

Association of Physical Exercise and Sleeping Habit with COVID-19 Severity and Hospitalization among the Recovered Individuals in Bangladesh

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Abstract

The outbreak of COVID-19 has adversely affected millions of people worldwide where many left with mildly symptomatic or even asymptomatic. This study aimed at evaluating the potential influence of pre-existing physical exercise (PE) pattern and sleep habit on the hospitalization and severity of COVID-19 infected people in Bangladesh with or without comorbidities. Data was collected from randomly selected 1025 recovered people from Jhenaidah and Dhaka districts and statistical analysis was completed using statistical package for the social sciences (SPSS) software (version 25). Reduced association of severity was observed for the patients accustomed to more than 30 min/day of regular PE (OR= 0.814; CI 0.580-1.305; p = 0.13; comorbid and OR= 0.935; CI 0.727-5.148; p = 0.07; non-comorbid), 6-7 hours sleeping (OR= 0.689; CI 0.413-0.149; p < 0.001; comorbid) and 7-8 hours sleeping (OR= 0.730; CI 0.357-1.495; p < 0.001; non-comorbid). Similar trend for PE with 6.2% (CI 0.456-2.252; p = 0.04; comorbid) and 35.5% (CI 0.106-3.940; p = 0.008; non-comorbid) less odds was observed for hospitalization. Sleeping duration of 6-7 hours (OR=0.823; CI 0.484-2.587; p < 0.001; non-comorbid) and 7-8 hours (OR=0.503; CI 0.152-1.661; p = 0.003; comorbid) was least associated with hospitalization. Duration of recovery was least for 6-7 hours of sleeping (19.0±5.9 days; comorbid and 17.2±9.8 days; non-comorbid) and regular PE (17.9±10.6 days) more than 30 min/day. Maintaining a healthy sleeping habit (6 to 8 hours/day) and regularity of PE may play a vital role in decreasing the possibility of hospitalization and lessening the severity of COVID-19 infected patients.

Keywords: COVID-19, physical exercise (PE), sleeping habit, severity, hospitalization.

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সারমর্ম: কোভিড-১৯ এর প্রাদুর্ভাব বিশ্বব্যাপী লক্ষ লক্ষ মানুষকে বিরূপভাবে প্রভাবিত করেছে, যেখানে অনেকেরই হালকা লক্ষণ বা এমনকি কোনো উপসর্গ দেখা যায়নি। এই গবেষণার লক্ষ্য ছিল বাংলাদেশে কোভিড-১৯ আক্রান্ত ব্যক্তিদের (সহ-অসুস্থতা বা অ-সহ-অসুস্থতা) হাসপাতালে ভর্তি এবং অসুস্থতার তীব্রতার উপর পূর্ব-বিদ্যমান শারীরিক ব্যায়াম (PE) এর ধরণ এবং ঘুমের অভ্যাসের সম্ভাব্য প্রভাব মূল্যায়ন করা। বিনাইদহ এবং ঢাকা জেলা থেকে এলোমেলোভাবে নির্বাচিত ১০২৫ জন সুস্থ ব্যক্তিদের নিকট থেকে তথ্য সংগ্রহ করা হয়েছিল এবং সামাজিক বিজ্ঞানের জন্য পরিসংখ্যানগত প্যাকেজ (SPSS) সফটওয়্যার (সংস্করণ-২৫) ব্যবহার করে পরিসংখ্যানগত বিশ্লেষণ সম্পন্ন করা হয়েছিল। ৩০ মিনিট/দিনের বেশি নিয়মিত PE (OR=0.814; CI 0.580-1.305; p=0.13; সহ-অসুস্থতা এবং OR=0.935; CI 0.727-5.148; p=0.07; অ-সহ-অসুস্থতা), ৬-৭ ঘন্টা ঘুম (OR= 0.689; CI 0.413-0.149; p<0.001; সহ-অসুস্থতা) এবং ৭-৮ ঘন্টা ঘুম (OR=0.730; CI 0.357-1.495; p<0.001; অ-সহ-অসুস্থতা)-এ অভ্যস্ত রোগীদের ক্ষেত্রে অসুস্থতার তীব্রতার সাথে হাস্যপ্রাপ্ত সম্পর্ক লক্ষ্য করা গেছে। PE-র ক্ষেত্রেও একই প্রবণতা দেখা গেছে, হাসপাতালে ভর্তির ক্ষেত্রে 6.2% (CI 0.456-2.252; p=0.04; সহ-অসুস্থতা) এবং 35.5% (CI 0.106-3.940; p=0.008; অ-সহ-অসুস্থতা) কম সম্ভাবনা দেখা গেছে। ৬-৭ ঘন্টা ঘুমের সময়কাল (OR=0.823; CI 0.484-2.587; p<0.001; অ-সহ-অসুস্থতা) এবং ৭-৮ ঘন্টা (OR=0.503; CI 0.152-1.661; p=0.003; সহ-অসুস্থতা) হাসপাতালে ভর্তির সাথে সম্পর্ক সবচেয়ে কম ছিল। ৬-৭ ঘন্টা ঘুমের (19.0±5.9 দিন; সহ-অসুস্থতা এবং 17.2±9.8 দিন; অ-সহ-অসুস্থতা) এবং নিয়মিত PE (17.9±10.6 দিন) ৩০ মিনিট/দিনের বেশি সময় ধরে, তাঁদের সুস্থতার সময়কাল সবচেয়ে কম ছিল। স্বাস্থ্যকর ঘুমের অভ্যাস (প্রতিদিন ৬ থেকে ৮ ঘন্টা) বজায় রাখা এবং নিয়মিত PE হাসপাতালে ভর্তির সম্ভাবনা কমাতে এবং কোভিড-১৯ সংক্রামিত রোগীদের অসুস্থতার তীব্রতা কমাতে গুরুত্বপূর্ণ ভূমিকা পালন করতে পারে।

1. Introduction

The highly contagious SARS-CoV-2 (COVID-19) outbreak in early 2019 has grown to be a severe global public health issue. The World Health Organization (WHO) proclaimed a global pandemic brought on by COVID-19 in March 2020. No doubt, the healthcare and socioeconomic challenges faced by the people during the early time of the pandemic will remember this cruel practicality towards the end of their life. Although the severity of COVID-19 is primarily associated with pre-existing health conditions, a poorly controlled lifestyle intensifies the risks of hospitalization and death [1]. COVID-19 causes severe illnesses in people with comorbidities, which can lead to hospitalization and death after the disease occurs [2–4]. The severity of COVID-19 is generally associated with multiple factors, including age, sex, obesity, residential hygiene, blood group, smoking, comorbidity, and alcohol addiction [5].

Yet, many factors intensifying the severity of COVID-19 infections still remain unclear.

Undoubtedly, a healthy lifestyle requires regular PE. WHO recommends that adult people should engage in 150 minutes (min) of moderate or 75 min of vigorous PE per week [6]. Studies have shown that following this WHO guideline not only can reduce the risk of cardiovascular disease (CVD), the incidence of type 2 diabetes, deadly cancer, and the aging process but also can improve of mental health [7–10]. Generally, regular PE boosts human immune cells to identify and kill the affected cells, releasing muscle-derived cytokines (IL-6, IL-7, and IL-15) that assist the human body against infection [11,12]. In addition, few studies supported that moderate exercise protects against respiratory infections [13–15]. Of note, intense and prolonged exercise was linked to an increase in upper respiratory tract infections, according to an early epidemiological study [16]. It is also reported that regular exercise decreases the mortality induced by the influenza virus [17]. Intense activity impairs the body's ability to fight off respiratory virus infections, according to preclinical studies [18,19]. In a larger study, PE was found as inversely associated with the risk of community-acquired pneumonia among women in US [20]. In another study, insufficiently active and adequately active (at least 150 min/week of moderate-vigorous activity) groups were linked to a lower association of infectious disease mortality as compared to the physically inactive group [21]. In terms of COVID-19, most recently, Hammer et al., 2020 and Brawner et al., 2021 found that higher hospitalization due to COVID-19 among patients who were physically inactive had smoking status and excessive alcohol consumption habits [22,23]. According to another study, increasing levels of PE can partially reduce the severity and hospitalization due to COVID-19 [24,25]. In addition, it has recently been observed that physically active people were less likely to be diagnosed with COVID-19 [26,27]. Furthermore, an interesting study involving 215 positive patients for COVID-19 found that physically active patients recovered more quickly than their counterpart [28].

Besides PE, quality sleep plays a key role in regulating cellular and humeral immunity, and sleep deprivation can weaken that response [29,30]. While regular sleep can significantly improve cardiometabolic health [31], the disruption in sleep may results in chronic inflammation [32]. Sleep duration is also important and has been shown to have a potential influence on the odds ratio (OR), where the higher values of OR generally represents the greater chance of exposure during a disease outbreak compared to the absence of the outbreak. For example, an increase in odds ratio (OR) and/or severity was observed in an epidemiologic study with short or long sleep for obesity, stroke, coronary heart disease and diabetes [33]. Although sleep duration is very important in healthy life, short sleep (< 6 hours/day) may develop

chronic disease with an increased risk of stroke, myocardial infarction, and cancer [34]. Besides physical health, mental health is also controlled by quality sleep [35–37]. Along that, quality sleep is also essential for building a strong immune system against pathogens [38,39] and highly contagious infection of COVID-19 [40]. The ongoing health complexities and their driving factors regarding COVID-19 infections are almost a new practicality all over the world. Studies have shown that number of infected people and their vulnerability may also depend on their race plus their geographic and demographic locations [41–43].

However, this study focuses on how PE and sleep habits are associated with hospitalization and severity due to COVID-19. Although linking PE with COVID-19 susceptibility, severity, and hospitalization has been addressed in very few other studies [22–27], studies showing the effect of sleep habits are limited in literature, except one [40] to the best of our knowledge. However, any combined report that includes detailed PE and sleeping time is not found. Furthermore, no study revealed PE and sleeping time impact on COVID-19 complications in terms of severity. As the association between pre-existing habit of PE and sleep duration with COVID-19 severity and hospitalization remains somewhat unclear, therefore, research data from COVID-19 infections, from Bangladesh may help to public health professionals and decision makers in managing and developing a better health care system for the ongoing and/or any future infectious disease like COVID-19. Therefore, we aimed at evaluating the potential influence of pre-existing physical exercise (PE) pattern and sleep habit on the hospitalization and severity of infected people in Bangladesh with or without comorbidities.

2. Experimental Section

2.1. Methods

Study design, sites, participants and data collection

We have followed the methodology described in details in a recently published article [44]. Briefly, individuals with laboratory-confirmed COVID-19 who were initially classified as positive and then confirmed to be negative at the Bangladesh Government Health Ministry designated COVID-19 test laboratory in Dhaka, Khulna, and Jessore Districts using RT-PCR assay were included in this study. The probable risk factors including age, BMI, sex, habitation, occupation, educational background and habit of PE and sleeping habit were analyzed to quantify their association with the degree of severity and hospital admission due to COVID-19. The recovered patients's symptoms were classified into three groups using the Directorate General of Health Services (DGHS), Ministry of Health and Family Welfare (MOHFW), Bangladesh, and World Health Organization guidelines: asymptomatic, mild, and severe (no moderate cases were identified, and critical cases weren't

included as they were so limited among the respondents). The COVID-19 severities of comorbid and non-comorbid patients were compared. We randomly selected 1025 recovered people from Bangladesh's Jhenaidah and Dhaka districts who submitted all of their information. Between November 2020 and March 2021, all data were gathered by telephone interviews, and with the respondents' permission, they were also recorded in an electronic format. To ensure the accuracy and reliability of the data, the appropriate author recorded everything in a written document. The Chattogram Veterinary and Animal Sciences University (CVASU), Chattogram, Bangladesh, ethics committee approved the protocol (CVASU/DIR/(R & E)/EC/2020.191/1).

2.2. Statistical analysis

The specific factors were analyzed using univariate, bivariate, and multivariate methods to determine their associations with the COVID-19 status. To identify the risk factors, we employed a graphical presentation and tabular format to illustrate the distribution of age, BMI, sex, place of residence, education level, and employment status. To compare age, hospitalization, and comorbidities between males and females, we used a bivariate method. The correlation between categorical factors (sex, BMI, habitation, educational background, PE, and sleeping habit) was analyzed using a Chi-square test, and the significance of the mean difference between the categorical variables was investigated using a Student's t-test (age). By using a t-test, the mean difference between comorbid and non-comorbid patients' recovery times was also analyzed. Three regression models were employed out in multivariate analysis to evaluate the contributing factors of two outcome variables, including hospitalization status (model 1) and degree of severity (model 2). The estimation of each significant model was done using the binary logistic regression analysis. It should be noted that the severity of the symptoms outcome variable was categorized as "severe" if the patients reported their symptoms to be "severe," and as "not severe" if they reported their symptoms to be "mild" or absent of symptoms. The explanatory variables were age (in years), sex (male vs. female), habitation (urban vs. village), BMI ($18.5 < \text{BMI}$, $18.5 \leq \text{BMI} \leq 25$ and $\text{BMI} > 25$), educational level (SSC or less, HSC/Diploma, Bachelor's, PhD or above and others) and exercise habit (irregular vs. regular and occasional; < 30 min regular/day vs. > 30 min regular/day) and sleeping duration (< 7 hours vs > 7 hours). To identify PE and sleeping pattern, a time period of at least 6 months prior to COVID-19 infection was taken into account while evaluating the association of PE and sleeping patterns with hospitalization and severity. For the variables in the models, we took into account the OR, 95% confidence intervals (CI), and p values. For all statistical analyses, we only considered them significant if $p < 0.05$ (two-tailed). Using SPSS (version 25), we carried out all of the statistical analysis.

3. Results and Discussion

3.1. Demographic study

The median age (year) of the comorbid COVID-19 patients were 45 ± 12.8 whereas non-comorbid patients were much younger (median age 31 ± 10.7 years represented in supporting information (SI) (**SI Fig. 1**). About 59% and 31% of the total patients were males and females (**SI Fig. 2**), where male patients were outnumbered than female counterparts for all age groups except comorbid patients with 11-20 years of range (**Fig. 1**). Most of the patients (81%) were from urban areas (**SI Fig. 3**). Almost half of the total patients (45.6%) completed their Bachelor's degree (**SI Fig. 4**), and they came from the diverse field of occupations (**SI Fig. 5**). Among the respondents, 45.6% of patients have at least one comorbidity (**SI Fig. 6**).

Age groups of 1-10 and 11-20 for both types of patients came with lower BMI (underweight, $BMI < 18.5$). Obesity was found to be increased with the increase of age up to 40 years (**Fig. 1**). Interestingly, all the 60+ aged patients exercised occasionally or regularly, where the tendencies of regular exercise for >30 min/day were highest for the 41-50 year age group (47.4%). However, an almost linear increase in the extended exercise (>30 min) was found with the increase in age (**Fig. 1**). The sleeping duration was higher in middle-aged patients (41-50 year age group) where 8+ hour was predominant in case of younger aged (<10 year age group). Asymptomatic (61.5%) condition was observed mostly for younger patients (1-20 year age group). On the other hand, severe patients were higher in the aged patients. For instance, 31.6% of patients from the 51-60 year age group were attributed to severe symptoms. Notable that their hospitalization rates were also higher than all other age groups (21%) (**Fig. 1**). Only 43.7% were identified with obesity conditions (**Fig. 2a**). Only 8.8% COVID-19 patients did not do PE at all where 18.9% occasionally do that. About 43% of patients reported doing >30 min for PE every day (**Fig. 2b**). In addition, 6-7 hours (43.2%) of sleeping habits were most common, followed by 7-8 hours duration (30%) among the patients (**Fig. 2c**).

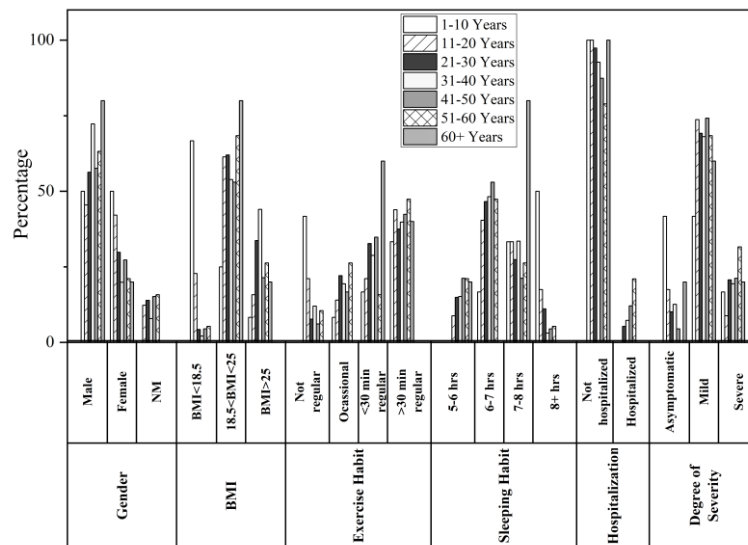


Figure 1 Comparative status of sex, degree of severity, exercise habit/day, sleeping duration/day, hospital admission rate and BMI for different age group of COVID-19 patients (N=1025)

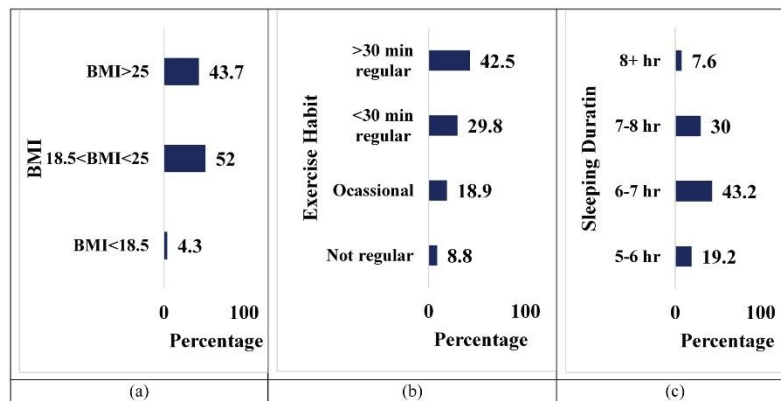


Figure 2 Demography of the COVID-19 patients (N=1025), (a) Obesity status, (b) Habit of PE/day and (c) Sleeping duration/day

The BMI of female comorbid patients was higher than that of male patients, but the non-comorbid patients showed quite the opposite pattern. Villagers upheld a comparatively balanced BMI than urban dwellers. Regular exercise habit was found beneficial for the

patients (**SI Table 1**). For instance, when patients exercised for >30 min/day, their obesity status was observed to be the least in both comorbid (51.9%) and non-comorbid (32.4%) individuals. In addition, the sleeping duration of 6-7 hours was associated with a balanced BMI. It is noteworthy that lower (5-6 hours) and higher (8+ hours) sleeping habit was associated with higher hospitalized cases (20.4% and 20.7%, respectively) of comorbid patients, whereas 7.9% of patients hospitalized who had a sleeping duration of 7-8 hours. Linear severity increment was observed for the increased BMI for the comorbid patients. Lowered BMI (<18.5) was associated with less severe symptoms (33.33%) where BMI>25 observed severity at a higher rate (39.2%). Balanced BMI was associated mostly with mild symptoms (59.2%). The hospitalization rate was the least for non-comorbid patients with BMI<18.5 (**SI Table 2**).

Female patients suffered from higher severity (38.4% and 28.8% of total comorbid and non-comorbid patients, respectively) after being infected by COVID-19. Consequently, their hospitalization rates were also higher (14.5% and 12.4%, respectively) than males (12.2% and 5.3%, respectively) (**SI Table 2**). Interestingly, highly educated patients experienced severe symptoms. For instance, 22.6% of non-comorbid Bachelor's degree holders and 60% of comorbid patients having PhD degrees suffered the most. However, 4.7% of non-comorbid Bachelor's degree holders were hospitalized, which is comparatively less than patients with less academic qualification. Teachers (42.9%), retired persons (66.7%) and journalists (100%) had no comorbidity but experienced higher severity. Teachers (14.3%) and government employees (12.3%) were admitted to hospitals at a higher rate (**SI Table 2**). Urban and villagers suffered badly (20.9% vs. 13.2%) and were subsequently hospitalized (7.2% and 4.4%) for non-comorbid patients. Likewise, comorbid patients exhibited a similar pattern (**SI Table 2**). Comorbid patients appeared with higher obesity (53.5%) than non-comorbid patients (35.5%) (**SI Fig. 7**) and they suffered from higher severity (37.5%) and hospitalization (12.6%) than non-comorbid patients (19.4% and 6.6% respectively) (**SI Fig. 8**). About 40% of non-comorbid and 46% of comorbid patients exercised regularly for >30 min daily (**SI Fig. 9**).

3.2. Influence of PE and sleep on hospitalization

Table 1 shows the influence of exercise and sleeping duration on hospitalization and severity. Among the 1025 patients, 45.6% were comorbid, and they required more hospitalization (12.6%) than non-comorbid (6.6%) patients. Comorbid patients were observed to have more severe conditions than non-comorbid individuals (37.5% vs. 19.4%). Patients with the habit of regular exercise were associated with less hospitalization (6.4%) than occasionally exercised non-comorbid patients (7.4%). Comorbid patients who did not exercise were found with a higher hospitalization rate (15.8%) than their counterparts (11.6%). Moreover, it was observed that with the increase in exercise time (from <30 min/day to >30 min/day), the hospitalization requirements were reduced (7.7% vs. 5.4%) for non-comorbid patients.

Hospitalization also decreased with the sleeping habit of 7 to 8 hours/day than the patients who slept of >8 hours/day (7.9% vs 20.4%) for comorbid patients. Noteworthy that non-comorbid individuals who had 5 to 6 hours/day sleeping habit were hospitalized most (9.5%) compared to others. In addition, the hospitalization rate was only 2.0% for non-comorbid patients who slept 8+ hours (**Table 1**).

Table 1: Influence of physical exercise and sleep on hospitalization and severity.

		Comorbid						Non-Comorbid					
		Hospitalization (%)		Severity (%)			Hospitalization (%)		Severity (%)				
		No	Yes	Asymptomatic	Mild	Severe	No	Yes	Asymptomatic	Mild	Severe		
Exercise	No	84.2 0	15.8 0	9.60	52. 60	37.7 0	92.9 0	7.1 0	14.10	66. 50	19.4 0		
	Yes	88.4 0	11.6 0	5.40	57. 20	37.4 0	93.6 0	6.4 0	10.30	70. 40	19.3 0		
Exercise Regularity	Occasional	82.6 0	17.4 0	10.50	50. 00	39.5 0	92.6 0	7.4 0	6.50	68. 50	25.0 0		
	Regular	88.4 0	11.6 0	5.40	57. 20	37.4 0	93.6 0	6.4 0	10.30	70. 40	19.3 0		
Exercise Duration	<30 min	87.1 0	12.9 0	5.80	58. 30	36.0 0	92.3 0	7.7 0	8.80	67. 50	23.7 0		
	>30 min	89.3 0	10.7 0	5.10	56. 50	38.3 0	94.6 0	5.4 0	10.40	73. 00	16.7 0		
Sleep Duration	5-6 Hours	79.6 0	20.4 0	3.50	54. 90	41.6 0	90.5 0	9.5 0	9.50	69. 00	21.4 0		
	6-7 hours	89.7 0	10.3 0	8.10	59. 50	32.4 0	92.6 0	7.4 0	10.50	68. 60	20.9 0		
	7-8 hours	92.1 0	7.90 0	6.40	55. 00	38.6 0	94.6 0	5.4 0	9.60	76. 60	13.8 0		
	8+ hours	79.3 0	20.7 0	6.90	44. 80	48.3 0	98.0 0	2.0 0	26.50	46. 90	26.5 0		
Sleep Binary	<7 hours	85.9 0	14.1 0	6.40	57. 70	35.9 0	92.1 0	7.9 0	10.20	68. 70	21.1 0		
	>7 hours	89.9 0	10.1 0	6.50	53. 30	40.2 0	95.4 0	4.6 0	13.40	69. 90	16.7 0		

3.3. Influence of PE and sleep on the severity

Severe symptoms were close to 37% and 19% for comorbid and non-comorbid patients respectively with or without exercise habit where mild symptoms were observed with a higher percentage for both comorbid (57.2%) and non-comorbid (70.4%) patients who exercised regularly (**Table 1**). Exercise duration of <30 min/day was associated with 23.7% of severe non-comorbid patients, whereas the percentage was 16.7% for >30 min/day of exercised patients (**Table 1**). Non-comorbid patients accustomed to very shorter (5-6 hours) and longer sleeping duration (8+ hours/day) experienced a higher degree of severity (21.4% and 26.5% of severe cases, respectively) for comorbid patients (**Table 1**). Similar results were observed for non-comorbid patients. Note that 6-7 hours of sleep duration per day was found comparatively appropriate for comorbid patients, whereas 7-8 hours per day for non-comorbid patients (**Table 1**).

3.4. Influence of exercise and sleep on recovery duration

Average recovery duration for the patients with different exercise and sleeping habits are portrayed in the **SI Fig. 10**. Comorbid patients required a greater recovery duration (19.5 ± 6.1 days) than the non-comorbid patients (17.5 ± 9.1 days). Sleeping time of 6-7 hours was found as the least duration of recovery for both comorbid (19.0 ± 5.9 days) and non-comorbid patients (17.2 ± 9.8 days), whereas 8+ hours of sleeping habit per day was found as the highest recovery duration for non-comorbid patients (18.5 ± 6.0 days) where 5-6 hours of sleeping were associated with greater time to recovery (19.8 ± 3.2 days respectively). Comorbid patients who exercised regularly (>30 min/day) were found to require less duration of recovery (17.9 ± 10.6 days) than those who did not exercise at all (20.2 ± 5.8 days). Similar phenomenon could be stated for the non-comorbid ones.

3.5. Chi-square test, t-test, and optimum regression model

The relationship between BMI (18/18+), sex (male/female), habitation (village/urban), comorbidity (comorbid/non-comorbid), exercise habit (regular/irregular), and sleeping habit (7 hours/>7 hours/day) was investigated using a chi-square test for independence with $\alpha=0.05$. In case of evaluation for the degree of severity, the chi-square tests were found statistically significant for age ($\chi^2 = 1032.375$, $p < 0.001$, $\phi=1.002$), BMI ($\chi^2 = 1038.423$, $p = 0.01$, $\phi=1.005$), sex, ($\chi^2 = 1039.023$, $p = 0.01$, $\phi=1.005$), habitation, ($\chi^2 = 1.033.279$, $p = 0.02$, $\phi=1.002$), comorbidity, ($\chi^2 = 35.688$, $p < 0.001$, $\phi=.187$), exercise regularity ($\chi^2 = 1035.433$, $p < 0.001$, $\phi=1.003$) and sleeping habit ($\chi^2 = 1029.151$, $p < 0.001$, $\phi= 1.000$). However, hospital admission were related to age ($\chi^2 = 1034.567$, $p < 0.001$, $\phi=1.002$), BMI ($\chi^2 = 1033.862$, $p = 0.004$, $\phi= 1.002$), sex ($\chi^2 = 1040.283$, $p < 0.001$, $\phi=1.005$), habitation ($\chi^2 = 1031.938$, $p = 0.01$, $\phi=1.001$), comorbidity ($\chi^2 = 10.793$, $p < 0.001$, $\phi=.103$), exercise regularity ($\chi^2 = 1030.875$, $p < 0.001$, $\phi=1.001$) and sleeping

habit ($\chi^2 = 1033.037$, $p < 0.001$, $\phi=1.002$). As a result, the null hypotheses could be rejected, and a relationship between these variables with severity and hospitalization was established (**SI Table 3**).

The mean recovery period for comorbidity status (comorbid vs non-comorbid), PE habit (regular vs irregular) and sleeping duration (<7 hours/day vs >7 hours/day) were analyzed by an independent sample (SI Table 4a and 4b). Therefore, an equal variance can be assumed for each of the groups. The t-test showed statistically significant differences in the mean recovery times of comorbid patients ($M=19.52$, $SD=9.06$) and non-comorbid patients ($M=17.51$, $SD=6.10$). The mean difference between the two groups was 2.018, 95% confidence interval [-3.012, -1.024]. In patients with regular exercise habits, the duration of recovery ($M=17.82$, $SD=5.137$, $p < 0.001$) was shorter than that of those who were irregular ($M=18.47$, $SD=7.786$, $P < .001$). Besides, higher sleeping duration were found with a slightly higher average duration of recovery ($M=18.27$ vs. 18.74) (**SI Fig. 11**).

In order to evaluate the influence of various variables on the likelihood that participants would report if they experienced a higher degree of severity and hospitalization depending on their sex, age, BMI, habitaion, comorbidity status, sleeping duration, and exercise habit, a binary logistic regression was employed. Using the methodology described previously [45], we performed binary logistic regression, taking into account several predictor factors (sex, age, place of residence and comorbidities) and one response variable (degree of severity or hospital admission) [45]. For multiple logistic regressions, we use the null and alternative hypotheses also described by the same author [44].

According to analysis, all model coefficients are equal to zero as per null hypothesis. That means, there is no statistically significant correlation between any of the predictor factors and the response variable. The best fit for developing the optimum model was observed to be a forward regression models including the independent variables (age, BMI, sex, Education, habitation, Habitation, exercise habit and sleeping duration). For the degree of severity, the entire model with all factors was statistically significant ($\chi^2= 49.022$, $p < 0.001$) with a -2 Log likelihood ratio of 1158.899. The model as a whole explained between 4.7% (Cox and Snell R squared) and 4.4% (Nagelkerke R squared) of the variance in sleep status, and correctly classified 75% of cases. Similar results were observed with hospital admission ($\chi^2= 26.466$, $p < 0.001$) with -2 Log likelihood ratio of 610.924. Cox-Snell and Nagelkerke R squared value was explained between 2.5% and 5.5% of the variance with correctly classification of 82% of cases (**SI Table 5 and 6**).

3.6. Risk Association of severity and hospitalization in terms of exercise habit and sleeping time

Table 2 manifests for a cursory glance at the likelihood of severe cases and hospitalization associated with the exercise habit and sleeping time varied with age, BMI, sex, habitation and educational background of the respondents. Aged non-comorbid patients (>40 years) had 3.6% (OR 1.036; CI 0.103 to 6.262; $p < 0.001$) and 9.5% (OR 1.095; CI 0.658 to 3.214; $p < 0.001$) higher likelihood of severity and hospital admission respectively where association was increased up to 50.5% (OR 1.505; CI 0.238 to 2.866; $p < 0.001$) and 32.5% (OR 1.325; CI 0.276 to 2.489; $p < 0.001$) for the counterparts. Severity was less associated with non-comorbid (24.6%, OR 0.754; CI 0.278 to 2.045; $p = 0.007$) and comorbid patients (15.1%, OR 0.849; CI 0.122 to 5.855; $p < 0.001$) when they had balanced BMI ($18.25 < \text{BMI} < 25$) where hospitalization was not associated significantly ($P > 0.05$). Obesity was associated with the severity and hospitalization with higher odds (7.3% and 92.9% for non-comorbid patients, respectively; 11% and 36% for comorbid patients, respectively). Non-comorbid female patients had 30.6% (OR 1.306; CI 0.783 to 3.658; $p = 0.003$) higher likelihood for developing severe symptoms than their counterparts. Similar cases were observed for comorbid females with 7.8% higher odds (OR 1.078; CI 0.365 to 2.779; $p < 0.001$). The educational background could not be attributed significantly. Urban comorbid patients were at 10.8% (OR 1.108; CI 0.387 to 5.255; $p = .01$) higher odds for severity. Non-comorbid urban patients also had higher association with hospitalization (OR 1.153, CI 0.513 to 4.572; $p = 0.003$). Habitation was not significantly associated for the hospitalization of urban comorbid patients and the severity of urban non-comorbid patients ($P > 0.05$).

Patients who exercised regularly for >30 min/day were found with 6.5% (OR 0.935, CI 0.727 to 5.148; $p = 0.007$) and 18.6% (OR 0.814, CI 0.580 to 1.305; $p = 0.01$) less likelihood of developing severe symptoms for non-comorbid and comorbid patients, respectively. A similar trend was also found in the case of hospitalization (6.2%, OR 0.938, CI 0.456 to 2.254; $p = 0.04$) and 35.5%, OR 0.645, CI 0.106 to 3.940; $p = 0.008$) for both types of patients, respectively. There was a less likelihood of severity (OR 0.898; CI 0.636 to 2.256; $p < 0.001$) and hospitalization (OR 0.823, CI 0.484 to 2.587; $p < 0.001$) for non-comorbid patients who slept 6-7 hours/day. The likelihood of severe symptoms and being hospitalized for comorbid patients were also decreased by 31.1% (OR 0.689, CI 0.413 to 1.149; $p < 0.001$) and 42.8% (OR 0.572, CI 0.184-1.779; $p < 0.001$) respectively.

Table 2: Risk association for hospitalization and severity

Category	Severity				Hospitalization			
	Non-comorbid		Comorbid		Non-comorbid		Comorbid	
	OR (95%CI)	P-value ^a	OR (95%CI)	P-value ^a	OR (95%CI)	P-value ^a	OR (95%CI)	P-value ^a
Age	<40 year	<0.001		<0.001		<0.001		<0.001
	>40 year	1.036 (0.103-6.262)	<0.001	1.505 (0.238-2.866)	<0.001	1.095 (0.658-3.214)	<0.001	1.325 (0.276-2.489)
BMI	BMI<18.5		0.002		<0.001		0.04	
	18.5<BMI<25	0.754 (0.278-2.045)	0.007	0.849 (0.122-5.855)	<0.001	1.086 (0.127-9.256)	0.11	1.003 (0.682-1.445)
	BMI>25	1.073 (0.389-2.958)	<0.001	1.110 (0.162-7.623)	<0.001	1.929 (0.228-16.319)	0.006	1.360 (0.743-2.487)
Sex	Male		0.008		<0.001		0.24	<0.001
	Female	1.306 (0.783-3.658)	0.003	1.078 (0.365-2.779)	<0.001	3.105 (1.435-6.721)	0.15	0.961 (0.477-1.936)
Education	SSC or less		0.003		0.02		0.17	
	HSC/Diploma	0.862 (0.141-3.806)	0.17	1.562 (0.641-3.806)	0.23	0.901 (0.132-1.218)	0.09	1.009 (0.691-3.118)
	Bachelor's	0.910 (0.384-4.965)	0.04	0.921 (0.384-4.965)	0.04	0.817 (0.077-6.12)	0.14	1.085 (0.776-4.360)
	PhD and above/ No comments	0.903 (0.762-5.956)	0.07	2.300 (0.888-5.956)	0.15	1.454 (0.132-3.559)	0.32	0.995 (0.523-2.147)
Habitation	Village		0.04		0.02		0.01	
	Urban	1.342 (0.699-2.574)	0.06	1.108 (0.387-5.255)	0.01	1.153 (0.513-4.572)	0.003	1.571 (0.842-2.724)
Exercise	Not at all		<0.001		0.05		0.005	<0.001
	Occasional	0.899 (0.357-7.952)	<0.001	1.042 (0.604-1.797)	0.24	0.735 (0.249-3.649)	0.15	0.778 (0.101-7.61)
	<30 min regular	0.654 (0.457-6.821)	0.09	0.757 (0.311-1.842)	0.06	0.871 (0.362-2.598)	0.22	0.757 (0.303-1.889)
	>30 min regular	0.935 (0.727-5.148)	0.007	0.814 (0.580-1.305)	0.01	0.938 (0.456-2.254)	0.04	0.645 (0.106-3.940)
Sleeping	5-6 hour		<0.001		<0.001		<0.001	<0.001
	6-7 hour	0.898 (0.636-2.256)	<0.001	0.689 (0.413-1.149)	<0.001	0.823 (0.484-2.587)	<0.001	0.572 (0.184-1.779)
	7-8 hour	0.730 (0.357-1.495)	<0.001	1.096 (0.630-1.906)	0.06	3.513 (0.430-8.685)	<0.001	0.503 (0.152-1.661)
	8+ hour	1.878 (0.765-4.608)	<0.001	1.636 (0.693-3.862)	0.05	2.594 (0.296-7.751)	0.02	1.217 (0.395-3.747)

4. Explanation of the facts

4.1. Demographic study

The majority of participants in this demographic were between the ages of 21 and 50 (**Fig. 1**) confirmed that Bangladesh has a higher prevalence of young patients. This indicates that there were higher number of peoples who were exposed to the outdoors due to their work and had a higher risk of infection, which was also observed all over the world, including Bangladesh [46]. This study also corroborated previously reported findings that elderly people with COVID-19 problems have weak immune systems and are more likely to develop major complications [47]. Aged comorbid patients (>40 years) had 50.5% and 32.5% higher odds for severe symptoms and hospitalization, respectively. Meanwhile, asymptomatic conditions were prevalent for the younger patients (1-20 years) like the previous report (**Fig. 1**) [48]. An inflated infection rate among men has been noted in earlier research as well [49,50], In accordance with the prior research, we discovered that male patients and patients from cities predominated [50,51]. Globally, urban dwellers were largely infected due to living in a dense areas and using public transport [52]. Comorbid patients who were teachers, housewives, retired peoples, journalists, bankers, private, govt., and armed/semi-armed force job holders suffered in higher percentages and were subsequently hospitalized (**SI Table 2**). However, non-comorbid patients who were

teachers, housewives, and govt. job holders are hospitalized most. Actually, whatever the profession, pre-existing comorbidity (can be responsible for lower PE and irregular/bad sleeping pattern) might be the hidden factor for their severity and hospitalization [1]. In fact, higher exposure to mass people at their workplace cannot be ruled out because of the higher infection rate among those professions.

Among 1025 patients, 45.6% were comorbid, and comorbidity was identified as a factor for hospitalization (**SI Table 1**). Our findings indicated comorbid patients required more hospitalization (12.6%) than non-comorbid (6.6%). Especially, non-comorbid female patients had 30.6% higher odds of developing severe symptoms. Comorbid females also appeared with higher odds (7.8%) for degree of severity as well. Actually, comorbid patients have a lower immune response which might be the prime reason for their suffering [53]. Besides that, we found comorbid patients with higher obesity, which may indicate their poor health condition. Of note, obesity is considered the factor that worsens health conditions [54]. In the present study, about 44% of the patients have a BMI higher than 25 (**Fig. 2a**), which might be highly related to the degree of severity and hospital admission rate. Middle-aged and older people had higher BMI (**Fig. 1**). Therefore, the obesity status of the aged people aggravates health condition after COVID-19 infection as obesity was associated with the severity and hospitalization with higher odds (92.9% and 36% for non-comorbid and comorbid patients, respectively). On the other hand, lower BMI (<18.5) was predominant in 1-20 years of age group probably due to malnutrition [55]. In fact, non-comorbid patients with lower BMI (<18) experienced higher severe conditions (18.4%) than balanced (18.5-25) counterparts (16.8%) might be due to malnutrition, where surprisingly, they required comparatively less hospitalization (2.6%) remains unclear to us (**SI Table 2**).

Sleeping duration and exercise habits were varied with respect to the age of the respondents. Younger patients were more irregular in the exercise, where exercise duration was increased almost linearly with age (**Fig. 1**). Expectedly, aged persons are more conscious about their exercise possibly to avoid age-dependent morbidities [56]. Moreover, comorbid patients did extensive exercise probably by following their doctor's advice. In our study, we observed that >30 min/day exercise is highest in case of the patients aged 51-60 years followed by 41-50 years age group. Younger patients were reported to sleep longer than adults, whereas aged patients found less sleep duration. Sleeping disturbance and disorders due to chronic diseases, along with sleep deprivation due to obesity, might be the reason behind less sleep for aged patients [57,58].

4.2. Hospitalization and severity with PE and sleeping duration:

CDC (Communicable Disease Control), USA stated that PE helps to maintain weight and protect against different diseases [59]. Moreover, moderate to intensified regular

exercise can reduce body fat and systolic-diastolic blood pressure [60]. On the other hand, a lack of PE may increase the probability of being affected by chronic diseases [61]. In some cases, exercise can prevent, even, can reverse the severity of some diseases such as hypertrophic cardiomyopathy [62]. Exercise is therefore recommended as a supplemental therapy for the treatment of 26 different diseases, including musculoskeletal disorders, metabolic diseases, cardiovascular diseases, and neurological conditions [63]. It was reported that doing any type of physical activity or exercise for at least five days a week (a total of 150 minutes) can reduce different comorbidities and the risk of premature death [64]. To keep in mind those, we hypothesized that pre-existing exercise and sleeping habit might be related to COVID-19 disease hospitalization and severity. Therefore, in this study, we have investigated the association of PE and sleeping habit with COVID-19 degree of severity and hospital admission rate among the recovered individuals in Bangladesh for the first time.

Both for comorbid and non-comorbid patients, those who exercised regularly required less hospitalization (**Table 1**). Patients who exercised regularly for >30 min/day were found with 6.5% and 18.6% of less likelihood for severity for non-comorbid and comorbid patients, respectively. The present results also indicated the habit of the higher duration of PE (>30 min/day) was found to prevail with less hospitalization. A similar observation was also obtained for the degree of severity, where reduced severity status was associated with the increased duration of PE (>30 min/day). It was noteworthy that severe cases were fewer in patients with the regular exercise habit for type of patients (**Table 1**). Furthermore, though severe symptoms were observed with a similar pattern, asymptomatic (10.3% vs 14.1%) and mild (70.4% vs 66.5%) cases deviated significantly with respect to exercise habit of non-comorbid patients and comorbid patients (**Table 1**). Our findings are coherent with some other previous studies. For instance, *Grande et al. and his group* quoted based on their findings that exercise may reduce the severity of symptoms and duration of sufferings from acute respiratory infections [65]. Most importantly, exercise habit was reported to fight against COVID-19 severity [66]. Furthermore, patients habituated with regular exercise of more than 30 min/day recovered comparatively faster (avg. 17.9 and 16.7 days for comorbid and non-comorbid patients), while the infection period for the patients with lack of exercise required up to 20 days (avg.) to recover (**SI Fig. 10**). This phenomenon suggested PE>30 min/day for individuals might play a key role in strengthening the immune system and concomitantly fighting against COVID-19. It was also found that exercise duration decreased with the increase of age though exceptions were observed for 51-60 year aged groups (**Fig. 1**). As a whole, comorbid patients were more regular in exercise than non-comorbid patients, probably due to their physician's advice because of their underlying medical

conditions and obesity (**SI Table 1**). Interestingly, regular exercise habit was found beneficial for the patients because of obtaining better BMI among them ($18.5 < \text{BMI} < 25$) (**SI Table 1**). Thus, a strong relationship is observed between the regularity of PE and balanced BMI, leading them to fight against COVID-19.

It is worthwhile to mention that lack of proper sleep also reported responsible for the chronic diseases [67]. It was reported that pulmonary disease is associated with sleep apnea [68–71]. Besides, the severity of different diseases can worsen due to reduced sleep duration [68]. Furthermore, sleep duration/day was also reported to alter the severity of COVID-19 illness [72]. To keep this in mind those over again, we have also analyzed the association of sleep duration with the comorbid and non-comorbid COVID-19 respondents' severity and hospitalization (**Table 1**). When sleep duration was accounted for 7-8 hours of sleep duration per day was associated with less hospital admission rate and reduced severe symptoms for both types of patients (**Table 1**). Hospitalization requirements were decreased to 2.0% from 9.5% when sleep duration increased from 5-6 hours to 8+ hours for non-comorbid (**Table 1**). The scenarios for the comorbid patients were different. For instance, 8+ hours of sleeping was associated with 20% hospitalization. However, 7-8 hours of sleeping may be beneficial for them, requiring less hospital admission. Interestingly, moderate-level sleeping duration (6-7 hours followed by 7-8 hours) was identified as responsible with the least severe symptoms in the COVID-19 patients for comorbid patients. For non-comorbid patients, 6-7 hours of sleeping was associated with least severe symptoms. In fact, binary logistic regression analysis showed that non-comorbid patients who slept 6-7 hours/day had a lower association with severity (OR 0.898) and hospitalization (OR 0.823). The comorbid patients' chances of experiencing severe symptoms and being admitted to the hospital were both reduced by 31.1% and 42.8%, respectively. Generally, sleep supports both neuro behavioral and immunological memory (CD4^+ T cell) formation which might strengthen immune system [73,74]. In addition to that, patients with an average sleeping duration of 6-7 hours/day recovered comparatively quite faster (avg 19.0 and 17.2 days for comorbid and non-comorbid) than (**SI Fig. 10**). Taken together, regular exercise (>30 min/day) and proper sleep duration (6-8 hours/day) were found to be effective to reduce the severity and hospitalization due to COVID-19 infection based on our investigation.

4.3. Strengths and limitations

Our findings were coherent with previous studies. For instance, Brawner *et.al.* investigated 246 patients where peak METs were significantly lower ($p < 0.001$) among patients who were hospitalized (6.7 ± 2.8) compared with those not hospitalized (8.0 ± 2.4) [22]. Cho *et. al.* found that patients with moderate to vigorous physical activity were associated with a lower odds of COVID-19 morbidity [26]. Rowlands *et. al.* reported irregular sleep patterns had higher associating indication

for the COVID-19 [40]. Our investigation is coherent with the previous findings of the relationship of physical activity and proper sleep pattern with hospitalization due to COVID-19. But there is lack of combined report with specific PE and sleeping duration. In fact, no study reported degree of severity due to COVID-19 complications. This investigation meets the limitations of the previous investigations. Moreover, we adjusted the association of PE and sleeping habit with age, BMI, sex, habitation and comorbidity status which have significant influence on hospitalization and degree of severity because of COVID-19 infection. This investigation provides the baseline study where a proper sleep duration of 6-8 hours/day and regular exercise for >30 min/day are recommended. Implication of the key findings of this study will be beneficiary to overcome COVID-19 complications. Authority should take necessary steps to encourage the people to maintain proper lifestyle to reduce the risk of hospitalization and severe conditions.

However, only two Bangladeshi cities were selected for our study of recovered patients, none of which had a distinct community population. As a result, the sample size's diversity can be questionable. Clinical data are unavailable to us. The duration of the underlying medical conditions is not provided. Due to digital dialing, the interviewer and participants may provide inaccurate or biased information. However, the present study reconfirms the global guidelines that regular PE and quality sleep are associated with low severity and hospitalization.

5. Conclusion

We concluded from the present study that proper exercise and sleep for individuals could be useful parameters for maintaining a healthy life. They can be considered a protective factor and/or self-belief for not being at risk of hospitalization and showing severe symptoms due to COVID-19 infection. In a nutshell, >30 min/day of PE and more or less 6 to 8 hours of sleep/day may help if infected by COVID-19 to reduce the risk of hospitalization and severity. In order to avoid the prevalent risk of being affected by severe COVID-19 complications and hospital admission requirements, a sound sleeping habit (6 to 8 hours/day) and regular of PE (>30 min/day) are highly recommended.

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Supplementary Information: Attached.

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Supplementary Information

Association of physical exercise and sleeping habit with COVID-19 severity and hospitalization among the recovered individuals in Bangladesh

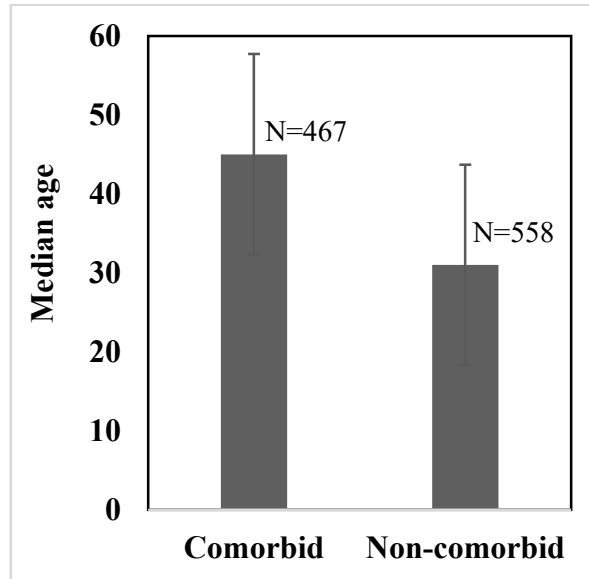


Figure S1: Median age of the comorbid and non-comorbid COVID-19 patients.

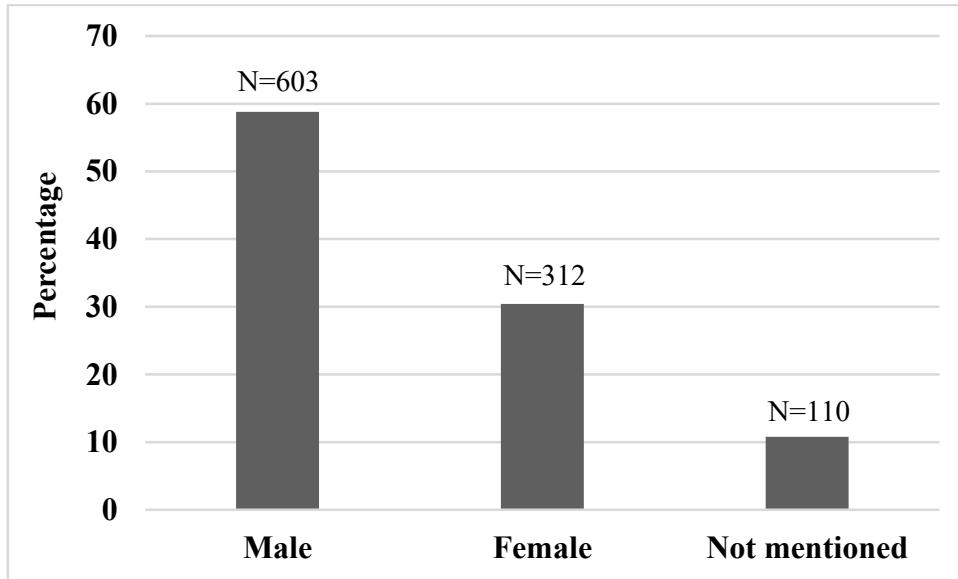


Figure S2: Demography of the COVID-19 patients according to their gender.

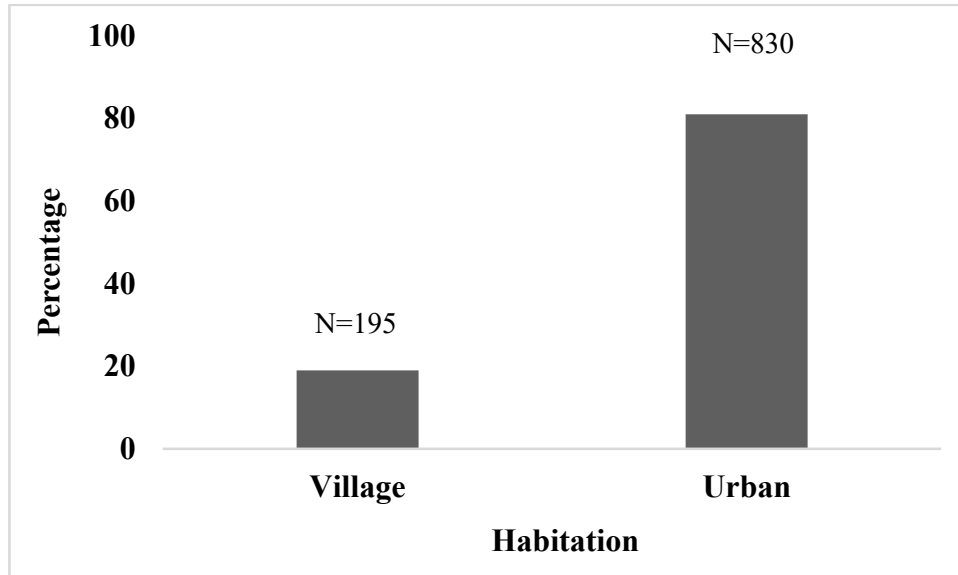


Figure S3: Habitation classification of the COVID-19 patients in village (N=195) and urban (N=830) area.

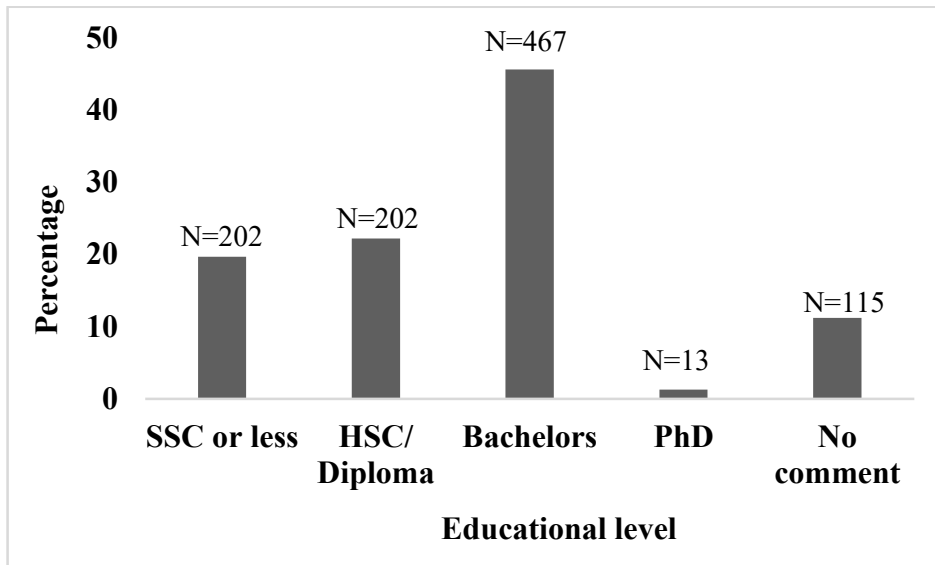


Figure S4: Educational levels of the COVID-19 patients. SSC (N=202), Bachelors (N=467), HSC/Diploma (N=228), PhD (N=13), No comment (N=115).

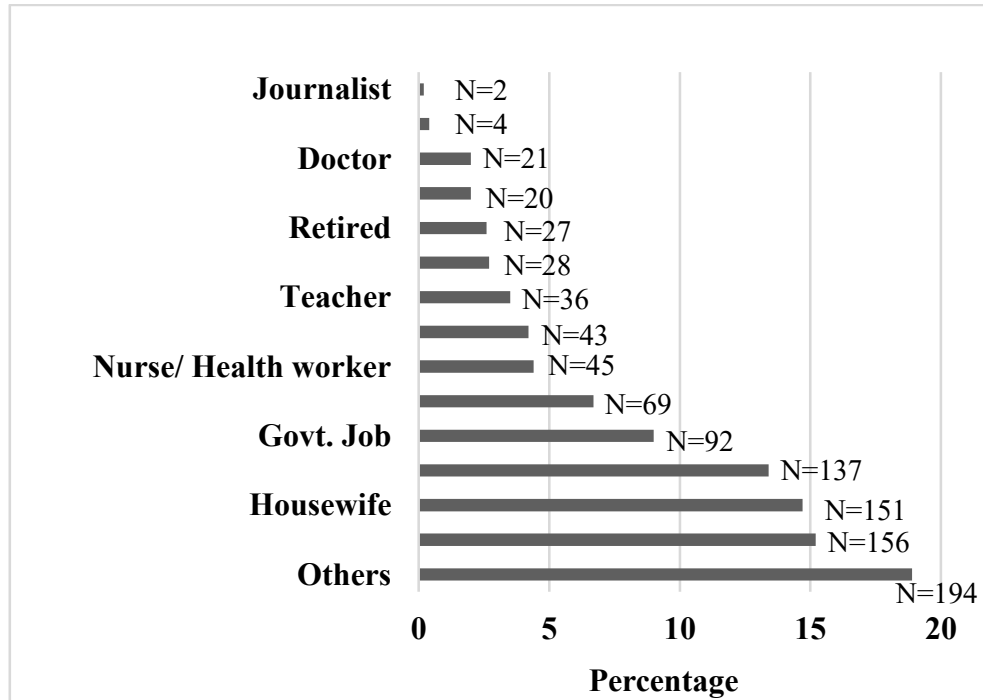


Figure S5: Occupational status/distribution of the COVID-19 patients.

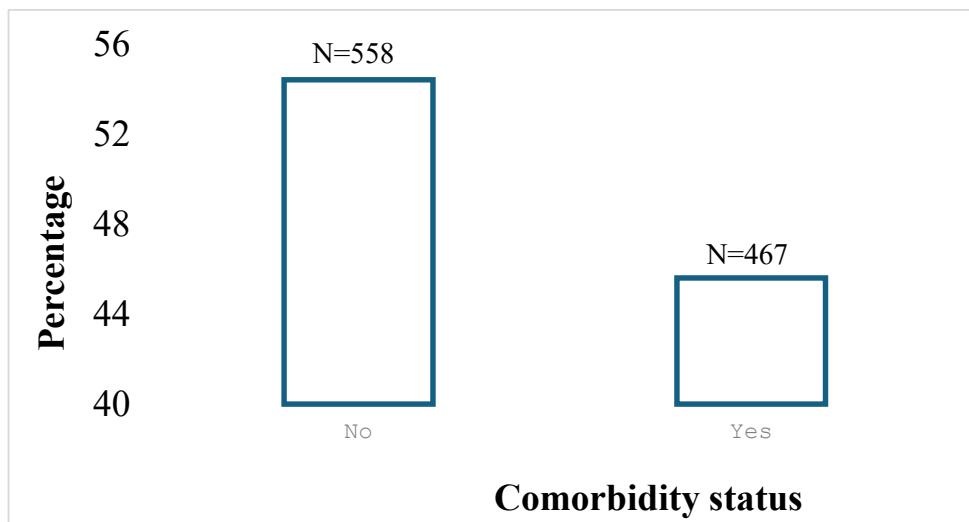


Figure S6: Comorbidity status of the COVID-19 patients, comorbid (N=467) and non-comorbid (N=558).

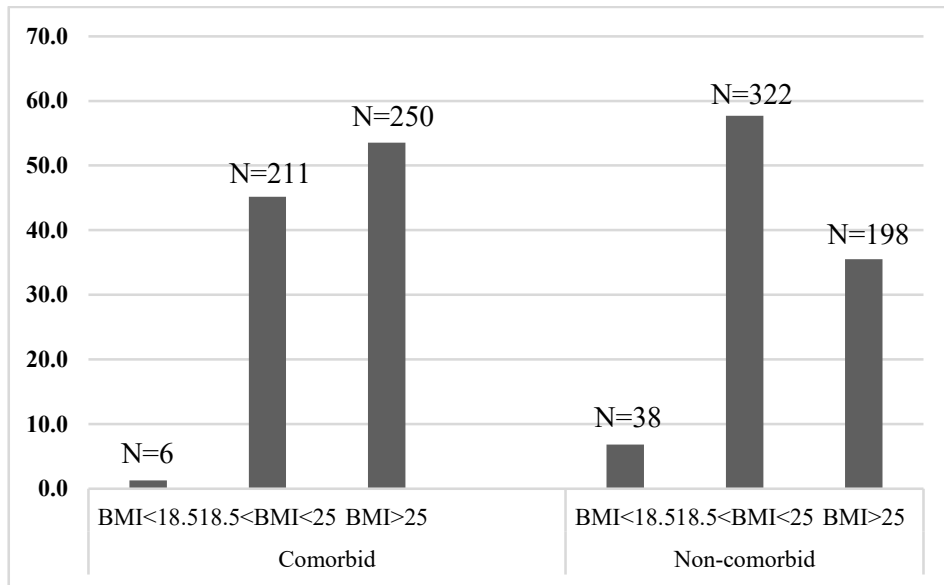


Figure S7: Obesity status of the COVID-19 patients.

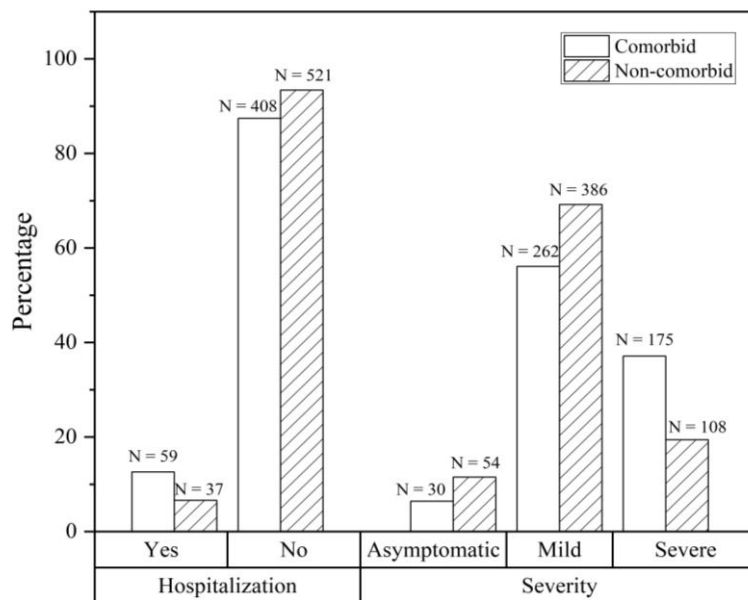


Figure S8: Hospitalization requirement and degree of severity of comorbid (N=467) and non-comorbid (N=558) patients.

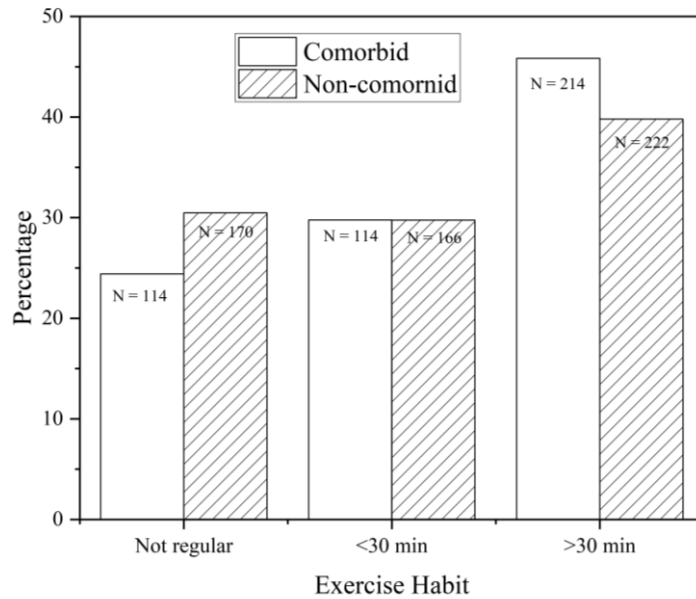


Figure S9: Exercise habit of comorbid (N=467) and non-comorbid (N=558) patients.

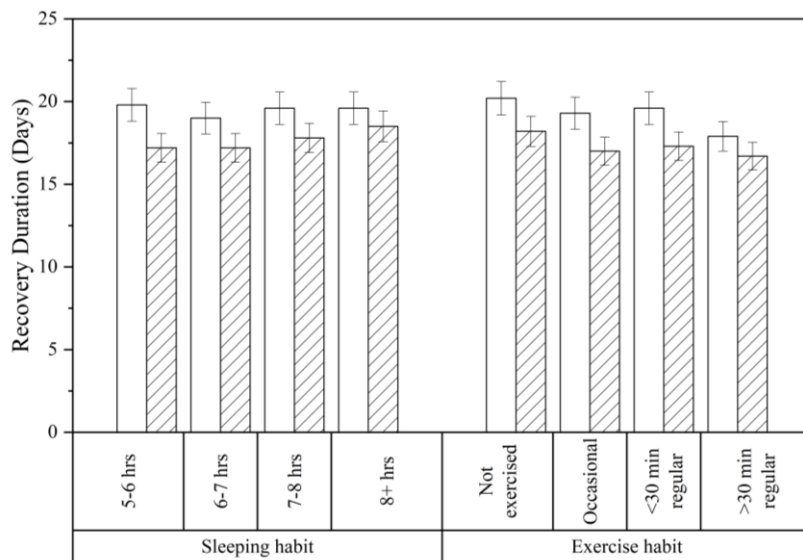


Figure S10: Days to recover from COVID-19 for patients with different sleeping and exercise habits.

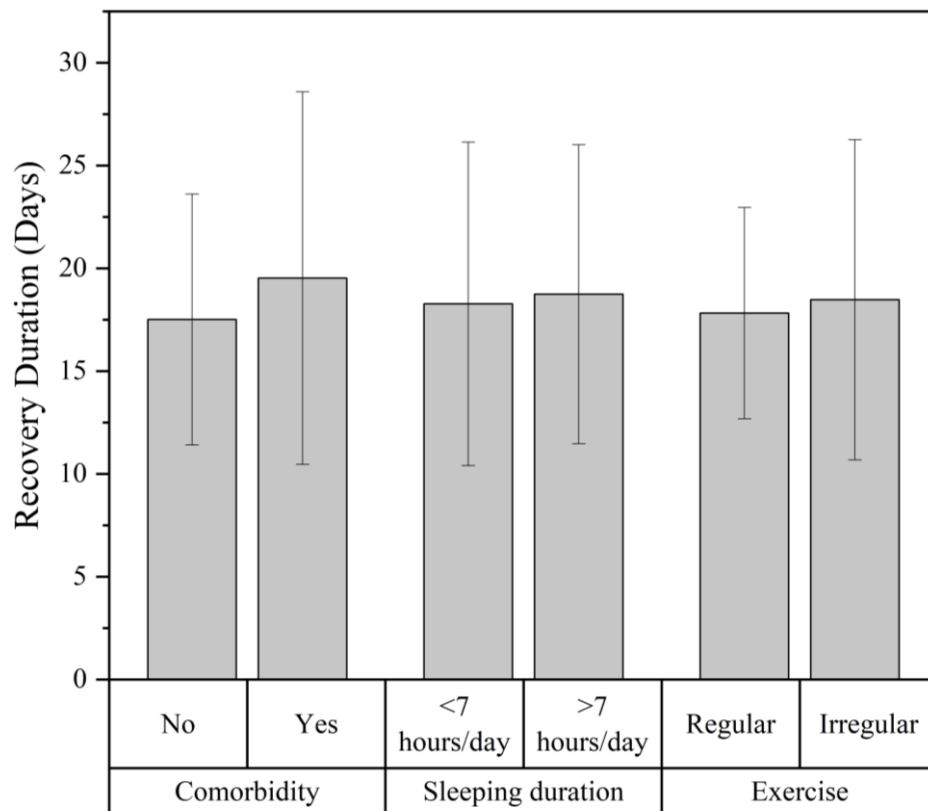


Figure S11: t-test of the duration of the recovery with respect to comorbidity status, sleeping duration and exercise habit.

Table S1 BMI status of different demographic parameters of COVID-19 patients (N=1025).

		Comorbid (467)			Non-comorbid (558)		
		BMI<18.5 (%)	18.5<BMI<25 (%)	BMI>25 (%)	BMI<18.5 (%)	18.5<BMI<25 (%)	BMI>25 (%)
Sex	Male	0.8	45.0	54.2	6.2	53.4	40.5
	Female	2.5	39.6	57.9	10.5	53.6	35.9
	Not mentioned	0.0	65.2	34.8	1.6	90.6	7.8
Habitation	Village	1.2	48.1	50.6	3.5	71.1	25.4
	Urban	1.3	44.6	54.1	7.7	54.3	38.1
Exercise Duration	Not regular	3.6	32.1	64.3	16.1	46.8	37.1
	Occasional	0.0	45.3	54.7	3.7	63.0	33.3
	<30 min/day regular	2.2	44.6	53.2	4.8	54.8	40.4
	>30 min/day regular	0.9	47.2	51.9	7.2	60.4	32.4
Sleeping Duration	5-6 hours/day	1.8	54.0	44.2	2.4	56.0	41.7
	6-7 hours/day	0.5	47.0	52.4	6.6	61.6	31.8
	7-8 hours/day	2.1	34.3	63.6	6.6	55.7	37.7
	8+ hours/day	0.0	51.7	48.3	16.3	46.9	36.7

Table S2 Degree of severity and hospital admission rate of different demographic parameters of COVID-19 patients (N=1025).

		Comorbid (N=467)					Non-comorbid (558)				
		Severity (%)			Hospitalization (%)		Severity (%)			Hospitalization (%)	
		Asymptomatic	Mild	Severe	No	Yes	Asymptomatic	Mild	Severe	No	Yes
Sex	Male	5.70	60.30	34.00	87.80	12.20	13.50	69.80	16.70	94.70	5.30
	Female	9.40	52.20	38.40	85.50	14.50	11.10	60.10	28.80	87.60	12.40
	Not mentioned	0.0	45.70	54.30	91.30	8.70	1.60	87.50	10.90	100.00	0.0
Educational level	SSC or less	11.10	59.30	29.60	91.70	8.30	12.80	77.70	9.60	90.40	9.60
	HSC/Diploma	4.90	53.90	41.20	85.30	14.70	14.30	69.80	15.90	93.70	6.30
	Bachelors	5.20	58.00	36.80	89.10	10.90	8.00	69.30	22.60	95.30	4.70
	PhD	0.0	40.00	60.00	100.00	0.0	0.0	100.00	0.0	100.00	0.0
	Not comment	5.60	50.00	44.40	74.10	25.90	19.70	52.50	27.90	88.50	11.50

Occupation	Armed/Semi-armed force	7.10	64.30	28.60	78.60	21.40	20.70	65.50	13.80	96.60	3.40
	Housewife	11.70	51.10	37.20	84.00	16.00	14.00	56.10	29.80	84.20	15.80
	Cleaning stuff	0.0	100.00	0.0	100.00	0.0	0.0	100.00	0.0	100.00	0.0
	Daily labour	0.0	75.00	25.00	100.00	0.0	8.30	83.30	8.30	91.70	8.30
	Retired	4.20	37.50	58.30	66.70	33.30	0.0	33.30	66.70	100.00	0.0
	Unemployed	0.0	43.80	56.30	93.80	6.30	8.30	83.30	8.30	100.00	0.0
	Others	4.10	68.40	27.60	87.80	12.20	15.60	74.00	10.40	95.80	4.20
	Journalist	0.0	0.0	100.00	0.0	100.00	0.0	0.0	100.00	100.00	0.0
	Banker	0.0	56.70	43.30	90.00	10.00	2.60	76.90	20.50	94.90	5.10
	Doctor	12.50	50.00	37.50	100.00	0.0	7.70	69.20	23.10	92.30	7.70
	Nurse/Health worker	5.60	61.10	33.30	94.40	5.60	18.50	63.00	18.50	92.60	7.40
	Teacher	4.50	45.50	50.00	90.90	9.10	7.10	50.00	42.90	85.70	14.30
	Student	16.00	44.00	40.00	100.00	0.0	10.70	74.10	15.20	99.10	0.90
	Govt. Job	4.80	69.00	26.20	85.70	14.30	10.00	64.00	26.00	88.00	12.00
	Private job	6.10	50.00	43.90	89.40	10.60	8.90	68.90	22.20	91.10	8.90
Habitat	Village	6.20	61.70	32.10	91.40	8.60	10.50	76.30	13.20	95.60	4.40
	Urban	6.50	54.90	38.60	86.50	13.50	11.70	67.30	20.90	92.80	7.20
BMI	<18.5	33.3	33.3	33.3	100.0	0.0	31.6	50.0	18.4	97.4	2.6
	18.5-25	5.2	59.2	35.5	85.8	14.2	8.4	74.8	16.8	95.3	4.7
	>25	6.8	54.0	39.2	88.4	11.6	12.6	63.6	23.7	89.4	10.6
Exercise habit	Not regular	7.10	60.70	32.10	89.30	10.70	27.40	62.90	9.70	93.50	6.50
	Occasional	10.50	50.00	39.50	82.60	17.40	6.50	68.50	25.00	92.60	7.40
	<30 min/day regular	5.80	58.30	36.00	87.10	12.90	10.20	66.90	22.90	92.20	7.80

	>30 min/day regular	5.10	56.5 0	38.3 0	89.30	10.70	10.40	73.0 0	16.7 0	94.60	5.40
	5-6 hours/day	3.50	54.9 0	41.6 0	79.60	20.40	27.40	62.9 0	9.70	90.50	9.50
Sleeping duration	6-7 hours/day	8.10	59.5 0	32.4 0	89.70	10.30	6.50	68.5 0	25.0 0	92.60	7.40
	7-8 hours/day	6.40	55.0 0	38.6 0	92.10	7.90	10.20	66.9 0	22.9 0	94.60	5.40
	8+ hours/day	6.90	44.8 0	48.3 0	79.30	20.70	10.40	73.0 0	16.7 0	98.00	2.00

Table S3: Pearson Chi-Square tests.

	χ^2	df	Asymptotic Significance (2-sided)
Degree of severity			
Age	1032.375	1	<0.001
BMI	1038.423	2	0.01
Sex	1039.023	2	0.01
Habitation	1033.279	1	0.02
Comorbidity	35.688	1	<.001
Exercise regularity	1035.433	1	<.001
Sleeping habit	1029.151	1	p<0.001
Hospitalization admission			
Age	1034.567	1	0.001
BMI	1033.862	2	0.004
Sex	1040.283	2	<.001
Habitation	1031.938	1	0.01
Comorbidity	10.793	1	<.001
Exercise regularity	1030.875	1	<.001
Sleeping habit	1033.037	1	<.001

Table S4 (a): t-test for Equality of Means of recovery of duration.

		t	df	Sig. (2-tailed)	Mean Diff.	Std. Error Diff.	95% Confidence Interval of the Diff.	
							Lower	Upper
Comorbidity	Assumed	-3.984	904	<0.001	-2.018	0.506	-3.012	-1.024
	Not assumed	-3.869	709.023	<0.001	-2.018	0.522	-3.042	-0.994
Exercise regularity	Assumed	-0.589	904	0.556	-0.650	1.105	-2.818	1.518
	Not assumed	-0.848	64.572	0.400	-0.650	0.767	-2.182	0.882
Sleeping habit	Assumed	-0.877	904	0.001	-0.467	0.533	-1.513	0.579
	Not assumed	-0.897	697.982	0.001	-0.467	0.521	-1.490	0.555

Table S4 (b): t-test statistics for recovery duration.

		N	Mean	Standard Deviation	Standard Error Mean
Comorbidity	No	488	17.51	6.10	0.275
	Yes	418	19.52	9.06	0.44
Exercise regularity	Regular	418	17.82	5.137	0.719
	Irregular	488	18.47	7.786	0.266
Sleeping habit	<7 hours	587	18.27	7.866	0.325
	>7 hours	319	18.74	7.270	0.407

Table S5: R squared value and 2log likelihood analysis.

	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
Degree of severity			
Step 1	1166.094 ^a	0.040	0.023
Step 2	1158.899 ^b	0.047	0.044
Hospital admission			
Step 1	626.613 ^a	0.010	0.050
Step 2	616.139 ^a	0.021	0.061
Step 3	610.924 ^b	0.025	0.055

Table S6: Forward regression models for identifying best fit.

		Chi-square	Df	Sig.	-2 log likelyhood
Degree of severity (R² = 0.75)					
Step 1	Step	41.827	1	<0.001	1166.094 ^a
	Block	41.827	1	<0.001	
	Model	41.827	1	<0.001	
Step 2	Step	7.195	2	0.02	1158.899 ^b
	Block	49.022	3	<0.001	
	Model	49.022	3	<0.001	
Hospitalization admission (R² = 0.82)					
Step 1	Step	10.776	1	<0.001	626.613 ^a
	Block	10.776	1	<0.001	
	Model	10.776	1	<0.001	
Step 2	Step	10.474	2	0.005	616.139 ^a
	Block	21.250	3	<0.001	
	Model	21.250	3	<0.001	
Step 3	Step	5.216	1	0.02	610.924 ^b
	Block	26.466	4	<0.001	
	Model	26.466	4	<0.001	