

Supplementary Material

Supplemental Table 1 – International classification of disease codes used for determining past medical history

Supplemental Table 2 – Illness Severity Concordance

Supplemental Table 3 – Missing Data

Supplemental Table 4 – Sensitivity analysis of the Logistic regression analysis of characteristics and outcomes associated with developing hypermagnesemia excluding patients with hypomagnesemia

Supplemental Table 5 – Sensitivity analysis of the survival analysis showing hazard ratios for death excluding patients with hypomagnesemia

Supplemental Figure 1 - Patient survival curves by median magnesium tertiles

Kaplan Meier curve for patient survival over time from admission for all patients stratified by tertiles of median magnesium (lowest values = Tertile 1 (blue) while highest values = Tertile 3 (green); $p < 0.001$).

Supplemental Table 1 – International classification of disease codes used for determining past medical history

DM	DM (continued)	HTN	CKD	Pulmonary Disease	Liver Disease
E10.10	E08.65	I10	N18.9	J45.909	B15.9
E10.21	E11.3513	I27.20	E11.22, I12.9, N18.4	J45.40	B16.1
E10.22	E11.69, N52.1	I12.9	N18.4	J44.1, J45.901	B16.9
E10.29	E11.22, N18.4, E11.65	I11.9	N18.3	J45.998	B17.0
E10.3553	E13.628, Z79.4	E11.22, I12.9, N18.4	N18.30	J45.20	B17.10
E10.36	E11.621, I97.502	O13.9	N18.6, Z99.2	J44.9	B17.8
E10.36, E10.65	E13.69, M86.9	G93.2	N18.5	J45.21	B17.9
E10.39	N25.1	I12.9, N18.3	N18.4, D63.1	J45.901	B18.0
E10.43, E10.65, K31.84	E10.319, E10.65	I12.9, N18.30	I12.9, N18.3	J45.30	B18.1
E10.51	E11.36	Z86.79	I12.9, N18.30	J45.991	B18.1, K74.60
E10.51, E10.65	E13.3313	I12.9, N18.4	E13.22, N18.3, E13.65	Z82.5	B18.2
E10.641	E10.3399, E10.65	I87.312, I97.929	N18.9, E83.9, M89.9	J45.909, Z79.52	B18.2, K74.60
E10.65	E11.621, I97.511	I11.0	I12.9, N18.4	J45.990	B18.9
E10.8	E09.65	E11.22, I12.0, N18.5	E13.22, N18.4, E13.65	R09.02, J45.909	B19.10
E10.9	E08.319, H54.7	I27.21	E11.22, I12.0, N18.5	O99.519, J45.909	B19.11
E11.00	E11.3521	O16.3	N18.9, D63.1	J45.42	B19.20
E11.00, Z79.4	E13.21	I16.1	E08.22	Z87.09	B19.20, G63
E11.10	E08.21	K76.6, I85.00	I12.9	J45.901, J44.9	B19.20, K74.69
E11.10, Z79.4	E10.22, E10.65, N18.6, Z99.2	K76.6	N18.5, D63.1	J45.41	B19.21
E11.11, Z79.4	E11.621, I97.425	I87.333, I97.919, I97.929	E11.22, I12.9	J45.50	B19.9
E11.21	E11.621, I97.509, Z79.4	I27.29, I26.99	N18.9, Z86.2	I50.1	B20, B19.10
E11.21, E11.65, Z79.4	O24.013	I11.0, I50.30	E11.22, Z79.4	J45.909, Z91.89	D89.1, B18.2
E11.22	E11.618, M75.02	O10.019	N18.2	J45.31	E80.6, K76.89, K83.1
E11.22, I12.0, N18.5	E13.319, H35.049	O10.919	E11.22, N18.2	J45.902	E80.6, K76.89, K83.8
E11.22, N18.2	E11.618, M75.01	K76.6, K31.89	E11.22, N18.5	J45.52	E83.01
E11.22, N18.2, Z79.4	E11.618	E11.22, I12.9	N17.9, N18.9, Z99.2	O99.512, J45.909	E83.10
E11.22, N18.3	E11.69, E88.9	E11.59, I10	E11.22, N18.3	J45.51	E83.110
E11.22, N18.3, Z79.4	O24.911	O16.9	E11.22, I12.9, N18.3	J45.32	E83.111
E11.22, N18.4	E11.65, E11.39, H42	Z87.59	N18.6	J45.22	E83.118
E11.22, N18.5	Z91.19	I16.9	N18.3, D63.1	O99.513, J45.909	E83.119
E11.22, N18.5, Z79.4	E11.3522	R03.0	N17.9, N18.9	J44.1	E83.19
E11.22, N18.6	E11.621, I97.515	I15.9	E11.22, N18.6, Z99.2, Z79.4	493	E84.8, K74.60
E11.22, N18.6, E11.65	E08.621, I97.524	I27.22	E11.22	493.9	E88.01
E11.22, N18.6, Z79.4, Z99.2	E10.29, R80.9	I87.339, I97.909	N18.6, D63.1, Z99.2	493.92	E88.1
E11.22, N18.6, Z99.2	E13.22, N18.2, E13.65	H35.033	I12.9, N18.2	493.02	G40.B19
E11.22, N18.6, Z99.2, Z79.4	E08.65, E08.22, N18.30, Z79.4	I16.0	N18.1	V12.69	J43.8, E88.01
E11.22, Z79.4	E08.319	E11.22, I12.9, N18.3	N17.9, N18.3	648.9	K70.0
E11.29	E10.22, N18.4, E10.65	I27.0	N17.9, N18.30	493.9	K70.10
E11.29, E11.65	E08.621, I97.519	IM00002	I12.0, N18.6, Z99.2	493.91	K70.11
E11.29, R80.9	E11.22, I12.0, Z99.2, N18.6	O11.9	Z01.818	466	K70.30
E11.29, Z79.4	E11.22, N18.1, E11.65	O10.219	E11.22, N18.3, Z79.4	493.12	K70.30, I85.10
E11.311	E11.69, E78.2	O14.15	E11.22, N18.4, Z79.4	493.22	K70.31
E11.311, E11.65	E11.01	I27.22, I05.9	I12.0, N18.5	493.82	K70.40
E11.319	E11.3412, E11.65, Z79.4	T86.49, K76.6	N18.30, D63.1	493.2	K70.9
E11.3299	E11.622, I97.929	I27.24	E11.22, N18.2, Z79.4	V17.5	K72.90, K74.60
E11.3312	E11.621, I97.423	Z86.79, Z87.59	N17.9, N18.4	493.1	K74.0
E11.3313	E11.42, Z79.4	I15.1, N28.89	I13.0, N18.1	493.2	K74.00
E11.3391	E11.621, I97.522	I12.9, N18.2	E10.22, N18.5	Z78.9	K74.1
E11.3393, Z79.4	E13.10	I15.8, T50.905A	N17.9, N18.5	J68.3	K74.2
E11.3499	E11.622, E11.65, I97.909	O13.3	E11.22, N18.30	J20.9	K74.3
E11.3513, H54.2X22	E11.3293, Z79.4	I27.29	N18.31	493.11	K74.3, K83.01
E11.3513, Z79.4	K86.89, E08.65	I15.2, E27.9	E11.22, N18.4	O99.519	K74.4
E11.3592, Z79.4	E10.649	H35.031	E10.22	O99.513	K74.5
E11.3593	E11.22, I12.9, N18.2	O14.14	I13.0, I50.21	J44.9	K74.60
E11.3593, Z79.4	E11.621, I97.521	I12.0, N18.6, Z99.2	E13.22, I12.9, N18.2	J43.9	K74.60, B19.10
E11.3599	O24.319	H35.039	N17.9, N18.2	J44.9, Z91.89	K74.60, I85.10
E11.39	E13.29, E13.65	I27.29, D86.9	I13.10, N18.2	J44.1	K74.60, K76.9
E11.39, E11.65	E11.621, I97.512	R09.89	E11.22, I12.9, N18.30	J44.1, J45.901	K74.60, R18.8
E11.39, H43.11	E08.8	I15.8	E10.22, N18.6, Z99.2	I27.23, J44.9	K74.69
E11.39, Z79.4	O24.019	H40.059	E11.22, N18.30, Z79.4	G47.33, J44.9	K74.69, B19.20
E11.40	E11.622, I97.309	I12.0, N18.5	I13.11, N18.6, Z99.2	J44.0	K74.69, J94.8
E11.40, M54.12	E13.01	I15.0	I13.10	J44.9, R06.03	K75.4
E11.40, Z79.4	E08.42	I87.393	I13.0	Z87.09	K75.81, K74.60
E11.41, G57.90	O24.113	I87.332, I97.929	E13.22, I12.9, N18.3	J44.9, J96.00	K76.0
E11.42	E11.41, Z79.4	I12.0, N18.6	I13.0, I50.40	J44.9, R64	K76.1
E11.43, E11.65	E11.3551, Z79.4	I27.23, J44.9	E11.22, N18.4, E11.65	J44.0, J20.9	K76.5
E11.43, K31.84	E08.29, R80.9, Z79.4	I13.0, N18.1	I10, N28.9	J96.00	K76.6
E11.49	E10.69	O16.5	E11.22, N18.5, Z79.4	496	K76.6, I85.00
E11.49, E11.65	E09.9	I11.9, I43	I13.0, I50.33	491.21	K76.6, K31.89
E11.49, Z79.4	E10.40	H40.052	E10.22, E10.65, N18.6, Z99.2	491.22	K76.7
E11.51	E11.51, I70.209	I15.8, Z94.9	I13.0, I50.30	G47.33	K76.81
E11.51, E11.65	E13.65	H40.053	I12.9, N18.1	V49.89	K76.89
E11.59	E10.22, N18.2	I10, R80.9	I13.10, N18.4	492.8	K76.9
E11.59, I10	M33.90	I13.0, I50.21	I13.2	493.9	K76.9, G99.0
E11.59, Z79.4	E08.29, R80.9	E13.22, I12.9, N18.2	E13.22, N18.2, E13.65	493.22	K76.9, J91.8
E11.621	E11.00, E11.65	I97.3	E08.65, E08.22, N18.30, Z79.4	J43.8	K83.01
E11.621, E11.69, I97.509, M86.9	E11.39, H43.10	I13.10, N18.2	E10.22, N18.4, E10.65	I27.23	K83.1
E11.621, I97.409	E10.43, K31.84	I15.1, E26.09	E11.22, N18.1, E11.65	Z78.9	K83.1, C80.1
E11.621, I97.411	Z71.89	I15.2, E26.09	N18.2, D63.1	J84.10	K85.90, K83.1
E11.621, I97.424	E08.621, I97.423	E11.22, I12.9, N18.30	Z87.448	J84.112	K91.89, K83.1
E11.621, I97.509	E11.621, I97.413	I27.22, I38	E11.22, I12.9, N18.2	Z87.09	O26.612, K83.1
E11.621, I97.509, E11.52	E08.621, I97.419	I27.23, J84.9	I13.10, N18.3	515	O26.613, K83.1
E11.621, I97.519	E08.621, I97.422	O14.94	I13.0, I50.32	516.31	O26.619, K76.0
E11.621, I97.526	E11.3492	I13.11, N18.6, Z99.2	E11.22, N18.6, Z99.2	E70.331	O26.619, K83.1
E11.621, I97.529	E11.621, I97.426	I13.10	I12.0		O98.412, B18.1
E11.622, I97.909	E13.29	I87.319, I97.909	E11.22, N18.6, Z79.4, Z99.2		O98.419, B17.10
E11.622, I98.499	E08.621, I97.515	E11.69, I10, E66.9, E11.59	N17.0, N18.9		O98.419, B19.10
E11.628, I03.119	E11.3219	E13.22, I12.9, N18.3	N17.0, N18.3		Q87.89, Q68.8, N28.9, K83.1
E11.628, I08.9	O09.291, Z86.32	I27.29, N18.6, Z99.2	E10.22, N18.2		T86.43, K75.4
E11.649	E11.52	I13.0, I50.40	N18.32		T86.49, K74.0
E11.649, Z79.4	E11.3591, Z79.4	I67.4	N17.9		T86.49, K76.6
E11.65	P70.0	I87.309	D63.1		T86.49, K83.1
E11.65, Z79.4	E10.621, I97.509	I15.2	S85.3		Z00.5, B19.10

E11.69	E10.628, L08.9	I10, N28.9	585.9		
E11.69, E66.9	E08.52, Z79.4	O10.013	585.5		
E11.69, E78.5	E08.621, L97.521	I87.321	285.21		
E11.69, I10, E66.9, E11.59	250	IM00001	585.4		
E11.8	O24.011	I87.303	403.11		
E11.8, E11.65	250.02	I13.0, I50.33	584.9		
E11.8, E11.65, Z79.4	250.62	I13.0, I50.30	585.1		
E11.8, Z79.4	250.01	I87.399	N17.0		
E11.9	V77.1	I12.9, N18.1	585.2		
E11.9, Z79.4	250.42	I13.10, N18.4	E09.22		
E11.9, Z91.89	E10.621	I11.0, I50.20	E13.22		
IM00001	250.92	I13.2	E13.21		
E11.22, I12.9, N18.4	249.61	H40.051	N17.1		
O24.419	250.4	I27.29, I77.6	I13.11		
E13.40	250.6	E11.22, I12.0, Z99.2, N18.6	403.1		
Z86.39	249	O13.4	N03.9		
Z83.3	249.01	I87.313, L97.919, L97.929	I10		
O24.410	E84.9	E11.22, I12.9, N18.2	585		
E13.22, N18.3, E13.65	648.03	I13.10, N18.3	V13.09		
E13.9	E11.622	I13.0, I50.32	Z86.2		
E13.22, N18.4, E13.65	E11.3551	I87.331, L97.919	250.4		
E08.22	250.9	O13.5	250.42		
E84.9, E08.9	E08.321	I12.0	N28.9		
E23.2	250.7	I11.0, I50.22	E08.65		
E11.22, I12.9	E08.3213	I27.23	N17.8		
O24.415	250.82	I27.21, D58.9	403.01		
E08.41	E10.618	O10.011	N15.9		
E08.29	E08.43	Z86.69	N99.0		
E09.9, T38.0X5A	E13.42	Z13.6	E08.22, Z79.4		
E11.610	E08.621	I13.0			
E10.610	O24.111	I11.0, I43			
E13.621, L97.509	648	I15.1			
E11.22, I12.9, N18.3	O24.12	O99.413, I27.0			
R73.03	O24.112	I87.311, L97.919			
E10.42	O24.313	O10.912			
E11.42, E11.65	E16.2	Z91.89			
E08.40	357.2	O16.1			
E11.69, B35.1	250.8	O13.2			
O24.414	E10.319	I27.29, Q24.9			
E11.52, Z79.4	250.61	401.1			
E11.39, H42	250.00	401.9			
O09.299, Z86.32	250.03	572.3			
Z86.32	250.91	O14.90			
E11.3213, Z79.4	250.53	Z82.49			
E11.21, Z79.4	250.5	V17.49			
E11.40, G56.20	250.41	O10.012			
R73.09	250.83	416			
Z13.1	E13.22	642.9			
E13.319	E09.22	I87.332			
O24.419, O09.40	250.2	I27.2			
O24.119	250.81	401			
O24.919	E13.649	E11.22			
E11.51, Z79.4	E13.8	O16.2			
M33.00	E08.39	I9-REG7.3			
E11.37X3, Z79.4	V18.0	403.11			
E10.59	E10.3599	401			
E23.0	E11.3592	997.91			
P70.1	E08.3511	402.9			
E11.3533	E10.359	796.2			
E11.3293	E11.359	250			
E11.3319	250.1	E10.22			
E11.3213	Z84.89	E11.59			
E08.9, Z79.4	253.5	642.13			
E11.22, N18.4, Z79.4	E08.00	O10.913			
E11.43	O09.299	642.1			
E11.621, L97.422	250.12	O10.911			
E08.9	250.52	E11.9			
E10.43	250.22	365.04			
E10.22, N18.5	633.01	416.8			
E10.3591	E08.49	405.19			
E11.3292	249.6	K31.89			
Z91.89	249.7	I87.319			
E11.69, K86.9	O24.311	I87.313			
E08.621, L97.502	588.1	403.9			
E08.621, L97.402	E09.49	I13.11			
E08.44, Z79.4	E89.1	642.3			
E08.10	E13.610	416			
E11.3393	648.8	402.91			
E11.22, N18.30	249.8	V12.59			
E08.621, L97.529	E11.341	403.1			
E13.22, I12.9, N18.2	250.21	405.11			
E11.29, R80.9, Z79.4	E13.59	405.99			
E08.40, E08.65	250.72	642.33			
E13.51	250.13	642.01			
E11.3413	O24.912	E13.22			
E11.41	O24.012	O10.93			
E13.69	249.51	642.03			
E11.59, I20.9	249.2	I87.329			
E11.22, I12.9, N18.30	648.83	402.1			
E11.21, E11.65	E10.49	38341003			
E10.3299	V12.29	642			
E10.22, N18.6	E09.311	459.3			
E10.22, N18.6, Z99.2	250.73	O14.10			
E11.22, N18.30, Z79.4	V23.49	V81.1			
E08.21, Z79.4	633	I87.312			
E13.43	Z76.89	B20			
E11.621, L97.525	249.4	403.01			
O24.439	E11.638	O99.413			
E11.618, Z79.4	E10.22, I12.0, Z99.2, N18.6	Z78.9			
E11.3553	E10.8, E10.65	I87.331			
E11.319, Z79.4	O24.419, Z79.4	R00.0			
E08.3593	E10.69, E10.65				
E10.3213	Z94.7				
E13.22, I12.9, N18.3					
E11.628					
E11.3511, Z79.4					
E11.621, L97.429					

Supplemental Table 2 - Illness Severity Concordance

Groupings	Concordance	
	n	%
Vasopressors + RRT Status	1324	78.6%
Mechanical Ventilation + RRT Status	1401	83.2%
Vasopressors + Mechanical Ventilation	1579	93.7%
Vasopressors + Mechanical Ventilation + RRT Status	1310	77.7%

Supplemental Table 3 - Missing Laboratory Values

Other Laboratory Findings	Total		Not Hypermagnesemic		Hypermagnesemic ^a	
	n	%	n	%	n	%
	1685	1685	1330	78.9%	355	21.1%
Calcium	0	0%	0	0%	0	0%
Phosphorus	182	11%	138	10%	44	12%
Potassium	0	0%	0	0%	0	0%
Lactate dehydrogenase	97	6%	94	7%	3	1%
Haptoglobin	1446	86%	1141	86%	205	58%
Creatine phosphokinase	271	16%	225	17%	46	13%
Erythrocyte sedimentation rate	174	10%	138	10%	36	10%
Alkaline phosphatase	15	1%	13	1%	2	1%
C-reactive protein	91	5%	72	5%	19	5%
Interleukin-6	1672	99%	1324	100%	348	98%

Supplemental Table 4 – Sensitivity analysis of the Logistic regression analysis of characteristics and outcomes associated with developing hypermagnesemia excluding patients with hypomagnesemia (red depicts changes from original model)

	Original Multivariable (n=1371)			Multivariable excluding any HypoMg (n=1237)			Multivariable excluding median Mg <1.7 (n=1357)		
	OR	CI	p	OR	CI	p	OR	CI	p
Demographics									
Age (per 10 years)	1.17	(1.06 - 1.29)	<0.01	1.17	(1.06 - 1.29)	<0.001	1.17	(1.06 - 1.29)	<0.01
Sex (reference: female)	2.11	(1.56 - 2.87)	<0.001	1.98	(1.45 - 2.71)	<0.001	2.12	(1.56 - 2.87)	<0.001
Race (reference: White ^a)	1.32	(0.95 - 1.85)	0.10	1.42	(1.00 - 2.00)	<0.05	1.32	(0.94 - 1.84)	0.11
PMHx									
HTN	0.71	(0.51 - 0.98)	<0.05	0.71	(0.51 - 0.99)	<0.05	0.70	(0.51 - 0.97)	<0.05
DM	0.73	(0.53 - 0.99)	<0.05	0.73	(0.53 - 1.00)	0.053	0.74	(0.54 - 1)	0.052
ESRD	1.64	(0.87 - 3.1)	0.13	1.48	(0.78 - 2.81)	0.23	1.61	(0.85 - 3.05)	0.14
Illness Severity									
Pressors									
Mechanical Ventilation									
AKI requiring RRT	3.08	(1.97 - 4.81)	<0.001	3.36	(2.06 - 5.45)	<0.001	3.04	(1.94 - 4.74)	<0.001
Labs									
any hypercalcemia, ^b mg/dL	0.88	(0.59 - 1.31)	0.52	0.88	(0.58 - 1.33)	0.54	0.90	(0.6 - 1.33)	0.59
any hyperkalemia, ^c mmol/L	1.59	(1.17 - 2.16)	<0.05	1.72	(1.26 - 2.36)	0.001	1.60	(1.18 - 2.17)	<0.01
Creatine phosphokinase (per 1000 U/L)	1.03	(1 - 1.06)	<0.05	1.03	(1.00 - 1.05)	0.06	1.03	(1 - 1.06)	<0.05
Lactate dehydrogenase (per 100 U/L)	1.03	(1 - 1.06)	0.08	1.03	(0.99 - 1.06)	0.11	1.03	(1 - 1.06)	0.08
Alkaline Phosphatase (per 10 U/L)	1.00	(0.99 - 1.01)	0.43	1.00	(0.99 - 1.01)	0.57	1.00	(0.98 - 1.01)	0.39
C-reactive protein (per 10 mg/L)	1.01	(0.99 - 1.02)	0.39	1.01	(0.99 - 1.02)	0.49	1.01	(0.99 - 1.02)	0.40

^a reference group White Non-Hispanic/Latino and White Hispanic/Latino

^b hypercalcemia defined as corrected calcium >ULN (10.3 mg/dL)

^c hyperkalemia defined as potassium >ULN (5.1 mmol/L)

Supplemental Table 5 – Sensitivity analysis of the survival analysis showing hazard ratios for death excluding patients with hypomagnesemia (red depicts changes from original model)

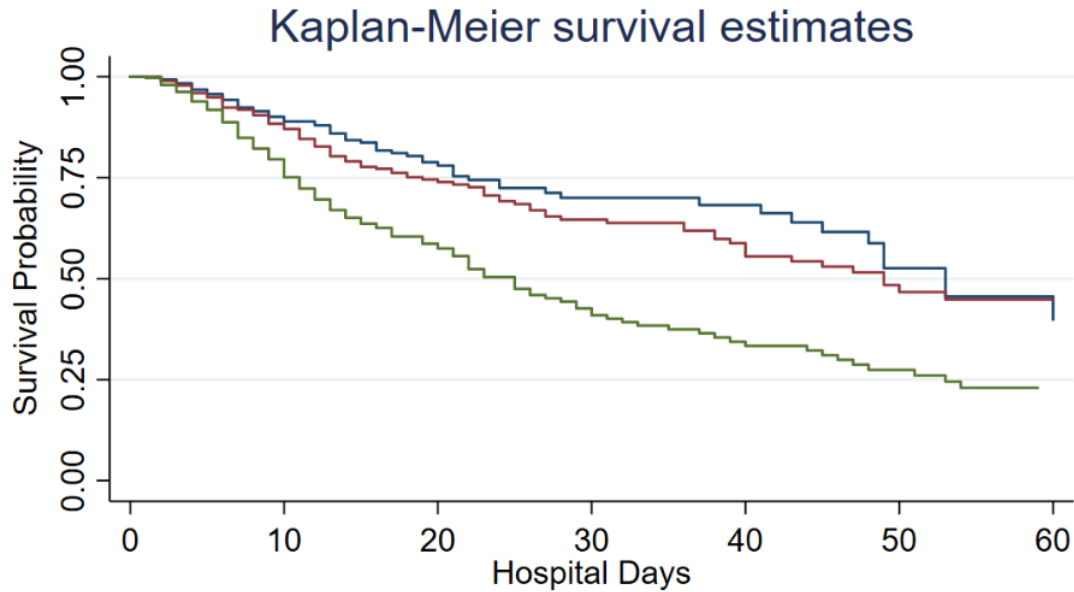
	Original Multivariable (n=1594)			Multivariable excluding any HypoMg (n=1443)			Multivariable excluding median Mg <1.7 (n=1569)		
	HR	CI	p	HR	CI	p	HR	CI	p
Demographics									
Age (per 10 years)	1.86	(1.68 - 2.06)	<0.001	1.88	(1.69 - 2.09)	<0.001	1.86	(1.68 - 2.06)	<0.001
Sex (reference: female)	1.24	(0.99 - 1.55)	0.06	1.16	(0.91 - 1.47)	0.22	1.23	(0.99 - 1.54)	0.07
Race (reference: White ^a)	1.01	(0.80 - 1.28)	0.92	1.03	(0.81 - 1.33)	0.79	1.00	(0.79 - 1.27)	0.99
PMHx									
HTN	1.07	(0.83 - 1.38)	0.60	0.92	(0.7 - 1.21)	0.55	1.08	(0.84 - 1.4)	0.56
DM	1.22	(0.97 - 1.52)	0.08	1.35	(1.06 - 1.71)	<0.05	1.22	(0.98 - 1.53)	0.08
ESRD	1.36	(0.78 - 2.40)	0.28	1.31	(0.74 - 2.31)	0.36	1.35	(0.77 - 2.38)	0.29
Illness Severity									
Pressors	1.98	(1.53 - 2.55)	<0.001	2.25	(1.73 - 2.94)	<0.001	1.98	(1.53 - 2.55)	<0.001
Mechanical Ventilation									
AKI requiring RRT									
Labs									
C-reactive protein (per 10 mg/L)	1.01	(1.00 - 1.03)	<0.05	1.01	(1 - 1.03)	<0.05	1.01	(1 - 1.03)	<0.05
hypermagnesemia ^b	2.03	(1.63 - 2.54)	<0.001	1.87	(1.49 - 2.34)	<0.001	2.03	(1.63 - 2.53)	<0.001

^a reference group White Non-Hispanic/Latino and White Hispanic/Latino

^b defined as median [Mg] > upper limit of normal (2.4 mmol/L)

Supplemental Figure 1 - Patient survival curves by median magnesium tertiles

Kaplan Meier curve for patient survival over time from admission for all patients stratified by tertiles of median magnesium (lowest values = Tertile 1 (blue) while highest values = Tertile 3 (green); $p < 0.001$).



Number at risk

MgTertile = 1	568	231	93	53	34	16	8
MgTertile = 2	576	272	120	81	54	28	12
MgTertile = 3	541	250	98	50	33	20	13

