Appendices: Opioid Prescribing for Opioid-Naïve Patients in Emergency Departments and Other Settings

These appendices provide further detail on methods and supplementary analyses to support the main findings.

1. Comparison of demographics: OLDW and US commercially insured
2. Codes used to identify exclusions for cancer and hospice care
3. Opioid drugs included/excluded
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Appendix 1: Comparison of demographics: OLDW and US commercially insured and Medicare Advantage

Under 65 privately insured population

	US privately insured	OLDW commercial
Race/ethnicity*		
White	72%	73%
Asian	6%	5%
Hispanic	12%	11%
Black	10%	11%
American Indian	<1%	N/A
Female	50%	49%
Age		
0 to 17	24%	24%
18 to 24	11%	10%
25 to 34	16%	16%
35 to 44	15%	18%
45 to 54	17%	18%
55 to 59	9%	8%
60 to 64	7%	6%

OLDW commercial includes people with both medical and prescription coverage; excludes people with unknown race/ethnicity, year of birth, or sex

* Source: Kaiser Family Foundation/Urban Institute analysis of CPS ASEC, 2011 data

** Source: CPS ASEC, 2015 data

Medicare Advantage

	US Medicare Advantage	OLDW Medicare Advantage
Race/ethnicity		
White	76%	76%
Black	11%	12%
Hispanic	8%	9%
Other	6%	3%
Female	55%	57%

OLDW Medicare Advantage includes people with both medical and prescription coverage; excludes people with unknown race/ethnicity or sex

US Medicare Advantage source: Kaiser Family Foundation, 2015 data

Appendix 2: Codes used to identify exclusions for cancer and hospice care

To limit the analysis to patients with an important risk of long-term opioid use, we excluded patients with active cancer diagnoses or hospice service use.

For the cancer population, we looked at claims for evaluation and management services in the 3 months prior to the index opioid fill. We identified patients with at least two claims on separate days that included a cancer diagnosis. We used Elixhauser comorbidity diagnoses for metastatic cancer or for solid tumors without metastases.[1]

Evaluation and management codes: 99024, 99201, 99202, 99203, 99204, 99205, 99211, 99212, 99213, 99214, 99215, 99217, 99218, 99219, 99220, 99221, 99222, 99223, 99224, 99225, 99226, 99231, 99232, 99233, 99234, 99235, 99236, 99238, 99239, 99241, 99242, 99243, 99244, 99245, 99251, 99252, 99253, 99254, 99255, 99261, 99262, 99263, 99271, 99272, 99273, 99274, 99275, 99281, 99282, 99283, 99284, 99285, 99289, 99290, 99291, 99292, 99293, 99294, 99299, 99300, 99301, 99302, 99303, 99304, 99305, 99306, 99307, 99308, 99309, 99310, 99311, 99312, 99313, 99315, 99316, 99318, 99321, 99322, 99323, 99324, 99325, 99326, 99327, 99328, 99331, 99332, 99333, 99334, 99335, 99336, 99337, 99339, 99340, 99341, 99342, 99343, 99344, 99345, 99347, 99348, 99349, 99350, 99351, 99352, 99353, 99356, 99357, 99358, 99359, 99360, 99361, 99362, 99366, 99367, 99368, 99371, 99372, 99373, 99374, 99375, 99376, 99377, 99378, 99379, 99380, 99415, 99416, 99438, 99441, 99442, 99443, 99444, 99446, 99447, 99448, 99449, 99466, 99467, 99471, 99472, 99475, 99476, 99478, 99479, 99480, 99487, 99488, 99489, 99490, 99495, 99496, 99497, 99498, 99499, 0188T, 0189T, S0257, S0260, S0310

To identify patients receiving hospice services, we looked for at least one claim with either a hospice procedure code or a hospice revenue code in the 3 months prior to the index fill

- Procedure codes: 99377, 99378, G0182, G0337, G9474,G9475, G9476, G9477, G9478, G9479, G9524, Q5001, Q5002, Q5003, Q5004, Q5005, Q5006, Q5007, Q5008, Q5009, Q5010, S0255, S9126, T2042, T2043, T2044, T2045, T2046
- Revenue codes: 115, 0125, 0135, 0145, 0155, 0235, 0650, 0651, 0652, 0653, 0654, 0655, 0656, 0657, 0658, 0659

Appendix 3: Opioid drugs included/excluded

We identified all opioid drugs present in the table of NDC codes in OptumLabs Data Warehouse. For the purposes of this analysis, we classified tramadol as an opioid. We excluded DEA schedule 5 drugs (codeine cough syrups).
To limit the sample to drugs intended for home use, we excluded any injected or infused drug—those for which the dosage form was vial, syringe, ampule, cartridge, IV solution, etc.
We included only drugs which had a defined dose unit like a tablet, pill, mg/mL, etc. This excludes drugs in powder or bulk form.
We included both single drug formulations and combinations of drugs. Table A1 includes all opioid drug combinations found in the table of NDC codes. Both long-acting and short-acting formulations were included.
Buprenorphine, methadone, and drug combinations including naloxone may be used for both pain management and medication-assisted therapy (MAT) for opioid use disorder. However, in an opioid naïve population, it is highly likely that these medications are being used for MAT. We excluded these drugs from the analysis of opioid naïve prescriptions. However, we did include them when determining whether a person was opioid naïve and in calculating the risk of progression to long-term use.

Table A1 Opioid drugs and combinations included

Opioid	Drug combinations included	Not eligible for index fill	Long acting	Short acting
Buprenorphine	Buprenorphine	X	X	
	Buprenorphine/Naloxone	X	X	
Butorphanol	Butorphanol			X
Codeine	Codeine			X
	Codeine/Acetaminophen			X
	Codeine/Acetaminophen/ Butabarbital			X
	Codeine/Acetaminophen/ Butalbital			X
	Codeine/Aspirin			X
	Codeine/Aspirin/Butalbital/ Caffeine			X
	Codeine/Aspirin/Carisoprodol			X
	Codeine/Aspirin/Phenacetin/ Caffeine			X
Dihydrocodeine	Dihydrocodeine/Acetaminophen/ Caffeine			X
	Dihydrocodeine/Aspirin/Caffeine			X
Fentanyl	Fentanyl		X	X
Hydrocodone	Hydrocodone		X	X
	Hydrocodone/Acetaminophen			X
	Hydrocodone/Acetaminophen/Diet.Sup.11			X
	Hydrocodone/Aspirin			X
	Hydrocodone/Ibuprofen			X
Hydromorphone	Hydromorphone		X	X
Levomethadyl	Levomethadyl		X	

Opioid	Drug combinations included	Not eligible for index fill	Long acting	Short acting
Levorphanol	Levorphanol		X	
Meperidine	Meperidine/Acetaminophen			X
	Meperidine/Promethazine			X
Methadone	Methadone	X	X	
Morphine	Morphine Sulfate		X	X
	Morphine Sulfate/Naltrexone		X	
Opium	Opium			X
	Opium/Belladonna			X
Oxycodone	Oxycodone		X	X
	Oxycodone/Acetaminophen			X
	Oxycodone/Aspirin			X
	Oxycodone/Ibuprofen			X
Oxymorphone	Oxymorphone		X	X
Pentazocine	Pentazocine/Acetaminophen			X
	Pentazocine/Aspirin			X
	Pentazocine/Naloxone	X		X
Propoxyphene	Propoxyphene			X
	Propoxyphene/Acetaminophen			X
	Propoxyphene/Aspirin/Caffeine			X
Tapentadol	Tapentadol		X	X
Tramadol	Tramadol		X	X
	Tramadol/Acetaminophen			X
	Tramadol/Dietary Supplement No. 11			X

Appendix 4: Definition of a opioid fill

An opioid fill was defined as a drug dispensed on a single day to an individual beneficiary by a single prescriber. Here, *drug* is defined by the opioid ingredient and formulation type: for example, all short-acting hydrocodone prescriptions filled on the same day with the same prescriber ID for the same individual would be counted as one fill. The total MME amount dispensed for each drug/person/prescriber combination is summed and divided by the maximum days supply across the prescriptions. Examples:

Patient	**Prescriber**	**Date**	**Drug**	**Formulation**	**Total MME**	**Days supply**
1	10	1/1/2011	Hydrocodone	SA	50	2
1	10	1/1/2011	Hydrocodone	SA	100	10
1	15	1/1/2011	Hydrocodone	LA	50	5
2	10	1/1/2011	Oxycodone	SA	50	5
2	15	1/1/2011	Oxycodone	SA	50	10

Patient 1 has 2 fills on 1/1/2011

1. 150 MME of SA Hydrocodone with a days supply of 10=15 MME per day
2. 50 MME of LA Hydrocodone with a days supply of 5=10 MME per day

Patient 2 has 2 fills on 1/1/2011:

1. 50 MME of SA Oxycodone with a days supply of 5 from prescriber 10=10 MME per day
2. 50 MME of SA Oxycodone with a days supply of 10 from prescriber 15=5 MME per day

Appendix 5: Determining prescription source

To determine the source of an opioid fill, we attempt to link a prescription claim to a medical claim representing the encounter where the beneficiary received the prescription. Because opioids are scheduled drugs, we expect that in most cases, the prescriber will see the patient in person before writing the prescription. As of 2013, 41 states and Washington, DC, had state laws requiring physical examinations in relation to prescriptions for a controlled substance.[2]

To find the visit that generated a prescription, we look for all medical claims in the 30 days prior to and including the date a prescription was filled. We used revenue and procedure codes identified by the National Committee for Quality Assurance (NCQA) to find inpatient, outpatient, and ED visits (except code 92888, used for physician consultation with EMS).[3] We used revenue codes to identify ambulatory surgery services, and Current Procedural Terminology (CPT) codes to identify dental services. All other procedures and visits that were not classified as inpatient, outpatient, ED, ambulatory surgery, or dental services were captured and labeled “other” services. This category includes laboratory tests, imaging, physical therapy, chiropractic care, etc.

We identified inpatient, outpatient, ED, ambulatory surgery, or dental visit in the 30 days up to and including the index fill date. We attempted to match the provider ID these visits to the prescriber ID on the pharmacy claim. If we found a matching visit, we assigned that visit as the most likely source of the prescription

(N=1,590,929; 30.3% of fills with any visit within 30 days). Due to limitations in the OLDW at the time the study was completed, we were unable to match prescriber IDs to medical claims physician IDs for Medicare Advantage beneficiaries.

If no visits were found with a provider ID matching the prescription, we assigned the most proximal visit as the source of the prescription. If no visits were found within 30 days of the index fill, but other services were present (for example, laboratory tests or imaging), we considered the prescription to have an unknown source. Of all prescriptions with a known source, 72% were filled on the same day as the visit, 85% within 3 days, and 90% within one week.

Once we identified the visit considered the most likely source of the fill, we classified the most likely source of each index fill as 1) ED visit only; 2) non-ED visit only, which combines inpatient, outpatient, ambulatory surgery, and dental/accidental dental; 3) unknown source. The unknown source category included both fills with no visit in the prior 30 days and fills where the beneficiary had both an ED visit and a non-ED visit on the same day.

A substantial proportion of prescriptions fall into the unknown source category: 26% for the Commercial population and 15-16% for the Medicare population; most of these fills were classified as unknown due to having no visit in the prior 30 days. Another study using a different source of commercial claims found a similarly high rate of prescriptions that could not be matched to a visit: 28%

unmatched with a look back period of 2 weeks (vs. 30 days for this study).[4] Some of these prescriptions were likely written by dentists, who have been estimated to write 6.4% of opioid prescriptions.[5] We did not observe most dental visits, as dentistry is not included in medical insurance benefits. In our sample of fills to opioid-naïve patients, 7.0% of fills with a known prescriber specialty were written by a dentist or other dental specialist. We present the results for prescriptions with unknown source throughout, but do not focus on the interpretation of this group of prescriptions.

Appendix 6: Calculation of confidence intervals in Table 1

Measure	Confidence interval calculation/statistical tests
• Naïve opioid fills per covered person per year of insurance coverage • Total opioid fills per covered person per year of insurance coverage • Mean number of comorbidities	Mean calculated with Poisson exact confidence interval
• Sex • Race/ethnicity • Prescription source • Insurance coverage after fill (3 mos, 6 mos, 12 mos) • Had any claims in (3 mos, 6 mos) before fill • Any comorbidity • Drug filled • DEA class • Greater than (50 MME, 90 MME, 3 days, 7 days) • Chronic opioid use	Confidence intervals for proportions calculated using logit transform
Age	N/A: Median with inter-quartile range

Appendix 7: Drug filled—complete list

	Commercial		Aged Medicare		Disabled Medicare	
Opioids	**% of fills**	**95 CI**	**% of fills**	**95 CI**	**% of fills**	**95 CI**
Hydrocodone SA	58.9	(58.9,59.0)	49.2	(49.1,49.4)	49.7	(49.3,50.0)
Oxycodone SA	18.8	(18.8,18.8)	16.6	(16.6,16.7)	19.4	(19.1,19.7)
Tramadol SA	8.7	(8.7,8.7)	20.2	(20.1,20.3)	18.7	(18.5,19.0)
Codeine	9.8	(9.8,9.9)	8.6	(8.5,8.7)	7.2	(7.0,7.4)
Propoxyphene	2.3	(2.3,2.3)	2.4	(2.4,2.5)	2.0	(1.9,2.1)
Morphine SA	<0.1	(<0.1,<0.1)	1.4	(1.4,1.5)	0.5	(0.4,0.5)
Hydromorphone SA	0.4	(0.4,0.4)	0.6	(0.5,0.6)	0.8	(0.8,0.9)
Oxycodone LA	0.2	(0.2,0.2)	0.3	(0.3,0.3)	0.4	(0.4,0.5)
Morphine LA	0.1	(0.1,0.1)	0.1	(0.1,0.1)	0.5	(0.4,0.5)
Meperidine	0.4	(0.4,0.4)	0.1	(0.1,0.1)	0.1	(0.1,0.2)
Fentanyl LA	<0.1	(<0.1,<0.1)	0.3	(0.3,0.3)	0.3	(0.3,0.3)
Tramadol LA	0.1	(0.1,0.1)	0.1	(0.1,0.1)	0.1	(0.1,0.2)
Tapentadol SA	0.1	(0.1,0.1)	<0.1	(<0.1,<0.1)	<0.1	(<0.1,<0.1)
Oxymorphone LA	<0.1	(<0.1,<0.1)	<0.1	(<0.1,<0.1)	0.1	(0.1,0.1)
Pentazocine	<0.1	(<0.1,<0.1)	<0.1	(<0.1,<0.1)	<0.1	(<0.1,<0.1)
Butorphanol	<0.1	(<0.1,<0.1)	<0.1	(<0.1,<0.1)	<0.1	(<0.1,<0.1)
Opium	<0.1	(<0.1,<0.1)	<0.1	(<0.1,<0.1)	<0.1	(<0.1,<0.1)
Tapentadol LA	<0.1	(<0.1,<0.1)	<0.1	(<0.1,<0.1)	<0.1	(<0.1,<0.1)
Oxymorphone SA	<0.1	(<0.1,<0.1)	<0.1	(<0.1,<0.1)	<0.1	(<0.1,<0.1)
Dihydrocodeine	<0.1	(<0.1,<0.1)	<0.1	(<0.1,<0.1)	<0.1	(<0.1,<0.1)
Hydromorphone LA	<0.1	(<0.1,<0.1)	<0.1	(<0.1,<0.1)	<0.1	(<0.1,<0.1)
Levorphanol	<0.1	(<0.1,<0.1)	<0.1	(<0.1,<0.1)	<0.1	(<0.1,<0.1)
Hydrocodone LA	<0.1	(<0.1,<0.1)	<0.1	(<0.1,<0.1)	<0.1	(<0.1,<0.1)
Fentanyl SA	<0.1	(<0.1,<0.1)	<0.1	(<0.1,<0.1)	<0.1	(<0.1,<0.1)

Appendix 8: Complete logistic regression results for analyses presented in Table 2

Table A2	Prescription characteristics					
	(1)	(2)	(3)	(4)	(5)	(6)
Odds ratios reported	>3 days	>7 days	>50 MME	>90 MME	Long-acting	Long-term use
Beneficiary population						
Commercial	1	1	1	1	1	1
	[1,1]	[1,1]	[1,1]	[1,1]	[1,1]	[1,1]
Aged Medicare	0.967	1.022	0.929	0.771	0.756	1.701
	[0.956,0.978]	[1.010,1.034]	[0.917,0.941]	[0.754,0.788]	[0.713,0.803]	[1.653,1.751]
Disabled Medicare	1.297	1.942	0.754	0.882	1.700	4.465
	[1.270,1.323]	[1.908,1.977]	[0.737,0.771]	[0.851,0.915]	[1.585,1.822]	[4.332,4.601]
Treatment setting						
Non-ED	1	1	1	1	1	1
	[1,1]	[1,1]	[1,1]	[1,1]	[1,1]	[1,1]
Unknown source	0.459	0.350	0.690	0.593	0.651	0.613
	[0.456,0.461]	[0.347,0.353]	[0.685,0.694]	[0.586,0.600]	[0.624,0.680]	[0.597,0.630]
ED	0.300	0.132	0.557	0.438	0.0799	0.535
	[0.298,0.302]	[0.130,0.134]	[0.553,0.561]	[0.432,0.445]	[0.0702,0.0911]	[0.518,0.553]
Treatment setting × population						
Unknown source × Aged Medicare	0.949	1.245	1.307	1.451	1.276	1.105
	[0.935,0.964]	[1.222,1.268]	[1.281,1.333]	[1.401,1.503]	[1.165,1.397]	[1.057,1.154]
Unknown source × Disabled Medicare	1.060	1.482	1.578	1.712	1.759	1.430
	[1.017,1.105]	[1.419,1.549]	[1.501,1.659]	[1.572,1.863]	[1.512,2.047]	[1.334,1.534]
ED × Aged Medicare	0.794	0.592	1.235	1.488	1.716	0.785
	[0.780,0.807]	[0.570,0.615]	[1.206,1.265]	[1.425,1.553]	[1.333,2.208]	[0.740,0.831]
ED × Disabled Medicare	0.567	0.388	1.318	1.261	1.397	0.686
	[0.544,0.590]	[0.355,0.425]	[1.249,1.390]	[1.138,1.396]	[0.912,2.141]	[0.627,0.751]
Female	0.937	0.933	0.988	1.122	0.720	0.923
	[0.934,0.941]	[0.928,0.937]	[0.984,0.993]	[1.113,1.130]	[0.702,0.739]	[0.911,0.936]
Race/ethnicity						
White	1	1	1	1	1	1
	[1,1]	[1,1]	[1,1]	[1,1]	[1,1]	[1,1]
Black	1.165	1.264	0.840	0.895	0.725	1.017

Table A2	Prescription characteristics					
Odds ratios reported	(1) >3 days	(2) >7 days	(3) >50 MME	(4) >90 MME	(5) Long-acting	(6) Long-term use
	[1.158,1.172]	[1.254,1.274]	[0.834,0.846]	[0.884,0.906]	[0.692,0.759]	[0.996,1.038]
Hispanic	1.230	1.399	0.815	0.894	0.749	0.853
	[1.222,1.237]	[1.388,1.411]	[0.809,0.822]	[0.882,0.906]	[0.712,0.787]	[0.832,0.875]
Asian	1.085	1.032	0.844	0.793	0.772	0.456
	[1.074,1.096]	[1.018,1.047]	[0.834,0.855]	[0.775,0.811]	[0.712,0.837]	[0.431,0.481]
Unknown race/ethnicity	1.003	1.008	0.952	0.918	1.069	0.872
	[0.993,1.013]	[0.995,1.022]	[0.941,0.964]	[0.899,0.937]	[1.003,1.139]	[0.841,0.904]
Year	1.019	1.035	0.907	0.767	0.946	0.952
	[1.018,1.020]	[1.033,1.036]	[0.906,0.908]	[0.766,0.769]	[0.940,0.952]	[0.949,0.955]
Age	0.943	0.901	0.908	0.882	1.075	1.317
	[0.942,0.944]	[0.900,0.902]	[0.906,0.909]	[0.880,0.883]	[1.064,1.087]	[1.305,1.330]
Age^2	1.001	1.003	1.002	1.002	0.999	0.995
	[1.001,1.001]	[1.002,1.003]	[1.002,1.002]	[1.002,1.003]	[0.999,0.999]	[0.995,0.996]
Age^3	1.000	1.000	1.000	1.000	1.000	1.000
	[1.000,1.000]	[1.000,1.000]	[1.000,1.000]	[1.000,1.000]	[1.000,1.000]	[1.000,1.000]
Elixhauser comorbidities (binary)						
CHF	1.036	1.051	0.948	1.049	0.844	1.165
	[1.014,1.058]	[1.030,1.072]	[0.926,0.969]	[1.012,1.087]	[0.782,0.911]	[1.119,1.214]
Arrhythmia	1.097	1.011	1.192	1.129	1.432	0.930
	[1.081,1.112]	[0.997,1.026]	[1.174,1.210]	[1.102,1.158]	[1.357,1.510]	[0.901,0.960]
Valvular disease	1.174	0.994	1.137	1.042	0.906	0.780
	[1.148,1.201]	[0.973,1.016]	[1.111,1.163]	[1.004,1.081]	[0.834,0.984]	[0.742,0.820]
Pulm. circ. dis.	1.174	1.158	0.953	0.929	1.112	1.196
	[1.132,1.217]	[1.119,1.199]	[0.918,0.989]	[0.874,0.987]	[0.992,1.247]	[1.117,1.281]
Peripheral vascular dis.	1.209	1.041	1.191	1.171	1.171	1.211
	[1.182,1.237]	[1.020,1.063]	[1.164,1.219]	[1.129,1.214]	[1.088,1.261]	[1.163,1.262]
Uncomp. HTN	1.217	1.222	1.130	1.136	1.547	1.203
	[1.208,1.225]	[1.213,1.231]	[1.121,1.139]	[1.121,1.151]	[1.494,1.602]	[1.182,1.225]
Comp. HTN	1.116	1.080	0.979	0.953	1.026	0.961
	[1.087,1.145]	[1.053,1.107]	[0.952,1.007]	[0.910,0.998]	[0.930,1.132]	[0.911,1.014]
Other neuro.	1.103	1.164	1.023	1.085	1.198	1.239
	[1.079,1.126]	[1.139,1.190]	[0.999,1.047]	[1.046,1.126]	[1.107,1.296]	[1.185,1.296]
Chronic pulm. dis.	1.173	1.185	1.109	1.128	1.569	1.379
	[1.160,1.187]	[1.171,1.200]	[1.096,1.124]	[1.106,1.151]	[1.495,1.648]	[1.342,1.417]

Table A2	Prescription characteristics					
Odds ratios reported	(1) >3 days	(2) >7 days	(3) >50 MME	(4) >90 MME	(5) Long-acting	(6) Long-term use
Peptic ulcer	1.466	1.359	0.910	1.005	1.072	1.614
	[1.368,1.571]	[1.275,1.448]	[0.848,0.976]	[0.899,1.123]	[0.861,1.333]	[1.435,1.814]
Uncomp. Diabetes	1.041	1.103	0.937	0.964	0.946	1.232
	[1.031,1.051]	[1.091,1.114]	[0.927,0.948]	[0.946,0.982]	[0.903,0.992]	[1.205,1.260]
Comp. Diabetes	1.037	1.033	0.927	0.933	0.978	1.125
	[1.014,1.061]	[1.011,1.056]	[0.904,0.950]	[0.895,0.973]	[0.893,1.072]	[1.076,1.175]
Paralysis	1.378	1.613	1.085	1.157	1.846	2.237
	[1.309,1.450]	[1.542,1.687]	[1.034,1.139]	[1.076,1.244]	[1.628,2.093]	[2.066,2.422]
Renal failure	0.978	1.002	0.930	0.933	0.867	1.020
	[0.956,1.001]	[0.980,1.024]	[0.906,0.954]	[0.895,0.973]	[0.795,0.946]	[0.975,1.067]
Solid tumor w/o mets	0.999	0.715	1.466	1.239	1.366	0.814
	[0.976,1.022]	[0.697,0.733]	[1.432,1.500]	[1.192,1.288]	[1.250,1.493]	[0.768,0.864]
Liver dis.	1.214	1.101	1.105	1.082	1.215	1.300
	[1.182,1.247]	[1.070,1.132]	[1.075,1.136]	[1.033,1.134]	[1.102,1.340]	[1.225,1.381]
Met. Cancer	1.588	1.329	1.495	1.292	2.314	1.852
	[1.476,1.708]	[1.243,1.422]	[1.404,1.593]	[1.168,1.428]	[1.947,2.751]	[1.603,2.139]
HIV/AIDS	1.115	1.104	0.991	0.979	1.275	1.076
	[1.053,1.180]	[1.033,1.181]	[0.927,1.059]	[0.871,1.100]	[0.979,1.660]	[0.921,1.257]
Rheumatoid Arthritis	1.497	2.017	0.961	0.992	2.207	2.304
	[1.462,1.532]	[1.973,2.061]	[0.937,0.985]	[0.951,1.034]	[2.038,2.390]	[2.209,2.402]
Hypothyroid	1.112	1.097	1.177	1.121	1.620	1.025
	[1.098,1.127]	[1.081,1.112]	[1.161,1.194]	[1.095,1.147]	[1.535,1.710]	[0.992,1.060]
Lymphoma	1.122	1.150	1.077	1.070	2.044	1.626
	[1.067,1.180]	[1.094,1.209]	[1.022,1.136]	[0.981,1.168]	[1.759,2.374]	[1.471,1.798]
Coagulopathy	1.191	1.065	1.351	1.134	1.410	1.063
	[1.157,1.227]	[1.035,1.097]	[1.313,1.390]	[1.082,1.188]	[1.282,1.550]	[0.996,1.135]
Obesity	1.272	1.152	1.744	2.115	1.992	1.095
	[1.252,1.292]	[1.132,1.172]	[1.717,1.771]	[2.067,2.164]	[1.877,2.114]	[1.050,1.141]
Weight Loss	1.170	1.234	1.152	1.358	1.668	1.655
	[1.131,1.210]	[1.196,1.274]	[1.114,1.192]	[1.291,1.427]	[1.524,1.827]	[1.556,1.761]
Fluid/Electrolyte Dis.	1.301	1.169	1.251	1.176	1.662	1.205
	[1.278,1.324]	[1.149,1.190]	[1.229,1.274]	[1.143,1.211]	[1.566,1.764]	[1.161,1.251]
Blood Loss Anemia	1.167	1.009	1.435	1.275	1.396	1.061
	[1.113,1.225]	[0.961,1.059]	[1.371,1.503]	[1.186,1.372]	[1.197,1.628]	[0.956,1.178]

Table A2	Prescription characteristics					
	(1)	(2)	(3)	(4)	(5)	(6)
Odds ratios reported	>3 days	>7 days	>50 MME	>90 MME	Long-acting	Long-term use
Deficiency Anemia	1.105	1.100	1.036	0.989	1.168	1.166
	[1.076,1.135]	[1.071,1.131]	[1.007,1.066]	[0.944,1.036]	[1.057,1.290]	[1.101,1.235]
Alcohol Abuse	1.245	1.214	1.194	1.147	1.351	1.529
	[1.201,1.291]	[1.167,1.263]	[1.149,1.240]	[1.075,1.223]	[1.198,1.523]	[1.417,1.650]
Drug Abuse	1.081	1.330	1.041	1.065	2.332	2.318
	[1.030,1.134]	[1.259,1.406]	[0.986,1.098]	[0.973,1.166]	[2.015,2.700]	[2.096,2.562]
Psychoses	0.908	0.961	0.884	1.031	1.013	1.272
	[0.874,0.943]	[0.925,0.998]	[0.846,0.923]	[0.964,1.102]	[0.900,1.139]	[1.188,1.361]
Depression	1.044	1.191	1.042	1.088	2.098	1.853
	[1.030,1.058]	[1.173,1.209]	[1.026,1.058]	[1.061,1.116]	[1.991,2.210]	[1.796,1.911]
Any claim 6 mos before fill	1.078	1.185	1.317	1.447	2.085	1.110
	[1.070,1.086]	[1.168,1.202]	[1.303,1.331]	[1.417,1.477]	[1.909,2.276]	[1.066,1.156]
Constant	1.16e-16	9.59e-31	6.99e+84	1.12e+231	8.69e+44	1.53e+39
	[1.86e-17,	[8.28e-32,	[7.41e+83,	[1.80e+229,	[2.02e+39,	[1.682e+36,
	7.27e-16]	1.11e-29]	6.59e+85]	6.93e+232]	3.761e+50]	1.386e+42]
Observations	5,243,498	5,243,498	5,243,498	5,243,498	5,243,498	3,658,393

Exponentiated coefficients; 95% confidence intervals in brackets

Appendix 9: Complete results for analysis of guideline concordance predicting long-term use

Table A3: logistic regression results

Odds ratios reported	(1)
	Long-term use
Prescription guideline concordance	
Fully concordant (<=3 days supply, <=50 MME per day, short-acting formulation)	0.259
	[0.250,0.269]
Treatment setting	
Non-ED	1
	[1,1]
Unknown source	0.764
	[0.743,0.786]
ED	0.489
	[0.469,0.511]
Guideline concordance × treatment setting	
Fully concordant × Non-ED	1
	[1,1]
Fully concordant × Unknown source	0.851
	[0.794,0.913]

Fully concordant × ED	3.099
	[2.883,3.331]
Enrollee population	
Commercial	1
	[1,1]
Aged Medicare	1.733
	[1.683,1.785]
Disabled Medicare	4.472
	[4.336,4.613]
Guideline concordance × Enrollee population	
Fully concordant × Commercial	1
	[1,1]
Fully concordant × Aged Medicare	0.801
	[0.748,0.857]
Fully concordant × Disabled Medicare	0.743
	[0.653,0.844]
Treatment setting × Enrollee population	
Non-ED × Commercial	1
	[1,1]

Non-ED × Aged Medicare	1
	[1,1]
Non-ED × Disabled Medicare	1
	[1,1]
Unknown source × Commercial	1
	[1,1]
Unknown source × Aged Medicare	1.053
	[1.005,1.103]
Unknown source × Disabled Medicare	1.308
	[1.214,1.409]
ED × Commercial	1
	[1,1]
ED × Aged Medicare	0.818
	[0.758,0.883]
ED × Disabled Medicare	0.666
	[0.587,0.755]
Guideline concordance × Treatment setting × Enrollee population	
Fully concordant × Non-ED × Commercial	1
	[1,1]

Fully concordant × Non-ED × Aged Medicare	1 [1,1]
Fully concordant × Non-ED × Disabled Medicare	1 [1,1]
Fully concordant × Unknown source × Commercial	1 [1,1]
Fully concordant × Unknown source × Aged Medicare	0.975 [0.840,1.131]
Fully concordant × Unknown source × Disabled Medicare	1.165 [0.909,1.493]
Fully concordant × ED × Commercial	1 [1,1]
Fully concordant × ED × Aged Medicare	1.183 [1.038,1.349]
Fully concordant × ED × Disabled Medicare	1.518 [1.225,1.881]
Year	0.957 [0.953,0.960]
Age	1.316 [1.304,1.328]

Age^2	0.995
	[0.995,0.996]
Age^3	1.000
	[1.000,1.000]
Elixhauser comorbidities	
CHF	1.169
	[1.122,1.217]
Arrhythmia	0.919
	[0.891,0.949]
Valvular disease	0.758
	[0.721,0.797]
Pulm. circ. dis.	1.182
	[1.104,1.267]
Peripheral vascular dis.	1.185
	[1.138,1.235]
Uncomp. HTN	1.158
	[1.138,1.179]
Comp. HTN	0.948
	[0.899,1.000]
Other neuro.	1.239
	[1.184,1.296]

Chronic pulm. dis.	1.346 [1.310,1.383]
Peptic ulcer	1.565 [1.392,1.760]
Uncomp. Diabetes	1.226 [1.199,1.254]
Comp. Diabetes	1.124 [1.075,1.175]
Paralysis	2.230 [2.058,2.416]
Renal failure	1.029 [0.984,1.076]
Solid tumor w/o mets	0.802 [0.756,0.851]
Liver dis.	1.256 [1.183,1.334]
Met. Cancer	1.729 [1.497,1.999]
HIV/AIDS	1.093 [0.936,1.277]

Rheumatoid Arthritis	2.193
	[2.103,2.287]
Hypothyroid	1.006
	[0.973,1.040]
Lymphoma	1.617
	[1.462,1.788]
Coagulopathy	1.034
	[0.968,1.104]
Obesity	1.036
	[0.993,1.080]
Weight Loss	1.630
	[1.532,1.734]
Fluid/Electrolyte Dis.	1.158
	[1.116,1.202]
Blood Loss Anemia	1.027
	[0.925,1.140]
Deficiency Anemia	1.157
	[1.093,1.226]
Alcohol Abuse	1.504
	[1.393,1.623]

Drug Abuse	2.304
	[2.083,2.548]
Psychoses	1.323
	[1.236,1.416]
Depression	1.854
	[1.797,1.913]
Any claim within 6 months before fill	1.057 [1.014,1.101]
Female	0.920
	[0.908,0.933]
Race/ethnicity	
White	1
	[1,1]
Black	0.998
	[0.977,1.019]
Hispanic	0.829
	[0.808,0.850]
Asian	0.452
	[0.428,0.478]
Unknown race/ethnicity	0.875 [0.844,0.907]

N	3,658,393

Exponentiated coefficients; 95% confidence intervals in brackets

Appendix 10: Risk ratios and confidence intervals for results presented in Figure 2

Table A5

Outcome	Treatment setting	Commercial			Aged Medicare			Disabled Medicare		
		Risk Ratio	Lower CI	Upper CI	Risk Ratio	Lower CI	Upper CI	Risk Ratio	Lower CI	Upper CI
>3 days supply	Non-ED (ref.)	1	-	-	1	-	-	1	-	-
	Unknown source	0.72	0.71	0.72	0.76	0.75	0.76	0.81	0.79	0.82
	ED	0.56	0.56	0.56	0.56	0.55	0.56	0.48	0.47	0.49
>50 MME/day	Non-ED (ref.)	1	-	-	1	-	-	1	-	-
	Unknown source	0.75	0.74	0.75	0.92	0.91	0.94	1.07	1.03	1.11
	ED	0.63	0.62	0.63	0.73	0.72	0.75	0.77	0.74	0.81
>7 days supply	Non-ED (ref.)	1	-	-	1	-	-	1	-	-
	Unknown source	0.41	0.40	0.41	0.56	0.55	0.56	0.66	0.64	0.68
	ED	0.16	0.16	0.16	0.12	0.12	0.13	0.09	0.08	0.10
>90 MME/day	Non-ED (ref.)	1	-	-	1	-	-	1	-	-
	Unknown source	0.62	0.61	0.63	0.87	0.84	0.90	1.01	0.93	1.09
	ED	0.46	0.46	0.47	0.67	0.64	0.69	0.57	0.52	0.63
Long-Acting/Extended Release	Non-ED (ref.)	1	-	-	1	-	-	1	-	-
	Unknown source	0.65	0.63	0.68	0.83	0.77	0.90	1.14	0.98	1.30
	ED	0.08	0.07	0.09	0.14	0.11	0.17	0.12	0.07	0.16
Long-term Opioid Use	Non-ED (ref.)	1	-	-	1	-	-	1	-	-
	Unknown source	0.62	0.60	0.64	0.70	0.67	0.72	0.90	0.85	0.95
	ED	0.54	0.53	0.56	0.44	0.42	0.46	0.42	0.39	0.45

Notes: Risk ratios calculated from marginal effects after logistic regression; 95% confidence intervals (CI) calculated for the ratio using the delta method

Appendix 11a: Supplementary analyses—Time trends in guideline concordance and progression to long-term use

To understand trends over the 7 years of our study period, we repeated the main analyses, but included time as a categorical variable fully interacted with beneficiary population and treatment setting. We calculated marginal effects (predicted probability of exceeding 3 days, 7 days, 50 MME, 90 MME, of prescribing a long-acting formulation, and of progression to long-term opioid use) and graphed them by beneficiary population and time. We also include an "as observed" analysis showing the average across the entire population.

Figure A2-a: Probability of prescription greater than 3 days supply

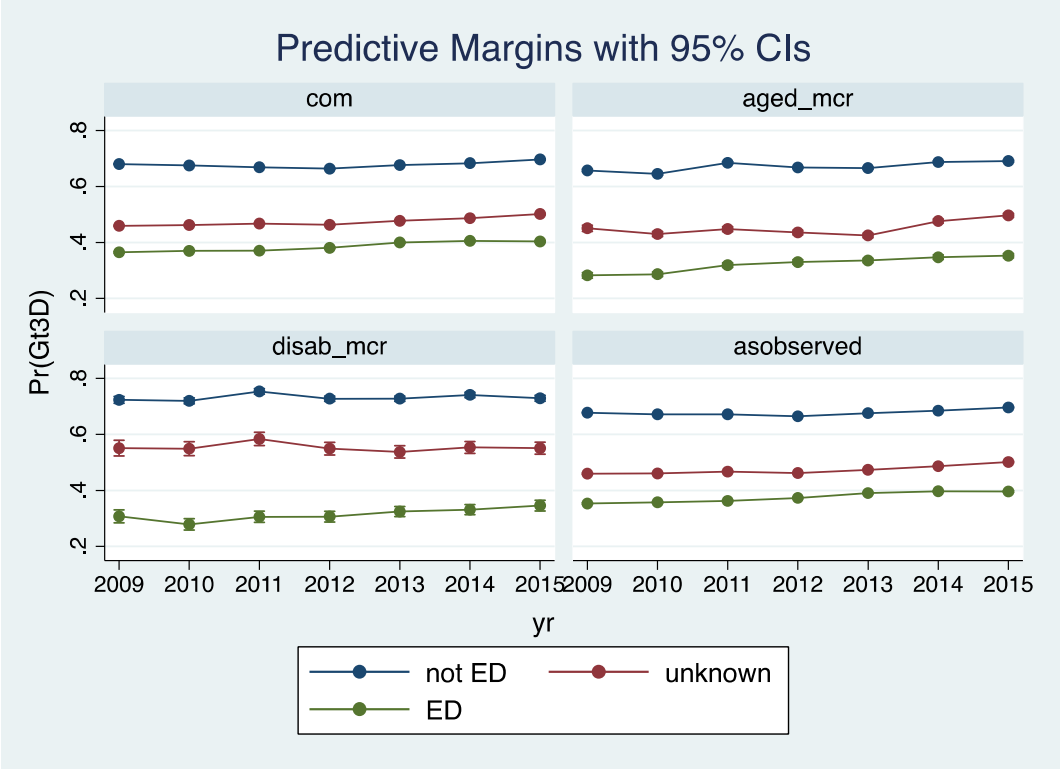


Table A6: Probability of prescription greater than 3 days supply, with 95% confidence intervals (CI)

	Commercial			Aged Medicare			Disabled Medicare		
	Pr(>3 days)	Lower CI	Upper CI	Pr(>3 days)	Lower CI	Upper CI	Pr(>3days)	Lower CI	Upper CI
2009									
not ED	0.680	0.679	0.681	0.657	0.652	0.662	0.724	0.712	0.735
ED	0.365	0.362	0.368	0.282	0.272	0.292	0.307	0.284	0.330
unknown	0.459	0.457	0.461	0.450	0.439	0.461	0.551	0.523	0.579
2010									
not ED	0.675	0.674	0.676	0.645	0.641	0.649	0.720	0.709	0.730
ED	0.370	0.366	0.373	0.286	0.278	0.295	0.278	0.258	0.298
unknown	0.462	0.460	0.464	0.430	0.420	0.439	0.549	0.524	0.574
2011									
not ED	0.668	0.667	0.670	0.684	0.680	0.689	0.754	0.743	0.764
ED	0.370	0.367	0.373	0.319	0.310	0.327	0.305	0.285	0.325
unknown	0.467	0.465	0.469	0.448	0.439	0.456	0.584	0.560	0.608
2012									
not ED	0.663	0.662	0.665	0.668	0.664	0.672	0.727	0.718	0.737
ED	0.381	0.377	0.384	0.330	0.321	0.338	0.306	0.287	0.325
unknown	0.463	0.461	0.465	0.435	0.427	0.444	0.549	0.527	0.571
2013									
not ED	0.676	0.675	0.678	0.666	0.662	0.669	0.728	0.718	0.737
ED	0.400	0.396	0.403	0.335	0.327	0.343	0.324	0.306	0.342
unknown	0.477	0.474	0.479	0.425	0.417	0.433	0.537	0.516	0.559
2014									
not ED	0.683	0.682	0.685	0.687	0.683	0.691	0.741	0.731	0.751
ED	0.405	0.402	0.409	0.347	0.339	0.355	0.331	0.313	0.349
unknown	0.487	0.484	0.489	0.476	0.468	0.484	0.554	0.532	0.575
2015									
not ED	0.696	0.695	0.698	0.690	0.687	0.694	0.729	0.719	0.740
ED	0.403	0.400	0.407	0.352	0.344	0.360	0.346	0.326	0.365
unknown	0.501	0.499	0.504	0.497	0.489	0.504	0.551	0.529	0.572

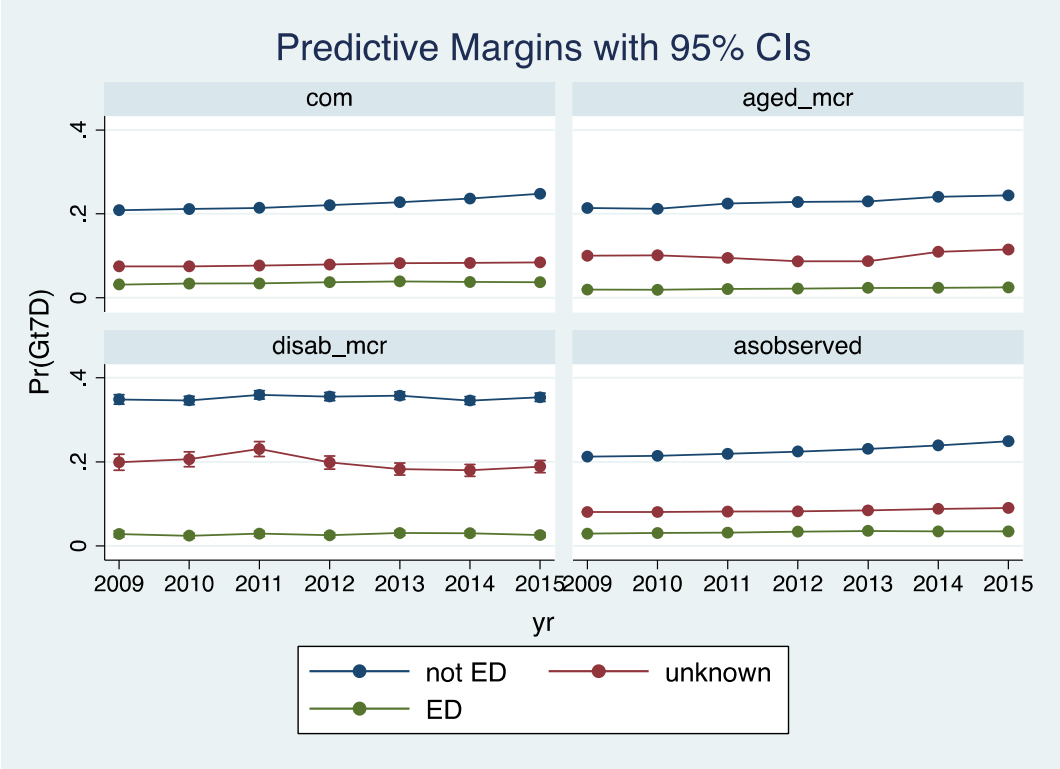

Predictive Margins with 95% CIs
com
aged_mcr
disab_mcr
asobserved
Pr(Gt7D)
0
.2
.4
2009
2010
2011
2012
2013
2014
2015
yr
not ED
unknown
ED

Table A7: Probability of prescription greater than 7 days supply, with 95% confidence intervals (CI)

	Commercial			Aged Medicare			Disabled Medicare		
	Pr(>7 days)	Lower CI	Upper CI	Pr(>7 days)	Lower CI	Upper CI	Pr(>7days)	Lower CI	Upper CI
2009									
not ED	0.209	0.208	0.210	0.214	0.210	0.217	0.349	0.337	0.360
ED	0.032	0.030	0.033	0.020	0.017	0.022	0.028	0.021	0.035
unknown	0.075	0.074	0.076	0.100	0.095	0.105	0.199	0.180	0.218
2010									
not ED	0.212	0.210	0.213	0.212	0.209	0.215	0.346	0.336	0.356
ED	0.034	0.032	0.035	0.019	0.017	0.021	0.024	0.018	0.030
unknown	0.075	0.074	0.076	0.101	0.097	0.105	0.206	0.189	0.224
2011									
not ED	0.214	0.213	0.215	0.225	0.222	0.227	0.360	0.350	0.370
ED	0.034	0.033	0.035	0.021	0.019	0.023	0.029	0.022	0.035
unknown	0.077	0.075	0.078	0.095	0.091	0.099	0.231	0.213	0.248
2012									
not ED	0.220	0.219	0.222	0.228	0.225	0.231	0.355	0.346	0.365
ED	0.037	0.036	0.039	0.022	0.020	0.024	0.025	0.019	0.031
unknown	0.079	0.078	0.080	0.087	0.084	0.090	0.198	0.183	0.214
2013									
not ED	0.228	0.226	0.229	0.230	0.227	0.233	0.358	0.349	0.367
ED	0.039	0.037	0.040	0.024	0.022	0.025	0.030	0.025	0.036
unknown	0.082	0.081	0.084	0.087	0.084	0.090	0.183	0.168	0.197
2014									
not ED	0.236	0.235	0.238	0.241	0.238	0.244	0.346	0.336	0.355
ED	0.037	0.036	0.039	0.024	0.022	0.026	0.030	0.024	0.036
unknown	0.083	0.081	0.084	0.109	0.106	0.113	0.180	0.166	0.194
2015									
not ED	0.248	0.246	0.249	0.244	0.241	0.247	0.354	0.344	0.364
ED	0.037	0.036	0.038	0.025	0.023	0.027	0.026	0.020	0.031
unknown	0.085	0.083	0.086	0.115	0.111	0.118	0.189	0.174	0.203

Figure A2-c: Probability of prescription greater than 50 MME per day

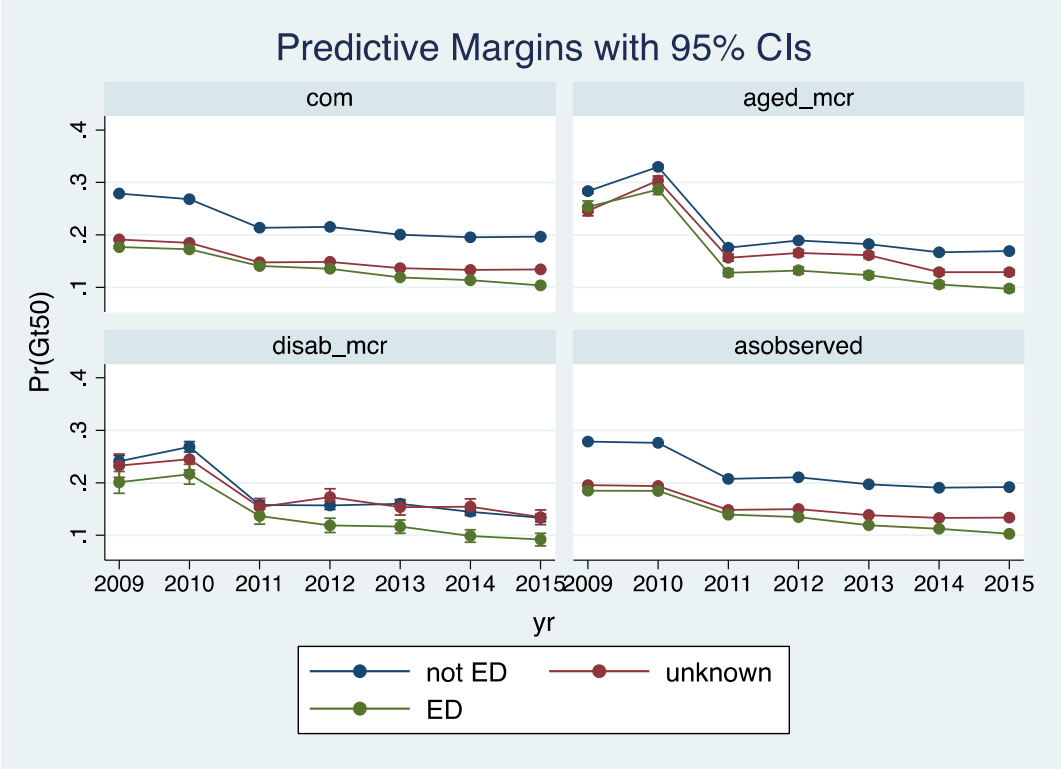

Predictive Margins with 95% CIs
com
aged_mcr
disab_mcr
asobserved
Pr(Gt50)
.1
.2
.3
.4
2009
2010
2011
2012
2013
2014
2015
yr
not ED
unknown
ED

Table A8: Probability of prescription greater than 50 MME per day, with 95% confidence intervals (CI)

	Commercial			Aged Medicare			Disabled Medicare		
	Pr(>50 MME)	Lower CI	Upper CI	Pr(>50 MME)	Lower CI	Upper CI	Pr(>50 MME)	Lower CI	Upper CI
2009									
not ED	0.279	0.277	0.280	0.283	0.279	0.288	0.241	0.230	0.252
ED	0.177	0.174	0.179	0.254	0.243	0.265	0.201	0.180	0.222
unknown	0.191	0.190	0.193	0.246	0.236	0.256	0.233	0.210	0.255
2010									
not ED	0.268	0.266	0.269	0.329	0.325	0.334	0.269	0.259	0.279
ED	0.172	0.170	0.175	0.286	0.277	0.296	0.216	0.197	0.235
unknown	0.185	0.183	0.186	0.303	0.295	0.312	0.245	0.224	0.265
2011									
not ED	0.213	0.212	0.215	0.175	0.172	0.179	0.158	0.150	0.166
ED	0.141	0.139	0.143	0.128	0.121	0.135	0.137	0.121	0.152
unknown	0.148	0.146	0.149	0.156	0.150	0.163	0.154	0.138	0.170
2012									
not ED	0.215	0.214	0.216	0.189	0.186	0.192	0.157	0.150	0.165
ED	0.135	0.133	0.138	0.132	0.125	0.139	0.119	0.105	0.133
unknown	0.149	0.147	0.150	0.165	0.159	0.172	0.173	0.157	0.189
2013									
not ED	0.200	0.199	0.202	0.182	0.179	0.186	0.160	0.153	0.167
ED	0.119	0.117	0.121	0.123	0.117	0.129	0.116	0.104	0.129
unknown	0.137	0.135	0.138	0.161	0.155	0.167	0.153	0.139	0.168
2014									
not ED	0.195	0.194	0.197	0.167	0.164	0.170	0.145	0.138	0.152
ED	0.114	0.111	0.116	0.105	0.100	0.111	0.099	0.087	0.111
unknown	0.133	0.131	0.135	0.129	0.124	0.134	0.155	0.140	0.169
2015									
not ED	0.197	0.195	0.198	0.169	0.166	0.172	0.133	0.126	0.141
ED	0.104	0.101	0.106	0.097	0.092	0.103	0.092	0.080	0.104
unknown	0.134	0.132	0.136	0.129	0.124	0.134	0.134	0.120	0.148

Figure A2-d: Probability of prescription greater than 90 MME per day

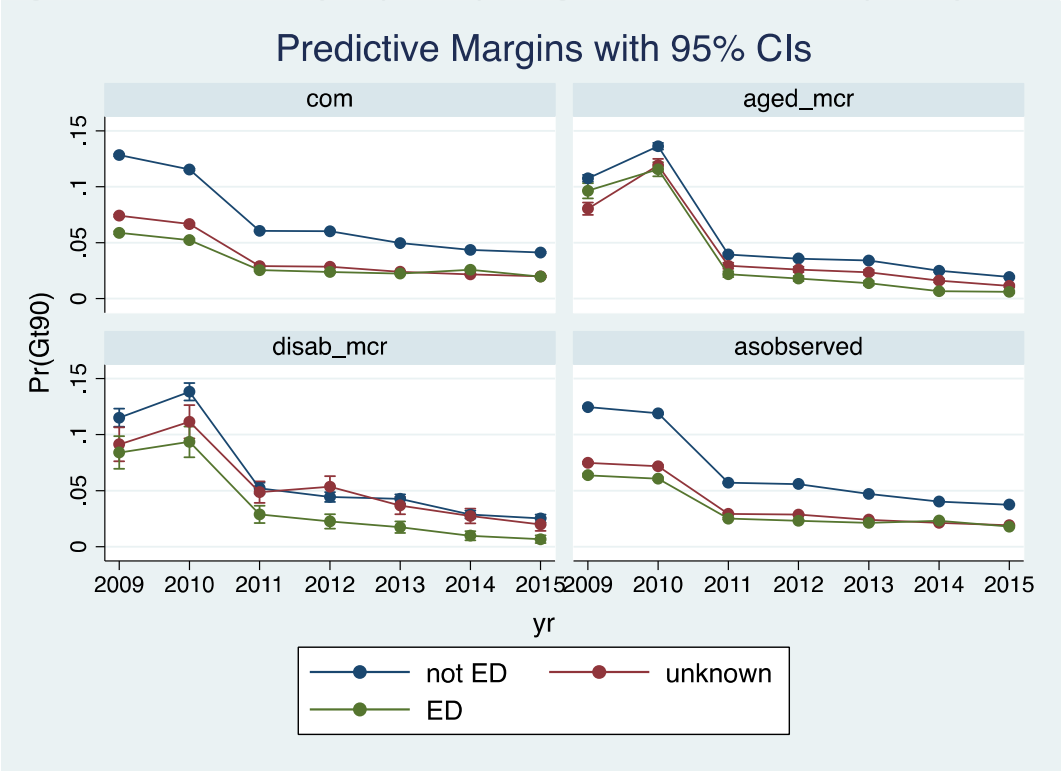


Table A9: Probability of prescription greater than 90 MME per day, with 95% confidence intervals (CI)

	Commercial			Aged Medicare			Disabled Medicare		
	Pr(>90 MME)	Lower CI	Upper CI	Pr(>90 MME)	Lower CI	Upper CI	Pr(>90 MME)	Lower CI	Upper CI
2009									
not ED	0.128	0.127	0.129	0.107	0.104	0.110	0.115	0.107	0.123
ED	0.059	0.057	0.060	0.096	0.090	0.103	0.084	0.069	0.099
unknown	0.074	0.073	0.075	0.080	0.075	0.086	0.091	0.076	0.106
2010									
not ED	0.115	0.114	0.116	0.136	0.133	0.139	0.138	0.131	0.146
ED	0.052	0.051	0.054	0.116	0.109	0.122	0.094	0.080	0.107
unknown	0.067	0.065	0.068	0.119	0.113	0.125	0.112	0.097	0.126
2011									
not ED	0.061	0.060	0.061	0.039	0.038	0.041	0.052	0.047	0.057
ED	0.025	0.024	0.026	0.022	0.019	0.024	0.029	0.021	0.036
unknown	0.029	0.028	0.030	0.029	0.027	0.032	0.049	0.039	0.058
2012									
not ED	0.060	0.059	0.061	0.036	0.034	0.037	0.044	0.040	0.049
ED	0.024	0.023	0.025	0.018	0.016	0.020	0.023	0.016	0.029
unknown	0.028	0.028	0.029	0.026	0.024	0.028	0.054	0.044	0.063
2013									
not ED	0.050	0.049	0.050	0.034	0.033	0.035	0.043	0.039	0.047
ED	0.022	0.021	0.023	0.014	0.012	0.016	0.017	0.012	0.023
unknown	0.024	0.023	0.025	0.023	0.021	0.026	0.037	0.029	0.044
2014									
not ED	0.043	0.043	0.044	0.025	0.024	0.026	0.029	0.025	0.032
ED	0.026	0.025	0.027	0.007	0.005	0.008	0.010	0.006	0.014
unknown	0.022	0.021	0.022	0.016	0.014	0.018	0.027	0.021	0.034
2015									
not ED	0.041	0.041	0.042	0.019	0.018	0.020	0.025	0.022	0.029
ED	0.020	0.019	0.021	0.006	0.005	0.007	0.007	0.003	0.010
unknown	0.020	0.019	0.021	0.011	0.010	0.013	0.020	0.014	0.026

Figure A2-e: Probability of prescription for long-acting/extended release formulation

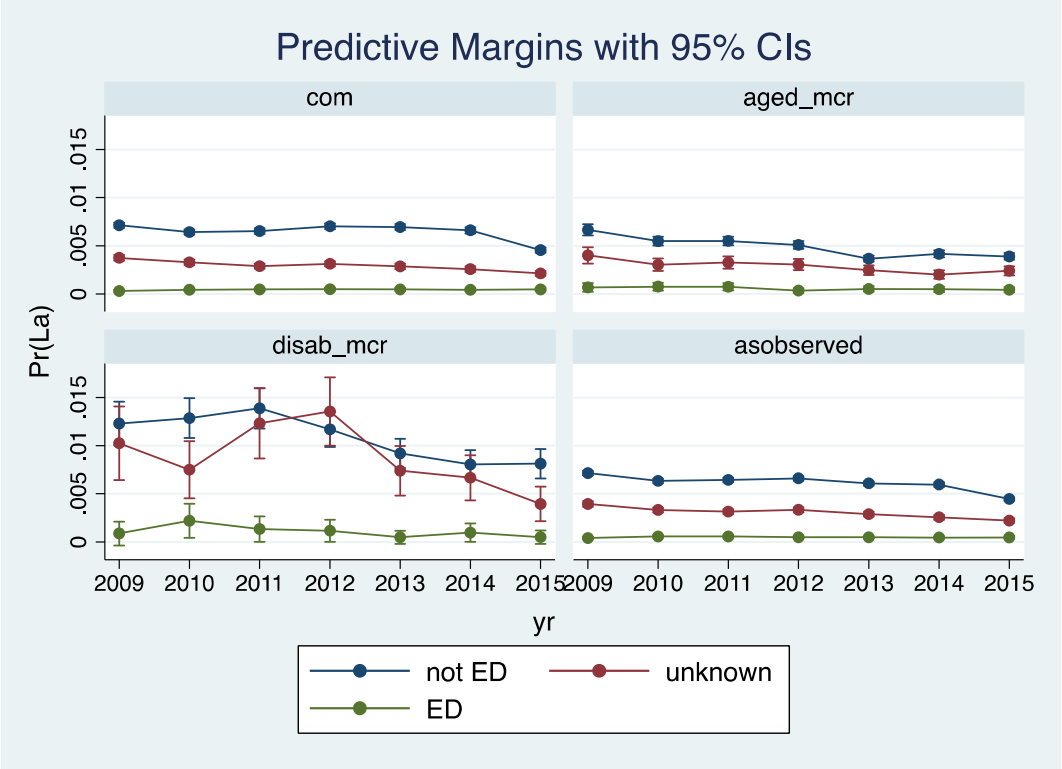


Table A10: Probability of prescription for a long-acting or extended release formulation, with 95% confidence intervals (CI)

	Commercial			Aged Medicare			Disabled Medicare		
	Pr(LA/ER)	Lower CI	Upper CI	Pr(LA/ER)	Lower CI	Upper CI	Pr(LA/ER)	Lower CI	Upper CI
2009									
not ED	0.007	0.007	0.007	0.007	0.006	0.007	0.012	0.010	0.015
ED	0.000	0.000	0.000	0.001	0.000	0.001	0.001	0.000	0.002
unknown	0.004	0.003	0.004	0.004	0.003	0.005	0.010	0.006	0.014
2010									
not ED	0.006	0.006	0.007	0.005	0.005	0.006	0.013	0.011	0.015
ED	0.000	0.000	0.001	0.001	0.000	0.001	0.002	0.000	0.004
unknown	0.003	0.003	0.004	0.003	0.002	0.004	0.007	0.005	0.010
2011									
not ED	0.007	0.006	0.007	0.005	0.005	0.006	0.014	0.012	0.016
ED	0.000	0.000	0.001	0.001	0.000	0.001	0.001	0.000	0.003
unknown	0.003	0.003	0.003	0.003	0.003	0.004	0.012	0.009	0.016
2012									
not ED	0.007	0.007	0.007	0.005	0.005	0.005	0.012	0.010	0.014
ED	0.001	0.000	0.001	0.000	0.000	0.001	0.001	0.000	0.002
unknown	0.003	0.003	0.003	0.003	0.002	0.004	0.014	0.010	0.017
2013									
not ED	0.007	0.007	0.007	0.004	0.003	0.004	0.009	0.008	0.011
ED	0.000	0.000	0.001	0.001	0.000	0.001	0.000	0.000	0.001
unknown	0.003	0.003	0.003	0.002	0.002	0.003	0.007	0.005	0.010
2014									
not ED	0.007	0.006	0.007	0.004	0.004	0.005	0.008	0.007	0.010
ED	0.000	0.000	0.001	0.000	0.000	0.001	0.001	0.000	0.002
unknown	0.003	0.002	0.003	0.002	0.002	0.002	0.007	0.004	0.009
2015									
not ED	0.005	0.004	0.005	0.004	0.004	0.004	0.008	0.007	0.010
ED	0.000	0.000	0.001	0.000	0.000	0.001	0.001	0.000	0.001
unknown	0.002	0.002	0.002	0.002	0.002	0.003	0.004	0.002	0.006

Figure A2-f: Probability of progression to long-term use

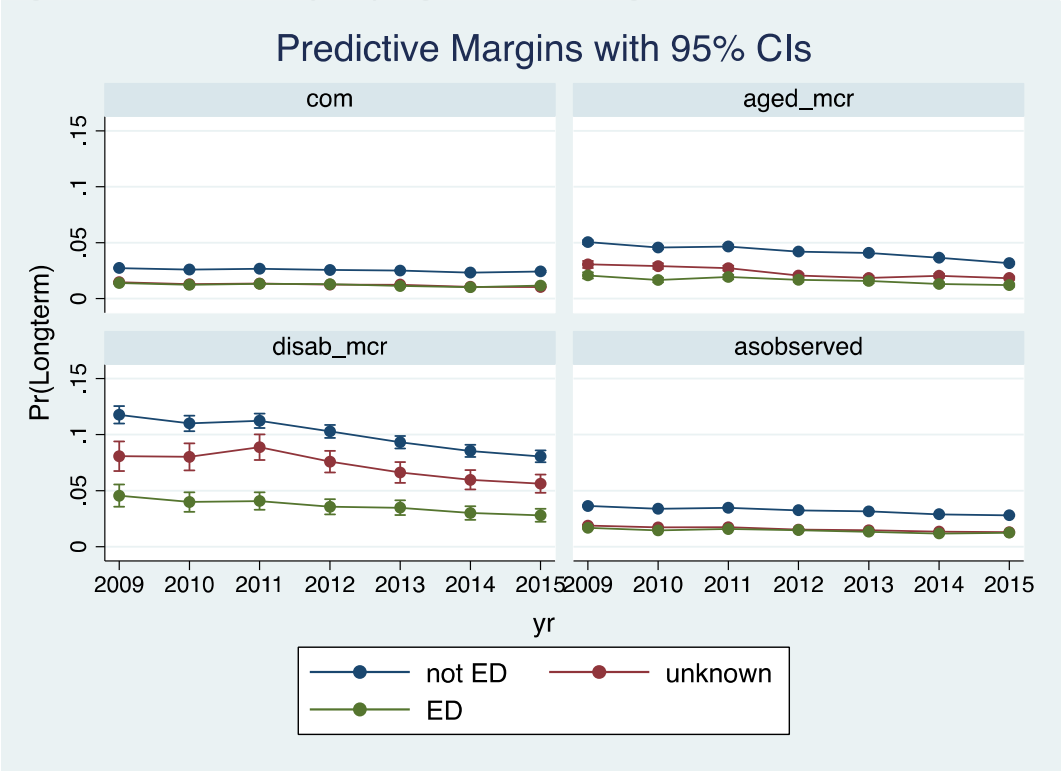


Table A11: Probability of progression to long-term opioid use, with 95% confidence intervals (CI)

	Commercial			Aged Medicare			Disabled Medicare		
	Pr(longterm)	Lower CI	Upper CI	Pr(long term)	Lower CI	Upper CI	Pr(longterm)	Lower CI	Upper CI
2009									
not ED	0.027	0.027	0.028	0.050	0.048	0.052	0.118	0.110	0.126
ED	0.014	0.013	0.015	0.021	0.018	0.023	0.045	0.036	0.055
unknown	0.015	0.014	0.015	0.031	0.027	0.034	0.081	0.067	0.094
2010									
not ED	0.026	0.025	0.026	0.046	0.044	0.047	0.110	0.103	0.117
ED	0.012	0.011	0.013	0.017	0.014	0.019	0.040	0.031	0.048
unknown	0.013	0.012	0.014	0.029	0.026	0.032	0.080	0.068	0.092
2011									
not ED	0.027	0.026	0.027	0.047	0.045	0.048	0.112	0.106	0.119
ED	0.013	0.012	0.014	0.019	0.017	0.021	0.041	0.033	0.048
unknown	0.013	0.013	0.014	0.027	0.025	0.029	0.089	0.077	0.100
2012									
not ED	0.026	0.025	0.026	0.042	0.041	0.043	0.103	0.097	0.109
ED	0.013	0.012	0.014	0.017	0.015	0.019	0.036	0.029	0.042
unknown	0.012	0.012	0.013	0.021	0.019	0.022	0.076	0.066	0.086
2013									
not ED	0.025	0.024	0.026	0.041	0.039	0.042	0.093	0.088	0.099
ED	0.011	0.010	0.012	0.016	0.014	0.018	0.035	0.028	0.041
unknown	0.012	0.012	0.013	0.018	0.017	0.020	0.066	0.057	0.075
2014									
not ED	0.023	0.023	0.024	0.037	0.035	0.038	0.085	0.080	0.091
ED	0.010	0.009	0.011	0.013	0.011	0.015	0.030	0.024	0.036
unknown	0.011	0.010	0.011	0.020	0.019	0.022	0.060	0.051	0.068
2015									
not ED	0.024	0.023	0.025	0.032	0.031	0.033	0.081	0.075	0.086
ED	0.012	0.011	0.013	0.012	0.011	0.013	0.028	0.022	0.034
unknown	0.010	0.010	0.011	0.018	0.017	0.020	0.056	0.048	0.064

Appendix 10b: Supplementary analyses—Comparison of results when limiting analysis to beneficiaries with at least 1 year of follow-up

Analyses of prescription guideline concordance by treatment setting included all qualifying prescriptions, regardless of the amount of follow-up time available for the beneficiary. Analysis of the risk of progression to long-term use was limited to those with at least one year of follow-up, as required by the definition of long-term use (120+days or 10+ fills over 12 months). To determine whether the results of the guideline concordance analyses were affected by the difference in the population included, we repeated all guideline concordance analyses, limiting them to people with at least one year of follow-up.
We present the results as forest plots—one for each beneficiary population (Commercial, aged Medicare, disabled Medicare). The risk ratios comparing the non-ED setting to the ED setting and the unknown setting are presented for each of the guideline concordance outcomes. The 1-year follow-up population is presented in red, while the population not limited by follow-up time is presented in blue. There were no statistically significant differences across the two populations.

Figure A3: Comparison of main results using population with 1 year of follow-up to those with any length of follow-up; commercial beneficiaries

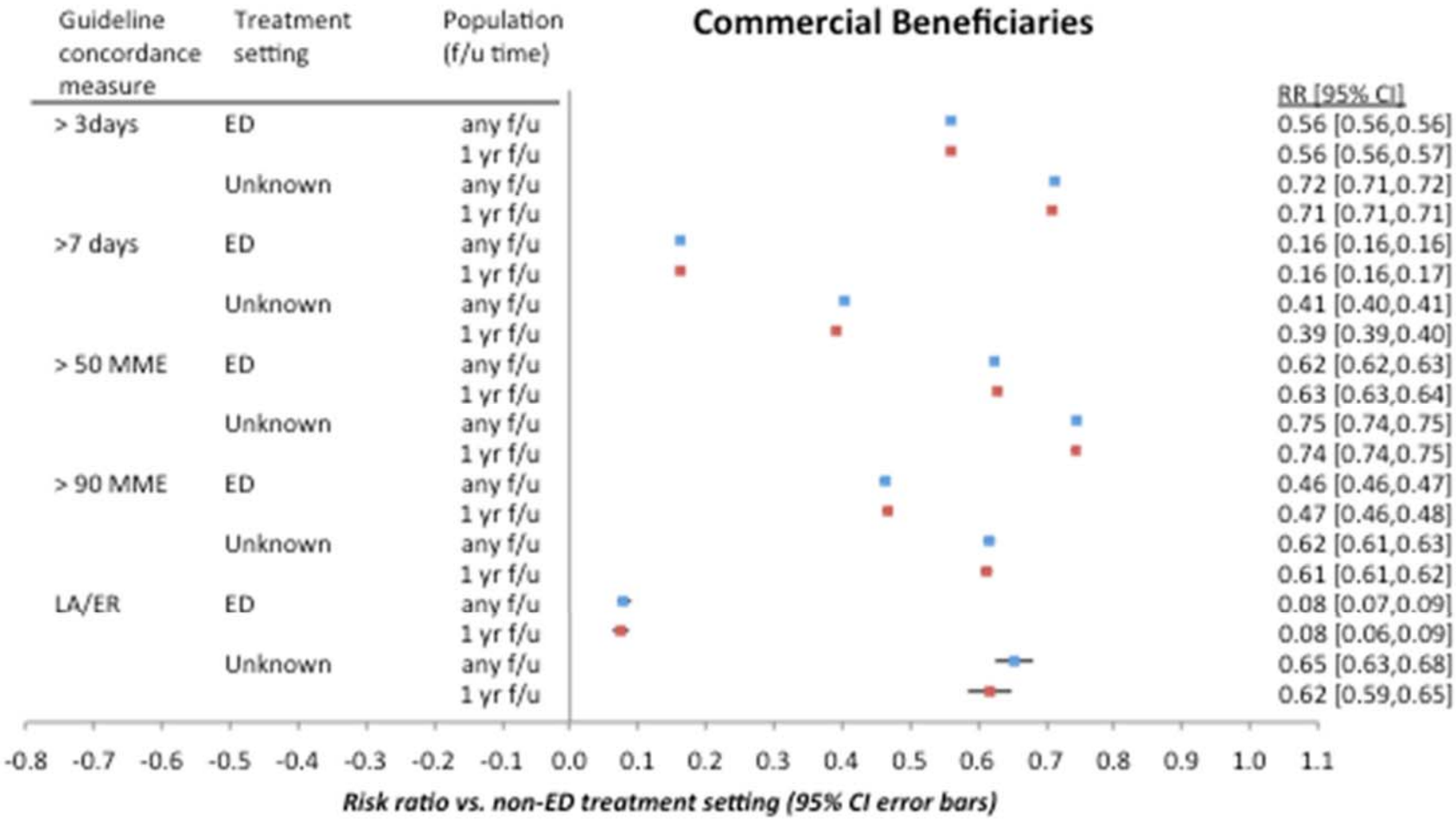


Figure A4: Comparison of main results using population with 1 year of follow-up to those with any length of follow-up; aged Medicare beneficiaries

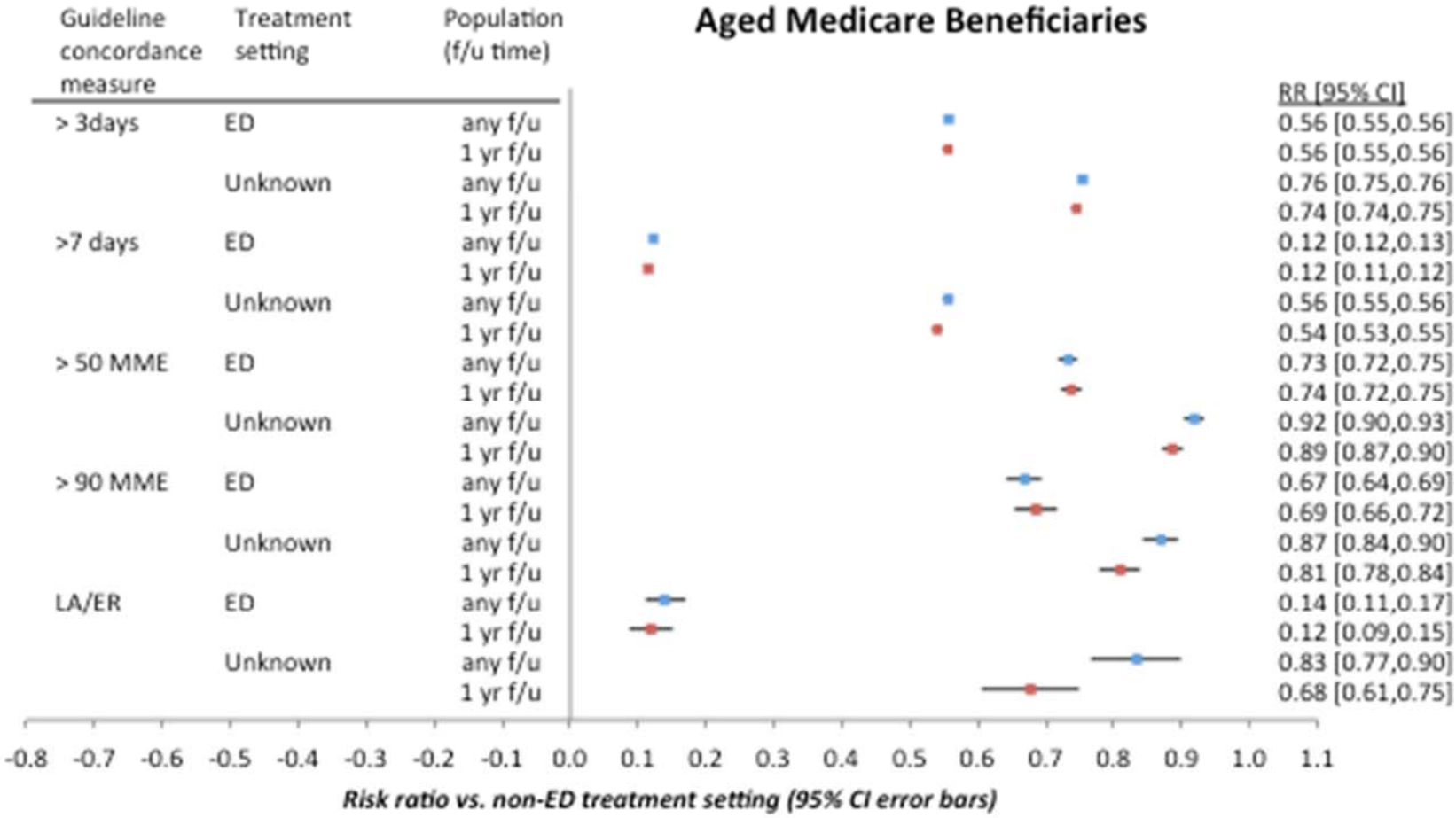
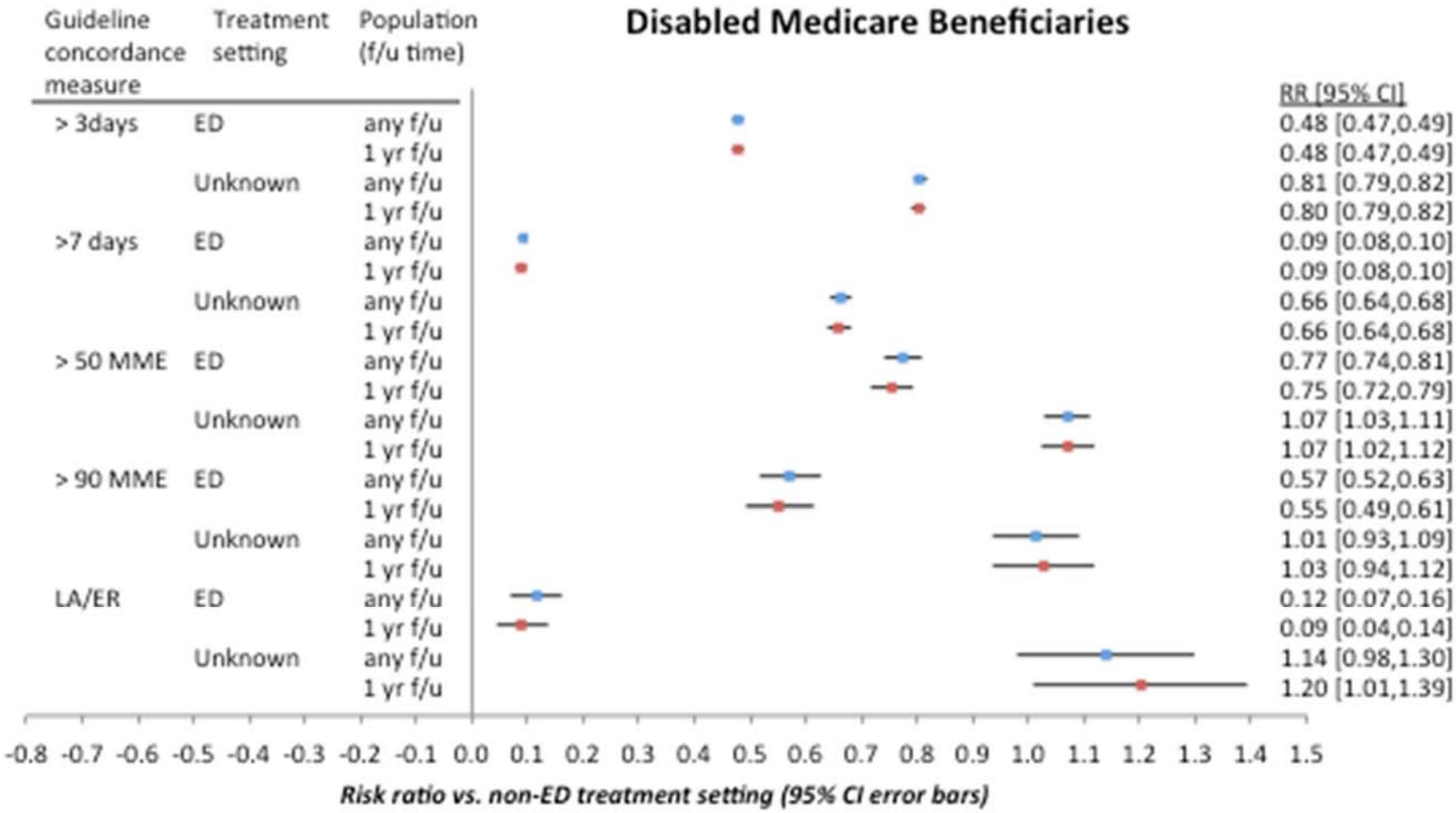


Figure A5: Comparison of main results using population with 1 year of follow-up to those with any length of follow-up; disabled Medicare beneficiaries



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