD patients, though the relationship appeared not to be linear across the severity classifications.

It is alarming to find mild and moderate COPD patients continue to smoke. The implementation of a co-ordinated tobacco control program immediately post diagnosis is needed for the effective pulmonary rehabilitation of COPD patients. The high alcohol consumption by COPD patients is also alarming. Alcohol control programs targeting male patients should be promoted during pulmonary rehabilitation in order to minimise the harm due to excessive drinking. Dietary supplements are popular for patients with COPD especially among older patients. The findings are important to clinical trials and experimental interventions advocating nutritional supplementation therapy for pulmonary rehabilitation. Patients with COPD had lower physical activity levels than the general elderly population. Older patients with very severe COPD and those who currently smoke should be targeted for intervention and encouraged to increase their participation in physical activity so as to maintain their health and well being. The high prevalence yet under-reporting of urinary incontinence suggested that education and regular assessment are needed after COPD diagnosis. Appropriate exercise and treatment tailored for the specific type of incontinence incurred should be incorporated within the rehabilitation program of COPD patients.

To maintain a healthy lifestyle and to achieve optimal outcomes during the pulmonary rehabilitation of COPD patients, the identified factors should be taken into consideration and health awareness programs should be promoted in conjunction with respiratory physicians and allied health professionals.

ABBREVIATIONS

BMI	Body Mass Index
CI	Confidence Interval
COPD	Chronic Obstructive Pulmonary Disease
FEV_1	Forced Expiratory Volume in one second
$FEV_{1.0\%}$	FEV_1/ FVC
FVC	Forced Vital Capacity
ICIQ-SF	International Consultation on Incontinence Questionnaire-Short Form
IPAQ	International Physical Activity Questionnaire
Min	Minutes
MET	Metabolic Equivalent Tasks
MRC	Medical Research Council
OR	Odds Ratio
SD	Standard Deviation

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CHAPTER 1

INTRODUCTION

1.1 Chronic obstructive pulmonary disease

Chronic obstructive pulmonary disease (COPD) is characterized by airflow limitation that is not fully reversible (Global Initiative for Chronic Obstructive Lung Disease, 2007). It is a lifestyle related disease and the main risk factor is tobacco smoking (Smit, 2001; Regional COPD working group, 2003; Butler *et al.*, 2004; Pauwels and Rabe, 2004). Patients with diagnosed COPD have symptoms that include chronic cough, production of sputum, and dyspnoea on exertion (Global Initiative for Chronic Obstructive Lung Disease, 2007). COPD was the fifth leading cause of death worldwide in 2002 and will be the fourth leading cause of death by 2030 (World Health Organization, 2007). It is expected to be the fifth leading cause of disability-adjusted life years by 2020 worldwide, just behind ischaemic heart disease, unipolar major depression, road-traffic accidents, and cerebrovascular disease (9^{th} in developed regions and 4^{th} in developing regions) (Murray and Lopez, 1996;1997).

The prevalence of smoking in Japan peaked at 83.7% for males and 18.0% for females in 1965. Since then, the prevalence of smoking has declined gradually to 41.3% for males and 12.4% for females in 2006 (Japan Health Promotion & Fitness Foundation, 2006). Nevertheless, smoking by Japanese men is still the fourth highest in the world (Japan Health Promotion & Fitness Foundation, 2006).

The COPD prevalence was conservatively estimated to be 8.6% (5% for females and 16.4% for males) with an estimated 5.3 million of the Japanese population aged > 40 years affected in 2000 (Fukuchi *et al.*, 2004). The burden of COPD has been increasing over the next 40 years in Japan because of continued tobacco consumption (Teramoto *et al.*, 2003).

According to Japanese studies, the total number of deaths from COPD increased linearly from 4000 in 1970 to over 13,600 in 2003 (Fukuchi *et al.*, 2002; Ministry of Health, Labour and Welfare, 2003). Although smoking rates have declined since the 1970s, the mortality rate caused by COPD has continued to rise as a result of the earlier increases in cigarette consumption.

Each year COPD costs Japan an estimated total of US$ 6.8 billion in terms of hospitalisation, outpatient care, home oxygen therapy, and sick leave payments. The total direct and indirect costs per patient with moderate to severe COPD was estimated to be US$ 3694 annually (Nishimura and Zaher, 2004). With increasing number of COPD patients, the burden of COPD is expected to be large. COPD is, therefore, an important public health issue.

1.2 Significance of the study

Japan has the fourth highest rate of cigarette consumption in the world (Japan Health Promotion & Fitness Foundation, 2006). Together with the aging population problem, this has resulted in the rising prevalence of COPD over the past decade. Knowledge on the characteristics of daily life of COPD patients in Japan can contribute to appropriate planning of pulmonary rehabilitation and treatment programs. To date, no epidemiological study has been published with respect to lifestyle characteristics and factors for COPD in Japan. Findings from this research will enhance the understanding of the relevant factors of this disease, which in turn can assist in the development of health promotion programs for the prevention of COPD.

1.3 Aim and objectives of the study

1.3.1 Aim

To investigate lifestyle characteristics including alcohol and cigarette consumption, dietary supplements intake, physical activity level, and urinary incontinence status in the daily life of Japanese patients with COPD.

1.3.2 Specific objectives

- To ascertain the smoking prevalence and factors affecting continuous smoking by Japanese patients within four years from diagnosis of COPD.
- To ascertain the level of alcohol intake (frequency, quantity and duration), beverage preference, and associated demographic and lifestyle factors of Japanese patients with COPD.
- To investigate the prevalence and type of dietary supplements taken by Japanese COPD patients, and to determine factors affecting their use in daily life.
- To assess the extent to which Japanese COPD patients were involved in various modes of physical activity in daily life and to determine factors affecting their physical activity levels.
- To examine the prevalence, type and characteristics of urinary incontinence among Japanese COPD patients. Demographic and clinical factors associated with urinary incontinence were also investigated.

1.4 Scope and outline of the thesis

A cross-sectional study of the consumption patterns of cigarette smoking, alcohol and dietary supplements, as well as physical activity levels in daily life and prevalence of urinary incontinence among COPD patients will be undertaken in Japan. These topics have not been thoroughly investigated in the literature.

The participants consisted of three hundred patients diagnosed with COPD within the past four years who were between 50 and 75 years of age. They were recruited from six hospitals in the middle of Japan.

Using a structured questionnaire, face-to-face interviews were conducted by the author to collect information on demographic and lifestyle characteristics, current tobacco smoking, dietary supplements intake, alcohol consumption, both current and lifelong physical activity exposure and current urinary incontinence status. In addition to univariate descriptive statistics, multivariable regression analyses were performed to quantify the effects of relevant factors on these lifestyle variables.

This thesis is presented as follows. Chapter one provides a brief introduction of the morbidity, mortality, and burden of COPD, and documents the aim and specific objectives of the study. Chapter two reviews the literature on lifestyle characteristics of COPD patients, namely, their smoking habit, alcohol intake, dietary supplement consumption, physical activity level and urinary incontinence status. Chapter three describes the methodology of the study, including the study design and location, recruitment of subjects, questionnaire and instruments used, interview and data collection procedure, and statistical analysis. Chapter four presents the detailed outcomes and results of this study. Chapter five discusses the results in relation to the literature, and provides a summary of the underlying limitations, to be followed by conclusions and recommendations based on the study findings. Additionally, information sheet, consent form, questionnaires and other relevant documents are given in the Appendices.

CHAPTER 2

REVIEW OF LITERATURE

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2.1 Introduction

Chronic obstructive pulmonary disease (COPD) is a major public health problem throughout the world. COPD was the fifth leading cause of death worldwide in 2002 and will be the fourth leading cause of death by 2030 (World Health Organization, 2007). It is expected to be the fifth leading cause of disability-adjusted life years (DALYs) by 2020 worldwide after ischaemic heart disease, unipolar major depression, road-traffic accidents, and cerebrovascular disease (Murray and Lopez, 1996;1997). COPD has a slow progression. Patients with moderate-to-severe COPD typically experience acute exacerbations of their illness, which may lead to hospitalization.

In Japan, the term COPD has only recently come into general use. COPD did not appear in Japanese government statistics until 1995. The main reason for the nearly 20-year lag behind the West in recognizing this disease was the small number of COPD cases caused by smoking at that time. The prevalence of smoking in Japan peaked in 1965 at 83.7% for males and 18% for females. The rise in the prevalence of smoking had accompanied the rapid economic growth from 1960s to 1970s. Since then the prevalence of smoking has declined gradually to 45.8% for males and 13.8% for females in 2005 (Japan Health Promotion & Fitness Foundation, 2006). Since the 1980s, the number of deaths caused by COPD has continued to rise, as a result of the earlier increases of cigarette consumption. Therefore, COPD is an important public health problem in Japan.

2.2 Definition and classifications

Several different definitions have been used for COPD in the past (Mannino, 2002). The definition given by the Global Initiative for Chronic Obstructive Lung Disease (GOLD) was disseminated worldwide and gained acceptance. The American Thoracic Society and the European Respiratory Society have acknowledged the validity of their approach and followed the GOLD definition (Celli and MacNee, 2004).

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COPD is defined as "*a preventable and treatable disease with some significant extrapulmonary effects that may contribute to the severity in individual patients. Its pulmonary component is characterized by airflow limitation that is not fully reversible. The airflow limitation is usually progressive and associated with an abnormal inflammatory response of the lung to noxious particles or gases*"(Global Initiative for Chronic Obstructive Lung Disease, 2007). Extrapulmonary effects of COPD such as weight loss, nutritional abnormalities, and skeletal dysfunction are well known (Global Initiative for Chronic Obstructive Lung Disease, 2007).

Figure 2.1 presents the mechanisms underlying airflow limitation in COPD. The airflow limitation is caused by a compound of parenchymal destruction (emphysema) and small airway disease (obstructive bronchiolitis). Chronic inflammation accounts for narrowing of the small airways, structural changes and parenchymal destruction, while parenchymal destruction leads to alveolar attachments to the small airways and lung elastic recoil (Global Initiative for Chronic Obstructive Lung Disease, 2007).

Although patients with COPD had either of two conditions, namely, chronic bronchitis and emphysema, in previous definitions of COPD (McKenzie *et al.*, 2003), they were not included in the current GOLD definition (Global Initiative for Chronic Obstructive Lung Disease, 2007).

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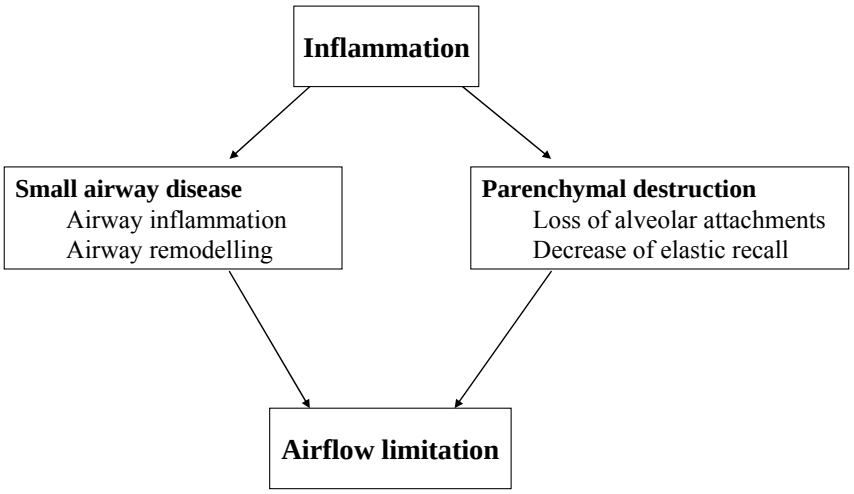
Figure 2.1 Mechanisms underlying airflow limitation in COPD (Global Initiative for Chronic Obstructive Lung Disease, 2007)



2.2.1 Natural history

COPD has a variable natural history and not all individuals follow the same course (Celli and MacNee, 2004). Continued exposure to noxious agents promotes a more rapid decline in lung function and increases the risk of repeated exacerbations (Pauwels and Rabe, 2004). Once COPD is developed, it cannot be cured (Global Initiative for Chronic Obstructive Lung Disease, 2007). If exposure to noxious agents is stopped, the disease may still progress because of the age-related decline in lung function and the persistence of aspects of the inflammatory response (Pauwels and Rabe, 2004).

2.2.2 Pathogenesis

COPD is characterized by chronic inflammation throughout the proximal airways, peripheral airways, parenchyma, and pulmonary vasculature. Inhaled noxious

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particles or gases cause the chronic inflammation and then, it leads to airflow limitation (Pauwels *et al.*, 2001). Lung inflammation is aggravated by an excess of proteases and oxidative stress in the lung (Global Initiative for Chronic Obstructive Lung Disease, 2007). Reduced respiratory function is related to increase levels of systemic inflammation (Gan *et al.*, 2004). Pathologic changes in the lungs develop pulmonary hypertension, osteoprosis, and cor pulmonale with right heart failure (Pauwels *et al.*, 2001). Additionally, COPD patients are at increased risk of skeletal muscle dysfunction because airway obstruction limits their ability to breathe (Wagner, 2006). As the disease progresses, exercise tolerance becomes limited and health status deteriorates. Thus, COPD patients have systemic manifestation (Wagner, 2006).

2.2.3 Symptoms

Patients with diagnosed COPD have symptoms that include cough, production of sputum, and dyspnoea on exertion (Global Initiative for Chronic Obstructive Lung Disease, 2007).

Cough

Chronic cough is the first symptom of COPD. It occurs intermittently, but later is present everyday (Pauwels and Rabe, 2004; Global Initiative for Chronic Obstructive Lung Disease, 2007).

Sputum production

Any pattern of chronic sputum production may indicate COPD (Pauwels and Rabe, 2004).

Dyspnoea

Breathlessness in COPD is usually the first symptom that drives patients to seek a medical consultation. It is characteristically persistent and progressive (Pauwels and Rabe, 2004). Dyspnoea is a main cause for the limiting exercise tolerance among patients (Global Initiative for Chronic Obstructive Lung Disease, 2007).

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2.2.4 Diagnosis

The diagnosis of COPD should be considered in any adult patients who has the symptoms of cough, sputum production, dyspnoea, or history of exposure to risk factors for the disease (Celli and MacNee, 2004). The diagnosis of COPD is confirmed by spirometry (Global Initiative for Chronic Obstructive Lung Disease, 2007). Although spirometry only measures a small aspect of the effect of COPD on a patient's health, it remains the gold standard for diagnosis because of high reproducibility, ease of interpretation and widespread availability (Pauwels and Rabe, 2004). Spirometry is performed according to the instructions of the American Thoracic Society and the European Respiratory Society (American Thoracic Society, 1995; Celli and MacNee, 2004).

Spirometry should measure the forced expiratory volume in one second (FEV_1) and forced vital capacity (FVC). The ratio of these measurements, $FEV_{1.0\%} = FEV_1/FVC$, is used to confirm COPD with $FEV_{1.0\%} < 70\%$. Details of the spirometric general classification are given in Table 2.1. COPD was classified into four stages of severity (GOLD criteria) (Global Initiative for Chronic Obstructive Lung Disease, 2007):

- mild ($FEV_1 \geq 80\%$ predicted; with or without chronic symptoms);
- moderate ($50\% \leq FEV_1 < 80\%$ predicted; shortness of breath typically developing on exertion and cough and sputum production sometimes present);
- severe ($30\% \leq FEV_1 < 50\%$ predicted; greater shortness of breath, reduced exercise capacity, presented fatigue, and repeated exacerbation); and
- very severe ($FEV_1 < 30\%$ predicted or $FEV_1 < 50\%$ predicted plus respiratory failure).

Because different countries use different formula, predicted FEV_1 was calculated based on the Japanese Respiratory Society's Guidelines (The Japanese Respiratory Society, 2004: pp. 6-17), viz, for Japanese men:

predicted FEV_1 (L) = 0.036*height (cm) – 0.028*age – 1.178;

for Japanese women,

predicted FEV_1 (L) = 0.022*height (cm) – 0.022*age – 0.005.

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Table 2.1 Classification of COPD by severity (Global Initiative for Chronic Obstructive Lung Disease, 2007)

Stage	**Characteristics**
I: Mild COPD	$FEV_1/FVC < 70\%$
	$FEV_1 \geq 80\%$ predicted
	With or without chronic symptoms (cough, sputum production)
II: Moderate COPD	$FEV_1/FVC < 70\%$
	$50\% \leq FEV_1 < 80\%$ predicted
	Shortness of breath typically developing on exertion and cough and sputum production sometimes present
III: Severe COPD	$FEV_1/FVC < 70\%$
	$30\% \leq FEV_1 < 50\%$ predicted
	Greater shortness of breath, reduced exercise capacity, presented fatigue, and repeated exacerbation
IV: Very Severe COPD	$FEV_1/FVC < 70\%$
	$FEV_1 \leq 30\%$ predicted or $FEV_1 < 50\%$ predicted plus respiratory failure

FEV_1 = forced expiratory volume in one second

FVC = forced vital capacity

Respiratory failure = arterial partial pressure of oxygen (PaO_2) less than 8.0 kPa (60 mmHg) with or without arterial partial pressure of CO_2 ($PaCO_2$) greater than 6.7 kPa (50 mm Hg) while breathing air at sea level

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2.2.5 Treatment

Treatment for COPD can reduce their symptoms, exacerbations, mortality and improve quality of life (Global Initiative for Chronic Obstructive Lung Disease, 2007). Effective management of COPD consists of four components: (1) Assess and monitor medical history and spirometry; (2) Reduce risk factors particularly smoking cessation; (3) Ensure stability such as exercise training, influenza vaccination, oxygen therapy and pharmacotherapy; and (4) Manage exacerbations including inhaled bronchodilators and non-invasive mechanical ventilation (Global Initiative for Chronic Obstructive Lung Disease, 2007).

2.3 Epidemiology of COPD

2.3.1 Methodological issues

Epidemiological studies have indicated that the prevalence, morbidity and mortality of COPD have increased over recent years in Asia and the USA (Mannino *et al.*, 2002; Department of Health and Human Services Center for Disease Control and Prevention, 2003). In Europe, the prevalence of COPD is projected to increase over the next 20 years before reaching a plateau, whereas the Japanese prevalence will continue to increase for the next 40 years (Teramoto *et al.*, 2003).

Despite its heavy burden, the prevalence and mortality of COPD is not well assessed (Halbert *et al.*, 2006) and often underestimated. There are several reasons (Mannino *et al.*, 1997; Rennard *et al.*, 2002; Croxton *et al.*, 2003; Regional COPD working group, 2003; Global Initiative for Chronic Obstructive Lung Disease, 2007):

1) COPD typically develops insidiously among individuals with a long history of tobacco smoking. The disease is usually not diagnosed until it is clinically apparent and moderately advanced.
2) COPD will not usually be apparent until middle age even among those who will develop COPD.
3) Different definitions of COPD are in use, making it hard to estimate the true prevalence of the disease. For example, many patients were described as suffering from emphysema, bronchitis, chronic bronchitis, chronic obstructive

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bronchitis, or obstructive lung diseases, but did not realize they had COPD. The use of multiple definitions and terminologies for COPD has complicated the epidemiological study of COPD.

4) Accurate epidemiological data on COPD are difficult and expensive to collect. Therefore, most of the available data on incidence and mortality of COPD came from developed countries.

2.3.2 Prevalence

Studies on COPD prevalence were based on spirometry, self-reported or physician diagnosis of COPD (Pauwels and Rabe, 2004).

A meta-analysis estimated that the prevalence of COPD (aged over 40 years) was 9% to 10% from 37 studies. Of those, studies using spirometry resulted in a higher prevalence (9.2%) than studies based on self-reported COPD (4.9%) (Halbert *et al.*, 2006).

In 2000, the Regional COPD working group investigated the prevalence of COPD in 12 Asian country populations aged 30 years and over using a questionnaire. The overall prevalence of COPD was 6.3%, but the rates varied two-fold amongst the 12 Asian countries (from a minimum of 3.5% in Hong Kong and Singapore to a maximum of 6.7% in Vietnam) (Regional COPD working group, 2003). The prevalence of COPD was estimated to be 6.1% in Japan.

The Nippon Epidemiology Study (NICE Study) was the first Japanese population-based trial to measure the prevalence of airflow limitation using spirometry. The study recruited 2343 subjects aged 40 years and older from the general population in 2000. The overall prevalence of COPD was at least 8.6% (16.4% for men and 5% for women), with an estimated 5.3 million Japanese over 40 years affected in 2000 (Fukuchi, 2002; Fukuchi *et al.*, 2004).

Three Japanese hospital-based spirometric studies involving 7103 to 8583 men and 4951 to 5017 women from medical check-up centers showed that the prevalence of COPD were 5.0% to 5.2% for men and 1.5% to 1.9% for women aged 40 years or

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older in 1997 to 2005 (Takemura *et al.*, 2005; Kojima *et al.*, 2007; Omori *et al.*, 2007) .

2.3.3 Mortality

COPD was the sixth most common cause of mortality in the world in 1990 (Murray and Lopez, 1997). It was the fifth leading cause of death in the world in 2002 (World Health Organization, 2002), and would be the fourth leading cause of death by 2030 (World Health Organization, 2002).

More than 2.5 million people died from COPD every year (Lopez *et al.*, 2006b). COPD was ranked the fifth leading cause of death in high-income countries (3.8% of total deaths) and the sixth leading cause of death in low-and-middle-income countries (4.9% of total deaths) in 2001 (Lopez *et al.*, 2006a).

A population-based prospective cohort study recruited 12,763 men aged 40-59 years from 16 different cohorts including Japan, Finland, Italy, Greece, former Yugoslavia, the USA, and Serbia between 1958 to1964 and followed them up for 25 years. The overall age-adjusted COPD mortality rate was 2.1%. The Japanese COPD mortality rate was relatively low at 0.4% when compared to other countries (Tabak *et al.*, 1998).

Another international study investigated death rates from COPD and allied conditions for men and women aged 35 to 74 years from 25 industrialized countries. The country with the highest death rate for men was Hungary, while Greece, Japan, and Israel had relatively low death rates. With regard to women, the highest death rate occurred in Scotland, following by New Zealand, USA, and Ireland, while lower death rates were reported in Greece, Japan, and Italy (Hurd, 2000). This study found that Japan had the second lowest death rate from COPD for both men and women. Nevertheless, the total number of deaths from COPD in Japan increased linearly from 4000 in 1970 to over 13,600 in 2003 (Fukuchi, 2002; Ministry of Health, Labour and Welfare, 2003). Japanese Ministry of Health, Labour and Welfare estimated that the death rate from COPD was 10.8 per 100,000 in 2003 and the

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disease was ranked the tenth leading cause of death (Ministry of Health, Labour and Welfare, 2003).

2.3.4 Burden of COPD

COPD accounted for 1.9% of disability-adjusted life years (DALYs) worldwide in 2000 (Lopez *et al.*, 2006b). It was ranked the seventh leading cause of DALYs in high-income countries (3.5% of total DALYs) and the tenth leading cause of DALYs in low and middle income countries (2.4% of total DALYs) in 2001 (Lopez *et al.*, 2006a). COPD is expected to be the fifth leading cause of DALYs by 2020 worldwide (Murray and Lopez, 1997).

The country with the highest financial burden for COPD was France ($14.3 billion to $74 billion), followed by Germany ($12.8 billion to $ 66.5 billion) and the USA ($12.2 billion to $ 63.2 billion). For Japan, the financial cost ranged between $8 billion and $36 billion (Tinkelman *et al.*, 2005).

COPD has significant economic effects on the Japanese healthcare system. The average length of hospital stay per admission was 37.8 days, which was longer than other respiratory diseases such as pneumonia (31.5 days) and asthma (13.3 days) (Ministry of Health, Labour and Welfare, 2003). In particular, the duration of hospitalisation for female COPD patients over 65 years was much longer at 60 days, incurring large expenditure for their inpatient stay. The total average direct cost per patient with moderate to severe COPD has been estimated to be ¥ 349000 (US$2958) annually (Nishimura and Zaher, 2004). Direct cost of COPD per patient in Japan is considerably higher when compared with other countries: $813 in Sweden; $1900 in the UK; $1500 in the USA (Pauwels and Rabe, 2004), although it is not readily comparable since the costs generally depend on the particular healthcare system of each country.

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2.4 Risk factors for COPD

COPD results from the interaction of many factors including host factors, environmental exposures and others (McKenzie *et al.*, 2003; Celli and MacNee, 2004; Pauwels and Rabe, 2004; Global Initiative for Chronic Obstructive Lung Disease, 2007). Host factors include genetic predisposition, while environmental exposures refer to polluted air, inhaled particles and gases. Worldwide, tobacco smoking is considered to be the most important aetiological factor (McKenzie *et al.*, 2003; Celli and MacNee, 2004; Pauwels and Rabe, 2004; Global Initiative for Chronic Obstructive Lung Disease, 2007). In addition, a number of factors are likely to be associated with the development of COPD.

2.4.1 Host factors

The best documented host factor is a rare hereditary deficiency of alpha-1 antitrypsin (Global Initiative for Chronic Obstructive Lung Disease, 2007). Individuals with a severe deficiency for alpha-1-antitrypsin who smoke cigarettes tend to develop more severe COPD at an earlier age than do non-smokers with a severe deficiency (Pauwels and Rabe, 2004). All patients with airflow limitation and family history of respiratory illness, and patients presenting with airflow limitation at relatively early age (40s or 50s) should be considered and evaluated for alpha-1 antitrypsin (Celli and MacNee, 2004). However, only 1% to 2% of COPD are attributed to alpha-1 antitrypsin (Mahadeva and Lomas, 1998). Other genes involved in the pathogenesis of COPD have not yet been identified (Global Initiative for Chronic Obstructive Lung Disease, 2007).

2.4.2 Environmental exposures

The main environmental factors are tobacco smoke, occupational dusts and chemicals (fumes, vapours, and irritants), and indoor and outdoor air pollution (Global Initiative for Chronic Obstructive Lung Disease, 2007); see Figure 2.2. In particular, cigarette smoking is the principle cause of COPD. The contributions to the burden of COPD from occupational exposure and from outdoor air pollution are

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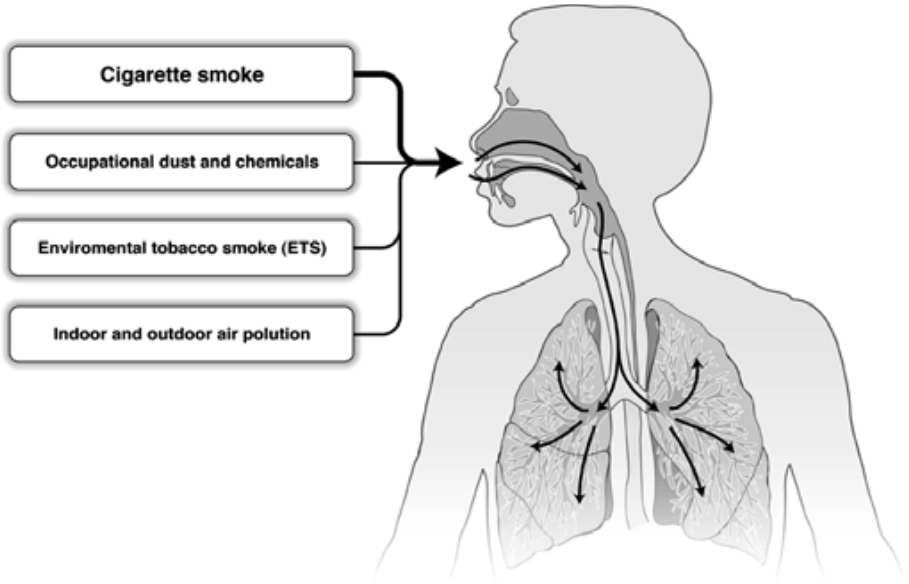
small when compared with smoking. However, its exact role in causing COPD is less clear (Regional COPD working group, 2003).

Figure 2.2 Risk of COPD: inhalational exposures (Global Initiative for Chronic Obstructive Lung Disease, 2007)



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2.4.2.1 Cigarette smoking

Of all COPD patients 95% are current smokers or ex-smokers (Madison and Irwin, 1998). Smoking with at least 20 pack-years is the main etiological factor (MacNee, 2000). A prospective study with 40 years follow up among 1711 Finish men aged 40 to 59 years reported that the incidence rate of COPD was 32% for continuous smokers, but 14% for ex-smokers and 12% among never-smokers (Pelkonen *et al.*, 2006). Another prospective study with 25 years follow-up involving 8045 men and women aged 30 to 60 years found that the highest incidence of 35.5% was reported among continuous smokers, while never smokers had the lowest incidence of 7.8% (Lokke *et al.*, 2006). In addition, cigarette smoking leads to a greater decline in lung function and development of respiratory symptoms (Tashkin *et al.*, 1994; Tabak *et al.*, 1998; Tabak *et al.*, 2001b). Also, environmental cigarette smoking is associated with a greater risk of COPD (Eisner *et al.*, 2005), while maternal smoking during pregnancy affects the lung function of infants (Tager *et al.*, 1995).

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Cigarette smoking has the harmful effect of increased oxidative stress on the lung directly and indirectly. An imbalance of oxidant and antioxidant in the lung may play a role in COPD development via biological actions (MacNee, 2000). Smoking not only has direct negative impacts on lung function, it also created an altered pattern of demand for specific nutrients (Margetts and Jackson, 1993). Two studies investigating the relationship between smoking and dietary habits in the UK revealed that smokers were more likely to consume cooked meat dishes, sugar, butter, and whole milk, but less intake of wholemeal bread, high fibre breakfast cereals, fruit, and carrots (Whichelow *et al.*, 1991; Margetts and Jackson, 1993). Smokers might have an imbalance between the metabolic demand for antioxidant protection and the dietary intake of antioxidant nutrients (Margetts and Jackson, 1993). This imbalance will also lead to oxidative damage in the lung.

Furthermore, it is known that continuous smoking increases the risk of death from COPD. A population-based prospective cohort study among 12,763 men aged 40-59 years from 16 different sites including Japan found a 2.4 fold higher risk of death from COPD for baseline smokers compared to non-smokers (95% CI 1.8-3.2) (Tabak *et al.*, 1998). A longitudinal study of 2,953 middle-aged men across three European countries observed a 20-year COPD mortality rate of 2.2 per 1,000 person-years for

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current smokers, as compared to 1.7 for former smokers and 0.6 for never smokers. Moreover, the COPD mortality was positively associated with smoking, the relative risk being 1.08 per 5 pack-years (95% CI 1.01-1.16) (Tabak *et al.*, 2001b). Another study of 47 COPD patients with chronic hypercapnia also found that current smoking increased the mortality risk by 7 fold (Nizet *et al.*, 2005).

In summary, smoking has many harmful effects. The overwhelming strength of the evidence has led to the incorporation of smoking cessation program as a key element of COPD prevention (Margetts and Jackson, 1993).

2.4.2.2 Occupational dust and chemicals

Occupational dusts and chemicals such as vapours, fumes and irritants occupied 10% to 20% of all causes for functional impairments or symptoms of COPD (Balmes *et al.*, 2003).

2.4.2.3 Indoor and outdoor air pollution

High levels of urban air pollution have harmful effect on COPD. Also, indoor air pollution such as heating and cooking by biomass fuel and poor ventilation can increase the risk of COPD, especially among women in developing countries (Anto *et al.*, 2001; Pauwels *et al.*, 2001).

2.4.3 Other factors

2.4.3.1 Gender

Unlike Japan, recent studies suggested that the prevalence of COPD is almost equal between males and females (Mannino *et al.*, 2002; Global Initiative for Chronic Obstructive Lung Disease, 2007; World Health Organization, 2007), although it was thought that prevalence and mortality of COPD was higher in men than in women (Global Initiative for Chronic Obstructive Lung Disease, 2007). Conversely, studies reported that females were more susceptible to the development of severe COPD than males (Xu *et al.*, 1994; Silverman *et al.*, 2000). Thus, the role of gender is still unclear.

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2.4.3.2 Lung growth

Lung growth is related to processes occurring during gestation, birth weight, and exposures during childhood including nutrition and infection (Global Initiative for Chronic Obstructive Lung Disease, 2007). Impaired growth of lung function, caused by frequent infections or tobacco smoking, may lead to lower maximally achieved lung function in early maturity (Celli and MacNee, 2004).

2.4.3.3 Age

Age is a significant risk factor for COPD. Subjects 70 years old or over were at 13-times higher risk for developing COPD within the population of smokers (Watson *et al.*, 2002). Moreover, age contributes considerably to the pack-years smoked by smokers.

2.4.3.4 Oxidative stress

Oxidative stress derived from smoking and other inhaled particulates produces direct injurious effects on the lung and activates molecular mechanisms which initiate lung inflammation. The imbalance between antioxidants and oxidants may contribute to the pathogenesis of COPD (MacNee, 2005).

2.4.3.5 Respiratory infections

Infections may play a role in the pathogenesis and progression of COPD. For example, severe emphysema was related to increase in the number inflammatory cells in the lung tissue and air spaces (Retamales *et al.*, 2001). Bacterial colonization is associated with airway inflammation and it may contribute to progressive COPD (Sethi *et al.*, 2006).

2.4.3.6 Socioeconomic status

Socio-economic status is a composite index of education, occupation, and income. Level of education is widely accepted as a valid measure of socio-economic status. Level of education, social class, and occupation are closely correlated. Education will affect health status while poor health may lead to low income (Prescott *et al.*, 1999). Poor housing condition, house dust, home humidity, and gas stove usage are associated with respiratory symptoms, declining lung function, and lower socio-economic status (Prescott *et al.*, 1999).

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A Copenhagen study examined the association between socio-economic status and respiratory disease by gender and age among 14223 subjects aged 20-90 years (Prescott *et al.*, 1999). The study showed that income and education were related to FEV_1 and FVC independently and the socioeconomic index was associated with lung function (FEV_1) (Prescott *et al.*, 1999). In summary, the evidence for socio-economic status on COPD is insufficient, although one study suggested the link between lung function and socio-economic status. Further confirmation is thus required.

2.4.3.7 Nutrition

The association between nutrition and risk of COPD is unclear (Global Initiative for Chronic Obstructive Lung Disease, 2007). Weight loss and malnutrition may reduce respiratory and periphery muscle strength and exercise tolerance.

2.4.3.8 Asthma

Asthma may contribute to the development of COPD, though convincing evidence is lacking. A prospective cohort study of 3099 adults with over 20 years of follow-up showed that participants with active asthma had significantly higher risk of COPD (hazard ratios = 12.5, 95% confidence interval (CI) 6.84-22.84) compared to those with inactive asthma and non-asthmatic subjects (Silva *et al.*, 2004).

2.5 Lifestyle characteristics of COPD patients

2.5.1 Continuous smoking after COPD diagnosis

It is known that continuous smoking increases the risk of death from COPD. A longitudinal study of 2953 middle-aged men across three European countries observed a 20-year COPD mortality rate of 2.2 per 1000 person-years for current smokers, as compared to 1.7 for former smokers and 0.6 for never smokers. Moreover, the COPD mortality was positively associated with cumulative smoking, the relative risk being 1.08 per 5 pack-years (95% CI 1.01-1.16) (Tabak *et al.*, 2001b). Another study of 47 COPD patients with chronic hypercapnia similarly showed that continuous smoking increased the mortality risk seven times (Nizet *et al.*, 2005).

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In the literature, prevalence of continuous smoking after COPD diagnosis has been reported to range between 27% and 36% (Nishimura *et al.*, 2002; van der Valk *et al.*, 2002; Nizet *et al.*, 2005; Coultas *et al.*, 2007; Lindberg *et al.*, 2007; Soriano *et al.*, 2007). A cohort study in Sweden reported that persistent smokers and re-starters tended to be younger among COPD patients aged 47-77 years (Lindberg *et al.*, 2007). However, an extensive literature search found little information on tobacco consumption pattern such as maximum and average number of cigarettes intake per day and duration of smoking. In view of the adverse effects of smoking addiction, the present study thus ascertained the smoking pattern and factors affecting continuous smoking by COPD patients in Japan. The findings are important for improving the management and rehabilitation of COPD patients.

2.5.2 Alcohol consumption

The harmful health effects and social consequences of alcohol have been well documented (Higuchi *et al.*, 2007). Besides being a major cause of liver cirrhosis, oropharyngeal and oesophageal cancers (World Health Organization, 2004), alcohol is associated with coronary heart disease and cardiovascular disease, though a U- or J-shaped relationship has been recognized (Murray *et al.*, 2002; Burke *et al.*, 2007). It is known that the risks of breast cancer and prostate cancer increase even with moderate alcohol intake (World Health Organization, 2004). Moreover, alcohol consumption is linked to all-cause mortality in Japan (Tsugane *et al.*, 1999; Nakaya *et al.*, 2004).

Although heavy alcohol consumption have deleterious effects on the lungs, recent and lifetime wine intake may improve pulmonary function (Schünemann *et al.*, 2002). A USA study involving 15294 adults reported altered pulmonary function and a reduced risk for lung restriction at modest levels of alcohol intake (Sisson *et al.*, 2005). The MORGEN study of 13651 Dutch subjects aged 20-59 years showed that the prevalence of COPD symptoms was lower in light drinkers (1-30 g/day) than both non-drinkers and moderate or heavy drinkers (Tabak *et al.*, 2001a). Similarly, a 20-year longitudinal study of 2953 middle-aged men across three European countries found a U-shaped relation between alcohol consumption and COPD mortality, with

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better lung function and lower relative risk of COPD mortality among light drinkers than non-drinkers and occasional drinkers (1-10 g/week), but a higher relative risk of COPD mortality for moderate-to-heavy drinkers (40-120 g/day) (Tabak *et al.*, 2001b). Despite such associations between alcohol and COPD, an extensive literature search found no published report on alcohol consumption by COPD patients in daily life. The present study therefore aimed to ascertain the level of alcohol intake, beverage preference, and associated demographic and lifestyle characteristics of Japanese patients with COPD.

2.5.3 Dietary supplements intake

The effects of dietary supplementation on patients with respiratory diseases have been extensively investigated in the literature. For example, vitamin E could reduce the risk of pneumonia among male smokers (Hemila *et al.*, 2004; Hemila *et al.*, 2006), and fish oil appeared to be protective for asthmatic patients suffering from exercise-induced bronchoconstriction (Mickleborough *et al.*, 2003; Mickleborough *et al.*, 2006). However, the relationship between nutritional supplements and respiratory diseases such as cystic fibrosis and asthma remained uncertain (Beckles Willson *et al.*, 2002; Pearson *et al.*, 2004; Shaheen *et al.*, 2007).

Several clinical trials and experimental interventions have examined the beneficial effects of dietary supplements on the exercise capacity and lung function of COPD patients. Evidence suggested that vitamin E could lower plasma lipid peroxide levels and thus prevent further oxidative damage (Daga *et al.*, 2003). A diet rich in omega-3 polyunsaturated fatty acids was shown to induce anti-inflammatory effects in the treatment of COPD (Matsuyama *et al.*, 2005), while pulmonary function could be improved by vitamin A supplementation (Paiva *et al.*, 1996). Another randomised trial demonstrated that pulmonary rehabilitation combined with oral creatine supplements led to increases in fat-free mass, peripheral muscle strength and endurance but not exercise capacity (Fuld *et al.*, 2005). Results of a systematic review concluded that nutritional supplements could improve the muscle strength, walking distance and the well-being of COPD patients (Stratton, 2000). Nevertheless, the efficacy of treating COPD patients by nutritional supplementation

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therapy is still inconclusive (Knowles *et al.*, 1988; Vermeeren *et al.*, 2001; Cai *et al.*, 2003; Creutzberg *et al.*, 2003; Steiner *et al.*, 2003).

Despite the immense interests of dietary supplements in pulmonary rehabilitation, a comprehensive literature search found only one published article documenting their usage in the daily life of COPD patients (George *et al.*, 2004). This descriptive study of 173 COPD patients in Australia reported a prevalence of 41% which was higher than that of the general population. Although in-depth interviews suggested that degree of knowledge, belief, and individual attitudes influenced the decision of patients to use supplements (George *et al.*, 2004), no quantitative analysis was undertaken to account for demographic and lifestyle confounders. The present study therefore aimed to ascertain the prevalence and type of dietary supplements taken by COPD patients in Japan, and to determine factors affecting their use in daily life.

2.5.4 Physical activity level in daily life

A sedentary lifestyle is one of the important risk factors for chronic illnesses (World Health Organization, 2007). The Centers for Disease Control in the USA have developed guidelines on physical activity for adults, recommending a minimum of 30 minutes of moderate activity daily (Pate *et al.*, 1995). Pulmonary rehabilitation programs have been launched for COPD patients that include physical exercise, such as muscle strength training, stationary cycle ergometer and walking (Nici *et al.*, 2006). A study of 151 ambulatory COPD patients in the USA demonstrated that pulmonary rehabilitation program could improve quality of life as well as exercise capacity (Berry *et al.*, 1999).

Physical activity in daily life contributes to the health and well being of COPD patients. In a Finnish study involving 186 men aged 40-59 years who were followed up for 25 years, those with increased physical activity had a slower decline in pulmonary function than the general population (Pelkonen *et al.*, 2003). Physical activity was found to reduce the risk of COPD among smokers in a Spanish population-based cohort study of 6790 participants (Garcia-Aymerich *et al.*, 2007). COPD patients who had regular physical activity appeared to incur lower risks of hospitalization and mortality (Garcia-Aymerich *et al.*, 2006). However, most COPD

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patients in Spain took part in very little or no regular physical activity (Garcia-Aymerich *et al.*, 2004). Indeed, COPD patients had significantly lower physical activity levels than healthy people according to three case-control studies conducted in the UK, Brazil and Australia (Pitta *et al.*, 2005b; Sandland *et al.*, 2005; McGlone *et al.*, 2006).

Apart from these few studies investigating physical activity of COPD patients, results concerning predictors of physical activity were also inconclusive. Two cross-sectional studies of 346 patients in Spain and 176 patients in Australia and a small case-control study involving 42 subjects in the UK suggested that long-term oxygen therapy (LTOT) was associated with lower physical activity levels (Okubadejo *et al.*, 1997; Garcia-Aymerich *et al.*, 2004; McGlone *et al.*, 2006). However, no conclusion on causation could be established because LTOT limited mobility while patients with LTOT had more severe COPD. The analyses were inconsistent after the inclusion of confounding factors such as age, sex, socioeconomic status, excessive alcohol intake, diabetes, depression and poor health status (Okubadejo *et al.*, 1997; Mackenbach *et al.*, 2001; Garcia-Aymerich *et al.*, 2004; McGlone *et al.*, 2006).

Recognising the importance of physical activity to the pulmonary rehabilitation of COPD patients, the present study determined the extent to which Japanese COPD patients were involved in various modes of physical activity and examined factors affecting their physical activity levels. An extensive literature search found no published report of physical activity in the daily life of Japanese patients with COPD.

2.5.5 Urinary incontinence status

As COPD progresses, one of the associated clinical conditions, urinary incontinence, will become more common (Hirayama *et al.*, 2005). The prevalence of urinary incontinence is known to be higher for women and increases with age (Hald, 2002: pp. 175-191). It is a disorder that affects the lifestyle, physical and psychological well-being of many older adults (Yip and Cardozo, 2007). The financial impacts on both individuals and the healthcare system are also high (Doran *et al.*, 2001). Urinary incontinence has been recognised as a worldwide problem for women with cystic fibrosis (Dodd and Langman, 2005). However, there is little reference to

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incontinence in COPD. A population-based study in the USA found an increased risk of incontinence among 856 older women with COPD, with an odds ratio (OR) of 1.4 (95% CI 1.1-1.9) (Brown *et al.*, 1996). Another study of 1584 community-dwelling women aged 70 to 79 years reported that incontinence, at least once per week, was experienced by a quarter of the 209 women with COPD, and a 5.5-fold increased odds of stress incontinence was evident among this disease subgroup (Jackson *et al.*, 2004). Similarly, a cross-sectional study of 2398 Italian elderly people over 65 years suggested a higher risk of urinary incontinence in women with COPD (OR = 1.5, 95% CI 1.1-2.1), but the prevalence of incontinence and associated sample sizes were not given (Maggi *et al.*, 2001). However, an extensive literature search found no published report on the prevalence, type and characteristics of urinary incontinence among COPD patients in Japan. Therefore, this study assessed the prevalence, type and characteristics of urinary incontinence among COPD patients in Japan. Demographic and clinical factors associated with urinary incontinence were also investigated. The findings are important for controlling the cost and burden of this distressing condition.

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CHAPTER 3

METHODOLOGY

This chapter describes the research methods including study location, study design, data collection procedure, research instruments, statistical analysis, and ethical considerations.

3.1 Study location

The study was conducted in Aichi, Gifu and Kyoto located in the middle of Japan. Aichi is the fourth largest prefecture in Japan after Tokyo, Kanagawa, and Osaka. Aichi prefecture has a population of 7.4 million with 2.9 million households and the population density is 1430 people/km^2. Gifu prefecture has a population of 2.1 million with 0.71 million households and the population density is 198 people/km^2. Kyoto has a population of 2.6 million with 1.1 million households and the population density is 572 people/ km^2 (Ministry of Internal Affairs and Communications, 2007).

Figure 3.1 Location of Aichi, Gifu, and Kyoto, middle of Japan

3.2 Study design and data collection procedure

The study was conducted by cross-sectional survey and the participants were referred from the outpatient departments of six hospitals in 2006:

- Department of Respiratory Medicine and Allergy, Tosei General Hospital, Seto, Aichi;
- Department of Respiratory Medicine and Allergy, Komaki City Hospital, Komaki, Aichi;
- Department of Respiratory Medicine and Clinical Immunology, Toyota Kosei Hospital Aichi Prefectural Welfare Federation of Agricultural Cooperatives, Toyota, Aichi;
- Department of Respiratory Medicine, Ichinomiya Municipal Hospital, Ichinomiya, Aichi;
- Department of Respiratory Medicine, Ogaki Municipal Hospital, Ogaki, Gifu;
- Respiratory Division, Kyoto-Katsura Hospital, Nishi-kyoku, Kyoto.

Three hundred COPD patients diagnosed by respiratory physicians were recruited. Patients were included in this study provided that they (i) were aged between 50 and 75 years; and (ii) had COPD as the primary functionally limiting illness which was diagnosed within the past four years. The patients were excluded if their ages were above 75 or below 50 years, their diagnosis was made more than four years ago, or if they had recent stroke, dementia or other conditions that prohibited them from answering the questions or recalling their lifestyle habits. Effort was made to ensure the correct identification of COPD patients in the participating hospitals through medical records, and confirmed by pulmonary function test using spirometry and screening questionnaires.

The sampling from different hospitals helped to minimise recruitment bias. To minimise recall error and inter-interviewer bias, face-to-face interviews were conducted entirely by the principal investigator. The advantages of face-to-face interviews include high response rate, immediate and accurate answers, and easy administration.

3.3 Research instruments

3.3.1 COPD severity and spirometry

According to the Global Initiative for Chronic Obstructive Lung Disease (GOLD) (Global Initiative for Chronic Obstructive Lung Disease, 2007), diagnosis of COPD was confirmed by spirometry with $FEV_1/FVC < 70\%$. COPD was classified into four stages of severity (GOLD criteria) (Global Initiative for Chronic Obstructive Lung Disease, 2007): mild ($FEV_1 \geq 80\%$ predicted; with or without chronic symptoms), moderate ($50\% \leq FEV_1 < 80\%$ predicted; shortness of breath typically developing on exertion, cough and sputum production sometimes present), severe ($30\% \leq FEV_1 < 50\%$ predicted; greater shortness of breath, reduced exercise capacity, presented fatigue, and repeated exacerbation), and very severe ($FEV_1 < 30\%$ predicted or $FEV_1 < 50\%$ predicted plus chronic respiratory failure). Predicted FEV_1 was calculated based on the Japanese Respiratory Society's Guidelines (The Japanese Respiratory Society, 2004: pp. 6-17), viz, for Japanese men:

predicted FEV_1 (L) = 0.036*height (cm) – 0.028*age – 1.178;

for Japanese women,

predicted FEV_1 (L) = 0.022*height (cm) – 0.022*age – 0.005.

In addition, two screening instruments, Medical Research Council dyspnoea scale (Bestall *et al.*, 1999) and the Australian Lung Foundation's Feeling Short of Breath scale (The Australian Lung Foundation, 2004), were used to confirm the COPD diagnosis of each individual. Meanwhile, clinical characteristics including lung function (FEV_1, FVC and $FEV_{1.0\%}$), height, weight and presence of any co-morbidity (e.g. diabetes, hypertension, cardiovascular disease), were retrieved from medical records.

3.3.1.1 Medical Research Council dyspnoea scale

In this study, the Medical Research Council (MRC) dyspnoea scale, translated into Japanese, was applied to screen for COPD. The MRC dyspnoea scale has been used for grading the breathlessness of patients on daily activity for many years. The scale measures perceived respiratory disability (Bestall *et al.*, 1999). It is simple to administer and indicates the extent to which patient's breathlessness affects their mobility.

The MRC dyspnoea scale is a five-item questionnaire (Johnson *et al.*, 2004):

1. breathlessness with strenuous exercise;
2. breathlessness when hurrying;
3. walk slower than people of the same age on the level or stop for breath while walking at own pace on the level;
4. stop for breath after 100 yards or after a few minutes on the level;
5. too breathlessness to leave the house.

A copy of the MRC dyspnoea scale is given in Appendix C.

It has been classified that MRC dyspnoea scale 3, 4, and 5 corresponded to moderate to severely disabling COPD (Wedzicha *et al.*, 1998; Bestall *et al.*, 1999). A study showed that the MRC dyspnoea scale together with the visual analogue scale were simpler and easier to determine clinically significant changes for patients' dyspnoea (de Torres *et al.*, 2002). They pointed out the Chronic Respiratory Disease Questionnaire (CRQ) was the most sensitive measure. It was concluded that the MRC dyspnoea scale and the CRQ dyspnoea evaluate similar domains (de Torres *et al.*, 2002).

3.3.1.2 Feeling short of breath scale

This questionnaire consisted of five simple questions:

1. Do you cough several times most days?
2. Do you bring up phlegm or mucous most days?
3. Do you get out breath more easily than others your age?
4. Are you over 40 years old?
5. Are you smoker or ex-smoker?

If participants answer yes to three or more of the above questions, they are more likely to suffer COPD (The Australian Lung Foundation, 2004). Appendix D gives the Feeling Short of Breath scale.

3.3.2 Questionnaire and interview

A structured questionnaire was administered to collect demographic information, including age, gender, height, weight, marital status (single, divorced or separated; married), education level (high school or below; college or university), location of

residence (urban; rural), retirement status (working; retired), dietary habits, a diagnosis of co-morbidity at any time (presence or absence), together with lifestyle characteristics such as current smoking and alcohol consumption, dietary supplements intake, physical activity levels, urinary incontinence status in daily life. Body mass index (BMI) was calculated as weight/height^2. A copy of the questionnaire is given in Appendix E. Each interview was conducted face-to-face by the principal investigator. Appointments with patients were made via their respiratory physicians. All interviews, averaging 40 minutes, took place in the hospital outpatient departments.

3.3.2.1 Measurement of cigarette consumption

Information on cigarette smoking was obtained using a validated questionnaire (Jian *et al.*, 2006). Smoking status was classified into never, ex- and current (regular/irregular) smoker. Current smokers and ex-smokers were then asked to report their smoking duration and maximum number of cigarettes ever smoked per day. Habitual tobacco consumption level was categorised as: 1 to 19 cigarettes (< 1 pack) per day, 20 to 39 cigarettes (1-2 packs) per day, and 40 or more cigarettes (≥ 2 packs) per day. Ex-smokers were also asked how long they had ceased smoking. A copy of the form is provided in Appendix F.

3.3.2.2 Measurement of alcohol consumption

Information on alcohol drinking was obtained using the validated and reliable food frequency questionnaire developed by the Japan Epidemiological Association (Japan Epidemiological Association, 2003). Participants drinking alcoholic beverages (sake, shochu, beer, whisky, and wine) at least once per month were asked to report the average quantity consumed for each beverage type and their frequency of intake in six levels: almost never, 1 to 3 days per month, 1 to 2 days per week, 3 to 4 days per week, 5 to 6 days per week, and almost daily. Participants were subsequently classified as either non-drinker (abstainer, ex-drinker) or drinker (at least once per month to daily) for statistical analysis. Both sake and shochu are popular Japanese traditional beverages.

To evaluate alcohol intake, the ethanol amount in each beverage type was taken to be: 15% in sake, 25% in shochu, 5% in beer, 43% in whisky, and 14% in wine (Ministry

of Health, Labour and Welfare, 2006). For each alcoholic beverage, alcohol intake (g/day) was calculated by multiplying the average quantity of beverage taken (ml) per day and ethanol concentration (%), with the specific gravity of ethanol (0.792). The following conventional measurements of quantity were adopted: sake and shochu (180 ml/cup), whisky (30 ml/glass), wine (60 ml/glass), beer (633 ml/bottle). Total alcohol intake (g/day) was then the sum of the amounts from the five beverages. Finally, the monthly alcohol consumption for each individual was given by the product of total alcohol intake (g/day) and his/her frequency of drinking (days/ month). A person was regarded as a heavy drinker if his/her mean daily alcohol intake exceeded 60g (Ministry of Health, Labour and Welfare, 2000). A copy of the alcohol consumption questionnaire is given in Appendix G.

3.3.2.3 Measurement of dietary supplements intake

Specific dietary supplements were classified into five categories, namely, multivitamin, beta-carotene, vitamin C, vitamin E, and miscellaneous, following the convention adopted by the Japan Public Health Center-based prospective study on cancer and cardiovascular disease (Ishihara *et al.*, 2003). The brand name, frequency, duration and dosage of all supplements consumed by each participant were recorded. Users of dietary supplements were defined as subjects who used at least one category of dietary supplement on a weekly basis for one year or longer (Ishihara *et al.*, 2003). Appendix H gives the form to record the intake of dietary supplements.

3.3.2.4 Measurement of physical activity

Physical activity was measured using the International Physical Activity Questionnaire (IPAQ) (Craig *et al.*, 2003), which was developed as a tool for cross-national monitoring of physical activity and inactivity. It has been translated into many languages and modified slightly to be culturally relevant, while reliability and validity have been established in 12 countries including Japan (Craig *et al.*, 2003). Both short and long versions of the questionnaire are available. The long version consists of 31 items on household and yard work activity, leisure-time physical activity, self-powered transport, occupational activity and sedentary activity. The short version consists of nine items about time spent: in walking (frequency, duration and pace), in vigorous activity (frequency and duration), in moderate activity (frequency and duration) and in sedentary activity (duration on weekday and

weekend). Because older people are more prone to memory problems, the present study adopted the short Japanese version of IPAQ translated by Murase and colleagues (Murase *et al.*, 2002).

The IPAQ incorporates a scoring mechanism whereby each activity is assigned an intensity code expressed in terms of metabolic equivalent tasks (MET). The MET is the ratio of metabolic rate during the activity compared with the metabolic rate during rest. For each type of activity, the weighted MET minutes (min) per week is calculated as follows:

- Walking MET min per week = 3.3*walking min*walking days,
- Moderate MET min per week = 4.0*moderate intensity activity min*moderate days,
- Vigorous MET min per week = 8.0*vigorous intensity activity min*vigorous intensity days.

The total physical activity MET min per week is then computed by summing the walking, moderate and vigorous MET min per week scores.

Information was also solicited on the duration of sedentary activities including sitting, lying, leisure time and studying, with questions such as "how many minutes per day did you sit on weekday" and "how many minutes per day did you sit on weekend". The short version of IPAQ administered in this study is provided in Appendix I.

The IPAQ was complemented by a further question on 'life-long physical activity involvement', defined as "doing active sports or vigorous exercise long enough to get sweaty, at least twice a week", over the entire life course (O' Brien Cousins and Tan, 2002). Response options were categorised as: "has never been involved to intermittently involved in such activity" and "has always been involved in such activity".

3.3.2.5 Measurement of urinary incontinence

The International Consultation on Incontinence Questionnaire-Short Form (ICIQ-SF), developed under the auspices of the second International Consultation on Incontinence (Hald, 2002: pp. 267-316), was used to assess urinary incontinence. It is a subjective measure for evaluating the severity of urinary loss and condition-

specific quality of life. The reliability, validity, and sensitivity of the ICIQ-SF have been established (Avery *et al.*, 2004; Karantanis *et al.*, 2004), while linguistic validation of its Japanese version was completed (Gotoh *et al.*, 2001). The questionnaire consists of three components to determine frequency, quantity, and impact of urine leakage (Hald, 2002: pp. 267-316). Frequency was categorised into 0 (never), 1 (about once a week or less often), 2 (two or three times a week), 3 (about once a day), 4 (several times a day), and 5 (all the time). Urinary incontinence was defined as a minimal amount of leakage of at least "once a week or less often". Quantity was measured from 0 (none), 2 (a small amount), 4 (a moderate amount) to 6 (a large amount). The impact on daily life was scored on an incremental scale from 0 (not at all) to 10 (a great deal). The three component scores were then summed to yield a total score ranging from 0 to 21, which reflected the overall level and extent of impact of incontinence. The circumstances of incontinence were recorded via a separate self-diagnostic item, with urge incontinence defined as "leaks before you can get to the toilet", stress incontinence defined as either "leaks when you cough or sneeze" or "leaks when you are physically active/exercising", whereas other incontinence referred to "leaks when you are asleep", "when you have finished urinating and are dressed", "for no obvious reason", and "all the time" (Terai *et al.*, 2004). Additional questions were appended to the ICIQ-SF to find out how long the patient had the condition and whether treatment was sought. Appendix J shows the questionnaire to assess urinary incontinence status.

3.4 Statistical analysis

All statistical analyses were undertaken using the SPSS for Windows package version 13. Besides descriptive statistics, univariate logistic regression was used in most cases to screen potentially significant variables for subsequent incorporation into the multivariable model. For each binary outcome of interest, its relationship with pertinent factors was assessed by adjusted OR, accounting for significant demographic and familial factors using multivariate logistic regression analysis. Stepwise regression analysis were also undertaken to identify the best subset of significant variables associated with the outcomes.

3.4.1 Cigarette smoking

Descriptive statistics were used to summarise participant characteristics. The prevalence of smoking was tabulated by year from COPD diagnosis, while cigarette consumption pattern was presented separately for ex-smokers and current smokers. Stepwise logistic regression analysis was then performed to identify factors affecting the current smoking status. Independent variables considered in the regression model included demographic and lifestyle factors, COPD severity, dyspnoea, co-morbidity status, and BMI.

3.4.2 Alcohol consumption

Descriptive statistics were used to summarise participant characteristics and drinking pattern. The prevalence and mean intake of each alcoholic beverage were obtained separately for all patients and drinkers only. Stepwise multiple regression was then performed to identify factors affecting monthly alcohol consumption level. Due to its positively skewed distribution, the alcohol consumption variable was logarithmically transformed prior to analysis. Independent variables considered in the multiple regression model included demographic and lifestyle factors, COPD severity, dyspnoea, co-morbidity status, and BMI.

3.4.3 Dietary supplements usage

Descriptive statistics were used to summarise participant characteristics. The prevalence of dietary supplement use for each demographic and lifestyle factor was calculated, together with corresponding crude OR and 95% CI. After tabulating the dietary supplements consumed according to category and type, stepwise logistic regression analysis was performed to identify factors affecting their use. Independent variables considered in the regression model included demographic and lifestyle factors, COPD severity, co-morbidity status, and BMI.

3.4.4 Physical activity level

Descriptive statistics were used to summarise participant characteristics and univariate tests (chi-square, *t* test and ANOVA) were applied to compare physical

activity levels and other outcomes between the four COPD severity groups. Stepwise multiple regressions were then performed to identify factors affecting total physical activity MET and walking activity MET. Due to their positively skewed distributions, these physical activity variables were logarithmically transformed prior to analyses. Independent variables considered in the regression models included demographic and lifestyle factors, COPD severity, co-morbidity status, and perceived life-long physical activity involvement.

3.4.5 Urinary incontinence

Descriptive statistics were used to summarise participant characteristics. The outcome variable was defined to be the presence of urinary incontinence. Independent variables considered in the logistic regression model included demographic and lifestyle factors, COPD severity, co-morbidity status, and BMI.

3.5 Ethical considerations

3.5.1 Consent

The purpose of the study was explained to each participant before obtaining their written consent; a copy of the information sheet and consent form is provided in Appendix B. Patients who declined to be interviewed did not have any negative consequences or were discriminated against in any way, particularly with respect to their treatment in the hospitals. Permission to recruit patients and access to medical records were granted by the participating hospitals in Japan. Approval of the study protocol was obtained from the Human Research Ethics Committee of Curtin University of Technology (approval number HR 90/2005); see Appendix A.

3.5.2 Confidentiality

Confidentiality of the information provided, and the right to withdraw without prejudice, were ensured and maintained throughout the study. All data were kept confidential and no patient identifiable information was released. The data stored in a personal computer is protected by password. The completed questionnaires are kept in a locked cupboard at Curtin University for five years, as required by the National

Health and Medical Research Council (NHMRC). No unauthorized persons are allowed to access the data. After the required storage time has expired, the questionnaires will be destroyed according to the guidelines of NHMRC.

CHAPTER 4

RESULTS

4.1 Sample characteristics

From the 300 COPD patients recruited, a total of 278 eligible participants (244 men and 34 women) were available for analysis after excluding patients with missing demographic details or incomplete pulmonary function testing. No statistically significant differences were found between the included and the excluded cases in terms of clinical and other variables. The majority were men (88%) with mean age 66.5 (SD 6.7) years and mean BMI 21.9 (SD 3.6). Most of participants were married (84%), had high school or below education (80%), lived in rural area (81%) and retired (55%). A substantial proportion of patients (23%) continued to smoke after diagnosis and 57% of patients consumed alcohol on at least a monthly basis. In terms of COPD severity, the distribution of patients was: mild, 17%; moderate, 40%; severe, 31%; very severe, 12%. Co-morbidities, predominantly hypertension and diabetes, were present in about half of the sample participants. The final sample sizes for the analyses are given in Table 4.1.

Table 4.1 Number of eligible participants for analysis

Outcome	Male	Female	Both genders
Cigarette smoking	243	33	276
Alcohol consumption	244	34	278
Dietary supplements usage	244	34	278
Physical activity	227	30	257
Urinary incontinence status	244	34	278

4.2 Cigarette smoking

A total of 276 eligible participants (243 men and 33 women) were available for analysis after excluding patients with missing demographic or cigarette consumption details; the response rate being 92%. No statistically significant differences were found between the included and the excluded cases in terms of clinical and other variables. Overall, 62 (53 male and 9 female) participants (22.5%) were current smokers the great majority (89%) of whom smoked daily. Only six (2.1%) participants were never smokers. The prevalence of smoking by time from diagnosis was: 24.5% (< 1 year), 20.6% (1-2 years), and 18.9% (2-4 years). Table 4.2 compares the sample characteristics between ex-smokers and current smokers, which shows that the two groups were significantly different in age. It is interesting to note that a high proportion (32.6%) of the 46 patients with mild COPD continued to smoke after diagnosis.

Table 4.3 shows the habitual tobacco consumption by the COPD patients. Although about half of them smoked between one pack (20 cigarettes) to two packs of cigarettes daily on average, a higher proportion (39%) of ex-smokers smoked at least two packs per day. For maximum number of cigarettes ever smoked per day, the mean consumption level was significantly less among current smokers than ex-smokers ($p = 0.017$). However, both groups were similar in terms of number of smoking years ($p = 0.129$). On average, the ex-smokers had stopped smoking for 5 (SD 7) years.

Significant factors affecting continuous smoking by COPD patients from stepwise logistic regression are presented in Table 4.4. Age, BMI and severity of the disease were found to be inversely associated with continuance of smoking. In particular, severe and very severe COPD patients were significantly less likely to continue smoking after diagnosis compared to mild COPD patients; the adjusted OR being 0.29 and 0.29, respectively.

Table 4.2 Comparison of characteristics between ex-smokers and current smokers

Characteristic	**Ex-smoker** n = 208	**Current smoker** n = 62	**p value**
Age: mean (SD): years	67.1 (6.3)	64.5 (7.6)	0.007†
BMI: mean (SD): kg/m^2	22.1 (3.6)	21.3 (3.5)	0.122†
Physical activity in metabolic equivalent task min/week: mean (SD)	1813.7 (3070)	1657.7 (3683)	0.742‡
Gender			0.192‡
Male	188 (90.4%)	53 (85.5%)	
Female	20 (9.6%)	9 (14.5%)	
Marital status			0.065‡
Single/divorced/separated	28 (13.5%)	14 (22.6%)	
Married	180 (86.5%)	48 (77.4%)	
Education level			0.478‡
High school or below	167 (80.3%)	49 (79.0%)	
College/university	41 (19.7%)	13 (20.1%)	
Retirement status			0.417‡
Retired	116 (55.8%)	33 (53.2%)	
Working	92 (44.2%)	29 (46.8%)	
Location of residence*			0.180‡
Urban	39 (18.8%)	8 (12.9%)	
Rural	166 (79.8%)	54 (87.1%)	
Alcohol drinking			0.217‡
No	91 (43.8%)	23 (37.1%)	
Yes	117 (56.2%)	39 (62.9%)	
Presence of co-morbidity			0.443‡
No	105 (50.5%)	30 (48.4%)	
Yes	103 (49.5%)	32 (51.6%)	
COPD severity*			0.088‡
Mild	31 (14.9%)	15 (24.2%)	
Moderate	77 (37.0%)	28 (45.2%)	
Severe	70 (33.7%)	12 (19.4%)	
Very severe	24 (11.5%)	6 (9.7%)	

Dyspnoea grade*			0.002‡
0	22 (10.6%)	17 (27.4%)	
I	56 (26.9%)	17 (27.4%)	
II	75 (36.1%)	12 (19.4%)	
III	37 (17.8%)	7 (11.3%)	
IV - V	16 (7.7%)	6 (9.7%)	

* missing data present; † t test; ‡ χ^2 test

Table 4.3 Habitual tobacco consumption by COPD patients

Characteristic	**Ex-smoker** n = 208	**Current smoker** n = 62	**p value**
Average consumption level per day			0.003‡
< 1 pack	17 (8.2%)	15 (24.2%)	
1-2 packs	110 (52.9%)	29 (46.8%)	
≥ 2 packs	81 (38.9%)	18 (29.0%)	
Maximum number of cigarettes ever smoked per day: mean (SD)	43.2 (22.0)	37.2 (15.7)	0.017†
Number of smoking years: mean (SD)	40.5 (10.0)	42.8 (11.8)	0.129†
Number of years quit smoking: mean (SD)	4.9 (7.0)	-	

† t test; ‡χ^2 test

Table 4.4 Significant factors associated with continuous smoking from stepwise logistic regression

Factor	**Adjusted OR**	**95% CI**	**p value**
Age: years	0.94	(0.90, 0.98)	0.006
BMI: kg/m^2	0.88	(0.80, 0.97)	0.012
COPD severity			0.018
Mild*	1	-	-
Moderate	0.79	(0.36, 1.75)	0.564
Severe	0.29	(0.12, 0.74)	0.009
Very severe	0.29	(0.09, 0.92)	0.036

* reference category

4.3 Alcohol consumption

Table 4.5 contrasts the sample characteristics between alcohol drinkers and non-drinkers. There were statistically significant differences in terms of gender distribution ($p = 0.000$) and dyspnoea grade ($p = 0.034$). Table 4.6 shows the distribution of the frequency of alcohol intake. Overall, 158 (150 male and 8 female) COPD patients (56.8%) drank alcohol regularly on at least a monthly basis, the majority of drinkers ($n = 116$, 73.4%) being daily drinkers. Prevalence and mean intake of each alcoholic beverage are given in Table 4.7. Beer was the most preferred alcoholic beverage drank by 30.9% of the COPD patients, followed by sake (26.6%). The mean alcohol consumption was 29.7 (SD 42.5) g per day for all patients, but drinkers had much higher mean intake of 52.2 (SD 44.8) g per day, and ranged from 10 to 325 g per day among male drinkers and 11 to 175 g per day among female drinkers.

Factors affecting total alcohol consumption from stepwise regression analysis are shown in Table 4.8. Alcohol intake appeared to be positively associated with the habit of adding soy sauce to foods, whereas dyspnoea of patients posed significant limitations for them to drink alcoholic beverages. Also, female patients tended to have lower alcohol consumption levels than their male counterparts. The difference in monthly alcohol consumption between the 244 male patients (mean 792.9g, SD 1095) and 34 female patients (mean 280.9g, SD 971.7) was significant according to two-sample t test ($p < 0.001$). However, COPD severity was not a significant factor.

Table 4.5 Characteristics of alcohol drinkers and non-drinkers

Characteristic	**Non-drinker** (n = 120)	**Drinker** (n = 158)	**p value**	**n**
Age (mean, SD): years	66.98 , 6.6	66.08, 6.8	0.271†	66.5, 6.7
BMI (mean, SD): kg/m^2	21.60, 3.7	22.08, 3.5	0.276†	21.9, 3.6
Gender (%)			0.000‡	
Male	94 (78.3%)	150 (94.9%)		244 (87.8%)
Female	26 (21.7%)	8 (5.1%)		34 (12.2%)
Marital status (%)			0.360‡	
Single/divorced/separated	21 (17.5%)	24 (15.2%)		45 (16.2%)
Married	99 (82.5%)	134 (84.8%)		233 (83.8%)
Education level* (%)			0.476‡	
High school or below	96 (80.0%)	125 (79.6%)		221 (79.5%)
College/university	23 (19.2%)	32 (20.4%)		55 (19.8%)
Retirement status* (%)			0.454‡	
Working	54 (45.0%)	69 (43.7%)		123 (44.2%)
Retired	65 (54.2%)	88 (55.7%)		153 (55.0%)
Location of residence* (%)			0.108‡	
Rural	92 (76.7%)	132 (83.5%)		224 (80.6%)
Urban	25 (20.8%)	23 (14.6%)		48 (17.3%)
Smoking status* (%)			0.192‡	
Non-smoker	97 (80.8%)	120 (75.9%)		217 (78.1%)
Current smoker	22 (18.3%)	37 (23.4%)		59 (21.2%)
Presence of co-morbidity (%)			0.398‡	
No	58 (48.3%)	80 (50.6%)		138 (49.6%)
Yes	62 (51.7%)	78 (49.4%)		140 (50.4%)
COPD severity* (%)			0.890‡	
Mild	20 (16.7%)	26 (16.5%)		46 (16.5%)
Moderate	43 (35.8%)	64 (40.5%)		107 (38.5%)
Severe	37 (30.8%)	46 (29.1%)		83 (29.9%)
Very severe	15 (12.5%)	17 (10.8%)		32 (11.5%)

Dyspnoea grade* (%)			0.034‡	
0	11 (9.2%)	29 (18.4%)		40 (14.4%)
I	37 (30.8%)	37 (23.4%)		74 (26.6%)
II	36 (30.0%)	53 (33.5%)		89 (32.0%)
III	19 (15.8%)	26 (16.5%)		45 (16.2%)
IV - V	14 (11.7%)	8 (5.1%)		22 (7.9%)
Drink green tea (%)			0.088‡	
No	9 (7.5%)	21 (13.3%)		30 (10.8%)
Yes	111 (92.5%)	137 (86.7%)		248 (89.2%)
Eating out (%)			0.291‡	
Never	34 (28.3%)	39 (24.7%)		73 (26.3%)
At least monthly	86 (71.7%)	119 (75.3%)		205 (73.7%)
Use prepared foods (%)			0.096‡	
Never	55 (45.8%)	59 (37.3%)		114 (41.0%)
Sometimes to daily	65 (54.2%)	99 (62.7%)		164 (59.0%)
Add salt to food (%)			0.042‡	
Never	92 (76.7%)	105 (66.5%)		197 (70.9%)
Sometimes to always	28 (23.3%)	53 (33.5%)		81 (29.1%)
Add soy sauce to food* (%)			0.002‡	
Never	55 (45.8%)	44 (27.8%)		99 (35.6%)
Sometimes to always	65 (54.2%)	113 (71.5%)		178 (64.0%)

* missing data present; † t test; ‡ χ^2 test

Table 4.6 Distribution of the frequency of alcohol intake by COPD patients

Frequency of intake	**Male**	**Female**	**Both genders**
Almost never	94 (38.5%)	26 (76.5%)	120 (43.2%)
1 to 3 days/month	7 (2.9%)	-	7 (2.5%)
1 to 2 days/week	16 (6.6%)	3 (8.8%)	19 (6.8%)
3 to 4 days/week	9 (3.7%)	-	9 (3.2%)
5 to 6 days/week	7 (2.9%)	-	7 (2.5%)
Almost daily	111 (45.5%)	5 (14.7%)	116 (41.7%)
Total	244	34	278

Table 4.7 Prevalence and alcohol intake of COPD patients by beverage type

Beverage	Drinker only	Overall
Beer		
Prevalence: n (%)		86 (30.9%)
Mean alcohol intake (SD) g/month	593.3 (632.5)	185.7 (447.4)
Sake		
Prevalence: n (%)		74 (26.6%)
Mean alcohol intake (SD) g/month	1128.7 (747.9)	300.5 (630.2)
Shochu		
Prevalence: n (%)		32 (11.5%)
Mean alcohol intake (SD) g/month	1711.8 (1393.6)	197.0 (719.0)
Whisky		
Prevalence: n (%)		18 (6.5%)
Mean alcohol intake (SD) g/month	765.1 (625.9)	49.5 (244.2)
Wine		
Prevalence: n (%)		3 (1.1%)
Mean alcohol intake (SD) g/month	190.3 (154.1)	2.05 (23.7)
Prevalence of drinker: n (%)		158 (56.8%)
Total mean alcohol intake (SD) g/month	1284.9 (1177.7)	730.3 (1092.1)
Total mean alcohol intake (SD) g/day/drinker	52.2 (44.8)	29.7 (42.5)

Table 4.8 Significant variables associated with monthly alcohol consumption* of COPD patients from stepwise regression analysis

Variable	Coefficient	95% CI	p value
Constant	4.95	(-1.94, 11.84)	0.168
Female	-2.34	(-3.71, -0.98)	0.001
Add soy sauce to food	1.18	(0.29, 2.07)	0.010
Dyspnea I	-1.53	(-2.91, -0.15)	0.030
Dyspnea IV-V	-2.44	(-4.41, -0.47)	0.015

* logarithmic transformed

4.4 Dietary supplements usage

Table 4.9 presents the sample descriptive statistics, together with the percentage of dietary supplement users and crude odds ratio in relation to the reference group by demographic and lifestyle characteristics. A total of 278 eligible participants (244 men and 34 women) were available for analysis after excluding patients with missing demographic and lifestyle details or incomplete pulmonary function testing. Overall, 117 (101 male and 16 female) participants (42.1%) were dietary supplement users, but the prevalence for female patients (47.1%) was higher than male patients (41.4%). Younger patients (≤ 60 years) and those with severe COPD had relatively low proportion of users (27.3% and 28.9%, respectively).

Prevalence of the five dietary supplement categories by gender is given in Table 4.10. Apart from the miscellaneous category, multivitamin was the most popular supplement for both male (7.0%) and female (11.8%) patients. The ten most common miscellaneous dietary supplements are listed in Table 4.11. Energy drink (11.1%) was ranked the most popular supplement for men, whereas women preferred vinegar (11.8%) followed by tree kale juice (8.8%).

Data on frequency and duration of intake for the three most popular supplements are presented in Table 4.12. It appears that they were often taken daily and consumed by users within the past few years except energy drink.

Stepwise logistic regression was next performed to identify factors affecting the likelihood of COPD patients to use dietary supplements, results of which are given in Table 4.13. The significant factors were age, co-morbidity status, and COPD severity. Older patients over 60 years were 2.5 times more likely to take supplements when compared to the younger age group. However, patients with co-morbidity were only half as likely to be supplement users. Although severe COPD patients appeared to use less than mild COPD patients (OR = 0.41, 95% CI 0.18-0.95), the relationship between COPD severity and supplement intake was not linear, as reflected in the adjusted odds ratio associated with each severity classification.

Table 4.9 Demographic and lifestyle characteristics in relation to dietary supplement usage

Characteristic	n	user (%)	OR	95% CI	p value
Age (mean, SD)	66.5, 6.7				
≤ 60 years*	44 (15.8%)	12 (27.3%)			
> 60 years	234 (84.2%)	105 (44.9%)	2.17	1.07, 4.42	0.033
BMI (mean, SD): kg/m^2	21.9, 3.6		1.01	0.94, 1.08	0.811
Gender					
Male*	244 (87.8%)	101 (41.4%)			
Female	34 (12.2%)	16 (47.1%)	1.26	0.61, 2.59	0.581
Marital status					
Single/divorced/separated*	45 (16.2%)	20 (44.4%)			
Married	233 (83.8%)	97 (41.6%)	0.89	0.47, 1.70	0.726
Education level[#]					
High school or below*	221 (79.5%)	95 (43.0%)			
College/university	55 (19.8%)	21 (38.2%)	1.00	1.00, 1.00	0.823
Retirement status[#]					
Working*	123 (44.2%)	48 (39.0%)			
Retired	153 (55.0%)	68 (44.4%)	1.25	0.77, 2.03	0.365
Location of residence[#]					
Rural*	224 (80.6%)	95 (42.4%)			
Urban	48 (17.3%)	20 (41.7%)	1.00	1.00, 1.00	0.662
Alcohol drinking					
None*	120 (43.2%)	50 (41.7%)			
At least monthly	158 (56.8%)	67 (42.4%)	1.03	0.64, 1.67	0.902
Smoking status[#]					
Non-smoker*	214 (77.0%)	86 (40.2%)			
Current smoker	62 (22.3%)	30 (48.4%)	1.00	1.00, 1.00	0.816
Presence of co-morbidity					
No*	138 (49.6%)	68 (49.3%)			
Yes	140 (50.4%)	49 (35.0%)	0.55	0.34, 0.90	0.016

COPD severity[#]					0.025
Mild*	46 (16.5%)	23 (50.0%)			
Moderate	107 (38.5%)	53 (49.5%)	0.98	0.49, 1.96	0.958
Severe	83 (29.9%)	24 (28.9%)	0.41	0.19, 0.86	0.018
Very severe	32 (11.5%)	13 (40.6%)	0.68	0.28, 1.70	0.415
Drinking green tea					
No*	30 (10.8%)	10 (33.3%)			
Yes	248 (89.2%)	107 (43.1%)	1.16	0.68, 3.38	0.306
Eating out					
None to 1-3 times/month*	145 (52.2%)	62 (42.8%)			
1-2 times/week to daily	133 (47.8%)	55 (41.4%)	0.94	0.59, 1.52	0.813
Use prepared food					
None to 1-3 times/month*	195 (70.1%)	80 (41.0%)			
1-2 times/week to daily	83 (29.9%)	37 (44.6%)	1.16	0.69, 1.94	0.583

[#] missing data present; [*] reference group

Table 4.10 Prevalence of the five dietary supplement categories by gender of COPD patient (multiple answers)

Category	Male	Female	Both genders
Multivitamin	17 (7.0%)	4 (11.8%)	21 (7.6%)
Beta-carotene	1 (0.4%)	0 (0%)	1 (0.4%)
Vitamin C	12 (4.9%)	3 (8.8%)	15 (5.4%)
Vitamin E	6 (2.5%)	1 (2.9%)	7 (2.5%)
Miscellaneous	86 (35.2%)	13 (38.2%)	99 (35.6%)
Overall	101 (41.4%)	16 (47.1%)	117 (42.1%)

Table 4.11 Ten most popular miscellaneous supplements consumed by COPD patients (multiple answers)

Type*	Male	Female	Both genders
Energy drink	27 (11.1%)	2 (5.6%)	29 (10.4%)
Vinegar	16 (6.6%)	4 (11.8%)	20 (7.2%)
Tree kale juice	14 (5.7%)	3 (8.8%)	17 (6.1%)
Garlic	12 (4.9%)	1 (2.9%)	13 (4.7%)
Coenzyme Q10	6 (2.5%)	0 (0%)	6 (2.6%)
Propolis	5 (2.0%)	0 (0%)	5 (1.8%)
Chlorella	5 (2.0%)	0 (0%)	5 (1.8%)
Yomeishu	5 (2.0%)	0 (0%)	5 (1.8%)
Royal jelly	4 (1.6%)	1 (2.9%)	5 (1.8%)
Calcium	4 (1.6%)	0 (%)	4 (1.4%)

* 33 other supplements not listed

Table 4.12 Frequency and duration of intake of popular supplements by users (n = 117)

Supplement	Male patient	Female patient	Both genders
Multivitamin			
Frequency			
0	84 (83.2%)	12 (75.0%)	96 (82.1%)
1-2 times/week	2 (2.0%)	0 (0%)	2 (1.7%)
3-4 times/week	0 (0%)	1 (6.3%)	1 (0.9%)
1 time/day	14 (13.9%)	2 (12.5%)	16 (13.7%)
2-3 times/day	1 (1.0%)	1 (6.3%)	2 (1.7%)
Duration			
0	84 (83.2%)	12 (75.0%)	96 (82.1%)
1-2 years	6 (5.9%)	3 (18.8%)	9 (7.7%)
3-4 years	3 (3.0%)	0 (0%)	3 (2.6%)
5-9 years	2 (2.0%)	1 (6.3%)	3 (2.6%)
≥ 10 years	6 (6.0%)	0 (0%)	6 (5.1%)
Vinegar			
Frequency			
0	85 (84.2%)	12 (75.0%)	97 (82.9%)
1-2 times/week	2 (2.0%)	0 (0%)	2 (1.7%)
3-4 times/week	0 (0%)	1 (6.3%)	1 (0.9%)
1 time/day	11 (10.9%)	3 (18.8%)	14 (12.0%)
2-3 times/day	3 (3.0%)	0 (0%)	3 (2.6%)
Duration			
0	85 (84.2%)	12 (75.0%)	97 (82.9%)
1-2 years	7 (6.9%)	4 (25.0%)	11 (9.4%)
3-4 years	6 (5.9%)	0 (0%)	6 (5.1%)
5-9 years	2 (2.0%)	0 (0%)	2 (1.7%)
≥ 10 years	1 (1.0%)	0 (0%)	1 (0.9%)

Energy drink			
Frequency			
0	74 (73.3%)	14 (87.5%)	88 (75.2%)
1-2 times/week	7 (6.9%)	2 (12.5%)	9 (7.7%)
3-4 times/week	4 (4.0%)	0 (0%)	4 (3.4%)
1 time/day	15 (14.9%)	0 (0%)	15 (12.8%)
2-3 times/day	1 (1.0%)	0 (0%)	1 (0.9%)
Duration			
0	74 (73.3%)	14 (87.5%)	88 (75.2%)
1-2 years	8 (7.9%)	0 (0%)	8 (6.8%)
3-4 years	1 (1.0%)	0 (0%)	1 (0.9%)
5-9 years	4 (4.0%)	1 (6.3%)	5 (4.3%)
≥ 10 years	14 (13.8%)	1 (6.3%)	15 (12.8%)

Table 4.13 Significant factors associated with dietary supplement use from stepwise logistic regression

Factor	**Adjusted OR**	**95% CI**	**p value**
Age			
≤ 60 years*	1.00		
> 60 years	2.44	(1.03, 5.80)	0.044
Presence of co-morbidity			
No*	1.00		
Yes	0.54	(0.32, 0.94)	0.028
COPD severity			0.033
Mild*	1.00		
Moderate	1.06	(0.49, 2.27)	0.883
Severe	0.41	(0.18, 0.95)	0.037
Very severe	0.96	(0.34, 2.71)	0.937

* reference group

4.5 Physical activity

Table 4.14 shows the characteristics of the sample by COPD severity. A total of 257 eligible participants (227 men and 30 women) were available for analysis after excluding patients with missing demographic, physical activity details or outliers. No statistically significant differences were found between the included and the excluded cases in terms of clinical and other variables. Overall, 198 (175 male and 23 female) of them (77%) participated in physical activities on a daily to weekly basis, but only 22% and 4% engaged in moderate and vigorous activities, respectively. Over 2/3 of participants walked at least weekly. Although the four severity groups of COPD patients were similar with respect to time spent on sitting, the prevalence of physical activity involvement was significantly lower (55%) for patients with very severe COPD ($p = 0.02$), and only half of them walked regularly. The mean MET were 1807 (SD 3124) min/week for male and 1656 (SD 3931) min/week for female patients, the difference in total physical activity levels being statistically significant ($p < 0.001$).

Table 4.15 compares total physical activity and walking activity levels among the four COPD severity groups. A marginal difference in average total physical activity MET was observed ($p = 0.045$), and a post-hoc Tukey test indicated that patients with very severe COPD had significantly less total physical activity than the severe COPD group ($p < 0.05$). Moreover, the very severe COPD patients undertook significantly less walking activity, with respect to walking MET, than other COPD severity groups combined ($p < 0.05$). Analysis was not conducted for vigorous MET and moderate MET because involvement by COPD patients in these activities, which required relatively greater exertion, was either slight or negligible. As shown in Table 4.14, over 95% of participants reported no vigorous activity and over 75% had not engaged in moderate activity.

Table 4.14 Demographic and lifestyle characteristics by COPD severity

Characteristic	All cases	Very severe	Severe	Moderate	Mild	Chi-square/ ANOVA p value
N	257 (100%)	31 (12%)	83 (32%)	98 (38%)	45 (18%)	
Age: years						
Mean	66.6	65.0	66.9	67.5	65.0	0.105†
SD	(6.64)	(7.84)	(6.84)	(5.45)	(7.49)	
BMI: kg/m^2						
Mean	21.9	19.1	21.6	22.7	22.9	0.001†
SD	(3.58)	(2.78)	(3.57)	(3.44)	(3.41)	
Gender						
Male	227 (88%)	30 (97%)	70 (84%)	86 (88%)	41 (91%)	0.284‡
Female	30 (12%)	1 (3%)	13 (16%)	12 (12%)	4 (9%)	
Marital status						
Married	215 (84%)	25 (81%)	67 (81%)	87 (89%)	36 (80%)	0.385‡
Single/divorced/ separated	42 (16%)	6 (19%)	16 (19%)	11 (11%)	9 (20%)	
Education level						
High school or below	221 (86%)	26 (84%)	70 (84%)	88 (90%)	37 (82%)	0.570‡
College or university	36 (14%)	5 (16%)	13 (16%)	10 (10%)	8 (18%)	
Retirement status						
Retired	143 (56%)	14 (45%)	45 (54%)	60 (61%)	24 (53%)	0.426‡
Working	114 (44%)	17 (55%)	38 (46%)	38 (39%)	21 (47%)	
Location of residence						
Urban	212 (82%)	24 (77%)	67 (81%)	84 (86%)	37 (82%)	0.696‡
Rural	45 (18%)	7 (23%)	16 (19%)	14 (14%)	8 (18%)	
Current smoker	57 (22%)	6 (19%)	12 (14%)	24 (25%)	15 (33%)	0.087‡
Alcoholic drinker	146 (57%)	17 (55%)	46 (55%)	58 (59%)	25 (56%)	0.947‡
Presence of co-morbidity	129 (50%)	11 (35%)	41 (49%)	58 (59%)	19 (42%)	0.071‡

Lifelong physical activity involvement						
Always involved	56 (22%)	5 (16%)	12 (14%)	22 (22%)	11 (24%)	0.241‡
Physical activity participation	198 (77%)	17 (55%)	67 (81%)	78 (80%)	36 (80%)	0.020‡
Vigorous activity participation	11 (4%)	3 (10%)	2 (2%)	5 (5%)	1 (2%)	0.316‡
Moderate activity participation	57 (22%)	6 (19%)	14 (17%)	24 (24%)	13 (29%)	0.395‡
Walking activity participation	179 (70%)	15 (48%)	63 (76%)	69 (70%)	32 (71%)	0.041‡
Time spent sitting weekday						
Mean mins/day (SD)	372.1 (200.66)	364.2 (199.76)	405.5 (194.95)	361.0 (205.37)	339.8 (199.39)	0.283†
Time spent sitting weekend						
Mean mins/day (SD)	398.7 (204.37)	410.3 (189.17)	421.8 (190.22)	387.4 (210.96)	372.7 (225.82)	0.536†

† F test; ‡ χ^2 test

Multiple stepwise regressions were next performed to identify predictive factors for total physical activity MET and walking MET, results of which are given in Table 4.16. Perceived life-long physical activity involvement appeared to be positively associated with total physical activity, whereas patients with very severe COPD tended to have significantly lower total physical activity levels. Besides COPD severity, both age and smoking exhibited a negative impact on walking. It is evident that walking activities decreased among very severe patients, current smokers and those in advanced age.

Table 4.15 Total physical activity MET and walking MET by COPD severity

Physical activity measure*	All cases	Very severe	Severe	Moderate	Mild	ANOVA p value
Total physical activity MET min/week						
Mean	5.30	3.81	5.51	5.44	5.63	0.045†
SD	(3.11)	(3.76)	(2.93)	(2.98)	(3.05)	
Walking MET min/week						
Mean	4.50	3.15	4.88	4.52	4.69	0.062†
SD	(3.11)	(3.40)	(2.95)	(3.06)	(3.14)	

* logarithmic transformed; † F test

Table 4.16 Stepwise regression results of total physical activity and walking activity

Factors	**Total physical activity MET**			**Walking MET**		
	Coefficient	95% CI	p value	Coefficient	95% CI	p value
Constant	4.94	(4.53, 5.36)	<0.001	9.05	(5.14, 12.95)	<0.001
Very severe COPD	-1.53	(-2.63, -0.43)	0.006	-1.68	(-2.83, -0.53)	0.004
Life-long physical activity involvement	2.95	(2.04, 3.86)	<0.001	-	-	-
Smoking	-	-	-	-1.26	(-2.17, -0.34)	0.008
Age; years	-	-	-	-0.06	(-0.12, -0.01)	0.038

4.6 Urinary incontinence status

Table 4.17 presents the patient demographic and lifestyle characteristics and their association with urinary incontinence. The overall prevalence of urinary incontinence was 12.6% (10% for men and 32% for women). As shown in Table 4.18, urine leakage among the 35 incontinent patients was typically "a small amount" (74%) and occurred once a week or less often (63%). Very few patients considered the condition interfered with their daily life to a great extent. No significant difference in ICIQ-SF total score was found between male (mean 7, SD 2.5) and female (mean 7.5, SD 5.8) incontinent patients, p = 0.75. The most common occurrence of urine loss was before reaching the toilet (n = 19, 54%) followed by coughing/sneezing (n = 8, 23%).

Table 4.19 presents the distribution of the incontinence type by gender. While urge incontinence was reported by 15 (63%) of the 24 male incontinent patients, 9 (82%) of the 11 female incontinent patients experienced stress incontinence. On average they had urine leakage for 3 (SD 3.2) years and the majority of them (n = 30, 86%) developed the condition after diagnosis of COPD. However, only two male patients consulted their physician for the incontinent problem.

Stepwise logistic regression analysis was next performed to identify factors associated with urinary incontinence. Independent variables considered in the multivariate regression model included demographic and lifestyle factors, COPD severity, co-morbidity status, and BMI. Incontinence was more likely among female patients (OR = 8.7, 95% CI 3.2-23.4) and older patients over 70 years (OR = 2.3, 95% CI 1.0-5.2). COPD severity was also found to be a significant factor (p = 0.007), with very severe patients at slightly higher risk of urinary incontinence (OR = 1.1, 95% CI 0.3-3.5) than mild COPD patients, though the relationship appeared not to be linear across the severity classifications; see Table 4.20.

Table 4.17 Demographic and lifestyle characteristics and their association with urinary incontinence

Characteristic	**n**	**UI (%)**	**OR**	**95% CI**	**p value**
Age[#] (mean, SD): years	66.46, 6.73	-	1.037	0.98, 1.10	0.209
BMI[#] (mean, SD): kg/m^2	21.87, 3.59	-	1.05	0.95, 1.16	0.32
Gender					
Male*	244 (87.8%)	24 (9.8%)			
Female	34 (12.2%)	11 (32.4%)	4.38	1.91, 10.08	0.001
Marital status[#]					
Single/divorced/separated*	43 (15.5%)	11 (25.6%)			
Married	233 (83.8%)	24 (10.3%)	0.33	0.15, 0.75	0.008
Education level[#]					
High school or below*	221 (79.5%)	27 (12.2%)			
College/university	55 (19.8%)	8 (14.5%)	1.00	0.97, 1.03	0.778
Retirement status[#]					
Retired *	153 (55.0%)	21 (13.7%)			
Working	123 (44.2%)	14 (11.4%)	0.81	0.39, 1.66	0.561
Location of residence[#]					
Urban*	48 (17.3%)	7 (14.6%)			
Rural	224 (80.6%)	27 (12.1%)	0.80	0.33, 1.97	0.631
Smoking status[#]					
Non-smoker*	214 (77.0%)	24 (11.2%)			
Current smoker	62 (22.3%)	11 (17.7%)	1.71	0.79, 3.72	0.178
Alcohol drinking					
None*	120 (43.2%)	17 (14.2%)			
At least monthly	158 (56.8%)	18 (11.4%)	0.78	0.38, 1.58	0.491
Presence of co-morbidity					
No*	138 (49.6%)	16 (11.6%)			
Yes	140 (50.4%)	19 (13.6%)	1.20	0.59, 2.44	0.620

COPD severity[#]					0.046
Mild*	46 (17.2%)	9 (19.6%)			
Moderate	107 (39.9%)	16 (15.0%)	0.72	0.29, 1.78	0.480
Severe	83 (31.0%)	3 (3.6%)	0.15	0.04, 0.60	0.007
Very severe	32 (11.9%)	6 (18.8%)	0.95	0.30, 3.00	0.928
Dyspnoea grade[#]					0.545
0*	40 (14.4%)	7 (17.5%)			
I	74 (26.6%)	6 (8.1%)	0.42	0.13, 1.34	0.141
II	89 (32.0%)	14 (15.7%)	0.88	0.33, 2.38	0.801
III	45 (16.2%)	6 (13.3%)	0.73	0.22, 2.37	0.595
IV - V	22 (7.9%)	2 (9.1%)	0.47	0.09, 2.50	0.377
Drink green tea					
No*	30 (10.8%)	4 (13.3%)			
Yes	248 (89.2%)	31 (12.5%)	0.93	0.30, 2.84	0.897

missing data present; * reference category

Table 4.18 Characteristics of COPD patients with urinary incontinence (n = 35)

ICIQ item	n	%
Frequency of leakage		
About once a week or less often	22	62.9
Two or three times a week	6	17.1
About once a day	2	5.7
Several times a day	5	14.3
All the time	0	0
Quantity of urine loss		
A small amount	26	74.3
A moderate amount	6	17.1
A large amount	3	8.6
Interfere with everyday life		
0 (not at all)	6	17.1
1-3	22	62.9
4-7	5	14.3
8-10 (a great deal)	2	5.7
When urine leakage occurs (multiple answers)		
Before reaching toilet	19	54.3
Coughing or sneezing	8	22.9
Physically active or exercising	4	11.4
After urinating and dressed	4	11.4
Asleep	2	5.7
Other (e.g. no obvious reason, all the time)	8	22.9

Table 4.19 Urinary incontinence type by gender of COPD patients

Type of incontinence	Male (n = 24)	Female (n = 11)	Both genders (n = 35)
Stress	2 (8.3%)	9 (81.8%)	11 (31.4%)
Urge	15 (62.5%)	3 (27.3%)	18 (51.4%)
Mixed	1 (4.2%)	0 (0%)	1 (2.9%)
Other	8 (33.3%)	1 (9.1%)	9 (25.7%)

Table 4.20 Significant factors associated with urinary incontinence

Factor	Adjusted OR	95% CI	p value
Age group			0.040
<70 years*	1.00		
>70 years	2.31	(1.04, 5.16)	
Female	8.69	(3.22, 23.42)	0.000
COPD severity			0.007
Mild*	1.00		
Moderate	0.55	(0.21, 1.46)	0.230
Severe	0.08	(0.02, 0.36)	0.001
Very severe	1.05	(0.32, 3.47)	0.939

* reference group

CHAPTER 5

DISCUSSION, LIMITATIONS AND CONCLUSION

5.1 Discussion

This is the first study investigating lifestyle characteristics of Japanese patients with COPD, including the smoking prevalence after diagnosis of COPD, the alcohol consumption pattern, the prevalence and type of dietary supplements usage, their physical activity level in daily life, as well as the prevalence, type and characteristics of urinary incontinence. Factors influencing such characteristics were also examined. Only patients diagnosed within four years were captured because of disease progression and increase in mortality risk over time.

5.1.1 Cigarette smoking

Although the overall smoking prevalence of 22.5% was lower than those (27-36%) reported in other countries, almost a third of the patients with mild COPD reported smoking daily. Under-estimation of the prevalence rates was unlikely in view of the rigorous protocol adopted to assess smoking status. Our preliminary evidence indicated that the proportion of persistent smokers has declined within four years from diagnosis.

Severity of the disease was identified as a significant clinical factor affecting the continuation of smoking, with decreased risk of smoking for more severe patients (adjusted OR being 0.29) relative to patients with mild COPD. Indeed, 28% of the mild/moderate COPD patients continued to smoke after diagnosis, compared to 16% for the group of severe/very severe patients.

Continuance of smoking was also found to be inversely related to age according to the multivariate logistic regression analysis. Similarly, a cohort study in Sweden reported that persistent smokers and re-starters tended to be younger among COPD patients aged 47-77 years (Lindberg *et al.*, 2007).

It has been suggested that patients with low BMI are at inflated risk for developing COPD, rather than as a consequence of established lung disease (Harik-Khan *et al.*, 2002). The observed inverse association between BMI and continuous smoking was supported by the literature that body mass was negatively related to smoking status

(both pack-years and continuance of smoking) in COPD, and that BMI was significantly lower in current smokers than ex-smokers (Karadag *et al.*, 2004).

5.1.2 Alcohol consumption

This study found high alcohol consumption by COPD patients in Japan. Although the prevalence of 62% for male drinkers and 24% for female drinkers were comparable with the 68% for Japanese men and 11% for Japanese women reported in a recent population-based study of 88,746 subjects aged 40-69 years (Marugame *et al.*, 2007), light drinkers (< 23 g per day) accounted for only 20% of male drinkers and 50% of female drinkers in our sample. The Japanese government has recommended a daily alcohol intake of no more than 20 g (Ministry of Health, Labour and Welfare, 2000). The observed mean consumption level of 52.2 g per day by COPD drinkers was 2.6-fold of the limit. Moreover, it is alarming that 21.7% of male and 5.9% of female COPD patients were heavy drinkers consuming over 60 g of alcohol per day, as compared to 4.1% of adult men and 0.3% of adult women in the general population (Ministry of Health, Labour and Welfare, 2000).

Female COPD patients had lower alcohol intake than male patients. This finding is consistent with three general population studies in Japan where the prevalence of alcohol drinkers was higher in males (68% to 77.1%) than females (11% to 25%) (Nakaya *et al.*, 2004; Lin *et al.*, 2005; Marugame *et al.*, 2007). As expected, alcohol consumption level was negatively associated with the dyspnoea grade of patients, though the corresponding decreases were not linear. Further investigation is needed to quantify the relationship between alcohol intake and breathlessness of COPD patients. Interestingly, alcohol intake was positively correlated with soy sauce, a fermented sauce made from soybeans, wheat, roasted grain, water and salt. Adding soy sauce to foods to enhance taste has led to drinking more alcohol by COPD patients.

On the other hand, consumption of alcoholic beverages appeared not related to the smoking status of the patients, unlike the general population in which the synergism between cigarette smoking and high levels of alcohol drinking was extensively documented (Tsugane *et al.*, 1999; Nakaya *et al.*, 2004; Marugame *et al.*, 2007).

Indeed, the prevalence of drinking between smokers (62.7%) and non-smokers (55.3%) was not significantly different ($\chi_1^2 = 1.04$, p = 0.31), while the majority (77%) of the patients had ceased smoking.

5.1.3 Dietary supplements usage

The overall prevalence of dietary supplements use of 42% was comparable with the 41% usage reported for Australian COPD patients (George *et al.*, 2004) and the 43% among the Japanese general population (Yamashita *et al.*, 2002). The most popular dietary supplements were energy drink for male patients and vinegar and multivitamin for female patients. The population-based telephone survey of 1000 Japanese respondents similarly found a high prevalence of 43% for nutritional and tonic drinks, especially among males, probably because these drinks were advertised well to revitalise exhausted men (Yamashita *et al.*, 2002). Female patients, on the other hand, preferred natural supplements such as vinegar, multivitamin and tree kale juice. These products are also widely advertised in Japan.

Several factors are found to affect the use of dietary supplements by COPD patients in daily life, which have important implications on future clinical trials and experimental interventions advocating nutritional supplementation therapy for pulmonary rehabilitation. Firstly, severity of the disease had a significant impact on usage, with the lowest prevalence of 28.9% reported for the severe group, though the relationship was not linear. Secondly, older patients over 60 years were more likely to take supplements when compared to the younger age group. The result was consistent with the general population study of 78531 subjects aged 45-75 years, in which supplements intake had a significant linear increase with age (Ishihara *et al.*, 2003). Another study of diabetic patients in the USA also showed older age (≥ 65 years) was positively associated with the use of complementary and alternative medicine (Egede *et al.*, 2002).

Patients with co-morbidity such as diabetes or hypertension were less likely to be supplement users. Dietary supplements have potential side-effect of harmful interactions with orthodox medicine (Kales *et al.*, 2004). For example, vitamins and

herbs may distort the effects of conventional drugs (Hyodo *et al.*, 2005). Patients with other illnesses already take several medicines regularly. Therefore, they may be recommended by physicians to take only prescribed medicine to avoid drug interactions. Ultimately, these patients tend not to use dietary supplements.

5.1.4 Physical activity level

Fewer than 5% of the COPD patients engaged in vigorous physical activity and only one in five participated in moderate activity. The total physical activity levels, 1807 (SD 3124) MET min per week for male and 1656 (SD 3931) MET min per week for female patients, were lower than the reported 2845 (SD 3088) MET min per week for males and 3046 (SD 3794) MET min per week for females in the Japanese elderly population (Murase *et al.*, 2005). Similar findings concerning the inactivity of COPD patients were observed in other countries (Schonhofer *et al.*, 1997; Singh and Morgan, 2001; Garcia-Aymerich *et al.*, 2004; Pitta *et al.*, 2005b; Sandland *et al.*, 2005). Because COPD directly impairs respiration, people suffering from the illness may find it hard to sustain regular physical exertion. The present study confirmed this expectation as COPD patients exercised at levels of 53-63% of the general population.

Patients with very severe COPD were found to participate little in physical activity, especially walking, when compared with less severe patients. The finding that severity of the disease affected physical activity levels was consistent with a Spanish cohort study of 2386 COPD patients aged 60 (SD 11) years (Garcia-Aymerich *et al.*, 2006). Another UK study involving 25 COPD patients aged 56 (SD 12) years and 25 healthy people aged 53 (SD 14) years showed that the number of steps exerted per day (as measured by a pedometer) was positively associated with FEV_1 and consequently inversely related to COPD severity (Schonhofer *et al.*, 1997). A study in Australia among 176 COPD patients aged 50-89 years also suggested a correlation between physical activity and disease severity in terms of $FEV_{1.0\%}$ predicted (McGlone *et al.*, 2006).

Life-long physical activity involvement was positively associated with total physical activity ($p < 0.001$). COPD patients who reported that they had an uninterrupted

lifelong involvement in active sports or vigorous exercise were engaged in significantly higher levels of physical activity than those who had never been involved or intermittently involved in such activities.

Walking activity among COPD patients appeared to decrease with age. The effect of age was consistent with a Spanish study of 346 COPD patients aged 69 (SD 9) years, which reported a significantly greater tendency for older patients to engage in low physical activity (Garcia-Aymerich *et al.*, 2004). Similarly, an Australian study involving 176 COPD patients with mean age 70 (SD 8) years found that the median number of steps per day (as recorded by a pedometer) correlated negatively with age ($r = -0.27$, $p < 0.01$) (McGlone *et al.*, 2006).

It is generally known that smoking impairs respiratory function and stamina. The significant negative impact of smoking on walking activity is thus expected. Incidentally, an American study of 218 COPD patients aged 68.8 (SD 4.6) years showed that patients who were current smokers walked significantly less distance than those who never smoked or quitted smoking (Cooper *et al.*, 2007).

The results have two implications. Firstly, continuous involvement in exercise activities can improve the physical health of COPD patients. Undertaking regular, long-term and a sustainable level of physical activity have many documented benefits to health and well being, and may even contribute to lowering the incidence of COPD. Indeed, a population-based cohort study of 6790 older adults in Spain demonstrated that moderate to vigorous activity could reduce 20% of the incidence of COPD among smokers (Garcia-Aymerich *et al.*, 2007). Secondly, it is desirable for COPD patients to cease smoking which has a deleterious effect on walking and exercise capacity, as evident in the present study.

Validated questionnaires such as IPAQ are inexpensive, easy to administer, and readily applicable to measure all kinds of habitual activity. However, they are based on self reports and hence subjected to both over- and under-estimation of physical activity levels (Klesges *et al.*, 1990). Alternatively, motion sensors including pedometers (measuring steps) and accelerometers (detecting body acceleration) have been used objectively to quantify physical activity of COPD patients in daily life

(Pitta *et al.*, 2006). Pedometer is a simple, small and inexpensive tool for counting vertical movement, but it cannot capture the time spent on different activities and their intensity during the day (Pitta *et al.*, 2006). Although accelerometer is designed to monitor the quantity and intensity of walking (Pitta *et al.*, 2005a), the device is costly and requires technical expertise to operate, which can pose problems for elderly participants (Pitta *et al.*, 2005b; Pitta *et al.*, 2006). In general, motion sensors cannot measure activities of the upper extremity and exercise in water such as swimming, resulting in under-estimation of the overall energy expenditure.

5.1.5 Urinary incontinence

The overall prevalence estimates of 10% for male and 32% for female patients were comparable with those reported for the Japanese general population using the ICIQ-SF, 13% for men and 30% to 42% for women aged over 40 years (Terai *et al.*, 2004; Araki *et al.*, 2005; Honjo *et al.*, 2005). Studies on female cystic fibrosis patients found the incontinent prevalence to vary between 30% and 68% (Cornacchia *et al.*, 2001; Orr *et al.*, 2001; Moran *et al.*, 2003), but the wide range was due to the inconsistency in defining urinary incontinence from yearly to weekly or more frequent urine loss.

Unlike cystic fibrosis where stress incontinence induced by coughing was prevalent (Cornacchia *et al.*, 2001; Orr *et al.*, 2001; Moran *et al.*, 2003), urge incontinence was more common in COPD, especially among male incontinent patients (63%). For stress incontinence, increase in abdominal pressure when coughing had been identified to cause leaking of urine (Maggi *et al.*, 2001; Hirayama *et al.*, 2005). Further research is needed to examine the cause and mechanism underlying urge incontinence in COPD, so that appropriate treatment of the condition can be developed.

Within the context of a progressive disease that requires time-consuming remedy and rehabilitation, it is not surprising that most incontinent COPD patients did not perceive the condition had seriously impacted their daily life, as reflected by their mean ICIQ-SF score less than the cut off value of 8 for bothersome urinary incontinence (Cetinel *et al.*, 2007).

Older patients above 70 years were twice more likely to have urine loss according to the multivariate analysis. The finding is consistent with previous population based studies involving COPD patients (Brown *et al.*, 1996; Maggi *et al.*, 2001). Lung disease is progressive in COPD and associated conditions are expected to worsen with advancing age. Similar to the general population (Hyodo *et al.*, 2005), female patients had a higher likelihood of urinary incontinence than their male counterparts. COPD severity also emerged as a significant risk factor affecting the prevalence. However, more data are required before any definite conclusion on the relationship can be drawn.

5.2 Limitations

There are some limitations that need to be considered when interpreting the findings of the study. In this study, information on habitual tobacco consumption, alcohol intake, dietary supplementation, physical activity, urinary incontinence and other characteristics were obtained from self report. Similar to other surveys of elderly subjects, the responses from the COPD patients inevitably incurred some recall error due to possible memory and cognitive loss. Therefore, face-to-face interviews were used to help improve the accuracy of their answers. In addition, all interviews were conducted by the principal investigator, thus minimising any potential miss-interpretation of the questions as well as eliminating the risk of inter-interviewer bias. In-depth interviews of our participants at the hospital outpatient departments were not possible due to time constraints. Another limitation was that the majority of our participants had retired and resided in the rural areas. Subjects were recruited from three areas (Aichi prefecture, Gifu prefecture, and Kyoto). Therefore, the participants were representative of the COPD population in the middle of Japan only. Although a small number of female participants were recruited, the gender ratio was typical for COPD in Japan due to the higher prevalence of smoking among males (Hirayama *et al.*, 2005). While the findings might be typical of elderly Japanese COPD patients, further studies in other areas and countries will be worthwhile to confirm the generalisability of the results.

In relation to cigarette smoking, calculation of pack-years was not possible from the categorical data on daily cigarette consumption. For future research, it is recommended to collect detailed information on smoking behaviours at diagnosis, so that a longitudinal study of smoking among COPD patients can be undertaken with minimal recall bias.

For alcohol consumption, individual drinking pattern can vary by season, resulting in some bias when estimating their frequencies of habitual intake. The adopted instrument also did not permit the distinction between ex-drinkers and abstainers, though it would not impact on the current consumption pattern of COPD patients. Another limitation was the lack of information on sociological and psychological factors that potentially influence alcohol drinking. Moreover, separate analysis of alcohol consumption level by gender was not performed due to the small number of female patients in our sample.

With respect to dietary supplements usage, a limitation was the lack of qualitative data on the perception and belief by COPD patients. Opinions about dietary supplementation, facilitators and intentions behind dietary supplement use were explored in an Australian study using a purposive sample of 28 patients (George *et al.*, 2004).

Although the IPAQ is a valid and reliable instrument, it pays little emphasis on assessing very low to moderate levels of physical activity and short-term activities that are less than 10 minutes in duration (Craig *et al.*, 2003; Ishikawa-Takata *et al.*, 2007). The short version of IPAQ in conjunction with face-to-face interviews was used to reduce recall error and to improve the accuracy of their responses. As discussed in the previous section, the lack of objective measurements through pedometer and accelerometer posed another problem in assessing physical activity levels in the daily life of COPD patients.

Finally, information on urinary incontinence was obtained using the ICIQ-SF based on self report, rather than objective measurements of urine loss, while seasonal alterations were not accounted for (Yoshimura *et al.*, 2007). Nevertheless, it is now

recognised that the use of psychometrically robust self-completion questionnaires is a valid approach for assessing urinary incontinence (Avery *et al.*, 2007). The ICIQ-SF has good measurement properties and encompasses all aspects of incontinence (Avery *et al.*, 2004; Karantanis *et al.*, 2004; Avery *et al.*, 2007). The observed prevalence of incontinence can be inflated by the progression of benign prostatic hyperplasia (BPH) among the older men, especially after therapeutic treatment or prostatectomy (Homma *et al.*, 2006), but information on BPH status was unavailable from the participants.

5.3 Recommendation and conclusion

The major risk factor for COPD is tobacco smoking. Patients with COPD must always be advised and encouraged to stop smoking in order to reduce symptoms and prevent progression of the disease (Rennard, 2004). Nonetheless, some of them continue to smoke. The present study found that younger patients and those with mild or moderate COPD are more likely to continue smoking after diagnosis of the disease, while most of the current smokers smoked on a daily basis. Tobacco control programs targeting these individuals should be developed to prevent further exacerbations. Apart from therapeutic treatments, implementation of a co-ordinated strategy stressing smoking cessation immediately post diagnosis that involves respiratory physicians, physiotherapists and health promotion professionals in conjunction with government and community support is needed for the effective pulmonary rehabilitation of COPD patients.

It is evident that COPD patients are characterized by higher alcohol intake per drinker than the general population. To minimise the harm of excessive consumption, alcohol control and health awareness programs especially targeting male patients should be promoted at both hospital and community levels and coordinated with respiratory physicians and health professionals during their pulmonary rehabilitation.

Further studies are recommended to confirm our findings on dietary supplements usage and to determine the extent of using other types of complementary and alternative medicine such as acupuncture, physiotherapy, massage and chiropractics.

The present study has shown that Japanese COPD patients are characterized by low engagement in various modes of physical activity. This has practical importance, suggesting the beneficial consequences of sustained long-term exercise activity and of smoking cessation. It is recommended that older patients, especially those with very severe COPD and those who continue to smoke, be targeted for intervention by programs stressing cessation of smoking and sustained regular physical activity, in order to maintain their health and well being.

Findings on urinary incontinence have important implications for preventing and treating incontinence in COPD patients, who already carry the burden of a chronic disease with high morbidity and mortality. It appears that the condition developed after the diagnosis of COPD, but the low number of patients seeking help is of particular concern. It is possible that the patients are either embarrassed or unaware that the condition is treatable (Homma *et al.*, 2006). With the increased likelihood of incontinence as COPD progresses, education is needed and patients should be regularly assessed for symptoms. In conclusion, addressing urinary incontinence should become part of the routine management of COPD. Appropriate exercise and treatment tailored for the specific type of incontinence involving urologists, therapists and respiratory physicians must be developed and incorporated within the rehabilitation program of COPD patients.

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APPENDICES

APPROVAL LETTER

memorandum

Curtin University of Technology

To	Fumi Hirayama, Public Health
From	Dr Stephan Millett, Executive Officer, Human Research Ethics Committee
Subject	Protocol Approval **HR 90/2005**
Date	28 June 2005
Copy	Prof. Colin W. Binns, Public Health Dr Andy H. Lee, Public Health Graduate Studies Officer, Division of Health Sciences

Office of Research and Development

Human Research Ethics Committee

TELEPHONE 9266 2784
FACSIMILE 9266 3793
EMAIL s.darley@curtin.edu.au

Thank you for your application submitted to the Human Research Ethics Committee (HREC) for the project titled *"Dietary factors for Japanese patients With Chronic Obstructive Pulmonary Disease"*.

Your application has been reviewed by members of the HREC reviewing panel who have recommended that your application be **APPROVED**.

- You are authorised to commence your research as stated in your proposal.
- The approval number for your project is **HR 90/2005**. *Please quote this number in any future correspondence.*
- Approval of this project is for a period of twelve months **27/06/2005** to **26/06/2006**.

If you are a Higher Degree by Research student, data collection must not begin before your Application for Candidacy is approved by your Divisional Graduate Studies Committee.

Applicants should note the following:

- It is the policy of the HREC to conduct random audits on a percentage of approved projects. These audits may be conducted at any time after the project starts. In cases where the HREC considers that there may be a risk of adverse events, or where participants may be especially vulnerable, the HREC may request the chief investigator to provide an outcomes report, including information on follow-up of participants.
- All recommendations for approval are referred to the next meeting of the HREC for ratification. In the event the Committee does not ratify the recommendation, or would like further information, you will be notified. **The next meeting of the HREC is on 23/08/2005.**

The attached **FORM B** is to be completed and returned as soon as possible to the Secretary, HREC, C/- Office of Research & Development:

- When the project has finished, or
- If at any time during the twelve months changes/amendments occur, or
- If a serious or unexpected adverse event occurs.

Please find attached your protocol details together with the application form/cover sheet.

Darley

Dr Stephan Millett
Executive Officer
Human Research Ethics Committee

Please Note: The following standard statement must be included in the information sheet to participants:
This study has been approved by the Curtin University Human Research Ethics Committee. If needed, verification of approval can be obtained either by writing to the Curtin University Human Research Ethics Committee, c/- Office of Research and Development, Curtin University of Technology, GPO Box U1987, Perth, 6845 or by telephoning 9266 2784.

INFORMATION SHEET

Information sheet for participants of the Japan COPD lifestyle study

The aim of this project is to investigate the protective factors and risk factors of chronic obstructive pulmonary disease (COPD). The major risk factor of COPD is cigarette smoking. Although the prevalence of Japanese smoking is high, the prevalence of COPD in Japan is lower than other countries. There may be other factors in the Japanese way of life that offset the effect of smoking on COPD.

This survey is for patients with COPD diagnosed within the past three years as well as healthy adults aged between 50 and 75 years. A simple device called a spirometer, will be used to assess the health of your lungs by testing how hard you can blow into the machine. The test is very simple, you will be asked to blow into a tube which has no adverse effect on your body. We would then like to ask you a number of questions about your diet, the medicines that you take, your general health and your physical activity level. The interview will take about thirty minutes. At the end of the study we will be happy to provide you with a summary of the group results.

The benefit of this study is to find ways to keep the older Japanese population even healthier through the development of dietary guidelines. There is no risk to you if you choose to participate and no interference in your daily life or your medical treatment.

You are free not to answer any question if you choose not to. Your participation is completely voluntary and you are free to withdraw from further participation at any time without any negative consequences. Your records will not be identified by name and all information provided will remain confidential. Confidentiality and anonymity issues will be guaranteed. If you decline to participate, you will not be discriminated against in any way.

All data will be kept confidential and no identifiable data will be released to anyone. The questionnaires will be kept in a locked area at Curtin University for five years as required by the National Health and Medical Research Council (NHMRC). No unauthorized persons will be allowed to access the data. If you have any further questions please contact the chief investigator or the Curtin Human Research Ethics Committee concerning ethical issues.

Chief Investigator: Fumi Hirayama
Address: 849-1 Imafuji, Ueki, Kamoto, Kumamoto 861-0104 JAPAN
Telephone/facsimile: 096 272 1661
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The Human Research Ethics Committee
Address: C/- Office of Research and Development, Curtin University of Technology,
GPO Box U1987, Perth WA 6845
Telephone: 010 61 8 9266 2784
Email: S.Darley@curtin.edu.au

CONSENT FORM

I agree to participate in the study of ***Lifestyle Characteristics for Japanese Patients with Chronic Obstructive Pulmonary Disease***, the outcome of which could benefit men and women by assisting in the development of dietary guidelines. I declare that I preserve my rights not to answer any question. I understand that I am free to withdraw from further participation at any time without any negative consequences. I also understand that while information gained in this study may be published, I shall not be identified (anonymity) and all information provided will remain confidential.

Full name of participant:

Signature:

Date:

MEDICAL RESEARCH COUNCIL DYSPNOEA SCALE

(1) I only get breathlessness after strenuous exercise

(2) I get short of breath when hurrying on the level or on a slight hill

(3) I walk slower than people of the same age on the level because of breathlessness or have to stop for breath when walking at my own pace on the level

(4) I have to stop for breath after walking 100 yards or after a few minutes on the level

(5) I am too breathless to leave the house

FEELING SHORT OF BREATH SCALE

If you answer YES to 3 or more of these questions, you may have COPD.

(1) Do you cough several times most days?

(2) Do you bring up phlegm or mucous most days?

(3) Do you get out of breath more easily than others your age?

(4) Are you over 40 years old?

(5) Are you a smoker or ex-smoker?

DEMOGRAPHIC QUESTIONNAIRE

Gender	Male	1
	Female	2
Date of Birth: __ __ / __ __ / __ __ (Y M D) _____years old		
Weight	Now_____ kilograms Five years ago _____kilograms	
Height	_____ centimetres	

Marital status		
	Never married	1
	Married	2
	Defacto	3
	Divorced or separated	4

What is the highest level of education you have completed?		
	No formal education	1
	Primary school	2
	Junior high school/high school	3
	College/special school/University	4
	Postgraduate school	5
	Other (please specify)	6

What was your occupation? (If you were self-employed, please give your occupation or job title e.g. hairdresser.)_____
Years in workforce? _____Years
How many years since retirement? _____years

What kinds of job? (_____)	
Businessmen/women	1
Professional	2
Technician	3
Self-employed (_____)	4
Labourer or farm worker	5
Part-time job	6
Household	7
Unemployed	8
Other	9
What was your partner's occupation? (_____)	
Businessmen/women	1
Professional	2
Technician	3
Self-employed (_____)	4
Labourer or farm worker	5
Part-time job	6
Household	7
Unemployed	8
Other	9

Living place now:_____	
Residence belonging:	
City	1
Suburb	2
Town	3
Country	4
Residential area	5
Years of residency in this location _____years	
Did you live in another place when you were working?	
No 1 Yes 2	
Living place when working:_____	

Do you have any relatives who have the following diseases?

	Yes/No	**Smoker? (current or ex)**	**Which relatives?**
COPD			
Lung Cancer			
Asthma			
Diabetes			
Heart disease			

Do you have any of the following diseases?

Disease	Year diagnosed	On treatment now	Admission past year for this disease
High blood pressure			
Stroke			
Diabetes			
Cancer			
Depression			

Have you had these diseases when you were child?	
Whooping cough	1
Asthma	2
Pneumonia	3
Nothing	4
Have you had malnutrition during childhood?	
No	1
Yes	2

CIGARETTE CONSUMPTION

Are you smoking?			
Current regular	1	Other current smoker	2
Ex-regular smoker	3	Never smoked regularly	4

What is the average number of cigarettes that you smoked per day?_____	
Occasionally 1 to 2	1
Often 1 to 4	2
5 to 9	3
10 to 14	4
15 to 19	5
≥20	6
≥30	7
≥40	8

How many cigarettes have you smoked the maximal number /day? _____pieces
What is the total number of years you smoked? _____Years
Have you ever smoked a total of 20 or more packs of cigarettes in your lifetime? No 1 Yes 2
If you quit smoking, how many years ago did you quit? _____Years

Are your relatives living with you smoking at home?	
No	1
Yes, but not in the same room	2
Having some smoking in room	3
Heavy smoking in room	4

What is the total number of cigarettes that your relatives smoked at home per day?	
Less than 10	1
≥10	2
≥20	3
≥30	4
≥40	5

How many years have you been living with others who smoke? _____years

ALCOHOL CONSUMPTION

a) How often do you drink Sake, Shochu, Awamori (rice. Distilled alcoholic beverages), Beer, Whisky, Brandy or Wine?
(1) Almost never
(2) 1-3 days/month
(3) 1-2 days/week
(4) 3-4 days/week
(5) 5-6 days/week
(6) Almost daily

b) Check the combination that you regularly drink in a day.
eg): If you drink one bottle of beer and 2 cups of sake, please circle" 1 bottle " at " beer," and " 2 cups" at "sake." For other beverages, circle "none"
Sake – 1 go (180mL)
(1) None (2) Less than 1/2 go (3) 1 go (4) 2 go
(5) 3 go (6) 4 go (7) 5-6 go (8) More than 7 go
Shochu / Awamori – 1 cup (180mL)
(1) None (2) Less than 1/2 go (3) 1 go (4) 2 go
(5) 3 go (6) 4 go (7) 5-6 go (8) More than 7 go
*Beer – Large bottle (633mL)
(1) None (2) Less than 1/2 bottle (3) 1 bottle (4) 2 bottles
(5) 3 bottles (6) 4 bottles (7) 5-6 bottles (8) More than 7 bottles
Whisky – Glass(30mL)
(1) None (2) Less than 1/2 glass (3) 1 glass (4) 2 glasses
(5) 3 glasses (6) 4 glasses (7) 5-6 glasses (8) More than 7 glasses
Wine – Glass (60mL)
(1) None (2) Less than 1/2 glass (3) 1 glass (4) 2 glasses
(5) 3 glasses (6) 4 glasses (7) 5-6 glasses (8) More than 7 glasses
(*) Medium beer bottle or beer can with 500 mL = 0.8 large bottle, small beer bottle or beer can with 350 mL = 0.6 large beer bottle.

DIETARY SUPPLEMENTS

Do you take a supplement, which you consume more than once per week, over one year?

No……1

Yes……2 → Please fill in a below table

	(F r e q u e n c y)						(Term)				
Name of supplement	1-2 times /week	3-4 times /week	5-6 times /week	Once /day	2-3 times /day	Over 4 times /day	1-2 years	3-4 years	5-9 years	10-19 years	Over 20 years
Multivitamins											
Vitamin A											
Vitamin C											
Vitamin E											
Calcium											
Beta-carotene											
Royal Jelly											
Propolis											
Chlorella											
Soybeans protein											
Agaricus Murill											
Garlic											
Prune											
Turmeric											
Aojiru											
Black/cider vinegar											
Chitosan											
Ganoderma Lucidum											

Codliver oil											
Ginseng											
Yomeisyu											
Coenzyme Q10											
Others											

INTERNATIONAL PHYSICAL ACTIVITY QUESTIONNAIRE

We are interested in finding out about the kinds of physical activities that people do as part of their everyday lives. The questions will ask you about the time you spent being physically active in the **last 7 days**. Please answer each question even if you do not consider yourself to be an active person. Please think about the activities you do at work, as part of your house and yard work, to get from place to place, and in your spare time for recreation, exercise or sport.

Think about all the **vigorous** activities that you did in the **last 7 days**. **Vigorous** physical activities refer to activities that take hard physical effort and make you breathe much harder than normal. Think *only* about those physical activities that you did for at least 10 minutes at a time.

1. During the **last 7 days**, on how many days did you do **vigorous** physical activities like heavy lifting, digging, aerobics, or fast bicycling?

   _____ **days per week**

   ☐ No vigorous physical activities → ***Skip to question 3***

2. How much time did you usually spend doing **vigorous** physical activities on one of those days?

   _____ **hours per day**

   _____ **minutes per day**

   ☐ Don't know/Not sure

Think about all the **moderate** activities that you did in the **last 7 days**. **Moderate** activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal. Think only about those physical activities that you did for at least 10 minutes at a time.

3. During the **last 7 days**, on how many days did you do **moderate** physical activities like carrying light loads, bicycling at a regular pace, or doubles tennis? Do not include walking.

_____ **days per week**

☐ No moderate physical activities → ***Skip to question 5***

4. How much time did you usually spend doing **moderate** physical activities on one of those days?

_____ **hours per day**

_____ **minutes per day**

☐ Don't know/Not sure

Think about the time you spent **walking** in the **last 7 days**. This includes at work and at home, walking to travel from place to place, and any other walking that you might do solely for recreation, sport, exercise, or leisure.

5. During the **last 7 days**, on how many days did you **walk** for at least 10 minutes at a time?

_____ **days per week**

☐ No walking → ***Skip to question 7***

6. How much time did you usually spend **walking** on one of those days?

_____ **hours per day**

_____ **minutes per day**

☐ Don't know/Not sure

How much speed did you use in your walking?

Fast 1

Moderate 2

Slow 3

The last question is about the time you spent **sitting** on weekdays during the **last 7 days**. Include time spent at work, at home, while doing course work and during leisure time. This may include time spent sitting at a desk, visiting friends, reading, or sitting or lying down to watch television.

7. During the **last 7 days**, how much time did you spend **sitting** on a **week day**?

_____ **hours per day**

_____ **minutes per day**

☐ Don't know/Not sure

How about on a week end?

_____ **hours per day**

_____ **minutes per day**

INTERNATIONAL CONSULTATION ON INCONTINENCE QUESTIONNAIRE - SHORT FORM

How often do you leak urine?	
Never	0
About once a week or less often	1
Two or three times a week	2
About once a day	3
Several times a day	4
All the time	5

How much urine do you usually leak (whether you wear protection or not)?	
None	0
A small amount	2
A moderate amount	4
A large amount	6

Overall, how much does leaking urine interfere with your everyday life? Please ring a number between 0 (not at all) and 10 (a great deal).
0 1 2 3 4 5 6 7 8 9 10 Not at all A great deal

When does urine leak? (Please tick all that apply to you)
Never – urine does not leak
Leaks before you can get to the toilet
Leaks when you cough or sneeze
Leaks when you are asleep
Leaks when you are physical active/exercising
Leaks when you have finished urinating and are dressed
Leaks for no obvious reason
Leaks all the time

How long have you had a urinary incontinence? _____ years