

SUPPLEMENTARY MATERIALS

Table S1. Full Baseline Characteristics for Veteran Nursing Home Residents Potentially Overtreated for Diabetes

		Unweighted			Weighted		
Variable	Full Sample (n=2,082)	Not De-intensified (n=1,528)	De-intensified (n=554)	Standardized Difference	Not De-intensified (n=554)	De-intensified (n=554)	Standardized Difference
DEMOGRAPHICS							
Age at admission				0.05			<0.01
65-74	797 (38.3)	585 (38.3)	212 (38.3)		212 (38.3)	212 (38.3)	
75-84	855 (41.1)	620 (40.6)	235 (42.4)		235 (42.4)	235 (42.4)	
≥85	430 (20.7)	323 (21.1)	107 (19.3)		107 (19.3)	107 (19.3)	
Race/ethnicity				0.08			<0.01
White	1560 (75.7)	1165 (76.2)	408 (73.6)		408 (73.6)	408 (73.6)	
Black	356 (17.3)	260 (17.0)	101 (18.2)		101 (18.2)	101 (18.2)	
Hispanic	109 (5.3)	79 (5.2)	32 (5.8)		32 (5.8)	32 (5.8)	
Other	37 (1.8)	24 (1.6)	13 (2.3)		13 (2.3)	13 (2.3)	
DIABETES-RELATED FACTORS							
Baseline HbA1c, %				0.34*			<0.01
<6.0	553 (26.6)	355 (23.2)	198 (35.7)		198 (35.7)	198 (35.7)	
6.0-<6.5	550 (26.4)	397 (26.0)	153 (27.6)		153 (27.6)	153 (27.6)	
6.5-<7.0	555 (26.6)	427 (27.9)	128 (23.1)		128 (23.1)	128 (23.1)	
7.0-7.5	424 (20.4)	349 (22.8)	75 (13.5)		75 (13.5)	75 (13.5)	
Short acting insulin	1175 (56.4)	800 (52.4)	375 (67.7)	0.32*	375 (67.7)	375 (67.7)	<0.01
Basal insulin	1017 (48.9)	800 (52.4)	217 (39.2)	0.27*	217 (39.2)	217 (39.2)	<0.01
Sulfonylureas	563 (27.0)	358 (23.4)	205 (37.0)	0.30*	205 (37.0)	205 (37.0)	<0.01
Other diabetes agents	426 (20.5)	308 (20.2)	118 (21.3)	0.03	118 (21.3)	118 (21.3)	<0.01
Peripheral vascular disease	670 (32.2)	505 (33.0)	165 (29.8)	0.07	165 (29.8)	165 (29.8)	<0.01
Diabetic eye disease	376 (18.1)	281 (18.4)	95 (17.1)	0.03	95 (17.1)	95 (17.1)	<0.01
Lower extremity ulcer	487 (23.4)	363 (23.8)	124 (22.4)	0.03	124 (22.4)	124 (22.4)	<0.01
Serious hypoglycemic event	178 (8.6)	137 (9.0)	41 (7.4)	0.06	41 (7.4)	41 (7.4)	<0.01
CARDIOVASCULAR RISK FACTORS							
Qualifying conditions (Coronary artery disease, Diabetes, Stroke)				0.04			<0.01
1 condition	485 (23.3)	360 (23.6)	125 (22.6)		125 (22.6)	125 (22.6)	
2 conditions	1140 (54.8)	829 (54.3)	311 (56.1)		311 (56.1)	311 (56.1)	
3 conditions	457 (21.9)	339 (22.2)	118 (21.3)		118 (21.3)	118 (21.3)	
Heart failure	692 (33.2)	520 (34.0)	172 (31.0)	0.06	172 (31.0)	172 (31.0)	<0.01
Hypertension	1988 (95.5)	1457 (95.4)	531 (95.8)	0.02	531 (95.8)	531 (95.8)	<0.01
Hyperlipidemia	1527 (73.3)	1132 (74.1)	395 (71.3)	0.06	395 (71.3)	395 (71.3)	<0.01
Venous thromboembolism	273 (13.1)	190 (12.4)	83 (15.0)	0.07	83 (15.0)	83 (15.0)	<0.01
Recent stroke/TIA	503 (24.2)	380 (24.9)	123 (22.2)	0.06	123 (22.2)	123 (22.2)	<0.01
Tobacco use	164 (7.9)	131 (8.6)	33 (6.0)	0.10*	33 (6.0)	33 (6.0)	<0.01
Body Mass Index				0.11*			<0.01
Underweight	63 (3.0)	41 (2.7)	22 (4.0)		22 (4.0)	22 (4.0)	
Normal/healthy weight	706 (33.9)	509 (33.3)	197 (35.6)		197 (35.6)	197 (35.6)	
Overweight	667 (32.0)	486 (31.8)	181 (32.7)		181 (32.7)	181 (32.7)	
Obese	646 (31.0)	492 (32.2)	154 (27.8)		154 (27.8)	154 (27.8)	

INDICATORS OF POOR PROGNOSIS							
Advanced dementia	598 (28.7)	459 (30.0)	139 (25.1)	0.11*	139 (25.1)	139 (25.1)	<0.01
MDS Mortality Risk Index (med, IQR)	39 [34-44]	39 [34-44]	39 [36-44]	0.13*	39 [36-45]	39 [36-44]	<0.01
<6 months prognosis	76 (3.7)	54 (3.5)	22 (4.0)	0.02	22 (4.0)	22 (4.0)	<0.01
Elixhauser conditions				0.02			<0.01
0-1	199 (9.6)	148 (9.7)	51 (9.2)		51 (9.2)	51 (9.2)	
2-3	448 (21.5)	327 (21.4)	121 (21.8)		121 (21.8)	121 (21.8)	
4-5	672 (32.3)	493 (32.3)	179 (32.3)		179 (32.3)	179 (32.3)	
>5	763 (36.7)	560 (36.6)	203 (36.3)		203 (36.3)	203 (36.3)	
Number of Drug Classes				0.037			<0.01
0-5	97 (4.7)	68 (4.5)	29 (5.2)		33 (5.9)	33 (5.9)	
6-10	750 (36.0)	553 (36.2)	197 (35.6)		197 (35.6)	197 (35.6)	
>10	1235 (59.3)	907 (59.4)	328 (59.2)		324 (58.5)	324 (58.5)	
Cancer	628 (30.1)	440 (28.8)	188 (33.9)	0.022	188 (33.9)	188 (33.9)	<0.01
End-Stage Renal Disease	562 (26.9)	416 (27.2)	146 (26.4)	0.02	146 (26.4)	146 (26.4)	<0.01
Leaves food uneaten	644 (30.9)	454 (29.7)	190 (34.3)	0.09	190 (34.3)	190 (34.3)	<0.01
Swallowing difficulty	411 (19.7)	296 (19.4)	115 (20.8)	0.03	115 (20.8)	115 (20.8)	<0.01
Mechanically altered diet	688 (33.1)	496 (32.5)	192 (34.7)	0.05	192 (34.7)	192 (34.7)	<0.01
IV/Parenteral Nutrition	260 (12.5)	179 (11.7)	81 (14.6)	0.09	81 (14.6)	81 (14.6)	<0.01
Shortness of breath	720 (34.6)	527 (34.5)	193 (34.8)	0.01	193 (34.8)	193 (34.8)	<0.01
Pain	1386 (66.6)	1008 (66.0)	378 (68.2)	0.05	378 (68.2)	378 (68.2)	<0.01
Infection	612 (29.4)	439 (28.7)	173 (31.2)	0.05	173 (31.2)	173 (31.2)	<0.01
Acute change in mental status	164 (7.9)	118 (7.7)	46 (8.3)	0.02	46 (8.3)	46 (8.3)	<0.01
Activities of Daily Living				0.11*			<0.01
Independent							
Requires extensive assistance	510 (24.5)	364 (23.8)	146 (26.4)		146 (26.4)	146 (26.4)	
Dependent/totally dependent	844 (40.5)	642 (42.0)	202 (36.5)		202 (36.5)	202 (36.5)	
	728 (35.0)	522 (34.2)	206 (37.2)		206 (37.2)	206 (37.2)	
Behavioral problems				0.12*			<0.01
None	1732 (83.2)	1270 (83.2)	461 (83.2)		461 (83.2)	461 (83.2)	
Moderate	232 (11.1)	161 (10.5)	71 (12.8)		71 (12.8)	71 (12.8)	
Severe/Very Severe	118 (5.7)	96 (6.3)	22 (4.0)		22 (4.0)	22 (4.0)	
Fall or fracture in 180 days prior to admission	988 (47.5)	724 (47.4)	264 (47.7)	0.01	264 (47.7)	264 (47.7)	<0.01
Fell in past 30 days	624 (30.0)	447 (29.3)	177 (31.9)	0.06	177 (31.9)	177 (31.9)	<0.01
Recent hospitalization				0.32*			<0.01
7 days prior	89 (4.3)	48 (3.1)	41 (7.4)		41 (7.4)	41 (7.4)	
14 days prior	215 (10.3)	128 (8.4)	87 (15.7)		87 (15.7)	87 (15.7)	
30 day prior	170 (8.2)	123 (8.0)	47 (8.5)		47 (8.5)	47 (8.5)	
Vital Signs							
Supplemental oxygen use	228 (10.9)	149 (9.8)	79 (14.3)	0.14	79 (14.3)	79 (14.3)	<0.01
Minimum systolic blood pressure (med, IQR)	116 [104-130]	117 [105-131]	113 [101-128]	0.18*	114 [102-128]	113 [101-128]	<0.01
Maximum Heart Rate (med, IQR)	82 [72-92]	82 [72-91]	82 [73-95]	0.09	84 [72-94]	82 [73-95]	<0.01
Maximum Respiratory Rate (med, IQR)	20 [18-20]	20 [18-20]	20 [18-20]	0.10*	20 [18-20]	20 [18-20]	<0.01

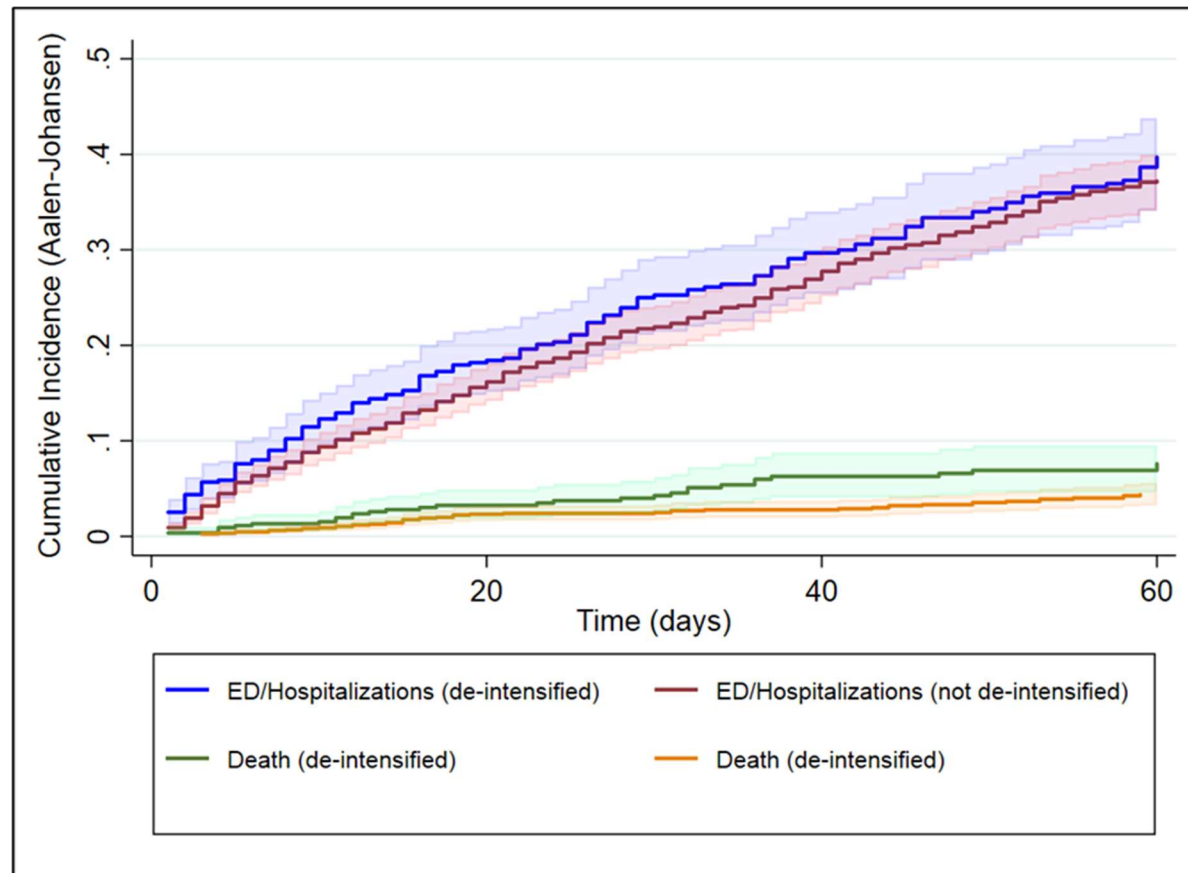
ENVIRONMENT OF CARE							
Fiscal Year of Admission				0.07			<0.01
2009-2012	1224 (58.8)	912 (59.7)	312 (56.3)		312 (56.3)	312 (56.3)	
2013-2015	858 (41.2)	616 (40.3)	242 (43.7)		242 (43.7)	242 (43.7)	
Living arrangement before admission				0.21*			<0.01
Acute/hospital	1411 (67.8)	998 (65.3)	413 (74.5)		413 (74.5)	413 (74.5)	
Home/assisted living	430 (20.7)	340 (22.3)	90 (16.2)		90 (16.2)	90 (16.2)	
Nursing home	176 (8.5)	135 (8.8)	41 (7.4)		41 (7.4)	41 (7.4)	
Next of kin relationship				0.06			<0.01
Spouse	902 (43.3)	658 (43.1)	244 (44.0)		244 (44.0)	244 (44.0)	
Child	820 (39.4)	608 (39.8)	212 (38.3)		212 (38.3)	212 (38.3)	
Sibling	181 (8.7)	127 (8.3)	54 (9.7)		54 (9.7)	54 (9.7)	
Other relative	70 (3.4)	53 (3.5)	17 (3.1)		17 (3.1)	17 (3.1)	
Friend or other	109 (5.2)	82 (5.4)	27 (4.9)		27 (4.9)	27 (4.9)	
CLC FACTORS							
Geographic region				0.09			<0.01
Northeast	311 (14.9)	241 (15.8)	70 (12.6)		70 (12.6)	70 (12.6)	
Midwest	684 (32.9)	497 (32.5)	187 (33.8)		187 (33.8)	187 (33.8)	
South +PR	740 (35.5)	540 (35.3)	200 (36.1)		200 (36.1)	200 (36.1)	
West	347 (16.7)	250 (16.4)	97 (17.5)		97 (17.5)	97 (17.5)	
Certified beds				0.06			<0.01
<60	231 (11.1)	173 (11.3)	58 (195 (35.2)		58 (195 (35.2)	58 (195 (35.2)	
60-120	687 (33.0)	492 (32.2)	195 (35.2)		195 (35.2)	195 (35.2)	
>120	1164 (55.9)	863 (56.5)	301 (54.3)		301 (54.3)	301 (54.3)	
Urban Influence Code				0.08			<0.01
Large metro	1068 (51.3)	767 (50.2)	301 (54.3)		301 (54.3)	301 (54.3)	
Small metro	791 (38.0)	593 (38.8)	198 (35.7)		198 (35.7)	198 (35.7)	
Micropolitan	151 (7.3)	113 (7.4)	38 (6.9)		38 (6.9)	38 (6.9)	
Noncore rural	72 (3.5)	55 (3.6)	17 (3.1)		17 (3.1)	17 (3.1)	

*Standardized Difference
≥0.10

Table S2. Most Frequent Causes of ED Visits and Hospitalizations

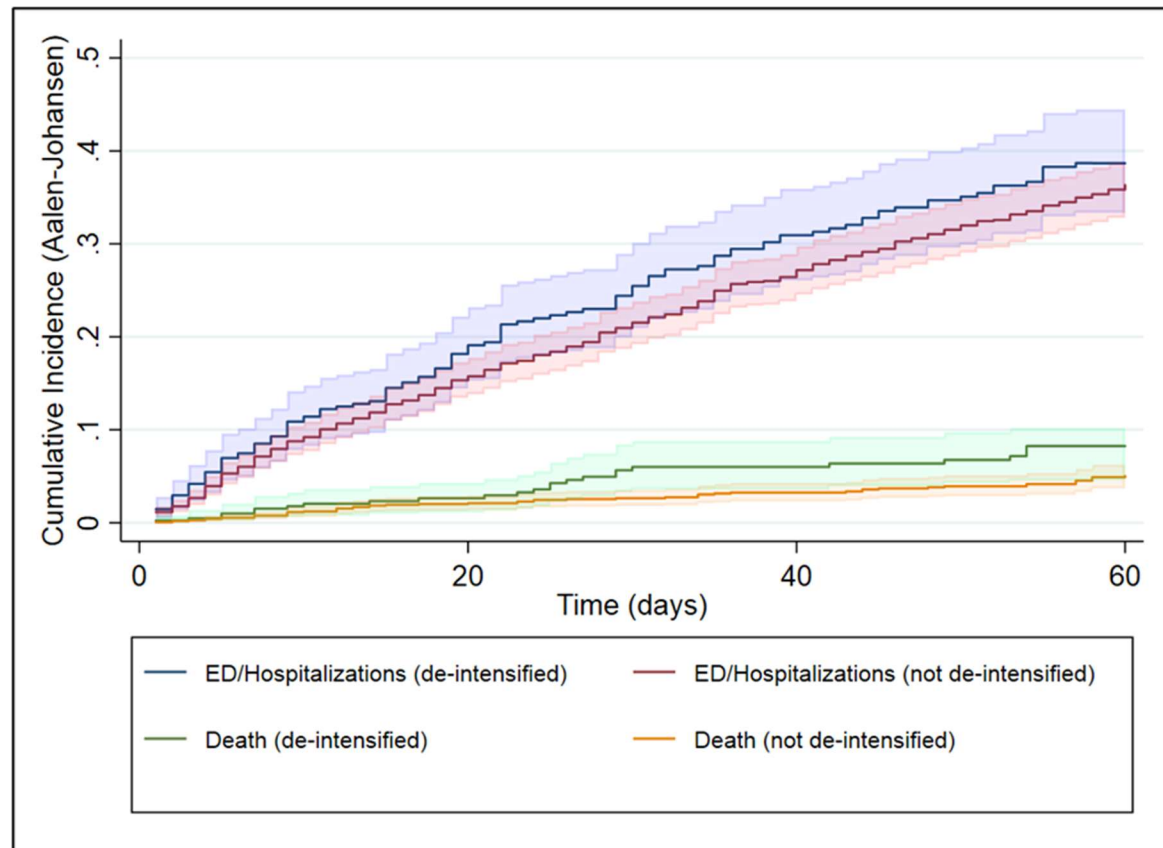
Overall	De-intensified	Not De-intensified
1. Circulatory system (19.9%) • Diseases of the heart ◦ Congestive heart failure ◦ Nonspecific chest pain ◦ Cardiac dysrhythmias • Diseases of arteries ◦ Other circulatory disease ◦ Peripheral and visceral atherosclerosis ◦ Aortic and peripheral arterial emboli • Cerebrovascular disease ◦ Acute cerebrovascular disease ◦ Late effects of cerebrovascular disease ◦ Occlusion or stenosis	1. Circulatory system (19.7%) • Diseases of the heart ◦ Congestive heart failure ◦ Cardiac dysrhythmias ◦ Nonspecific chest pain • Cerebrovascular disease ◦ Acute cerebrovascular disease ◦ Occlusion or stenosis ◦ Other and ill-defined • Diseases of arteries ◦ Other circulatory disease	1. Circulatory system (20.4%) • Diseases of the heart ◦ Congestive heart failure ◦ Nonspecific chest pain ◦ Cardiac dysrhythmias • Diseases of arteries ◦ Other circulatory disease ◦ Peripheral and visceral atherosclerosis ◦ Aortic and peripheral arterial emboli • Cerebrovascular disease ◦ Acute cerebrovascular disease ◦ Late effects of cerebrovascular disease ◦ Occlusion or stenosis
2. Respiratory system (15.4%) • Respiratory infections ◦ Pneumonia ◦ Acute bronchitis ◦ Other upper respiratory infections • Respiratory failure, insufficiency ◦ Respiratory failure ◦ Other respiratory insufficiency • Aspiration pneumonia	2. Respiratory system (16.0%) • Respiratory failure, insufficiency ◦ Respiratory failure ◦ Other respiratory insufficiency • Respiratory infections ◦ Pneumonia ◦ Other upper respiratory infections • Aspiration pneumonia	2. Respiratory system (14.2%) • Respiratory infections ◦ Pneumonia ◦ Acute bronchitis • Aspiration pneumonia • Respiratory failure ◦ Respiratory failure ◦ Other respiratory insufficiency • COPD ◦ Obstructive chronic bronchitis ◦ Chronic airway obstruction ◦ Other pulmonary disease
3. Genitourinary system (9.9%) • Diseases of the urinary system ◦ Urinary tract infections ◦ Acute unspecified renal failure ◦ Genitourinary symptoms	3. Injury and poisoning (8.5%) • Complications ◦ Complications of surgical procedures ◦ Complications of device • Other injuries • Fractures ◦ Fracture of neck of femur (hip)	3. Genitourinary system (10.6%) • Diseases of the urinary system ◦ Urinary tract infections ◦ Acute unspecified renal failure ◦ Genitourinary symptoms

Figure S1. Unweighted Association of De-intensifying Diabetes Medications with All-Cause Events (N=2,082 residents)



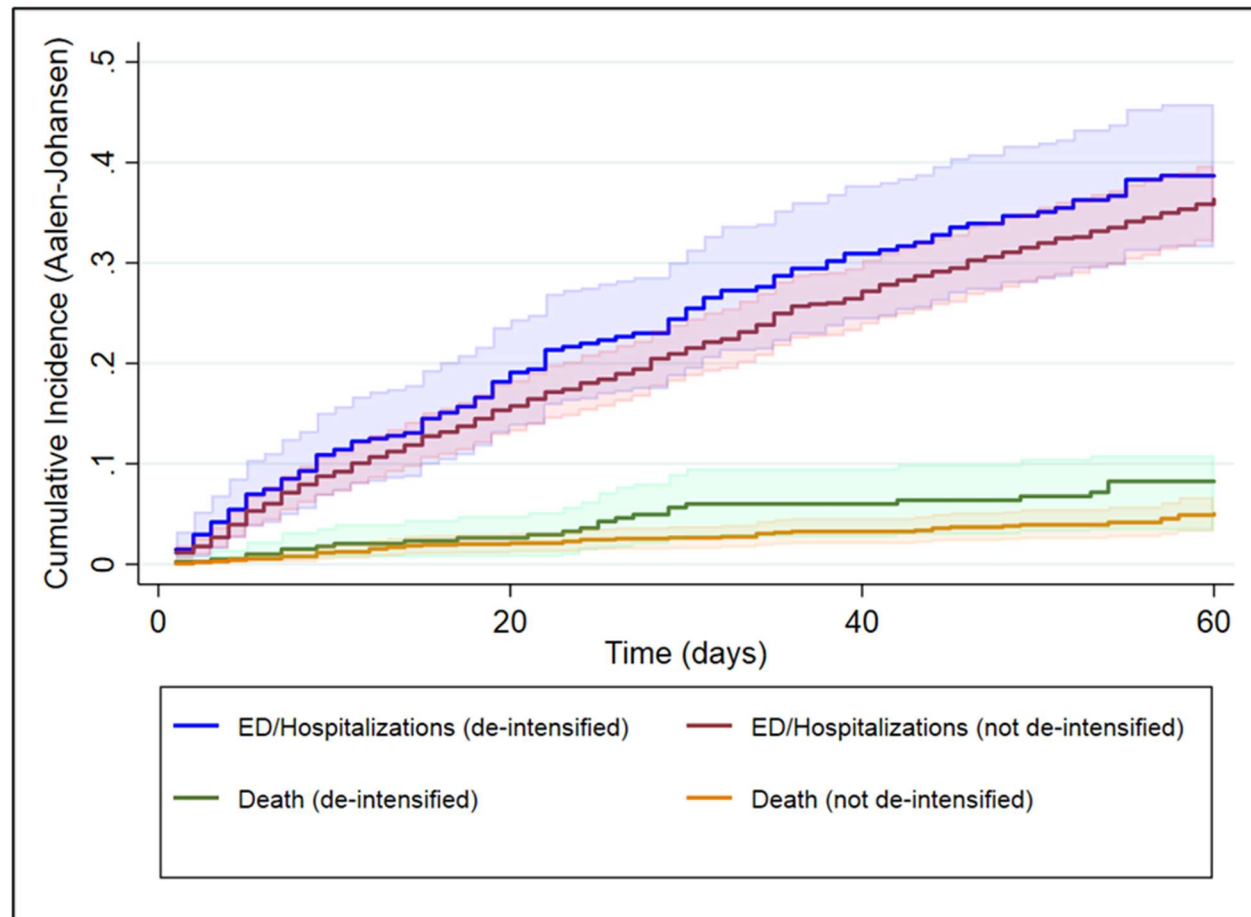
Outcome	Time Point	Cumulative Incidence	Risk Difference	Risk Ratio
ED/Hospitalization (n=594)	15-day	De-intensified: 0.153 [0.121, 0.184] Not: 0.129 [0.111, 0.147]	+0.024 [-0.011, 0.060]	1.19 [0.92, 1.49]
	30-day	De-intensified: 0.253 [0.214, 0.294] Not: 0.219 [0.196, 0.242]	+0.034 [-0.010, 0.082]	1.16 [0.96, 1.39]
	45-day	De-intensified: 0.324 [0.280, 0.370] Not: 0.305 [0.279, 0.332]	+0.019 [-0.031, 0.072]	1.06 [0.90, 1.25]
	60-day	De-intensified: 0.397 [0.351, 0.448] Not: 0.372 [0.342, 0.400]	+0.025 [-0.028, 0.087]	1.07 [0.93, 1.25]
Death (n=81)	15-day	De-intensified: 0.028 [0.015, 0.043] Not: 0.018 [0.011, 0.025]	+0.010 [-0.004, 0.027]	1.56 [0.81, 3.07]
	30-day	De-intensified: 0.043 [0.05, 0.062] Not: 0.025 [0.017, 0.034]	+0.018 [-0.001, 0.038]	1.72 [0.97, 2.90]
	45-day	De-intensified: 0.063 [0.041, 0.088] Not: 0.032 [0.023, 0.042]	+0.031 [0.006, 0.057]	1.97 [1.18, 3.14]*
	60-day	De-intensified: 0.076 [0.051, 0.103] Not: 0.044 [0.032, 0.056]	+0.032 [0.004, 0.062]	1.73 [1.08, 2.70]*

Figure S2. Unweighted Analysis Using 14-day Definition for De-intensification (N=1,877 residents)



Outcome	Time Point	Cumulative Incidence	Risk Difference	Risk Ratio
ED/Hospitalization (n=532)	15-day	De-intensified: 0.145 [0.110, 0.182] Not: 0.127 [0.110, 0.146]	+0.018 [-0.023, 0.058]	1.14 [0.83, 1.48]
	30-day	De-intensified: 0.255 [0.209, 0.301] Not: 0.215 [0.192, 0.238]	+0.04 [-0.010, 0.089]	1.19 [0.95, 1.44]
	45-day	De-intensified: 0.335 [0.283, 0.387] Not: 0.295 [0.268, 0.322]	+0.04 [-0.017, 0.098]	1.14 [0.94, 1.34]
	60-day	De-intensified: 0.387 [0.333, 0.445] Not: 0.363 [0.333, 0.392]	+0.024 [-0.040, 0.088]	1.07 [0.89, 1.25]
Death (n=78)	15-day	De-intensified: 0.023 [0.009, 0.039] Not: 0.019 [0.013, 0.027]	+0.004 [-0.012, 0.022]	1.21 [0.47, 2.47]
	30-day	De-intensified: 0.060 [0.036, 0.088] Not: 0.026 [0.018, 0.036]	+0.034 [0.009, 0.063]	2.31 [1.31, 3.97]*
	45-day	De-intensified: 0.064 [0.039, 0.093] Not: 0.037 [0.027, 0.048]	+0.027 [0.00, 0.058]	1.73 [0.99, 2.88]
	60-day	De-intensified: 0.072 [0.045, 0.102] Not: 0.050 [0.038, 0.064]	+0.022 [-0.009, 0.055]	1.44 [0.83, 2.29]

Figure S3. Entropy-Weighted Analysis Using 14-day Definition for De-intensification (N=1,877 residents)



Outcome	Time Point	Cumulative Incidence	Risk Difference	Risk Ratio
ED/Hospitalization (n=532)	15-day	De-intensified: 0.145 [0.109, 0.182] Not: 0.135 [0.107, 0.174]	+0.01 [-0.043, 0.057]	1.07 [0.73, 1.51]
	30-day	De-intensified: 0.255 [0.210, 0.301] Not: 0.224 [0.185, 0.269]	+0.031 [-0.031, 0.092]	1.14 [0.87, 1.47]
	45-day	De-intensified: 0.335 [0.283, 0.387] Not: 0.319 [0.266, 0.371]	+0.016 [-0.056, 0.087]	1.05 [0.85, 1.32]
	60-day	De-intensified: 0.387 [0.333, 0.445] Not: 0.379 [0.322, 0.434]	+0.008 [-0.069, 0.087]	1.02 [0.83, 1.26]
Death (n=78)	15-day	De-intensified: 0.023 [0.009, 0.040] Not: 0.023 [0.009, 0.038]	0.000 [-0.019, 0.022]	1.00 [0.41, 3.00]
	30-day	De-intensified: 0.060 [0.036, 0.088] Not: 0.030 [0.014, 0.050]	+0.030 [0.001, 0.062]	2.00 [1.03, 4.71]
	45-day	De-intensified: 0.064 [0.039, 0.093] Not: 0.036 [0.018, 0.056]	+0.028 [-0.003, 0.062]	1.78 [0.93, 3.82]
	60-day	De-intensified: 0.072 [0.045, 0.102] Not: 0.078 [0.038, 0.111]	-0.006 [-0.049, 0.047]	0.92 [0.52, 2.05]