



Chronic Obstructive Pulmonary Diseases Related Health Resources Allocation in Hunan Province of China

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Abstract

Background: Information about Chronic obstructive pulmonary diseases (COPD)-related health resources allocation in China is very limited. The aim of the study was to explore the distribution of COPD-related health resources allocation among different levels public hospitals (PHs) in Hunan Province of central south China.

Methods: We randomly collected data from 57 Public Hospitals (PHs) at 3 different levels in Hunan province as well as 893 pulmonary physicians (PPs) who worked there in 2009. Questionnaires based on the recommendations of COPD guideline were designed, including availability of spirometers, inhaled agents for COPD and COPD-related health education for local residents, as well as PPs' educational levels.

Results: Spirometers equipped ratio in 3rd level PHs was much higher than 1st, 2nd PHs. The disparity varied vastly from 0% to 100%. The inhaled agents equipped ratio was 5.56%, 70.85% and 100% respectively for the 1st, 2nd and 3rd levels PHs. No 1st level PHs launched COPD-related healthcare education for local residents, only 10 of 24 for the 2nd level PHs and 10 of 15 for the 3rd level PHs. PPs of high educational levels concentrate in 3rd levels PHs, however, PPs working in 1st levels PHs and 2nd levels PHs were mainly low and median educational levels PPs' knowledge of COPD of 3rd levels PHs was much better than of 1st levels PHs and 2nd levels PHs.

Conclusion: The extreme imbalance and disparity existed in COPD-related health resources allocation at three levels PHs in central south China. Inequity and insufficient in COPD-related health resources in 1st and 2nd levels PHs should be improved.

Keywords: Allocation, COPD, Public Hospitals, Pulmonary physicians, Resourcec, China

Introduction

China is the world's largest cigarette consumer and producer (1). In 2002, about 350 million Chinese adults reported having smoked at some point and 300 million reported being smokers at the time (2). Chronic obstructive pulmonary diseases (COPD) are a growing health problem and remain a major consumer of health-care resources in China and in the world. It will be the third leading cause of death by 2030 worldwide (3) and its

prevalence and mortality will continue to increase in the next decades (4-6). The disease has an overall prevalence of 8.2 percent among individuals aged 40 years or older in China (7). It is costly for individuals and society, accounting for a great burden on the healthcare cost for Chinese medical system (6, 8-10). Pulmonary function test is the gold standard to diagnose COPD (11, 12). Inhaled agents, which usually include β_2 -agonists,

anticholinergics and methylxanthines, are the mainstay of management in symptoms and improvement in lung function and health status for COPD (11, 12). However, COPD has still not driven serious health concern and still largely under diagnosis, under treatment and so neglected by physicians, public health and government officials (4, 12, 13). What's more, for cultural and economic reasons, most of Chinese citizens, especially rural residents, are reluctant to visit a physician or postponed seeing a doctor even if they are acutely ill, which leads to difficulty in prevent and manage such asymptomatic disease and rural residents have a higher increased risk of dying from COPD than urban residents in China. Nearly two thirds of residents with spirometric evidence of COPD had never been diagnosed with COPD and the rate of COPD under diagnosis in rural areas was much higher than urban areas (14).

In China, according to the infrastructure and administrative, all public hospitals are ranked as three levels by the Ministry of Health of local and central bureau: first, second and third level hospitals (15). Most of early COPD diagnosis and treatment is usually given by primary healthcare physicians, such as the first and second level hospitals. They are most primary healthcare providers and play a central and core role in primary healthcare, whose one of most important functions is managing and preventing common chronic diseases such as COPD. However, the previous study has shown eighty percent of health resources are allocated to the cities, among which two thirds are being allocated to big hospitals, especially allocated in 3rd level PHs, whereas health resources of PHs in rural regions are severely insufficient in China (16). As is estimated, about 800 million Chinese residents live in rural areas, but only 20% of the medical resources are concentrated in rural areas (17). The Chinese government is facing a mammoth task in trying to provide adequate medical resources to meet the basic needs for rural residents and small hospitals.

Health resources allocation has always been a highlighted issue in the public hospitals by healthcare providers and government in every country (18,

19), especially in developing countries, which means distribution of manpower, facilities, revenue, equipment, and supplies to produce requisite healthcare and services. The literatures always emphasize on rural-urban, coastal-inland, rich-poor disparities in access to health resources and on high cost and inequality in healthcare expenditure about Chinese care system (17, 20). PPs' basal knowledge of COPD is tested based on the recommendation of Global Initiative for Chronic Obstructive Lung Disease (GOLD) (12) and their educational levels, availability of spirometers and pharmacotherapy as well as COPD education for local residents are all investigated through the questionnaires.

The objective of the research was to investigate the COPD-related health resources allocation at three levels PHs in central south China.

Materials and Methods

Sample and grouping

In Hunan Province of central south China, there are totally 44 third level public hospitals (PHs), 292 second levels public hospitals (PHs) and 193 first level public hospitals (PHs) (21). We collected different levels PHs as our sample and used the questionnaires to obtain the data about the COPD-related health resources allocation among three levels public hospitals in central south China from July, 2009 to July, 2010.

According to random number table, 57 PHs at three different levels in Hunan province were included. All PHs were divided into three groups according to their levels, as follows: 15 PHs at 3rd level (26.32% of the study sample), 24 PHs at 2nd level (42.11%), 18 PHs at 1st level (31.57%). 893 PPs were enrolled and only 846 qualified, who were finally divided into 3 groups by their PHs' levels: 192 physicians in 3rd level PHs (22.69% of the study sample), 559 physicians in 2nd level PHs (66.08%) as well as 95 physicians in 1st level PHs (11.23%). According to the PPs' educational levels, they were also divided into three groups: high, median and low educational levels. High educational level were defined as PhD and master's de-

gree of medicine, median educational levels mean Bachelor degree of medicine, low educational levels indicated someone just finished junior medical college or medical school, even bare-foot doctors and did not study further.

We have the IRB approval before the investigation and all the PPs signed informed consent first.

Survey questionnaires design

Two kinds of survey questionnaires were utilized in the study. The first questionnaire was for the chiefs of the respiratory department to investigate whether their wards had spirometers, inhaled bronchodilator medications as well as COPD-related health education for patients or not. The second questionnaire was designed for PPs to investigate their educational levels and test their knowledge of COPD about the diagnosis and treatment based on COPD guideline. We cooperated with a pulmonary expert advisory group to devise the questionnaire on the basis of the existing published recommendations of Chinese COPD guideline in 2007 (22). The questionnaire contained 10 single-choice questions, which were primarily patient-oriented and related to the PPs' treatment strategies on diagnosis and treatment of COPD. Those specific questions about COPD included hallmark symptom Of COPD, pathogen of COPD, criteria of airflow limitation, grading criteria of COPD, curing medicine of COPD, oxygen therapy of COPD, treatment of COPD, acute exacerbation cause of COPD and indication of non-invasive venation. There was 100 score for 10 questions and 10 score was recorded for each correct answer.

Internal consistency was assessed by calculation of the Cronbach's alpha coefficients. A separate sample of ten experts in the field of COPD and/or designing the questionnaire reviewed the questionnaire and answered the question: 'How well do you think the questionnaire measures knowledge, attitude and practice of a physician about COPD?' They responded using a 5-point Likert scale from 1 (not at all) to 5 (very well). The content validity of the final questionnaire was determined according to the clarity, relevancy, simplicity, and consistency of each question with

the questionnaire set from 10 experts in the field of COPD (5 persons) and methodologists (5 persons). They examined the questionnaire for important omissions or inappropriate choice of items.

Questionnaires were sent to 893 PPs in 57 PHs, 869 of who returned back, with a recovery rate of 97.31%. At last only 846 questionnaires were qualified according to the study design, 23 were excluded because of any unanswered question, with an effective rate of 94.74%. A pulmonary physician was judged to know the guideline proficiently if his/her total score was more than 75, familiarly if his/her total score was between 50 and 75, insufficiently if his/her total score was between 25 and 50, poorly if his/her total score was less than 25.

Data analysis

Stratified sampling method was used in this investigation. Data were input to an Excel spreadsheet and analyzed through simple descriptive statistics. Comparison results about the spirometers, inhaled agents equipped ratio and Accuracy Rate (AR) were obtained by chi-square testing among different levels PHs, differences between the groups were considered significant if $P \leq 0.05$. Comparison results about educational levels of the PPs at different levels hospitals were compared by chi-square testing, it were considered significant if $P \leq 0.05$.

Results

Reliability and validity of the questionnaire

Cronbach's Alpha score, measuring the internal consistency of questions was 0.73 and 0.77 respectively for the first and the second questionnaires. All experts rated the questionnaire 4 or higher except one person, producing an overall mean of 4. The characteristics of the content validity of the whole parts of the questionnaire were clarity: 92.34% for the first and 90.12% for the second, relevancy: 94.46% for the first and 92.96% for the second, simplicity: 91.25% for the first and 90.33% for the second,

consistency of each question with the questions' set: 93.57% for the first and 92.56% for the second.

Allocation of Spirometers in three levels PHs

The spirometers equipped ratio of 57 PHs was very different at three different levels (Table 1). The overall ratio of 57 PHs equipped with spirometers was 40.35 %. For 18 PHs at 1st level, there were no spirometers for COPD; *only 8 of 24* PHs at 2nd level had spirometers, accounting for a 33.34% equipped ratio in 2nd level PHs. For 15 PHs at 3rd level, all of them were equipped with spirometers, with a 100% equipped ratio. Apparently, spirometers equipped ratio in 3rd level PHs was much higher than 1st, 2nd PHs. The disparity varied vastly from 0% to 100%.

Table 1: Spirometers' Equipment of 57 PHs at three different levels

PHs levels	Total PHs Number	PHs number Equipped with spirometers	Equipped Ratio (%)
1 st	18	0	0.00%
2 nd	24	8	33.34%*
3 rd	15	15	100.00%*

* P ≤ 0.05

Allocation of Inhaled agents in three levels PHs

The inhaled agents equipped ratio of 57 PHs was very different at three different levels (Table 2). The overall equipped ratio of inhaled agents in 57 PHs was 57.89%. There was only 1 hospital equipped with inhaled agents in 18 PHs at 1st level, 17 of 24 PHs at 2nd level were equipped with inhaled agents, however, all 3rd level PHs were equipped with inhaled agents. Equipped ratio was 5.56%, 70.85% and 100% respectively for the three different levels PHs.

Allocation of COPD-related healthcare education in three levels PHs

Totally speaking, COPD-related healthcare education for COPD patients was not enough (Table 3).

Table 2: Inhaled agents Equipped Ratio of 57 PHs at three levels

PHs levels	Total PHs Number	PHs numbers equipped with inhaled agents	Equipped Ratio (%)
1 st	18	1	5.56
2 nd	24	17	70.85*
3 rd	15	15	100.00*

* P ≤ 0.05

There were 20 hospitals in 57 PHs who carried out COPD-related healthcare education, accounting for an overall ratio of 35.09% in the study. Of the total, unfortunately, no 1st level PHs launched COPD-related healthcare education for local residents, only 10 of 24 for the 2nd level PHs and 10 of 15 for the 3rd level PHs. Obviously, it was not optimistic for the current state that COPD-related healthcare education had a so low popularity in all PHs, especially in 1st level PHs.

Table 3: Number of Public Hospitals (PHs) launching COPD-related healthcare education

PHs levels	Total Number	PHs numbers with healthy education	Ratio (%)
1 st	18	0	0.00
2 nd	24	10	41.67*
3 rd	15	10	66.67*

* P ≤ 0.05

PPS educational levels in three levels PHs

The great disparities in educational levels of PPs at three levels PHs existed in Hunan province, most PPs' education background was mainly median educational levels (See Table 4). Of the total 846 PPs, there were 82 PPs in high educational levels, 604 PPs in median educational levels and 160 PPs in low educational levels, accounting for 9.70%, 71.39% and 18.91% of the study sample respectively. In 1st levels PHs, constituent ratio of high, median and low PPs' educational levels in 95 PPs was 0%, 66.32% and 33.68% correspondingly; in 2nd levels PHs, constituent ratio of high, median and low PPs' educational levels in 559 PPs was 1.61%, 75.85% and 22.54% respectively. In 3rd levels PHs, constituent ratio of high, median and

low PPs' educational levels in 192 PPs was 38.02%, 60.94% and 1.04%. PPs of high educational levels concentrate in 3rd levels PHs, how-

ever, PPs working in 1st levels PHs and 2nd levels PHs were mainly low and median educational levels.

Table 4: Pulmonary Physicians (PPs)' educational levels in 57 PHs at three levels

PHs levels	PPs Total numbers	High educational levels numbers (%)	Median educational levels numbers (%)	Low educational levels numbers (%)
1 st	95	0(0.00)	63(66.32)	32(33.68)
2 nd	559	9(1.61)	424(75.85)	126(22.54)
3 rd	192	73(38.02)	117(60.94)	2(1.04)

PPs' basal knowledge of COPD in three kinds of levels PHs

PPs' basal knowledge of COPD of 3rd levels PHs was much better than of 1st levels PHs and 2nd levels PHs. Accuracy Rate (AR) of each question to test PPs' knowledge of COPD in 57 PHs at three levels was calculated (Table 5). Except question 9

(Acute exacerbation cause of COPD) without difference between 2nd and 3rd level PHs ($P > 0.01$), ARs of the rest 9 questions all had significant differences among PPs at three levels. The lower the level of PHs was the worse the PPs' basal knowledge of COPD is.

Table 5: Accuracy Rate (AR) of every question of physicians in three different levels hospitals

Questionnaire 2	3 rd levels PHs n=192		2 nd levels PHs n=559		1 st levels PHs n=95	
	AR (%)	AR (%)	AR (%)	AR (%)	AR (%)	AR (%)
1. Hallmark symptom of COPD	191	99.48*	428	76.57*	4	4.21
2. Pathogen of COPD	131	68.23*	302	54.03*	67	70.53
3. Criteria of Airflow limitation	189	98.44*	438	78.35*	18	18.95
4. Diagnostic tools of COPD	192	100.0*	464	83.01*	63	66.32
5. Grading criteria of COPD	175	91.15*	345	61.72*	4	4.21
6. Medicine of COPD	160	83.33*	419	74.96*	13	13.68
7. Oxygen therapy of COPD	168	87.50*	320	57.25*	0	0.00
8. Treatment of COPD	188	97.92*	375	67.08*	0	0.00
9. Acute exacerbation cause of COPD	167	86.98*	474	84.79*	61	64.21
10. Indication of non-invasive venation	167	86.98*	365	65.30*	11	11.58

* $P \leq 0.05$

Discussion

This study reports distribution of allocation of COPD-related medical resources in different levels hospitals of Hunan Province. It indicates allocation of COPD-related diagnosis equipment, pharmacy, and healthcare education for COPD patients as well as PPs themselves varies vastly from 1st levels PHs to 3rd level PHs. A public hospital's COPD-related healthcare resources is correlated with its level positively, which means

the higher the level of the PH is, the more COPD-related healthcare resources it possesses; the lower its level is, the less it possesses. Inequality of COPD-related medical resources exists in low and median levels PHs in China. Prior research about it is limited. It should evoke sufficient attention from the health-care profession, governments and other health-care providers (23). Despite COPD is described as a preventable and treatable disease by the Global Initiative for Chronic Obstructive Lung Disease in 2007 (12)

and 2011 (24), however, enormous barriers to the understanding and implementing COPD guidelines for PHs and PPs is still living in central south China. Although many studies have explored and emphasized the impact of spirometers, inhaled agents and healthcare education for COPD, for some economic and political reasons, most 2nd level hospitals and almost all of 1st level PHs can't afford advanced diagnostic medical equipment, such as pulmonary function testing machines or simple spirometers and expensive inhaled agent drugs. In comparison, majority of 3rd level hospitals have so abundant funds to purchase advanced facilities and valuable drugs. It's very unoptimistically, the spirometer equipped ratio in 57 PHs ranged from 0 at 1st level PHs and 100% at 3rd level PHs. Obviously, Diagnosis and treatment of COPD will be affected and delayed directly without spirometer. Consequently, the number of under diagnosis and under treatment of COPD will be likely to continue to increase. Referred to inhaled agents, only 5.56% of the 1st level PHs has inhaled agents, 70.85% at 2nd level PHs and 100% have inhaled agents. It will affect the treatment of COPD patients heavily. It is also pessimistic that COPD-related healthcare education carried out by PHs for local residents was rare in all PHs, especially in low levels hospitals. Various reasons may explain why disparities in COPD-related resources during three levels PHs. It was greatly caused by the availability of government fund and investment. China is the largest agricultural country in the world, whose population reached 1.3 billion in 2005 (25) and more than 60% individuals live in rural areas (17). Majority of Chinese COPD patients in rural strict or small town usually receive their medical care from 1st levels PHs and 2nd levels PHs. What is relatively clear in this study is that COPD-related healthcare resources of 1st, 2nd level PHs in small towns and rural areas is much less limited than 3rd levels PHs in the urban areas. In China, there is not a strict transfer system in health care services. Moreover, because of economic, geographical and politic reasons, physicians rarely transfer their patients to upper level hospitals. Therefore, most Chinese citizens accept their health care services in 1st and 2nd level hospit-

als. Such inefficiency and inequality in infrastructures, spirometers, drug inhaled agents, human resources and healthcare education of COPD in low and median levels PHs should be addressed urgently by the government. Providing sufficient healthcare resources timely to people with COPD is the current priority for all healthcare providers in China. A list of measures should be taken as discussed below for government and healthcare workers.

First, since spirometer is an essential tool to detect irreversible airflow limitation for COPD diagnosis (26), it must be equipped in each levels PHs so that it can be used to find the earlier stage of COPD and give the earlier interventions. With regard to inhaled bronchodilator medications, it is very beneficial to improve the symptoms and lung function for COPD. However, most of them were made in foreign drug company and owing to the expensive price; most 1st and 2nd level PHs didn't recommend it and most COPD patients couldn't afford it because of out-of-pocket payments at high levels. In Hunan Province, it may take a farmer's total income to buy these medications. In a word, despite Chinese government is taking steps to increase government funds on health for all citizens (27), gap to satisfy the need of the low and median levels PHs still lies there. Central and local government should still attach greater importance and more adequate funds to the infrastructures and drug in the low and median levels PHs and at least help them to purchase more inevitable diagnostic equipment and necessary drugs.

Secondly, PHs at three levels and PPs should offer COPD-related healthcare education frequently for COPD patients. The general population does not seem to be familiar with the term COPD (28). Self-knowledge of COPD patients was much poorer compared with generally asymptomatic disease (29). COPD-related healthcare education can not only reduce the need of visiting doctors and costs for reliever medication (30), but also improve lung function (31) and elevate the compliance with inhaled agents (32). Despite education have so power to ease the burden and is beneficial for COPD, none of PHs at 1st levels, less than half of PHs at 2nd levels and even one third of PHs at

3rd levels, neglected its importance and didn't carried out it. The chiefs of the PHs at all levels should highlight COPD-related healthcare education and take it as PHs' necessary service for COPD patients.

Thirdly, Knowledge about COPD guidelines should be enhanced and improved urgently. This survey revealed PPs' knowledge about COPD is poorest in 1st level PHs, median in 2nd level PHs and best 3rd level PHs. They are serious lack of necessary knowledge of COPD such as the hallmark symptom, pathogen, criteria of airflow limitation, diagnostic tool, grading criteria, curing medicine, pharmacotherapy and oxygen therapy, cause of acute exacerbation as well as Indication of non-invasive ventilation of COPD. The results are comparable to some publications (33, 34), it was reported that most primary health care physicians were lack of awareness of COPD and did not use COPD guidelines (33, 34). This study helps PHs and their PPs identify the targets of further education about COPD. COPD continuing medical education may be generalized to improve physician application of knowledge because of its effectiveness (35, 36).

High-level educational PPs should be encouraged to work in 1st levels and 2nd levels PHs in china. This study have shown low and median levels PHs are serious lack of PPs with high educational levels, most high educational background PPs who have got PhD and master degree were concentrated in 3rd level hospitals. The majority of PPs working in 1st and 2nd level hospital do not have formal medical residency training. In contrast, almost all 3rd level hospital physicians have graduated from medical colleges, and have pursued formal medical residency training. It could not meet the increasing need of COPD patients in 1st levels and 2nd levels PHs and follow up with severe COPD epidemic in rural areas. Low educational level PPs means weaker professional knowledge than PPs with high educational levels. It will affect proper diagnosis and management of COPD and deteriorate the national health of COPD patients. The educational level of PPs ranges from three years of medical school to five years of medical college after secondary school

training. This study may help ministry make useful policy to distribute reasonable human resource for 1st levels and 2nd levels PHs.

This study has some limitations. The contents of COPD-related healthcare resources are not comprehensive in the survey. It did not include other important COPD-related medical resource, such as beds, nurses, ventilators, respiratory intensive care unit, among three levels hospitals. For certain geographical and personal reasons, number of the sampled in total hospitals of Hunan province is not so large.

In conclusion, the extreme imbalance and disparity exist in COPD-related health resources allocation at three levels PHs in central south China. Inequity and inefficiency in COPD-related health resources in 1st and 2nd levels PHs should be improved. This study will be valuable for healthcare providers to deliver healthcare resources reasonably and for physicians to rethink highly of effective prevention and management about COPD.

Conclusion

The extreme imbalance and disparity existed in COPD-related health resources allocation at three levels PHs in central south China. Inequity and insufficient in COPD-related health resources in 1st and 2nd levels PHs should be improved.

Ethical considerations

Ethical issues (Including plagiarism, Informed Consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc) have been completely observed by the authors.

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The authors declare that there is no conflict of interest.

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