

Supplementary Online Content

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

eTable 1: Characteristics of IMPACT vs. PACT patients, Engaged vs. Non-Engaged IMPACT patients, and IMPACT patients who responded to the baseline vs. baseline and follow-up surveys

	IMPACT (n = 140)	PACT (n = 405)		IMPACT Engaged (n = 96)	IMPACT Non-Engaged (n = 44)		Baseline Survey Only (n = 36)	Baseline + Follow-up Survey (n = 54)	
	n (%) ^a	n (%) ^a	P-value ^b	n (%) ^a	n (%) ^a	P-value ^b	n (%) ^a	n (%) ^a	P-value ^b
Age, mean (SD)	66.4 (14.0)	65.7 (13.0)	0.62	68.3 (14.2)	62.1 (12.6)	0.01	70.9 (13.4)	67.5 (13.3)	0.24
<30	1 (1)	3 (1)		0 (0)	1 (2)		0 (0)	0 (0)	
30-50	12 (9)	27 (7)		8 (8)	4 (9)		1 (3)	5 (9)	
51-64	51 (36)	182 (45)		31 (32)	20 (45)		8 (22)	19 (35)	
65-74	42 (30)	98 (24)		28 (29)	14 (32)		14 (39)	15 (28)	
75 +	34 (24)	95 (24)		29 (30)	5 (11)		13 (36)	15 (27)	
Male Sex	130 (93)	365 (90)	0.33	89 (93)	41 (93)	0.92	33 (92)	51 (94)	0.61
Geographical Indicator			0.27			0.04			0.16
Urban	125 (89)	372 (92)		90 (94)	35 (80)		31 (86)	52 (96)	
Rural	11 (8)	29 (7)		4 (4)	7 (16)		4 (11)	1 (2)	
Unknown	4 (3)	4 (1)		2 (2)	2 (5)		1 (3)	1 (2)	
Race/Ethnicity			0.52			0.28			0.22
White, Non-Hispanic	79 (56)	240 (59)		58 (60)	21 (48)		23 (64)	30 (56)	
Black, Non-Hispanic	20 (14)	68 (17)		14 (15)	6 (14)		7 (19)	6 (11)	
Hispanic	9 (6)	27 (7)		4 (4)	5 (11)		0 (0)	3 (5)	
Other	32 (23)	70 (17)		20 (21)	12 (27)		6 (16)	15 (28)	
Chronic Conditions, mean (SD)	10.2 (3.5)	10.5 (3.4)	0.38	10.3 (3.5)	10.2 (3.5)	0.94	10.4 (3.7)	9.8 (3.7)	0.44
0-6	18 (13)	46 (11)		12 (13)	6 (14)		5 (14)	8 (15)	
7-9	40 (29)	115 (28)		27 (28)	13 (30)		9 (25)	16 (29)	
10-12	50 (36)	130 (32)		35 (36)	15 (34)		12 (33)	20 (37)	
13 or more	32 (23)	114 (28)		22 (23)	10 (23)		10 (28)	10 (18)	
Non-VA Health Insurance (Any)^c	74 (53)	224 (55)	0.62 ^c	57 (59)	17 (39)	0.02 ^c	24(67)	29(54)	0.22 ^c
Medicare and/or Med Advantage	69 (49)	205 (51)		54 (56)	15 (34)		22(61)	29(54)	
Major Medical ^c	12 (9)	38 (9)		10 (10)	2 (5)		4(11)	5(9)	
Medicaid	4 (3)	10 (2)		3 (3)	1 (2)		1(3)	0(0)	
All Other	3 (2)	11 (3)		3 (3)	0 (0)		1(3)	2(4)	
Homelessness (ICD-9 60.0)	35 (25)	104 (26)	0.87	21 (22)	14 (32)	0.21	10 (28)	10 (18)	0.30
CAN Score, mean (SD)^d	95 (6)	94 (6)	0.44	95 (6)	94 (6)	0.89	95 (5)	94 (6)	0.60
Acute Med/Surg Hosps, mean (SD)	1.2 (1.4)	1.2 (1.4)	0.70	1.2 (1.4)	1.1 (1.3)	0.53	2.2 (2)	1.3 (1)	0.01
Emergency Dept Visits, mean (SD)	3.4 (3.3)	3.3 (3.3)	0.70	3.5 (3.5)	3.1 (2.9)	0.48	3.4 (3)	3.5 (3)	0.83

^a Unless otherwise indicated

^b P-values reflect t-tests for continuous variables (Age, Chronic Condition Number, CAN Score, Acute Medical/Surgical Hospitalizations, Emergency Department Visits) and chi-square tests for dichotomous/categorical variables (Sex, Geographical Indicator, Race/Ethnicity, Homelessness).

^c Insurance Status categories are not mutually exclusive. P-value reflects chi-square test for the proportion of patients who have any form of health insurance outside of VA coverage. Major Medical Insurance category Includes HMO, PPO, Champus, and Indemnity.

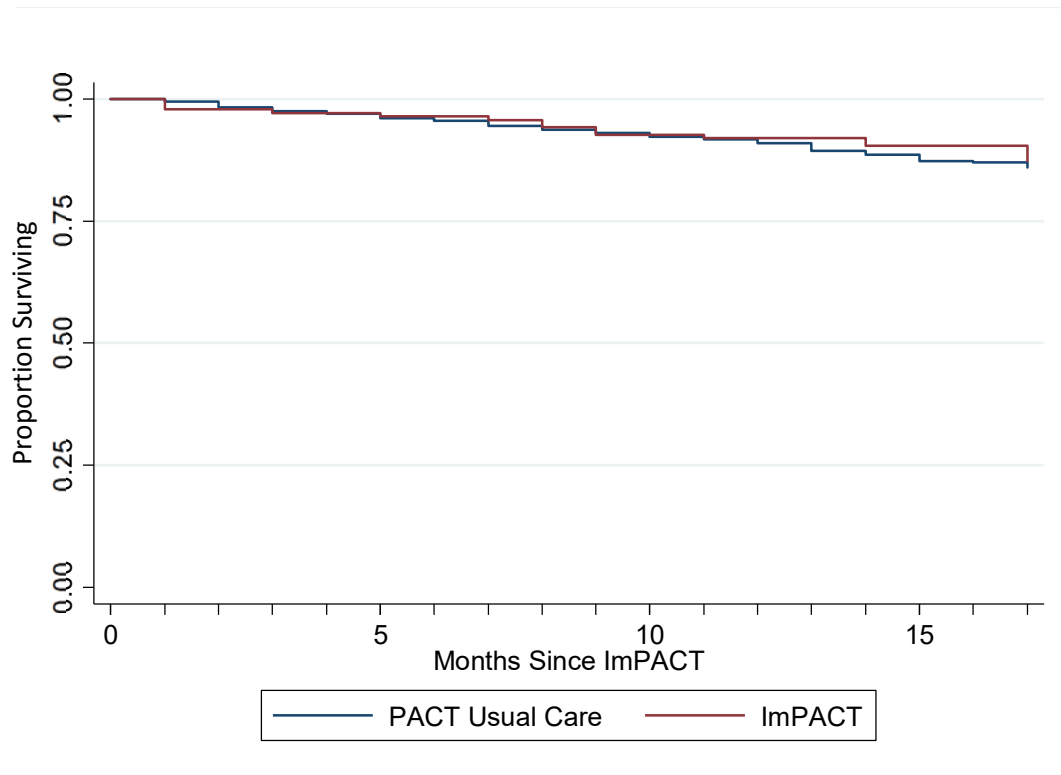
^d Care Assessment Need Score (Wang, *et al.*, *Medical Care*, 2013)

eTable 2: Chronic condition diagnoses among IMPACT vs. PACT patients, and Engaged vs. Non-Engaged IMPACT patients

	ImPACT (n=140)	PACT (n=405)		Engaged (n=96)	Not-Engaged (n=44)	
	n (%)	n (%)	P-Value^a	n (%)	n (%)	P-Value^a
Cancer						
Cancer (solid/heme cancers, melanoma)	29 (21)	112 (28)	0.11	20 (21)	9 (20)	0.96
Cardiovascular						
Hypertension	100 (71)	288 (71)	0.94	70 (73)	30 (68)	0.57
Coronary Artery Disease	51 (36)	114 (28)	0.07	36 (38)	15 (34)	0.70
Heart Failure	34 (24)	87 (21)	0.49	25 (26)	9 (20)	0.47
Arrhythmia/Conduction Disorder	46 (33)	150 (37)	0.37	34 (35)	12 (27)	0.34
Cerebrovascular Disease	18 (13)	55 (14)	0.83	11 (11)	7 (16)	0.47
Vascular Disease	41 (29)	117 (29)	0.93	32 (33)	9 (20)	0.12
Endocrine/Metabolic/Nutritional						
Diabetes Mellitus	47 (34)	152 (38)	0.40	34 (35)	13 (30)	0.50
Lipid Disorders	89 (64)	243 (60)	0.46	62 (65)	27 (61)	0.71
Overweight/Obesity	35 (25)	116 (29)	0.41	25 (26)	10 (23)	0.67
Thyroid Disorders	17 (12)	57 (14)	0.57	11 (11)	6 (14)	0.71
Gastrointestinal						
Esophageal/Gast/Duod Disorders	63 (45)	178 (44)	0.83	44 (46)	19 (43)	0.77
Liver Disease or Hepatitis C	30 (21)	107 (26)	0.24	16 (17)	14 (32)	0.04
Mental Health						
Any Mental Health Condition	95 (68)	280 (69)	0.78	62 (65)	33 (75)	0.22
Depression	68 (49)	195 (48)	0.93	47 (49)	21 (48)	0.89
PTSD	32 (23)	115 (28)	0.20	22 (23)	10 (23)	0.98
Anxiety Disorders	20 (14)	86 (21)	0.07	13 (14)	7 (16)	0.71
Bipolar Disorders	12 (9)	25 (6)	0.33	8 (8)	4 (9)	0.88
Personality Disorders	12 (9)	38 (9)	0.77	6 (6)	6 (14)	0.15
Schizophrenia	11 (8)	24 (6)	0.42	5 (5)	6 (14)	0.09
Psychotic Disorders- Other	9 (6)	39 (10)	0.25	6 (6)	3 (7)	0.90
Alcohol Use Disorders	30 (21)	103 (25)	0.34	16 (17)	14 (32)	0.04
Drug Use Disorders	41 (29)	102 (25)	0.34	24 (25)	17 (39)	0.10
Musculoskeletal						
Spine Disorders	65 (46)	187 (46)	0.96	43 (45)	22 (50)	0.57
Joint Disorders	80 (57)	237 (59)	0.78	58 (60)	22 (50)	0.25
Musculoskeletal Conditions- Other	73 (52)	188 (46)	0.24	51 (53)	22 (50)	0.73
Neurologic						
Traumatic Brain Injury	10 (7)	25 (6)	0.69	7 (7)	3 (7)	0.92
Dementia	13 (9)	17 (4)	0.02	8 (8)	5 (11)	0.57
Spinal Cord Injury or Paralysis	5 (4)	16 (4)	0.84	2 (2)	3 (7)	0.16
Peripheral Nerve Disorders	25 (18)	78 (19)	0.72	17 (18)	8 (18)	0.95
Nervous System Sx/Disorders- Other	57 (41)	180 (44)	0.44	37 (39)	20 (45)	0.44
Renal/Urinary						
Renal Failure or Nephropathy	40 (29)	101 (25)	0.40	28 (29)	12 (27)	0.82
Kidney/Ureter/Urinary Conditions	48 (34)	174 (43)	0.07	36 (38)	12 (27)	0.24
Respiratory						
Chronic Obstructive Pulmonary Disease	34 (24)	76 (19)	0.16	24 (25)	10 (23)	0.77
Asthma	9 (6)	34 (8)	0.46	6 (6)	3 (7)	0.90
Respiratory Conditions- Other	82 (59)	248 (61)	0.58	57 (59)	25 (57)	0.78
Hematologic/Immunologic						
Anemia	36 (26)	114 (28)	0.58	28 (29)	8 (18)	0.17
Thrombocytopenia	6 (4)	30 (7)	0.20	4 (4)	2 (5)	0.92
Coagulation and Hem Disorders	5 (4)	20 (5)	0.51	3 (3)	2 (5)	0.67
Hematologic/Imm Conditions- Other	10 (7)	38 (9)	0.42	8 (8)	2 (5)	0.42

^a P-values reflect chi-square tests

eFigure 1: Kaplan-Meier survival curves for patients in ImPACT and PACT



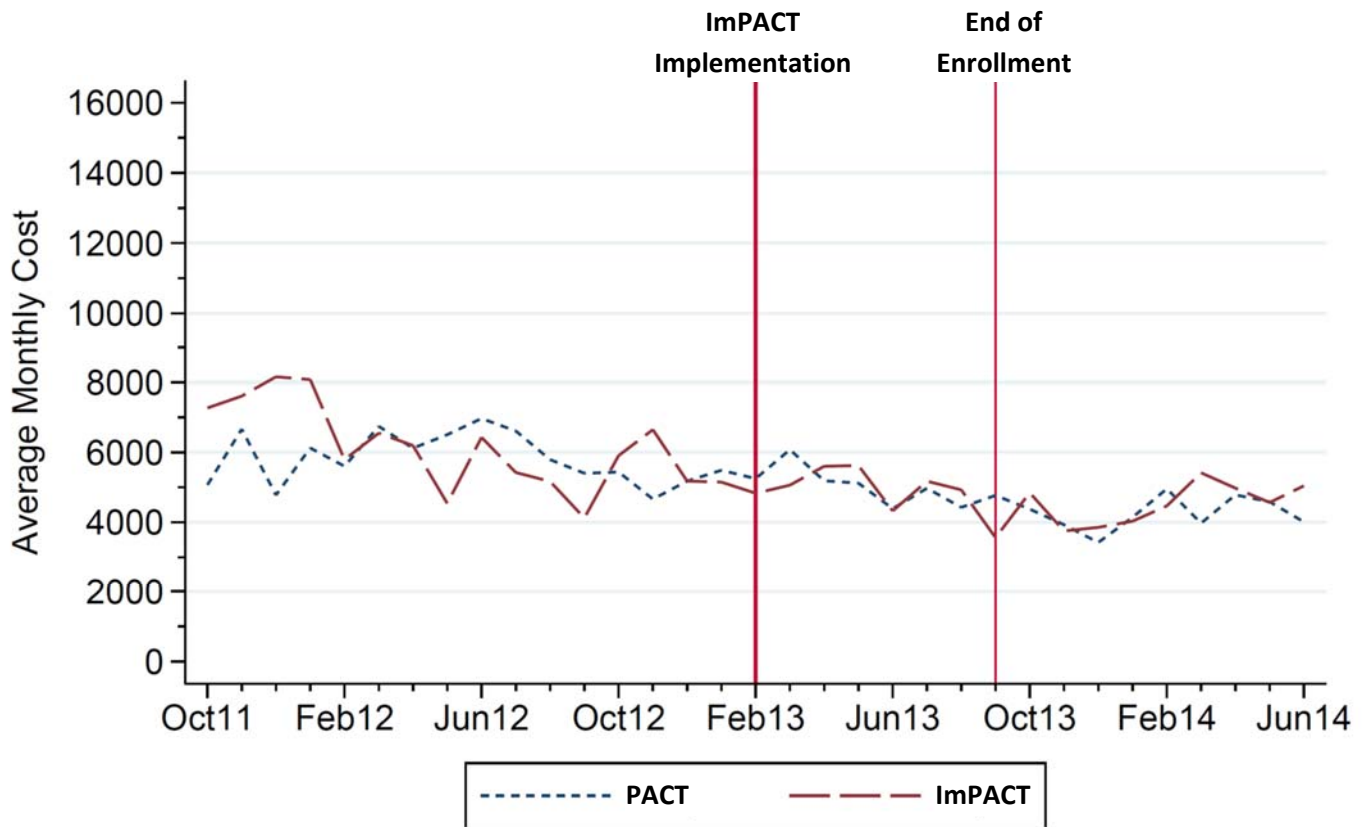
eTable 3. Estimated program effects on person-level monthly utilization rates (mean, standard error)^a among intention-to-treat patients in ImPACT vs. PACT

Utilization Measure	Monthly Utilization	
	D-in-D	Standard Error
Acute Med/Surg Admissions	0.005	(0.010)
Acute Med/Surg Days	-0.035	(0.079)
Acute MH Admissions	-0.002	(0.005)
Acute MH Days	0.003	(0.079)
Extended Med Admissions	-0.001	(0.003)
Extended Med Days	-0.022	(0.290)
Extended MH Admissions	0.002	(0.002)
Extended MH Days	0.131	(0.251)
ED Visits	-0.008	(0.017)
Primary Care Visits	0.900	(0.094)
Specialty Care Visits	0.053	(0.080)
MH Outpatient Visits	-0.079	(0.100)

eTable 3 presents estimated program effects on person-level monthly utilization rates. These effects represent difference-in-differences (D-in-D) among all patients in the intention-to-treat population, which correspond to the change in monthly utilization among patients in ImPACT, minus the change in monthly utilization for patients in PACT. A negative program effect corresponds to a larger decline in utilization over the study period among patients in ImPACT, compared to patients in PACT. Changes in monthly costs were estimated using linear regression, controlling for patient fixed effects.

MH: Mental Health; Acute Med/Surg: medicine/surgery hospital ward; Acute MH: acute psychiatric hospital ward; Extended Med: inpatient rehabilitation, extended care, hospice; Extended MH: inpatient mental health/PTSD, substance use rehabilitation, domiciliary, domiciliary/foundation of recovery; ED: Emergency Department.

eFigure 2. Estimated monthly person-level total costs^a among intention-to-treat patients in ImpACT vs. PACT, during baseline (10/11-1/13) and follow-up (2/13-6/14) periods



^a Total costs include all inpatient/outpatient/fee-basis costs including costs associated with ImpACT encounters

eTable 4. Estimated program effects on monthly person-level costs (mean, standard error)^a among intention-to-treat patients in ImPACT vs. PACT

	n	Total Costs ^b	Inpatient Costs					Outpatient Costs				Fee Basis Costs	ImPACT Encounter Costs
			Inpatient (All)	Acute Med/Surg	Acute MH	Extended Med	Extended MH	ED Visits	Primary Care	Specialty	MH		
All patients	545	-101 (623)	-411 (587)	-144 (370)	-59 (156)	-277 (387)	49 (107)	-5 (11)	30** (14)	26 (28)	-22 (35)	-92 (97)	136 (12)
Age under 65	276	-922 (1014)	-1375 (911)	-379 (574)	-309 (288)	-724 (586)	11 (229)	13 (19)	35 (21)	45 (39)	-50 (65)	-45 (75)	127 (18)
Age 65 and older	269	465 (773)	412 (765)	130 (496)	150 (151)	65 (519)	55 (39)	-21 (13)	27 (17)	14 (41)	-1 (33)	-123 (164)	143 (15)
HF/DM/COPD	306	-754 (775)	-993 (766)	-938 (516)	282 (184)	-394 (478)	42 (56)	-25 (16)	27 (18)	26 (39)	-76 (41)	-172 (149)	145 (15)
MH diagnosis	380	-40 (725)	-252 (713)	-154 (422)	-84 (226)	-88 (484)	68 (155)	-7 (15)	25 (17)	2 (33)	-35 (50)	-146 (137)	139 (15)
No MH diagnosis	165	-246 (1,202)	-770 (1,038)	-112 (741)	-5 (5)	-705 (636)	3 (21)	-3 (16)	44** (21)	80 (54)	6 (21)	29 (69)	130 (18)
Hospitalization in 6 mo pre-enrollment	197	-198 (1336)	-908 (1220)	-571 (882)	85 (397)	-310 (559)	-147 (241)	1 (22)	24 (23)	109** (56)	-64 (62)	-46 (92)	172 (23)
High-cost at baseline	356	-5 (828)	-178 (808)	-244 (506)	-24 (230)	1 (550)	83 (160)	-15 (14)	9 (17)	14 (38)	-32 (47)	-189 (142)	121 (14)
High-risk at baseline	402	4 (674)	-363 (600)	-205 (447)	-88 (195)	-192 (321)	103 (89)	-8 (14)	39** (16)	16 (31)	-39 (37)	5 (64)	143 (14)
Eligibility: High-risk & hosp 6 mo pre-enrollment	171	-657 (1364)	-1119 (1258)	-915 (956)	97 (449)	-379 (537)	37 (191)	-9 (25)	18 (25)	51 (54)	-70 (65)	-25 (104)	173 (24)

** p<0.05

HF/DM/COPD: Heart Failure, Diabetes, or Chronic Obstructive Pulmonary Disease; ED: Emergency Department; MH: Mental Health; Acute Med/Surg: medicine/surgery hospital ward; Acute MH: acute psychiatric hospital ward; Extended Med: inpatient rehabilitation, extended care, hospice; Extended MH: inpatient mental health/PTSD, substance use rehabilitation, domiciliary, domiciliary/foundation of recovery.

^a Estimated program effects represent difference-in-differences among all patients in the intention-to-treat population, which correspond to the change in monthly costs among patients in ImPACT, minus the change in costs for patients in PACT. A negative program effect corresponds to a larger decline in costs over the study period among patients in ImPACT, compared to patients in PACT. Changes in monthly costs were estimated using linear regression, controlling for patient fixed effects. If patients died or moved away, their costs were set to 0 and missing, respectively, for subsequent months.

^b Total costs include all inpatient/outpatient/fee-basis costs including costs associated with ImPACT encounters (in far-right column)

eTable 5. Estimated program effects on monthly person-level costs (mean, standard error)^a among patients who engaged in ImpACT (treatment on the treated, estimated using randomization as an instrument for participation)

	Total Costs ^b	Inpatient Costs					Outpatient Costs				Fee Basis Costs	Impact Encounter Costs
		Inpatient (All)	Acute Med/Surg	Acute MH	Extended MED	Extended MH	ED Visits	Primary Care	Outpatient Specialty	Outpatient MH		
All patients	-145 (842)	-588 (870)	-206 (481)	-84 (217)	-397 (506)	71 (178)	-8 (14)	44** (17)	37 (37)	-32 (51)	-132 (155)	194 (14)
Age under 65	-1466 (1402)	-2185 (1491)	-603 (932)	-492 (452)	-1150 (891)	17 (371)	21 (30)	57 (33)	71 (66)	-79 (91)	-71 (114)	202 (26)
Age 65 and older	806 (1175)	547 (1012)	173 (714)	199 (199)	86 (818)	74 (63)	-28** (14)	36 (20)	18 (56)	-2 (37)	-163 (188)	189 (17)
HF/DM/COPD	-1057 (1029)	-1392 (867)	-1,314 (674)	395 (258)	-552 (712)	59 (64)	-35 (22)	38 (27)	37 (58)	-106 (58)	-240 (187)	203 (18)
MH diagnosis	-61 (929)	-380 (1145)	-232 (695)	-127 (355)	-132 (624)	103 (211)	-10 (21)	37 (23)	3 (46)	-53 (68)	-221 (196)	209 (16)
No MH diagnosis	-317 (1508)	-991 (1505)	-145 (870)	-7 (5)	-908 (848)	4 (26)	-3 (21)	56** (30)	103 (67)	8 (25)	37 (107)	167 (14)
Hospitalization in 6 mo pre-enrollment	-255 (1870)	-1171 (1555)	-736 (1187)	110 (432)	-400 (680)	-190 (366)	2 (33)	31 (25)	141 (78)	-82 (72)	-60 (117)	222 (24)
High-cost at baseline	-8 (1160)	-266 (1122)	-363 (796)	-36 (340)	1 (884)	123 (249)	-23 (20)	13 (25)	21 (52)	-48 (64)	-281 (231)	180 (14)
High-risk at baseline	6 (1051)	-515 (855)	-291 (692)	-125 (292)	-273 (446)	147 (148)	-11 (20)	55** (24)	22 (38)	-55 (48)	7 (81)	203 (18)
Eligibility: High-risk & hosp 6 mo pre-enrollment	-851 (1652)	-1450 (1804)	-1185 (1297)	125 (630)	-491 (712)	48 (253)	-11 (37)	24 (33)	66 (63)	-90 (97)	-32 (152)	223 (26)

** p<0.05

HF/DM/COPD: Heart Failure, Diabetes, or Chronic Obstructive Pulmonary Disease; ED: Emergency Department; MH: Mental Health; Acute Med/Surg: medicine/surgery hospital ward; Acute MH: acute psychiatric hospital ward; Extended Med: inpatient rehabilitation, extended care, hospice; Extended MH: inpatient mental health/PTSD, substance use rehabilitation, domiciliary, domiciliary/foundation of recovery.

^a Estimated program effects represent difference-in-differences for patients who engaged in ImpACT, which correspond to the change in monthly costs among patients in ImpACT, minus the change in costs for patients in PACT. A negative program effect corresponds to a larger decline in costs over the study period among patients in ImpACT, compared to patients in PACT. Changes in monthly costs were estimated using linear regression, controlling for patient fixed effects. If patients died or moved away, their costs were set to 0 and missing, respectively, for subsequent months.

^b Includes all inpatient/outpatient/fee-basis costs including costs associated with ImpACT encounters (in far-right column)

eTable 5 reports results from secondary analyses in which we estimated the effect of the intervention on patients who actively engaged in ImpACT (defined *a priori* as completing an intake and at least three additional encounters) using randomization as an instrument for participation. These analyses are in contrast to the intention-to-treat analyses presented in eTable 4, where we estimated the effect of being randomized to receive ImpACT. As expected, we estimate effects that are modestly larger than those from the intention-to-treat analyses.