

Supplementary materials

Table S1: All variables with missing data from MIMIC-IV 2.0

variables	total	missing number	Percentage (%)
Age	20193	0	0
Gender	20193	0	0
Ethnicity	20193	0	0
Insurance type	20193	0	0
Admission location	20193	0	0
Emergency surgery	20193	0	0
BMI	20193	0	0
Vital signs			
HR	20193	6	0.03
MAP	20193	87	0.43
RR	20193	35	0.17
Temperature	20193	604	3.00
SpO ₂	20193	16	0.08
Laboratory Values			
WBCs	20193	203	1.01
HGB	20193	208	1.03
HCT	20193	196	0.97
PLTs	20193	207	1.03
PT	20193	2849	14.12
INR	20193	2849	14.12
PTT	20193	3022	14.97
BUN	20193	181	0.90
Scr	20193	178	0.88
Serum chloride,	20193	202	1.00
Serum sodium,	20193	201	1.00
Serum potassium,	20193	213	1.05
Serum calcium,	20193	1857	9.20
Blood glucose	20193	107	0.53
Comorbidities, n (%)			
Myocardial infarct	20193	0	0
CHF	20193	0	0
Peripheral vascular disease	20193	0	0
Cerebrovascular disease	20193	0	0
Dementia	20193	0	0
Chronic pulmonary disease	20193	0	0
Rheumatic disease	20193	0	0
Peptic ulcer disease	20193	0	0
Diabetes	20193	0	0
Paraplegia	20193	0	0
Malignant tumor	20193	0	0
Liver disease	20193	0	0
Renal disease	20193	0	0
AIDS	20193	0	0
Sepsis	20193	0	0
GCS	20193	1010	5.00

Scores of Severity			
SIRS	20193	0	0
SOFA	20193	0	0
APS III	20193	0	0
SAPS II	20193	0	0
OASIS	20193	0	0
Treatment measures			
Vasoactive drugs	20193	0	0
Cardiotonic drugs	20193	0	0
Invasive ventilation	20193	0	0
CRRT	20193	0	0
Propofol	20193	0	0
Midazolam	20193	0	0
Dexmedetomidine	20193	0	0
Fentanyl	20193	0	0
Family communication	20193	0	0
Outcomes			
Delirium	20193	0	0
LOS of ICU	20193	0	0
ICU mortality	20193	0	0

Abbreviations: BMI: body mass index; HR: heart rate; MAP: mean arterial pressure; RR: respiratory rate; SpO₂: pulse oxygen saturation; WBCs: white blood cell counts; HGB: hemoglobin; HCT: hematocrit; PLTs: platelet counts; PT: prothrombin time; INR: international normalized ratio; PTT: partial thromboplastin time; BUN: blood urea nitrogen; Scr: serum creatinine; CHF: congestive heart failure; AIDS: acquired immune deficiency syndrome; SIRS: System Inflammatory Reaction Syndrome; SOFA: sequential organ failure assessment; APS III: acute physiology score III; SAPS II: Simplified Acute Physiology Scores II; OASIS: Oxford Acute Severity of Illness Score; GCS: Glasgow Coma Scale; CRRT: continuous renal replacement therapy; LOS: length of stay.

Table S2 Akaike information criterion (AIC) value of different model

model	Crude model	Model 1	Model 2	Model 3
AIC	24910.860	26511.791	26632.947	24572.515
P value	<0.001	<0.001	<0.001	<0.001

Abbreviations: AIC Akaike information criterion

Table S3 Model 1: Univariate and multivariate analysis for assessing the delirium incidence

	Univariate analysis		Multivariate analysis		VIF
	RR (95% CI)	P value	RR (95% CI)	P value	
BMI category					
Healthy weight	Reference	1	Reference	1	
Underweight	1.103 (1.023 ~1.190)	0.011	1.094 (0.996 ~1.202)	0.060	1.12
Overweight	0.925 (0.879 ~0.974)	0.003	0.934 (0.878 ~0.994)	0.031	1.27
Obesity grade 1	0.884 (0.827 ~0.944)	<0.001	0.886 (0.819 ~0.959)	0.003	1.20
Obesity grade 2	0.941 (0.859 ~1.031)	0.193	0.966 (0.865 ~1.079)	0.539	1.10
Obesity grade 3	1.135 (1.031 ~1.250)	0.010	1.170 (1.036 ~1.320)	0.011	1.08
Age	1.007 (1.005 ~1.008)	<0.001	1.004 (1.002 ~1.006)	0.001	
					1.21
Gender					
Female	Reference	1	Reference	1.	
Male	0.961 (0.922 ~1.002)	0.063	0.962 (0.914 ~1.012)	0.138	1.04
Ethnicity					
Others	Reference	1	Reference	1	
White	0.875 (0.825 ~0.927)	0	0.855 (0.796 ~0.918)	<0.001	1.93
Black	1.002 (0.926 ~1.085)	0.962	0.956 (0.866 ~1.055)	0.368	1.62
Hispanic/Latino	0.816 (0.720 ~0.924)	0.001	0.825 (0.711 ~0.958)	0.012	1.25
Asian	0.721 (0.626 ~0.831)	<0.001	0.704 (0.596 ~0.832)	<0.001	1.23
Comorbidities					
CHF	1.111 (1.060 ~1.164)	<0.001	0.992 (0.934 ~1.053)	0.790	1.11
Cerebrovascular disease	1.325 (1.255 ~1.399)	<0.001	1.246 (1.156 ~1.342)	<0.001	1.10
Dementia	2.157 (2.024 ~2.298)	<0.001	1.926 (1.730 ~2.145)	<0.001	1.04
Paraplegia	1.630 (1.500 ~1.771)	<0.001	1.502 (1.395 ~1.618)	<0.001	1.09
Liver disease	1.461 (1.382 ~1.544)	<0.001	1.484 (1.312 ~1.679)	<0.001	1.04
Laboratory Values					
BUN	1.007 (1.006 ~1.008)	<0.001	1.006 (1.005 ~1.008)	<0.001	1.97
Scr	1.049 (1.037 ~1.060)	<0.001	0.996 (0.978 ~1.013)	0.627	1.86
					mean VIF=1.29

Abbreviations: BMI: body mass index; CHF: congestive heart failure; BUN: blood urea nitrogen; Scr: serum creatinine.

Note: In the multivariate analysis model, for the variable of ethnicity, we selected “others” as the reference group, and we also conducted “white” as the reference group, which did not affect the relationship between BMI and the incidence of delirium.

Table S4 Model 2: Univariate and multivariate analysis for assessing the delirium incidence

	Univariate analysis		Multivariate analysis		VIF
	RR (95%CI)	P value	RR (95%CI)	P value	
BMI category					
Healthy weight	Reference	1	Reference	1	
Underweight	1.103 (1.023 ~1.190)	0.011	1.104 (1.005 ~1.213)	0.039	1.12
Overweight	0.925 (0.879 ~0.974)	0.003	0.929 (0.873 ~0.988)	0.019	1.27
Obesity grade 1	0.884 (0.827 ~0.944)	<0.001	0.893 (0.826 ~0.967)	0.005	1.20
Obesity grade 2	0.941 (0.859 ~1.031)	0.193	0.969 (0.868 ~1.082)	0.577	1.10
Obesity grade 3	1.135 (1.031 ~1.250)	0.010	1.182 (1.047 ~1.334)	0.007	1.08
Age	1.007 (1.005 ~1.008)	<0.001	1.005 (1.003 ~1.007)	<0.001	1.18
Gender					
Female	Reference	1	Reference	1	
Male	0.961 (0.922 ~1.002)	0.063	0.98 (0.931 ~1.031)	0.427	1.03
Ethnicity					
Others	Reference	1	Reference	1	
White	0.875 (0.825 ~0.927)	<0.001	0.858 (0.798 ~0.922)	<0.001	1.93
Black	1.002 (0.926 ~1.085)	0.962	0.973 (0.882 ~1.074)	0.585	1.61
Hispanic/Latino	0.816 (0.720 ~0.924)	0.001	0.825 (0.71 ~0.957)	0.011	1.24
Asian	0.721 (0.626 ~0.831)	<0.001	0.707 (0.598 ~0.835)	<0.001	1.23
Comorbidities					
CHF	1.111 (1.060 ~1.164)	<0.001	1.029 (0.968 ~1.093)	0.361	1.15
Cerebrovascular disease	1.325 (1.255 ~1.399)	<0.001	1.226 (1.138 ~1.32)	<0.001	1.10
Dementia	2.157 (2.024 ~2.298)	<0.001	1.954 (1.756 ~2.175)	<0.001	1.04
Paraplegia	1.630 (1.500 ~1.771)	<0.001	1.589 (1.476 ~1.71)	<0.001	1.09
Liver disease	1.461 (1.382 ~1.544)	<0.001	1.466 (1.297 ~1.658)	<0.001	1.02
Renal disease	1.200 (1.144 ~1.259)	<0.001	1.122 (1.053 ~1.196)	<0.001	1.13
					mean VIF =1.21

Abbreviations: BMI: body mass index; CHF: congestive heart failure.

Table S5 Model 3: Univariate and multivariate analysis for assessing the delirium incidence

	Univariate analysis		Multivariate analysis		VIF
	RR (95%CI)	P value	RR (95%CI)	P value	
BMI category					
Healthy weight	Reference	1	Reference	1	-
Underweight	1.103 (1 .023 ~ 1. 190)	0.011	1.007 (0.939~1.081)	0.838	1.13
Overweight	0.925 (0 .879 ~0.974)	0.003	0.947 (0.904~0.992)	0.021	1.29
Obesity grade 1	0.884 (0 .827 ~0.944)	<0 .001	0.902 (0.850~0.957)	0.001	1.24
Obesity grade 2	0.941 (0 .859 ~ 1.031)	0.193	0.954 (0.880~1.034)	0.254	1.13
Obesity grade 3	1. 135 (1 .031 ~ 1.250)	0.010	1.014 (0.930~1.106)	0.752	1.12
Age	1.007 (1 .005 ~ 1.008)	<0 .001	1.007 (1.006~1.009)	<0.001	1.59
Gender					
Female	Reference	1	Reference	1	-
Male	0.961 (0 .922 ~ 1.002)	0.063	0.910 (0.875~0.946)	<0.001	1.10
Ethnicity					
Others	Reference	1	Reference	1	
White	0.875 (0 .825 ~ 0.927)	<0 .001	0.952 (0.903~1.005)	0.074	2.00
Black	1.002 (0 .926 ~ 1.085)	0.962	1.034 (0.959~1.114)	0.387	1.70
Hispanic/Latino	0.816 (0 .720 ~ 0.924)	0.001	0.854 (0.761~0.958)	0.007	1.28
Asian	0.721 (0 .626 ~ 0.831)	<0 .001	0.813 (0.714~0.925)	0.002	1.26
Admission location					
Others	Reference	1	Reference	1	
Emergency room	0.997 (0 .931 ~ 1.067)	0.922	1.032 (0.969~1.099)	0.321	2.82
Physician referral	0.801 (0 .744 ~0.861)	<0 .001	0.902 (0.843~0.965)	0.003	2.71
Transfer from hospital	1.053 (0 .979 ~ 1. 133)	0.165	1.011 (0.945~1.082)	0.752	2.36
Vital signs					
Temperature	1.348 (1 .303 ~ 1.395)	<0 .001	1.111 (1.083~1.140)	<0.001	1.17
HR	1.008 (1.007 ~1.008)	<0.001	1.002 (1.001~1.003)	<0.001	1.31
RR	1.017 (1.014 ~ 1.020)	<0.001	1.000 (0.997~1.003)	0.985	1.20
MAP	1.004 (1 .003 ~ 1.005)	<0 .001	1.003 (1.003~1.004)	<0.001	1.07
SpO2	0.990 (0 .986 ~0.993)	<0 .001	1.001 (0.998~1.004)	0.488	1.10
Comorbidities					
CHF	1. 111 (1 .060 ~ 1. 164)	<0 .001	0.935 (0.895~0.977)	0.003	1.22
Cerebrovascular disease	1.325 (1 .255 ~ 1.399)	<0 .001	1.261 (1.196~1.330)	<0.001	1.13
Dementia	2. 157 (2 .024 ~2.298)	<0 .001	1.720 (1.597~1.851)	<0.001	1.06
Paraplegia	1.630 (1 .500 ~ 1.771)	<0 .001	1.384 (1.270~1.507)	<0.001	1.10
Liver disease	1.461 (1 .382 ~ 1.544)	<0 .001	1.151 (1.090~1.217)	<0.001	1.14
Sepsis	2.429 (2 .311 ~2.553)	<0 .001	1.417 (1.341~1.497)	<0.001	1.39
Chronic pulmonary disease	1. 107 (1 .056 ~ 1. 161)	<0 .001	1.030 (0.987~1.076)	0.178	1.12
Scores of Severity					
APS III	1.018 (1 .017 ~ 1.019)	<0 .001	1.005 (1.004~1.006)	<0.001	2.33
SOFA	1. 125 (1 .120 ~ 1. 129)	<0 .001	1.040 (1.034~1.047)	<0.001	2.42
GCS	0.937 (0.930 ~ 0.943)	<0.001	0.972 (0.965~0.979)	<0.001	1.16
Laboratory Values					
HCT	0.989 (0 .986 ~0.993)	<0 .001	1.001 (0.998~1.004)	0.441	1.25
BUN	1.007 (1 .006 ~ 1.008)	<0 .001	1.002 (1.001~1.003)	<0.001	2.29
Scr	1.049 (1 .037 ~ 1.060)	<0 .001	0.981 (0.966~0.997)	0.017	1.98
Blood glucose	1.001 (1 .001 ~ 1.001)	<0 .001	1.000 (0.999~1.000)	<0.001	1.00
Serum sodium	1.029 (1 .024 ~ 1.034)	<0 .001	1.009 (1.005~1.012)	<0.001	1.06
Treatment measures					
Family communication	1.779 (1.612 ~ 1.963)	<0.001	1.137 (1.035~1.248)	0.007	1.05
Fentanyl	2.146 (2.056 ~ 2.240)	<0.001	1.246 (1.177~1.320)	<0.001	2.2

Invasive ventilation	1.841 (1.769 ~ 1.917)	<0.001	1.174 (1.121~1.230)	<0.001	1.73
Propofol	1.895 (1.813 ~1.980)	<0.001	1.033 (0.976~1.094)	0.258	2.34
Midazolam	2.120 (2.038 ~2.206)	<0.001	1.085 (1.036~1.136)	0.001	1.49
Dexmedetomidine	2.343 (2.255 ~ 2.435)	<0.001	1.450 (1.387~1.516)	<0.001	1.29
Emergency surgery	1.033 (0.986 ~1.083)	0.172	1.009 (0.966~1.053)	0.692	1.04
ICU_LOS	1.048 (1.044 ~1.053)	<0.001	1.014 (1.012~1.017)	<0.001	1.33
					mean VIF 1.45

Abbreviations: BMI: body mass index; HR: heart rate; RR: respiratory rate; MAP: mean arterial pressure; SpO2: pulse oxygen saturation; HCT: hematocrit; BUN: blood urea nitrogen; Scr: serum creatinine; CHF: congestive heart failure; SOFA: sequential organ failure assessment; APS III: acute physiology score III; GCS: Glasgow Coma Scale; ICU: intensive care unit; LOS: length of stay.

Table S6 Baseline and Clinical Characteristics of the Study Participants

Variable name	BMI categories N=20193						P value
	Underweight BMI<18.5 kg/m² N=1533	Healthy weight 18.5≤BMI<25 kg/m² N=7618	Overweight 25≤BMI<30 kg/m² N=5989	Obesity grade 1 30≤BMI<35 kg/m² N=2983	Obesity grade 2 35≤BMI<40 kg/m² N=1235	Obesity grade 3 BMI≥40 kg/m² N=835	
Age, year	67 (56, 78)	68 (56, 79)	67 (57, 77)	65 (55, 74)	63 (53, 72)	62 (51, 70)	<0.001
Gender, male, n (%)	654 (42.66)	4162 (54.63)	3748 (62.58)	1745 (58.50)	607 (49.15)	367 (43.95)	<0.001
Ethnicity, n (%)							<0.001
Hispanic/Latino	43 (2.80)	291 (3.82)	235 (3.92)	125 (4.19)	50 (4.05)	20 (2.40)	
Asian	119 (7.76)	383 (5.03)	138 (2.30)	24 (0.80)	5 (0.40)	1 (0.12)	
White	1041 (67.91)	5284 (69.36)	4234 (70.70)	2068 (69.33)	828 (67.04)	565 (67.66)	
Black	182 (11.87)	735 (9.65)	579 (9.67)	327 (10.93)	136 (11.01)	114 (13.65)	
Others	148 (9.65)	925 (12.14)	803 (13.41)	440 (14.75)	216 (17.49)	135 (16.17)	
Insurance type, n (%)							<0.001
Medicaid	110 (7.18)	486 (6.38)	309 (5.16)	184 (6.17)	70 (5.67)	53 (6.35)	
Medicare	723 (47.16)	3446 (45.23)	2627 (43.86)	1208 (40.50)	487 (39.43)	326 (39.04)	
Others	700 (45.66)	3686 (48.39)	3053 (50.98)	1591 (53.34)	678 (54.90)	456 (54.61)	
Admission location, n (%)							<0.001
Emergency room	645 (42.07)	2997 (39.94)	2153 (35.95)	1017 (34.09)	439 (35.55)	302 (36.17)	
Physician referral	417 (27.20)	2378 (31.22)	1887 (31.51)	982 (32.92)	400 (32.39)	234 (28.02)	
Transfer from hospital	277 (18.07)	1366 (17.93)	1300 (21.71)	692 (23.20)	283 (22.91)	207 (24.79)	
Others	194 (12.65)	877 (11.51)	649 (10.84)	292 (9.79)	113 (9.15)	92 (11.02)	
Emergency surgery &, n (%)							<0.001
Yes	1092 (7.23)	5621 (37.19)	4516 (29.88)	2282 (15.10)	938 (6.21)	664 (4.39)	
No	441 (8.68)	1997 (39.31)	1473 (29.00)	701 (13.80)	297 (5.85)	171 (3.37)	
Vital signs							
HR, bpm	104 (90, 119)	102 (89, 117)	99 (88, 114)	100 (89, 114)	102 (90, 115)	103 (91, 117)	<0.001
MAP, mmHg	101 (90, 115)	101 (90, 113)	101 (91, 114)	101 (91, 115)	102 (92, 115)	105 (93, 119)	<0.001
RR, bpm	28 (24, 32)	27 (24, 32)	27 (24, 31)	27 (24, 32)	28 (24, 32)	29 (25, 33)	<0.001
Temperature, °C	37.2 (36.9, 37.6)	37.2 (36.9, 37.6)	37.2 (36.9, 37.6)	37.2 (36.9, 37.6)	37.2(37.0, 37.1)	37.2 (37.0, 37.6)	<0.001
SpO₂, %	93 (90, 95)	93 (90, 95)	93 (91, 95)	92 (90, 94)	92 (90, 94)	92 (90, 94)	<0.001
Laboratory Values							
WBCs, *10⁹/L	12.0 (8.3, 16.7)	12.1 (8.7, 17.0)	12.7 (9.1, 17.1)	13.3 (9.7, 18.0)	13.3 (9.4, 18.2)	13.5 (9.7, 18.7)	<0.001
HGB, mg/dl	9.3 (7.8, 10.9)	9.5 (8.0, 11.3)	10.0 (8.3, 11.7)	10.1 (8.5, 11.8)	10.3 (8.6, 11.9)	10.2 (8.6, 11.9)	<0.001
HCT, %	28.4 (24.2, 33.1)	29.1 (24.5, 34.3)	30.2 (25.4, 35.2)	30.9 (26.1, 35.5)	31.3 (26.6, 36.2)	31.8 (26.9, 36.6)	<0.001
PLTs, *10⁹/L	180 (120, 250)	168 (114, 233)	165 (118, 225)	168 (126, 229)	182 (132, 235)	190 (141, 253)	<0.001

PT, s	12.8 (11.6, 14.8)	13.0 (11.7, 14.9)	12.8 (11.7, 14.6)	12.8 (11.8, 14.5)	12.8 (11.7, 14.4)	13.1 (11.9, 15.3)	0.323
INR	1.3 (1.1, 1.6)	1.3 (1.1, 1.6)	1.3 (1.1, 1.6)	1.3 (1.1, 1.5)	1.3 (1.1, 1.5)	1.3 (1.2, 1.6)	0.041
PTT, s	32.5 (28.4, 41.5)	32.5 (28.2, 42.3)	31.9 (27.9, 41.2)	31.6 (27.8, 40.6)	30.9 (27.7, 39.9)	32.1 (27.9, 45.3)	<0.001
BUN, mmol/L	21 (13, 35)	20 (13, 32)	19 (14, 30)	20 (14, 32)	20 (14, 32)	21 (15, 34)	0.005
Scr, mg/dl	1.0 (0.7, 1.5)	1.0 (0.7, 1.5)	1.0 (0.8, 1.5)	1.1 (0.8, 1.6)	1.1 (0.8, 1.6)	1.1 (0.8, 1.8)	<0.001
Serum chloride, mmol/L	105 (101, 109)	105 (102, 109)	106 (102, 109)	106 (102, 109)	105 (102, 108)	104 (100, 107)	<0.001
Serum sodium, mmol/L	139 (137, 142)	139 (137, 142)	139 (137, 142)	140 (137, 142)	140 (137, 142)	140 (137, 142)	0.056
Serum potassium, mmol/L	4.4 (4.0, 4.9)	4.4 (4.0, 4.8)	4.4 (4.1, 4.8)	4.5 (4.1, 4.9)	4.5 (4.1, 5.0)	4.5 (4.1, 5.0)	<0.001
Serum calcium, mmol/L	8.1 (7.5, 8.6)	8.2 (7.7, 8.7)	8.2 (7.8, 8.7)	8.3 (7.8, 8.7)	8.3 (7.8, 8.8)	8.3 (7.9, 8.7)	<0.001
Blood glucose, mg/dL	151 (121, 200)	154 (122, 200)	162 (129, 206)	171 (136, 213)	169 (133, 214)	171 (133, 222)	<0.001
Comorbidities, n (%)							
Myocardial infarct	161 (10.50)	1034 (13.57)	1014 (16.93)	526 (17.63)	199 (16.11)	124 (14.85)	<0.001
CHF	318 (20.74)	1762 (23.13)	1362 (22.74)	755 (25.31)	351 (28.42)	290 (34.73)	<0.001
Peripheral vascular disease	172 (11.22)	861 (11.30)	651 (10.87)	319 (10.69)	106 (8.58)	63 (7.54)	0.003
Cerebrovascular disease	153 (9.98)	908 (11.92)	761 (12.71)	359 (12.03)	145 (11.74)	78 (9.34)	0.013
Dementia	71 (4.63)	260 (3.41)	170 (2.84)	69 (2.31)	21 (1.70)	5 (0.60)	<0.001
Chronic pulmonary disease	440 (28.70)	1545 (20.28)	1242 (20.74)	710 (23.80)	369 (29.88)	292 (34.97)	<0.001
Rheumatic disease	78 (5.09)	272 (3.57)	172 (2.87)	95 (3.18)	38 (3.08)	26 (3.11)	0.001
Peptic ulcer disease	42 (2.74)	165 (2.17)	112 (1.87)	45 (1.51)	22 (1.78)	22 (2.63)	0.044
Diabetes	305 (19.90)	1782 (23.39)	1812 (30.26)	1166 (39.09)	495 (40.08)	401 (48.02)	<0.001
Paraplegia	36 (2.35)	244 (3.20)	192 (3.21)	84 (2.82)	33 (2.67)	28 (3.35)	0.410
Malignant tumor	367 (23.94)	1526 (20.03)	932 (15.56)	389 (13.04)	121 (9.80)	71 (8.50)	<0.001
Liver disease	158 (10.31)	785 (10.30)	566 (9.45)	298 (9.99)	107 (8.66)	79 (9.46)	0.361
Renal disease	298 (19.44)	1475 (19.36)	1163 (19.42)	614 (20.58)	238 (19.27)	175 (20.96)	0.653
AIDS	11 (0.72)	68 (0.89)	26 (0.43)	10 (0.34)	4 (0.32)	0 (0.00)	<0.001
Sepsis	977 (63.73)	4234 (55.58)	3138 (52.40)	1516 (50.82)	674 (54.57)	468 (56.05)	<0.001
Scores of Severity, score							
SIRS	3 (2, 3)	3 (2, 3)	3 (2, 3)	3 (2, 3)	3 (2, 3)	3 (2, 3)	0.001
SOFA	4 (2, 7)	4 (2, 7)	4 (2, 7)	4 (2, 7)	4 (2, 7)	4 (2, 7)	0.085
APS III	44 (33, 58)	41 (30, 55)	38 (29, 53)	39 (29, 53)	40 (30, 54)	43 (31, 58)	<0.001
SAPS II	36 (28, 45)	34 (27, 43)	34 (26, 42)	33 (25, 42)	33 (25, 41)	33 (23, 42)	<0.001
OASIS	31 (25, 37)	30 (24, 36)	30 (24, 36)	29 (24, 36)	29 (24, 35)	31 (24, 37)	<0.001
GCS	15 (15, 15)	15 (15, 15)	15 (15, 15)	15 (15, 15)	15 (15, 15)	15 (15, 15)	0.004
Treatment measures, n (%)							
Vasoactive drugs ^a	582 (37.96)	2395 (31.44)	1668 (27.85)	834 (27.96)	354 (28.66)	269 (32.22)	<0.001
Cardiotonic drugs ^b	58 (3.78)	297 (3.90)	211 (3.52)	107 (3.59)	46 (3.72)	27 (3.23)	0.846
Invasive ventilation	438 (28.57)	2208 (28.98)	1984 (33.13)	979 (32.82)	423 (34.25)	301 (36.05)	<0.001

CRRT	43 (2.80)	233 (3.06)	194 (3.24)	108 (3.62)	57 (4.62)	48 (5.75)	<0.001
Propofol	708 (46.18)	3549 (46.59)	3074 (51.33)	1539 (51.59)	643 (52.06)	449 (53.77)	<0.001
Midazolam	348 (22.70)	1375 (18.05)	932 (15.56)	435 (14.58)	198 (16.03)	182 (21.80)	<0.001
Dexmedetomidine	288 (18.79)	1164 (15.28)	1013 (16.91)	492 (16.49)	231 (18.70)	185 (22.16)	<0.001
Fentanyl	676 (44.10)	3125 (41.02)	2617 (43.70)	1311 (43.95)	547 (44.29)	413 (49.46)	<0.001
Family communication	1391 (90.74)	6921 (90.85)	5440 (90.83)	2687 (90.08)	1127 (91.26)	739 (88.50)	0.233
Outcomes							
Delirium, n (%)	537 (35.03)	2419 (31.75)	1759 (29.37)	837 (28.06)	369 (29.88)	301 (36.05)	<0.001
LOS of ICU, d	2.44 (1.62, 4.16)	2.32 (1.54, 4.08)	2.19 (1.41, 3.92)	2.25 (1.43, 3.94)	2.23 (1.44, 3.91)	2.61 (1.62, 5.12)	<0.001
ICU mortality, n (%)	44 (2.87)	130 (1.71)	141 (2.35)	80 (2.68)	32 (2.59)	23 (2.75)	0.004

Data are expressed as the median (IQR) or n (%). The Kruskal–Wallis test and Chi-square (or Fisher’s exact) test were used for comparisons among the groups. P values were adjusted for multiple testing using Bonferroni correction and a significance level of $\alpha=0.05$ was applied. [&]: Emergency surgery was defined as surgery performed within 24 hours of admission. ^a: Vasoactive drugs included norepinephrine, vasopressin, phenylephrine, and dopamine. ^b: Cardiotonic drugs included dobutamine, milrinone, and adrenaline.

Abbreviation: BMI: body mass index; HR: heart rate; MAP: mean arterial pressure; RR: respiratory rate; SpO₂: pulse oxygen saturation; WBCs: white blood cell counts; HGB: hemoglobin; HCT: hematocrit; PLTs: platelet counts; PT: prothrombin time; INR: international normalized ratio; PTT: partial thromboplastin time; BUN: blood urea nitrogen; Scr: serum creatinine; CHF: congestive heart failure; AIDS: acquired immune deficiency syndrome; SIRS: System Inflammatory Reaction Syndrome; SOFA: sequential organ failure assessment; APS III: acute physiology score III; SAPS II: Simplified Acute Physiology Scores II; OASIS: Oxford Acute Severity of Illness Score; GCS: Glasgow Coma Scale; CRRT: continuous renal replacement therapy; LOS: length of stay.

Table S7 Comparison of the Baseline and Clinical Characteristics between the Delirium-Positive and Delirium-Negative Groups

Variable name	Group according to Delirium		P value
	N=20193 Delirium positive n=6,222	Delirium negative N=13,971	
Age, year	68 (57, 79)	66 (55, 76)	<0.001
Gender, male, n (%)	3416 (54.90)	7867 (56.31)	0.063
BMI category, n (%)			<0.001
Underweight	537 (8.63)	996 (7.13)	
Healthy weight	2419 (38.88)	5199 (37.21)	
Overweight	1759 (28.27)	4230 (30.28)	
Obesity grade 1	837 (13.45)	2146 (15.36)	
Obesity grade 2	369 (5.93)	866 (6.20)	
Obesity grade 3	301 (4.84)	534 (3.82)	
Ethnicity, n (%)			<0.001
Hispanic/Latino	214 (3.44)	550 (3.94)	
Asian	166 (2.67)	504 (3.61)	
White	4213 (67.71)	9807 (70.20)	
Black	713 (11.46)	1359 (9.73)	
Others	916 (14.72)	1751 (12.53)	
Insurance type, n (%)			<0.001
Medicaid	392 (6.30)	820 (5.87)	
Medicare	3007 (48.33)	5810 (41.59)	
Others	2823 (45.37)	7341 (52.54)	
Admission location, n (%)			<0.001
Emergency room	2448 (39.34)	5105 (36.54)	
Physician referral	1640 (26.36)	4658 (33.34)	
Transfer from hospital	1413 (22.71)	2712 (19.41)	
Others	721 (11.59)	1496 (10.71)	
Emergency surgery &, n (%)			0.176
Yes	4618 (30.56)	10495 (69.44)	
No	1604 (31.57)	3476 (68.43)	
Vital sign			
HR, bpm	105 (91,120)	99 (88, 113)	<0.001
MAP, mmHg	103 (92, 117)	100 (91, 113))	<0.001
RR, bpm	28 (24, 33)	27 (24, 31)	<0.001
Temperature, °C	37.3 (37.0, 37.8)	37.2 (36.9, 37.5)	<0.001
SpO ₂ , %	92 (90, 95)	93 (91, 95)	0.004
Laboratory values			
WBCs, *10 ⁹ /L	13.1 (9.3, 18.1)	12.4 (8.9, 16.9)	<0.001
HGB, mg/dl	9.5 (7.9, 11.3)	9.9 (8.3, 11.6)	<0.001
HCT, %	29.3 (24.5, 34.6)	30.1 (25.4, 35.1)	<0.001
PLTs, *10 ⁹ /L	166 (111, 231)	172 (123, 233)	0.010
PT, s	13.1 (11.8, 15.5)	12.8 (11.7,14.4)	<0.001
INR	1.3 (1.1, 1.7)	1.3 (1.1, 1.5)	<0.001
PTT, s	32.5 (28.1, 43.4)	31.9 (28.0, 40.9)	<0.001
BUN, mmol/L	23 (15, 39)	19 (13, 29)	<0.001
Scr, mg/dl	1.1 (0.8, 1.8)	1.0 (0.8, 1.4)	<0.001
Serum chloride, mmol/L	105 (101, 109)	105 (102, 109)	0.440
Serum sodium, mmol/L	140 (137, 143)	139 (137, 142)	<0.001
Serum potassium, mmol/L	4.5 (4.1, 5.0)	4.4 (4.1, 4.8)	<0.001
Serum calcium, mmol/L	8.2 (7.7, 8.7)	8.2 (7.8, 8.7)	<0.001

Blood glucose, mg/dL	162 (127, 212)	160 (126, 203)	<0.001
Comorbidities, n (%)			
Myocardial infarct	904 (14.53)	2154 (15.42)	0.104
CHF	1613 (25.92)	3225 (23.08)	<0.001
Peripheral vascular disease	642 (10.32)	1530 (10.95)	0.180
Cerebrovascular disease	945 (15.19)	1459 (10.44)	<0.001
Dementia	383 (6.16)	213 (1.52)	<0.001
Chronic pulmonary disease	1531 (24.61)	3067 (21.95)	<0.001
Rheumatic disease	200 (3.21)	481 (3.44)	0.406
Peptic ulcer disease	139 (2.23)	269 (1.93)	0.150
Diabetes	1979 (31.81)	3982 (28.50)	<0.001
Paraplegia	304 (4.89)	313 (2.24)	<0.001
Malignant tumor	1044 (16.78)	2362 (16.91)	0.824
Liver disease	858 (13.79)	1135 (8.12)	<0.001
Renal disease	1410 (22.66)	2553 (18.27)	<0.001
AIDS	41 (0.66)	78 (0.56)	0.388
Sepsis	4631 (74.43)	6376 (45.64)	<0.001
Scores of Severity			
SIRS	3 (2, 3)	2 (2, 3)	<0.001
SOFA	6 (4, 9)	3 (2, 6)	<0.001
APS III	51 (38, 71)	36 (28, 48)	<0.001
SAPS II	39 (31, 49)	32 (25, 40)	<0.001
OASIS	35 (29, 41)	28 (23, 33)	<0.001
GCS	15 (14, 15)	15 (15, 15)	<0.001
Treatment measures, n (%)			
Vasoactive drugs ^a	2828 (45.45)	3274 (23.43)	<0.001
Cardiotonic drugs ^b	321 (5.16)	425 (3.04)	<0.001
Invasive ventilation	2843 (45.69)	3490 (24.98)	<0.001
CRRT	454 (7.30)	229 (1.64)	<0.001
Propofol	4035 (64.85)	5927 (42.42)	<0.001
Midazolam	1901 (30.55)	1569 (11.23)	<0.001
Dexmedetomidine	1989 (31.97)	1384 (9.91)	<0.001
Fentanyl	3848 (61.85)	4841 (34.65)	<0.001
Family communication	5881 (94.52)	12424 (88.93)	<0.001
Outcomes			
LOS of ICU, d	3.76 (2.11, 7.28)	2.01 (1.34, 3.12)	<0.001
ICU mortality, n (%)	317 (5.09)	133 (0.95)	<0.001

Data are expressed as the median (IQR) or n (%). The Kruskal Wallis test and chi-square (or Fisher's exact) tests were used for comparisons among the groups. Statistical significance ($P \leq 0.05$). &: Emergency surgery was defined as surgery performed within 24 hours of admission. ^a: Vasoactive drugs included norepinephrine, vasopressin, phenylephrine, and dopamine. ^b: Cardiotonic drugs included dobutamine, milrinone, and adrenaline.

Abbreviations: BMI: body mass index; HR: heart rate; MAP: mean arterial pressure; RR: respiratory rate; SpO₂: pulse oxygen saturation; WBCs: white blood cell counts; HGB: hemoglobin; HCT: hematocrit; PLTs: platelet counts; PT: prothrombin time; INR: international normalized ratio; PTT: partial thromboplastin time; BUN: blood urea nitrogen; Scr: serum creatinine; CHF: congestive heart failure; AIDS: acquired immune deficiency syndrome; SIRS: System Inflammatory Reaction Syndrome; SOFA: sequential organ failure assessment; APS III: acute physiology score III; SAPS II: Simplified Acute Physiology Scores II; OASIS: Oxford Acute Severity of Illness Score; GCS: Glasgow Coma Scale; CRRT: continuous renal replacement therapy; LOS: length of stay.

Table S8: Crude model

	RR	SD	Z value	p-value	[95% CI]	
					Lower	Upper
BMI category						
Healthy weight	1	.	.	Reference	.	.
Underweight	1.103	0.043	2.54	0.011	1.023	1.190
Overweight	0.925	0.024	-2.98	0.003	0.879	0.974
Obesity grade 1	0.884	0.030	-3.66	0.000	0.827	0.944
Obesity grade 2	0.941	0.044	-1.30	0.193	0.859	1.031
Obesity grade 3	1.135	0.056	2.59	0.010	1.031	1.250

Abbreviations: BMI: body mass index.

Figure_S1

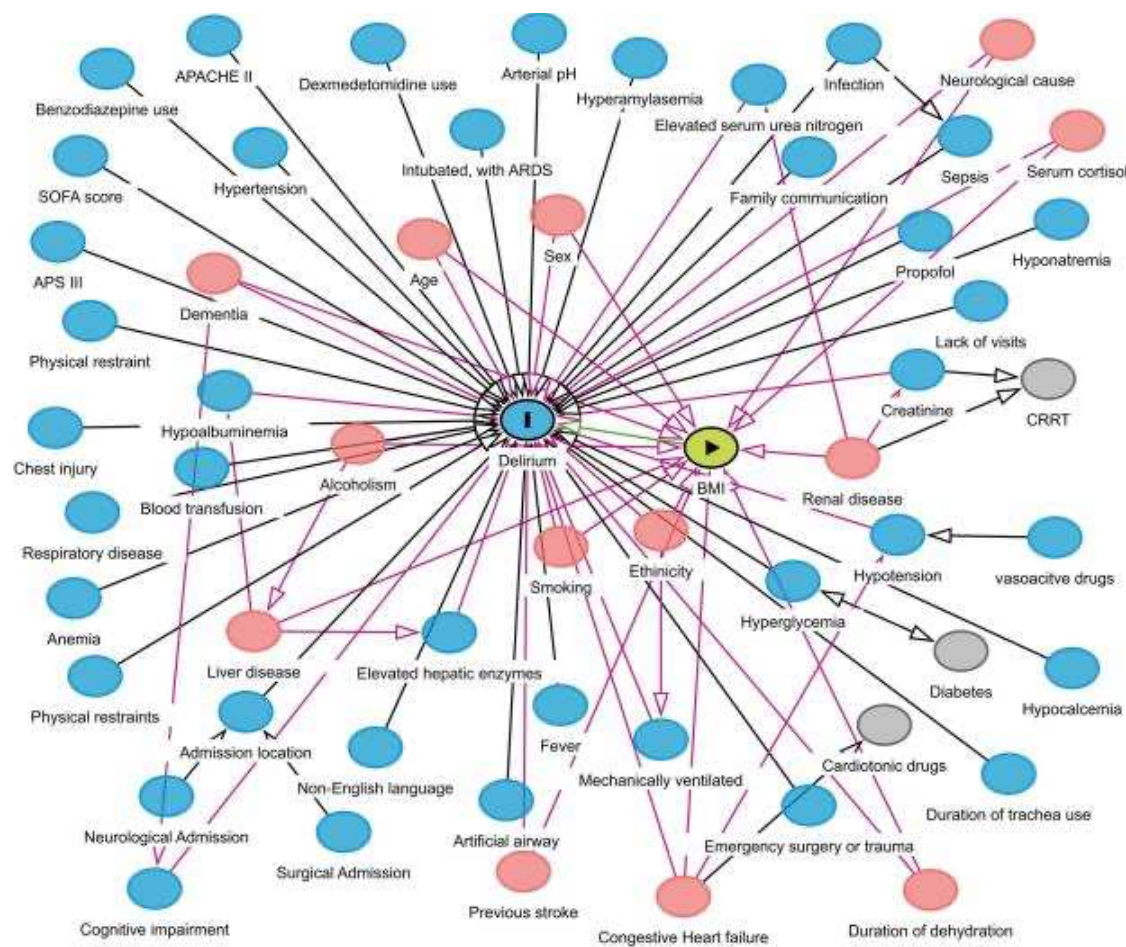


Figure S1: Directed acyclic graph for selecting confounders

Figure_S2

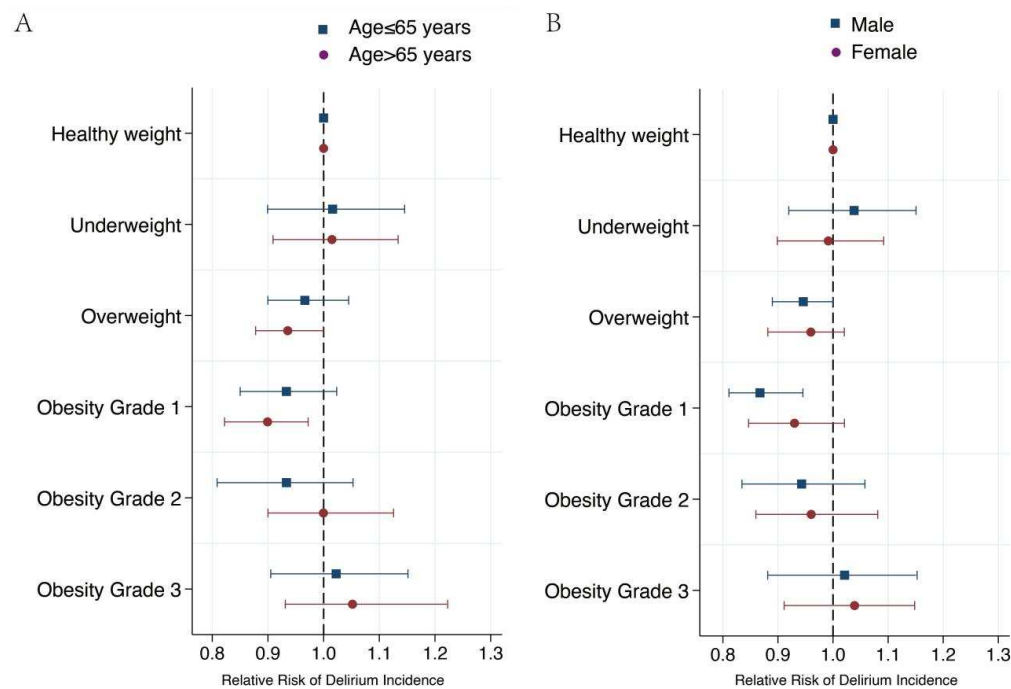


Figure S2: Subgroup Analyses Between BMI levels and Delirium Incidence stratified by age (A) and gender (B)

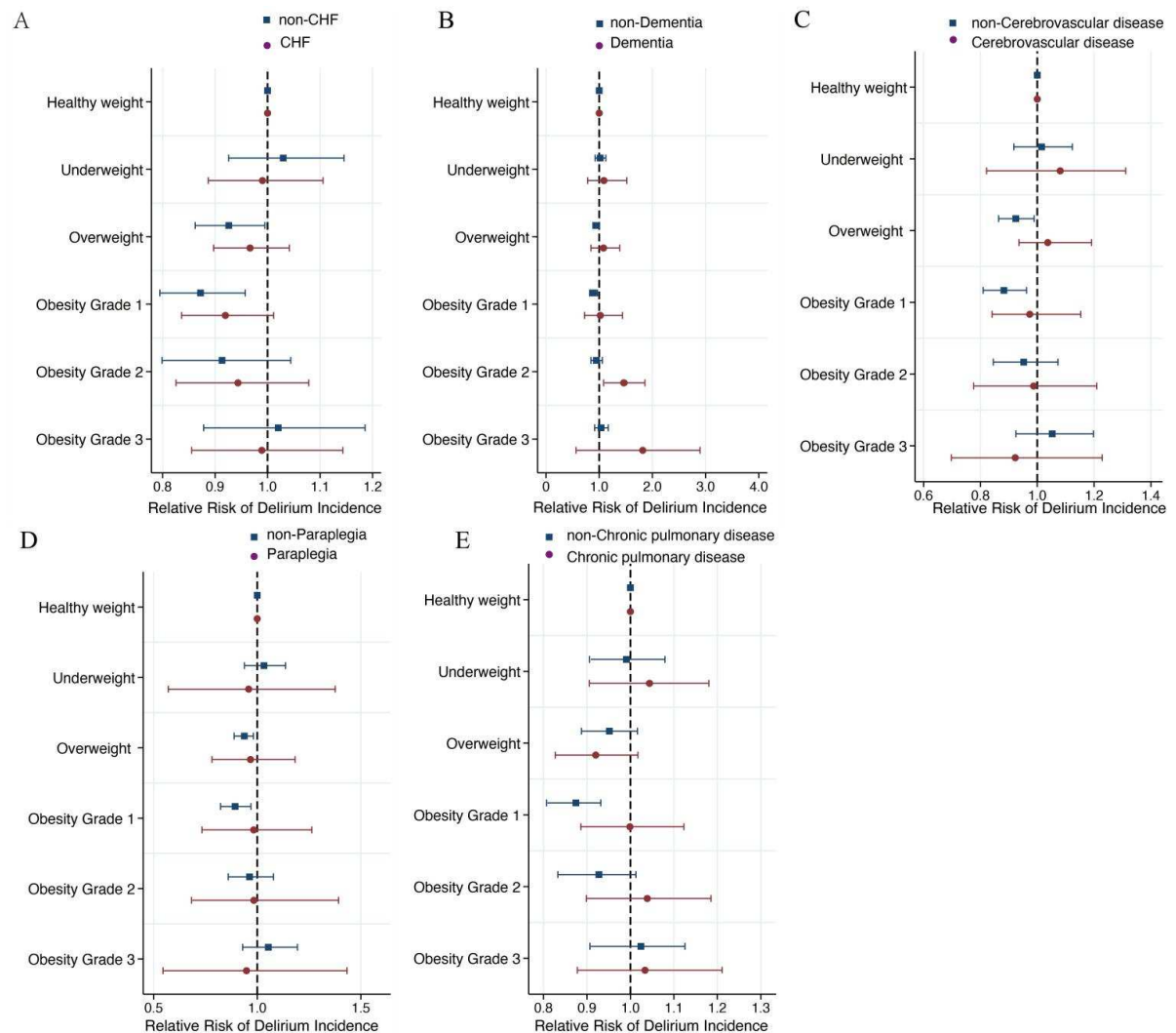
Figure_S3

Figure S3: Subgroup Analyses Between BMI levels and Delirium Incidence stratified by CHF (A), dementia (B), cerebrovascular disease (C), paraplegia (D), chronic pulmonary disease (E)

Abbreviations: CHF: congestive heart failure

Figure_S4

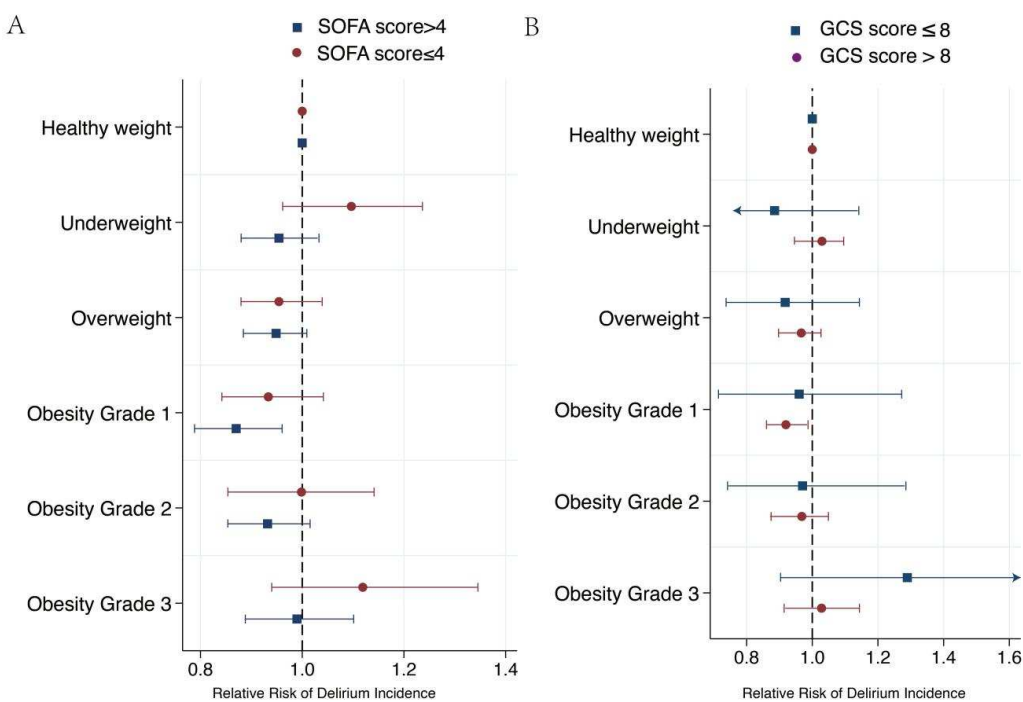


Figure S4: Subgroup Analyses Between BMI levels and Delirium Incidence stratified by SOFA score (A) and GCS score (B)

Abbreviations: SOFA: sequential organ failure assessment; GCS: Glasgow Coma Scale.

Figure_S5

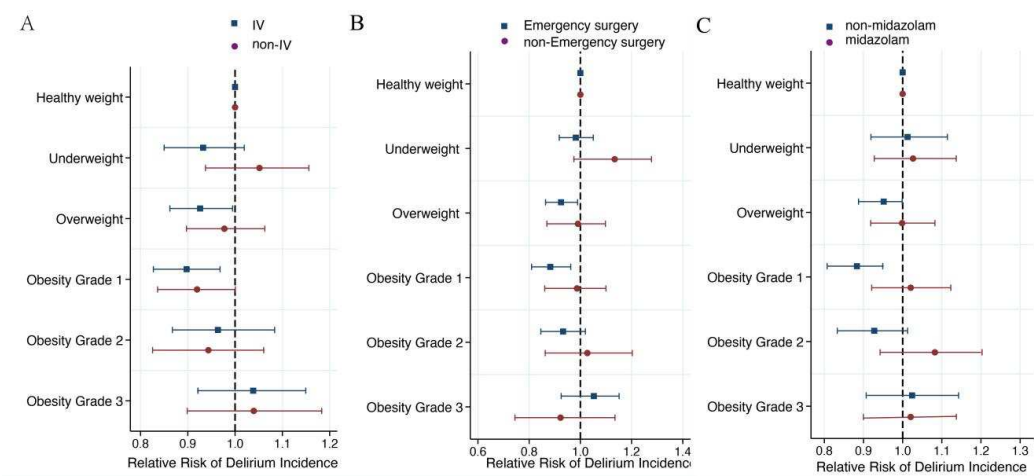


Figure S5: Subgroup Analyses Between BMI levels and Delirium Incidence stratified by IV (A), Emergency surgery (B) and midazolam (C)

Abbreviations: IV: invasive ventilation.