

Comorbid conditions related to readmissions of Chinese older patients

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To the Editor: China is the most populated country, and it is aging more quickly than almost any other country in the world. According to Worldometer,^[1] the population size of China, as of 2020, is around 1.4 billion, with the proportion of the 60-year olds and older being 17.30% in 2017 and expected to reach 35% in 2050. Older age tended to be closely correlated with multimorbidity. Ward and Schiller^[2] reported that 65% of men and 72% of women aged >65 years in the US had at least two chronic conditions in 2010. Accordingly, older adults living with multiple chronic conditions tend to be readmitted after discharge, further leading to increased expenditure and more utilization of medical resources. Many studies have reported higher read mission rates in elderly patients. However, previous studies have focused on investigating the factors that influence read mission for a single disease, rather than for the chronic comorbid conditions in the initial hospitalization and the changes in these conditions from initial hospitalization to read mission among the elderly in China. Furthermore, most studies have focused on Caucasian patients and have been conducted in the US. Little is known about Chinese patients due to the lack of large-scale data. Identifying the common chronic comorbid conditions and the changes in these conditions from initial hospitalization to read mission among older people is important as it will help in the understanding of the chronic conditions leading to avoidable read mission and facilitate the development of efficient intervention strategies for the reduction of read missions.

We conducted a retrospective cohort study based on inpatient records from the China National Social Health Insurance system (NSHIS) database from a major metropolitan area in Western China. The study was approved by the Ethics Committee of West China Hospital, Sichuan University (No. 2021–1006). The patients included were based on: (1) age >65 years and (2) discharged between January 1, 2014, and December 31, 2014. Patients who

died during the initial hospitalization were excluded. For the patients who were discharged and readmitted on the same day, these two hospitalizations were merged into one hospitalization. If a patient had multiple read missions, we only considered the first read mission when computing the time to read mission [Supplementary Figure 1, <http://links.lww.com/CM9/A825>].

The following patient characteristics were obtained from the data during the qualifying period: the primary, secondary, and tertiary diagnosis of morbidities, demographic factors, such as age and sex, insurance types (Basic Medical Insurance for Urban Employees and Basic Medical Insurance Urban and Rural Residents), and the time lag between the discharge date from the initial hospitalization and the date of the first read mission.

By leveraging 515,123 inpatients who were aged >65 years from the 2014 claims data, our goal was to (1) identify the most common chronic comorbid conditions at initial admission and read mission; (2) explore the changes in the comorbid conditions for 1 year on read mission among the patients who were discharged; and (3) obtain the 10th, 25th, and 50th percentiles of the time to read mission (in days) for each comorbidity using the Kaplan-Meier estimation, stratified by gender, age, and insurance type. All statistical tests were two-sided, and the significance level was set at 0.05. Statistical analyses were performed using the R software (The R Foundation, version 3.5.2).

Among the 515,123 inpatients, 303,464 had at least one of 32 chronic conditions (the ICD-10 codes are listed in [Supplementary Table 1, <http://links.lww.com/CM9/A825>]). These 32 chronic conditions were chosen as they were considered to be the most prevalent chronic diseases in China. Of the included 515,123 patients, a total of 201,372 patients were readmitted in 2014 [Supplementary Table 2, <http://links.lww.com/CM9/A825>]. There were more people aged between 65 and 74 years than those

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aged ≥ 75 years; however, the read mission rate was lower than that in the older age group. Similarly, there were more women than men, while the read mission rate in men was higher than that in women. Most patients had hypertension and chronic obstructive pulmonary disease (COPD) among their first three diagnoses; the numbers were 129,327 and 103,807, respectively.

We identified the top ten chronic comorbid conditions from a total of 209,994 patients, with 40.77% and 69.20% being older patients (515,123) and older patients with at least one of the 32 chronic conditions (303,464), respectively. Figure 1A presents the top ten chronic comorbid conditions at the initial hospitalization among all the older patients (515,123). COPD was the most frequently observed (10.83%), followed by hypertension (8.42%), stroke (4.26%), diabetes (3.59%), and ischemic heart disease (IHD) (2.91%). Consistent with these results, the top five chronic comorbid conditions among the readmitted patients (201,372) were COPD (13.42%), hypertension (6.88%), stroke (3.62%), diabetes (3.49%), and IHD (3.15%) [Figure 1B]. As for patients without read missions (313,751), the most frequently observed chronic condition was hypertension (9.41%), followed by COPD (9.16%), stroke (4.67%), diabetes (3.65%), and a combination of hypertension and diabetes (3.13%) [Figure 1C].

We further explored the changes in the chronic comorbid conditions from initial hospitalization to the first read mission among the top five conditions mentioned above. As shown in Figure 1D, the most common reason for COPD read mission was the recurrence of chronic disease. Among 27,033 readmitted patients with COPD, 38.12% were readmitted to the hospital due to the recurrence of COPD. The read mission rates due to the recurrence of chronic disease in patients with hypertension, stroke, diabetes, and IHD were 38.34%, 25.67%, 54.78%, and 28.66%, respectively [Figure 1 E–H]. In addition, some patients were readmitted to the hospital with more chronic conditions. For example, 8.09% of the COPD patients were readmitted to the hospital due to the co-occurrence of COPD and pulmonary heart disease [Figure 1D], while 8.02% of the diabetic patients were readmitted to the hospital due to the co-occurrence of hypertension and diabetes [Figure 1G]. Interestingly, 4.32% of the patients with stroke had their diagnosis changed to COPD during the first read mission to hospital [Figure 1F], and 2.79% of the COPD patients were readmitted to the hospital due to the occurrence of hypertension within 1 year [Figure 1D].

We obtained the 10th, 25th, and 50th percentile (median) times to read mission for the top ten chronic comorbid conditions at the initial hospitalization using Kaplan-Meier

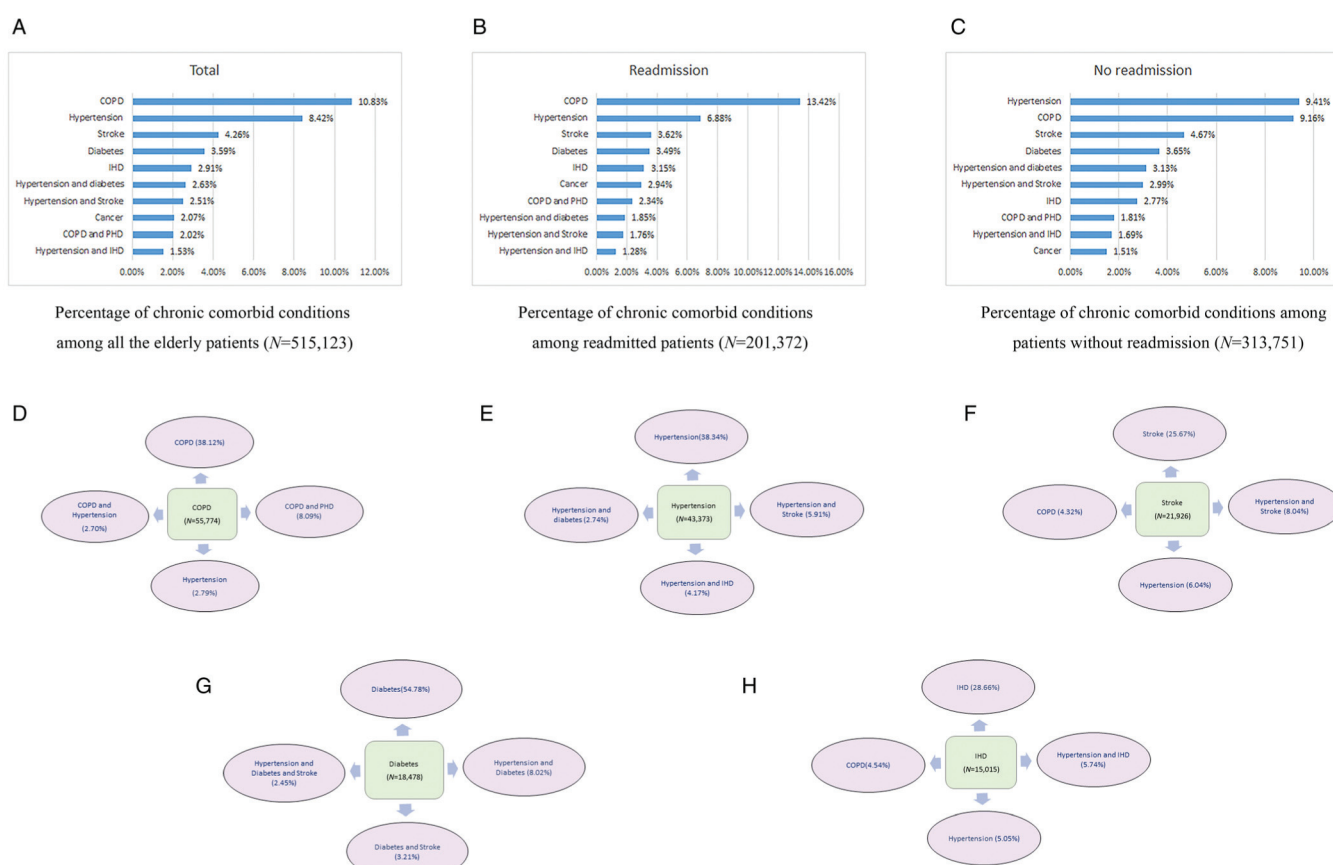


Figure 1: Percentages of the chronic conditions among (A) all the elderly patients ($N = 515,123$), (B) readmitted patients ($N = 201,372$), and (C) patients without read mission ($N = 313,751$). Changes of the chronic conditions of (D) COPD, (E) Hypertension, (F) Stroke, (G) Diabetes, and (H) IHD from initial hospitalization to the first read mission. The inside circle represents the chronic conditions and the numbers of the patients diagnosed at the initial hospitalization. The four outer circles represent the chronic conditions and read mission rates among the patients readmitted with COPD ($N = 27,033$), hypertension ($N = 13,854$), stroke ($N = 7,288$), diabetes ($N = 7,019$), and IHD ($N = 6,337$) for the first read mission. COPD: Chronic obstructive pulmonary disease; HD: Heart disease; IHD: Ischemic heart disease; PHD: Pulmonary heart disease.

analysis [Supplementary Table 3, <http://links.lww.com/CM9/A825>]. It was demonstrated that among the top ten chronic comorbid conditions, diabetes and cancer had relatively short times to read mission. The Kaplan-Meier plots for the complete top ten comorbidities stratified by age, sex, and medical insurance type are available in [Supplementary Figures 2–11, <http://links.lww.com/CM9/A825>]. For patients with COPD, diabetes, and IHD, men and patients aged ≥ 75 years had shorter 50th percentiles of times to read mission compared to female patients aged < 75 years. Interestingly, for patients with cancer, men and patients aged between 64 and 75 years had a shorter 50th percentile of time to read mission.

This large-scale retrospective study identified the top five chronic comorbid conditions at initial hospitalization and read mission: COPD, hypertension, stroke, diabetes, and IHD. The most common reason for read mission among the top five chronic comorbidities was the recurrence of the disease itself. Chronic disease is the leading cause of death and disability and can easily recur, which further leads to read mission. For COPD, diabetes, and IHD patients, males and patients aged ≥ 75 years had shorter median read mission times, which may result from an unhealthy lifestyle, such as alcohol and tobacco intake, as well as more chronic diseases in the much older population. COPD was found to be the most common cause of initial hospitalization and read mission, which is consistent with the observations in other countries. The read mission rate of patients for whom one of their diagnoses was COPD in our study was approximately 45% within 1 year after discharge, which was consistent with the reported read mission rates of 47% by Benzo *et al.*^[3] Respiratory disease was the most common reason for read mission, and COPD was the most common diagnosis. In the USA, COPD is the third most common cause of read mission among Medicare beneficiaries, and acute exacerbation of COPD is closely correlated with a higher read mission rate. Our results revealed that diabetic patients had the shortest median time to read mission among all the top five chronic comorbid conditions, and the 1-year read mission rate was 33.98% among patients for whom one of their diagnoses was diabetes. Indeed, in the USA, 22% of patients with recurrent diabetes were readmitted to the hospital within 1 year.^[4] However, as few studies have focused on the time to read mission among diabetic patients, our study provides some data evidence for the median time to read mission and the most common reason for read mission of diabetic patients. We also observed that the read mission rate of patients for whom one of their diagnoses was stroke was 31.88%, and stroke patients seemed to have faster and shorter-term read mission. It has been reported that the read mission rate was highest in the first 6 months after the discharge of stroke patients,^[5] which might be associated with shorter-term read mission after discharge. Therefore, in the current study, the 50th percentile of stroke patients was NA, indicating that more than 50% of these patients were not readmitted to the hospital within 1 year. Interestingly, our study reported that younger cancer patients (aged between 65 and 74 years) had significantly shorter time to read mission than older cancer patients (aged ≥ 75 years), given that few studies had compared between age groups among cancer patients. However, patients aged

≥ 75 years were less likely to undergo surgery, although cancer surgery was associated with higher post-surgery read mission rates. Therefore, our results seem to support the hypothesis that younger patients are more likely to be readmitted due to the surgery.

The results of our study may inform effective strategies to reduce unplanned hospitalizations in China and, in particular, suggest that (1) read mission reduction projects, similar to those conducted in developed countries, should be implemented in China, and management of the most common chronic conditions, such as COPD, hypertension, diabetes, and cancer, should be prioritized; (2) value-based payment programs could be implemented in order to incentivize hospitals to improve their quality of care and decrease unnecessary read missions; and (3) team approaches, which include coordinated care from physicians, nurses, therapists, and nutritionists, can provide collaborative high quality care to outpatients and inpatients, and, in the mean time, provide essential education on self-management and nutrition, especially among high-risk patients, as detected in this study.

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Conflicts of interest

None.

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