

Analysis of disease pattern and drug formulary at Da Nang Hospital for Lung Diseases before the time of the COVID-19 pandemic

Phân tích mô hình bệnh tật và danh mục thuốc
tại Bệnh viện Phổi Đà Nẵng trước thời điểm đại dịch COVID-19

Ngo Thi Viet Trinh^{a,b}, Dinh Dao^{c*}, Ha Hai Anh^{d*}
Ngô Thị Việt Trinh^{a, b}, Đinh Đạo^{c*}, Hà Hải Anh^{d*}

^aMaster student of K22MPM, School of Medicine and Pharmacy, Duy Tan University, Da Nang 550000, Viet Nam

^aHọc viên cao học K22MPM, Trường Y Dược, Đại học Duy Tân, Đà Nẵng, Việt Nam

^bDa Nang Hospital for Lung Diseases, Da Nang 550000, Viet Nam

^bBệnh viện Phổi Đà Nẵng, Việt Nam

^cGeneral department, School of Medicine and Pharmacy, Duy Tan University, Da Nang 550000, Viet Nam

^cPhòng Tổng hợp, Trường Y Dược, Đại Học Duy Tân, Đà Nẵng, Việt Nam

^dFaculty of Pharmacy, School of Medicine and Pharmacy, Duy Tan University, Da Nang 550000, Viet Nam

^dKhoa Dược, Trường Y Dược, Đại Học Duy Tân, Đà Nẵng, Việt Nam

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Abstract

Introduction: Since the COVID-19 outbreak, there have been studies showing the impact of the disease on other respiratory diseases, leading to an impact on prevention and treatment. Therefore, it is necessary to analyze data on disease patterns and hospital drug lists in order to have data as a basis for adjustment for the periods during and after the epidemic, and to meet the treatment needs that may change. **Methods:** In this study, we collected information from the drug supply, treatment activities, drug used and value. Drug categories and ABC analysis were used for drug formulary. ICD-10 (*International Classification of Diseases 10th Revision*) classification was used to analyze disease pattern. Other supporting data on drug supply activities were also used, contributing to the findings. **Results and discussion:** The disease pattern represents the intensive professional activities of the respiratory hospital. The disease with the highest proportion is pulmonary tuberculosis. Another respiratory disease accounted for a large proportion is COPD (*Chronic obstructive pulmonary disease*). The results of drug formulary analysis indicated that the hospital has developed a reasonable drug list, consistent with the disease pattern before the time of the COVID-19 pandemic. Low inventory value indicated that drug planning is close to reality. These data also suggested that further research on supportive regimens for COPD treatment in case of pulmonary disease occurrence, such as COVID-19 is required. **Conclusion:** This study provides pre-pandemic data to serve as the basis for future comparative studies and to identify further research directions in response to the periods during and after COVID-19. Research data also suggested the potential risks of stockpiling, inventory, as well as increasing the use of domestic drugs may be more proactive in drug supply.

Keywords: Disease pattern, Da Nang Hospital for Lung Diseases, hospital drug formulary, pre-COVID-19, respiratory disease, COPD.

* *Corresponding Author:* Dinh Dao, General department, School of Medicine and Pharmacy, Duy Tan University; Ha Hai Anh, Faculty of Pharmacy, School of Medicine and Pharmacy, Duy Tan University, Da Nang, Vietnam.

Email: thsdinhdao@gmail.com; hahaianh@dtu.edu.vn

Tóm tắt

Giới thiệu: Kể từ khi bùng phát COVID-19, đã có những nghiên cứu chỉ ra tác động của bệnh này đối với các bệnh đường hô hấp khác, ảnh hưởng đến việc phòng và điều trị. Vì vậy, để có số liệu làm cơ sở điều chỉnh cho các giai đoạn trong và sau dịch, đáp ứng nhu cầu điều trị có thể biến đổi, việc phân tích số liệu về mô hình bệnh tật, danh mục thuốc bệnh viện là cần thiết. **Phương pháp:** Trong nghiên cứu này, chúng tôi thu thập thông tin từ các hoạt động cung ứng thuốc và điều trị, lượng sử dụng và giá trị của thuốc. Các loại thuốc và phân tích ABC đã được sử dụng cho danh mục thuốc. Phân loại ICD-10 được sử dụng để phân tích mô hình bệnh tật. Dữ liệu hỗ trợ khác về các hoạt động cung ứng thuốc cũng được vận dụng, góp phần vào kết luận của nghiên cứu. **Kết quả và bàn luận:** Mô hình bệnh tật thể hiện hoạt động chuyên môn sâu của bệnh viện hô hấp. Bệnh có tỷ lệ cao nhất là lao phổi. Một bệnh lý đường hô hấp khác chiếm tỷ lệ lớn là COPD. Kết quả phân tích danh mục thuốc cho thấy, bệnh viện đã xây dựng danh mục thuốc hợp lý, phù hợp với mô hình bệnh tật trước thời điểm xảy ra đại dịch COVID-19. Số liệu tồn kho thấp thể hiện việc lập dự trữ thuốc sát với thực tế sử dụng. Những dữ liệu này cũng gợi ý cho nghiên cứu tiếp theo để phát triển phác đồ hỗ trợ điều trị COPD trong trường hợp xuất hiện bệnh lý hô hấp mới, chẳng hạn như COVID-19. **Kết luận:** Nghiên cứu này cung cấp dữ liệu trước đại dịch để làm cơ sở cho các nghiên cứu so sánh trong tương lai và xác định các hướng nghiên cứu tiếp theo để ứng phó với các giai đoạn trong và sau COVID-19. Dữ liệu nghiên cứu cũng chỉ ra một số rủi ro tiềm ẩn của việc dự trữ, tồn kho, cũng như tăng cường sử dụng thuốc trong nước để có thể chủ động hơn trong việc cung ứng thuốc.

Từ khóa: mô hình bệnh tật, Bệnh viện Phổi Đà Nẵng, danh mục thuốc bệnh viện, trước COVID-19, bệnh hô hấp, COPD.

1. Introduction

The respiratory characteristics of a community have a strong influence on the health of that community[1-3]. There are specialized respiratory hospitals in the province serving diagnosis and treatment. Since the outbreak of the COVID-19 epidemic, the complicating factors of lung diseases have been increasingly clarified, and the role of provincial respiratory hospitals has become more important as well[4]. Da Nang Hospital for Lung Diseases (DNHLD) is one such unit.

In the activities of drug supply and use, it is important to establish a drug formulary suitable to the disease pattern. Since the COVID-19 outbreak, there are recent studies showing the impact of this disease on other respiratory diseases, indicating an impact on prevention and treatment[4, 5]. Therefore, it is necessary to analyze data on respiratory disease pattern and hospital drug formulary. Analysis result may be used as a basis for adjustment for the periods during and after the epidemic, to meet the treatment needs that possibly change during and after the pandemic.

This study is mainly aimed at analyzing pre-pandemic data on disease and drug formulary of DNHLD. The analysis results also contribute

viewpoints to the need for broader studies on disease patterns and point out suggestions on the planning and supply of drugs at DNHLD.

2. Materials and Methods

In this observational study, a retrospective cross-sectional method was carried out. The data retrieval method was implemented as follows:

- Data collection: The sample size was defined as the total population, including all information within 2019, about the disease being treated, the drugs prescribed, the value of the drug. The data was checked and compared with the records, stored at DNHLD.

- Data processing: For disease data, the collected disease names were classified according to IDC-10, together with the frequency of occurrence during treatment activities of the hospital in 2019. For drug data, all drug preparations were categorized in groups, according to the appendix of Circular No.30/2018/TT-BYT.

Data analysis: The disease frequencies were calculated and compared by the proportion method. After classification, each drug group in the formulary was calculated for the monetary value. Then ABC analysis was performed as described previously [6].

Figures and tables are presented by common office software in Microsoft Office 365 system.

3. Results

3.1. Disease pattern

The most treated diseases include tuberculosis, the highest being pulmonary tuberculosis. The most common respiratory diseases are COPD. The analysis data shows that the hospital has a reasonably built drug list, consistent with the disease pattern before the time of the COVID-19 pandemic. Small differences between inventory, procurement,

and use lead to low inventory value. However, for the unpredictable impact of the epidemic, the restructuring of the drug formulary, the adjustment of the estimated drug demand is necessary to ensure responsiveness to the treatment needs that may be changed drastically after the COVID-19 pandemic. The data in the literature suggested that, diseases that require more attention include pulmonary tuberculosis, some lung diseases, and COPD in the context of respiratory pandemic. A low inventory ratio may be a risk factor when there is unusually high demand for certain drug classes.

Table 1. Pattern of prevalence of diseases in DNHLĐ in 2019

No.	Disease group	Number of case	Ratio (%)
1	Pulmonary tuberculosis	1,092	51.6
2	Extra-pulmonary tuberculosis	233	11.0
3	Respiratory diseases	791	37.4
	Total	2,116	100.0

However, in the major disease pattern (Table 1), the most common diseases are pulmonary tuberculosis (51.6%), respiratory diseases (37.4%) and extra-pulmonary tuberculosis accounts for only (11.0%). In order to gain more data about major proportions of those disease pattern, we carried out the analysis by ICD-10 code for main groups, including pulmonary tuberculosis and respiratory

diseases. Our analysis indicated that, pulmonary tuberculosis prevalence in DNHLĐ consists of 2 main ICD-10 codes: A15.0 and A16.0. The chart in Figure 1 showed that, patients with pulmonary tuberculosis can be divided into 2 main groups as they are confirmed (about 2/3 number of cases) or not yet confirmed (about 1/3 number of cases) by para-clinical data.

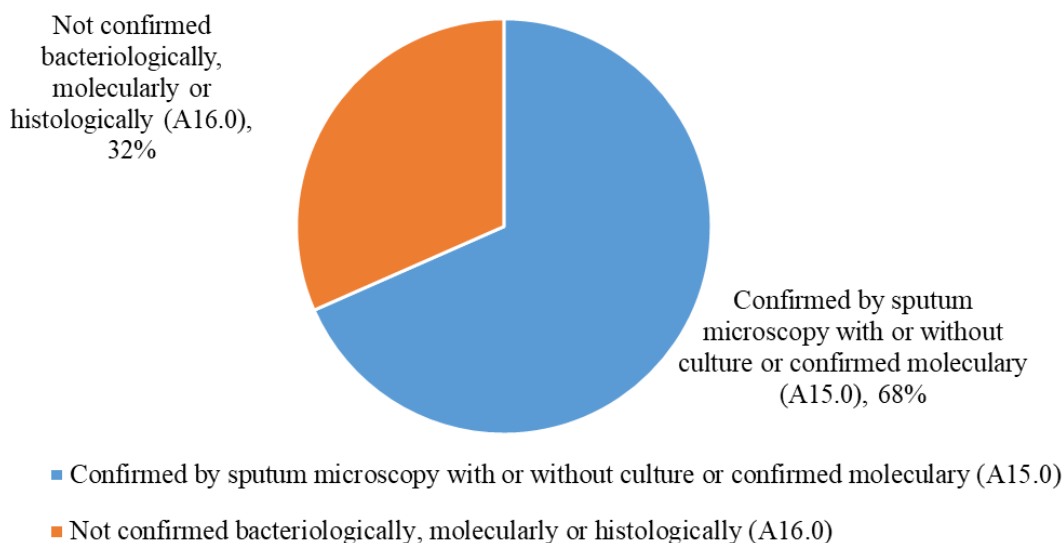


Figure 1: Pattern of pulmonary tuberculosis patients in DNHLĐ, classified by ICD-10

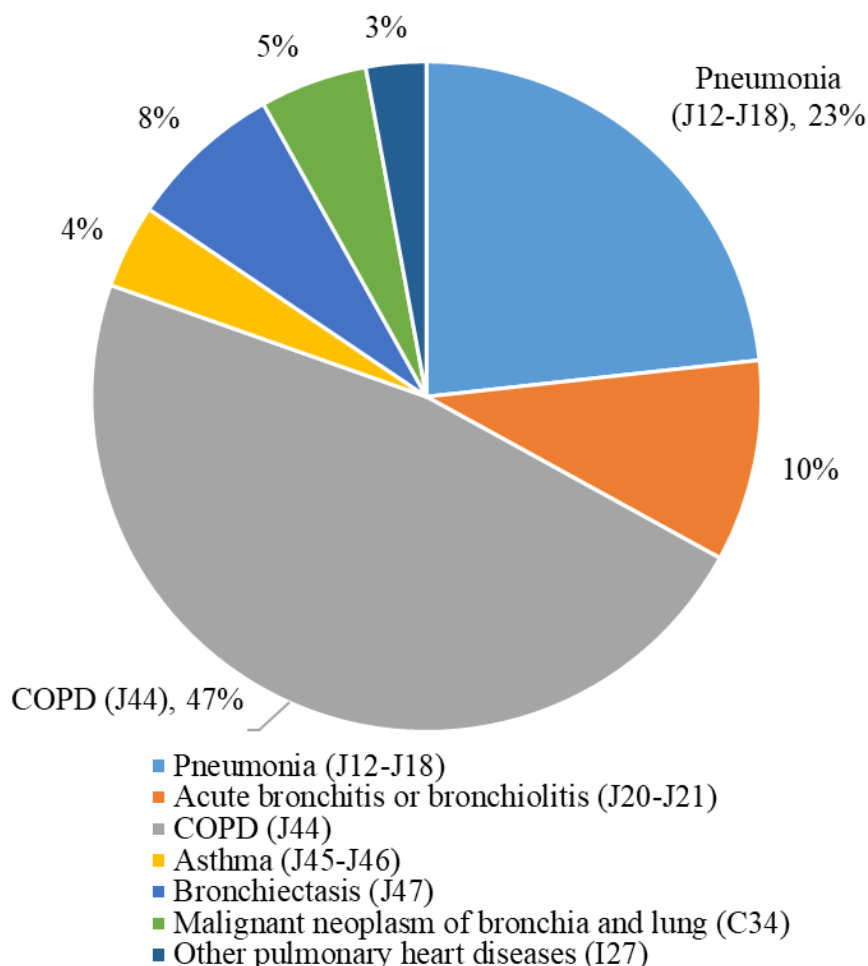


Figure 2: Pattern of respiratory disease in DNHL, classified by ICD-10

Table 2. Drug formulary of DNHL by therapeutic group and ABC classification

No	Therapeutic group	API	Value (*)	Ratio (%)	Class
1	Anti-parasite, anti-infective drugs	19	466.8	72.4	A
2	Drugs acting on the respiratory tract	11	283.0		
3	Analgesics, antipyretics, nonsteroidal anti-inflammatory drugs, drugs used to treat gout, and disease-modifying anti-rheumatic drugs	5	92.2		
4	Drugs affecting the blood	5	65.1	18.7	B
5	Vitamins and minerals	10	59.7		
6	Gastrointestinal drugs	15	51.1		
7	Traditional medicines	4(**)	41.8		
8	Hormones and other endocrine drugs	5	33.0	8.9	C
9	Cardiovascular drugs	12	19.3		

No	Therapeutic group	API	Value (*)	Ratio (%)	Class
10	Analgesics, antipyretics, nonsteroidal anti-inflammatory drugs, drugs used to treat gout, and disease-modifying anti-rheumatic drugs	5	15.8		
11	Disinfectants and antiseptics	2	14.6		
12	Anti-allergies and drugs used in anaphylaxis	6	5.3		
13	Diagnostics	2	2.7		
14	Muscle relaxants and cholinesterase inhibitors	1	2.0		
15	Antipsychotic drugs and drugs acting on the nervous system	5	1.8		
16	Antidotes and other substances used in poisonings	1	1.6		
17	Drugs for urinary tract treatment	1	1.5		
18	Anesthesia, anesthetic	1	0.6		
19	Diuretics	2	0.5		
20	Dermatological drugs	1	0.1		
21	Anti-migraine drugs	1	< 0.1		

*: Unit: million Vietnam Dong

** : Traditional preparation counted instead of API

On the other respiratory diseases pattern, our analysis showed that, prevalence of these diseases in DNHL D consists of various ICD-10 codes. Notably, the COPD (J44) accounts for first-ranked proportion (47%). The second-ranked is Pneumonia (J12-J18), accounting for 23%. The chart in Figure 2 revealed that, in addition, there are several types of respiratory diseases prevalence in DNHL D, with the proportion about 10% or less.

3.2. Drug formulary

Result in Table 2 showed that, the DNHL D drug formulary was developed to match the size and nature of a provincial respiratory hospital. The drug list includes 115 APIs, corresponding to 155 drugs, consists of 21 therapeutic groups.

The ABC analysis indicated that class A (72.4% of the value) consists of 3 therapeutic groups. The class B and C (18.7% and 8.9% respectively) consist of remaining therapeutic groups (4 and 14 groups, respectively).

Due to the importance of class A among therapeutic groups of drug formulary, we analyzed the largest drug group of anti-infective products for further details, including number of API and brand name. The result in Table 3 showed that the API of these drugs mostly antibiotics (namely beta-lactam group, aminoglycoside), and some other synthetic antibacterial agents (such as quinolone, sulfamide).

Table 3. Active pharmaceutical ingredients of anti-infective drug used in DNLP in 2019

No.	Anti-infective drug	API	Brand name
1	Nitroimidazol	1	1
2	Aminoglycoside	1	1
3	Beta-lactam	7	9
4	Quinolone	2	3
5	Macrolide	3	3
6	Tetracycline	1	1
7	Sulfamide	1	1
8	Other	1	1
	Total	15	20

3.3. Analysis on selected factors affecting the drug availability in DNHL

In the context of COVID-19, one of the factors affecting the readiness of hospital pharmacy operations, ensuring responsiveness within the changes of disease patterns, is drug availability. In which the supply of drugs, as well as the inventory and stockpiling of drugs at the hospital are important factors. Based on the

Table 4. Drug categories by origin

Drug origin	No. of preparation	Ratio (%)
Domestic drugs	107	68.2
Imported drugs	48	31.8
Total	155	100

One of the other factors affecting the availability of hospital pharmacy is the ratio of inventory and reserve. In the absence of a pandemic event, low inventories are beneficial. However, when a pandemic event occurs, more stocks will be needed for drugs that have the potential to be used when disease patterns change or when hospitals are overwhelmed. Table 5 indicated that the inventory value of pharmacy department accounts for a low

above analysis, we realize that it is necessary to analyze the origin of the drug, because logistics activities are often disrupted when a pandemic arises. At that time, domestic drug usually has more availability than the imported drug. The data in Table 4 indicated that domestic drugs account for a larger proportion, approximately twice as many preparations, when compared to imported drugs.

proportion (12.7% and 13.1% at the end of 2018 and 2019 respectively). This is also a factor to consider when needing to expand the supply of drugs to cope with the pandemic. For better understand which drug therapeutic group need to be stockpiled, we need to analyze current disease patterns in larger scale, during and after the COVID-19 pandemic. This will be discussed in the next section.

Table 5. Drug inventory and procurement value of DNHL in 2019

No.	Drug supply/inventory terms in 2019	Value (*)	Ratio % (**)
1	Inventory of 2018 transferred to 2019	148.6	12.7
2	Drug procurement in 2019	1,166.0	100.0
3	Drug used in 2019	1,158.0	99.3
4	Inventory till 31 Dec. 2019	152.6	13.1

*: Unit: million Vietnam Dong

** : compared to drug expenditure in 2019

4. Discussion

The pattern of respiratory disease and its changes during and after the COVID-19 pandemic outbreak are the interests of studies globally [5, 7]. However, such studies in Vietnam are limited [4]. Although DNHLĐ is a small hospital, the respiratory disease pattern shows agreement with previous studies in Vietnam [1, 8], as well as in several reports from other countries [9, 10]. The two main groups of diseases, which are the most concerned and also account for the highest proportion, namely pulmonary tuberculosis (as shown in shown in Table 1, Figures 1) and COPD (in Figure 2).

In response to such a disease model, our analysis results show the rationality and responsiveness of the hospital drug formulary. It is compliant with the specialty function of a respiratory hospital, that requires a large proportion of anti-infective drugs, drugs acting on the respiratory tract, and anti-inflammatory drugs (Table 2).

The relationship between pulmonary tuberculosis and COVID-19 is still unclear although several studies on this topic have been conducted [7, 11, 12]. In addition, the COVID-19 prevention measures also limit other respiratory transmission diseases, including tuberculosis. However, the interrelation of COPD and COVID-19 has been taking more interests of researchers recently [13, 14]. It is known that the co-morbidity or background disease is one of the key prognosis factor for COVID-19 patient. Among the background diseases, there is accumulated evidence that the COPD patients may have negative interrelationships with COVID-19 and worse treatment outcomes [14]. Therefore, our findings, that COPD with high ratio in disease pattern is notable signal for the DNHLĐ prepare for the treatment therapeutics that

support COPD patient with COVID-19 or similar pneumonia epidemic in the future. Results of this study also suggested that the expansion of inventory capacity and diversifying drug origin, toward domestic drug suppliers should be taken in DNHLĐ to increase the drug availability, in cases of pandemic that related to respiratory system.

5. Conclusion

This study is limited to a retrospective of pre-pandemic disease patterns, but could be useful data in comparison with later periods, and so to contribute to future studies or forecasting purpose. These findings can be used to serve the organization of hospital pharmacy management within DNHLĐ, as well as for reference at a larger scale studies.

References

- [1] Trần Thị Huệ, N.V.T. (2020), *Khảo sát mô hình bệnh tật Khoa Khám bệnh đa khoa theo yêu cầu Bệnh viện Phổi Trung ương năm 2018*. Tạp chí Y học Cộng đồng. **54**(1): p. 67-72.
- [2] Venkataraman, S., et al. (2022), *Screening for respiratory morbidities and obstructive lung function among municipal waste handlers in Puducherry: A community-based cross-sectional study*. Journal of Family Medicine and Primary Care. **11**(3): p. 1119.
- [3] Halabi, K.C., et al. (2022), *Clinical and socioeconomic burden of rhinoviruses/enteroviruses in the community*. Influenza and Other Respiratory Viruses.
- [4] Anh, H.Q. (2021), *Đánh giá thay đổi mô hình bệnh tật trong thời kỳ COVID và một số yếu tố liên quan tại khoa khám bệnh đa khoa theo yêu cầu Bệnh viện Phổi Trung Ương*. Tạp Chí Y học Cộng đồng. **62**(7).
- [5] Liu, P., et al. (2022), *The changing pattern of common respiratory and enteric viruses among outpatient children in Shanghai, China: Two years of the COVID-19 pandemic*. Journal of Medical Virology. **94**(10): p. 4696-4703.
- [6] Thazin, M.P. and R. Sakulbumrungsil (2022), *Analysis of pharmaceutical inventory management in a state hospital in Myanmar*. Thai Journal of Pharmaceutical Sciences. **46**(2).
- [7] Wang, Q., et al. (2022), *Global prevalence, treatment and outcome of tuberculosis and COVID-19 coinfection: a systematic review and meta-analysis (from November 2019 to March 2021)*. BMJ open. **12**(6): p. e059396.
- [8] Nguyen, T.-A., et al. (2021), *Factors affecting healthcare pathways for chronic lung disease management in*

Vietnam: a qualitative study on patients' perspectives. BMC public health. **21**(1): p. 1-13.

- [9] Umoh, V.A., et al. (2013), *The pattern of respiratory disease morbidity and mortality in a tertiary hospital in southern-eastern Nigeria.* Pulmonary medicine. **2013**.
- [10] Adeniyi, B., et al. (2017), *Pattern of Respiratory Disease Admissions among Adults at Federal Medical Centre, Owo, South-West, Nigeria: A 5-Year Review.* Annals of Medical and Health Sciences Research. **7**(7).
- [11] Dheda, K., et al. (2022), *The intersecting pandemics of tuberculosis and COVID-19: population-level and patient-level impact, clinical presentation, and corrective interventions.* The Lancet Respiratory Medicine.
- [12] Liu, W.-D., et al. (2022), *Accelerated progression of pulmonary tuberculosis in a COVID-19 patient after corticosteroid treatment.* Journal of Microbiology, Immunology, and Infection. **55**(2): p. 347.
- [13] Rubio, M.C., et al. (2022), *Consensus on the Management of the COPD Patient in the COVID-19 Setting: COPD Forum Working Group.* Archivos de bronconeumologia.
- [14] Singh, D., A.G. Mathioudakis, and A. Higham (2022), *Chronic obstructive pulmonary disease and COVID-19: interrelationships.* Current Opinion in Pulmonary Medicine. **28**(2): p. 76.