Leicestershire Healthcare Inequalities Improvement Training Doctoral Training Programme - funded by Wellcome

Recovery at 1-year post COVID-19 hospitalisation in adults with pre-existing multiple long-term conditions: a propensity-score matched analysis

Lucy Gardiner[1,2,3], Daniel Lozano Rojas[1,2], Iain Stewart[4], Nikki Smith[5], Jane Espley[5], Sally J Singh[1,2,3], Rod S Taylor[6], Rachael A Evans[1,2,3] on behalf of the PHOSP Collaborative Group

1) Department of Respiratory Sciences, University of Leicester, 2) NIHR Leicester Biomedical Research Centre – Respiratory, University of Leicester, 3) University Hospitals of Leicester NHS Trust, 4) National Heart & Lung Institute - Faculty of Medicine, Imperial College London, 5) Long Covid LTC Study Patient Advisory Group, Leicester, 6) MRC/CSO Social and Public Health Sciences Unit and Robertson Centre for Biostatistics, University of Glasgow

Background

- Living with multiple long-term conditions (MLTCs) represents significant burden to an individual, their support network, healthcare systems and broader society; particularly in disadvantaged communities and settings[1] (*Figure 1*).
- Having pre-existing MLTCs is associated with severe SARS-CoV-2 infection (defined by hospitalisation or death)[12] and non-recovery and multiorgan abnormalities at 5-months post COVID-19 hospitalisation[3,4].
- Certain single pre-existing LTCs (e.g., diabetes[5]) have been identified as risk factors for poorer outcomes at one-year post hospitalisation. However there is limited understanding as to how MLTCs affect recovery and whether there is any difference according to how MLTCs are categorised.

Aims

1. To compare patient-perceived recovery at one-year post COVID-19 hospitalisation between propensity-matched adults **with and without pre-existing MLTCs**.
2. To compare patient-perceived recovery at one-year post COVID-19 hospitalisation according **to varied categorisation of MLTCs** (*e.g.,* number of LTCs, number/type of bodily systems involved, MLTCs weighted score).

Methods

- Using the Post Hospitalisation COVID-19 (PHOSP-COVID) study[6], which recruited adults between 2020-2022, we propensity-matched adults with and without MLTCs 1:1 for risk factors associated with the development of MLTCs.
- Patient-perceived recovery was defined by responses to the question "*Do you feel fully recovered*?" (Yes/No).
- Multivariate logistic regression (including age, sex, ethnicity, deprivation, severity of acute illness, admission duration, obesity, and smoking history) was used to model patient-perceived recovery at one-year post-discharge.
- Further analyses in adults with MLTCs compared varied categorisation of MLTCs.
- Complete-case analysis was used for primary and exploratory analyses.

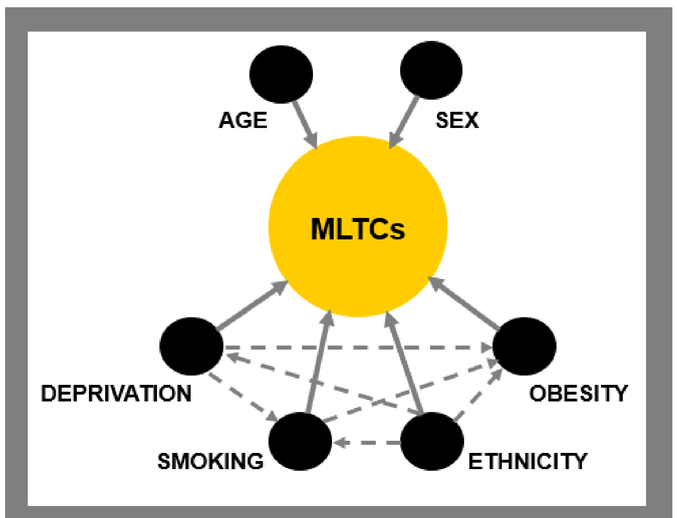
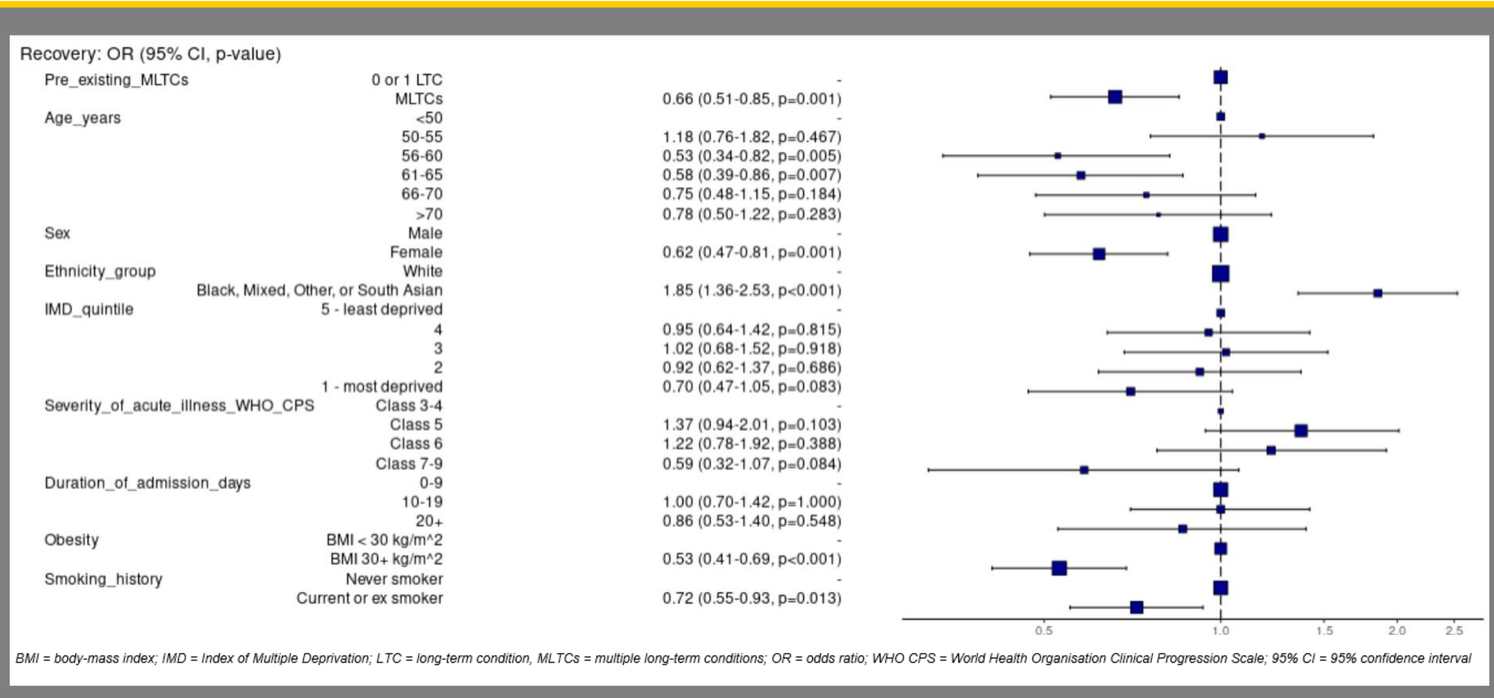


Figure 1. Intersectional risk factors associated with the development of MLTCs

Results 1 – matched cohort

647 adults with and 647 without MLTCs were matched (*Table 1)*:

- Median age 59 [IQR 52-67] years
- 61.9% male
- 79.6% of white British ethnicity
- Median admission duration 8 [IQR 4-16] days



BMI = body-mass index; IMD = Index of Multiple Deprivation; LTC = long-term condition, MLTCs = multiple long-term conditions; OR = odds ratio; WHO CPS = World Health Organisation Clinical Progression Scale; 95% CI = 95% confidence interval

Figure 2. Patient-perceived recovery at one-year post-COVID-19 hospitalisation

Table 1. Propensity-score matched cohort

		Matched participants (n=1294)		0 or 1 LTC (n=647)		MLTCs (n=647)		SMD
		n	%	n	%	n	%	
Age (years)	<30	16	1.2	10	1.5	6	0.9	0.04
	30-39	57	4.4	32	4.9	25	3.9	0.04
	40-49	191	14.8	106	16.4	85	13.1	0.09
	50-59	411	31.8	201	31.1	210	32.5	-0.03
	60-69	397	30.7	190	29.4	207	32.0	-0.06
	70-79	202	15.6	96	14.8	106	16.4	-0.05
	80+	20	1.5	12	1.9	8	1.2	0.05
Sex	Female	493	38.1	260	40.2	233	36.0	0.09
	Male	801	61.9	387	59.8	414	64.0	-0.09
Ethnicity	Black	69	5.3	39	6.0	30	4.6	0.06
	Mixed	27	2.1	15	2.3	12	1.9	0.03
	Other	53	4.1	30	4.6	23	3.6	0.05
	South Asian	115	8.9	60	9.3	55	8.5	0.03
	White	1030	79.6	503	77.7	527	81.5	-0.09
IMD quintile	1 – most deprived	284	21.9	144	22.3	140	21.6	0.02
	2	260	20.1	136	21.0	124	19.2	0.05
	3	243	18.8	119	18.4	124	19.2	-0.02
	4	245	18.9	118	18.2	127	19.6	-0.04
	5 – least deprived	262	20.2	130	20.1	132	20.4	-0.01
Obesity	Obese	526	40.6	266	41.1	260	40.2	0.02
	Non-obese	768	59.4	381	58.9	387	59.8	-0.02
Smoking history	Current	19	1.5	11	1.7	8	1.2	0.04
	Ex	543	42.0	268	41.4	275	42.5	-0.02
	Never	732	56.6	368	56.9	364	56.3	0.01

IMD = Index of Multiple Deprivation; LTC = long-term condition, MLTCs = multiple long-term conditions; SMD = standardised mean difference

Results 2 – MLTCs cohort

922 adults with MLTCs had complete data relevant to the analyses

- **Type and number of bodily systems** negatively affected recovery *(Table 2)*

Table 2. Patient-perceived recovery at one-year post-COVID-19 hospitalisation according to further categorisation of pre-existing MLTCs (*n=922*)

Further categorisation of MLTCs		Reference	OR [95% CI] for recovery at one-year*	*p* value
Number of LTCs	≥3	2 LTCs	0.91 [0.45-1.27]	0.574
	≥4	2 LTCs	0.87 [0.63-1.21]	0.421
	≥5	2 LTCs	0.78 [0.52-1.14]	0.206
MLTCs - single bodily system	Cardiovascular	Absence	0.75 [0.49-1.17]	0.206
	Respiratory	Absence	0.49 [0.34-0.70]	<0.001
	Gastrointestinal	Absence	0.64 [0.42-0.98]	0.044
	Neurological or psychiatric	Absence	0.56 [0.37-0.83]	0.004
	Rheumatological	Absence	0.96 [0.63-1.44]	0.841
	Metabolic, endocrine, or renal	Absence	1.40 [0.89-2.19]	0.140
	Malignancy or haematological	Absence	0.65 [0.34-1.21]	0.185
MLTCs - multiple bodily systems	≥2	1 system	0.67 [0.47-0.95]	0.026
	≥3	1 system	0.61 [0.42-0.88]	0.009
Mental and physical health LTCs		Physical only	0.64 [0.42-0.96]	0.033

**Adjusted for age, sex, ethnicity, IMD, severity of acute illness, duration of admission, obesity and smoking history*
CI = confidence interval; LTC = long-term condition, MLTCs = multiple long-term conditions

Conclusion

- Adults with pre-existing MLTCs were less likely to report full recovery at one-year post COVID-19 hospitalisation compared to adults without MLTCs.
- We report novel prognostication for pre-existing MLTCs relevant for clinical care post-COVID-19 hospitalisation.

References

1. Skou et al. Multimorbidity. Nature Reviews Disease Primers. 2022 Jul 14;8(1):48. **2.** Chudasama et al. Patterns of multimorbidity and risk of severe SARS-CoV-2 infection. BMC infectious diseases. 2021 Dec;21:1-2. **3.** Evans et al. Clinical characteristics with inflammation profiling of long COVID and association with 1-year recovery following hospitalisation in the UK. The Lancet Respiratory Medicine. 2022 Aug 1;10(8):761-75. **4.** Raman et al. Multiorgan MRI findings after hospitalisation with COVID-19 in the UK (C-MORE). The Lancet Respiratory Medicine. 2023 Nov 1;11(11):1003-19. **5.** Gharibzadeh et al. Long term health outcomes in people with diabetes 12 months after hospitalisation with COVID-19 in the UK. EClinicalMedicine. 2025 Jan 1;79. **6.** Elneima et al. Cohort profile: post-hospitalisation COVID-19 (PHOSP-COVID) study. International Journal of Epidemiology. 2024 Feb 1;53(1):165.

Disclosure

PHOSP-COVID is jointly funded by a grant from the MRC-UK Research and Innovation and the Department of Health and Social Care through the National Institute for Health Research (NIHR) rapid response panel to tackle COVID-19 (grant references: MR/V027859/1 and COV0319). The views expressed in the publication are those of the author(s) and not necessarily those of the National Health Service (NHS), the NIHR or the Department of Health and Social Care.
LG is supported by the Wellcome Trust as part of the Leicestershire Health Inequalities Improvement Doctoral Training Programme [223512/Z/21/Z]. This study is supported by the National Institute for Health and Care Research (NIHR) Leicester Biomedical Research Centre (BRC).

LUCY GARDINER
lg317@le.ac.uk
@LHIIP_DTP