**Prevalent comorbidities among young and underprivileged:
Death portrait of COVID-19 among 235 555 hospitalized patients in Brazil**

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Background COVID-19 has been alarmingly spreading worldwide, with Brazil ranking third in total number of cases and second in deaths. Being a continental country, which comprises many ethnic groups and an engrained social inequality, the pandemic evidenced this heterogeneous discrepancy. We aimed to estimate the impact of associated risk factors, isolated or combined, on COVID-19 severeness, detecting specific epidemiological profiles for multiple age ranges in hospitalized Brazilians.

Methods In this large retrospective cohort study, we used open-access data from the Ministry of Health of Brazil with COVID-19 confirmed hospitalized patients annotated in SRAG system between February and August 2020, a total of 235555 entries. The association of COVID-19 death with socio-demographic and clinical characteristics was analysed and presented as odds ratios adjusted by confounding co-variables. We also presented marginal mean aOR values for high-order interactions either by or not another fixed level or condition. We kept all other variables in the multivariate logistic models in their mean values or equal proportions.

Findings Younger individuals with one or more comorbidities had an adjusted odds ratio up to four-fold compared to those without it, in the same age interval. Younger diabetic patients either self-declared as brown ethnicity (aOR 5·58, 95% CI 4·97-6·25; p<0·0001) or with some other associated comorbidities, mainly chronic hematologic disease (21·09, 13·64-32·6; p<0·0001) and obesity (aOR 21·7, 95% CI not calculated; p<0·0001), resulted in outstanding death risk. Age over 60, particularly over 90 (28·91, 24·5-34·11; p<0.001), usage of invasive ventilatory support (16·23, 14·05-18·75; p<0·001), admission to intensive care units (3·14, 2·82-3·48; p<0·001), multiple respiratory symptoms (3·24, 2·79-3·75; p<0·0001), black ethnicity (1·78, 1·52-2·07; p<0·05), and diagnosis previous to hospitalization (1·32, 1·19-1·47; p<0·05) were associated with higher death odds. As protective factors, with roughly one third less death risk, we found hospitalization duration of (4, 7] days and illness onset to hospitalization over 6 days.

Interpretation We found evidence for increased COVID-19 risk in two distinct groups: younger patients with prevalent comorbidities, especially in brown ethnicity, and patients with

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black ethnicity. We speculate that the pro-inflammatory synergism of COVID-19 and comorbidities, promoting an overproduction of cytokines, is partially the cause of higher mortality in this young group. Brazilian black and brown are underprivileged populations, with structural social inequality, limited healthcare access and, thus, remarkable disease vulnerability. Our study supplies essential data to patient stratification upon admission, optimizing hospital management, and to guide public policy determinations, including group prioritization for COVID-19 vaccination in Brazil.

Research in context
Evidence before this study
COVID-19 is still very active, having spread to over two hundred countries and caused more than one million deaths worldwide. Its current situation requires large-scale studies to assess the impact of preexisting comorbidities, symptoms, and socioeconomic issues regarding mortality rate, especially where lack of control is evident. We searched PubMed, Google Scholar, medRxiv, and bioRxiv on Dec 12, 2020, for studies published in English or Brazilian Portuguese, estimating the impact of several risk factors in COVID-19 prognosis. We used the search terms "Brazil" or "risk factors" or "ethnicity" or "cohort" or "diabetes mellitus" or "mortality" or "symptoms" or "comorbidities", and related synonyms, combined with "SARS-CoV-2" or "COVID-19". Many pre-existing conditions have shown to directly impact patient prognosis, out of which cancer, chronic kidney disease, chronic obstructive pulmonary disease, cardiovascular disease, obesity, and diabetes, among others, are well established in SARS-CoV-2 infection severeness. Some studies reported an increased death risk for non-white Brazilians, but no large scale cohort analyzing the impact of one or more associated risk factors in younger Brazilians patients were found.
Added value of this study
We found that the impact of having one or two or more risk factors on mortality are progressively higher in ages (60, 80], (40, 60], (20, 40], and (0, 20], compared with people of the same age interval without comorbidities. We also found that young brown individuals with diabetes, as well as black ethnicity on its own, are population subgroups at remarkably higher risk for severe COVID-19 in Brazil. Furthermore, advanced age, usage of ventilatory support, admission to intensive care units, multiple respiratory symptoms, and diagnosis previous to hospitalization were associated with higher death odds. As protective factors, we found hospitalization duration of (4, 7] days and illness onset to hospitalization over 6 days.
Implications of all the available evidence
We identified multiple epidemiological profiles associated with death risk in different age ranges in Brazilian COVID-19 hospitalized patients. These findings unveil that a large part of Brazilian working-age population is at a higher risk for SARS-CoV-2 death, a neglected situation that is further exacerbating inequalities, leading to a striking sociodemographic and economic impact. We hope that our analysis aids patient risk stratification, hospital management optimization, and public policy determination, including prioritization for COVID-19 vaccination in Brazil.

INTRODUCTION

Coronavirus disease (COVID-19), the recently discovered virus named Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2), was first reported in December 2019, in Wuhan, China,[1] and on February 25th, 2020, in Brazil.[2] Due to its high transmission rate, the World Health Organization (WHO) declared, in January 2020, COVID-19 as a Public Health Emergency epidemic, and considered it a pandemic on March 11th, 2020.[3,4]

As of October 16th, 2020, more than 38619674 cases and 1093522 deaths caused by SARS-CoV-2 have been reported worldwide; 7833851 cases and 215199 deaths reported in the USA and 5140863 cases and 151747 deaths reported in Brazil, the first and third biggest epicenters, respectively.[5] Although Brazil population accounts for only 2·75% of the world population,[6] 13·31% of reported cases and 13·87% of reported deaths are from this country,[5] showing a remarkable lack of transmission control effectiveness.

COVID-19 has heterogeneous clinical manifestations, ranging from mild nonspecific flu-like symptoms to severe pneumonia with multiple organ failure and death. Most common symptoms may include fever, cough, fatigue, dyspnoea, myalgia, and sputum production.[7] Headache, gastrointestinal symptoms, anosmia, and dysgeusia can also occur.[8,9] Cancer, chronic kidney disease, chronic obstructive pulmonary disease, cardiovascular disease, obesity, sickle cell disease, smoking, organ transplantation, and type 2 diabetes mellitus are consistently considered risk factors for COVID-19 severity.[10]

Diabetes mellitus (DM) is a global public health issue,[11] Brazil being the fifth country in the number of affected people.[11] DM is an aggravating factor among other respiratory coronavirus infections as well,[12,13] and, similarly to other COVID-19 severity risk factors, leads to a chronic proinflammatory state with an attenuation of the immunity response with vascular impairment. The cytokine-driven response is highly correlated with cytokine storm, and the unbalanced immune system becomes a vital promoter of worsening of the patient's condition.[14]

Based on data from the Health Ministry of Brazil, we aimed to estimate the impact of social demographic features, comorbidities, and clinical conditions, resulting in the identification of an epidemiological profile of COVID-19 hospitalization in Brazil. We found younger individuals with one or more comorbidities, younger diabetic self-declared as brown ethnicity, and black ethnicity patients at outstanding aggravating death risk.

METHODS
STUDY DESIGN AND PATIENTS

In this retrospective cohort study, an official open-source (creative commons licensed) dataset called "Severe Acute Respiratory Syndrome Database", kept and updated by the Ministry of Health of Brazil,[15] has been used, and its data released on August 12th, 2020, 19:05 (UTC-03:00), have been analysed. Only patients with positive laboratory samples (polymerase chain reaction or serological) or clinical (symptoms, imaging, or epidemiological link) COVID-19 diagnosis, hospitalized and dismissed from February 20th to August 9th were included in the analyses.[16] Among 575935 records, 282495 were discarded from analyses, due to presenting a confirmed etiologic agent other than SARS-CoV-2 or being waiting for conclusive results. Furthermore, entries with sex marked as ignored (83 records), without a disclosed clinical

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evolution (56099 records), with age equal to 0 (4 records) or age under one year (1699 records) were also discarded, resulting in the 235555 records used in the analyses.

Records that had the "other risk factors" (in this study referred to as "unlisted risk factors") field marked as true and text description that included "HAS", "H.A.S.", "HIPERTENSO", "HIPERTENSAO" (when not "HIPERTENSAO PULMONAR"), "HIPERTENSA", or "HA" were assigned to a new chronic high blood pressure variable (29017 records). Entries whose description included "OBESIDADE", "OBESO", and "OBESA" were assigned to obesity (4854 records) as a standard term. In cases where this was the only description for unlisted risk factors, the variable was changed to false (25004 records).

DATA COLLECTION

COVID-19 monitoring in Brazil is made possible due to the repurposing of two sentinel surveillance systems created by the Ministry of Health: influenza-like illness (denominated flu-like syndrome) and severe acute respiratory syndrome tracking (here abbreviated as SRAG). The compulsory notification occurs on the online platform "e-SUS Notifica", nationally, made by health professionals from public and private institutions. All influenza and influenza-like illnesses are monitored, annotated, and compiled in the SIVEP-GRIPE database,[17] with government restricted access as of August 12, 2020. Cases of hospitalizations or deaths due to acute respiratory syndrome severeness are also annotated in the open-access SRAG database.[17] According to the Ministry of Health of Brazil, the classification of SRAG demands the patient fulfills the flu-like syndrome definition and manifests dyspnea, respiratory distress, chest pain, oxygen saturation less than 95%, or cyanosis.[17] In children, particularly, intercostal retraction, dehydration, and inappetence are also considered.[17]

SEVERE ACUTE RESPIRATORY SYNDROME FORM

The SRAG form comprises 154 variables, including extensive sociodemographic and clinical information, some limited to the government. The form has mandatory fields for annotation in the Information System for Notifiable Diseases (SINAN). An extra field is also available for complementary observations. Out of those, we selected the following for the analyses: annotation date, symptoms offset date, case disclosure date, hospitalization date, sex, age, ethnicity, schooling level, pregnancy, fever, cough, sore throat, dyspnea, respiratory distress, saturation level, diarrhea, vomiting, presence of risk factors, postpartum period, chronic cardiovascular disease, chronic hematologic disease, down syndrome, chronic hepatic disease, asthma, diabetes mellitus, chronic neurological disease, immunodeficiency or immunosuppression, chronic renal disease, obesity, obesity body mass index, unlisted risk factors, ventilatory support, chest x-ray, computerized tomography, intensive care unit, previously known diagnosis, final diagnosis, and patient outcome.

STATISTICAL ANALYSIS

For the description of the patients who died or not due to COVID-19 and its consequences up to the time of the study, according to their socio-demographic and clinical characteristics, for continuous numerical variables, we used density plots, medians, and interquartile intervals, and performed non-parametric Mann-Whitney tests comparing central tendencies; for

nominal/categorical variables, we used bar plots, calculated absolute and relative frequencies, and tested independence with Fisher's exact tests.

In determining factors associated with death risk and protection, we used fixed-effect generalized linear parametric models with a logistic link function (Binomial family). The measure of association was presented as a function of odds ratios either adjusted by co-variables of confounding (aOR) or not (OR). P-values were corrected by the number of comparisons with the reference level by the Holm-Sidak method. We kept all other variables in the multivariate logistic models in their mean values or equal proportions to estimate marginal mean aOR values and its 95% confidence intervals for high-order interactions either by or not another fixed level or condition. Again, p-values were corrected by the number of comparisons with the reference level by the Holm-Sidak method.

All statistical analyses were performed in the software R v.3.6.3 and the library 'emmeans' and its dependencies.

ROLE OF THE FUNDING SOURCE

There was no funding source for this study. All authors had access to all used data. All authors have responsibility for the decision to submit the paper for publication.

RESULTS

Out of the 181964 patients, 56·3% were males and 43·7% females (Table 1). Of 96567 deaths, 58·23% were among males and 41·77% among females, resulting in 41% mortality (Table 1). The median age was 61 (IQR=28), the mean age 59·44, and the standard deviation 18·53 (Table 1). The ethnic analysis shows that 31% were self-declared as white, 4·6% black, 1·1% yellow, 32·4% brown, 0·3% red (indigenous), and 30·6% blank or ignored (Table 1). Schooling level demonstrated 2·5% were illiterate, 8·8% completed Elementary school only partially, 6·3% completed Elementary school, 11·2% completed High school, and 5·3% graduated from College. Over half of schooling level entries were missing or marked as ignored (Table 1). Pregnancy stage analysis revealed 31·4% of patients were not pregnant, 0·1% were in the first trimester of gestational age, 0·2% were in the second trimester, 0·6% in the third trimester, and 0·1% were pregnant but with no disclosed gestational age (Table 1).

Only 22·9% of patients were diagnosed and notified as COVID-19 before requiring hospitalization, whereas 48·1% were assigned as COVID-19 positive just after, and this information was marked as ignored in 29% of cases (Table 2). The median hospitalization duration was 7 days (IQR=9), mean 10·11 days, and standard deviation 10·26 (Table 2). The median time from illness onset to hospitalization was 6 days (IQR=6), and the median time from illness onset to cure or death was 14 days (IQR=11) (Table 2). The median notification delay was 0 days (IQR=2) (Table 2). Half the patients did not use intensive care unit, while 30·2% used it, and 19·6% had this information blank or marked as ignored (Table 2). Ventilatory support was not used by 24·5%, invasive ventilatory support by 18·5%, and non-invasive ventilatory support by 37·5% of patients (Table 2).

Cough was the most reported symptom on admission, followed by dyspnea, fever, respiratory distress, oxygen saturation < 95%, sore throat, diarrhea, and vomiting (Table 2). Some risk factors were present in over half of patients. Chronic cardiovascular diseases were the most prevalent, followed by diabetes mellitus, unlisted risk factors, and high blood pressure (Table

2). Less frequent comorbidities were obesity, chronic renal disease, chronic neurological disease, chronic pneumopathy, immunodeficiency or immunosuppression, asthma, chronic hepatic disease, chronic hematologic disease, postpartum period, and down syndrome, respectively (Table 2).

Critical factors which increasingly impact outcomes, found as statistically significant by logistic analysis, were: respiratory distress, oxygen saturation < 95%, patients diagnosed with COVID-19 prior to hospitalization, dyspnea, use of non-invasive ventilatory support, black ethnicity, pre-existing chronic neurological disease, pre-existing immunodeficiency or immunosuppression, need of intensive care unit, age (60, 90], usage of invasive ventilatory support, and age greater than 90 (Table 3; Figure 1). As protective factors, illness onset prior to hospitalization greater than 6 but less than or equal 9 days, greater than 9 days, and patients with a hospitalization duration greater than 4 but less than or equal to 7 days (Table 3; Figure 1).

The combination of oxygen saturation < 95%, dyspnea, and respiratory distress was shown to be the worst association of respiratory symptoms with death, followed by oxygen saturation < 95% with respiratory distress, oxygen saturation < 95% with dyspnea, and dyspnea with respiratory distress (Figure 2; appendix p 1).

Regarding the impact of having one risk factor alone, patients aged (0, 20] had the worst outcome, followed by those (20, 40], and those (40, 60] (Figure 3; appendix p 1). To what concerns the impact of any two or more risk factors, patients aged (20, 40] had the worst outcome, followed by those (40, 60], and minor impact in (60, 80] (Figure 3; appendix p 2).

Finally, we analyzed the impact of diabetes mellitus (DM) combined with other risk factors on death, focusing on different age intervals. In patients up to 20 years old, DM, either with chronic hematologic diseases or obesity, leads to approximately a twenty-one-fold increase in death risk, followed by roughly a six-fold by brown ethnicity (white as reference) (Figure 4; appendix p 3). At age (20, 40], DM, either with chronic cardiovascular diseases or chronic high blood pressure, showed a four-fold increase in death risk (Figure 4; appendix p 3). Yet, among the younger population, DM, when associated either with chronic neurological diseases, chronic pneumopathy diseases, chronic renal diseases, or unlisted risk factors, shows a recurring pattern of worse outcome (Figure 4).

DISCUSSION

This large-scale retrospective cohort study identified and estimated the impact of several risk factors for death in COVID-19 Brazilian hospitalized patients, as well as their severe increase in association with diabetes. Individually, advanced age, invasive ventilatory support, admission to intensive care units, and multiple respiratory symptoms were associated with higher death odds. Usage of non-invasive ventilatory support, immunodeficiency or immunosuppression, black ethnicity, and COVID-19 diagnosis previous to hospitalization were also aggravating factors for death, with less impact. Younger diabetic patients either self-declared as brown ethnicity or with some comorbidities, mainly chronic hematologic disease and obesity, presented an outstanding death risk. As protective factors, we found hospitalization duration of (4, 7] and illness onset to hospitalization interval greater than 6 days.

Fever and cough have been reported as the most prevalent COVID-19 symptoms worldwide, with substantial heterogeneity between countries.[7,18,19] Our study of hospitalized patients

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confirmed this fact, with fever reported in 67·4% of cases and cough in 72·8%. Compared with other countries, the prevalence found in our data was among the highest for both symptoms, with 32% in Korea and 83% in Singapore for fever and 18% in Korea and 76% in the Netherlands for cough.[18] Although high prevalence, no statistically significant impact on death was found here in Brazil. Many other countries, such as Italy,[20] Spain,[21] and Egypt,[22] found a correlation of dyspnea or low oxygen saturation with higher hospital deaths. Our data corroborate this, showing that a combination of both symptoms more than doubles hospital death risk. Additionally, respiratory distress and the association of multiple respiratory symptoms are important risk factors, with Brazilian patients manifesting all three respiratory symptoms having an approximately three-fold increase in death risk.

Regarding the usage of intensive care units, invasive ventilatory support and non-invasive ventilatory support, our data shows respectively 30·2%, 18·5% and 37·5%, higher than the respectively formerly reported 17%, 9% and 19% among worldwide hospitalized patients.[18] Unfortunately, almost half of COVID-19 Brazilian hospitalized patients are only diagnosed during admission. Despite one of the countries with most cases, Brazil is in 125th place in the number of SARS-CoV-2 real-time polymerase chain reaction exams per million inhabitants.[23] We suggest that the high usage of intensive care units and ventilatory support in Brazil, compared to elsewhere, may be in part due to late COVID-19 diagnosis. This fact reflects significant disparities in health care accessibility and socioeconomic inequalities throughout the country.[24] Hospitalization duration of (4, 7] and illness onset to hospitalization interval greater than 6 days as protective factors are probably related to viral shedding. Better understanding of this dynamic is a must for optimizing pandemic hospital management in Brazil and saving lives, especially for risk groups composed of subpopulations.

Aging leads to a natural decline in the immune system and a chronic inflammatory state,[25] and has been reported as a biological vulnerability for COVID-19 mortality.[21,26,27] We also found age greater than 60 as a prominent risk factor, particularly over 90 years. A nationwide large cohort study in the United Kingdom showed that while age is per se an independent risk factor, the mortality on elderly patients is partially explained by the higher prevalence of comorbidities, such as poorer lung function, hypertension, muscle weakness, and multiple long-term conditions.[27] Conversely, our data revealed that the impact of having one or a combination of two or more risk factors on mortality are progressively higher in ages (60, 80], (40, 60], (20, 40], and (0, 20] compared with people of the same age interval without comorbidities. This discrepancy could be due to the British study using, as a reference group, people less than 65 years old with or without comorbidities. The synergism of COVID-19, pro-inflammatory comorbidities and a young immune profile, leading to overproduction of cytokines, must be further investigated as it partially explains the higher mortality in this intersection group.

Beyond advanced age, some features, as ethnicity and gender, have been also identified as biological concern for COVID-19 mortality.[28,29] Although over half of the hospitalized patients were men, gender independently was not statistically associated with higher hospital death risk in Brazil, despite other reports which associate male sex with worse in-hospital outcomes.[30] Still, biological factors underlying higher mortality in ethnic groups are limited and need to be further addressed. We observed young brown individuals with diabetes and black ethnicity as population subgroups at higher risk for severe COVID-19. A longitudinal analysis of 2012–16 economic recession in Brazil showed an increase in mortality in the same groups, due to

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socioeconomic factors, labour market participation, and underlying morbidities.[31] As in past economic crises, actual pandemics highlights Brazilian social and health care access inequalities. Historically, compared with white, black and brown Brazilians have lower schooling levels, a higher index of informal jobs, lower incomes, and restricted access to the health care system,[32] particularly for men.[33] Other study showed that COVID-19 death rate is higher in these Brazilians subpopulations and might be partly due to non-ICU admission, especially for brown.[34] We also found brown ethnicity as a independent risk factor prior to using ventilatory support and ICU usage as confounding variables, what supports the former study hypothesis.[34]

Diabetes Mellitus is often associated with other comorbidities and has been consistently correlated with an increase in severity and mortality of COVID-19 patients.[14,35] Diabetes, high blood pressure, chronic renal diseases, Alzheimer disease, pneumopathy, and obesity are conditions that lead to an upregulation expression of ACE2, resulting in increased viral uptake, turning them into susceptible sites.[36,37] ACE2 (Angiotensin-converting enzyme 2) is one of the surface receptors used by SARS-CoV-2 to enter host cells, and it is constitutively expressed in a wide variety of epithelial, non-epithelial cells, and organs as lungs, heart, kidneys, and adipocyte tissue.[36,38] Those tissues normally express higher amounts of ACE2 receptor, added to the fact that some conditions potentially increased ACE2 expression. This combination partially explains higher death risk in COVID-19 patients with comorbidities. The infection itself can cause deleterious effects on immunity, and a synergic event between diseases causes hyperactivity of the immune system, leading to a chronic proinflammatory state, what contributes to the cytokine storm seen in some severe COVID-19 patients.[14,36]

Our study has some key limitations, mainly regarding data quality, annotation accuracy, suspected under-reported data, and lack of government open-access information of non-hospitalized patients in Brazil. This is a relevant bias as studies based only on hospitalized patients are focused on more severe cases and fatalities. Furthermore, we cannot guarantee that missing information is not subject to bias. Although extensive, some fundamental information that greatly affects the prognosis of the disease is missing in the SRAG form, mainly regarding smoking, alcohol intake, oncological disorders, and chronic high blood pressure.[39–42] As for our study's relevance, drawing attention to diabetes, lack of reliable data on Body Mass Index (BMI) prevented us from differentiating the impact of obesity and severe obesity in mortality. This is mainly important because obesity is a chronic inflammatory condition associated with cardiometabolic and immune dysfunction, increased risk of diabetes and hematological disease, leading patients to be more susceptible to develop severe forms of COVID-19.[36] The under-reporting in the BMI may be aggravated due to professionals being not properly instructed on how to use and fill out the form items. Thus, we suggest remodeling the form, together with better orientation on how to deal with information gathering. Nonetheless, despite all Brazilian health system challenges, the average notification delay was 0 days (IQR=2), demonstrating high efficiency in national information flow.

To the best of our knowledge, this is the largest retrospective cohort study of hospitalized Brazilians COVID-19 patients up to date. Older age, multiple respiratory symptoms, younger patients with some risk factor, and younger diabetics with multiple comorbidities are risk groups that play an important role in the death by COVID-19 scenario. Globally, measures have been focused on health workers and older patients as risk groups and priority for vaccination.

Our findings have shone a spotlight upon a risk group that is so far neglected in Brazil, as younger patients with comorbidities and younger diabetic patients with further comorbidities. The understanding of how comorbidities increased risk mortality by COVID-19 is fundamental for implementing appropriate public health and therapeutic strategies. We expect this meaningful nationwide analysis to be highly considered to help establish patient risk stratification upon admission, optimizing hospital management, and guide public policy determinations, including group prioritization for COVID-19 vaccination and vulnerable populations health care accessibility in Brazil.

CONTRIBUTORS

EP conceived the research question. EP, GPA, MRA and MA designed the study and analyses plan. EP obtained and performed initial data cleanup. MRA carried out the analyses. EP and GPA drafted the initial version of the manuscript. All authors drafted and edited the final version of the manuscript. MFFB performed spelling and grammar reviewing. All authors had access to all used data. All authors critically reviewed and approved the final version of the manuscript.

DECLARATION OF INTERESTS

We declare no competing interests.

DATA SHARING

SRAG data is publicly available on the Ministry of Health of Brazil website. The analysis source code will be available upon request to the authors.

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Table 1: Sociodemographic findings of patients on admission.

Feature	Category	Overall	Cure	Death	P-value
Sex					< 0.001
	Female	103014 (43.7%)	62680 (26.6%)	40334 (17.1%)	
	Male	132541 (56.3%)	76308 (32.4%)	56233 (23.9%)	
Age					< 0.001
		61 (IQR=28)	53 (IQR=26)	70 (IQR=21)	
Age Range					< 0.001
	(0, 10]	1804 (0.8%)	1670 (0.7%)	134 (0.1%)	
	(10, 20]	2493 (1.1%)	2181 (0.9%)	312 (0.1%)	
	(20, 30]	10942 (4.6%)	9784 (4.2%)	1158 (0.5%)	
	(30, 40]	25329 (10.8%)	21726 (9.2%)	3603 (1.5%)	
	(40, 50]	34067 (14.5%)	26739 (11.4%)	7328 (3.1%)	
	(50, 60]	42101 (17.9%)	28348 (12%)	13753 (5.8%)	
	(60, 70]	46675 (19.8%)	23951 (10.2%)	22724 (9.6%)	
	(70, 80]	40130 (17%)	15653 (6.6%)	24477 (10.4%)	
	(80, 90]	25646 (10.9%)	7547 (3.2%)	18099 (7.7%)	
	(90, 100]	6090 (2.6%)	1349 (0.6%)	4741 (2%)	
	(100, 110]	273 (0.1%)	39 (0%)	234 (0.1%)	
	> 110	5 (0%)	1 (0%)	4 (0%)	
Ethnicity					< 0.001
	White	72913 (31%)	44949 (19.1%)	27964 (11.9%)	
	Black	10870 (4.6%)	5863 (2.5%)	5007 (2.1%)	
	Yellow	2539 (1.1%)	1453 (0.6%)	1086 (0.5%)	
	Brown	76311 (32.4%)	41890 (17.8%)	34421 (14.6%)	
	Red	734 (0.3%)	367 (0.2%)	367 (0.2%)	
	Unknown	72188 (30.6%)	44466 (18.9%)	27722 (11.8%)	

Schooling level					< 0.001
	0 years	5976 (2.5%)	2112 (0.9%)	3864 (1.6%)	
	5 years	20795 (8.8%)	10165 (4.3%)	10630 (4.5%)	
	9 years	14823 (6.3%)	8508 (3.6%)	6315 (2.7%)	
	12 years	26320 (11.2%)	18602 (7.9%)	7718 (3.3%)	
	Graduated	12468 (5.3%)	9695 (4.1%)	2773 (1.2%)	
	N.A.	608 (0.3%)	561 (0.2%)	47 (0%)	
	Unknown	154565 (65.6%)	89345 (37.9%)	65220 (27.7%)	
Pregnancy					< 0.001
	No	74029 (31.4%)	45485 (19.3%)	28544 (12.1%)	
	1st Trimester	176 (0.1%)	169 (0.1%)	7 (0%)	
	2nd Trimester	490 (0.2%)	439 (0.2%)	51 (0%)	
	3rd Trimester	1335 (0.6%)	1248 (0.5%)	87 (0%)	
	Unknown Trimester	125 (0.1%)	113 (0%)	12 (0%)	
	N.A.	147806 (62.8%)	83851 (35.6%)	63955 (27.2%)	
	Unknown	11575 (4.9%)	7668 (3.3%)	3907 (1.7%)	

Age represented as median (IQR) and proportions represented by n (%). Schooling level expressed as the number of years of study. P-values were calculated either by Mann-Whitney or Fisher's exact tests. N.A.=Not Applicable.

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Table 2: Clinical and radiologic finding of patients.

Feature	Category	Overall	Cure	Death	P-value
Fever					< 0.001
	No	48316 (20.5%)	27543 (11.7%)	20773 (8.8%)	
	Ues	158847 (67.4%)	98796 (41.9%)	60051 (25.5%)	
	Unknown	28392 (12.1%)	12649 (5.4%)	15743 (6.7%)	
Cough					< 0.001
	No	38100 (16.2%)	21042 (8.9%)	17058 (7.2%)	
	Yes	171405 (72.8%)	106745 (45.3%)	64660 (27.5%)	
	Unknown	26050 (11.1%)	11201 (4.8%)	14849 (6.3%)	
Sore throat					< 0.001
	No	124521 (52.9%)	74822 (31.8%)	49699 (21.1%)	
	Yes	46117 (19.6%)	31003 (13.2%)	15114 (6.4%)	
	Unknown	64917 (27.6%)	33163 (14.1%)	31754 (13.5%)	
Dyspnea					< 0.001
	No	44237 (18.8%)	32928 (14%)	11309 (4.8%)	
	Yes	162640 (69%)	89491 (38%)	73149 (31.1%)	
	Unknown	28678 (12.2%)	16569 (7%)	12109 (5.1%)	
Respiratory distress					< 0.001
	No	60879 (25.8%)	43642 (18.5%)	17237 (7.3%)	
	Yes	129968 (55.2%)	69439 (29.5%)	60529 (25.7%)	
	Unknown	44708 (19%)	25907 (11%)	18801 (8%)	
Oxygen saturation < 95%					< 0.001
	No	62311 (26.5%)	46972 (19.9%)	15339 (6.5%)	
	Yes	128895 (54.7%)	65884 (28%)	63011 (26.8%)	
	Unknown	44349 (18.8%)	26132 (11.1%)	18217 (7.7%)	
Diarrhea					< 0.001
	No	135235 (57.4%)	81912 (34.8%)	53323 (22.6%)	
	Yes	31053 (13.2%)	20931 (8.9%)	10122 (4.3%)	
	Unknown	69267 (29.4%)	36145 (15.3%)	33122 (14.1%)	
Vomiting					< 0.001
	No	144483 (61.3%)	88567 (37.6%)	55916 (23.7%)	
	Yes	17752 (7.5%)	11477 (4.9%)	6275 (2.7%)	
	Unknown	73320 (31.1%)	38944 (16.5%)	34376 (14.6%)	

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Risk Factor					< 0.001
	No	89699 (38.1%)	63309 (26.9%)	26390 (11.2%)	
	Yes	145856 (61.9%)	75679 (32.1%)	70177 (29.8%)	
Postpartum period*					< 0.001
	No	212159 (90.1%)	126458 (53.7%)	85701 (36.4%)	
	Yes	621 (0.3%)	484 (0.2%)	137 (0.1%)	
	Unknown	22775 (9.7%)	12046 (5.1%)	10729 (4.6%)	
Chronic Cardiovascular Disease					< 0.001
	No	130153 (55.3%)	86280 (36.6%)	43873 (18.6%)	
	Yes	75916 (32.2%)	37500 (15.9%)	38416 (16.3%)	
	Unknown	29486 (12.5%)	15208 (6.5%)	14278 (6.1%)	
Chronic Hematologic Disease					< 0.001
	No	172689 (73.3%)	107620 (45.7%)	65069 (27.6%)	
	Yes	1903 (0.8%)	911 (0.4%)	992 (0.4%)	
	Unknown	60963 (25.9%)	30457 (12.9%)	30506 (13%)	
Down Syndrome					< 0.001
	No	173851 (73.8%)	108151 (45.9%)	65700 (27.9%)	
	Yes	571 (0.2%)	271 (0.1%)	300 (0.1%)	
	Unknown	61133 (26%)	30566 (13%)	30567 (13%)	
Chronic Hepatic Disease					< 0.001
	No	172113 (73.1%)	107413 (45.6%)	64700 (27.5%)	
	Yes	2087 (0.9%)	841 (0.4%)	1246 (0.5%)	
	Unknown	61355 (26%)	30734 (13%)	30621 (13%)	
Asthma					< 0.001
	No	169828 (72.1%)	105508 (44.8%)	64320 (27.3%)	
	Yes	5964 (2.5%)	3980 (1.7%)	1984 (0.8%)	
	Unknown	59763 (25.4%)	29500 (12.5%)	30263 (12.8%)	
Diabetes Mellitus					< 0.001
	No	139666 (59.3%)	91270 (38.7%)	48396 (20.5%)	
	Yes	58764 (24.9%)	28364 (12%)	30400 (12.9%)	
	Unknown	37125 (15.8%)	19354 (8.2%)	17771 (7.5%)	
Chronic Neurological Disease					< 0.001
	No	168243 (71.4%)	106170 (45.1%)	62073 (26.4%)	
	Yes	9071 (3.9%)	3326 (1.4%)	5745 (2.4%)	

	Unknown	58241 (24.7%)	29492 (12.5%)	28749 (12.2%)	
Chronic Pneumopathy					< 0.001
	No	168305 (71.5%)	106011 (45%)	62294 (26.4%)	
	Yes	8534 (3.6%)	3314 (1.4%)	5220 (2.2%)	
	Unknown	58716 (24.9%)	29663 (12.6%)	29053 (12.3%)	
Immunodeficiency / Immunosuppression					< 0.001
	No	169112 (71.8%)	105999 (45%)	63113 (26.8%)	
	Yes	6460 (2.7%)	2965 (1.3%)	3495 (1.5%)	
	Unknown	59983 (25.5%)	30024 (12.7%)	29959 (12.7%)	
Chronic Renal Disease					< 0.001
	No	167141 (71%)	105644 (44.8%)	61497 (26.1%)	
	Yes	9820 (4.2%)	3522 (1.5%)	6298 (2.7%)	
	Unknown	58594 (24.9%)	29822 (12.7%)	28772 (12.2%)	
Obesity					< 0.001
	No	163198 (69.3%)	102374 (43.5%)	60824 (25.8%)	
	Yes	13940 (5.9%)	7703 (3.3%)	6237 (2.6%)	
	Unknown	58417 (24.8%)	28911 (12.3%)	29506 (12.5%)	
High Blood Pressure					< 0.001
	No	89699 (38.1%)	63309 (26.9%)	26390 (11.2%)	
	Yes	29017 (12.3%)	14661 (6.2%)	14356 (6.1%)	
	Unknown	116839 (49.6%)	61018 (25.9%)	55821 (23.7%)	
Unlisted risk factors					< 0.001
	No	156916 (66.6%)	99739 (42.3%)	57177 (24.3%)	
	Yes	37370 (15.9%)	18154 (7.7%)	19216 (8.2%)	
	Unknown	41269 (17.5%)	21095 (9%)	20174 (8.6%)	
Number of risk factors					< 0.001
	0	90282 (38.3%)	63737 (27.1%)	26545 (11.3%)	
	1	68017 (28.9%)	39438 (16.7%)	28579 (12.1%)	
	2	49711 (21.1%)	24416 (10.4%)	25295 (10.7%)	
	3	19933 (8.5%)	8635 (3.7%)	11298 (4.8%)	
	4	5805 (2.5%)	2194 (0.9%)	3611 (1.5%)	
	5	1433 (0.6%)	451 (0.2%)	982 (0.4%)	
	6	293 (0.1%)	83 (0%)	210 (0.1%)	
	7	44 (0%)	11 (0%)	33 (0%)	

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	8	14 (0%)	9 (0%)	5 (0%)	
	9	8 (0%)	5 (0%)	3 (0%)	
	10	5 (0%)	4 (0%)	1 (0%)	
	11	6 (0%)	3 (0%)	3 (0%)	
	12	3 (0%)	1 (0%)	2 (0%)	
	13	1 (0%)	1 (0%)	0 (0%)	
Ventilatory Support					< 0.001
	No	57750 (24.5%)	47265 (20.1%)	10485 (4.5%)	
	Yes, invasive	43647 (18.5%)	7248 (3.1%)	36399 (15.5%)	
	Yes, non-invasive	88419 (37.5%)	60862 (25.8%)	27557 (11.7%)	
	Unknown	45739 (19.4%)	23613 (10%)	22126 (9.4%)	
X-ray					< 0.001
	Normal	5175 (2.2%)	3692 (1.6%)	1483 (0.6%)	
	Interstitial infiltrate	39480 (16.8%)	23453 (10%)	16027 (6.8%)	
	Consolidation	5716 (2.4%)	3173 (1.3%)	2543 (1.1%)	
	Mixed	6904 (2.9%)	3815 (1.6%)	3089 (1.3%)	
	Other	37728 (16%)	24473 (10.4%)	13255 (5.6%)	
	Unrealized	40684 (17.3%)	25804 (11%)	14880 (6.3%)	
	Unknown	99868 (42.4%)	54578 (23.2%)	45290 (19.2%)	
Computerized tomography					< 0.001
	No	62 (0.5%)	48 (0%)	14 (0%)	
	COVID-19 typical	6275 (48.7%)	3672 (1.6%)	2603 (1.1%)	
	COVID-19 undetermined	283 (2.2%)	136 (0.1%)	147 (0.1%)	
	COVID-19 atypical	136 (1.1%)	63 (0%)	73 (0%)	
	Other	651 (5.1%)	399 (0.2%)	252 (0.1%)	
	Unrealized	3577 (27.8%)	2010 (0.9%)	1567 (0.7%)	
	Unknown	1893 (14.7%)	995 (0.4%)	898 (0.4%)	
Intensive Care Unit					< 0.001
	No	118289 (50.2%)	87797 (37.3%)	30492 (12.9%)	
	Yes	71190 (30.2%)	26166 (11.1%)	45024 (19.1%)	
	Unknown	46076 (19.6%)	25025 (10.6%)	21051 (8.9%)	
Know grippal case†					< 0.001
	No	113275 (48.1%)	71856 (30.5%)	41419 (17.6%)	

	Yes	54041 (22.9%)	29837 (12.7%)	24204 (10.3%)	
	Unknown	68239 (29%)	37295 (15.8%)	30944 (13.1%)	
Illness onset to hospitalization					< 0.001
	Days	6 (IQR=6)	6 (IQR=6)	5 (IQR=6)	
Illness onset to cure or death					
	Days	14 (IQR=11)	15 (IQR=10)	13 (IQR=14)	< 0.001
Hospitalization duration					
	Days	7 (IQR=9)	7 (IQR=8)	8 (IQR=11)	
Notification delay					< 0.001
	Days	0 (IQR=2)	0 (IQR=2)	1 (IQR=3)	

Time duration (in days) represented as medians (IQR) and proportions represented by n (%). P-values were calculated either by Mann-Whitney or Fisher's exact tests. COVID-19=2019 novel coronavirus disease. *Up to 45 days after giving birth. †Diagnosed and notified as COVID-19 before hospitalization.

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Table 3: Logistic analysis for COVID-19 death.

Feature	Category	Cure	Death	OR (CI95%)	P-value	Adj. p-value*	aOR† (CI95%)	P-value	Adj. p-value*
Sex									
	Female	62680 (45.1%)	40334 (41.77%)	Reference	Reference	Reference	Reference	Reference	Reference
	Male	76308 (54.9%)	56233 (58.23%)	1.15 (1.13-1.16)	< 0.001	< 0.001	0.95 (0.78-1.17)	0.634	1
Pregnancy									
	No	45485 (32.73%)	28544 (29.56%)	Reference	Reference	Reference	Reference	Reference	Reference
	1st Trimester	169 (0.12%)	7 (0.01%)	0.07 (0.04-0.1)	< 0.001	< 0.001	0 (0-6.247E+192)	1	1
	2nd Trimester	439 (0.32%)	51 (0.05%)	0.19 (0.16-0.22)	< 0.001	< 0.001	1.82 (0.91-3.66)	1	1
	3rd Trimester	1248 (0.9%)	87 (0.09%)	0.11 (0.1-0.13)	< 0.001	< 0.001	0.83 (0.49-1.42)	1	1
	Unknown Trimester	113 (0.08%)	12 (0.01%)	0.17 (0.12-0.23)	< 0.001	< 0.001	0.39 (0.11-1.38)	1	1
	N.A.	83851 (60.34%)	63955 (66.23%)	1.22 (1.2-1.23)	< 0.001	< 0.001	1.39 (1.24-1.56)	< 0.05	1
	Unknown	7668 (5.52%)	3907 (4.05%)	0.81 (0.79-0.83)	< 0.001	< 0.001	0.75 (0.65-0.86)	0.1694	1
Ethnicity									
	White	44949 (32.34%)	27964 (28.96%)	Reference	Reference	Reference	Reference	Reference	Reference
	Black	5863 (4.22%)	5007 (5.19%)	1.37 (1.34-1.41)	< 0.001	< 0.001	1.78 (1.52-2.07)	< 0.001	< 0.05
	Yellow	1453 (1.05%)	1086 (1.12%)	1.2 (1.15-1.26)	< 0.001	< 0.05	1.49 (1.14-1.95)	0.0887	1
	Brown	41890 (30.14%)	34421 (35.64%)	1.32 (1.31-1.34)	< 0.001	< 0.001	1.2 (1.11-1.29)	< 0.05	1
	Red	367 (0.26%)	367 (0.38%)	1.61 (1.48-1.75)	< 0.001	< 0.001	2.64 (1.62-4.29)	< 0.05	1
	Unknown	44466 (31.99%)	27722 (28.71%)	1 (0.99-1.02)	0.8449	1	0.66 (0.6-0.73)	< 0.001	< 0.001
Schooling level									
	12 years	18602 (13.38%)	7718 (7.99%)	Reference	Reference	Reference	Reference	Reference	Reference
	0 years	2112 (1.52%)	3864 (4%)	4.41 (4.27-4.55)	< 0.001	< 0.001	1.44 (1.22-1.71)	0.0981	1
	5 years	10165 (7.31%)	10630 (11.01%)	2.52 (2.47-2.57)	< 0.001	< 0.001	1.03 (0.92-1.16)	1	1
	9 years	8508 (6.12%)	6315 (6.54%)	1.79 (1.75-1.83)	< 0.001	< 0.001	0.83 (0.73-0.95)	0.447	1
	Graduated	9695 (6.98%)	2773 (2.87%)	0.69 (0.67-0.71)	< 0.001	< 0.001	0.69 (0.58-0.81)	0.0981	1
	N.A.	561 (0.4%)	47 (0.05%)	0.2 (0.17-0.24)	< 0.001	< 0.001	0 (0-6.47E+115)	1	1
	Unknown	89345 (64.28%)	65220 (67.54%)	1.76 (1.73-1.79)	< 0.001	< 0.001	0.73 (0.66-0.8)	< 0.05	0.3423
Fever									
	No	27543 (19.82%)	20773 (21.51%)	Reference	Reference	Reference	Reference	Reference	Reference
	Yes	98796 (71.08%)	60051 (62.19%)	0.81 (0.79-0.82)	< 0.001	< 0.001	0.95 (0.85-1.05)	0.4048	1
	Unknown	12649 (9.1%)	15743 (16.3%)	1.65 (1.61-1.69)	< 0.001	< 0.001	1.28 (1.02-1.6)	0.1419	1
Cough									
	No	21042 (15.14%)	17058 (17.66%)	Reference	Reference	Reference	Reference	Reference	Reference
	Yes	106745 (76.8%)	64660 (66.96%)	0.75 (0.73-0.76)	< 0.001	< 0.001	0.81 (0.72-0.91)	< 0.05	0.4745
	Unknown	11201 (8.06%)	14849 (15.38%)	1.64 (1.59-1.68)	< 0.001	< 0.001	1.02 (0.8-1.3)	0.8928	1
Sore throat									
	No	74822 (53.83%)	49699 (51.47%)	Reference	Reference	Reference	Reference	Reference	Reference

	Yes	31003 (22.31%)	15114 (15.65%)	0.73 (0.72-0.75)	< 0.001	< 0.001	1.1 (0.97-1.25)	0.4388	1
	Unknown	33163 (23.86%)	31754 (32.88%)	1.44 (1.42-1.47)	< 0.001	< 0.001	1.01 (0.79-1.28)	0.9714	1
Dyspnea									
	No	32928 (23.69%)	11309 (11.71%)	Reference	Reference	Reference	Reference	Reference	Reference
	Yes	89491 (64.39%)	73149 (75.75%)	2.38 (2.33-2.43)	< 0.001	< 0.001	1.42 (1.26-1.62)	< 0.001	< 0.001
	Unknown	16569 (11.92%)	12109 (12.54%)	2.13 (2.07-2.19)	< 0.001	< 0.001	1.24 (0.97-1.59)	0.1569	1
Respiratory distress									
	No	43642 (31.4%)	17237 (17.85%)	Reference	Reference	Reference	Reference	Reference	Reference
	Yes	69439 (49.96%)	60529 (62.68%)	2.21 (2.17-2.25)	< 0.001	< 0.001	1.31 (1.17-1.47)	< 0.001	< 0.05
	Unknown	25907 (18.64%)	18801 (19.47%)	1.84 (1.8-1.88)	< 0.001	< 0.001	0.86 (0.69-1.08)	0.2777	1
Oxygen saturation < 95%									
	No	46972 (33.8%)	15339 (15.88%)	Reference	Reference	Reference	Reference	Reference	Reference
	Yes	65884 (47.4%)	63011 (65.25%)	2.93 (2.88-2.98)	< 0.001	< 0.001	1.32 (1.17-1.48)	< 0.001	< 0.05
	Unknown	26132 (18.8%)	18217 (18.86%)	2.14 (2.09-2.18)	< 0.001	< 0.001	1.08 (0.86-1.34)	0.5858	1
Diarrhea									
	No	81912 (58.93%)	53323 (55.22%)	Reference	Reference	Reference	Reference	Reference	Reference
	Yes	20931 (15.06%)	10122 (10.48%)	0.74 (0.73-0.76)	< 0.001	< 0.001	1.02 (0.88-1.17)	1	1
	Unknown	36145 (26.01%)	33122 (34.3%)	1.41 (1.39-1.43)	< 0.001	< 0.001	0.94 (0.69-1.29)	1	1
Vomiting									
	No	88567 (63.72%)	55916 (57.9%)	Reference	Reference	Reference	Reference	Reference	Reference
	Yes	11477 (8.26%)	6275 (6.5%)	0.87 (0.84-0.89)	< 0.001	< 0.001	0.99 (0.84-1.18)	1	1
	Unknown	38944 (28.02%)	34376 (35.6%)	1.4 (1.38-1.42)	< 0.001	< 0.001	0.89 (0.65-1.22)	1	1
Risk Factor									
	No	63309 (45.55%)	26390 (27.33%)	Reference	Reference	Reference	Reference	Reference	Reference
	Yes	75679 (54.45%)	70177 (72.67%)	2.23 (2.19-2.26)	< 0.001	< 0.001	1.08 (0.89-1.31)	0.4298	1
Postpartum period‡									
	No	126458 (90.98%)	85701 (88.75%)	Reference	Reference	Reference	Reference	Reference	Reference
	Yes	484 (0.35%)	137 (0.14%)	0.42 (0.36-0.49)	< 0.001	< 0.001	0.54 (0.21-1.39)	0.3832	1
	Unknown	12046 (8.67%)	10729 (11.11%)	1.31 (1.28-1.35)	< 0.001	< 0.001	1.19 (0.96-1.48)	0.3832	1
Chronic Cardiovascular Disease									
	No	86280 (62.08%)	43873 (45.43%)	Reference	Reference	Reference	Reference	Reference	Reference
	Yes	37500 (26.98%)	38416 (39.78%)	2.02 (1.98-2.05)	< 0.001	< 0.001	0.96 (0.85-1.09)	0.6098	1
	Unknown	15208 (10.94%)	14278 (14.79%)	1.85 (1.81-1.89)	< 0.001	< 0.001	1.28 (1.02-1.62)	0.1586	1
Chronic Hematologic Disease									
	No	107620 (77.43%)	65069 (67.38%)	Reference	Reference	Reference	Reference	Reference	Reference
	Yes	911 (0.66%)	992 (1.03%)	1.8 (1.67-1.94)	< 0.001	< 0.001	1.81 (1.08-3.04)	0.1175	1
	Unknown	30457 (21.91%)	30506 (31.59%)	1.66 (1.63-1.68)	< 0.001	< 0.001	0.82 (0.43-1.58)	0.6175	1

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Condition	Category	N1	N2						
Down Syndrome									
	No	108151 (77.81%)	65700 (68.04%)	Reference	Reference	Reference	Reference	Reference	Reference
	Yes	271 (0.19%)	300 (0.31%)	1.82 (1.59-2.09)	< 0.001	< 0.001	0.84 (0.37-1.89)	1	1
	Unknown	30566 (21.99%)	30567 (31.65%)	1.65 (1.62-1.67)	< 0.001	< 0.001	1.28 (0.64-2.56)	1	1
Chronic Hepatic Disease									
	No	107413 (77.28%)	64700 (67%)	Reference	Reference	Reference	Reference	Reference	Reference
	Yes	841 (0.61%)	1246 (1.29%)	2.46 (2.29-2.65)	< 0.001	< 0.001	1.8 (1.17-2.77)	< 0.05	1
	Unknown	30734 (22.11%)	30621 (31.71%)	1.65 (1.63-1.68)	< 0.001	< 0.001	1.68 (0.96-2.92)	0.1282	1
Asthma									
	No	105508 (75.91%)	64320 (66.61%)	Reference	Reference	Reference	Reference	Reference	Reference
	Yes	3980 (2.86%)	1984 (2.05%)	0.82 (0.78-0.86)	< 0.001	< 0.001	0.82 (0.61-1.09)	0.5067	1
	Unknown	29500 (21.22%)	30263 (31.34%)	1.68 (1.66-1.71)	< 0.001	< 0.001	0.96 (0.62-1.49)	0.8847	1
Diabetes Mellitus									
	No	91270 (65.67%)	48396 (50.12%)	Reference	Reference	Reference	Reference	Reference	Reference
	Yes	28364 (20.41%)	30400 (31.48%)	2.02 (1.99-2.06)	< 0.001	< 0.001	1.19 (1.06-1.35)	< 0.05	1
	Unknown	19354 (13.92%)	17771 (18.4%)	1.73 (1.7-1.77)	< 0.001	< 0.001	0.76 (0.61-0.95)	< 0.05	1
Chronic Neurological Disease									
	No	106170 (76.39%)	62073 (64.28%)	Reference	Reference	Reference	Reference	Reference	Reference
	Yes	3326 (2.39%)	5745 (5.95%)	2.95 (2.85-3.07)	< 0.001	< 0.001	1.99 (1.58-2.5)	< 0.001	< 0.001
	Unknown	29492 (21.22%)	28749 (29.77%)	1.67 (1.64-1.69)	< 0.001	< 0.001	1.72 (1.22-2.44)	< 0.05	1
Chronic Pneumopathy									
	No	106011 (76.27%)	62294 (64.51%)	Reference	Reference	Reference	Reference	Reference	Reference
	Yes	3314 (2.38%)	5220 (5.41%)	2.68 (2.58-2.78)	< 0.001	< 0.001	1.38 (1.1-1.73)	< 0.05	1
	Unknown	29663 (21.34%)	29053 (30.09%)	1.67 (1.64-1.69)	< 0.001	< 0.001	0.64 (0.43-0.96)	0.0684	1
Immunodeficiency / Immunosuppression									
	No	105999 (76.26%)	63113 (65.36%)	Reference	Reference	Reference	Reference	Reference	Reference
	Yes	2965 (2.13%)	3495 (3.62%)	1.98 (1.9-2.06)	< 0.001	< 0.001	2.48 (1.92-3.21)	< 0.001	< 0.001
	Unknown	30024 (21.6%)	29959 (31.02%)	1.68 (1.65-1.7)	< 0.001	< 0.001	0.82 (0.54-1.25)	0.4432	1
Chronic Renal Disease									
	No	105644 (76.01%)	61497 (63.68%)	Reference	Reference	Reference	Reference	Reference	Reference
	Yes	3522 (2.53%)	6298 (6.52%)	3.07 (2.96-3.18)	< 0.001	< 0.001	1.49 (1.19-1.86)	< 0.05	0.7342
	Unknown	29822 (21.46%)	28772 (29.79%)	1.66 (1.63-1.68)	< 0.001	< 0.001	0.75 (0.52-1.08)	0.1981	1
Obesity									
	No	102374 (73.66%)	60824 (62.99%)	Reference	Reference	Reference	Reference	Reference	Reference
	Yes	7703 (5.54%)	6237 (6.46%)	1.36 (1.32-1.4)	< 0.001	< 0.001	1.16 (0.96-1.39)	0.3912	1
	Unknown	28911 (20.8%)	29506 (30.55%)	1.72 (1.69-1.75)	< 0.001	< 0.001	1.13 (0.87-1.48)	0.4385	1
High Blood Pressure									

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	No	63309 (45.55%)	26390 (27.33%)	Reference	Reference	Reference	Reference	Reference	Reference
	Yes	14661 (10.55%)	14356 (14.87%)	2.35 (2.3-2.4)	< 0.001	< 0.001	1.01 (0.85-1.2)	0.8998	1
	Unknown	61018 (43.9%)	55821 (57.81%)	2.2 (2.16-2.23)	< 0.001	< 0.001	1.08 (0.92-1.27)	0.8596	1
Unlisted risk factors									
	No	99739 (71.76%)	57177 (59.21%)	Reference	Reference	Reference	Reference	Reference	Reference
	Yes	18154 (13.06%)	19216 (19.9%)	1.85 (1.81-1.88)	< 0.001	< 0.001	1.12 (0.98-1.26)	0.3025	1
	Unknown	21095 (15.18%)	20174 (20.89%)	1.67 (1.64-1.7)	< 0.001	< 0.001	1.07 (0.89-1.29)	0.5569	1
Ventilatory Support									
	No	47265 (34.01%)	10485 (10.86%)	Reference	Reference	Reference	Reference	Reference	Reference
	Yes, invasive	7248 (5.21%)	36399 (37.69%)	22.64 (22.1-23.19)	< 0.001	< 0.001	16.23 (14.05-18.75)	< 0.001	< 0.001
	Yes, non-invasive	60862 (43.79%)	27557 (28.54%)	2.04 (2-2.08)	< 0.001	< 0.001	1.45 (1.3-1.62)	< 0.001	< 0.001
	Unknown	23613 (16.99%)	22126 (22.91%)	4.22 (4.14-4.31)	< 0.001	< 0.001	2.74 (2.27-3.31)	< 0.001	< 0.001
X-ray									
	Normal	3692 (2.66%)	1483 (1.54%)	Reference	Reference	Reference	Reference	Reference	Reference
	Interstitial infiltrate	23453 (16.87%)	16027 (16.6%)	1.7 (1.65-1.76)	< 0.001	< 0.001	1.31 (1.05-1.64)	0.4185	1
	Consolidation	3173 (2.28%)	2543 (2.63%)	2 (1.91-2.08)	< 0.001	< 0.001	1.36 (1.03-1.78)	0.4185	1
	Mixed	3815 (2.74%)	3089 (3.2%)	2.02 (1.94-2.1)	< 0.001	< 0.001	1.92 (1.48-2.49)	0.0567	1
	Other	24473 (17.61%)	13255 (13.73%)	1.35 (1.3-1.4)	< 0.001	< 0.001	1.72 (1.37-2.16)	0.0685	1
	Unrealized	25804 (18.57%)	14880 (15.41%)	1.44 (1.39-1.49)	< 0.001	< 0.001	1.49 (1.19-1.85)	0.2419	1
	Unknown	54578 (39.27%)	45290 (46.9%)	2.07 (2-2.13)	< 0.001	< 0.001	1.39 (1.12-1.74)	0.3585	1
Computerized tomography									
	No	48 (0.66%)	14 (0.25%)	Reference	Reference	Reference	Reference	Reference	Reference
	COVID Typical	3672 (50.14%)	2603 (46.87%)	2.43 (1.77-3.33)	< 0.05	0.7437	2.22 (1.36-3.63)	0.1868	1
	COVID Indetermined	136 (1.86%)	147 (2.65%)	3.71 (2.64-5.2)	< 0.001	< 0.05	2.83 (1.68-4.76)	0.1148	1
	COVID Atypical	63 (0.86%)	73 (1.31%)	3.97 (2.77-5.7)	< 0.001	< 0.05	3.93 (2.27-6.82)	0.06	1
	Other	399 (5.45%)	252 (4.54%)	2.17 (1.56-3)	< 0.05	1	1.9 (1.15-3.16)	0.1883	1
	Unrealized	2010 (27.45%)	1567 (28.21%)	2.67 (1.95-3.67)	< 0.05	0.404	3.03 (1.85-4.96)	0.0807	1
	Unknown	995 (13.59%)	898 (16.17%)	3.09 (2.25-4.26)	< 0.001	0.0982	3.35 (2.04-5.5)	0.06	1
Intensive Care Unit									
	No	87797 (63.17%)	30492 (31.58%)	Reference	Reference	Reference	Reference	Reference	Reference
	Yes	26166 (18.83%)	45024 (46.62%)	4.96 (4.87-5.04)	< 0.001	< 0.001	3.14 (2.82-3.48)	< 0.001	< 0.001
	Unknown	25025 (18.01%)	21051 (21.8%)	2.42 (2.38-2.47)	< 0.001	< 0.001	1.87 (1.48-2.37)	< 0.001	< 0.001
Previous grippal case**									
	No	71856 (51.7%)	41419 (42.89%)	Reference	Reference	Reference	Reference	Reference	Reference
	Yes	29837 (21.47%)	24204 (25.06%)	1.41 (1.38-1.43)	< 0.001	< 0.001	1.32 (1.19-1.47)	< 0.001	< 0.05
	Unknown	37295 (26.83%)	30944 (32.04%)	1.44 (1.42-1.46)	< 0.001	< 0.001	1.39 (1.22-1.59)	< 0.001	< 0.05
Age Range									
	(20,30]	9784 (7.04%)	1158 (1.2%)	Reference	Reference	Reference	Reference	Reference	Reference

|				OR (95% CI)†	P-value*	Adj P-value	aOR (95% CI)†	P-value*	Adj P-value
	(0,1]	329 (0.24%)	30 (0.03%)	0.77 (0.68-0.88)	0.3539	1	0 (0-3.846E+76)	0.9646	1
	(1,6]	853 (0.61%)	74 (0.08%)	0.73 (0.67-0.8)	< 0.05	1	0.19 (0.11-0.35)	0.2403	1
	(6,20]	2669 (1.92%)	342 (0.35%)	1.08 (1.04-1.13)	0.3539	1	0.44 (0.32-0.59)	0.2403	1
	(30,40]	21726 (15.63%)	3603 (3.73%)	1.4 (1.37-1.44)	< 0.001	< 0.001	0.85 (0.74-0.99)	0.9151	1
	(40,50]	26739 (19.24%)	7328 (7.59%)	2.32 (2.26-2.37)	< 0.001	< 0.001	1.69 (1.48-1.94)	< 0.05	1
	(50,60]	28348 (20.4%)	13753 (14.24%)	4.1 (4.01-4.19)	< 0.001	< 0.001	2.09 (1.83-2.38)	< 0.001	0.103
	(60,70]	23951 (17.23%)	22724 (23.53%)	8.02 (7.84-8.19)	< 0.001	< 0.001	4.22 (3.7-4.81)	< 0.001	< 0.001
	(70,80]	15653 (11.26%)	24477 (25.35%)	13.21 (12.92-13.51)	< 0.001	< 0.001	7.37 (6.45-8.41)	< 0.001	< 0.001
	(80,90]	7547 (5.43%)	18099 (18.74%)	20.26 (19.8-20.73)	< 0.001	< 0.001	12.68 (11.07-14.53)	< 0.001	< 0.001
	> 90	1389 (1%)	4979 (5.16%)	30.29 (29.41-31.19)	< 0.001	< 0.001	28.91 (24.5-34.11)	< 0.001	< 0.001
Illness onset to hosptalization (days)									
	(0,3]	23532 (18.66%)	20681 (24.4%)	Reference	Reference	Reference	Reference	Reference	Reference
	(3,6]	30246 (23.99%)	19545 (23.06%)	0.74 (0.72-0.75)	< 0.001	< 0.001	0.94 (0.85-1.05)	0.484	1
	(6,9]	31096 (24.66%)	15396 (18.16%)	0.56 (0.55-0.57)	< 0.001	< 0.001	0.67 (0.59-0.75)	< 0.001	< 0.05
	> 9	30502 (24.19%)	14862 (17.53%)	0.55 (0.55-0.56)	< 0.001	< 0.001	0.59 (0.51-0.68)	< 0.001	< 0.05
	Unknown***	10717 (8.5%)	14290 (16.86%)	1.52 (1.49-1.55)	< 0.001	< 0.001	1.89 (1.66-2.15)	< 0.001	< 0.001
Illness onset to cure or death (days)									
	(0,9]	26703 (21.23%)	30781 (32.02%)	Reference	Reference	Reference	Reference	Reference	Reference
	(9,14]	35358 (28.11%)	20226 (21.04%)	0.5 (0.49-0.5)	< 0.001	< 0.001	0.79 (0.7-0.89)	< 0.05	1
	(14,20]	34176 (27.17%)	18046 (18.77%)	0.46 (0.45-0.47)	< 0.001	< 0.001	0.82 (0.7-0.96)	0.3089	1
	> 20	29306 (23.3%)	24077 (25.04%)	0.71 (0.7-0.72)	< 0.001	< 0.001	0.96 (0.78-1.19)	1	1
	Unknown***	255 (0.2%)	3008 (3.13%)	10.23 (9.41-11.13)	< 0.001	< 0.001	0.79 (0.39-1.56)	1	1
Hospitalization duration (days)									
	(0,4]	31523 (26.99%)	21656 (25.64%)	Reference	Reference	Reference	Reference	Reference	Reference
	(4,7]	29323 (25.11%)	13773 (16.31%)	0.68 (0.67-0.7)	< 0.001	< 0.001	0.67 (0.6-0.74)	< 0.001	< 0.001
	(7,13]	30220 (25.87%)	19743 (23.38%)	0.95 (0.94-0.97)	< 0.001	< 0.05	0.86 (0.76-0.98)	0.2506	1
	> 13	23819 (20.39%)	23125 (27.38%)	1.41 (1.39-1.44)	< 0.001	< 0.001	0.84 (0.7-1)	0.2506	1
	Unknown***	1908 (1.63%)	6162 (7.3%)	4.7 (4.54-4.87)	< 0.001	< 0.001	4.56 (3.69-5.64)	< 0.001	< 0.001

Death and cure proportions represented by n (%). Schooling level expressed as the number of years of study. Adj=Adjusted. *P-values were corrected by the number of comparisons with the reference level by the Holm-Sidak method. †Odds Ratios were adjusted by all significant variables in bivariate models (OR) and added as confounding variables in the multivariate logistic models (aOR) whenever applicable. ‡Up to 45 days after giving birth. **Diagnosed and notified as COVID-19 before hospitalization. ***Zero included in the unknown.

Figure 1: Risk factors for COVID-19 death.
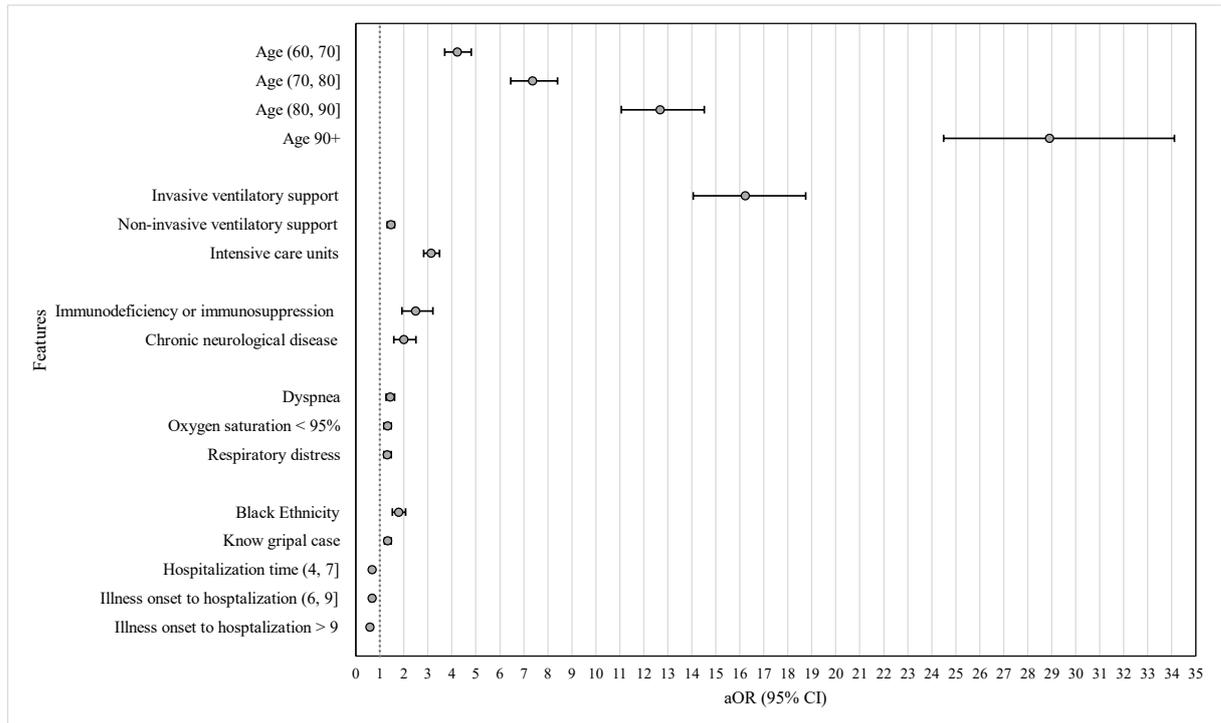
For each feature, aOR was estimated against its reference (Table 3), its mean represented by the dot and the 95% CI given by the respective black line. Vertical dotted line at aOR = 1. All significant variables in bivariate models were added as confounding variables in the multivariate logistic models.

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Figure 2: Risk of the combination of respiratory symptoms for COVID-19 death.
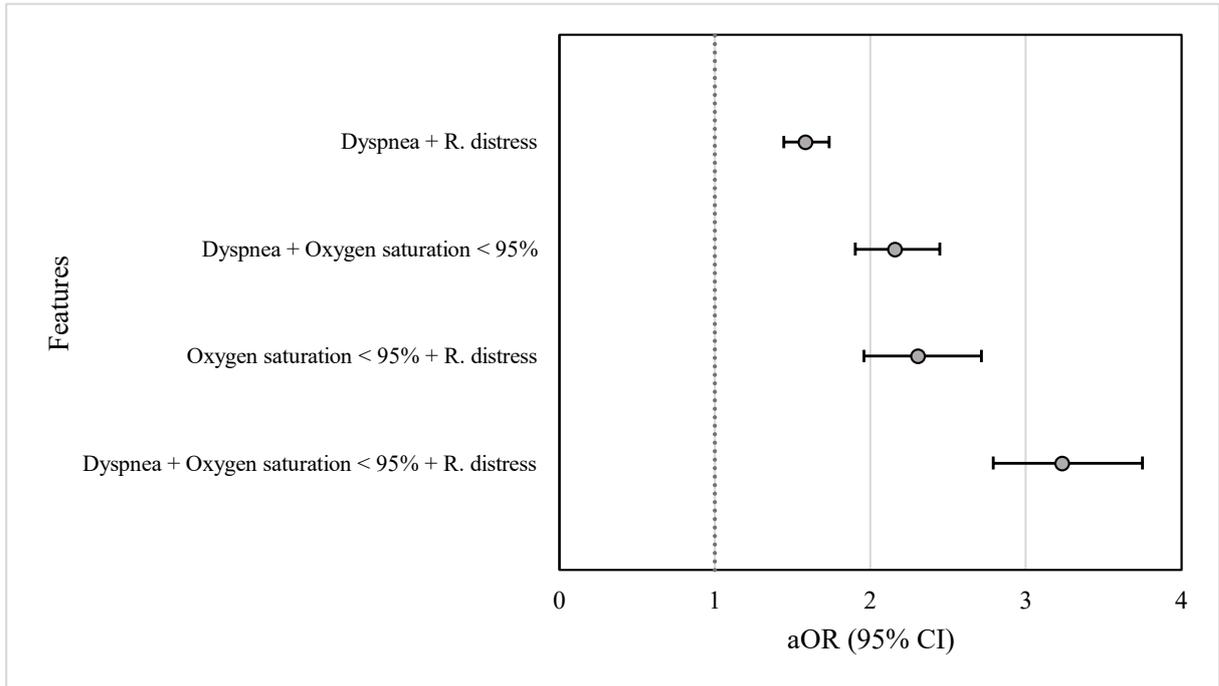
For each respiratory symptoms combination, the aOR was estimated against subjects without all three respiratory symptoms (appendix p 1), its mean represented by the dot and the 95% CI given by the respective black line. Vertical dotted line at aOR = 1. The confounding variables, i.e., ethnicity, ventilatory support, and intensive care unit, were kept in equal proportions in the multivariate logistic models. R. distress=Respiratory distress.

Figure 3: Risk of the combination of the number of any COVID-19 risk factors with age for death.
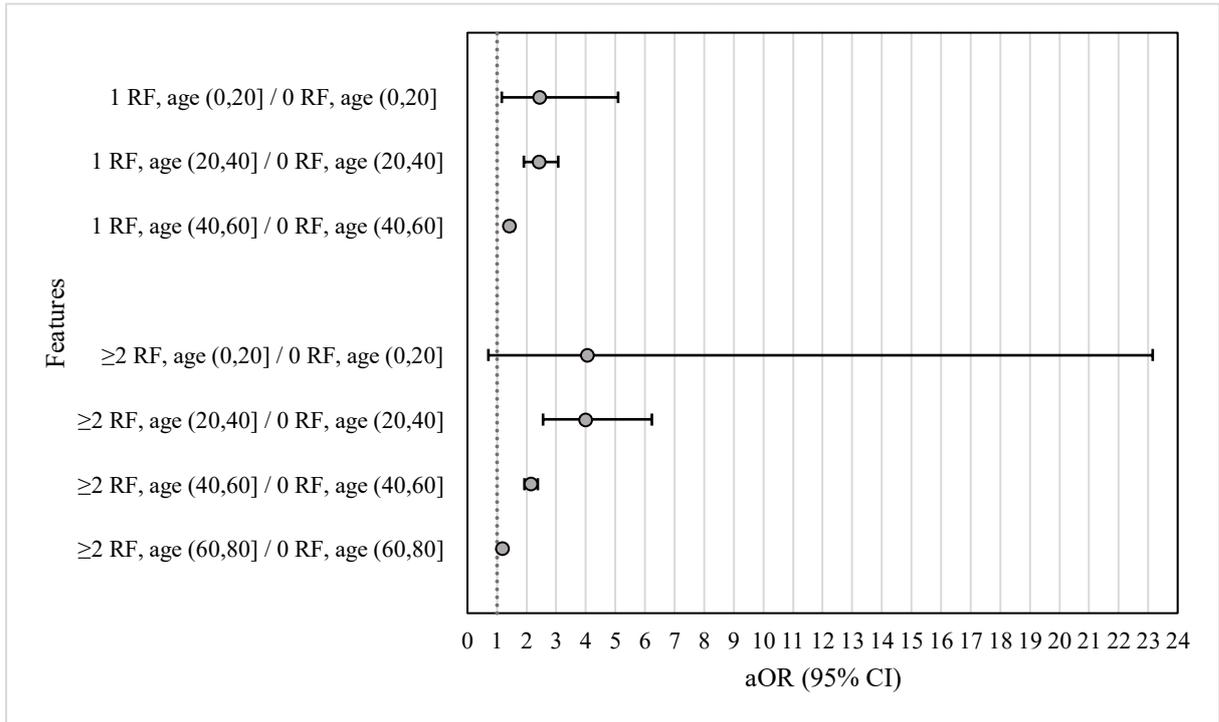
For each number of risk factors and age combination, the aOR was estimated against its reference (appendix p 2), its mean represented by the dot and the 95% CI given by the respective black line. Vertical dotted line at aOR = 1. The confounding variables, i.e., ethnicity, ventilatory support, and intensive care unit, were kept in equal proportions in the multivariate logistic models. RF= Risk Factor.

Figure 4: Risk of the combination of diabetes mellitus and other risk factors for COVID-19 death.
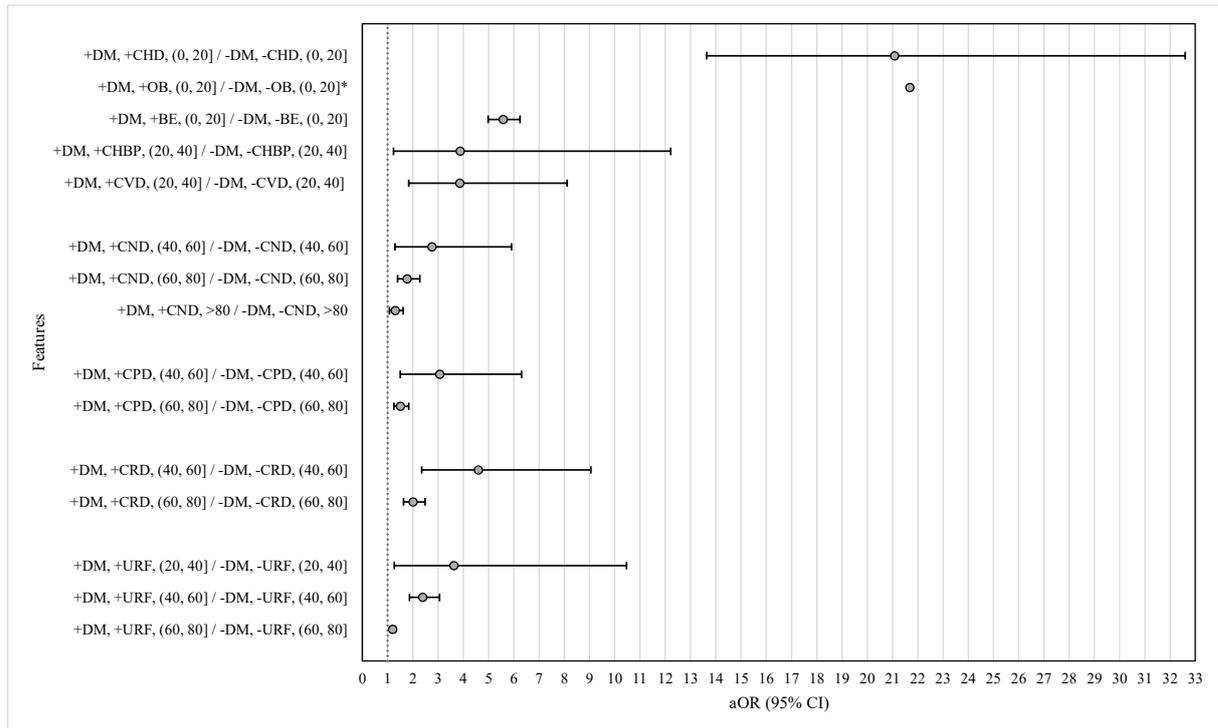
For each number of risk factors and age combination, the aOR was estimated against its reference (appendix p 3), its mean represented by the dot and the 95% CI given by the respective black line. Vertical dotted line at aOR = 1. The confounding variables, i.e., ethnicity, ventilatory support, and intensive care unit, were kept in equal proportions in the multivariate logistic models. * 95% CI not calculated. DM=Diabetes Mellitus. CHD=Chronic Hematologic Disease. OB=Obesity. BE=Brown Ethnicity. CHBP=Chronic High Blood Pressure. CVD=Chronic Vascular Disease. CND=Chronic Neurologic Disease. CPD=Chronic Pneumopathy Disease. CRD=Chronic Renal Disease. URF='Unlisted Risk Factors'.

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