

# Supplementary material

**Supplementary Table 1: Explanatory variables included in the multivariable natural effects model exploring postoperative death associated with time period, mediated by SARS-COV-2 infection.**

		Pre-pandemic period		Pandemic period		Odds Ratio (95% CI)
		No (n=2497)	Yes (n=17)	No (n=4054)	Yes (n=76)	
Age	<60 years	731 (29.3)	1 (5.9)	1302 (32.1)	8 (10.5)	-
	60-69 years	779 (31.2)	4 (23.5)	1195 (29.5)	20 (26.3)	2.25 (95% CI: 1.03 to 4.91, p=0.041)
	>70 years	987 (39.5)	12 (70.6)	1557 (38.4)	48 (63.2)	4.07 (95% CI: 1.96 to 8.42, p<0.001)
Sex	Female	1163 (46.6)	8 (47.1)	2091 (51.6)	21 (27.6)	-
	Male	1334 (53.4)	9 (52.9)	1963 (48.4)	55 (72.4)	1.69 (95% CI: 1.03 to 2.75, p=0.036)
ASA Grade	I-II	1736 (69.5)	6 (35.3)	2816 (69.5)	36 (47.4)	-
	III-V	761 (30.5)	11 (64.7)	1238 (30.5)	40 (52.6)	1.76 (95% CI: 1.08 to 2.86, p=0.023)
BMI Group	Not obese	1704 (68.2)	13 (76.5)	3101 (76.5)	60 (78.9)	-
	Obese	793 (31.8)	4 (23.5)	953 (23.5)	16 (21.1)	0.81 (95% CI: 0.48 to 1.37, p=0.437)
Smoking Status	Not current	2223 (89.0)	14 (82.4)	3671 (90.6)	65 (85.5)	-
	Current	274 (11.0)	3 (17.6)	383 (9.4)	11 (14.5)	1.47 (95% CI: 0.78 to 2.78, p=0.238)
Chronic Lung Disease	No	2088 (83.6)	12 (70.6)	3626 (89.4)	68 (89.5)	-
	Yes	409 (16.4)	5 (29.4)	428 (10.6)	8 (10.5)	0.83 (95% CI: 0.44 to 1.55, p=0.550)
Cardiovascular Disease	No	1475 (59.1)	5 (29.4)	2075 (51.2)	29 (38.2)	-
	Yes	1022 (40.9)	12 (70.6)	1979 (48.8)	47 (61.8)	1.16 (95% CI: 0.72 to 1.87, p=0.554)
Diabetes Mellitus	No	2132 (85.4)	13 (76.5)	3335 (82.3)	51 (67.1)	-
	Yes	365 (14.6)	4 (23.5)	719 (17.7)	25 (32.9)	1.61 (95% CI: 1.00 to 2.61, p=0.050)
Operative Approach	Minimally-invasive	1440 (57.7)	2 (11.8)	1925 (47.5)	15 (19.7)	-
	Open	1057 (42.3)	15 (88.2)	2129 (52.5)	61 (80.3)	4.85 (95% CI: 2.82 to 8.35, p<0.001)
Operative Site	Lower Abdominal	2033 (81.4)	12 (70.6)	3157 (77.9)	47 (61.8)	-
	Upper Abdominal	362 (14.5)	2 (11.8)	796 (19.6)	19 (25.0)	0.54 (95% CI: 0.28 to 1.06, p=0.072)
	Thoracoabdominal	102 (4.1)	3 (17.6)	101 (2.5)	10 (13.2)	2.90 (95% CI: 1.31 to 6.43, p=0.009)
Operative complexity	Intermediate / Major	1637 (65.6)	10 (58.8)	2911 (71.8)	37 (48.7)	-
	Complex Major	860 (34.4)	7 (41.2)	1143 (28.2)	39 (51.3)	1.71 (95% CI: 0.94 to 3.10, p=0.077)

**Abbreviations:** ASA = American Society of Anesthesiologists (ASA), BMI = Body Mass Index.

**Supplementary Table 2:** Multivariable natural effects model of postoperative pulmonary complications and death associated with timeperiod, mediated by SARS-COV-2 infection (high-income countries and open operations only)

	Postoperative Death*	
	Odds ratio (95% CI)	Percentage mediation
<b>Total effect in high-income countries</b>	<b>2.58 (95% CI: 1.48 to 4.50, p&lt;0.001)</b>	-
Natural direct effect	1.46 (95% CI: 0.83 to 2.58, p=0.193)	39.8%
Natural indirect effect	1.77 (95% CI: 1.40 to 2.23, p<0.001)	60.2%
<b>Total effect in open operations only</b>	<b>2.42 (95% CI: 1.33 to 4.39, p=0.004)</b>	-
Natural direct effect	1.51 (95% CI: 0.83 to 2.74, p=0.180)	46.5%
Natural indirect effect	1.60 (95% CI: 1.29 to 1.99, p<0.001)	53.5%

\* Multivariate adjustment for sociodemographic and operative differences in case-mix.

**Supplementary Table 3: Multilevel model of the association between pulmonary complications and 30-day postoperative mortality in elective abdominal cancer surgery (excluding SARS-COV-2 infection from the model).**

		30-day Postoperative Mortality			
		Died	Alive	OR (univariable)	OR (multilevel)
30-day pulmonary complication	No	51 (0.7)	6861 (99.3)	-	-
	Yes	56 (11.4)	434 (88.6)	17.36 (11.74-25.73, p<0.001)	13.11 (7.53-22.82, p<0.001)
Age	<60 years	11 (0.5)	2270 (99.5)	-	-
	60-69 years	26 (1.2)	2187 (98.8)	2.45 (1.24-5.19, p=0.013)	2.57 (1.05-6.30, p=0.039)
	>70 years	70 (2.4)	2838 (97.6)	5.09 (2.81-10.18, p<0.001)	4.24 (1.78-10.14, p=0.001)
Sex	Female	34 (0.9)	3610 (99.1)	-	-
	Male	73 (1.9)	3685 (98.1)	2.10 (1.41-3.20, p<0.001)	1.36 (0.79-2.32, p=0.267)
ASA Grade	I-II	48 (1.0)	4913 (99.0)	-	-
	III-V	59 (2.6)	2171 (97.4)	2.78 (1.90-4.10, p<0.001)	1.96 (1.13-3.40, p=0.017)
Obesity (BMI ≥ 30 kg/m <sup>2</sup> )	Not obese	73 (1.5)	4917 (98.5)	-	-
	Obese	20 (1.1)	1798 (98.9)	0.75 (0.44-1.21, p=0.255)	0.68 (0.37-1.24, p=0.207)
Smoking Status	Not current	92 (1.4)	6569 (98.6)	-	-
	Current	15 (2.0)	726 (98.0)	1.48 (0.82-2.48, p=0.167)	1.39 (0.68-2.85, p=0.366)
Chronic Lung Disease	No	92 (1.4)	6361 (98.6)	-	-
	Yes	15 (1.6)	934 (98.4)	1.11 (0.62-1.87, p=0.709)	0.70 (0.34-1.42, p=0.319)
Cardiovascular Disease	No	38 (0.9)	4004 (99.1)	-	-
	Yes	69 (2.1)	3291 (97.9)	2.21 (1.49-3.32, p<0.001)	1.33 (0.77-2.30, p=0.307)
Diabetes Mellitus	No	73 (1.2)	6095 (98.8)	-	-
	Yes	34 (2.8)	1200 (97.2)	2.37 (1.55-3.54, p<0.001)	2.11 (1.20-3.71, p=0.010)
Operative Approach	Minimally-invasive	21 (0.6)	3749 (99.4)	-	-
	Open	86 (2.4)	3543 (97.6)	4.33 (2.74-7.18, p<0.001)	4.95 (2.63-9.32, p<0.001)
Operative Site	Lower Abdominal	66 (1.1)	5791 (98.9)	-	-
	Upper Abdominal	27 (2.1)	1280 (97.9)	1.85 (1.16-2.87, p=0.008)	0.53 (0.23-1.19, p=0.125)
	Thoracoabdominal	14 (5.9)	224 (94.1)	5.48 (2.92-9.62, p<0.001)	1.36 (0.47-3.91, p=0.565)
Operative complexity	Intermediate / Major	55 (1.1)	5039 (98.9)	-	-
	Complex Major	52 (2.3)	2256 (97.7)	2.11 (1.44-3.10, p<0.001)	1.80 (0.90-3.61, p=0.098)

Abbreviations: ASA = American Society of Anesthesiologists (ASA), BMI = Body Mass Index. Number in model = 6644, Number of groups = 493, AIC = 773.2, C-statistic = 0.968.

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