

Appendix 1. Mean annual total out-of-pocket (OOP) costs and prevalence of high OOP burden for Medicare beneficiaries with diabetes, by income level and race/ethnicity, 1999–2017*

Year	Overall		By Income Level [†]								By Race/Ethnicity					
			< 25%		25-50%		50-75%		75%		White, non-Hispanic		Black, non-Hispanic		Others [‡]	
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Total OOP costs (\$)§																
1999	3,609	114	2,989	290	3,840	202	3,686	159	4,409	227	3,885	131	2,968	330	2,264	346
2000	3,787	124	3,146	255	4,267	190	4,626	254	5,366	446	4,490	235	3,348	261	2,449	274
2001	4,004	101	3,064	208	4,069	195	4,518	175	5,459	314	4,280	139	2,999	231	3,575	712
2002	4,332	120	3,101	164	4,365	158	5,107	300	5,485	278	4,598	140	3,199	300	3,258	492
2003	4,567	132	3,169	250	5,112	303	5,209	243	5,489	345	4,911	191	4,003	528	2,323	305
2004	4,412	119	2,903	243	4,760	247	5,353	260	6,371	590	5,139	299	2,971	261	2,702	381
2005	4,777	146	3,512	264	4,960	262	5,198	265	6,269	410	5,184	150	3,265	329	3,744	999
2006	4,818	113	3,330	279	4,681	373	5,400	238	6,205	618	5,123	131	3,496	361	3,498	633
2007	4,746	162	2,852	220	5,293	490	5,425	318	5,586	243	5,117	200	3,069	235	3,231	871
2008	4,463	94	2,902	151	4,520	223	5,112	186	5,664	294	4,777	104	3,355	364	2,653	304
2009	4,623	119	3,202	232	4,421	235	5,234	187	6,085	371	4,962	120	3,528	481	2,666	238
2010	4,639	202	3,350	540	4,725	172	5,050	173	6,153	446	5,017	243	3,688	302	2,198	210
2011	4,866	142	2,806	160	5,069	201	5,971	226	6,394	488	5,217	168	4,079	293	2,361	228
2012	5,280	171	2,767	169	5,158	257	6,476	355	7,417	604	5,836	215	3,834	312	2,298	254
2013	4,848	187	2,570	160	4,716	246	6,223	546	6,214	342	5,333	216	3,263	340	2,858	225
2015	4,831	146	2,903	191	4,751	228	5,757	325	6,077	282	5,136	171	4,042	329	3,516	305
2016	4,593	162	2,521	157	4,791	333	5,425	336	5,919	343	4,921	194	3,962	529	3,107	392
2017	4,612	142	2,370	164	4,702	195	5,043	188	6,715	463	4,891	147	3,420	280	3,943	437
Percentage of beneficiaries with OOP burden > 10% of income																
1999	57%	1%	66%	2%	73%	2%	57%	3%	29%	3%	63%	2%	52%	4%	46%	6%
2000	58%	1%	67%	2%	76%	2%	63%	3%	31%	3%	64%	2%	57%	4%	53%	7%
2001	64%	1%	68%	3%	82%	2%	67%	3%	37%	3%	67%	2%	62%	4%	62%	6%
2002	68%	1%	67%	2%	84%	2%	70%	3%	40%	3%	71%	2%	57%	4%	53%	5%
2003	71%	1%	70%	2%	90%	1%	75%	2%	46%	3%	75%	1%	62%	4%	47%	5%
2004	69%	1%	66%	3%	88%	2%	79%	2%	41%	3%	73%	1%	60%	4%	55%	5%
2005	72%	1%	72%	2%	88%	2%	75%	3%	50%	4%	75%	1%	63%	4%	58%	6%
2006	68%	1%	65%	2%	87%	1%	80%	2%	41%	3%	72%	1%	61%	3%	58%	6%
2007	67%	1%	61%	2%	88%	2%	76%	2%	42%	3%	72%	1%	56%	4%	52%	5%

2008	69%	1%	67%	2%	86%	2%	75%	3%	47%	3%	73%	1%	53%	4%	58%	6%
2009	68%	1%	70%	2%	82%	2%	75%	2%	38%	3%	70%	1%	57%	4%	60%	5%
2010	67%	1%	66%	2%	88%	2%	70%	2%	37%	3%	69%	2%	62%	4%	54%	4%
2011	67%	1%	62%	2%	87%	2%	77%	2%	37%	3%	68%	1%	61%	4%	59%	5%
2012	65%	1%	60%	2%	82%	2%	72%	2%	37%	3%	67%	1%	59%	3%	46%	4%
2013	66%	1%	61%	2%	83%	2%	73%	2%	38%	3%	69%	1%	51%	3%	53%	5%
2015	64%	1%	73%	3%	80%	2%	66%	2%	30%	3%	65%	1%	64%	5%	54%	5%
2016	62%	2%	69%	3%	83%	2%	63%	4%	29%	5%	64%	2%	60%	5%	48%	6%
2017	58%	2%	61%	3%	83%	2%	54%	2%	25%	3%	60%	2%	51%	4%	47%	5%

Percentage of beneficiaries with OOP burden > 20% of income

1999	30%	1%	53%	2%	43%	3%	19%	2%	7%	2%	35%	2%	31%	3%	27%	5%
2000	32%	1%	50%	3%	50%	3%	28%	3%	9%	2%	38%	2%	35%	4%	38%	7%
2001	33%	1%	49%	3%	47%	3%	26%	3%	7%	2%	36%	2%	31%	3%	38%	6%
2002	38%	1%	51%	3%	52%	2%	29%	3%	8%	2%	39%	2%	37%	3%	33%	4%
2003	41%	1%	50%	3%	60%	3%	33%	2%	11%	2%	42%	2%	34%	3%	29%	5%
2004	39%	1%	48%	2%	56%	3%	31%	3%	12%	2%	41%	2%	28%	3%	31%	5%
2005	40%	1%	56%	3%	57%	3%	33%	4%	9%	2%	43%	2%	37%	4%	27%	4%
2006	39%	1%	50%	2%	61%	2%	37%	3%	10%	2%	43%	2%	31%	3%	31%	4%
2007	38%	1%	47%	2%	61%	2%	33%	2%	11%	2%	42%	1%	35%	4%	28%	5%
2008	35%	1%	48%	2%	53%	3%	30%	3%	9%	2%	39%	1%	27%	3%	31%	5%
2009	37%	1%	53%	2%	48%	3%	33%	2%	7%	1%	38%	1%	30%	4%	28%	5%
2010	35%	1%	48%	2%	49%	3%	26%	3%	10%	2%	37%	1%	30%	3%	26%	4%
2011	37%	1%	43%	2%	56%	3%	35%	2%	10%	2%	39%	1%	31%	3%	30%	5%
2012	37%	1%	41%	2%	51%	3%	35%	2%	14%	2%	38%	1%	31%	3%	27%	4%
2013	35%	1%	40%	2%	46%	3%	34%	2%	11%	2%	36%	1%	26%	3%	26%	4%
2015	33%	1%	48%	3%	47%	2%	25%	3%	5%	1%	34%	2%	30%	4%	25%	3%
2016	32%	2%	46%	4%	44%	3%	27%	4%	6%	1%	32%	2%	34%	5%	25%	7%
2017	29%	2%	41%	4%	45%	3%	20%	3%	4%	1%	29%	2%	28%	5%	26%	5%

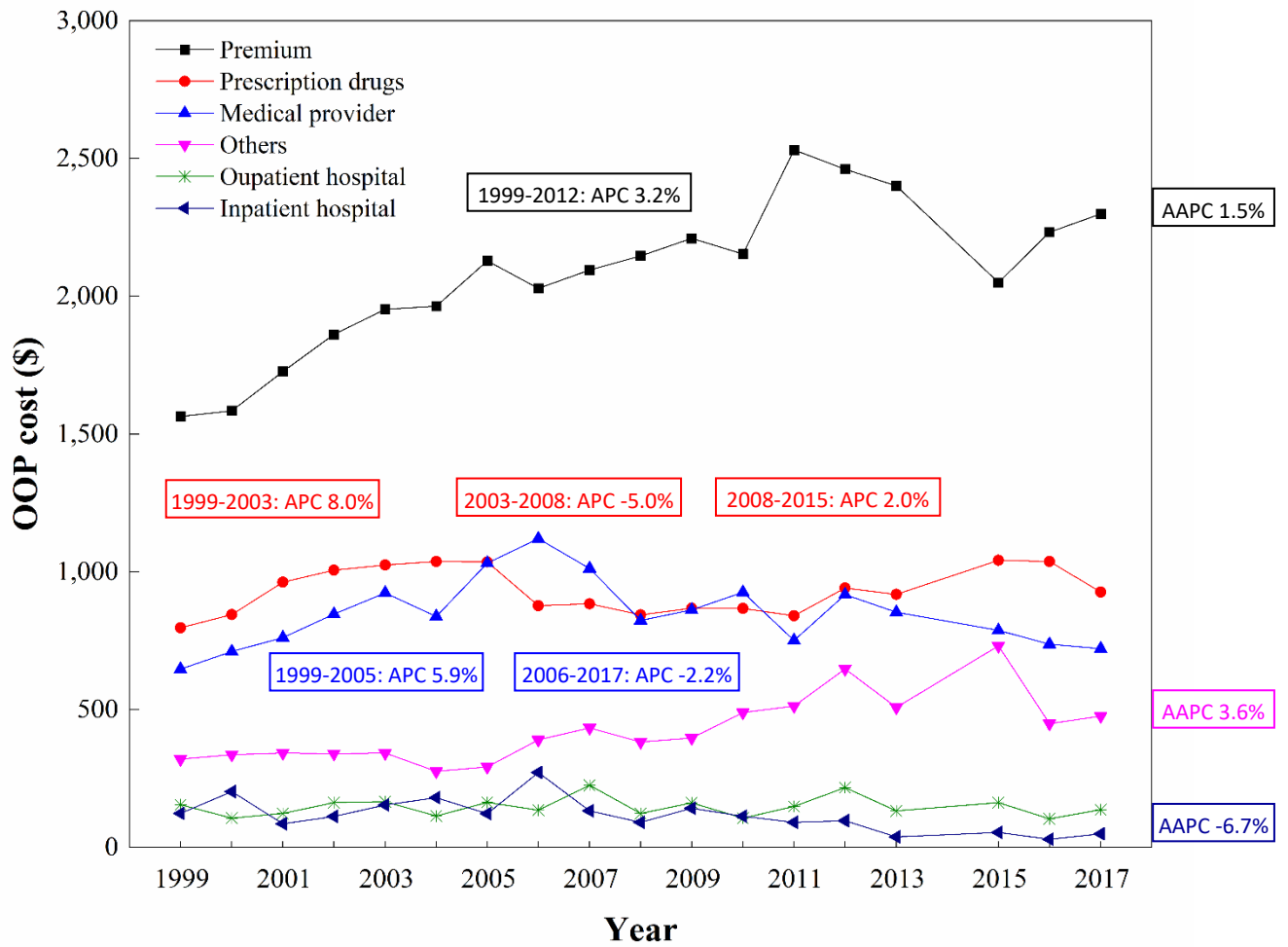
*OOP costs included coinsurance, copayment, deductible, and health insurance premiums. Population weights were adjusted for all estimates. †Income category was based on individual income quartile. ‡Others included Hispanics, non-Hispanic Asians, American Indians, and other defined races. §All costs were adjusted to 2017 dollars using the Consumer Price Index.

Appendix 2. Trends in mean annual total out-of-pocket (OOP) costs and the prevalence of high OOP burden (>10% and >20% of pretax income) among Medicare beneficiaries, by income level and race/ethnicity, 1999–2017*

	Trend 1		Trend 2		Trend 3		Trend 4		Average APC
	Years	APC	Years	APC	Years	APC	Years	APC	AAPC
OOP costs (\$)†									
All	1999-2005	4.89[‡]	2005-2008	-2.6	2008-2012	3.2	2012-2017	-2.11	1.27
By Income Level									
< 25%	#	-	-	-	-	-	-	-	-1.32[§]
25-<50%	1999-2003	5.51[‡]	2003-2017	0.04	-	-	-	-	1.23[§]
50-<75%	1999-2002	11.50[§]	2002-2010	-0.02	2010-2013	9.66	2013-2017	-7.61[‡]	1.60
≥75%	-	-	-	-	-	-	-	-	1.38[§]
By Race/Ethnicity									
White, non-Hispanic	1999-2005	4.91	2005-2008	-3.30	2008-2012	3.88[‡]	2012-2017	-2.70[‡]	1.13
Black, non-Hispanic	-	-	-	-	-	-	-	-	1.26[§]
Others [¶]	1999-2012	-0.75	2012-2017	9.69[‡]	-	-	-	-	2.05
Percentage of beneficiaries with high OOP burden >10% of pretax individual income									
All	1999-2003	5.91[§]	2003-2017	-0.98[§]	-	-	-	-	0.51
By Income Level									
< 25%	-	-	-	-	-	-	-	-	-0.21
25-50%	1999-2003	5.32[§]	2003-2017	-0.67[§]	-	-	-	-	0.63[‡]
50-75%	1999-2004	6.11[§]	2004-2015	-1.18[‡]	2015-2017	-0.44	-	-	-0.44
>75%	1999-2005	7.98[§]	2005-2017	-4.34[§]	-	-	-	-	-0.40
By Race/Ethnicity									
White, non-Hispanic	1999-2003	5.05[§]	2003-2017	-1.21[§]	-	-	-	-	0.15
Black, non-Hispanic	-	-	-	-	-	-	-	-	-0.13
Others ^d	-	-	-	-	-	-	-	-	-0.38
Percentage of beneficiaries with high OOP burden >20% of pretax individual income									
All	1999-2003	8.20[§]	2003-2017	-1.63[§]	-	-	-	-	0.06
By Income Level									
< 25%	-	-	-	-	-	-	-	-	-1.07[‡]
25-50%	1999-2005	4.97[‡]	2005-2017	-2.70[§]	-	-	-	-	-0.21
50-75%	1999-2005	11.87	2005-2013	0.20	2013-2017	-11.02	-	-	0.01
>75%	1999-2012	2.85	2012-2017	-18.65[‡]	-	-	-	-	-3.63
By Race/Ethnicity									
White, non-Hispanic	1999-2006	2.30[§]	2006-2009	-5.34	2009-2012	0.92	2012-2017	-4.89[§]	-1.00
Black, non-Hispanic	-	-	-	-	-	-	-	-	-1.89
Others ^d	-	-	-	-	-	-	-	-	-1.63[§]

*Total OOP costs included coinsurance, copayment, deductible, and health insurance premiums. Population weights were adjusted for all estimates. †All costs were adjusted to 2017 dollars using the Consumer Price Index. ‡Significant at $P < 0.05$. §Significant at $P < 0.01$. ||Income category was based on individual income quartile. ¶Others included Hispanics, non-Hispanic Asians, American Indians, and other defined races. #No joinpoints were identified

Appendix 3. Trends in mean annual total out-of-pocket (OOP) costs by premium and service type for Medicare beneficiaries with diabetes, 1999-2017



All APCs and AAPCs were significant at $P < 0.05$. Others included dental, facility, home health, hospice, and institutional services. APC, annual percent change; AAPC, average annual percent change

Appendix 4. Full regression results of generalized linear model and logistic regression model, using pooled data from 2012-2017 MCBS.

	Out-of-pocket costs		High OOP burden >10%			High OOP burden >20%		
	β	SE	OR	95% CI		OR	95% CI	
Diabetes (ref: no diabetes)	0.10	0.02	1.32	1.21	1.44	1.25	1.15	1.35
Age (ref: 65-69)								
70-74	0.16	0.02	1.52	1.38	1.68	1.44	1.25	1.65
75-79	0.24	0.02	1.73	1.57	1.91	1.64	1.43	1.88
80-84	0.33	0.02	2.01	1.81	2.23	1.98	1.74	2.25
85+	0.56	0.02	2.47	2.24	2.73	2.82	2.49	3.18
Sex (ref: female)								
Male	-0.09	0.02	0.78	0.73	0.84	0.79	0.73	0.85
Education (ref: < High school)								
High school graduate	0.17	0.02	1.45	1.32	1.61	1.42	1.28	1.59
Some college	0.29	0.02	1.55	1.40	1.71	1.62	1.46	1.80
Income level (ref: <25% quartile)								
25-50%	0.38	0.03	1.17	1.06	1.29	0.59	0.53	0.65
50-75%	0.54	0.03	0.38	0.34	0.42	0.18	0.17	0.21
>75%	0.64	0.03	0.08	0.07	0.09	0.04	0.03	0.05
Race/Ethnicity (ref: White, non-Hispanic)								
Black, non-Hispanic	-0.28	0.03	0.59	0.52	0.67	0.56	0.49	0.63
Hispanic	-0.59	0.08	0.34	0.27	0.42	0.33	0.26	0.41
Other, non-Hispanic	-0.24	0.04	0.53	0.44	0.64	0.49	0.40	0.62
# of chronic conditions (ref: 0-2)								
3-4	0.08	0.02	1.27	1.17	1.39	1.24	1.11	1.38
5+	0.21	0.02	1.69	1.55	1.84	1.64	1.48	1.82
constant	7.53	0.03	0.80	0.70	0.91	0.31	0.26	0.36

Using a pooled data from 2012-2017 Medicare Current Beneficiary Survey, out-of-pocket costs were estimated using a generalized linear model with gamma distribution and log link, and the prevalence of high OOP burden were estimated using a multivariable logistic regression. All models were adjusted for age, sex, education, income level, race/ethnicity, and number of chronic conditions. All estimates were statistically significant at α level of .05. OOP, out-of-pocket; OR, odds ratio

Appendix 5. Characteristics of Medicare beneficiaries with diabetes in the study, 1999-2017

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2015	2016	2017
Sample size (n)	1,717	1,780	1,835	1,890	1,932	1,602	1,565	1,665	1,766	1,831	1,691	1,674	1,660	1,852	1,886	1,787	1,284	1,453
Population size (N)	5,455,116	5,911,449	6,286,414	6,600,989	6,844,302	5,968,210	5,886,744	6,439,169	6,915,789	7,400,701	7,493,990	7,727,811	7,916,144	8,778,319	9,432,068	10,556,430	8,985,186	10,129,541
Age (mean)	75	74	75	74	74	74	74	74	74	74	75	74	74	74	74	74	74	74
Age group (%)																		
65-69	25	27	27	29	29	29	29	29	31	30	30	33	31	32	31	32	33	34
70-74	29	27	26	26	27	26	26	26	26	25	26	24	27	26	27	27	27	27
75-79	23	24	24	22	22	22	22	21	20	21	20	19	20	20	20	18	18	18
80-84	14	13	14	14	14	15	15	16	14	14	14	13	12	13	13	13	12	12
85+	9	8	9	8	9	8	9	8	9	9	11	10	9	10	10	11	9	9
Male (%)	46	45	44	44	45	45	46	46	48	49	51	50	50	49	50	50	50	49
Race (%)																		
White, no Hispanic	80	81	80	80	81	80	81	81	81	81	81	80	80	78	78	76	75	76
Black, no Hispanic	14	14	13	13	13	13	13	13	12	12	12	13	13	13	13	14	14	12
Others	6	5	6	7	6	7	6	6	6	7	7	8	7	9	9	10	11	11
Education (%)																		
< High school	42	42	41	39	37	36	34	34	31	30	29	30	30	29	27	22	20	19
High school graduate	27	27	28	28	30	29	29	29	31	31	32	29	27	26	27	29	28	27
> High school	30	30	32	33	33	35	37	37	38	39	39	41	44	45	47	49	52	54
Income (mean, \$)	29,434	28,871	28,384	29,342	27,750	28,642	28,411	27,510	26,456	27,692	26,136	27,608	27,295	27,982	27,996	32,591	34,324	35,765
Income by quartile (mean, \$)																		
< 25%	9,234	9,389	9,577	9,370	9,373	9,299	9,327	9,115	9,238	9,939	9,304	10,442	10,031	9,924	9,668	9,519	9,766	10,366
25-50%	17,156	17,257	17,439	17,671	17,493	17,238	17,405	17,033	17,373	18,595	17,590	19,033	18,293	18,448	18,207	18,521	19,580	21,195
50-75%	28,118	27,624	27,747	27,918	27,800	26,994	27,875	27,582	28,126	29,058	28,854	29,812	29,215	30,307	30,174	32,582	34,400	38,256
> 75%	68,995	65,787	63,917	67,313	60,467	62,591	61,823	65,319	60,396	61,110	64,209	67,479	64,149	67,286	65,759	82,596	87,456	90,230
Area of residence (%)																		
Metro	75	76	78	78	77	77	76	77	76	75	77	76	77	77	77	77	77	77
Non-metro	25	24	22	22	23	23	24	23	24	25	23	24	23	23	23	23	23	23
Chronic conditions (%)																		
0-2	35	34	32	33	27	25	23	24	25	22	11	11	11	11	9	10	12	12
3-4	55	56	57	56	59	60	56	53	52	52	42	42	42	42	42	44	44	44
≥5	10	10	11	11	15	15	21	23	24	26	47	47	47	47	48	46	44	44
Married (%)	54	55	53	54	54	56	55	54	55	55	55	56	56	55	54	54	56	55
Medicare coverage (%)																		
Part A/B only	84	83	82	81	81	80	80	43	40	39	37	36	32	27	23	18	17	19
Part A/B with Part D	-	-	-	-	-	-	-	37	41	43	45	45	47	51	56	54	59	59
Dual eligible (Medicaid)	16	17	18	19	19	20	20	20	19	18	19	19	21	21	21	28	24	22
Supplemental coverage (%)																		
Medicaid	14	15	16	16	17	18	18	18	17	16	17	18	19	19	19	22	19	18
Private, ESI	34	34	36	37	38	38	38	38	37	36	36	35	32	30	27	26	22	26
Private, Individually	25	25	25	24	23	23	23	21	21	20	18	18	17	19	18	24	29	26
Others	22	21	18	17	16	16	16	17	19	22	24	24	25	26	30	20	21	21
No coverage	5	5	4	6	6	5	5	5	6	6	5	5	7	7	6	8	8	8

Medicare and supplemental health insurance were measured using a combination of administrative enrollment indicators (Medicare and Medicaid), supplemented by self-reported enrollment in up to five private plans. Medicare coverage was categorized as Part A or Part B only, Part A or Part B with Part D, and both Medicare and Medicaid (i.e., dual eligible beneficiaries). For supplemental coverage, we generated mutually exclusive categories: 1) Medicaid; 2) employer-sponsored insurance (ESI); 3) other private insurance enrolled individually; 4) any other health insurance; and 5) having no health insurance. ESI, employer-sponsored insurance