

Supplementary Online Content

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This supplementary material has been provided by the authors to give readers additional information about their work.

Table S1. Subject motivational factors

Motivational factor	Question	Response range
<i>Self-efficacy</i>	How confident are you that you will be able to make a full recovery after surgery?	1 (Not at all confident) – 6 (Highly certain)
<i>Effort attribution</i>	Your effort is important for the success of your recovery.	1 (Strongly disagree) – 6 (Strongly agree)
<i>Implicit theory of change</i>	No matter how hard you try, you can't really change how successful your recovery will be.	
<i>Locus of control</i>	You have a lot of control over how successful your recovery will be.	

Table S2. Modified Wilcox radiographic atelectasis severity scoring *per lung*

Score	Description
0	No atelectasis
1	Plate atelectasis
2	Segmental atelectasis (mild lobar collapse)
3	Partial lobar atelectasis (moderate lobar collapse)
4	Complete atelectasis of one lung lobe
5	Complete atelectasis of one lung lobe in addition to any of the above

Table S3. Subject characteristics

	Variable		Per-protocol			Intent-to-treat				
			Control Bell OFF	Experimental Bell ON	P value	Control Bell OFF	Experimental Bell ON	P value		
Preoperative factors	Number of patients		Overall	n=74	n=71	0.5889	n=80	n=80	0.9999	
			Non-elective	n=43	n=47	0.3923	n=45	n=51	0.4199	
			Elective	n=31	n=24	0.3923	n=35	n=29	0.4199	
	Age, years, mean (95%CI)		Overall	69.7 (67.5-72.0)	67.5 (65.2-69.9)	0.1028	69.9 (67.7-72.1)	67.5 (65.4-69.6)	0.0586	
			Non-elective	69.1 (66.1-72.0)	66.9 (64.3-69.6)	0.2898	69.0 (66.2-71.9)	66.8 (64.3-69.3)	0.2420	
			Elective	70.7 (67.0-74.3)	68.7 (63.9-73.4)	0.4930	70.9 (67.5-74.4)	68.7 (64.6-72.8)	0.3990	
	Male, %		Overall	78.4% [n=58]	76.1 [n=54]	0.8435	77.5% [n=62]	76.3% [n=61]	0.9999	
			Non-elective	48.6% [n=36]	50.7% [n=36]	0.8686	46.3% [n=37]	48.8% [n=39]	0.6162	
			Elective	29.7% [n=22]	25.4% [n=18]	0.5820	31.3% [n=25]	27.5% [n=22]	0.7803	
	BMI, mean (95%CI)		Overall	31.0 (29.8-32.2)	30.6 (29.4-31.7)	0.6535	31.0 (29.9-32.2)	30.7 (29.6-31.8)	0.8125	
			Non-elective	30.3 (28.9-31.8)	30.5 (29.2-31.8)	0.8616	30.6 (29.0-32.1)	30.7 (29.4-31.9)	0.9465	
			Elective	31.9 (29.9-33.9)	30.7 (28.2-33.1)	0.4352	31.6 (29.7-33.6)	30.9 (28.8-33.0)	0.5786	
	ASA class, mean (95%CI)		Overall	4.0 (3.9-4.0)	4.0 (3.9-4.0)	0.9666	4.0 (3.9-4.0)	4.0 (3.9-4.0)	0.6506	
			Non-elective	4.0 (3.9-4.0)	4.0 (3.9-4.0)	0.6152	4.0 (3.9-4.0)	3.9 (3.8-4.0)	0.3046	
			Elective	4.0 (3.9-4.0)	4.0 (4.0-4.0)	0.3839	4.0 (3.9-4.0)	4.0 (4.0-4.0)	0.3669	
	FEV1		L, mean (95%CI)	Overall	2.0 (1.8-2.1)	2.0 (1.8-2.2)	0.9939	2.0 (1.8-2.2)	2.0 (1.9-2.2)	0.6813
				Non-elective	1.9 (1.7-2.2)	2.0 (1.7-2.2)	0.9369	2.0 (1.7-2.2)	2.0 (1.7-2.2)	0.9021
				Elective	2.1 (1.8-2.3)	2.1 (1.8-2.4)	0.9669	2.1 (1.8-2.3)	2.2 (1.9-2.5)	0.5088
			% predicted, mean (95%CI)	Overall	71.4 (66.8-76.0)	70.1 (64.9-75.3)	0.7035	70.9 (66.1-75.6)	68.7 (63.3-74.1)	0.5478
				Non-elective	66.5 (60.1-73.0)	68.0 (60.9-75.1)	0.7561	67.4 (61.1-73.6)	68.2 (61.3-75.2)	0.8554
				Elective	77.0 (70.6-83.3)	70.0 (62.3-77.7)	0.1695	76.6 (70.4-82.9)	73.2 (65.9-80.5)	0.4902
FVC		L, mean (95%CI)	Overall	2.5 (2.3-2.7)	2.6 (2.3-2.8)	0.5300	2.5 (2.3-2.7)	2.6 (2.4-2.8)	0.3545	
			Non-elective	2.4 (2.1-2.6)	2.5 (2.2-2.8)	0.5836	2.4 (2.1-2.6)	2.5 (2.2-2.8)	0.5817	
			Elective	2.6 (2.3-2.9)	2.7 (2.4-3.1)	0.5860	2.6 (2.3-2.8)	2.8 (2.5-3.1)	0.2893	
		Overall	64.5 (60.5-68.5)	65.5 (61.0-70.0)	0.7592	65.1 (61.3-68.9)	66.1 (61.9-70.4)	0.7148		

		% predicted, mean (95%CI)	Non-elective	59.8 (54.6-64.9)	64.1 (57.7-70.4)	0.2986	60.6 (55.5-65.6)	64.0 (57.9-70.1)	0.3964	
			Elective	71.1 (65.6-76.6)	68.1 (36.4-72.9)	0.4171	70.9 (65.7-76.1)	69.9 (65.2-74.5)	0.7726	
OSA, %			Overall	21.6% [n=16]	21.1% [n=15]	0.9999	20.0% [n=16]	22.5% [n=18]	0.8470	
			Non-elective	12.2% [n=9]	14.1% [n=10]	0.9999	11.3% [n=9]	15.0% [n=12]	0.8058	
			Elective	9.5% [n=7]	7.0% [n=5]	0.9999	8.8% [n=7]	7.5% [n=6]	0.9999	
Asthma, %			Overall	5.4% [n=4]	8.5% [n=6]	0.5272	6.3% [n=5]	7.5% [n=6]	0.9999	
			Non-elective	1.4% [n=1]	4.2% [n=3]	0.6180	12.5% [n=1]	3.8% [n=3]	0.6200	
			Elective	4.1% [n=3]	4.2% [n=3]	0.9999	5.0% [n=4]	3.8% [n=3]	0.9999	
Smoker, %	Current			Overall	9.5% [n=7]	7.0% [n=5]	0.8497	10.0% [n=8]	7.5% [n=6]	0.7924
				Non-elective	8.1% [n=6]	5.6% [n=4]	0.5956	7.5% [n=6]	6.3% [n=5]	0.8416
				Elective	1.4% [n=1]	1.4% [n=1]	0.9999	2.5% [n=2]	1.3% [n=1]	0.4748
	Former			Overall	51.4% [n=38]	54.9% [n=39]	0.8497	53.8% [n=43]	52.5% [n=42]	0.7924
				Non-elective	27.0% [n=20]	36.6% [n=26]	0.5956	27.5% [n=22]	35.0% [n=28]	0.8416
				Elective	24.3% [n=18]	18.3% [n=13]	0.9999	26.3% [n=21]	17.5% [n=14]	0.4748
	Never			Overall	39.2% [n=29]	38.0% [n=27]	0.8497	36.3% [n=29]	40.0% [n=32]	0.7924
				Non-elective	23.0% [n=17]	23.9% [n=17]	0.5956	21.3% [n=17]	22.5% [n=18]	0.8416
				Elective	16.2% [n=12]	14.1% [n=10]	0.9999	15.0% [n=12]	17.5% [n=14]	0.4748
Pack-years, mean (95%CI)			Overall	11.4 (5.8-17.1)	8.0 (4.5-11.4)	0.8389	12.3 (6.8-17.9)	7.3 (4.1-10.4)	0.4402	
			Non-elective	6.2 (1.9-10.5)	7.0 (2.9-11.0)	0.7076	6.0 (1.9-10.1)	6.7 (3.0-10.5)	0.5846	
			Elective	18.6 (6.5-30.8)	9.9 (2.9-16.8)	0.2045	20.5 (9.3-31.8)	8.2 (2.3-14.0)	0.1580	
COPD, %			Overall	13.5% [n=10]	15.5% [n=11]	0.8155	13.8% [n=11]	15.0% [n=12]	0.9999	
			Non-elective	9.5% [n=7]	9.9% [n=7]	0.9999	8.8% [n=7]	10.0% [n=8]	0.9999	
			Elective	4.1% [n=3]	5.6% [n=4]	0.6862	5.0% [n=4]	5.0% [n=4]	0.9999	
Diabetes mellitus, %			Overall	52.7% [n=39]	43.7% [n=31]	0.3200	51.3% [n=41]	43.8% [n=35]	0.4287	
			Non-elective	35.1% [n=26]	29.6% [n=21]	0.1462	33.8% [n=27]	27.5% [n=22]	0.1076	
			Elective	17.6% [n=13]	14.1% [n=10]	0.9999	17.5% [n=14]	16.3% [n=13]	0.8009	
GERD, %			Overall	25.7% [n=19]	23.9% [n=17]	0.8493	25.0% [n=20]	25.0% [n=20]	0.9999	
			Non-elective	12.2% [n=9]	11.3% [n=8]	0.7885	11.3% [n=9]	10.0% [n=8]	0.6035	
			Elective	13.5% [n=10]	12.7% [n=9]	0.7780	13.8% [n=11]	15.0% [n=12]	0.4433	
SpO ₂ , mean (95%CI)			Overall	97.1% (96.7-97.5)	97.2% (96.7-97.6)	0.6502	97.2% (96.8-97.6)	97.3% (96.8-97.7)	0.5719	
			Non-elective	97.0% (96.4-97.6)	97.2% (96.7-97.7)	0.5558	97.0 (96.4-97.6)	97.1 (96.6-97.7)	0.6527	
			Elective	97.3% (96.7-97.9)	97.0% (96.3-97.8)	0.6346	97.4% (96.9-98.0)	97.5 (96.8-98.2)	0.9028	
Perioperative factors	Duration of anesthesia, minutes, mean (95%CI)		Overall	294 (282-312)	288 (276-306)	0.6808	294 (282-312)	300 (282-318)	0.7848	
			Non-elective	294 (276-318)	288 (270-306)	0.6201	294 (276-312)	294 (276-312)	0.9283	
			Elective	294 (270-318)	288 (252-324)	0.8579	300 (276-318)	300 (264-342)	0.8159	
			Overall	114 (102-126)	114 (102-120)	0.7956	114 (102-126)	114 (102-120)	0.8138	

Duration of cardiopulmonary bypass, minutes, mean (95%CI)		Non-elective	114 (96-126)	114 (102-120)	0.8955	114 (96-126)	114 (102-120)	0.9710	
		Elective	114 (96-132)	114 (90-132)	0.7501	114 (96-132)	108 (90-132)	0.7167	
Duration of aortic cross clamp, minutes, mean (95%CI)		Overall	93 (83-102)	90 (81-99)	0.6773	92 (83-101)	90 (81-99)	0.7518	
		Non-elective	89 (77-100)	88 (77-98)	0.8723	88 (77-99)	88 (78-98)	0.9667	
		Elective	98 (83-113)	95 (77-113)	0.7995	97 (84-111)	93 (75-112)	0.7317	
Number of vessels bypassed (95%CI)		Overall	3 (3-3)	3 (3-3)	0.6847	3 (3-3)	3 (3-3)	0.6234	
		Non-elective	3 (3-3)	3 (3-3)	0.2950	3 (3-3)	3 (3-3)	0.2506	
		Elective	3 (2-3)	3 (2-3)	0.4741	3 (2-3)	3 (2-3)	0.4998	
Graft type	Left internal mammary artery, %	Overall	89.2% [n=66]	98.6% [n=70]	0.0337	87.5% [n=70]	97.5% [n=78]	0.0317	
		Non-elective	90.7% [n=39]	100% [n=47]	0.0483	91.1% [n=41]	100% [n=51]	0.0449	
		Elective	87.1% [n=27]	95.8% [n=23]	0.3728	82.9% [n=29]	93.1% [n=27]	0.2754	
	Right internal mammary artery, %	Overall	6.8% [n=5]	14.1% [n=10]	0.1786	7.5% [n=6]	15.0% [n=12]	0.2101	
		Non-elective	9.3% [n=4]	14.9% [n=7]	0.5268	8.9% [n=4]	17.6% [n=9]	0.2457	
		Elective	3.2% [n=1]	12.5% [n=3]	0.3074	5.7% [n=2]	10.3% [n=3]	0.6515	
	Bilateral internal mammary artery, %	Overall	5.4% [n=4]	14.1% [n=10]	0.0952	6.3% [n=5]	15.0% [n=12]	0.1218	
		Non-elective	7.0% [n=3]	14.9% [n=7]	0.3202	6.7% [n=3]	17.6% [n=9]	0.1300	
		Elective	3.2% [n=1]	12.5% [n=3]	0.3074	5.7% [n=2]	10.3% [n=3]	0.6515	
	Saphenous vein, %	Overall	91.9% [n=68]	93.0% [n=66]	0.9999	91.3% [n=73]	93.8% [n=75]	0.7655	
		Non-elective	93.0% [n=40]	97.9% [n=46]	0.3451	93.3% [n=42]	98.0% [n=50]	0.3379	
		Elective	90.3% [n=28]	83.3% [n=20]	0.6862	88.6% [n=31]	86.2% [n=25]	0.9999	
	Radial artery, %	Overall	12.2% [n=9]	7.0% [n=5]	0.4014	11.3% [n=9]	7.5% [n=6]	0.5889	
		Non-elective	16.3% [n=7]	8.5% [n=4]	0.3402	15.6% [n=7]	7.8% [n=4]	0.3379	
		Elective	6.5% [n=2]	4.2% [n=1]	0.9999	5.7% [n=2]	6.9% [n=2]	0.9999	
	CABG performed with additional surgical procedure, %		Overall	25.7% [n=19]	28.2% [n=20]	0.8517	26.3% [n=21]	28.8% [n=23]	0.8596
			Non-elective	9.5% [n=7]	14.1% [n=10]	0.5988	8.8% [n=7]	13.8% [n=11]	0.6015
			Elective	16.2% [n=12]	14.1% [n=10]	0.9999	17.5% [n=14]	15.0% [n=12]	0.9999
Additional surgical procedures	Aortic valve replacement, %	Overall	12.2% [n=9]	19.7% [n=14]	0.2586	12.5% [n=10]	18.8% [n=15]	0.3841	
		Non-elective	9.3% [n=4]	12.8% [n=6]	0.7419	8.9% [n=4]	11.8% [n=6]	0.7456	
		Elective	16.1% [n=5]	33.3% [n=8]	0.2018	17.1% [n=6]	31.0% [n=9]	0.2419	
	Mitral valve replacement, %	Overall	2.7% [n=2]	1.4% [n=1]	0.9999	3.8% [n=3]	2.5% [n=2]	0.9999	
		Non-elective	0.0% [n=0]	2.1% [n=1]	0.9999	0.0% [n=0]	3.9% [n=2]	0.4967	
		Elective	6.5% [n=2]	0.0% [n=0]	0.4990	8.6% [n=3]	0.0% [n=0]	0.2448	
	Mitral valve repair, %	Overall	5.4% [n=4]	1.4% [n=1]	0.3668	5.0% [n=4]	1.3% [n=1]	0.3671	
		Non-elective	2.3% [n=1]	0.0% [n=0]	0.4778	2.2% [n=1]	0.0% [n=0]	0.4688	
		Elective	9.8% [n=3]	4.2% [n=1]	0.6237	8.6% [n=3]	3.4% [n=1]	0.6198	
	Maze, %	Overall	6.8% [n=5]	2.8% [n=2]	0.4422	6.3% [n=5]	2.5% [n=2]	0.4426	
		Non-elective	2.3% [n=1]	2.1% [n=1]	0.9999	2.2% [n=1]	2.0% [n=1]	0.9999	
		Elective	12.9% [n=4]	4.2% [n=1]	0.3728	11.4% [n=4]	3.4% [n=1]	0.3663	

				Left atrial appendage closure, %	Overall	6.8% [n=5]	2.8% [n=2]	0.4422	6.3% [n=5]	2.5% [n=2]	0.4426		
				Non-elective	4.7% [n=2]	2.1% [n=1]	0.6043	4.4% [n=2]	2.0% [n=1]	0.5984			
				Elective	9.7% [n=3]	4.2% [n=1]	0.6237	8.6% [n=3]	3.4% [n=1]	0.6198			
				Coronary endarterectomy, %	Overall	0.0% [n=0]	4.2% [n=3]	0.1149	0.0% [n=0]	5.0% [n=4]	0.1203		
				Non-elective	0.0% [n=0]	4.3% [n=2]	0.4954	0.0% [n=0]	3.9% [n=2]	0.4967			
				Elective	0.0% [n=0]	4.2% [n=1]	0.4364	0.0% [n=0]	7.0% [n=2]	0.2168			
				Insertion of intra-aortic balloon pump, %	Overall	2.7% [n=2]	1.4% [n=1]	0.9999	2.5% [n=2]	1.3% [n=1]	0.9999		
				Non-elective	4.7% [n=2]	2.1% [n=1]	0.6043	4.4% [n=2]	2.0% [n=1]	0.6022			
				Elective	0.0% [n=0]	0.0% [n=0]	0.9999	0.0% [n=0]	0.0% [n=0]	0.9999			
				Carotid endarterectomy, %	Overall	1.4% [n=1]	0.0% [n=0]	0.9999	1.3% [n=1]	1.3% [n=1]	0.9999		
				Non-elective	2.3% [n=1]	0.0% [n=0]	0.4778	2.2% [n=1]	2.0% [n=1]	0.9999			
				Elective	0.0% [n=0]	0.0% [n=0]	0.9999	0.0% [n=0]	0.0% [n=0]	0.9999			
				Septal myectomy, %	Overall	1.4% [n=1]	0.0% [n=0]	0.9999	1.3% [n=1]	0.0% [n=0]	0.9999		
				Non-elective	0.0% [n=0]	0.0% [n=0]	0.9999	0.0% [n=0]	0.0% [n=0]	0.9999			
				Elective	3.2% [n=1]	0.0% [n=0]	0.9999	2.9% [n=1]	0.0% [n=0]	0.9999			
				Ligation of coronary artery to pulmonary artery fistula, %	Overall	1.4% [n=1]	0.0% [n=0]	0.9999	1.3% [n=1]	0.0% [n=0]	0.9999		
				Non-elective	0.0% [n=0]	0.0% [n=0]	0.9999	0.0% [n=0]	0.0% [n=0]	0.9999			
				Elective	3.2% [n=1]	0.0% [n=0]	0.9999	2.9% [n=1]	0.0% [n=0]	0.9999			
				Lung lobectomy, %	Overall	0.0% [n=0]	0.0% [n=0]	0.9999	1.3% [n=1]	0.0% [n=0]	0.9999		
				Non-elective	0.0% [n=0]	0.0% [n=0]	0.9999	0.0% [n=0]	0.0% [n=0]	0.9999			
				Elective	0.0% [n=0]	0.0% [n=0]	0.9999	2.9% [n=1]	0.0% [n=0]	0.9999			
				Redo sternotomy, %	Overall	2.7% [n=2]	1.4% [n=1]	0.9999	2.5% [n=2]	1.3% [n=1]	0.9999		
				Non-elective	4.7% [n=2]	2.1% [n=1]	0.6043	4.4% [n=2]	2.0% [n=1]	0.6017			
				Elective	0.0% [n=0]	0.0% [n=0]	0.9999	0.0% [n=0]	0.0% [n=0]	0.9999			
				Chest tube size, Fr, %	Mediastinal	32	Overall	95.9% [n=71]	87.3% [n=62]	0.0742	96.3% [n=77]	88.8% [n=71]	0.1307
							Non-elective	93.0% [n=40]	89.4% [n=42]	0.7160	93.3% [n=42]	90.2% [n=46]	0.7192
							Elective	100.0% [n=31]	83.3% [n=20]	0.0312	100.0% [n=35]	86.2% [n=25]	0.0374
						28	Overall	50.0% [n=37]	45.1% [n=32]	0.6189	50.0% [n=40]	46.3% [n=37]	0.7518
Non-elective	58.1% [n=25]	40.4% [n=19]	0.1391				60.0% [n=27]	39.2% [n=20]	0.0651				
Elective	38.7% [n=12]	54.2% [n=13]	0.2864				37.1% [n=13]	58.6% [n=17]	0.1309				
24	Overall	1.4% [n=1]	1.4% [n=1]			0.9999	1.3% [n=1]	2.5% [n=2]	0.9999				
	Non-elective	2.3% [n=1]	2.1% [n=1]			0.9999	2.2% [n=1]	2.0% [n=1]	0.9999				
	Elective	0.0% [n=0]	0.0% [n=0]			0.9999	0.0% [n=0]	3.4% [n=1]	0.4531				
19	Overall	1.4% [n=1]	2.8% [n=2]			0.6146	1.3% [n=1]	3.8% [n=3]	0.6202				
	Non-elective	0.0% [n=0]	2.1% [n=1]			0.9999	0.0% [n=0]	3.9% [n=2]	0.4967				
	Elective	3.2% [n=1]	4.2% [n=1]			0.9999	2.9% [n=1]	3.4% [n=1]	0.9999				
Pleural	28	Overall	43.2% [n=32]	43.7% [n=31]	0.9999	43.8% [n=35]	43.8% [n=35]	0.9999					

			24	Non-elective	41.9% [n=18]	46.8% [n=22]	0.6756	40.0% [n=18]	49.0% [n=25]	0.4156
				Elective	45.2% [n=14]	37.5% [n=9]	0.5945	48.6% [n=17]	34.5% [n=10]	0.3138
				Overall	50.0% [n=37]	53.5% [n=38]	0.7404	48.8% [n=39]	52.5% [n=42]	0.7519
				Non-elective	55.8% [n=24]	53.2% [n=25]	0.8349	57.8% [n=26]	51.0% [n=26]	0.5432
				Elective	41.9% [n=13]	54.2% [n=13]	0.4224	37.1% [n=13]	55.2% [n=16]	0.2081
				Overall	1.4% [n=1]	1.4% [n=1]	0.9999	1.3% [n=1]	1.3% [n=1]	0.9999
			19	Non-elective	0.0% [n=0]	2.1% [n=1]	0.9999	0.0% [n=0]	2.0% [n=1]	0.9999
				Elective	3.2% [n=1]	0.0% [n=0]	0.9999	2.9% [n=1]	0.0% [n=0]	0.9999
				Overall	24.2 (7.5-40.9)	16.9 (14.3-19.5)	0.2165	23.5 (8.1-39.0)	18.5 (14.6-22.40)	0.1293
				Non-elective	31.7 (2.9-60.5)	16.8 (13.6-20.0)	0.2813	31.0 (3.5-58.4)	16.7 (13.7-19.7)	0.2716
Postoperative factors	Duration of mechanical ventilation, hours, mean (95%CI)	Elective	13.8 (9.3-18.3)	17.0 (12.2-21.8)	0.3218	14.0 (9.9-18.1)	21.6 (11.9-31.3)	0.1238		
		Overall	48.7% [n=36]	45.1% [n=32]	0.7399	48.8% [n=39]	47.5% [n=38]	0.9999		
		Non-elective	32.4% [n=24]	32.4% [n=23]	0.5341	31.3% [n=25]	33.8% [n=27]	0.8394		
	Presence of NGT or OGT, %	Elective	16.2% [n=12]	12.7% [n=9]	0.9999	17.5% [n=14]	13.8% [n=11]	0.9999		
		Overall	4.3 (3.6-5.0)	3.9 (3.4-4.4)	0.3799	4.3 (3.7-4.9)	3.9 (3.4-4.3)	0.2736		
		Non-elective	4.7 (3.8-5.7)	3.8 (3.2-4.4)	0.1167	4.8 (3.9-5.7)	3.8 (3.2-4.4)	0.0830		
	Duration with ≥1 chest tube, days, mean (95%CI)	Elective	3.7 (2.8-4.6)	4.1 (3.2-5.1)	0.5727	3.7 (2.9-4.5)	3.9 (3.1-4.7)	0.7157		

Table S4. Subject motivational factors

Motivational factor		Per-protocol			Intent-to-treat		
		Control Bell OFF mean (95%CI)	Experimental Bell ON mean (95%CI)	P value	Control Bell OFF mean (95%CI)	Experimental Bell ON mean (95%CI)	P value
Self-efficacy	Overall	4.4 (4.2-4.6)	4.4 (4.2-4.6)	0.9285	4.4 (4.2-4.6)	4.4 (4.2-4.6)	0.9285
	Non-elective	4.5 (4.2-4.7)	4.4 (4.2-4.6)	0.5485	4.5 (4.3-4.7)	4.5 (4.2-4.6)	0.7501
	Elective	4.3 (4.0-4.6)	4.4 (4.1-4.7)	0.5485	4.3 (4.0-4.5)	4.4 (4.0-4.6)	0.7501
Effort attribution	Overall	4.5 (4.4-4.7)	4.6 (4.4-4.7)	0.4971	4.5 (4.4-4.7)	4.6 (4.5-4.7)	0.3801
	Non-elective	4.5 (4.3-4.7)	4.6 (4.4-4.7)	0.9327	4.6 (4.3-4.7)	4.6 (4.4-4.8)	0.8372
	Elective	4.5 (4.2-4.7)	4.6 (4.3-4.8)	0.9327	4.5 (4.2-4.7)	4.6 (4.3-4.8)	0.8372
Implicit theory of change	Overall	2.1 (1.8-2.3)	2.1 (1.9-2.4)	0.7731	2.0 (1.8-2.3)	2.1 (1.9-2.4)	0.6159
	Non-elective	2.1 (1.8-2.4)	2.3 (1.9-2.6)	0.3532	2.0 (1.7-2.3)	2.1 (1.8-2.4)	0.9290
	Elective	2.1 (1.7-2.5)	1.9 (1.5-2.4)	0.3532	2.0 (1.7-2.4)	2.1 (1.7-2.6)	0.9290
Locus of control	Overall	4.4 (4.2-4.6)	4.3 (4.1-4.5)	0.2959	4.4 (4.3-4.6)	4.3 (4.1-4.4)	0.1194
	Non-elective	4.4 (4.2-4.6)	4.3 (4.1-4.5)	0.5858	4.4 (4.2-4.6)	4.1 (3.7-4.4)	0.3882
	Elective	4.5 (4.2-4.7)	4.3 (3.9-4.5)	0.5858	4.4 (4.2-4.6)	4.3 (4.1-4.5)	0.3882

Table S5. Mean daily IS inspiratory volumes

		Per-protocol			Intent-to-treat		
		Control Bell OFF Mean (95% CI)	Experimental Bell ON Mean (95% CI)	P value	Control Bell OFF Mean (95% CI)	Experimental Bell ON Mean (95% CI)	P value
IS inspiratory volumes, mL	Overall	976.8 (873.5-1080.1)	1022.9 (909.9-1135.9)	0.5525	974.1 (875.6-1072.5)	1007.8 (903.1-1112.5)	0.6429
	Non-elective	1008.2 (865.74-1150.6)	981.7 (839.3-1124.0)	0.5615	998.4 (860.0-1136.9)	945.3 (811.2-1079.5)	0.9569
	Elective	948.3 (804.8-1091.8)	1065.1 (887.9-1242.2)	0.5615	970.4 (836.2-1104.7)	1031.4 (870.4-1192.5)	0.9569

Table S6. Rate of change of pulmonary function tests

Rate of change to preoperative baseline		Measurement	Per-protocol			Intent-to-treat		
			Control Bell OFF Rate (95% CI)	Experimental Bell ON Rate (95% CI)	P value	Control Bell OFF Rate (95% CI)	Experimental Bell ON Rate (95% CI)	P value
FEV1	L/day	Measured each postoperative morning with three patient attempts using a handheld spirometer (Micro1, CareFusion, San Diego, CA) with automatically calculated NHANES III ²⁷ predicted values (based on age, sex, race, height) and compared to pre-operative baseline values measured using the same handheld spirometer.	0.1 (0.0-0.1)	0.1 (0.1-0.1)	0.2565	0.1 (0.0-0.1)	0.1 (0.1-0.1)	0.3443
	% predicted/day		2.2 (1.8-2.7)	2.7 (2.1-3.2)	0.2080	2.0 (1.4-2.6)	2.4 (1.8-3.1)	0.3829
FVC	L/day		0.1 (0.1-0.1)	0.1 (0.1-0.1)	0.1943	0.1 (0.1-0.1)	0.1 (0.1-0.1)	0.4809
	% predicted/day		2.3 (1.8-2.7)	2.6 (2.1-3.2)	0.2673	2.0 (1.4-2.7)	2.4 (1.8-3.0)	0.4620
FEV1/FVC	%/day		-0.7 (-1.2 - -0.2)	-0.7 (-1.1 - -0.3)	0.9720	-0.7 (-1.1 - -0.2)	-0.6 (-1.0 - -0.2)	0.9571
	% predicted/day		-0.7 (-1.4 - -0.0)	-1.4 (-2.0 - -0.8)	0.1384	-0.7 (-1.4 - -0.1)	-0.7 (-2.1-0.7)	0.9581
PEF	L/s/day		0.1 (0.1-0.2)	0.2 (0.1-0.2)	0.2416	0.1 (0.1-0.2)	0.1 (0.1-0.2)	0.9605
	% predicted/day		1.8 (1.2-2.3)	2.1 (1.5-2.7)	0.4106	1.7 (1.0-2.3)	1.7 (0.8-2.6)	0.9436

FEV1 = Forced expiratory volume in the first second; FVC = Forced vital capacity; PEF = Peak expiratory flow.

Table S7. High-flow nasal cannula and non-rebreather mask use duration

		Per-protocol			Intent-to-treat		
		Control Bell OFF Mean (95%CI)	Experimental Bell ON Mean (95%CI)	P value	Control Bell OFF Mean (95%CI)	Experimental Bell ON Mean (95%CI)	P value
High-flow nasal cannula, hours	Overall	20.0 (11.6-28.5)	13.8 (6.6-21.1)	0.1387	19.9 (11.8-27.9)	12.3 (5.8-18.8)	0.0771
	Non-elective	23.4 (10.4-36.3)	11.1 (4.0-18.1)	0.0495	24.2 (11.5-36.9)	10.2 (3.6-16.8)	0.0251
	Elective	15.4 (6.4-24.4)	19.2 (2.8-35.6)	0.3374	14.3 (6.1-22.4)	16.1 (2.3-29.8)	0.4101
Non-rebreather mask, hours	Overall	0.2 (0.0-0.6)	0.0 (0.0-0.1)	0.1416	0.1 (0.0-0.3)	0.1 (0.0-0.2)	0.3998
	Non-elective	0.2 (0.0-0.6)	0.0 (0.0-0.1)	0.2831	0.2 (0.0-0.6)	0.0 (0.0-0.1)	0.2844
	Elective	0.0 (0.0-0.0)	0.2 (0.0-0.3)	0.1279	0.0 (0.0-0.0)	0.2 (0.0-0.4)	0.0706

Table S8. Noninvasive positive pressure ventilation use duration

Duration, hours, mean (95%CI)		Per-protocol			Intent-to-treat		
		Control Bell OFF Mean (95%CI)	Experimental Bell ON Mean (95%CI)	P value	Control Bell OFF Mean (95%CI)	Control Bell OFF Mean (95%CI)	P value
	Overall	8.7 (3.8-19.5)	5.1 (2.2-11.8)	0.1856	8.7 (3.9-19.2)	5.9 (2.7-13.0)	0.2445
	Non-elective	9.7 (3.4-27.8)	3.1 (1.1-8.5)	0.0619	10.5 (3.7-29.6)	3.3 (1.2-8.9)	0.0570
	Elective	7.2 (2.1-25.0)	9.1 (2.2-37.1)	0.4055	6.4 (2.0-20.8)	10.3 (2.8-37.7)	0.2944

Table S9. Reintubation and tracheostomy

			Per-protocol			Intent-to-treat		
			Control Bell OFF	Experimental Bell ON	P value	Control Bell OFF	Experimental Bell ON	P value
Reintubation	Overall	Rate, % (95%CI)	12.2% (5.5-26.9)	8.5% (3.3-21.3)	0.2781	13.8% (7.0-27.0)	10.0% (4.7-21.5)	0.2691
		Duration, hours, mean (95%CI)	7.9 (1.2-54.3)	5.7 (0.8-40.4)	0.4048	10.5 (2.0-56.1)	6.7 (1.3-35.6)	0.3519
	Non-elective	Rate, % (95%CI)	16.3% (6.5-40.1)	6.4% (1.8-22.3)	0.1178	17.8% (8.1-39.2)	5.9% (1.8-19.4)	0.0643
		Duration, hours, mean (95%CI)	9.6 (0.8-112.8)	1.9 (0.2-19.8)	0.1712	14.1 (1.6-121.6)	1.7 (0.2-13.1)	0.0809
	Elective	Rate, % (95%CI)	6.5% (1.4-29.9)	12.5% (3.2-48.2)	0.26165	8.6% (2.5-28.9)	17.2% (6.4-46.7)	0.1904
		Duration, hours, mean (95%CI)	5.6 (0.3-100.7)	13.1 (0.5-352.4)	0.3495	5.9 (0.5-67.9)	15.4 (1.1-224.6)	0.3013
Tracheostomy	Overall	Rate, % (95%CI)	0.0% (0.0-0.0)	0.0% (0.0-0.0)	0.9999	0.0% (0.0-0.0)	0.0% (0.0-0.0)	0.9999

Table S10. Postoperative pulmonary complication rates

Complication	Measurement		Per-protocol			Intent-to-treat		
			Control Bell OFF	Experimental Bell ON	P value	Control Bell OFF	Experimental Bell ON	P value
Pneumonia	Physician-diagnosed and treated, with (+) sputum culture, rate, % (n)	Overall	5.4% (4)	1.4% (1)	0.1834	6.3% (5)	1.3% (1)	0.1049
		Non-elective	7.0% (3)	2.1% (1)	0.2753	8.9% (4)	2.0% (1)	0.1443
		Elective	3.2% (1)	0.0% (0)	0.5636	2.9% (1)	0.0% (0)	0.5469
Pneumothorax	Radiologist reported, on any postoperative CXR, rate, % (n)	Overall	20.3% (15)	22.5% (16)	0.4481	21.3% (17)	21.3% (17)	0.5765
		Non-elective	23.3% (10)	25.5% (12)	0.4986	24.4% (11)	25.5% (13)	0.5479
		Elective	16.1% (5)	16.7% (4)	0.6185	17.1% (6)	13.8% (4)	0.4945
Pleural effusion	Radiologist reported effusion > "small", on any postoperative CXR, rate, % (n)	Overall	8.1% (6)	9.9% (7)	0.4683	7.5% (6)	8.8% (7)	0.5000
		Non-elective	9.3% (4)	10.6% (5)	0.5572	9.9% (4)	9.8% (5)	0.5799
		Elective	6.5% (2)	8.3% (2)	0.5914	5.7% (2)	6.9% (2)	0.6189
Bronchospasm	Administration of bronchodilator (albuterol, levalbuterol, ipratropium, or ipratropium-albuterol), rate, % (n)	Overall	5.4% (4)	12.7% (9)	0.1069	5.0% (4)	11.3% (9)	0.1233
		Non-elective	9.35 (4)	12.8% (6)	0.4281	9.1% (4)	11.5% (6)	0.4810
		Elective	0.0% (0)	12.5% (3)	0.0771	0.0% (0)	10.3%	0.0877
Pulmonary embolism	Diagnosed by CT chest, any postoperative day, rate, % (n)	Overall	1.4% (1)	0.0% (0)	0.5103	2.5% (2)	0.0% (0)	0.2484
		Non-elective	2.3% (1)	0.0% (0)	0.4778	4.4% (2)	0.0% (0)	0.2171
		Elective	0.0% (0)	0.0% (0)	0.9999	0.0% (0)	0.0% (0)	0.9999
Pulmonary edema severity	CXR severity scores (graded 0-3) ¹⁹ between First postoperative CXR off positive airway pressure (extubated, noninvasive positive pressure ventilation) and Final CXR before discharge. Scored by two experienced thoracic radiologists.	First CXR, mean (95%CI)	0.7 (0.6-1.0)	0.7 (0.6-1.0)	0.9748	0.8 (0.6-1.0)	0.8 (0.6-1.0)	0.9109
		Final CXR, mean (95%CI)	0.3 (0.2-0.4)	0.3 (0.2-0.4)	0.9939	0.3 (0.2-0.4)	0.3 (0.2-0.4)	0.7970

Table S11. Discharge location

Discharge Location		Per-protocol			Intent-to-treat		
		Control Bell OFF Rate, % (n)	Experimental Bell ON Rate, % (n)	P value	Control Bell OFF Rate, % (n)	Experimental Bell ON Rate, % (n)	P value
Home	Overall	60.8% (45)	59.2% (42)	0.4864	58.8% (47)	60.0% (48)	0.5000
	Non-elective	55.8% (24)	61.7% (29)	0.3621	43.6% (24)	60.8% (31)	0.2981
	Elective	67.7% (21)	54.2% (13)	0.2271	65.7% (23)	58.6% (17)	0.3724
Nursing facility*	Overall	35.1% (26)	39.4% (28)	0.3580	36.3% (29)	37.5% (30)	0.5000
	Non-elective	37.2% (16)	38.3% (18)	0.5445	40.0% (18)	37.3% (19)	0.4734
	Elective	32.3% (10)	41.7% (10)	0.3305	31.4% (11)	37.9% (11)	0.3887

*Nursing facility includes skilled nursing facility and rehabilitation center.

Table S12. In-hospital causes of death

		Sex	Age, years	Postoperative day	Immediate cause of death	Cardiopulmonary-related death
Bell OFF	Per-protocol	M	70.5	42	Pneumonia	Yes
		M	73.2	53	Sepsis due to acute respiratory failure	Yes
		M	74.8	9	Sustained ventricular tachycardia	Yes
	Intent-to-treat	F	87.3	4	Hypoxia due to respiratory arrest	Yes
Bell ON	Per-protocol	M	80.0	42	Sepsis due to pancreatic cyst abscess	No

Table S13. Daily nursing workload

Parameter		Per-protocol			Intent-to-treat		
		Control Bell OFF Mean (95%CI)	Experimental Bell ON Mean (95%CI)	P value	Control Bell OFF Mean (95%CI)	Experimental Bell ON Mean (95%CI)	P value
Number of <i>Episodes</i> reminded patient to use IS	Overall	3.0 (2.6-3.3)	3.0 (2.7-3.4)	0.7746	2.9 (2.6-3.3)	3.1 (2.8-3.4)	0.5051
	Non-elective	2.6 (2.2-3.0)	3.0 (2.6-3.4)	0.8223	2.6 (2.2-3.0)	2.9 (2.6-3.4)	0.4843
	Elective	3.5 (3.0-4.1)	3.1 (2.6-3.8)	0.8223	3.4 (2.9-3.9)	3.3 (2.8-4.0)	0.4843
<i>Minutes</i> nurses spent doing IS-related activities per patient	Overall	6.2 (5.5-7.0)	6.8 (5.9-7.9)	0.3170	6.2 (5.5-6.9)	6.7 (5.9-7.7)	0.8953
	Non-elective	5.7 (4.8-6.9)	6.6 (5.6-7.7)	0.4100	5.8 (4.8-6.8)	6.5 (5.5-7.5)	0.3873
	Elective	6.0 (5.1-7.0)	6.0 (4.7 (7.9)	0.4100	5.8 (5.0-6.7)	6.1 (4.8-7.7)	0.3873