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[Amar Ali Moussa](#) ^{*}, [Marwa Mohammad](#), Andreas Halgreen Eiset, Signe Freja Storgaard, [Christian Wejse](#)

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Article

COVID-19 Readmission Is Highest Among Refugees in Denmark

Amar Ali Moussa ^{1,†,‡,*}, Marwa Mohammad ^{1,‡}, Andreas Halgreen Eiset ¹, Signe Freja Storgaard ¹ and Christian Wejse ^{1,2}

¹ Department of Public Health, Aarhus University, Aarhus, Denmark

² Department of Infectious Diseases, Aarhus University Hospital, Aarhus, Denmark

* Correspondence: amar-moussa@hotmail.com; Tel.: +45-53276008

[†] Current address: The Research Unit for Global Health, Department of Public Health, Aarhus University.

[‡] These authors contributed equally to this work.

Abstract: In several countries, a higher incidence of COVID-19 is seen in vulnerable groups including certain immigrant groups compared to host population. This study compared the severity of COVID-19 at the onset of admission and the odds ratio (OR) of COVID-19 readmission within 30 days among Refugees, Others, and native Danes. This cross-sectional study was based on clinical data from 159 COVID-19 positive patients admitted at hospitals in Region Midtjylland in 2020. The medians with interquartile ranges revealed no major differences between the groups in status at admission based on certain clinical parameters or biomarkers. Refugees (51.8%) and Others (41.7%) had less comorbidities than native Danes (61.2%) in the Charlson Comorbidity Index (CCI). Native Danes constituted the largest percentage of the highest CCI scores. 17.5% of all 159 patients were readmitted. The readmission prevalence among Refugees was 23.1%, 8.3% in Others, and 17.0% in native Danes. When adjusting for age, sex, and CCI, Refugees had an OR of 1.88 (95% CI, 0.61-5.74) and Others had an OR of 0.61 (95% CI, 0.07-5.41) of readmission compared to native Danes. Refugees had the highest prevalence and adjusted OR for COVID-19 14 readmission. However, the results of the logistic regression were not statistically significant

Keywords: COVID-19; migrant health; refugee health; readmission; COVID-19 status at admission

1. Introduction

The Coronavirus Disease 2019 (COVID-19) is a respiratory infection causing a worldwide pandemic affecting all layers of society. Initially in Denmark, COVID-19 cases were primarily found amongst the well-educated and globalized individuals but in a short time, the infection spread to less privileged individuals [1]. Throughout the pandemic, Western countries including Denmark, found higher COVID-19 incidences among certain immigrant groups compared with host population [1–4].

In 2019, 10% of the Danish population consisted of immigrants and 58% were from non-Western countries [5]. A report from the Danish Health Authority has shown that immigrants from Iran, Turkey, Pakistan, Somalia, Lebanon, Ex-Yugoslavia, and Iraq have a higher burden of disease compared to native Danes. This report also found a higher incidence of a range of diseases; diabetes, chronic respiratory disease, and heart diseases [6]. These comorbidities have shown to be risk factors for severe COVID-19 outcomes [7,8], raising concern for immigrant groups with a high incidence of COVID-19 and comorbidities. Furthermore, immigrants and refugees are also at high risk for other infectious diseases such as HIV [9], tuberculosis [9], HPV [9], and hepatitis [9].

Some immigrant groups including immigrants from Iran, Turkey, Pakistan, Ex-Yugoslavia, Poland, Sri Lanka, Lebanon, Syria, Afghanistan, and Iraq are likely to have lower socioeconomic status (SES) in terms of poorer educational, economical, and occupational parameters compared to native Danes [5]. SES is known to affect health status in general; low SES has generally a negative

effect on health status. Low SES is associated with higher incidence of several somatic diseases, psychiatric diseases, and lower remaining lifetime. SES also relates to housing conditions and type of employment, factors that affect the transmission of COVID-19 [1,5,6,10].

Not only are immigrants at higher risk of COVID-19 transmission but studies have shown their COVID-19 outcomes are more severe compared to host populations [2,4]. Certain vital parameters, biomarkers, and clinical factors have been used as predictors for severe outcomes of COVID-19; C-reactive protein (CRP), lactate dehydrogenase (LDH), D-dimer, body temperature, and peripheral oxygen saturation (SAT) [11–17]. Additionally, older age, male sex, smoking, high BMI, and comorbidities have emerged as important risk factors for adverse outcomes such as readmission [7,17–21]. Readmitted patients may be at increased risk of hypoxia and death [22].

Lower SES and higher incidence of comorbidities and COVID-19 among immigrants raises concern that immigrants potentially could be a vulnerable group concerning adverse outcomes of COVID-19. Data on immigrants with COVID-19 in Denmark are limited. Therefore, it is necessary to clarify the characteristics and outcomes of the COVID-19 cases in the Danish population focusing on the role of immigrant status and more targeted public health interventions among immigrants [23]. This study will investigate how immigrant status affects the severity of COVID-19 at admission and the COVID-19 outcome, using readmission as a variable for the severe outcome. The hypothesis is that a difference in COVID-19 readmission does not exist in the study population after adjustment for certain variables.

2. Materials and Methods

2.1. Study Design and Study Population

This cross-sectional study was based on clinical data from patients admitted at hospitals in Region Midtjylland (including Aarhus University Hospital, the Regional Hospital in Horsens, the Regional Hospital in Viborg, the Regional Hospital in Goedstrup) due to COVID-19 from the 1st January 2020 till 4th November 2020. COVID-19 was confirmed with a positive real-time reverse-transcriptase-polymerase-chain-reaction (RT-PCR) assay of a pharyngeal swab. The study population included 159 patients with a positive COVID-19 test, above 18 years of age, and one prior hospital discharge after treatment for COVID-19. The study excluded five patients, due to death during their first COVID-19 admission.

The study population was divided into three groups according to asylum-generating country of origin, other countries of origin, and native Danes. Asylum-generating countries are Syria, Somalia, Afghanistan, Iraq, and individuals with Palestinian and Kurdish roots [1,5,24–26]. Those deriving from asylum-generating countries were assumed to have a Danish residence permit through asylum application i.e., “Refugees”. Other countries of origin were Turkey, Iran, Ex-Yugoslavia, Poland, England, Sri Lanka, and Comoro, assuming immigrants from these countries were holders of a Danish residence permit for work, education, family reunification, etc. Patients from these countries were defined as “Others” [5,25,27]. The group, “native Danes”, were defined as individuals with a Danish ethnicity and used as the reference group [6].

2.2. Data Collection and Variables

Patient data such as age, sex, smoking, BMI, comorbidities, immigrant status, clinical parameters, biomarkers, and readmission was based on quantitative survey for COVID-19 hospital-admitted patients. The sex of the patients was obtained by the Central Person Register (CPR). The exposure in this study was immigrant status. The outcomes were COVID-19 readmission within 30 days and status at admission characterized by temperature, SAT, CRP, D-dimer, and LDH. The Charlson Comorbidity Index (CCI) was used as a measure of comorbidity, thus not studying the effect of specific comorbidity. The CCI predicts 10-year survival in patients with multiple comorbidities using a scoring system dependent on the specific comorbidity [28–30]. However, the CCI has been used in several COVID-19 studies to measure the comorbidity burden [21,31,32]. In this

study, this version of CCI was not adjusted for age, as age was an independent variable in the adjusted model.

2.3. Statistical Analysis

Logistic regression was used for the statistical analysis, immigrant status being exposure and readmission within 30 days being event, providing an Odds Ratio (OR) as an outcome along with a 95% confidence interval (CI). A crude and two adjusted models were created. All reported p-values were two-sided with $p < 0.05$ considered statistically significant. Model 1 was adjusted for age, and sex while model 2 was additionally adjusted for CCI.

3. Results

Table 1 describes the baseline characteristics for Native Danes, Refugees, Others, and a column with unknown immigrant status and missing data. The study included 116 native Danes, 27 Refugees and 12 Others. The median age was lower among Refugees and Others compared to native Danes; respectively 54 [39–61], 53 [45–62], and 67 [52–75]. The study included 43.4% females. All groups had a median body temperature that was sub-febrile or febrile at admission. CRP was elevated for all groups at admission. The three groups had similar median CCI-score. In total, 27 of 159 patients (17.5%) were readmitted in relation to COVID-19. The highest COVID-19 readmission percentage was among Refugees with 23.1% compared to 8.3% among Others and 17.0% among native Danes.

Table 2 illustrates the distribution of CCI scores in the different groups. Table 2 showed that 48.2% of Refugees, 58.3% of Others, and 38.8% of native Danes had no comorbidities. In general, the distribution of Refugees and Others were primarily 0-2 points and a lower percentage of these groups scored 3-7 points compared to native Danes. There was no missing data in terms of comorbidities, but the unknown column represented missing data on immigrant status.

Table 3 illustrates the OR (95% CI) for COVID-19 readmission among the groups. The Refugees' and Others' crude OR for readmission was respectively 1.47 (95% CI, 0.52-4.14) and 0.44 (95% CI, 0.05-3.65) compared to native Danes. In model 1, the OR (95% CI) for readmission for Refugees and Others was respectively 1.89 (95% CI, 0.62-5.79) and 0.63 (95% CI, 0.07-5.47). In model 2, the OR (95% CI) for readmission for Refugees and Others was respectively 1.88 (95% CI, 0.61-5.74) and 0.61 (95% CI, 0.07-5.41) showing that Refugees had the highest odds of readmission.

Table 1. Baseline characteristics of COVID-19 patients.

Characteristics	All	Native Danes	Refugees	Others	Unknown*
Total ^a	159 (100%)	116 (73%)	27 (17%)	12 (7.5%)	4
Age ^b , years	59 [50–73]	67 [52–75]	54 [39–61]	53 [45–62]	2
Sex ^a , female	69 (43.4%)	51 (44%)	11 (40.7%)	6 (50%)	0
Smoking					
Never	74 (54.8%)	51 (50.8%)	13 (65.0%)	7 (77.8%)	24c
Former	52 (38.5%)	45 (44.1%)	5 (25.0%)	1 (11.1%)	
Current	9 (6.7%)	6 (5.9%)	2 (10.0%)	1 (11.1%)	
BMI ^b , kg/m ²	26.7 [24.2-30.4]	26.5 [24.2-30.3]	26.7 [24.6-34.2]	29.4 [24.0-35.2]	22
Clinical parameters**					
Body temperature ^b , ^d	38.3 [37.7-39.1]	38.3 [37.7-39.2]	38.5 [37.5-39.1]	37.8 [37.3-39.2]	10
SAT ^b , %	96 [94–97]	95 [94–97]	97 [95–99]	97 [96–99]	10
Clinical parameters**					

CRP ^b , mg/L	42 [18-91]	43 [18-109]	35 [24-83]	48 [4-86]	38
D-dimer ^b , mg/L (FEU)	0.7 [0.4-1.1]	0.7 [0.5-1.3]	0.6 [0.3-1.1]	0.8 [0.4-3.8]	102
LDH ^b , U/L	239 [173-348]	247 [187-357]	190 [158-269]	284 [166-357]	95
CCI ^b	1 [0-2]	1 [0-2]	1 [0-2]	0 [0-1]	0
COVID-19 readmission ^a					
Yes	27 (17.5%)	19 (17.0%)	6 (23.1%)	1 (8.3%)	
No	127 (82.5%)	93 (83.0%)	20 (76.9%)	11 (91.7%)	5

a: Total number (%), b: Median [interquantile range], c: Total number of missing data smoking, d: Degrees Celcius, *Total number of missing data, **The clinical parameters and biomarkers were obtained at the onset of admission. Abbreviations: COVID-19, Corona Virus Disease 2019; BMI, Body Mass Index; CRP, C-Reactive Protein; FEU, Fibrinogen-Equivalent Units; LDH, Lactate Dehydrogenase; SAT, Saturation; CCI, Charlson Comorbidity Index.

Table 2. Charlson Comorbidity Index*.

CCI	All (n = 159)	Native Danes (n = 116)	Refugees (n = 27)	Others (n = 12)	Unknown (n = 4)
0	67 (42.1%)	45 (38.8%)	13 (48.2%)	7 (58.3%)	2 (50.0%)
1	42 (26.4%)	32 (27.6%)	7 (25.9%)	3 (25.0%)	0
2	33 (20.8%)	25 (21.6%)	6 (22.2%)	1 (8.3%)	1 (25.0%)
3	6 (3.8%)	6 (5.2%)	0	0	0
4	5 (3.1%)	3 (2.6%)	1 (3.7%)	1 (8.3%)	0
5	2 (1.3%)	2 (1.7%)	0	0	0
6	2 (1.3%)	1 (0.9%)	0	0	1 (25.0%)
7	2 (1.3%)	2 (1.7%)	0	0	0

*Total number (%).

Table 3. Odds Ratios (OR) for Readmission with COVID-19 Patients.

Group	Model 1*		Model 2**	
	Crude OR (95% CI)	p-value	Adjusted OR (95% CI)	p-value
Native Danes	1.0	-	1.0	-
Refugees	1.47 (0.52–4.14)	0.47	1.89 (0.62–5.79)	0.26
Others	0.44 (0.05–3.65)	0.45	0.63 (0.07–5.47)	0.67

*Model 1: Adjusted for age and sex, **Model 2: Adjusted for age, sex, and CCI.

4. Discussion

A difference in status at admission between Refugees, Others, and native Danes was not notable based on certain clinical parameters and biomarkers. Overall, the results showed that Refugees and Others had less comorbidities than native Danes while Refugees had the highest adjusted OR for readmission. This could be explained by the fact that native Danes were the oldest group and the risk of comorbidities increases with age [33,34].

COVID-19 is a relatively new infection, the literature about the disease is limited and it is still unclear on which clinical parameters, biomarkers, and comorbidities are the main risk factors for a severe COVID-19 outcome [11].

Several reasons have been suggested to explain the difference in COVID-19 incidence among vulnerable groups compared to host populations. One of the main reasons is the housing and family conditions. Immigrants generally live with more people and more family generations in fewer square meters compared to native Danes [1]. This can complicate isolation and makes the elder immigrants more vulnerable to COVID-19 transmission. Furthermore, immigrants are overrepresented in occupations with a high potential of exposure to COVID-19 and close physical proximity to others such as transportation, travel agencies, cleaning services, hotels, restaurants, health services, and social services. These businesses are closely related to the COVID-19 positive cases in Denmark, according to The Danish State Serum Institute [35]. Additionally, it is suggested that the national campaigns with information and precautions on COVID-19 have an inadequate effect among some immigrants due to the language barrier and lack of education. Despite the written translations in several languages from the Danish Health Authority, 43 some immigrants have limited reading skills in their native language, especially the elderly [1].

Several studies have indicated that race was not an independent risk factor for severe COVID-19 outcomes [1,20,35–40]. An American study using a 2-month observation period from discharge showed that 9,504 (9%) of 106,543 surviving patients (85%) were readmitted. When adjusting for risk factors for COVID-19, White persons were more likely to be readmitted compared to other racial groups [36].

A Korean study has shown that 328 (4.3%) of 7590 patients were readmitted and patients with medical benefits had a higher risk of readmission. Thus, indicating that SES influences the transmission and outcome of COVID-19 [37,38]. Another study has shown that the hospitalization rate was higher among Hispanic patients than among Black or White patients. However, the mortality rate was higher among White patients than among Black or Hispanic patients; this finding is potentially explained by higher proportions of White patients in the oldest age groups [39]. Another study has shown that COVID-19 positivity and high risk of hospitalization were associated with Black race, but it was not associated with a higher risk of intensive care unit admission [20]. Thus, suggesting that the prevalence of COVID-19 might depend on immigrant status but might not independently increase the risk of severe outcomes. This is also supported by another American study which has shown that race was not significantly associated with ICU treatment or mortality [40].

Hospital readmissions can have a negative impact on patient outcomes and increase hospital expenses. Reasons for hospital readmissions are not fully understood but poor care coordination after discharge and poor follow-up care have been suggested as important factors [41]. A study suggests that patients with lower SES were less likely to discuss health concerns with health professionals after discharge. Moreover, the study showed that male patients were less likely to understand self-care after discharge compared to females [41]. A late response to signs of progress of COVID-19 might explain why some patients need readmission and contribute to longer readmission. A short admission could lead to readmission due to less adequate treatment on the first admission [42].

COVID-19 restrictions might also affect the course of admission and readmission. Visiting restrictions have been implemented at the hospitals for example only one visitor during an admission [43]. This could be difficult for immigrant patients since they are to a greater extent used to be surrounded by many family members [1]. This might also complicate language barriers between patients and health care professionals. An American study has shown that patients receiving interpretation at admission and/or discharge were less likely to be readmitted within 30 days compared with patients receiving no interpretation [44]. The free translation opportunities in Denmark are only available to selected patients and therefore relatives of the patients are often used as translators [45,46].

One of the limitations of this study is the small sample size which might have limited the estimates of the logistic regression. The small sample size could also have affected the difference in status at admission between the groups, especially in the variables with a high number of missing data [47,48]. Additionally, selection bias is a limitation in this study as the statistical analysis only included complete cases and thus missing data was not taken into account. Furthermore, the logistic regression only adjusted for certain variables. However, these variables were prioritized based on the current evidence on important variables affecting the severity of COVID-19 outcomes.

The study included patients from a whole region in Denmark, Region Midtjylland, thus making the results more representative of all cases in Denmark. Another strength of this study is the grouping of the study population because it considers the differences in SES depending on immigrant status [5]. Thus, giving a more valid result on how immigrant status affects readmission.

5. Conclusions

In summary, a difference in status at admission between Refugees, Others, and native Danes was not notable based on body temperature, SAT, CRP, D-dimer, and LDH. Overall, Refugees and Others had less comorbidities than native Danes. The results showed that 27 (17.5%) of 159 patients were readmitted in relation to COVID-19 and Refugees had the highest prevalence among the groups. A difference in OR for readmission between the groups was found after adjustment for certain variables; the adjusted OR was highest among Refugees. However, the ORs were not statistically significant.

Further investigation is needed to understand the association of immigrant status on status at admission and readmission in COVID-19 patients.

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Data Availability Statement: The data presented in this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

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