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Appendix 1: Segmented regression model.

We analyzed the quarterly prevalence of comorbidities and medical complications by using multivariable segmented regression models to evaluate three different aspects of the time series (slope before the transition, change in the level at the ICD transition, and slope following the transition). The dependent variables were comorbidities and complications.

Model specification

The equation is as follows:

$$\text{Logit } y = \beta_0 + \beta_1 * \text{time} + \beta_2 * \text{level} + \beta_3 * (\text{time\_post\_intervention}) + \beta_c * (\text{covariates});$$

Where:

β_0 = intercept at time 0,

β_1 = slope of an outcome before the ICD transition from FY2011 to FY2015,

β_2 = change in the level of an outcome when the transition occurred (October 1st, 2015),

β_3 = slope of an outcome after the ICD transition from FY2016 to FY2018,

β_c = coefficients of all covariates included in the model,
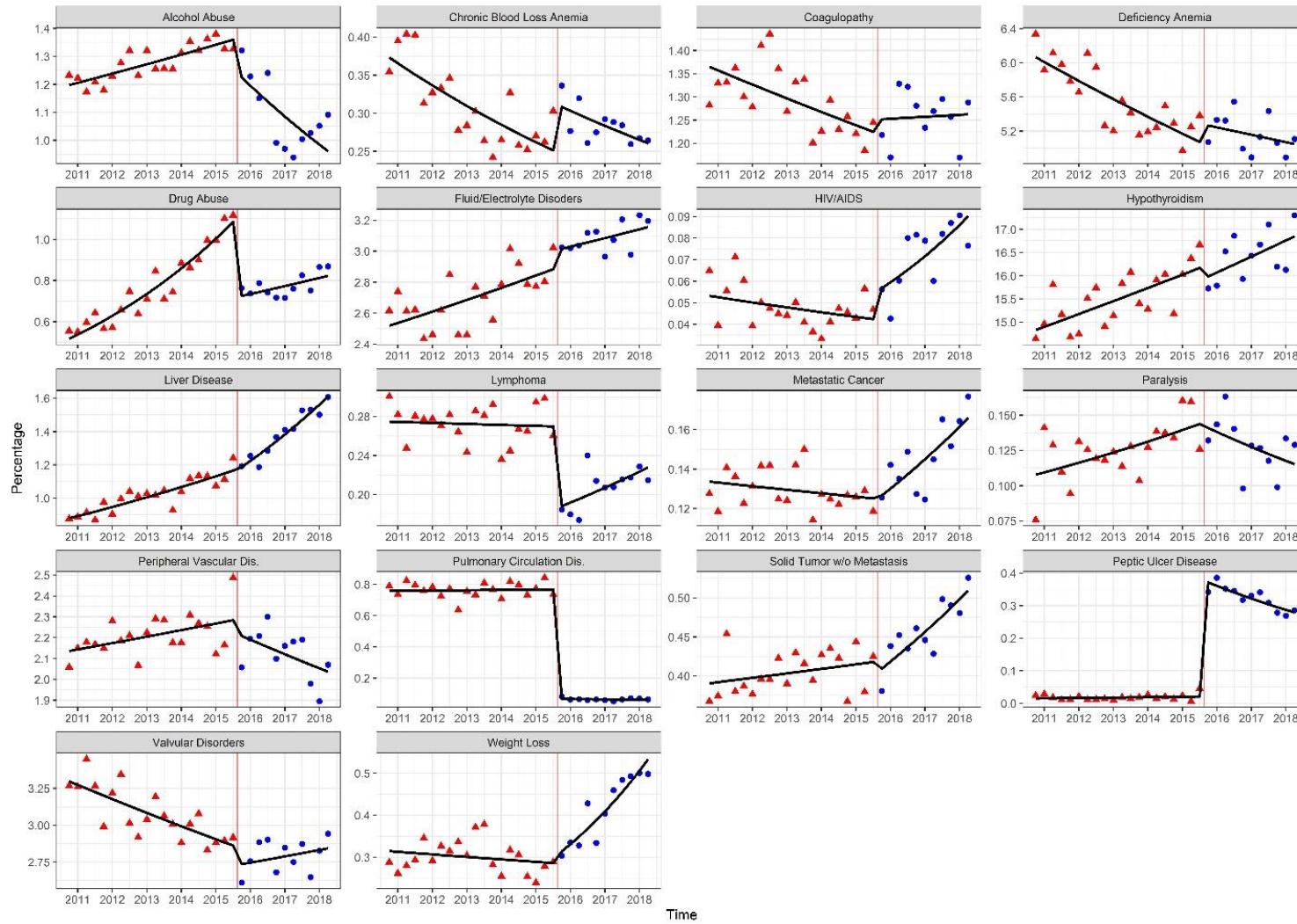
time = the value of quarter from FY2011 to FY2018,

level = the transition to ICD-10 (Yes/No),

time_post_intervention [level*(time – transition start time+1)].

Supplement Figure 1.
Title: Quarterly trends of comorbidities (unselected)

Legend: Red triangle = quarterly percentage before the ICD transition, blue circle = quarterly percentage after the ICD transition. The predictive values are derived from the model presented in table 3.

Appendix table 1. ICD-9 and ICD-10 diagnosis codes for complications.

Complications	ICD9 codes	ICD-10 codes
Myocardial infarction	410.XX	I21.XX
Cerebrovascular accident	433.01, 433.11, 433.21, 433.31, 433.81, 433.91, 434.01, 434.11, 434.91, 997.02	I63.02, I63.00, I63.09, I63.011, I63.012, I63.013, I63.019, I63.031, I63.032, I63.033, I63.039, I63.10, I63.111, I63.112, I63.113, I63.119, I63.12, I63.131, I63.132, I63.133, I63.139, I63.19, I63.20, I63.22, I63.231, I63.232, I63.233, I63.239, I63.211, I63.212, I63.213, I63.219, I63.29, I63.30, I63.311, I63.312, I63.313, I63.319, I63.321, I63.322, I63.323, I63.329, I63.331, I63.332, I63.333, I63.339, I63.341, I63.342, I63.343, I63.349, I63.39, I63.6, I63.40, I63.411, I63.412, I63.413, I63.419, I63.421, I63.422, I63.423, I63.429, I63.431, I63.432, I63.433, I63.439, I63.441, I63.442, I63.443, I63.449, I63.49, I63.50, I63.511, I63.512, I63.513, I63.519, I63.521, I63.522, I63.523, I63.529, I63.531, I63.532, I63.533, I63.539, I63.541, I63.542, I63.543, I63.549, I63.59, I63.8, I63.9
Pulmonary embolism/Deep vein thrombosis	415.1, 451.1, 451.2, 451.8, 451.9, 453.2, 453.4, 453.8, 453.9	T80.0XXA, I80.00, I80.01, I80.02, I80.03, I80.10, I80.11, I80.12, I80.13, I80.201, I80.202, I80.203, I80.209, I80.211, I80.212, I80.213, I80.219, I80.221, I80.222, I80.223, I80.229, I80.231, I80.232, I80.233, I80.239, I80.291, I80.292, I80.293, I80.299, I80.3, I80.8, I80.9, I82.210, I82.220, I82.290, I82.401, I82.402, I82.403, I82.409, I82.411, I82.412, I82.413, I82.419, I82.421, I82.422, I82.423, I82.429, I82.431, I82.432, I82.433, I82.439, I82.4Y1, I82.4Y2, I82.4Y3, I82.4Y9, I82.441, I82.442, I82.443, I82.449, I82.491, I82.492, I82.493, I82.499, I82.4Z1, I82.4Z2, I82.4Z3, I82.4Z9, I82.611, I82.612, I82.613, I82.619, I82.621, I82.622, I82.623, I82.629, I82.601, I82.602, I82.603, I82.609, T82.817A, T82.818A, T82.867A, T82.868A, I82.890, I82.90, T82.9XXA, I82.A11, I82.A12, I82.A13, I82.A19, I82.B11, I82.B12, I82.B13, I82.B19, I82.C11, I82.C12, I82.C13, I82.C19, I26.01, I26.09, I26.90, I26.99
Acute respiratory failure	518.5, 518.51, 518.52, 518.81, 518.82, 518.84	J96.00, J96.01, J96.02, J95.1, J95.2, J96.20, J96.21, J96.22, J95.821, J95.822, J96.90, J96.91, J96.92, J80, R06.03
Pulmonary edema	514, 518.4, 428.0, 276.6, 276.69	E87.71, E87.70, E87.79, I50.20, I50.21, I50.23, I50.30, I50.31, I50.33, I50.40, I50.41, I50.43, I50.810, I50.811, I50.813, I50.814, I50.82, I50.83, I50.84, I50.89, I50.9, J81.0

Pneumonia	481, 482.XX, 483, 485, 486, 507.0, 997.31, 997.39	J13, J14, J15.XX, J16.0, J16.8, J18.0, J18.1, J18.8, J18.9, J69.0, J95.851, J95.4
Sepsis	038, 038.0, 038.1x, 038.2, 038.3, 038.40, 038.41, 038.42, 038.43, 038.44, 038.49, 038.8, 038.9, 790.7	A02.1, A22.7, A26.7, A32.7, A40.0, A40.1, A40.3, A40.8, A40.9, A41.01, A41.02, A41.1, A41.2, A41.3, A41.4, A41.50, A41.51, A41.52, A41.53, A41.59, A41.81, A41.89, A41.9, A42.7, A54.86, R78.81, B37.7
Urinary tract Infection	032.84, 590.2, 590.3, 590.80, 590.81, 590.9, 595.0, 595.1, 595.2, 595.3, 595.4, 595.81, 595.82, 595.89, 595.9, 597.0, 597.80, 597.81, 597.89, 598.00, 598.01, 599.0	A36.85, A56.01, A56.00, A56.02, A56.09, N10, N12, N13.6, N15.1, N15.9, N16, N28.84, N28.85, N28.86, N30.00, N30.01, N30.30, N30.31, N30.40, N30.41, N30.80, N30.81, N30.90, N30.91, N34.0, N34.1, N34.2, N35.111, N35.112, N35.113, N35.114, N35.119, N35.12, N37, N39.0

XX = wildcard variable that can take any integer or character

Appendix Table 2. Characteristics of patients undergoing total hip and knee arthroplasties from FY2011 to FY2018

	ICD9					ICD10		
	FY2011	FY2012	FY2013	FY2014	FY2015	FY2016	FY2017	FY2018
	N=199064	N=220310	N=239837	N=262980	N=277321	N=299819	N=303429	N=203821
Age, mean ± SD	65.6 ± 10.9	65.6 ± 10.7	65.7 ± 10.6	65.7 ± 10.5	65.7 ± 10.4	66.0 ± 10.4	66.3 ± 10.2	66.3 ± 10.1
Male gender, n (%)	77753 (39.1%)	86865 (39.4%)	95629 (39.9%)	105558 (40.1%)	112272 (40.5%)	121174 (40.4%)	122487 (40.4%)	84300 (41.4%)
Race, n (%)								
African Americans	16139 (8.1%)	17950 (8.1%)	18790 (7.8%)	19389 (7.4%)	21491 (7.7%)	24610 (8.2%)	24408 (8.0%)	16701 (8.2%)
Caucasian	153588 (77.2%)	174285 (79.1%)	191877 (80.0%)	213983 (81.4%)	230831 (83.2%)	253528 (84.6%)	256256 (84.5%)	171293 (84.0%)
Other	29337 (14.7%)	27896 (12.7%)	28617 (11.9%)	29079 (11.1%)	22792 (8.2%)	18020 (6.0%)	18488 (6.1%)	13496 (6.6%)
Payor category, n (%)								
MCO	59314 (29.8%)	64994 (29.5%)	70468 (29.4%)	77062 (29.3%)	79292 (28.6%)	80851 (27.0%)	77743 (25.6%)	50744 (24.9%)
Medicaid	6170 (3.1%)	7444 (3.4%)	8094 (3.4%)	10562 (4.0%)	13687 (4.9%)	14511 (4.8%)	14598 (4.8%)	9001 (4.4%)
Medicare	108874 (54.7%)	120373 (54.6%)	132942 (55.4%)	146687 (55.8%)	152999 (55.2%)	169364 (56.5%)	175101 (57.7%)	117345 (57.6%)
Other	24706 (12.4%)	27499 (12.5%)	28333 (11.8%)	28669 (10.9%)	31343 (11.3%)	35093 (11.7%)	35987 (11.9%)	26731 (13.1%)
THA, n (%)	133674 (67.2%)	145767 (66.2%)	157684 (65.7%)	170953 (65.0%)	178133 (64.2%)	190202 (63.4%)	193680 (63.8%)	125475 (61.6%)
TKA, n (%)	65415 (32.9%)	74572 (33.8%)	82172 (34.3%)	92064 (35.0%)	99222 (35.8%)	109673 (36.6%)	109804 (36.2%)	78366 (38.4%)
Hospital characteristics, n (%)								
Teaching hospital	84817 (42.6%)	93110 (42.3%)	98764 (41.2%)	106872 (40.6%)	112485 (40.6%)	124749 (41.6%)	128874 (42.5%)	89955 (44.1%)
Urban hospital	178833 (89.8%)	195889 (88.9%)	214623 (89.5%)	235404 (89.5%)	248794 (89.7%)	267513 (89.2%)	268886 (88.6%)	179941 (88.3%)
Bed size								
0-99	8609 (4.3%)	10609 (4.8%)	12580 (5.2%)	15646 (5.9%)	17371 (6.3%)	21782 (7.3%)	23983 (7.9%)	16701 (8.2%)
100-199	29900 (15.0%)	35505 (16.1%)	38618 (16.1%)	45201 (17.2%)	49512 (17.9%)	52728 (17.6%)	54513 (18.0%)	37955 (18.6%)
200-299	37236 (18.7%)	44138 (20.0%)	46966 (19.6%)	50464 (19.2%)	55169 (19.9%)	57851 (19.3%)	56835 (18.7%)	36212 (17.8%)
300-399	38463 (19.3%)	40461 (18.4%)	43779 (18.3%)	47090 (17.9%)	48929 (17.6%)	48105 (16.0%)	46080 (15.2%)	32118 (15.8%)
400-499	29781 (15.0%)	32191 (14.6%)	34777 (14.5%)	35810 (13.6%)	36730 (13.2%)	39406 (13.1%)	36256 (11.9%)	24130 (11.8%)
500+	55075 (27.7%)	57406 (26.1%)	63117 (26.3%)	68769 (26.1%)	69610 (25.1%)	79947 (26.7%)	85762 (28.3%)	56705 (27.8%)
LOS, days, median (IQR)	3 [3, 3]	3 [2, 3]	3 [2, 3]	3 [2, 3]	2 [2, 3]	2 [2, 3]	2 [2, 3]	2 [1, 3]
Hospital mortality, n (%)	172 (0.1%)	185 (0.1%)	178 (0.1%)	206 (0.1%)	159 (0.1%)	208 (0.1%)	200 (0.1%)	121 (0.1%)

MCO: managed care organization, THA: total hip arthroplasty, TKA: total knee arthroplasty, LOS: length of stay

Appendix Table 3. Prevalence of comorbidities and complications for the two quarters immediately before and after the ICD transition.

	ICD9	ICD10
	N=43855	N=52482
Comorbidity		
CHF, n (%)	1216 (2.8%)	1398 (2.7%)
Valvular disease, n (%)	1286 (2.9%)	1468 (2.8%)
Pulmonary circulation disorder, n (%)	352 (0.8%)	50 (0.1%)
Hypertension, n (%)	28687 (65.4%)	34170 (65.1%)
Peripheral vascular disease, n (%)	1093 (2.5%)	1093 (2.1%)
Paralysis, n (%)	60 (0.1%)	72 (0.1%)
Other neurological disorders, n (%)	1948 (4.4%)	2277 (4.3%)
COPD, n (%)	7057 (16.1%)	8070 (15.4%)
Diabetes, complicated, n (%)	890 (2.0%)	1877 (3.6%)
Diabetes, uncomplicated, n (%)	7979 (18.2%)	8513 (16.2%)
Hypothyroidism, n (%)	7373 (16.8%)	8542 (16.3%)
Renal failure, n (%)	2567 (5.9%)	2859 (5.4%)
Liver disease, n (%)	524 (1.2%)	631 (1.2%)
Peptic ulcer disease, n (%)	24 (0.1%)	25 (0.0%)
Acquired immune deficiency syndrome, n (%)	24 (0.1%)	25 (0.0%)
Lymphoma, n (%)	123 (0.3%)	93 (0.2%)
Metastatic cancer, n (%)	46 (0.1%)	67 (0.1%)
Solid tumor without metastasis, n (%)	193 (0.4%)	200 (0.4%)
Rheumatoid arthritis, n (%)	2053 (4.7%)	2123 (4.0%)
Coagulopathy, n (%)	532 (1.2%)	636 (1.2%)
Obesity, n (%)	10619 (24.2%)	12494 (23.8%)
Weight loss, n (%)	118 (0.3%)	147 (0.3%)

Fluid/electrolyte disorders, n (%)	1319 (3.0%)	1597 (3.0%)
Blood loss anemia, n (%)	142 (0.3%)	200 (0.4%)
Deficiency anemia, n (%)	2348 (5.4%)	2748 (5.2%)
Alcohol abuse, n (%)	581 (1.3%)	667 (1.3%)
Psychoses, n (%)	1071 (2.4%)	773 (1.5%)
Depression, n (%)	6656 (15.2%)	6870 (13.1%)
Drug abuse, n (%)	468 (1.1%)	397 (0.8%)
Complications		
Myocardial infarction, n (%)	64 (0.1%)	56 (0.1%)
Cerebrovascular accident, n (%)	34 (0.1%)	33 (0.1%)
Pulmonary embolism/DVT, n (%)	131 (0.3%)	185 (0.4%)
Respiratory failure, n (%)	321 (0.7%)	410 (0.8%)
Pulmonary edema, n (%)	108 (0.2%)	158 (0.3%)
Pneumonia, n (%)	223 (0.5%)	220 (0.4%)
Sepsis, n (%)	53 (0.1%)	81 (0.2%)
Urinary Tract Infection, n (%)	167 (0.4%)	245 (0.5%)