Age and chest radiography as possible parameters for rapid triage in COVID-19 outbreak surge

Wei Enli Wycliffe (wycliffe.wei@mohh.com.sg)
National Centre for Infectious Diseases, Singapore
Tan Cher Heng
Tan Tock Seng Hospital, Singapore
Monica Chan
National Centre for Infectious Diseases, Singapore
Tan Thuan TOng
Singapore General Hospital
Surinder Kaur Pada
Ng Teng Fong General Hospital, SIngapore
Sophia Archuleta
National University Hospital, Singapore
Ooi Say Tat
Khoo Teck Puat Hospital, Singapore
Loh Jiashen
Sengkang General Hospital
Raymond Fong Kok Choon
Changi General Hospital, Singapore
Thoon Koh Cheng
KK Women's and Children's Hospital, Singapore
Louisa Jin Sun
National University Hospital, Singapore
Shawn Vasoo
National Centre for Infectious Diseases, Singapore
Vernon JM Lee
Ministry of Health, Singapore
Leo Yee Sin
National Centre for Infectious Diseases, Singapore
David C Lye
National Centre for Infectious Diseases, Singapore
Matthias PHS Toh
National Centre for Infectious Diseases, Singapore

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Abstract

Background

To evaluate the utility of age and chest radiography(CXR) in triaging COVID-19 patients for hospitalization versus isolation in non-hospital facilities, we examined how age and CXR at diagnosis were associated with clinical needs from late-January to early-April.

Methods

Clinical status of all COVID-19 cases was monitored for national disease surveillance. Cases were isolated in hospitals until SARS-CoV-2 RNA was undetectable on PCR. Age and CXR results on admission were analysed for association with oxygen supplementation and mechanical ventilation, the outcomes of interest.

Results

Till 4 April 2020, there were 1,481 COVID-19 cases in Singapore. Overall, 11.4% required supplemental oxygen while 4.8% required mechanical ventilation and intensive care. The respective proportions increased to 40.9% and 16.5% for cases aged ≥70 years. As a predictor of subsequent mechanical ventilation, age had an area under the receiver operator characteristic curve(AUROC) of 0.772 (95%CI:0.699-0.845). A combined criterion of either an abnormal CXR or age≥55 years had a sensitivity of 86.7% and specificity of 58.0% for the same outcome. A similar performance was observed for predicting oxygen supplementation needs.

Conclusions

Age and CXR at diagnosis may be valuable in excluding severe disease, allowing safe triage for isolation in non-hospital facilities.

Introduction

Healthcare systems can be easily overwhelmed in a sudden outbreak surge of COVID-19 such as in Wuhan(1–3), Lombardy(4) or New York(5). Singapore encountered a surge of COVID-19 cases in April 2020, coinciding with outbreaks in migrant worker dormitories(6). A policy of institutional rather than home-based isolation had been adopted, as the former was shown to be better in containing community spread(7). The sudden surge in cases posed a challenge to this and non-hospital isolation facilities were set up to manage the surge in cases.

While isolation in non-hospital facilities would avoid overwhelming hospitals reserved for cases requiring medical care, there was a need to determine if a COVID-19 patient could be safely managed in this way. We needed simple and sensitive triage tools in an outbreak involving thousands of new cases daily, many

of whom were migrant workers that did not speak local languages with possible undiagnosed comorbidities. Such rapid triage tools are thus crucial for responses to outbreak surges.

Validated predictors of COVID-19 severity require a combination of clinical and laboratory markers; COVID-GRAM involves age, CXR, dyspnoea, haemoptysis, unconsciousness, comorbidities, history of cancer, neutrophil to lymphocyte ratio, lactate dehydrogenase and direct bilirubin(8) while CALL requires age, comorbidities, lymphocytes and lactate dehydrogenase (9). In contrast, age and CXR are readily available information that may offer a simple yet sensitivity triage tool. COVID-19 severity and mortality have been associated with older age (10,11) and chest radiography(CXR) abnormalities(12,13). As possible triage parameters, the performances of age and CXR in predicting severe disease are of interest.

This study aimed to evaluate the age-related effects on COVID-19 severity and to characterise the performance of age and CXR at initial diagnosis in predicting severe disease.

Materials And Methods

Singapore is an island-state that reported its first imported COVID-19 case on January 23, 2020. We examined all cases reported in Singapore from then to April 7, 2020, the day after which stringent social distancing measures and activity restrictions were implemented(14). Up to 20 March 2020, all patients were isolated and managed in isolation or cohort wards in hospitals. Thereafter, low-risk patients were managed in isolation facilities in the community(15). Cases were isolated until they were deemed non-infectious by two consecutive negative SARS-CoV-2 PCR tests at least 24 hours apart on nasopharyngeal swabs.

COVID-19 cases were detected through contact tracing, surveillance and active case finding, the details of which were described previously(16). Suspect case definitions were based on high-risk exposures and acute respiratory symptoms, and diagnosis was confirmed through SARS-CoV-2 PCR testing. All laboratories and physicians were required to notify the Ministry of Health when a case was confirmed. Furthermore, hospitals are required to submit daily clinical status updates on COVID-19 cases to the Ministry of Health (MOH), Singapore. These comprise information on oxygen supplementation and intensive care needs of each patient admitted.

Additionally, data on CXR routinely performed at admission were collected for patients admitted to National Centre for Infectious Diseases (NCID) that managed the majority (62.3%) of COVID-19 patients during the study period. NCID is the national isolation and treatment centre for COVID-19. It received cases identified by epidemiological investigations and cases that presented for medical attention at primary care, including its emergency department. An abnormal CXR suggestive of pneumonia was defined as any opacities regardless of severity.

The 2019 resident population of Singapore (5.63 million), comprising citizens and permanent residents, was used in the calculation of incidence rates. Age and gender distributions of the non-resident

population which comprised work and visit pass holders were unavailable and thus age and gender-specific incidence rates were not calculated for this subgroup.

The primary outcome of interest in this study is oxygen requirement and intensive care unit admission. Patients on any form of oxygen supplementation (administered if oximetry $\leq$94%) were considered to be receiving supplemental oxygen. Intensive care patients were mechanically ventilated via endotracheal intubation. The duration of disease was defined as the time from disease onset to discharge from isolation and care in hospital.

There was a change in the management and isolation of cases from March 20, 2020, where clinically stable patients still tested positive on PCR were transferred from hospitals to community isolation facilities. As such, analyses of hospital discharge rates were limited to the period up to this date. Other outcomes were determined up to April 7, 2020.

Event-time data was obtained for initial isolation, oxygen supplementation, mechanical ventilation and discharge from hospital. Analysis of event-time data was by Kaplan-Meier survival analysis and hazard ratios were evaluated with the Cox proportional hazards model. Adjusted hazard ratios (aHR) controlled for gender and age group unless otherwise stated. Proportions of cases requiring a level of care were ascertained by obtaining Kaplan-Meier failure estimates at day 30 from the start time; longer time scales demonstrate little change, if any, of these estimated proportions. Time that 50% of cases requiring a certain level of care was obtained by considering time-to-event for cases with the event only, along with the 25th and 75th percentiles.

Performance of age and abnormal CXR at diagnosis as predictive criteria for the primary outcome of oxygen requirement and intensive care unit admission was evaluated among cases who had at least 30 days of follow-up at the end of the study period. A receiver operator characteristic (ROC) curve was plotted for age based on all subjects. Sensitivity, specificity, positive and negative predictive values were calculated for abnormal CXR among NCID patients (as CXR data was available for this subgroup). The test performance of either an age cut-off or abnormal CXR was met was evaluated for the latter subgroup. All statistical analyses were performed with Stata 15 (StataCorp, TX, USA).

The collection of data and the analysis was performed for national disease surveillance as approved under the Ministry of Health and the legal provisions of the Infectious Diseases Act in Singapore, with waiver of informed consent.

Results

As of April 7, 2020, a total of 1,481 COVID-19 cases were detected in Singapore. The median age was 37 years (interquartile range [IQR] 27-53 years). The majority of cases (922/1,481, 62.3%) was admitted to NCID.

Of these cases, 923 (62.3%) were Singapore residents, 503 (34.0%) were non-residents and 55 (3.7%) were visitors. Among residents, the incidence was 22.9 cases per 100,000 population. The 20-29 age group had the highest incidence of COVID-19 while the number of detected cases was low among those below 20 years of age (**Table 1**).

Timely isolation of cases, being a key public health intervention for disease control, was evaluated. The median time of isolation of cases from disease onset was 4 days (IQR 2-7 days) and was longer in older age groups (HR = 0.72 for cases aged ≥ 70, 95% CI 0.55-0.95, p=0.005) (**Table 2**). However, after adjustment for linkage to a known cluster, age was no longer associated with a difference in the rate at which cases were isolated (aHR = 0.83 for cases aged ≥ 70, 95%CI 0.63-1.09 p=0.19; overall effect of age p=0.16).

The median duration from hospital admission to discharge was 15 days (IQR 11-19 days). The duration of hospitalisation was significantly longer in the older age groups (≥70years compared with < 30 years, HR 0.20, 95%CI 0.07-0.58). The corresponding duration from disease onset to hospital discharge was 20 days (IQR 16-25 days) and was also longer in the older age groups (≥70years compared with < 30 years, HR 0.27, 95%CI 0.09-0.80) (**Table 2**). As of 7 April 2020, two COVID-19 deaths were recorded.

Age, Oxygen Supplementation and Mechanical Ventilation

Overall, an estimated 11.4% of all cases required oxygen supplementation, with half of them requiring it by day 8 of illness (IQR 6-11 days). Less than 1% of cases below 30 years old required oxygen. This proportion increased to 20% for persons aged 50-59 years and 40.9% for persons aged 70 and above (p<0.001) (**Table 2**).

This age-specific increased risk was similarly seen for mechanical ventilation needs. Overall, an estimated 4.8% of cases required mechanical ventilation. The median duration from disease onset to mechanical ventilation was 8 days (IQR 5-10 days). None below 30 years required mechanical ventilation, but the proportion increased after age 50 years, with an estimated 19.3% (95% confidence interval [95% CI] 13.2%-27.8%) of cases aged 60 to 69 years requiring it (**Table 2**).

The median duration of oxygen supplementation was 11 days (IQR 5 – 25 days) and median duration of mechanical ventilation was 14 days (IQR 8-21 days). Older persons required a longer duration of increased care, with statistically significant differences in the rates of oxygen supplementation (p<0.01) and mechanical ventilation (p=0.041) between age groups (**Table 2**).

Chest Radiography, Oxygen Supplementation and Mechanical Ventilation

In a subgroup analysis of patients at NCID, the finding of pneumonia on CXR at admission was an independent predictor of oxygen supplementation and mechanical ventilation (**Table 3**). The timing of this investigation in the course of illness corresponded to the time to isolation, which was a median of four days. Patients with pneumonia on CXR had higher risk of requiring oxygen supplementation (aHR 4.15, 95%CI 2.29-7.53, p<0.001) and mechanical ventilation (aHR 3.84, 95%CI 1.36-10.85, *p*=0.011).

Performance of Age and Abnormal CXR in Predicting Clinical Outcomes

Age discriminated cases who subsequently required oxygen supplementation (area under ROC curve [AUROC] 0.736, 95%CI: 0.667-0.805; **Figure 1A**) or mechanical ventilation (AUROC 0.772, 95%CI 0.699-0.845; **Figure 1B**). A cut-off of 55 years and above achieved sensitivity of 57% and specificity of 72% for the outcome of oxygen supplementation, and sensitivity of 64% and specificity of 70% for the outcome of mechanical ventilation.

In the subgroup of patient admitted to NCID for whom CXR data was available, an abnormal CXR had sensitivity of 55% and specificity of 75% for supplemental oxygen, and sensitivity of 60% and specificity of 71% for mechanical ventilation (**Table 4**).

When the cut-off age ≥ 55 years and abnormal CXR were combined to identify cases who met either criteria, sensitivity of 83% and specificity of 63% were observed for supplemental oxygen while sensitivity of 87% and specificity of 58% were attained for mechanical ventilation (**Table 4**).

Discussion

The severity of COVID-19, as indicated by oxygen supplementation and mechanical ventilation, was associated with older age. A combined criterion where either age ≥ 55 years or abnormal CXR showed moderately high sensitivity for severe disease.

The age-specific rates of intensive care needs in Singapore are similar to those reported in the United States (11), although lower in younger age groups (<40 years of age) in our study. In this study, none of the cases below 30 years required mechanical ventilation. This is concordant with other studies that young persons and children experience milder COVID-19 (10,11). Pneumonia on chest radiograph at diagnosis was associated with 3.84 times the risk of requiring mechanical ventilation in our study. This is consistent with a study in Shanghai, China where abnormality on chest computed tomography or plain radiography was associated with 4.5 times the odds of being admitted to intensive care (17). However, a study highlighted that a normal CXR did not exclude the possibility of severe infection based on observation that most COVID-19 patients had normal CXR in emergency departments(18). While we similarly observed a low rate of abnormal CXR at presentation (15%), we found high negative predictive value of a normal CXR in relation to oxygen supplementation and mechanical ventilation, suggesting that it may be a useful tool to triage the site and level of care.

The performance of age and abnormal CXR in distinguishing cases who required oxygen supplementation and mechanical ventilation suggests that they may be useful triage criteria for COVID-19 cases. Age alone predicting mechanical ventilation had an AUROC of 0.77. While having less discriminatory power than the 10-item COVID-GRAM (AUROC 0.88) and 4-item CALL (AUROC 0.91)(8,9), its AUROC demonstrated that age has significant triage value on its own. When a cut-off age ≥ 55 years was combined with abnormal CXR, it achieved moderately high sensitivity of 86.7% but lower specificity of 58.0% for mechanical ventilation. This is inferior to the 4-item CALL (sensitivity 95.0% and specificity

78.0% at cut-off of 6 points). Nevertheless, requiring only 2 items with a high negative predictive value of 97.0% in our sample, the criteria could serve as a convenient and quick triage tool to identify cases unlikely to have severe disease allowing them to be sent to community isolation facilities.

While more detailed and accurate predictors of COVID-19 disease progression such as COVID-GRAM and CALL are available(8,9), they require detailed history taking and blood investigations which can be labour-intensive and time-consuming. This is challenging in large surges such as that experienced in Singapore, which coincided with outbreaks in the migrant worker dormitories, in April 2020 with 500-1000 cases daily(19). Age and CXR form quick and simple triage tools and may be used to avert overwhelming the healthcare system while safely caring for patients in non-hospital isolation facilities.

The result also highlights the importance of protecting the elderly and adopting age-segmented risk management strategies. Settings vulnerable to transmission among the elderly should be reviewed and policies enhanced to ensure strict infection control precautions. Outbreaks in aged care facilities are costly events with respect to morbidity and mortality(20), and provide strong impetus to enhance infection control in these settings. In many countries, residential care facilities do not have dedicated infection control teams(21). With the current COVID-19 pandemic, infection control programmes have become critical to the operation of such facilities.

Strengths and Limitations

The COVID-19 containment strategy in this period consisted of aggressive active case finding and isolation of all cases, enabling the study population to be highly representative of disease severity in Singapore. However, asymptomatic cases could have been missed.

In this study, clinical information such as features at presentation, underlying comorbidities, laboratory investigations and functional status were not collected and thus unadjusted for. This may limit the assessment of the independent effect of age on outcome. However, these factors are to a large extent age-dependent and may mediate the effect of age. The analysis provided estimates of the overall effect of age on disease severity and the parameters of care required. A similar limitation in the availability of clinical information applied to the assessment of CXR.

In the assessment of the test performance of age and CXR, the number of cases with the outcomes of interest was relatively small, particularly for mechanical ventilation. Nevertheless, it was sufficient to provide reasonable interval estimates. The study could not consider death as an outcome measure, as there were only two COVID-19 deaths during the study period.

The performance of age and abnormal CXR in predicting the severity of disease may vary between COVID-19 patient populations due to differences in clinical spectrum. The local case-fatality rate has been low at 0.05% and the triage performance of age and CXR may differ in settings of higher case fatality rates.

Conclusion

COVID-19 severity is strongly correlated with older age which may guide the projection of healthcare resources needed to manage COVID-19 surges. A combined criterion using age and abnormal CXR at initial diagnosis may be valuable as a triage tool. This should be validated in different geographic areas.

Declarations

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Conflict of Interests

The authors do not have conflicts of interests related to this article.

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Data Access

The data that support the findings of this study are available from the Ministry of Health, Singapore but restrictions apply to the availability of these data, which were used for national disease surveillance under the Infectious Diseases Act, and so are not publicly available. Data are however available from the authors upon reasonable request and with permission of the Ministry of Health, Singapore.

Contributions

Conceptualisation of study: LYS, TM

Development and design of methodology: LYS, TM, WEW

Formal analysis of data: WEW

Data management and curation: TCH, WEW, TTT, PSK, AS, OST, LJ, FKCR, TKC

Writing of Original Draft: WEW

Review and Editing: LYS, LDC, TM, LVJM, TCH, CM, AS, OST, TKC, VS

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Tables

Table 1. Characteristics of COVID-19 Cases in Singapore Reported up to April 7, 2020.

Characteristics	All Cases		Resident Population Only		
	Frequency (n=1,481)	Proportion	Frequency (n=923)	Proportion	Stratum-Specific Incidence (per 100,000)
Singapore Residents	923	62.3%	923		22.9
Age in years, Median (IQR)	37	(27-53)	42	26-58	
Age 0-9	21	1.4%	15	1.6%	3.9
Age 10-19	37	2.5%	26	2.8%	6.0
Age 20-29	406	27.4%	246	26.7%	45.8
Age 30-39	343	23.2%	135	14.6%	22.7
Age 40-49	238	16.1%	138	15.0%	22.5
Age 50-59	210	14.2%	171	18.5%	28.1
Age 60-69	153	10.3%	131	14.2%	26.2
Age ≥70	73	4.9%	61	6.6%	16.9
Gender					
Male	941	63.5%	511	55.4%	25.9
Female	540	36.5%	412	44.6%	20.0
Ethnicity					
Chinese	654	44.2%	593	64.2%	19.8
Indian	248	16.8%	135	14.6%	37.2
Malay	164	11.1%	135	14.6%	25.0
Others	415	28.0%	60	6.5%	46.5
Local / Imported					
Local Transmission	914	61.7%	522	56.6%	
Imported Cases	567	38.3%	401	43.4%	
Clinical Care Needs					
Admitted, Ever	1,481	100%			
Discharged	282	19.0%			
Supplemental Oxygen, Ever	135	9.1%			
Ceased Supplemental Oxygen	86	5.8%			
Mechanical Ventilation, Ever	68	4.6%			
Ceased Mechanical Ventilation	36	2.4%			
Deaths	2	0.1%			

Table 2. Clinical care needs of COVID-19 cases.

Outcome	Proportion Requiring, % (95% CI)[a]	Time from Onset at which Half of Cases Requiring Care Commences (IQR)	HR (95% CI) *Rates Requiring Care*	*p*	Duration of Care Specified, Median (IQR)	HR (95% CI) *Rates Recovering from Care*	*p*
Isolation	All	4 (2-9)			15 (11-19)		
Age <30	All	3 (2-6)	Referent	0.005	16 (8-18)	Referent	0.007
Age 30-39	All	3 (2-6)	1.05 (0.91-1.22)		13 (11-18)	0.81 (0.47-1.39)	
Age 40-49	All	4 (2-7)	0.88 (0.75-1.04)		13 (10-16)	1.02 (0.58-1.79)	
Age 50-59	All	4 (2-7)	0.87 (0.74-1.03)		16 (11-24)	0.61 (0.35-1.07)	
Age 60-69	All	4 (2-7)	0.85 (0.74-1.02)		15 (10-22)	0.60 (0.33-1.12)	
Age ≥70	All	4 (2-7)	0.72 (0.55-0.95)		* (13-*)	0.20 (0.07-0.58)	
Gender							
Female	All	4 (2-7)	Referent	0.027	18 (16-24)	Referent	0.57
Male	All	4 (2-7)	1.12 (1.00-1.25)		20 (17-25)	0.91 (0.65-1.27)	
Oxygen Supplementation	11.4 (9.5-13.8)	8 (6-11)			11 (5-25)		
Age <30	0.6 (0.1-2.2)	10 (10-11)	Referent	<0.001	7 (7-7)	Referent	<0.001
Age 30-39	3.1 (1.5-6.1)	6 (5-7)	8.10 (1.80-36.55)		10 (2-13)	0.77 (0.09-6.97)	
Age 40-49	8.5 (5.3-13.6)	9 (4-11)	16.60 (3.84-71.86)		4 (3-8)	2.68 (0.34-21.04)	
Age 50-59	20.4 (14.7-27.8)	9 (7-11)	38.21 (9.21-159)		9 (4-18)	1.01 (0.01-7.66)	
Age 60-69	34.9 (26.1-45.6)	8 (6-11)	63.12 (15.29-261)		15 (6-25)	0.59 (0.08-4.48)	
Age ≥70	40.9 (28.6-55.9)	7 (5-11)	91.74 (21.73-387)		48 (11-48)	0.26 (0.03-2.21)	
Gender							
Female	9.9 (7.5-13.1)	9 (6-11)	Referent	0.12	5 (2-13)	Referent	0.088
Male	12.5 (9.7-15.9)	8 (6-10)	1.32 (0.93-1.88)		7 (3-12)	0.65 (0.39-1.09)	

Mechanical Ventilation	5 (4-6)	8 (5-10)			14 (8-21)		
Age <30	0 (0-0)						
Age 30-39	0.7 (0.2-2.9)	6 (6-8)	Referent		8 (8-8)	Referent	
Age 40-49	2.0 (0.8-5.3)	4 (2-10)	1.77 (0.40-7.9)		8 (4-8)	1.41 (0.16-12.6)	
Age 50-59	8.3 (5.0-13.7)	7 (6-10)	8.9 (2.62-30)	<0.001	10 (6-15)	0.51 (0.06-4.08)	
Age 60-69	19.3 (13.2-27.8)	9 (5-11)	18 (5.46-59)		15 (9-19)	0.39 (0.05-3.11)	
Age ≥70	16.5 (8.8-29.8)	6 (4-8)	22.2 (6.38-77)		27 (23-27)	0.10 (0.01-1.01)	0.041
Gender							
Female	4.2 (2.7-6.6)	10 (4-12)	Referent		9 (6-15)	Referent	
Male	5.1 (3.6-7.3)	7 (6-9)	1.35 (0.82-2.24)	0.24	15 (8-23)	0.61 (0.31-1.22)	0.16

[a] Estimated from survival analysis. Hence, there is no corresponding frequency data.

[b] There were inadequate discharges to estimate 50th and 75th percentile of duration of hospitalisation for cases aged 70 and above (*).

Table 3. Subgroup analysis of COVID-19 cases on the association of chest radiography at admission and subsequent care requirements.

	Overall (n=744)		**Normal CXR at Admission (n=122)**		**Abnormal CXR at Admission (n=111)**		**HR (95%CI)[a]**	***p***	**aHR (95%CI)[b]**	***p***
Total	744	100%	633 / 744	85%	111/744	15%	-	-		
Cases requiring oxygen supplementation	54/744	7%	23/633	4%	31/111	28%	7.25 (4.13, 12.70)	<0.001	4.15 (2.29, 7.53)	<0.001
Cases requiring mechanical ventilation	20/744	3%	7/633	1%	13/111	12%	7.23 (2.69, 19.40)	<0.001	3.84 (1.36, 10.85)	0.011

[a]HR with normal CXR as referent group.

[b]aHR: adjusted for age and gender.

Table 4. Cross-tabulation of cases with at least 30 days of follow-up at end of study and performance of abnormal CXR and age as triage criteria: (a) abnormal CXR as criteria with supplemental oxygen as outcome, (b) abnormal CXR as criteria with mechanical ventilation as outcome, (c) abnormal CXR or age 55 years or greater as criteria with supplemental oxygen as outcome, (d) abnormal CXR or age 55 years or greater as criteria with mechanical ventilation as outcome (PPV: positive predictive value, NPV: negative predictive value)

(a)	CXR		
Requiring Supplemental Oxygen	**Normal**	**Abnormal**	**Total**
No	73	25	**98**
Yes	13	16	**29**
Total	**86**	**41**	**127**

Sensitivity	0.552 (95%CI:0.371, 0.733)
Specificity	0.745 (95%CI:0.659, 0.831)
PPV	0.390 (95%CI:0.241, 0.54)
NPV	0.849 (95%CI:0.773, 0.925)

(b)	CXR		
Requiring mechanical ventilation	**Normal**	**Abnormal**	**Total**
No	80	32	**112**
Yes	6	9	**15**
Total	**86**	**41**	**127**

Sensitivity	0.600 (95%CI:0.352, 0.848)
Specificity	0.714 (95%CI:0.631, 0.798)
PPV	0.220 (95%CI:0.093, 0.346)
NPV	0.930 (95%CI:0.876, 0.984)

(c)	CXR or Age>=55		
Requiring supplemental oxygen	**No**	**Yes**	**Total**
No	62	36	**98**
Yes	5	24	**29**
Total	**67**	**60**	**127**

Sensitivity	0.828 (95%CI:0.69, 0.965)
Specificity	0.633 (95%CI:0.537, 0.728)
PPV	0.400 (95%CI:0.276, 0.524)
NPV	0.925 (95%CI:0.862, 0.988)

(d)	CXR or Age>=55		
Requiring mechanical ventilation	**No**	**Yes**	**Total**
No	65	47	**112**
Yes	2	13	**15**

Sensitivity	0.867 (95%CI:0.695, 1.00)
Specificity	0.580 (95%CI:0.489, 0.672)
PPV	0.217 (95%CI:0.112, 0.321)
NPV	0.970 (95%CI:0.929, 1.00)

Total	67	60	127

Figures

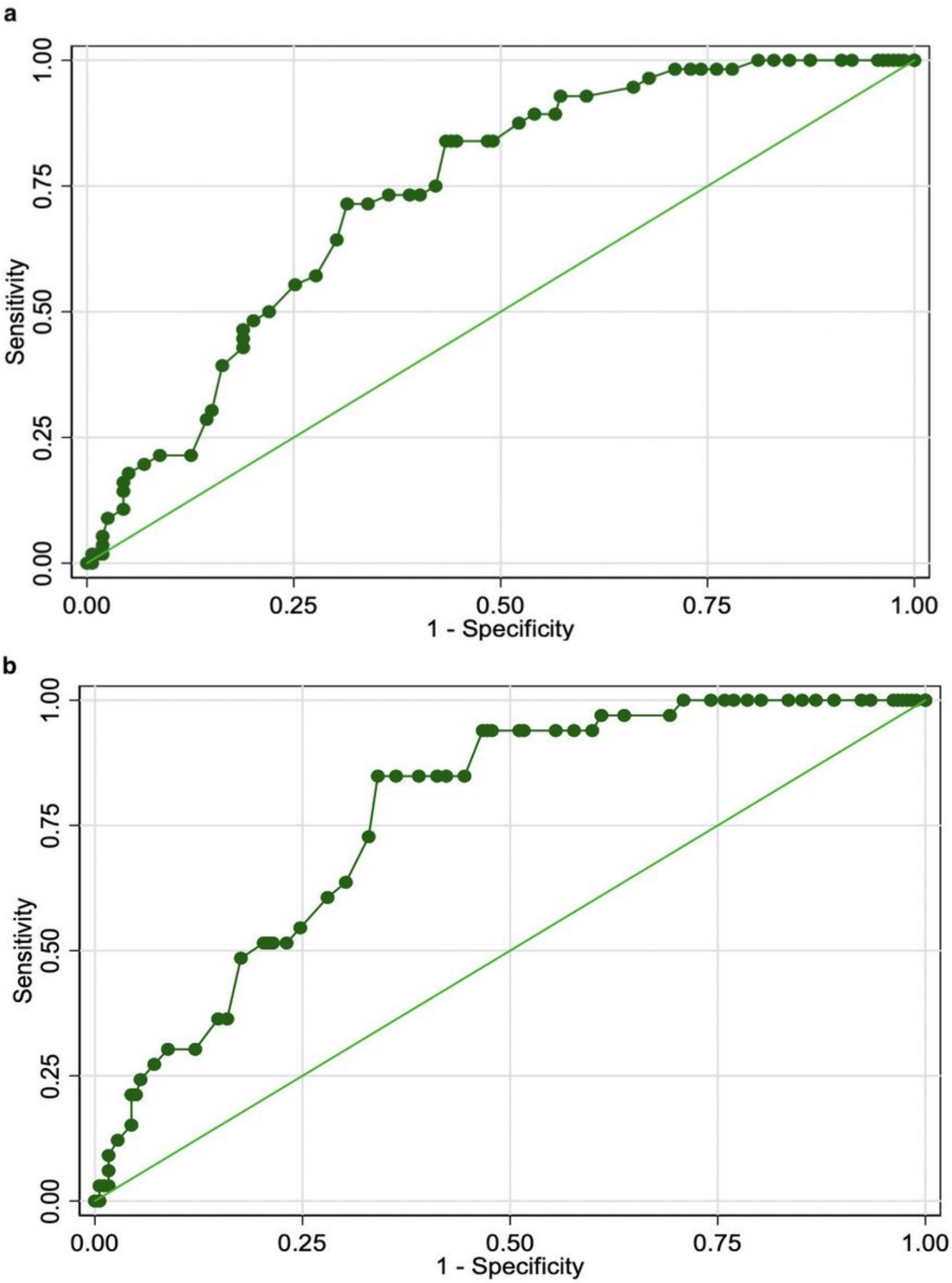

Figure 1

Receiver-Operator Curves (ROC) of age as a predictor of subsequent (a) oxygen supplementation and (b) mechanical ventilation needs. (a) Age as a predictor of subsequent oxygen supplementation. At cut-off of age ≥ 55 years: Sensitivity 57%, Specificity: 72% Area under the ROC: 0.736 (95%CI: 0.667, 0.805) (b) Age as a predictor of mechanical ventilation. At cut-off of age ≥ 55 years: Sensitivity 64%, Specificity: 70% Area under the ROC: 0.772 (95%CI: 0.699, 0.845)