

## Original article

### Comorbidity and its impact on 1,590 patients with COVID-19 in China: A Nationwide Analysis

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## Abstract

**Objective:** To evaluate the spectrum of comorbidities and its impact on the clinical outcome in patients with coronavirus disease 2019 (COVID-19).

**Design:** Retrospective case studies

**Setting:** 575 hospitals in 31 province/autonomous regions/provincial municipalities across China

**Participants:** 1,590 laboratory-confirmed hospitalized patients. Data were collected from November 21<sup>st</sup>, 2019 to January 31<sup>st</sup>, 2020.

**Main outcomes and measures:** Epidemiological and clinical variables (in particular, comorbidities) were extracted from medical charts. The disease severity was categorized based on the *American Thoracic Society* guidelines for community-acquired pneumonia. The primary endpoint was the composite endpoints, which consisted of the admission to intensive care unit (ICU), or invasive ventilation, or death. The risk of reaching to the composite endpoints was compared among patients with COVID-19 according to the presence and number of comorbidities.

**Results:** Of the 1,590 cases, the mean age was 48.9 years. 686 patients (42.7%) were females. 647 (40.7%) patients were managed inside Hubei province, and 1,334 (83.9%) patients had a contact history of Wuhan city. Severe cases accounted for 16.0% of the study population. 131 (8.2%) patients reached to the composite endpoints. 399 (25.1%) reported having at least one comorbidity. 269 (16.9%), 59 (3.7%), 30 (1.9%), 130 (8.2%), 28 (1.8%), 24 (1.5%), 21 (1.3%), 18 (1.1%) and 3 (0.2%) patients reported having hypertension, cardiovascular diseases, cerebrovascular diseases, diabetes, hepatitis B infections, chronic obstructive pulmonary disease, chronic kidney diseases,

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malignancy and immunodeficiency, respectively. 130 (8.2%) patients reported having two or more comorbidities. Patients with two or more comorbidities had significantly escalated risks of reaching to the composite endpoint compared with those who had a single comorbidity, and even more so as compared with those without (all  $P < 0.05$ ). After adjusting for age and smoking status, patients with COPD (HR 2.681, 95%CI 1.424-5.048), diabetes (HR 1.59, 95%CI 1.03-2.45), hypertension (HR 1.58, 95%CI 1.07-2.32) and malignancy (HR 3.50, 95%CI 1.60-7.64) were more likely to reach to the composite endpoints than those without. As compared with patients without comorbidity, the HR (95%CI) was 1.79 (95%CI 1.16-2.77) among patients with at least one comorbidity and 2.59 (95%CI 1.61-4.17) among patients with two or more comorbidities.

**Conclusion:** Comorbidities are present in around one fourth of patients with COVID-19 in China, and predispose to poorer clinical outcomes.

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**Key words:** SARS-CoV-2; comorbidity; clinical characteristics; prognosis

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## Highlights

### *What is already known on this topic?*

- Since November 2019, the rapid outbreak of coronavirus disease 2019 (COVID-19) has recently become a public health emergency of international concern. There have been 79,331 laboratory-confirmed cases and 2,595 deaths globally as of February 25<sup>th</sup>, 2020
- Previous studies have demonstrated the association between comorbidities and other severe acute respiratory diseases including SARS and MERS.
- No study with a nationwide representative cohort has demonstrated the spectrum of comorbidities and the impact of comorbidities on the clinical outcomes in patients with COVID-19.

### *What this study adds?*

- In this nationwide study with 1,590 patients with COVID-19, comorbidities were identified in 399

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patients. Comorbidities of COVID-19 mainly included hypertension, cardiovascular diseases, cerebrovascular diseases, diabetes, hepatitis B infections, chronic obstructive pulmonary disease, chronic kidney diseases, malignancy and immunodeficiency.

- The presence of as well as the number of comorbidities predicted the poor clinical outcomes (admission to intensive care unit, invasive ventilation, or death) of COVID-19.

- Comorbidities should be taken into account when estimating the clinical outcomes of patients with COVID-19 on hospital admission.

## **Introduction**

Since November 2019, the rapid outbreak of coronavirus disease 2019 (COVID-19), which arose from severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection, has recently become a public health emergency of international concern [1]. COVID-19 has contributed to an enormous adverse impact globally. Hitherto, there have been 79,331 laboratory-confirmed cases and 2,595 deaths globally as of February 25<sup>th</sup>, 2020 [2].

The clinical manifestations of COVID-19 are, according to the latest reports [3-8], largely heterogeneous. On admission, 20-51% of patients reported as having at least one comorbidity, with diabetes (10-20%), hypertension (10-15%) and cardiovascular and cerebrovascular diseases (7-40%) being most common [3,4,6]. Previous studies have demonstrated that the presence of any comorbidity has been associated with a 3.4-fold increased risk of developing acute respiratory distress syndrome in patients with H7N9 infection [9]. Similar with influenza [10-14], Severe Acute

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Respiratory Syndrome coronavirus (SARS-CoV) [15] and Middle East Respiratory Syndrome coronavirus (MERS-CoV) [16-24], COVID-19 more readily predisposed to respiratory failure and death in susceptible patients [4]. Nonetheless, previous studies have been certain limitations in study design including the relatively small sample sizes and single center observations. Studies that address these limitations is needed to explore for the factors underlying the adverse impact of COVID-19.

Our objective was to compare the clinical characteristics and outcomes of patients with COVID-19 by stratification according to the presence and category of comorbidity, thus unraveling the subpopulations with poorer prognosis.

## **Methods**

### ***Data sources and data extraction***

This was a retrospective cohort study that collected data from patients with COVID-19 throughout China, under the coordination of the National Health Commission which mandated the reporting of clinical information from individual designated hospitals which admitted patients with COVID-19. After careful medical chart review, we compiled the clinical data of laboratory-confirmed hospitalized cases from 575 hospitals between November 21<sup>st</sup>, 2019 and January 31<sup>st</sup>, 2020. The diagnosis of COVID-19 was made based on the *World Health Organization* interim guidance [25]. Confirmed cases denoted the patients whose high-throughput sequencing or real-time reverse-transcription polymerase-chain-reaction (RT-PCR) assay findings for nasal and pharyngeal swab specimens were positive [3]. See *Online Supplement* for details.



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The clinical data (including recent exposure history, clinical symptoms and signs, comorbidities, and laboratory findings upon admission) were reviewed and extracted by experienced respiratory clinicians, who subsequently entered the data into a computerized database for further cross-checking. Manifestations on chest X-ray or computed tomography (CT) was summarized by integrating the documentation or description in medical charts and, if available, a further review by our medical staff. Major disagreement of the radiologic manifestations between the two reviewers was resolved by consultation with another independent reviewer. Because disease severity reportedly predicted poorer clinical outcomes of avian influenza [9], patients were classified as having severe or non-severe COVID-19 based on the *American Thoracic Society* guidelines for community-acquired pneumonia because of its global acceptance [26].

Comorbidities were determined based on patient's self-report on admission. Comorbidities were initially treated as a categorical variable (Yes vs. No), and subsequently classified based on the number (Single vs. Multiple). Furthermore, comorbidities were sorted according to the organ systems (i.e. respiratory, cardiovascular, endocrine). Comorbidities that were classified into the same organ system (i.e. coronary heart disease, hypertension) would be merged into a single category.

The primary endpoint of our study was a composite measure which consisted of the admission to intensive care unit (ICU), or invasive ventilation, or death. This composite measure was adopted because all individual components were serious outcomes of H7N9 infections [9]. Secondary endpoints mainly included the mortality rate, and the time from symptom onset to reaching to the composite endpoints.

### ***Statistical analysis***

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Statistical analyses were conducted with SPSS software version 23.0 (Chicago, IL, USA). No formal sample size estimation was made because there has not been any published nationwide data on COVID-19. Nonetheless, our sample size was deemed sufficient to power the statistical analysis given its representativeness of the national patient population. Continuous variables were presented as means and standard deviations or medians and interquartile ranges (IQR) as appropriate, and the categorical variables were presented as counts and percentages. Independent t-test, Kruskal-Wallis test and chi-square test were applied for the comparisons between the two groups as appropriate. Cox proportional hazard regression models were applied to determine the potential risk factors associated with the composite endpoints, with the hazards ratio (HR) and 95% confidence interval (95%CI) being reported.

### ***Patient and public involvement***

No patients were directly involved in our study design, setting the research questions, the interpretation of data, or asked to advise on writing up of the report.

## **Results**

### ***Demographic and clinical characteristics***

The National Health Commission has issued 11,791 patients with laboratory-confirmed COVID-19 in China as of January 31<sup>st</sup>, 2020. At this time point for data cut-off, our database has included 1,590 cases from 575 hospitals in 31 province/autonomous regions/provincial municipalities (see *Online Supplement* for details). Of these 1,590 cases, the mean age was 48.9 years. 686 patients (42.7%)

were females. 647 (40.7%) patients were managed inside Hubei province, and 1,334 (83.9%) patients had a contact history of Wuhan city. The most common symptom was fever on or after hospitalization (88.0%), followed by dry cough (70.2%). Fatigue (42.8%) and productive cough (36.0%) were less common. At least one abnormal chest CT manifestation (including ground-glass opacities, pulmonary infiltrates and interstitial disorders) was identified in more than 70% of patients. Severe cases accounted for 16.0% of the study population. 131 (8.2%) patients reached to the composite endpoints during the study (**Table 1**).

### ***Presence of comorbidities and the clinical characteristics and outcomes of COVID-19***

Of the 1,590 cases, 399 (25.1%) reported having at least one comorbidity. The most common comorbidities encompassed hypertension (269 [16.9%]), diabetes (130 [8.2%]), and cardiovascular diseases (59 [3.7%]). Chronic obstructive pulmonary disease (COPD) was identified in 24 cases. At least one comorbidity was seen more commonly in severe cases than in non-severe cases (32.8% vs. 10.3%). Patients with at least one comorbidity were older (mean: 60.8 vs. 44.8 years), were more likely to have shortness of breath (41.4% vs. 17.8%), nausea or vomiting (10.4% vs. 4.3%), and tended to have abnormal chest X-ray manifestations (29.2% vs. 15.1%) (**Table 1**).

### ***Clinical characteristics and outcomes of COVID-19 stratified by the number of comorbidities***

We have further identified 130 (8.2%) patients who reported having two or more comorbidities. Two or more comorbidities were more commonly seen in severe cases than in non-severe cases (40.0% vs. 29.4%,  $P<0.001$ ). Patients with two or more comorbidities were older (mean: 66.2 vs. 58.2 years), were more likely to have shortness of breath (55.4% vs. 34.1%), nausea or vomiting (11.8% vs. 9.7%), unconsciousness (5.1% vs. 1.3%) and less abnormal chest X-ray (20.8% vs. 23.4%) compared

with patients who had single comorbidity (**Table 2**).

### *Clinical characteristics and outcomes of COVID-19 stratified by organ systems of comorbidities*

A total of 269 (16.9%), 59 (3.7%), 30 (1.9%), 130 (8.2%), 28 (1.8%), 24 (1.5%), 21 (1.3%), 18 (1.1%) and 3 (0.2%) patients reported having hypertension, cardiovascular diseases, cerebrovascular diseases, diabetes, hepatitis B infections, COPD, chronic kidney diseases, malignancy and immunodeficiency, respectively. Severe cases were more likely to have hypertension (32.7% vs. 12.6%), cardiovascular diseases (33.9% vs. 15.3%), cerebrovascular diseases (50.0% vs. 15.3%), diabetes (34.6% vs. 14.3%), hepatitis B infections (32.1% vs. 15.7%), COPD (62.5% vs. 15.3%), chronic kidney diseases (38.1% vs. 15.7%) and malignancy (50.0% vs. 15.6%) compared with non-severe cases. Furthermore, comorbidities were more common patients treated in Hubei province as compared with those managed outside Hubei province (all  $P<0.05$ ) as well as patients with an exposure history of Wuhan as compared with those without (all  $P<0.05$ ) (**Table 3**).

### *Prognostic analyses*

The composite endpoint was documented in 77 (19.3%) of patients who had at least one comorbidity as opposed to 54 (4.5%) patients without comorbidities ( $P<0.001$ ). This figure was 37 cases (28.5%) in patients who had two or more comorbidities. Significantly more patients with hypertension (19.7% vs. 5.9%), cardiovascular diseases (22.0% vs. 7.7%), cerebrovascular diseases (33.3% vs. 7.8%), diabetes (23.8% vs. 6.8%), COPD (50.0% vs. 7.6%), chronic kidney diseases (28.6% vs. 8.0%) and malignancy (38.9% vs. 7.9%) reached to the composite endpoints compared with those without (**Table 3**).

Patients with two or more comorbidities had significantly escalated risks of reaching to the composite endpoint compared with those who had a single comorbidity, and even more so as compared with those without (all  $P < 0.05$ , **Figure 1**). After adjusting for age and smoking status, patients with COPD (HR 2.68, 95%CI 1.42-5.05), diabetes (HR 1.59, 95%CI 1.03-2.45), hypertension (HR 1.58, 95%CI 1.07-2.32) and malignancy (HR 3.50, 95%CI 1.60-7.64) were more likely to reach to the composite endpoints than those without (**Figure 2**). As compared with patients without comorbidity, the HR (95%CI) was 1.79 (95%CI 1.16-2.77) among patients with at least one comorbidity and 2.59 (95%CI 1.61-4.17) among patients with two or more comorbidities (**Figure 2**).

## Discussion

Our study is the first nationwide investigation that systematically evaluates the impact of comorbidities on the clinical characteristics and prognosis in patients with COVID-19 in China. Circulatory and endocrine comorbidities were common among patients with COVID-19. Patients with at least one comorbidity, or more even so, were associated with poor clinical outcomes. These findings have provided further objective evidence, with a large sample size and extensive coverage of the geographic regions across China, to take into account baseline comorbid diseases in the comprehensive risk assessment of prognosis among patients with COVID-19 on hospital admission.

Overall, our findings have echoed the recently published studies in terms of the commonness of comorbidities in patients with COVID-19 [3-7]. Despite considerable variations in the proportion in individual studies due to the limited sample size and the region where patients were managed, circulatory diseases (including hypertension and coronary heart diseases) remained the most

common category of comorbidity [3-7]. Apart from circulatory diseases, endocrine diseases such as diabetes were also common in patients with COVID-19. Notwithstanding the commonness of circulatory and endocrine comorbidities, patients with COVID-19 rarely reported as having comorbid respiratory diseases (particularly COPD). The reasons underlying this observation have been scant, but could have arisen from the lack of awareness and the lack of spirometric testing in community settings that collectively contributed to the underdiagnosis of respiratory diseases [27]. Consistent with recent reports [3-7], the percentage of patients with comorbid renal disease and malignancy was relatively low. Our findings have therefore added to the existing literature the spectrum of comorbidities in patients with COVID-19 based on the larger sample sizes and representativeness of the whole patient population in China.

A number of existing literature reports have documented the escalated risks of poorer clinical outcomes in patients with avian influenza [10-14], SARS-CoV [15] and MERS-CoV infections [16-24]. The most common comorbidities associated with poorer prognosis included diabetes [21,24], hypertension [24], respiratory diseases [15,24], cardiac diseases [15,24], pregnancy [12], renal diseases [24] and malignancy [15]. Our findings suggested that, similar with other severe acute respiratory outbreaks, comorbidities such as COPD, diabetes, hypertension and malignancy predisposed to adverse clinical outcomes in patients with COVID-19. The strength of association between different comorbidities and the prognosis, however, was less consistent when compared with the literature reports [12,15,21,24]. For instance, the risk between cardiac diseases and poor clinical outcomes of influenza, SARS-CoV or MERS-CoV infections was inconclusive [12,15,21,24]. Except for diabetes, no other comorbidities were identified to be the predictors of poor clinical outcomes in patients with MERS-CoV infections [21]. Few studies, however, have explored the

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mechanisms underlying these associations. Kulscar et al showed that MERS-CoV infections resulted in prolonged airway inflammation, immune cell dysfunction and an altered expression profile of inflammatory mediators [23]. A network-based analysis indicated that SARS-CoV infections led to immune dysregulation that could help explain the escalated risk of cardiac diseases, bone diseases and malignancy [28]. Therefore, immune dysregulation and prolonged inflammation might be the key drivers of the poor clinical outcomes in patients with COVID-19 but await verification in more mechanistic studies.

There has been a considerable overlap in the comorbidities which has been widely accepted. For instance, diabetes [29] and COPD [30] frequently co-exist with hypertension or coronary heart diseases. Therefore, patients with co-existing comorbidities are more likely to have poorer baseline well-being. Importantly, we have verified the significantly escalated risk of poor prognosis in patients with two or more comorbidities as compared with those who had no or only a single comorbidity. Our findings implied that both the category and number of comorbidities should be taken into account when predicting the prognosis in patients with COVID-19.

Our findings suggested that patients with comorbidities had greater disease severity compared with those without. A greater number of comorbidities correlated with greater disease severity of COVID-19. The public health implication of our study was that proper triage of patients should be implemented in out-patient clinics or on hospital admission by carefully inquiring the medical history because this will help identify patients who would be more likely to develop serious adverse outcomes during the progression of COVID-19. A multidisciplinary team with specialists would be needed to manage the comorbid conditions in a timely fashion. Moreover, patients with COVID-19

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who had comorbidities should be isolated immediately upon confirmation of the diagnosis, which would help provide with this susceptible population better personal medical protection.

The main limitation of our study was the self-report of comorbidities on admission. Underreporting of comorbidities, which could have stemmed from the lack of awareness and/or the lack of diagnostic testing, might contribute to the underestimation of the true strength of association with the clinical prognosis. However, significant underreporting was unlikely because the spectrum of our report was largely consistent with existing literature [3-7] and all patients were subject to a thorough history taking after hospital admission. Moreover, the duration of follow-up was relatively short and some patients remained in the hospital as of the time of writing. More studies that explore the associations in a sufficiently long time frame are warranted. As with other observational studies, our findings did not provide direct inference about the causation or reverse causation of comorbidities and the poor clinical outcomes.

## Conclusions

Comorbidities are present in around one fourth of patients with COVID-19 in China, and predispose to poorer clinical outcomes. A thorough assessment of comorbidities may help establish risk stratification of patients with COVID-19 upon hospital admission.

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## Statements

All authors have completed the ICMJE uniform disclosure form at [http://www.icmje.org/coi\\_disclosure.pdf](http://www.icmje.org/coi_disclosure.pdf) and declare: no support from any organisation for the submitted work; no financial relationships with any organisations that might have an interest in the submitted work in the previous three years, no other relationships or activities that could appear to have influenced the submitted work.

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## Tables

**Table 1: Demographics and clinical characteristics of patients with or without any comorbidities.**

Variables	Any comorbidity			
	Total (n=1590)	No (n=1191)	Yes (n=399)	P Value
Age (years)	48.9±16.3	44.8±15.2	60.8±13.4	<b>&lt;0.001</b>
Incubation period (day)	3.6±4.2	3.7±4.3	3.5±3.9	0.329
Temperature on admission (°C)	37.4±0.9	37.4±0.9	37.3±0.9	<b>0.034</b>
Respiratory rate on admission (breath/min)	21.2±12.0	21.2±13.7	21.3±4.7	0.876
Heart rate on admission (beat/min)	88.7±14.6	88.5±14.7	89.2±14.4	0.402
Systolic pressure on admission (mmHg)	126.1±16.4	123.5±15.2	133.2±17.5	<b>&lt;0.001</b>
Diastolic pressure on admission (mmHg)	79.5±25.6	79±28.9	80.9±12.6	0.22
Highest temperature (°C)	38.3±1.6	38.3±1.1	38.2±2.6	0.634
<b>Sex</b>				0.241
Male	904/1578 (57.3)	667/1182 (56.4)	237/396 (59.8)	
Female	674/1578 (42.7)	515/1182 (43.6)	159/396 (40.2)	
<b>Smoking status</b>				<b>&lt;0.001</b>
Never/unknown	1479/1590 (93)	1127/1191 (94.6)	352/399 (88.2)	
Former/current	111/1590 (7)	64/1191 (5.4)	47/399 (11.8)	
<b>Symptoms</b>				
Fever	1351/1536 (88)	1002/1148 (87.3)	349/388 (89.9)	0.176
Conjunctival congestion	10/1345 (0.7)	7/1014 (0.7)	3/331 (0.9)	0.715
Nasal congestion	73/1299 (5.6)	59/979 (6)	14/320 (4.4)	0.328
Headache	205/1328 (15.4)	151/1002 (15.1)	54/326 (16.6)	0.537



Dry cough	1052/1498 (70.2)	775/1116 (69.4)	277/382 (72.5)	0.271
Pharyngodynia	194/1317 (14.7)	148/999 (14.8)	46/318 (14.5)	0.928
Productive cough	513/1424 (36)	363/1064 (34.1)	150/360 (41.7)	<b>0.011</b>
Fatigue	584/1365 (42.8)	435/1031 (42.2)	149/334 (44.6)	0.446
Hemoptysis	16/1315 (1.2)	9/991 (0.9)	7/324 (2.2)	0.084
Shortness of breath	331/1394 (23.7)	185/1041 (17.8)	146/353 (41.4)	<b>&lt;0.001</b>
Nausea/vomiting	80/1371 (5.8)	44/1025 (4.3)	36/346 (10.4)	<b>&lt;0.001</b>
Diarrhea	57/1359 (4.2)	39/1023 (3.8)	18/336 (5.4)	0.213
Myalgia/arthralgia	234/1338 (17.5)	174/1007 (17.3)	60/331 (18.1)	0.739
Chill	163/1333 (12.2)	129/1006 (12.8)	34/327 (10.4)	0.285
<b>Signs</b>				
Throat congestion	21/1286 (1.6)	16/973 (1.6)	5/313 (1.6)	1
Tonsil swelling	31/1376 (2.3)	22/1024 (2.1)	9/352 (2.6)	0.678
Enlargement of lymph nodes	2/1375 (0.1)	1/1027 (0.1)	1/348 (0.3)	0.442
Rash	3/1378 (0.2)	2/1032 (0.2)	1/346 (0.3)	1
Unconsciousness	20/1421 (1.4)	11/1063 (1)	9/358 (2.5)	0.064
<b>Abnormal chest image</b>				
Radiograph	243/1590 (15.3)	236/1566 (15.1)	44/336 (29.2)	0.079
Computed tomography	1130/1590 (71.1)	1113/1566 (71.1)	17/24 (70.8)	1
<b>Hubei</b>				<b>&lt;0.001</b>
Yes	647/1590 (40.7)	434/1191 (36.4)	213/399 (53.4)	
No	943/1590 (59.3)	757/1191 (63.6)	186/399 (46.6)	
<b>Wuhan-contacted</b>				<b>0.012</b>
Yes	1334/1590 (83.9)	983/1191 (82.5)	351/399 (88)	

No	256/1590 (16.1)	208/1191 (17.5)	48/399 (12)	
<b>Severity</b>	254/1590 (16)	123/1191 (10.3)	131/399 (32.8)	<b>&lt;0.001</b>
<b>Composite endpoint</b>	131/1590 (8.2)	54/1191 (4.5)	77/399 (19.3)	<b>&lt;0.001</b>
<b>Death</b>	50/1590 (3.1)	15/1191 (1.3)	35/399 (8.8)	<b>&lt;0.001</b>

Data are mean  $\pm$  standard deviation, n/N (%), where N is the total number of patients with available data. p values are calculated by  $\chi^2$  test, Fisher's exact test, or Mann-Whitney U test. COPD=chronic obstructive pulmonary disease.

Data in bold indicated the statistical comparisons with significance.

**Table 2: Demographics and clinical characteristics of patients with 1 or  $\geq 2$  comorbidities.**

Variables	1 comorbidity (n=269)	$\geq 2$ comorbidities (n=130)	P Value
Age (years)	58.2 $\pm$ 13.1	66.2 $\pm$ 12.2	<b>&lt;0.001</b>
Incubation period (days)	3.2 $\pm$ 3.1	4.0 $\pm$ 5.2	0.124
Temperature on admission ( $^{\circ}$ C)	37.4 $\pm$ 0.9	37.1 $\pm$ 0.9	<b>&lt;0.001</b>
Respiratory rate on admission (breath/min)	21.4 $\pm$ 4.6	21.2 $\pm$ 5	0.977
Heart rate (bit/minute)	90.2 $\pm$ 14.6	87.2 $\pm$ 13.7	0.134
Systolic pressure on admission (mmHg)	132.2 $\pm$ 16.5	135.3 $\pm$ 19.4	<b>&lt;0.001</b>
Diastolic pressure on admission (mmHg)	81.7 $\pm$ 12.5	79.5 $\pm$ 12.9	0.350
Highest temperature ( $^{\circ}$ C)	38.2 $\pm$ 3.0	38.4 $\pm$ 0.8	0.424

<b>Sex</b>			0.430
Male	158/268 (59.0)	79/128 (61.7)	
Female	110/268 (41.0)	49/128 (38.3)	
<b>Smoking status</b>			<b>&lt;0.001</b>
Never/unknown	234/269 (87.0)	118/130 (90.8)	
Former/current	35/269 (13.0)	12/130 (9.2)	
<b>Symptoms</b>			
Fever	241/263 (91.6)	108/125 (86.4)	0.126
Conjunctival congestion	3/222 (1.4)	0/109 (0)	0.374
Nasal congestion	5/213 (2.3)	9/107 (8.4)	<b>0.046</b>
Headache	34/220 (15.5)	20/106 (18.9)	0.589
Dry cough	195/258 (75.6)	82/124 (66.1)	0.088
Pharyngodynia	33/218 (15.1)	13/100 (13.0)	0.872
Productive cough	101/241 (41.9)	49/119 (41.2)	<b>0.036</b>
Fatigue	97/227 (42.7)	52/107 (48.6)	0.444
Hemoptysis	4/219 (1.8)	3/105 (2.9)	0.149
Shortness of breath	79/232 (34.1)	67/121 (55.4)	<0.001
Nausea/vomiting	23/236 (9.7)	13/110 (11.8)	<b>&lt;0.001</b>
Diarrhea	11/229 (4.8)	7/107 (6.5)	0.359
Myalgia/arthralgia	45/227 (19.8)	15/104 (14.4)	0.457
Chill	25/222 (11.3)	9/105 (8.6)	0.400
<b>Signs</b>			
Throat congestion	4/216 (1.9)	1/97 (1)	0.868
Tonsil swelling	5/234 (2.1)	4/118 (3.4)	0.685

Enlargement of lymph nodes	1/232 (0.4)	0/116 (0)	0.441
Rash	0/231 (0)	1/115 (0.9)	0.249
Unconsciousness	3/240 (1.3)	6/118 (5.1)	<b>0.002</b>
<b>Abnormal chest image</b>			
Radiograph	63/269 (23.4)	27/130 (20.8)	<b>&lt;0.001</b>
Computed tomography	200/269 (74.3)	96/130 (73.8)	0.283
<b>Hubei</b>			<b>&lt;0.001</b>
Yes	120/269 (44.6)	93/130 (71.5)	
No	149/269 (55.4)	37/130 (28.5)	
<b>Wuhan-contacted</b>			<b>0.003</b>
Yes	229/269 (85.1)	122/130 (93.8)	
No	40/269 (14.9)	8/130 (6.2)	
<b>Severity</b>	79/269 (29.4)	52/130 (40.0)	<b>&lt;0.001</b>
<b>Composite endpoint</b>	40/269 (14.9)	37/130 (28.5)	<b>&lt;0.001</b>
<b>Deaths</b>	15/269 (5.6)	20/130 (15.4)	<b>&lt;0.001</b>

Data are mean  $\pm$  standard deviation, n/N (%), where N is the total number of patients with available data. p values are calculated by  $\chi^2$  test, Fisher's exact test, or Mann-Whitney U test. COPD=chronic obstructive pulmonary disease.

Data in bold indicated the statistical comparisons with significance.

**Table 3: Demographics and clinical characteristics of patients stratified by different comorbidities.**

	COPD			Diabetes			Hypertension			Cardiovascular disease			Cerebrovascular disease		
	No (n=1566)	Yes (n=24)	P Value	No (n=1460)	Yes (n=130)	P Value	No (n=1321)	Yes (n=269)	P Value	No (n=1531)	Yes (n=59)	P Value	No (n=1560)	Yes (n=30)	P Value
Age (year)	48.5±16.0	74.7±6.8	<0.001	47.8±16.1	61.2±13.4	<0.001	46.2±15.6	62.1±12.5	<0.001	48.2±15.9	66.3±15.1	<0.001	48.5±16.1	70.4±8.9	<0.001
Incubation period (day)	3.6±4.2	4.5±3.2	0.331	3.6±4.1	3.8±5	0.619	3.6±4.2	3.6±4.1	0.958	3.7±4.2	3.3±3.7	0.564	3.6±4.2	3.8±3.4	0.867
Temperature on admission (□)	37.4±0.9	37.3±0.9	0.921	37.4±0.9	37.2±1	0.048	37.4±0.9	37.2±0.9	0.013	37.4±0.9	37.3±1	0.570	37.4±0.9	36.9±0.8	0.007
Respiratory rate on admission (breath/min)	21.2±12.1	21.8±5.2	0.843	21.2±12.4	21.4±5.4	0.869	21.2±13.1	21.3±4.5	0.887	21.2±12.2	21.4±6.2	0.911	21.3±12.1	19.9±3.3	0.537
Heart rate (bit/minute)	88.6±14.6	90.2±12.8	0.631	88.6±14.6	89.1±14.3	0.730	88.6±14.7	89±14.3	0.729	88.8±14.6	86.4±14.9	0.250	88.8±14.6	84.5±11.4	0.127
Systolic pressure on admission (mmHg)	126±16.4	131±17.5	0.16	125.3±15.9	134.4±19.1	<0.001	123.9±15.2	135.4±18.2	<0.001	125.8±16.3	132.3±18.8	0.005	125.9±16.4	132.9±16	0.026
Diastolic pressure on admission (mmHg)	79.6±25.7	77±11.9	0.640	79.4±26.4	80.9±13.2	0.551	79.2±27.7	81±12.5	0.298	79.6±25.9	78.4±13.6	0.746	79.6±25.8	77.4±9.6	0.655
Highest temperature (□)	38.3±1.6	38.5±0.6	0.543	38.3±1.7	38.4±0.8	0.338	38.3±1.3	38.2±2.7	0.678	38.3±1.7	38.5±0.8	0.482	38.3±1.6	38.2±1	0.892

<b>Sex</b>		0.011		0.711		0.635		0.500		0.039					
Male	884/1554	20/24		828/1449	76/129		748/1312	156/266		868/1520	36/58		881/1548	23/30	
	(56.9)	(83.3)		(57.1)	(58.9)		(57)	(58.6)		(57.1)	(62.1)		(56.9)	(76.7)	
Female	670/1554	4/24 (16.7)		621/1449	53/129		564/1312	110/266		652/1520	22/58		667/1548	7/30 (23.3)	
	(43.1)			(42.9)	(41.1)		(43)	(41.4)		(42.9)	(37.9)		(43.1)		
<b>Smoking status</b>		0.232		0.002		0.430		0.298		0.152					
Never/unknown	1458/1566	21/24		1368/1460	111/130		1232/1321	247/269		1426/1531	53/59		1453/1560	26/30	
	(93.1)	(87.5)		(93.7)	(85.4)		(93.3)	(91.8)		(93.1)	(89.8)		(93.1)	(86.7)	
Former/current	108/1566	3/24 (12.5)		92/1460	19/130		89/1321	22/269		105/1531	6/59 (10.2)		107/1560	4/30 (13.3)	
	(6.9)			(6.3)	(14.6)		(6.7)	(8.2)		(6.9)			(6.9)		
<b>Symptoms</b>															
Fever	1331/1513	20/23 (87)	0.751	1239/1412	112/124	0.473	1113/1273	238/263	0.177	1308/1482	43/54	0.051	1328/1507	23/29	0.150
	(88)			(87.7)	(90.3)		(87.4)	(90.5)		(88.3)	(79.6)		(88.1)	(79.3)	
Conjunctival congestion	10/1325	0/20 (0)	>0.999	9/1237	1/108 (0.9)	0.568	9/1120	1/225 (0.4)	>0.999	10/1299	0/46 (0)	>0.999	10/1320	0/25 (0)	>0.999
	(0.8)			(0.7)			(0.8)			(0.8)			(0.8)		
Nasal congestion	72/1281	1/18 (5.6)	>0.999	66/1195	7/104 (6.7)	0.655	62/1079	11/220 (5)	0.750	67/1253	6/46 (13)	0.040	73/1275	0/24 (0)	0.394
	(5.6)			(5.5)			(5.7)			(5.3)			(5.7)		

Headache	202/1309 (15.4)	3/19 (15.8)	>0.999	187/1225 (15.3)	18/103 (17.5)	0.317	166/1106 (15)	39/222 (17.6)	0.359	197/1283 (15.4)	8/45 (17.8)	0.674	197/1303 (15.1)	8/25 (32)	0.043
Dry cough	1038/1474 (70.4)	14/24 (58.3)	0.259	972/1378 (70.5)	80/120 (66.7)	0.405	854/1238 (69)	198/260 (76.2)	0.021	1018/1442 (70.6)	34/56 (60.7)	0.135	1035/1469 (70.5)	17/29 (58.6)	0.217
Pharyngodynia	189/1300 (14.5)	5/17 (29.4)	0.091	182/1219 (14.9)	12/98 (12.2)	0.555	165/1102 (15)	29/215 (13.5)	0.674	185/1272 (14.5)	9/45 (20)	0.288	192/1296 (14.8)	2/21 (9.5)	0.757
Productive cough	502/1400 (35.9)	11/24 (45.8)	0.391	462/1309 (35.3)	51/115 (44.3)	0.055	403/1178 (34.2)	110/246 (44.7)	0.002	499/1373 (36.3)	14/51 (27.5)	0.235	504/1397 (36.1)	9/27 (33.3)	0.842
Fatigue	573/1347 (42.5)	11/18 (61.1)	0.15	529/1257 (42.1)	55/108 (50.9)	0.085	488/1143 (42.7)	96/222 (43.2)	0.882	564/1318 (42.8)	20/47 (42.6)	>0.999	574/1344 (42.7)	10/21 (47.6)	0.663
Hemoptysis	15/1296 (1.2)	1/19 (5.3)	0.209	12/1214 (1)	4/101 (4)	0.029	12/1096 (1.1)	4/219 (1.8)	0.323	15/1268 (1.2)	1/47 (2.1)	0.443	16/1292 (1.2)	0/23 (0)	>0.999
Shortness of breath	316/1371 (23)	15/23 (65.2)	<0.001	277/1279 (21.7)	54/115 (47)	<0.001	223/1154 (19.3)	108/240 (45)	<0.001	310/1342 (23.1)	21/52 (40.4)	0.007	319/1366 (23.4)	12/28 (42.9)	0.023
Nausea/vomiting	77/1350 (5.7)	3/21 (14.3)	0.119	69/1264 (5.5)	11/107 (10.3)	0.051	55/1134 (4.9)	25/237 (10.5)	0.002	73/1321 (5.5)	7/50 (14)	0.023	79/1348 (5.9)	1/23 (4.3)	>0.999
Diarrhea	57/1338	0/21 (0)	>0.999	48/1255	9/104 (8.7)	0.035	46/1129	11/230	0.590	53/1313 (4)	4/46 (8.7)	0.123	57/1336	0/23 (0)	0.621



	(4.3)			(3.8)			(4.1)	(4.8)				(4.3)			
Myalgia/arthralgia	231/1320 (17.5)	3/18 (16.7)	>0.999	218/1234 (17.7)	16/104 (15.4)	0.687	188/1112 (16.9)	46/226 (20.4)	0.213	227/1294 (17.5)	7/44 (15.9)	>0.999	233/1317 (17.7)	1/21 (4.8)	0.153
Chill	159/1313 (12.1)	4/20 (20)	0.294	151/1230 (12.3)	12/103 (11.7)	1.000	140/1111 (12.6)	23/222 (10.4)	0.432	161/1290 (12.5)	2/43 (4.7)	0.156	162/1310 (12.4)	1/23 (4.3)	0.347
Signs															
Throat congestion	21/1269 (1.7)	0/17 (0)	>0.999	20/1189 (1.7)	1/97 (1)	>0.999	18/1075 (1.7)	3/211 (1.4)	>0.999	21/1245 (1.7)	0/41 (0)	>0.999	21/1266 (1.7)	0/20 (0)	>0.999
Tonsil swelling	31/1355 (2.3)	0/21 (0)	>0.999	28/1265 (2.2)	3/111 (2.7)	0.734	25/1133 (2.2)	6/243 (2.5)	0.811	29/1326 (2.2)	2/50 (4)	0.312	31/1348 (2.3)	0/28 (0)	>0.999
Enlargement of lymph nodes	2/1355 (0.1)	0/20 (0)	>0.999	2/1267 (0.2)	0/108 (0)	>0.999	2/1135 (0.2)	0/240 (0)	>0.999	1/1325 (0.1)	1/50 (2)	0.071	2/1347 (0.1)	0/28 (0)	>0.999
Rash	3/1357 (0.2)	0/21 (0)	>0.999	2/1270 (0.2)	1/108 (0.9)	0.217	2/1141 (0.2)	1/237 (0.4)	0.433	3/1327 (0.2)	0/51 (0)	>0.999	3/1351 (0.2)	0/27 (0)	>0.999
Unconsciousness	18/1400 (1.3)	2/21 (9.5)	0.034	18/1309 (1.4)	2/112 (1.8)	0.668	12/1175 (1)	8/246 (3.3)	0.013	17/1371 (1.2)	3/50 (6)	0.031	19/1392 (1.4)	1/29 (3.4)	0.340
Abnormal chest image															

Radiograph	236/1566 (15.1)	7/24 (29.2)	0.079	218/1460 (14.9)	25/130 (19.2)	0.203	178/1321 (13.5)	65/269 (24.2)	<0.001	231/1531 (15.1)	12/59 (20.3)	0.269	231/1560 (14.8)	12/30 (40)	0.001
Computed tomography	1113/1566 (71.1)	17/24 (70.8)	>0.999	1034/1460 (70.8)	96/130 (73.8)	0.545	926/1321 (70.1)	204/269 (75.8)	0.065	1090/1531 (71.2)	40/59 (67.8)	0.561	1111/1560 (71.2)	19/30 (63.3)	0.416
<b>Hubei</b>			0.094			<0.001			<0.001			<0.001			<0.001
Yes	633/1566 (40.4)	14/24 (58.3)		568/1460 (38.9)	79/130 (60.8)		491/1321 (37.2)	156/269 (58)		609/1531 (39.8)	38/59 (64.4)		623/1560 (39.9)	24/30 (80)	
No	933/1566 (59.6)	10/24 (41.7)		892/1460 (61.1)	51/130 (39.2)		830/1321 (62.8)	113/269 (42)		922/1531 (60.2)	21/59 (35.6)		937/1560 (60.1)	6/30 (20)	
<b>Wuhan-contacted</b>			0.408			0.025			0.003			0.471			0.210
Yes	1312/1566 (83.8)	22/24 (91.7)		1216/1460 (83.3)	118/130 (90.8)		1092/1321 (82.7)	242/269 (90)		1282/1531 (83.7)	52/59 (88.1)		1306/1560 (83.7)	28/30 (93.3)	
No	254/1566 (16.2)	2/24 (8.3)		244/1460 (16.7)	12/130 (9.2)		229/1321 (17.3)	27/269 (10)		249/1531 (16.3)	7/59 (11.9)		254/1560 (16.3)	2/30 (6.7)	
<b>Severity</b>	239/1566 (15.3)	15/24 (62.5)	<0.001	209/1460 (14.3)	45/130 (34.6)	<0.001	166/1321 (12.6)	88/269 (32.7)	<0.001	234/1531 (15.3)	20/59 (33.9)	<0.001	239/1560 (15.3)	15/30 (50)	<0.001
<b>Composite endpoint</b>	119/1566	12/24 (50)	<0.001	100/1460	31/130	<0.001	78/1321	53/269	<0.001	118/1531	13/59 (22)	0.001	121/1560	10/30	<0.001

	(7.6)			(6.8)	(23.8)		(5.9)	(19.7)		(7.7)		(7.8)	(33.3)	
<b>Deaths</b>	44/1566 (2.8)	6/24 (25)	<0.001	37/1460 (2.5)	13/130 (10)	<0.001	22/1321 (1.7)	28/269 (10.4)	<0.001	42/1531 (2.7)	8/59 (13.6)	<0.001	44/1560 (2.8)	6/30 (20) <0.001
	<b>Hepatitis B infection</b>			<b>Malignancy</b>			<b>Chronic kidney disease</b>			<b>Immunodeficiency</b>				
	<b>No (n=1566)</b>	<b>Yes (n=24)</b>	<b>P Value</b>	<b>No (n=1460)</b>	<b>Yes (n=130)</b>	<b>P Value</b>	<b>No (n=1321)</b>	<b>Yes (n=269)</b>	<b>P Value</b>	<b>No (n=1531)</b>	<b>Yes (n=59)</b>	<b>P Value</b>		
Age (year)	48.9±16.3	50.8±14.8	0.559	48.7±16.2	63.1±12.1	<0.001	48.8±16.2	63.7±14	<0.001	48.9±16.3	51±21.7	0.824		
Incubation period (day)	3.7±4.2	3±2.8	0.417	3.7±4.2	3.1±3.1	0.633	3.6±4.1	3.3±7.5	0.750	3.6±4.1	12.7±16.3	0.437		
Temperature on admission (°C)	37.4±0.9	37.3±0.8	0.864	37.4±0.9	37.3±0.9	0.597	37.4±0.9	37.2±1	0.353	37.4±0.9	36.6±0.2	0.147		
Respiratory rate on admission (breath/min)	21.2±12.1	21.2±3	0.995	21.3±12.1	20.2±1.6	0.701	21.3±12.1	19±2.8	0.425	21.3±12	19±1	0.746		
Heart rate (bit/minute)	88.7±14.6	86.3±13.2	0.405	88.7±14.6	89.4±13.1	0.834	88.7±14.6	89.1±12.5	0.909	88.7±14.6	91±18.5	0.782		
Systolic pressure on admission (mmHg)	126.1±16.4	124.8±14.7	0.708	126±16.4	128.3±14.5	0.557	125.9±16.3	135.4±20.5	0.012	126.1±16.4	127.3±7.4	0.895		
Diastolic pressure on admission (mmHg)	79.6±25.7	78.3±13	0.817	79.5±25.7	81.2±8.8	0.784	79.5±25.7	79.8±14	0.967	79.5±25.6	84.7±15	0.728		

Highest temperature (°C)	38.3±1.5	37.6±4.4	0.457	38.3±1.6	38.5±0.9	0.516	38.3±1.6	38.5±0.5	0.586	38.3±1.6	38±0.5	0.789
<b>Sex</b>			0.336			0.814			0.361			0.078
Male	885/1550 (57.1)	19/28 (67.9)		893/1560 (57.2)	11/18 (61.1)		891/1559 (57.2)	13/19 (68.4)		904/1575 (57.4)	0/3 (0)	
Female	665/1550 (42.9)	9/28 (32.1) (42.9)		667/1560 (42.8)	7/18 (38.9) (42.8)		668/1559 (42.8)	6/19 (31.6) (42.8)		671/1575 (42.6)	3/3 (100)	
<b>Smoking status</b>			0.440			0.032			>0.999			0.195
Never/unknown	1454/1562 (93.1)	25/28 (89.3)		1465/1572 (93.2)	14/18 (77.8)		1459/1569 (93)	20/21 (95.2)		1477/1587 (93.1)	2/3 (66.7)	
Former/current	108/1562 (6.9)	3/28 (10.7) (6.9)		107/1572 (6.8)	4/18 (22.2) (6.8)		110/1569 (7)	1/21 (4.8) (7)		110/1587 (6.9)	1/3 (33.3)	
<b>Symptoms</b>												
Fever	1326/1508 (87.9)	25/28 (89.3)	>0.999	1335/1519 (87.9)	16/17 (94.1)	0.711	1334/1516 (88)	17/20 (85)	0.725	1348/1533 (87.9)	3/3 (100)	>0.999
Conjunctival congestion	9/1323 (0.7)	1/22 (4.5) (0.7)	0.153	10/1330 (0.8)	0/15 (0) (0.8)	>0.999	10/1328 (0.8)	0/17 (0)	>0.999	10/1343 (0.7)	0/2 (0)	>0.999

Nasal congestion	73/1277 (5.7)	0/22 (0)	0.631	71/1285 (5.5)	2/14 (14.3)	0.184	73/1282 (5.7)	0/17 (0)	0.619	73/1297 (5.6)	0/2 (0)	>0.999
Headache	202/1306 (15.5)	3/22 (13.6)	>0.999	203/1314 (15.4)	2/14 (14.3)	>0.999	203/1311 (15.5)	2/17 (11.8)	>0.999	205/1326 (15.5)	0/2 (0)	>0.999
Dry cough	1037/1472 (70.4)	15/26 (57.7)	0.193	1039/1481 (70.2)	13/17 (76.5)	0.791	1037/1479 (70.1)	15/19 (78.9)	0.614	1050/1495 (70.2)	2/3 (66.7)	>0.999
Pharyngodynia	188/1294 (14.5)	6/23 (26.1)	0.134	193/1303 (14.8)	1/14 (7.1)	0.707	191/1300 (14.7)	3/17 (17.6)	0.728	193/1315 (14.7)	1/2 (50)	0.273
Productive cough	508/1401 (36.3)	5/23 (21.7)	0.190	504/1408 (35.8)	9/16 (56.3)	0.115	505/1407 (35.9)	8/17 (47.1)	0.446	512/1421 (36)	1/3 (33.3)	>0.999
Fatigue	570/1340 (42.5)	14/25 (56)	0.221	577/1349 (42.8)	7/16 (43.8)	>0.999	581/1350 (43)	3/15 (20)	0.113	583/1363 (42.8)	1/2 (50)	>0.999
Hemoptysis	16/1293 (1.2)	0/22 (0)	>0.999	15/1299 (1.2)	1/16 (6.3)	0.179	16/1300 (1.2)	0/15 (0)	>0.999	16/1313 (1.2)	0/2 (0)	>0.999
Shortness of breath	321/1370 (23.4)	10/24 (41.7)	0.05	323/1377 (23.5)	8/17 (47.1)	0.039	321/1375 (23.3)	10/19 (52.6)	0.006	330/1392 (23.7)	1/2 (50)	0.419
Nausea/vomiting	78/1349	2/22 (9.1)	0.371	78/1355	2/16 (12.5)	0.239	79/1351	1/20 (5)	>0.999	80/1369	0/2 (0)	>0.999

	(5.8)			(5.8)			(5.8)			(5.8)		
Diarrhea	55/1337 (4.1)	2/22 (9.1)	0.235	57/1343 (4.2)	0/16 (0)	>0.999	56/1339 (4.2)	1/20 (5)	0.578	56/1356 (4.1)	1/3 (33.3)	0.121
Myalgia/arthritis	232/1316 (17.6)	2/22 (9.1)	0.403	231/1322 (17.5)	3/16 (18.8)	0.75	233/1323 (17.6)	1/15 (6.7)	0.491	233/1336 (17.4)	1/2 (50)	0.319
Chill	161/1310 (12.3)	2/23 (8.7)	>0.999	162/1318 (12.3)	1/15 (6.7)	>0.999	161/1317 (12.2)	2/16 (12.5)	>0.999	163/1331 (12.2)	0/2 (0)	>0.999
<b>Signs</b>												
Throat congestion	21/1264 (1.7)	0/22 (0)	>0.999	20/1271 (1.6)	1/15 (6.7)	0.220	21/1271 (1.7)	0/15 (0)	>0.999	20/1284 (1.6)	1/2 (50)	0.032
Tonsil swelling	30/1353 (2.2)	1/23 (4.3)	0.410	30/1359 (2.2)	1/17 (5.9)	0.323	30/1356 (2.2)	1/20 (5)	0.368	31/1373 (2.3)	0/3 (0)	>0.999
Enlargement of lymph nodes	2/1352 (0.1)	0/23 (0)	>0.999	2/1359 (0.1)	0/16 (0)	>0.999	2/1355 (0.1)	0/20 (0)	>0.999	2/1372 (0.1)	0/3 (0)	>0.999
Rash	3/1355 (0.2)	0/23 (0)	>0.999	3/1361 (0.2)	0/17 (0)	>0.999	3/1360 (0.2)	0/18 (0)	>0.999	3/1376 (0.2)	0/2 (0)	>0.999
Unconsciousness	19/1397	1/24 (4.2)	0.290	20/1404	0/17 (0)	>0.999	20/1401	0/20 (0)	>0.999	20/1418	0/3 (0)	>0.999

	(1.4)			(1.4)			(1.4)			(1.4)		
<b>Abnormal chest image</b>												
Radiograph	240/1562 (15.4)	3/28 (10.7)	0.79	239/1572 (15.2)	4/18 (22.2)	0.504	240/1569 (15.3)	3/21 (14.3)	>0.999	243/1587 (15.3)	0/3 (0)	>0.999
Computed tomography	1111/1562 (71.1)	19/28 (67.9)	0.679	1113/1572 (70.8)	17/18 (94.4)	0.033	1116/1569 (71.1)	14/21 (66.7)	0.634	1127/1587 (71)	3/3 (100)	0.561
<b>Hubei</b>			0.439			0.030			0.001			0.570
Yes	638/1562 (40.8)	9/28 (32.1)		635/1572 (40.4)	12/18 (66.7)		631/1569 (40.2)	16/21 (76.2)		645/1587 (40.6)	2/3 (66.7)	
No	924/1562 (59.2)	19/28 (67.9)		937/1572 (59.6)	6/18 (33.3)		938/1569 (59.8)	5/21 (23.8)		942/1587 (59.4)	1/3 (33.3)	
<b>Wuhan-contacted</b>			0.436			0.097			>0.999			>0.999
Yes	1312/1562 (84)	22/28 (78.6)		1316/1572 (83.7)	18/18 (100)		1316/1569 (83.9)	18/21 (85.7)		1331/1587 (83.9)	3/3 (100)	
No	250/1562 (16)	6/28 (21.4)		256/1572 (16.3)	0/18 (0)		253/1569 (16.1)	3/21 (14.3)		256/1587 (16.1)	0/3 (0)	

<b>Severity</b>	245/1562 (15.7)	9/28 (32.1)	0.032	245/1572 (15.6)	9/18 (50)	0.001	246/1569 (15.7)	8/21 (38.1)	0.012	253/1587 (15.9)	1/3 (33.3)	0.407
<b>Composite endpoint</b>	128/1562 (8.2)	3/28 (10.7)	0.498	124/1572 (7.9)	7/18 (38.9)	<0.001	125/1569 (8)	6/21 (28.6)	0.005	130/1587 (8.2)	1/3 (33.3)	0.227
<b>Deaths</b>	49/1562 (3.1)	1/28 (3.6)	0.594	47/1572 (3)	3/18 (16.7)	0.017	45/1569 (2.9)	5/21 (23.8)	<0.001	50/1587 (3.2)	0/3 (0)	>0.999

Data are mean  $\pm$  standard deviation, n/N (%), where N is the total number of patients with available data. p values are calculated by  $\chi^2$  test, Fisher's exact test, or Mann-Whitney U test. COPD=chronic obstructive pulmonary disease.



## Figure legends

### Figure 1. Comparison of the time-dependent risk of reaching to the composite endpoints

Figure 1-A, The time-dependent risk of reaching to the composite endpoints between patients with (orange curve) or without any comorbidity (dark blue curve);

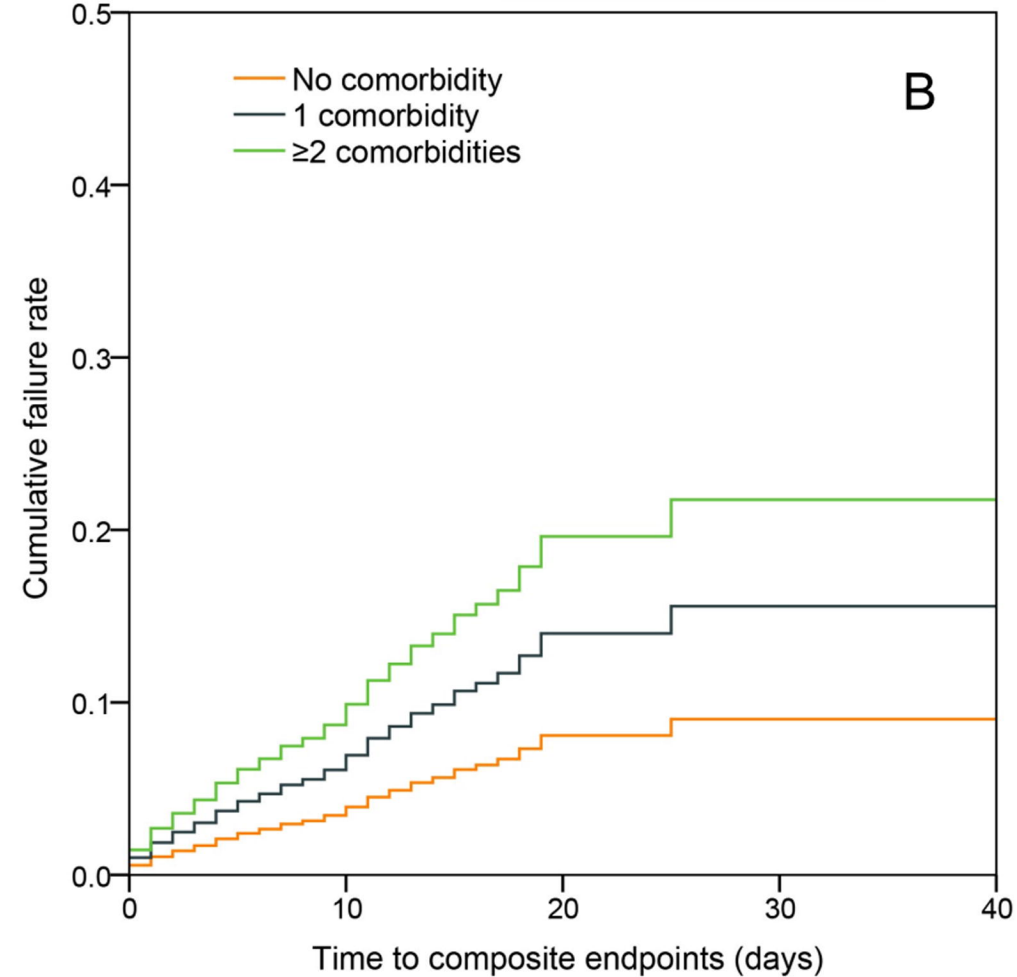
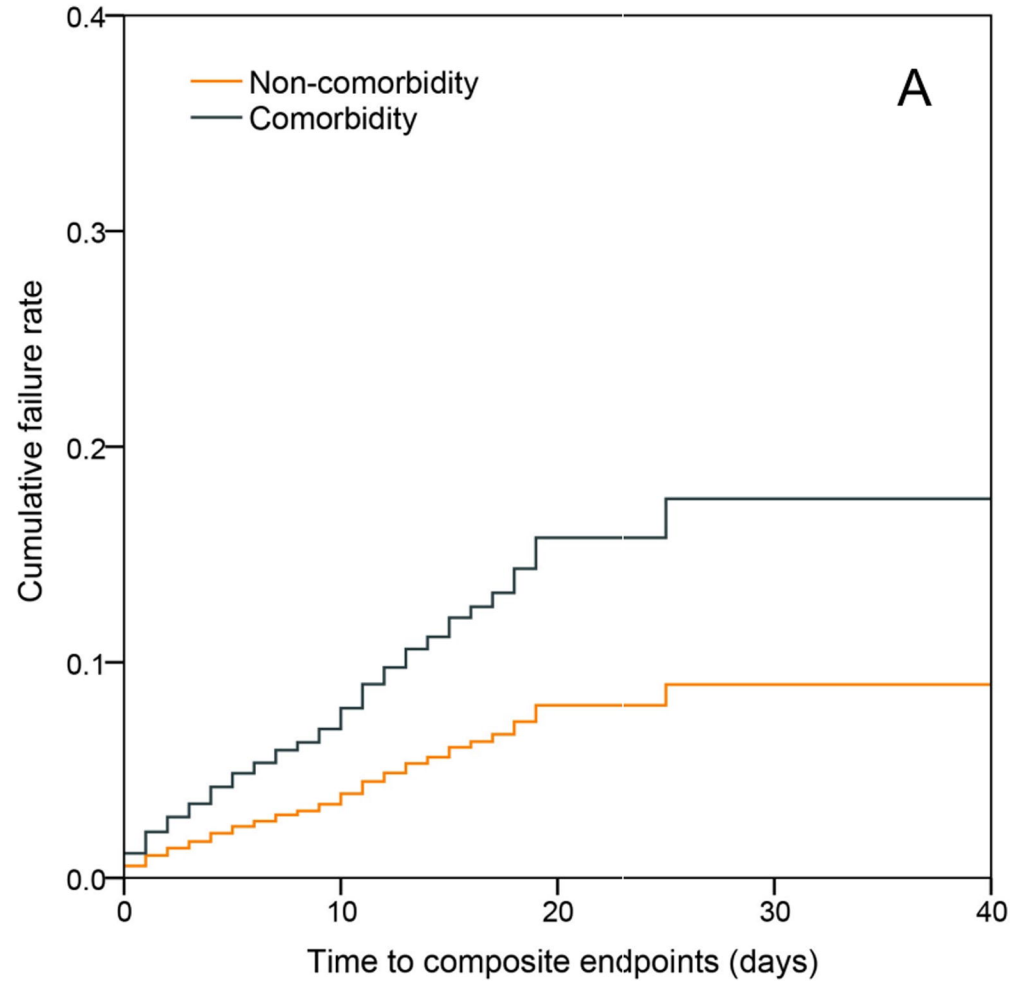
Figure 1-B, The time-dependent risk of reaching to the composite endpoints between patients without any comorbidity (orange curve), patients with a single comorbidity (dark blue curve), and patients with two or more comorbidities (green curve).







### Figure 2. Predictors of the composite endpoints in the proportional hazards model

Shown in the figure are the hazards ratio (HR) and the 95% confidence interval (95%CI) for the risk factors associated with the composite endpoints (admission to intensive care unit, invasive ventilation, or death). The comorbidities were classified according to the organ systems as well as the number.

The scale bar indicates the HR.

The model has been adjusted with age and smoking status



Features		Hazard Ratio (95%CI)		P Value
Type of comorbidities				
COPD		2.681	(1.424-5.048)	0.002
Diabetes		1.586	(1.028-2.449)	0.037
Hypertension		1.575	(1.069-2.322)	0.022
Malignant tumor		3.501	(1.604-7.643)	0.002
Number of comorbidities				
1		1.789	(1.155-2.772)	0.009
2 or more		2.592	(1.611-4.171)	<0.001
	