ORIGINAL ARTICLE

Treatment of patients with chronic obstructive pulmonary disease as practised in a defined Hong Kong community: a cross-sectional pilot survey

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Objectives To examine the characteristics of chronic obstructive pulmonary disease patients of the Kwai-Tsing area, Hong Kong, and the chronic treatments they received.

Design Cross-sectional survey.

Setting Four clinic settings in Hong Kong: Respiratory Specialist Clinic, Princess Margaret Hospital (group 1); Medical Specialist Clinics, Princess Margaret Hospital (group 2); General Outpatient Clinics, Princess Margaret Hospital (group 3); South Kwai Chung Chest Clinic, Department of Health (group 4).

Patients Thirty physician-diagnosed chronic obstructive pulmonary disease patients in each of the above groups with post-bronchodilator 1-second forced expiratory volume/forced vital capacity ratios of less than 70% predicted values, who had been followed up at any of the participating clinics for at least 6 months.

Results There were 111 male and nine female patients. The median age was 72.5 years and 79% had at least one medical co-morbidity. The mean duration of their chronic obstructive pulmonary disease was 9.8 years, and their mean post-bronchodilator 1-second forced expiratory volumes were 45% (for males) and 58% (for females) of predicted values. There were significantly fewer stage I and more stage IV patients in group 1. Influenza vaccination coverage within the previous 1 year was 54% and did not differ significantly between groups. Chronic obstructive pulmonary disease education was given significantly more often to group 1 patients. Short-acting beta agonists were used to treat all patients but long-acting bronchodilators and pulmonary rehabilitation were used almost exclusively in group 1. Overall, long-acting bronchodilators and pulmonary rehabilitation were offered to 16% and 5%, respectively, of those for whom these were indicated (according to international guidelines).

Conclusion In general there was insufficient education and under-treatment for chronic obstructive pulmonary disease patients. Management of such patients warrants improvements by way of increased accessibility to structured education programmes, pulmonary rehabilitation programmes, long-acting bronchodilator drugs, and respiratory specialist care.

Key words
Airway obstruction; Forced expiratory volume; Lung diseases, obstructive; Pulmonary disease, chronic obstructive; Vital capacity

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New knowledge added by this study

- Chronic obstructive pulmonary disease (COPD) patients are old, and mostly males with medical co-morbidities.
- There is significant under-use of long-acting bronchodilators and pulmonary rehabilitation in managing these patients.
- A significant proportion of severe to very severe COPD patients are followed up in primary care clinics.

Implications for clinical practice or policy

- Proper assessment of COPD disease severity enables appropriate treatment.
- Patients with severe to very severe COPD may be better managed at specialist respiratory clinics.

Introduction

Chronic obstructive pulmonary disease (COPD) imposes a high burden. According to World Health Organization estimates, 80 million persons worldwide have moderate-to-severe COPD, and in 2005 more than 3 million people died of the disease, which corresponds to 5% of all global deaths.[1] In 2002, COPD was the fifth leading cause of death, and since mortality from it continues to increase, the disease is likely to become the third leading cause of death by 2030.[1] In Hong Kong the burden of COPD is also high[2-4]; affected patients currently occupy approximately 10% of all medical beds in public hospitals, and as a cause of death this disease is ranked fifth.

The clinical management of COPD is complex. According to the Global Initiative for Chronic Obstructive Lung Disease (GOLD) guidelines, COPD management has four components, namely: assessment and monitoring, reducing risk factors, managing stable disease, and managing exacerbations. Managing stable disease is further divided into education, pharmacological treatment, and non-pharmacological treatment.[5] However, the level of adherence to guidelines has been consistently unsatisfactory, as revealed by overseas questionnaire surveys targeting respiratory physicians and primary care physicians.[6-11] Specifically, under-utilisation of effective treatments and under-use of spirometry is of particular concern. Moreover, physician knowledge of COPD treatment guidelines is generally poor.[12-15]

Active identification of problem areas could be useful in designing treatment programmes aimed at improving COPD care. One approach to observe the level of adherence to clinical guidelines is to examine COPD subjects prospectively to assess their disease severity and then correlate the same with treatments they actually receive. To our knowledge, such a study has not been performed locally. We therefore set out to conduct a prospective survey on COPD patients managed in different health care settings in a local community (Kwai Chung and Tsing Yi, or Kwai-Tsing) with a population of about 530 000 inhabitants. The primary objective was to observe the management practice for COPD in different health care settings. The secondary objective was to correlate disease severity with the level of treatments received.

Methods

This was a multicentre cross-sectional survey carried out in the Department of Medicine and Geriatrics, Princess Margaret Hospital (PMH), Hong Kong. Collaborating sites included general out-patient clinics in the Kwai-Tsing area run by the Hospital Authority (HA), and the South Kwai Chung Chest Clinic run by Department of Health.

香港其中一個區域的醫院診所對慢性阻塞性肺病患者的治療：橫斷面試點調查

目的 探討香港葵青區慢性阻塞性肺病患者的特性以及接受的長期治療。

設計 橫斷面調查。

安排 香港葵青區轄下四間診所：瑪嘉烈醫院胸肺科專科診所（第一組）；瑪嘉烈醫院內科專科診所（第二組）；瑪嘉烈醫院普通科診所（第三組）；衛生署轄下的南葵涌胸肺科診所（第四組）。

患者 每個組別於上述診所隨訪期至少有六個月而被醫生確診的30位慢性阻塞性肺病患者，他們使用支氣管擴張劑後用力呼氣一秒容積／用力呼氣肺活量比例均少於預測值的70%。

結果 共有111位男性及9位女性患有慢性阻塞性肺病，他們的年齡中位數為72.5歲，平均患病年期為9.8年；其中79%至少有一種共病。患者使用支氣管擴張劑後用力呼氣一秒平均容積為預測值的45%（男性）及58%（女性）。第一組中明顯有較少I期及較多IV期患者。過去一年內流感疫苗接種覆蓋率為54%，不同組別間未見顯著相關性。第一組患者明顯有較多機會接受慢性阻塞性肺病的健康教育。所有病人都曾接受短效β受體激動劑的治療，但幾乎只有第一組的患者有長效支氣管擴張劑及肺康復治療。（按國際準則）長效支氣管擴張劑及肺康復治療分別給予16%及5%的患者。

結論 總括來說，慢性阻塞性肺病患者的健康教育和治療並不足夠。要改善慢性阻塞性肺病患者的治療結果，必須為病人提供有系統的教育服務，並確保他們有更多機會接受肺康復治療計劃，以及長效支氣管擴張劑和呼吸專科護理。

Thirty COPD subjects were recruited from each of the following settings:

- Group 1: Respiratory Specialist Out-Patient Clinic, Department of Medicine & Geriatrics, PMH;
- Group 2: General Medical Specialist Out-patient Clinics, Department of Medicine & Geriatrics, PMH;
- Group 3: All five HA Family Medicine Clinics or General Out-Patient Clinics in the Kwai-Tsing area, where there was no set quota for each and subjects were drawn randomly; and
- Group 4: South Kwai Chung Chest Clinic, Department of Health.

During planning of this study, we intended to recruit a fifth group of 30 patients with regular follow-up by general practitioners. We found very few patients in this category however, and hence this group was not included.

Subject lists for groups 1 to 3 were generated from the HA Clinical Data Analysis and Reporting System (CDARS). The subjects had to have a valid

future appointment in that clinic and one of the following diagnostic codes: 490 (bronchitis, not specified as acute or chronic); 491 (chronic bronchitis); 492 (emphysema); 496 (chronic airway obstruction, not elsewhere classified). Subjects were randomly selected from the list and invited to participate in the study by telephone. An appointment was given to verbally consenting subjects to attend an interview at PMH. Recruitment for each group ceased when 30 consenting and evaluable subjects had been accrued. For group 4, since no patient list could be generated, COPD subjects were invited to participate in the study as they attended the follow-up at the clinic. Otherwise the workflow was similar to the other groups.

At the PMH visit, which was the only study visit, subjects were checked for study entry criteria. Inclusion criteria were: (1) physician-diagnosed COPD; (2) post-bronchodilator forced expiratory volume in one second (FEV_1)/force vital capacity ratio <70% of predicted; (3) regular follow-up at the participating clinic for treatment of stable COPD for at least 6 months; (4) willingness and ability to comply with study requirements (spirometry and 6-minute walk test); and (5) willingness to give written informed consent. Exclusion criteria were: (1) non-COPD diagnosis as judged by the principal investigator; (2) regular follow-up at another clinic and/or irregular attendance at a participating clinic for acute exacerbations of COPD or other problems; (3) significant co-existing chronic lung disease (asthma, pulmonary fibrosis, bronchiectasis, and restrictive lung disease); and (4) history of lung resection.

When the subjects satisfied all inclusion and exclusion criteria, written informed consent was obtained. Demographic and illness data were then collected using a standard data entry form. All available medical records were reviewed to obtain information on the use of spirometry and chest radiographs in the diagnosis and subsequent management of COPD, vaccination, and current medication usage. If not performed within the preceding year, spirometry was undertaken at PMH (as per American Thoracic Society/European Respiratory Society protocols[16]). Moreover, it was a requirement that the subject had no COPD exacerbation within the preceding 4 weeks. Local reference values were used for FEV_1 and other spirometric parameters.[17] The 6-minute walking distance test was performed, and pulse oximetry monitoring being carried out before, during, and after the test.

After the study visit, the subjects continued to attend regular follow-up at their original clinic. A summary of the subject's clinical findings and/or treatment recommendations was supplied to the caregiver on request.

To compare mean values of patient variables in different groups, either analysis of variance (ANOVA) (for samples generated from population following normal distribution) or non-parametric Kruskal-Wallis H (for all other situations) test were employed. To decide between these two methods, we used the Shapiro-Wilk test to check for normal distributions. To compare distributions among groups, Pearson Chi squared or Fisher's exact tests (for analyses with number of expected cases in certain categories less

TABLE 1. Subject screening and recruitment summary*

Group	Clinic	Screening and invitation			Attended study visit			Analysed
		No.	No. failed	Reason	No.	No. excluded	Reason	
1	Respiratory PMH	37	4	Refused	30	0		30
			1	Suspected active TB				
			1	Significant bronchiectasis				
			1	Died before visit				
2	Medicine PMH	35	3	Refused	32	2	Not COPD	30
3	GOPC total	37	3		34	4		30
	Tsing Yi	9	2	Refused	7	2	Not COPD	5
	Cheung Hong	7	0		7	0		7
	South Kwai Chung	9	1	Refused	8	0		8
	North Kwai Chung	5	0		5	1	Not COPD	4
	Ha Kwai Chung	7	0		7	1	Spirometry failed	6
4	Chest Clinic	35	4	Refused	31	1	Not COPD	30
All groups		144	17		127	7		120

* PMH denotes Princess Margaret Hospital, TB tuberculosis, COPD chronic obstructive pulmonary disease, and GOPC general out-patient clinics

TABLE 2. Demographics data

Demographics*	Group 1 (n=30)	Group 2 (n=30)	Group 3 (n=30)	Group 4 (n=30)	Overall (n=120)	P value†
M:F	28:2	26:4	30:0	27:3	111:9	0.242‡
Male %	93%	87%	100%	90%	93%	
Age (years)						
Mean	71.3	74.2§	67.6§¶	73.9¶	71.8	0.004
Median	73	75	67	73.5	72.5	
Range	60-81	57-86	46-87	62-86	46-87	
Abode						
Own home	29 (97%)	27 (90%)	30 (100%)	29 (97%)	115 (96%)	0.468‡
RCHE	1 (3%)	2 (7%)	0 (0%)	1 (3%)	4 (3%)	
Others	0 (0%)	1 (3%)	0 (0%)	0 (0%)	1 (1%)	
Chinese ethnicity	30 (100%)	30 (100%)	30 (100%)	30 (100%)	120 (100%)	NA
Occupation						
Labourer	26 (87%)	22 (73%)	29 (97%)	24 (80%)	101 (84%)	0.105‡
Retired	29 (97%)	28 (93%)	24 (80%)	28 (93%)	109 (91%)	0.208‡
Smoking habit						
Never	2 (7%)	1 (3%)	0 (0%)	2 (7%)	5 (4%)	0.585‡
Previous	22 (73%)	20 (67%)	23 (77%)	24 (80%)	89 (74%)	
Current	6 (20%)	9 (30%)	7 (23%)	4 (13%)	26 (22%)	
Mean pack-year	74.4	65.5	55.7	50.9	61.5	0.128
Co-morbidity						
Hypertension	10 (33%)	20 (67%)§	7 (23%)§¶	17 (57%)¶	54 (45%)	0.002
BPH	7 (23%)	4 (13%)	4 (13%)	8 (27%)	23 (19%)	0.310
Old TB	3 (10%)	3 (10%)	6 (20%)	6 (20%)	18 (15%)	0.551‡
DM	2 (7%)	6 (20%)	3 (10%)	4 (13%)	15 (13%)	0.523‡
Any	24 (80%)	29 (97%)§	17 (57%)§	25 (83%)	95 (79%)	0.001
None	6 (20%)	1 (3%)	13 (43%)	5 (17%)	25 (21%)	

* RCHE denotes residential care home for the elderly, BPH benign prostatic hypertrophy, TB tuberculosis, and DM diabetes mellitus
† All P values are generated either from analysis of variance or Chi squared test, except otherwise indicated
‡ P value from Fisher's exact test
§¶ Pairwise significant difference from Tukey test (§), or Mann-Whitney *U* test with Bonferroni correction (¶)

than 5) were adopted. To deal with groups with discrepancies after identifying significant results, we used the post-hoc Tukey test for the ANOVA, Mann-Whitney *U* test, Chi squared test for Kruskal-Wallis H, and the Chi squared test. The alpha level of Mann-Whitney *U* test and Chi squared test for post hoc purposes was adjusted using the Bonferroni correction. A P value of less than 0.05 was considered statistically significant.

The study was approved by the Clinical Research Ethics Committee of the Kowloon West HA Cluster, as well as the Ethics Committee of the Department of Health.

Results

Subject recruitment started in June 2008 and was completed in June 2009. Seventeen of 144 randomly selected subjects either failed the initial screening or refused to participate in the study. Of the 127 remaining subjects who attended the study visit, six were excluded because they did not have COPD, and one because of failed spirometry. Breakdown for the different clinics is shown in Table 1. Data of the remaining 120 subjects were analysed.

Overall there were 111 males and 9 females, all of Chinese ethnicity. Their median age was 72.5 years and the range was 46 to 87 years. The number who never smoked, ex-smokers, and current smokers were 5 (4%), 89 (74%) and 26 (22%), respectively. For ever-smokers, the median pack-years was 71 with a range of 5 to 200. Most subjects (115; 96%) lived in their own homes; only four lived in residential care homes for the elderly and one was a long-term in-patient of a psychiatric institute. The majority of subjects were labourers (101; 84%) and had retired (109; 91%). The commonest medical co-morbidity was hypertension (54; 45%), followed by benign

TABLE 3. Chronic obstructive pulmonary disease severity*

Disease severity	Group 1 (n=30)	Group 2 (n=30)	Group 3 (n=30)	Group 4 (n=30)	Overall (n=120)	P value†
Duration of COPD (years)						
Mean	8.6	10.4	11.3	8.9	9.8	0.465‡
Range	2-30	0.5-40	0.5-30	1-30	0.5-40	
Post-BD FEV_1 mean values (L)						
Males	0.75§/¶/‖	1.12§	1.15¶	1.10‖	1.03	0.002‡
Males % predicted	34%§/¶/‖	50%§	48%¶	50%‖	45%	0.003‡
Females	-	-	-	-	0.84	NA
Females % predicted	-	-	-	-	58%	NA
GOLD stage						
Stage I	0 (0%)	5 (17%)	2 (7%)	3 (10%)	10 (8%)	
Stage II	4 (13%)§/¶	11 (37%)§	12 (40%)	11 (37%)¶	38 (32%)	0.021
Stage III	13 (43%)	9 (30%)	11 (37%)	13 (43%)	46 (38%)	
Stage IV	13 (43%)	5 (17%)	5 (17%)	3 (10%)	26 (22%)	
Mean BMI (kg/m^2)						
Males	21.4	22.6	21.5	22.9	22.1	0.295
Females	-	-	-	-	24.0	NA
Mean 6-minute walking distance (m)						
Males	262	242	267	238	253	0.421
Females	-	-	-	-	264	NA

* BD denotes bronchodilator, BMI body mass index, COPD chronic obstructive pulmonary disease, FEV_1 1-sec forced expiratory volume, GOLD Global Initiative for Chronic Obstructive Lung Disease, and NA not applicable

† All P values are generated either from analysis of variance or Chi squared test, except otherwise indicated

‡ Kruskal-Wallis H

§/¶/‖ Pairwise significant difference from Tukey test (§), Mann-Whitney *U* test with Bonferroni correction (¶) or Chi squared test with Bonferroni correction (‖)

prostatic hypertrophy (23; 19%), old pulmonary tuberculosis (18; 15%), diabetes mellitus (15; 13%), and ischaemic heart disease (12; 10%); 95 (79%) of the patients had at least one co-morbidity. Group 3 patients were significantly younger and significantly fewer had hypertension than in groups 2 and 4. Group 2 has the highest proportion of patients with at least one co-morbidity, which was significantly greater than in group 3. Otherwise there was no statistically significant difference in the demographic characteristics of the four groups (Table 2).

The mean duration of known COPD was 9.8 years (range, 0.5-40 years). Only 12 (10%) subjects had had spirometry performed in PMH within the last year; eight were in group 1, two in group 3, and two in group 4. The remaining 108 subjects had spirometry performed at the study visit. The mean post-bronchodilator FEV_1 and % predicted values for males and females were 1.03 L, 45% and 0.84 L, 58%, respectively. Division into GOLD stages was as follows: stage I: 10 (8%), stage II: 38 (32%), stage III: 46 (38%), stage IV: 26 (22%). The mean post-bronchodilator FEV_1 was significantly lower in group 1, as reflected by a significantly lower proportion being stage I subjects and higher proportion being stage IV. The mean body mass index (BMI) values of the males and females were 22.1 kg/m^2 and 24.0 kg/m^2, respectively. The mean 6-minute walking distances for males and females were 253 m and 264 m, respectively. The differences in COPD duration, BMI, and 6-minute walking distance among the four groups were not statistically significant (Table 3).

Table 4 tabulates data on clinical management in the four groups. In all, 22 (18%) subjects had ever received structured COPD education. Inhaler technique was taught within the previous 6 months to 24 (20%) subjects and within the last 2 years to 46 (38%) of them. Significantly more patients in group 1 had received COPD education and teaching on inhaler technique within the past 2 years. In all, 79 (66%) of the subjects had received influenza vaccination in the past, 65 (54%) in the previous year. There was no significant difference among the groups with respect to receipt of influenza vaccination. In all, 13 (11%) of the patients had received long-term oxygen therapy but only one (1%) was receiving non-invasive ventilation at home. Almost all the patients who received oxygen were in group 1.

Regarding drug treatment, there was more use of short-acting beta agonists (SABAs) in group 3 and group 4 subjects, while more theophyllines were

TABLE 4. Treatment for stable chronic obstructive pulmonary disease

Treatment*	Group 1 (n=30)	Group 2 (n=30)	Group 3 (n=30)	Group 4 (n=30)	Overall (n=120)	P value†
COPD education						
Ever received	13 (43%)§/¶	2 (7%)§	3 (10%)¶	4 (13%)	22 (18%)	0.001
Inhaler technique taught within 6 months	10 (33%)	5 (17%)	6 (20%)	4 (13%)	25 (20%)	0.241
Inhaler technique taught within 2 years	20 (67%)§/¶/‖	11 (37%)§	8 (27%)¶	7 (23%)‖	46 (38%)	0.000
Influenza vaccination						
Within 1 year	18 (60%)	18 (60%)	13 (43%)	16 (53%)	65 (54%)	0.552
Ever	21 (70%)	23 (77%)	15 (50%)	20 (67%)	79 (66%)	0.161
LTOT	10 (33%)§/¶/‖	1 (3%)§	1 (3%)¶	1 (3%)‖	13 (11%)	0.000‡
Home NIV	1 (3%)	0 (0%)	0 (0%)	0 (0%)	1 (1%)	1.000‡
Oral bronchodilator						
Sustained-release SABA	6 (20%)	9 (30%)	22 (73%)	18 (60%)	55 (46%)	<0.001‡
Theophylline	19 (63%)	12 (40%)	14 (47%)	12 (40%)	57 (48%)	0.223
Both	2 (7%)§	3 (10%)	11 (37%)§	8 (27%)	24 (20%)	0.010
None	7 (23%)	12 (40%)	5 (17%)	8 (27%)	32 (27%)	0.218
Mucolytic						
Regular	9 (30%)	0 (0%)	7 (23%)	7 (23%)	23 (19%)	
p.r.n.	7 (23%)§	8 (27%)§/¶/‖	13 (43%)¶	10 (33%)‖	38 (32%)	0.016
None	14 (47%)	22 (73%)	10 (33%)	13 (43%)	59 (49%)	
Inhaled SABA						
Regular	26 (87%)	17 (57%)	25 (83%)	17 (57%)	85 (71%)	0.008
p.r.n.	4 (13%)§/¶	13 (43%)§	5 (17%)	13 (43%)¶	35 (29%)	
None	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	
Ipratropium						
Regular	21 (70%)	17 (57%)	16 (53%)	8 (27%)	62 (52%)	0.005‡
p.r.n.	2 (7%)§	2 (7%)	0 (0%)	1 (3%)§	5 (4%)	
None	7 (23%)	11 (37%)	14 (47%)	21 (70%)	53 (44%)	
Tiotropium	3 (10%)	0 (0%)	0 (0%)	0 (0%)	3 (3%)	0.058‡
LABA	15 (50%)§/¶/‖	2 (7%)§	0 (0%)¶	0 (0%)‖	17 (14%)	<0.001

* COPD denotes chronic obstructive pulmonary disease, LTOT long-term oxygen therapy, NIV non-invasive ventilation, SABA short-acting beta agonists, p.r.n. according as circumstances may require, and LABA long-acting beta agonists

† All P values are generated either from analysis of variance or Chi squared test, except otherwise indicated

‡ P value from Fisher's exact test

§/¶/‖ Pairwise significant difference from Tukey test (§), Mann-Whitney *U* test with Bonferroni correction (¶) or Chi squared test with Bonferroni correction (‖)

used by those in group 1, though only the former difference was statistically significant. Some form of oral bronchodilator was given to 88 (73%) of the patients, but there was no significant difference between the groups. In all, 61 (51%) of the patients received some form of mucolytic, but significantly fewer in group 2. An inhaled SABA was prescribed for all patients, with regular (versus as required) use being significantly more common in groups 1 and 3. Ipratropium was increasingly used in the order: group 4, group 3, group 2, and group 1, there being a significant difference between group 1 and group 4. The use of long-acting bronchodilators (beta-agonist and tiotropium) was almost limited to group 1 (Table 4).

Table 5 shows the breakdown on the use of long-acting bronchodilator, inhaled corticosteroid, and pulmonary rehabilitation, in the four groups according to GOLD staging. Overall, long-acting bronchodilators were only given to 17 (15%) of the 110 subjects in whom it was indicated (according to the GOLD guidelines for stages II, III, and IV). Inhaled corticosteroids were given to 49 (68%) of 72 of stages III and IV subjects in whom it was indicated. Only six patients received pulmonary rehabilitation, three each for patients in stages III and IV. These six patients comprised 5% of the 110 stages II, III, and IV subjects in whom it was indicated. For all these treatment modalities, group 1 received significantly more prescriptions.

TABLE 5. Prescription of long-acting bronchodilators, inhaled corticosteroids, and pulmonary rehabilitation according to GOLD stage

Treatment*	Group 1 (n=30)	Group 2 (n=30)	Group 3 (n=30)	Group 4 (n=30)	Overall (n=120)	P value†
Any long-acting bronchodilator						
GOLD I	0/0	0/5	0/2	0/3	0/10	1.000
GOLD II	1/4 (25%)	0/11	0/12	0/11	1/38 (3%)	0.105
GOLD III	5/13 (38%)§/¶/‖	0/9§	0/11¶	0/13‖	5/46 (11%)	0.002
GOLD IV	9/13 (69%)§/¶	2/5 (40%)	0/5§	0/3¶	11/26 (42%)	0.032
GOLD II+III+IV	15/30 (50%)§/¶/‖	2/25 (8%)§	0/28 (0%)¶	0/27 (0%)‖	17/110 (15%)	0.000
Inhaled corticosteroids						
GOLD I	0/0	2/5 (40%)	1/2 (50%)	2/3 (67%)	5/10 (50%)	1.000
GOLD II	1/4 (25%)	3/11 (27%)	5/12 (42%)	4/11 (36%)	13/38 (34%)	0.960
GOLD III	12/13 (92%)§/¶	5/9 (56%)	5/11 (45%)§	6/13 (46%)¶	28/46 (61%)	0.038
GOLD IV	12/13 (92%)§	5/5 (100%)	3/5 (60%)	1/3 (33%)§	21/26 (81%)	0.048
GOLD III+IV	24/26 (92%)§/¶	10/14 (71%)	8/16 (50%)§	7/16 (44%)§	49/72 (68%)	0.002
Pulmonary rehabilitation						
GOLD I	0/0	0/5	0/2	0/3	0/10	1.000
GOLD II	0/4	0/11	0/12	0/11	0/38	1.000
GOLD III	2/13 (15%)	1/9 (11%)	0/11	0/13	3/46 (7%)	0.267
GOLD IV	3/13 (23%)	0/5	0/5	0/3	3/26 (12%)	0.575
GOLD II+III+IV	5/30 (17%)§/¶	1/25 (4%)	0/28 (0%)§	0/27 (0%)¶	6/110 (5%)	0.011

* GOLD denotes Global Initiative for Chronic Obstructive Lung Disease

† P value from Fisher's exact test

§/¶/‖ Pairwise significant difference from Tukey test (§), Mann-Whitney *U* test with Bonferroni correction (¶) or Chi squared test with Bonferroni correction (‖)

Discussion

The management of COPD involves proper patient assessment and monitoring, and repeated education about various aspects of the disease, a host of different treatment modalities, and especially the proper use of inhaled medications. Local and overseas data suggest that many patients are under-monitored and under-treated.[4-9] Conceivably, better adherence to internationally accepted treatment guidelines could improve COPD care with a consequent reduction in hospitalisations including readmission rates.

Our data show that COPD subjects attending public sector facilities of Kwai-Tsing district are old, mostly males, mainly of lower social class, and have high rate of medical co-morbidities. Moreover, about half of them had severe to very severe COPD. By and large, data on the treatment of stable COPD confirmed our suspicion that there is considerable room for improvement. First, the proportion of subjects who receive education about COPD and techniques on how to use inhalers is very low. Patient education is often part of pulmonary rehabilitation programmes and it can improve skills, ability to cope with illness, and their health status.[18] Recently the HA has developed nurse clinics and patient empowerment programmes, which will hopefully provide an impetus in this area.

Influenza vaccination is proven to reduce COPD exacerbations, hospitalisation, and associated serious illness and mortality.[19,20] In our cohort, vaccine coverage for 54% of the patients within the preceding 1 year is suboptimal. This ensued despite intensive Government efforts (public propaganda and incentive schemes) to boost vaccine uptake in targeted populations in recent years. The medical profession can perhaps help to disseminate the beneficial effects of influenza vaccination, and encourage COPD patients to accept this important intervention.

Inhaled SABAs such as salbutamol and terbutaline are standard treatments for symptomatic COPD, and were uniformly prescribed for our subjects. Oral bronchodilators (sustained release salbutamol, terbutaline, and theophyllines) were often given as adjuncts to inhaled therapy; their use did not differ significantly between groups. Conversely, inhaled ipratropium, which has proven additive benefit on top of inhaled SABAs,[21,22] was more frequently prescribed in group 1 patients. Regarding the newer and more efficacious long-acting bronchodilators including long-acting beta agonists (LABAs) such as salmeterol and formoterol and the long-acting muscarinic agent tiotropium, in nearly all instances they were used in group 1 patients. For the prescribing of latter agents, cost

appeared to be an important consideration. However, there is now a large body of evidence showing that they can improve many clinical outcome parameters and reduce hospital admissions,[23-26] and are therefore cost-effective.[27,28] Nevertheless, even in group 1 nearly half the patients for whom they were indicated did not receive them. The Hong Kong data in the EPOCA study reveal that among 153 COPD patients with mean FEV_1 values 34% of predicted, only 2% were prescribed tiotropium and 13% were prescribed LABA/inhaled corticosteroid combinations. Both figures were the lowest among the participating countries.[11]

There is universal agreement on the beneficial effects of pulmonary rehabilitation and it is generally agreed that COPD patients in stages II, III and IV should receive this form of treatment.[18,29,30] Disappointingly, only a very small proportion of our subjects with indications had received it. Nonetheless, under-provision of pulmonary rehabilitation appears to be a general phenomenon and surveys in Canada and the UK showed that only 1 to 2% of the COPD population had access to it,[31,32] which may be related to the need for multi-disciplinary involvement and high costs.

Although group 1 subjects had more severe disease, the proportion of severe and very severe disease patients in the other groups was by no means low (about half). Yet in these groups many patients were not prescribed long-acting bronchodilators, pulmonary rehabilitation and long-term oxygen therapy. For pulmonary rehabilitation and long-term oxygen therapy, it may well be that the patients are preferentially followed up at specialist respiratory clinics. Though the reasons for such differential prescribing between groups are not entirely clear, they may be related to availability and cost considerations. Another possibility is that doctors in the general clinics care for a large variety of patients and may be less familiar with COPD treatment guidelines, as has been shown in overseas studies.[9,10,13,14] Interestingly, group 1 patients had a comparable mean 6-minute walking distance to other groups, despite having significantly lower mean FEV_1 values. This appears to suggest that they enjoyed better overall management than other groups, though our study was not designed to examine this possibility.

Crucially, our subjects were prospectively recruited and all attended for clinical assessment and lung function testing at the study site. Thus, the diagnosis of COPD and stratification into severity groups was likely to have been accurate. Another advantage was that our study involved patients in all clinic settings and we randomly selected individuals from the different groups (except group 4) to improve representativeness. Nevertheless, our study was designed to provide equal numbers of study subjects from each group, whereas the numbers of COPD patients followed up at these different clinics were far from equal. Hence the proportion of patients with different grades of disease severity in each of our groups was not representative of the actual proportions of COPD patients being followed up. Also, the Kwai-Tsing population was less than one-tenth of the total population of Hong Kong, and our conclusions may not be applicable to other geographic areas. Future surveys should be performed, based on a complete list of COPD subjects followed up at all public and private clinics in Kwai-Tsing, so that a truly representative sample can be generated. Better still, a territory-wide survey should be performed, so as to obtain a complete picture of the COPD situation in Hong Kong.

In conclusion, COPD patients followed up at public sector facilities in Kwai Tsing had a high proportion of subjects with severe disease. Ideally the latter patients should have been followed up at respiratory units with structured COPD care programmes. More patient education and the prescribing of long-acting bronchodilators and pulmonary rehabilitation appear necessary, so as to optimise their chronic care.

Declaration

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