Supplemental material

BMJ Publishing Group Limited (BMJ) disclaims all liability and responsibility arising from any reliance placed on this supplemental material which has been supplied by the author(s)

BMJ Open

Supplementary Appendix

A -- Additional Trend Figures

Figure S1 supplement the trends showcased in Figure 1 (within the main text) by reporting charges and expenditure (per capita) mean trends for office-based visits (Figure S1A), emergency room visits (Figure S1B), outpatient department visits (Figure S1C), and hospital inpatient stays (Figure S1D). A clear trend across all of these figures is the steady increase in charges.

Figure S1: Trends in Inflation Adjusted ($2017) Charges and Expenditures by Type of Health Care Services, 2002 – 2017.

Supplemental material

BMJ Publishing Group Limited (BMJ) disclaims all liability and responsibility arising from any reliance placed on this supplemental material which has been supplied by the author(s)
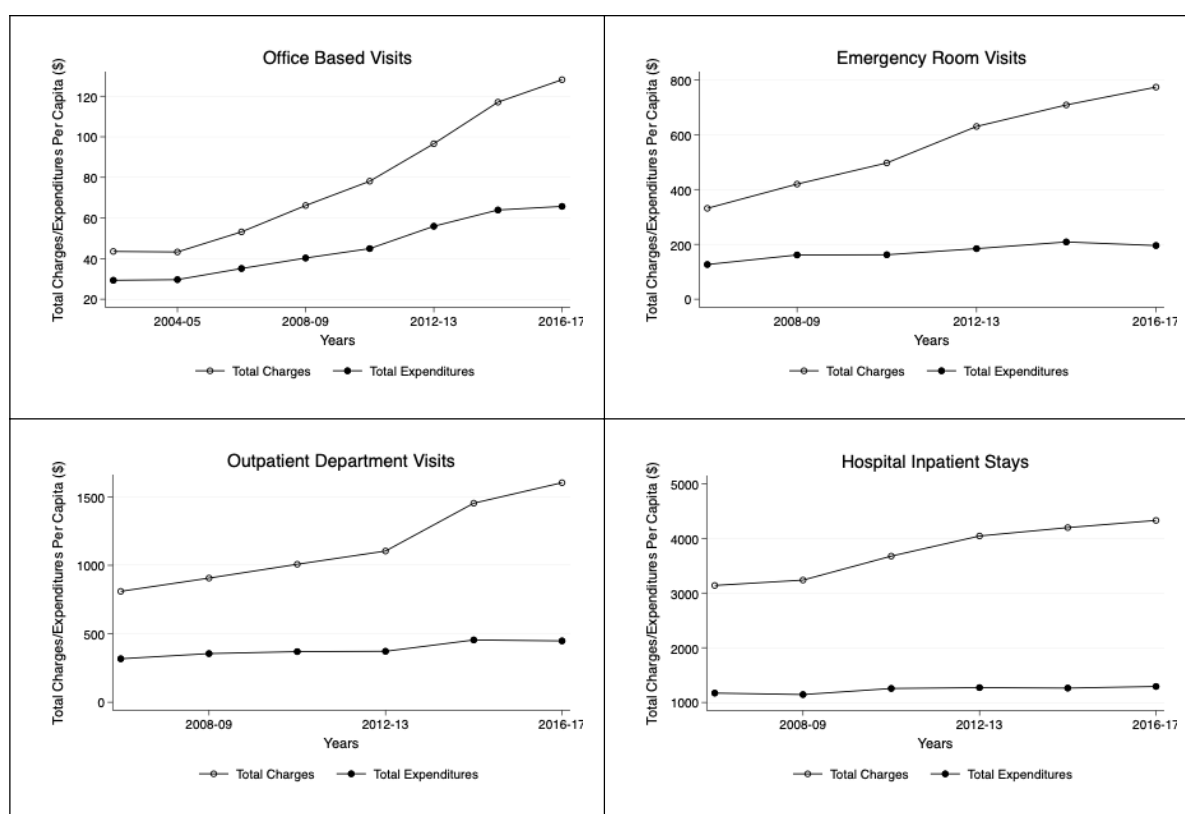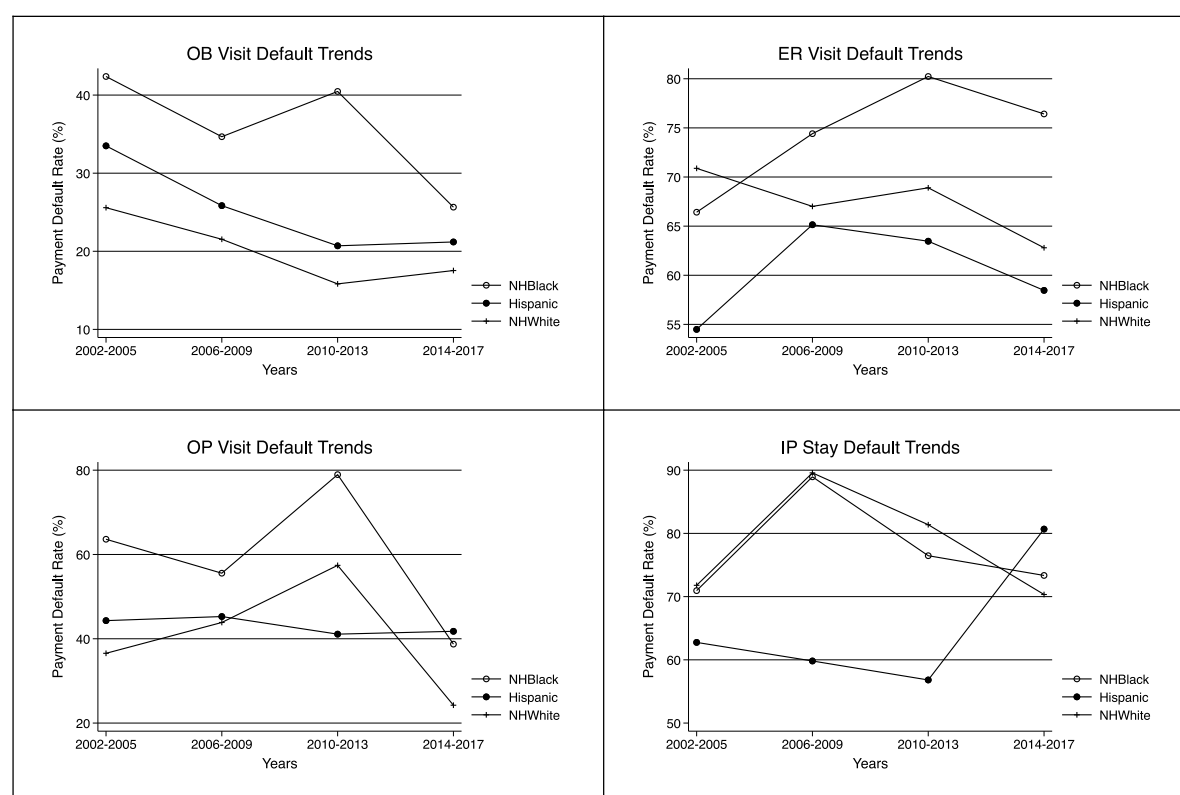
BMJ Open

Figure 2S supplements the results within Table 2 (within the main text) by presenting the payment default rates across race/ethnicity. These trends are reported across office-based visits (Figure S2A), emergency room visits (Figure S2B), outpatient department visits (Figure S2C), and hospital inpatient stays (Figure S2D). A clear trend across Figures S2A, S2B and S2C is the elevated default rates among NHB patients.

Figure S2: Trends in Uninsured Patient Payment Default Rates Across Race/Ethnicity and Across the Type of Health Care Services, 2002 – 2017.

Supplemental material

BMJ Publishing Group Limited (BMJ) disclaims all liability and responsibility arising from any reliance placed on this supplemental material which has been supplied by the author(s)

BMJ Open

B – Additional Details on Sample Selection

Table S1 contains additional details on the sample inclusion restrictions imposed on each of the samples (across office based, ER, outpatient and inpatient events). The numbers reported within each column correspond to the observation drop counts.

Table S1: Sample inclusion restrictions and observation drop count for each set of restrictions.

Inclusion Restrictions:	Observation Drop Count			
	OB Visits	ER Visits	OP Visits	IP Stays
Individuals that are uninsured and aged 18 to 65	2,667,717	521,086	646,690	501,182
Drop if event has missing charge/pay information	45,265	62,293	67,213	68,407
Remove those listing payment source as other than self-paying	58,125	6,833	6,822	2,367
Remove events coded as free, or which are likely to be free (follow-up; post-operative visits); and pre-paid events (if applicable).	8,601	169	392	35
Drop likely entry error: charge < payment	132	3	4	1
Drop if event coded as partial payment, but consolidated file implies full payment.	13	0	2	0
Drop if race/ethnicity other than Non-Hispanic Black, Hispanic or Non-Hispanic white	2,519	133	143	9
Drop if missing values for any of the covariates	6,717	398	192	60
Final Sample	**39,711**	**3,244**	**1,702**	**336**

C – Robustness Checks

C1 – Generalized Linear Model Estimates

Table S2 provides a robustness check for results reported within Table 2 (of the main text) using a Generalized Linear Model (log-link with gamma distribution). The results within Table S2 are the marginal effects of the Charge ($100) independent variable, and these are seen to be qualitatively similar to the main results (within Table 2), providing some support for the robustness of these findings.

Table S2: Generalized Linear Model (log-link with gamma distribution) Estimates for Total Payments Among Uninsured US Adults 2002-2017.

Sample:	OB Visits	ER Visits	OP Visits	IP Stays
	(1) Total Payment	(2) Total Payment	(3) Total Payment	(4) Total Payment
Charge ($100s)	10.90*** (0.91)	2.66*** (0.50)	3.63*** (0.63)	0.24** (0.10)
Observations	39,711	3,244	1,702	336
Controls Included	YES	YES	YES	Partial
Year FEs	YES	YES	YES	YES
Region FEs	YES	YES	YES	YES

Note: Standard errors are reported within parentheses. Significance is denoted as: *** $p<0.01$, ** $p<0.05$, * $p<0.1$. Control variables included for the OB, ER, OP samples: race/ethnicity, predisposing factors, enabling factors, need factors and the visit contextual factors from Table 1. A more limited (partial) set of controls were used for the IP stays sample in order to ensure the model estimation converged. The IP stays controls are: race/ethnicity and the visit contextual factors from Table 1. Associations are given by the marginal effect estimates when other controls are evaluated at their means. Reported estimates are based on using the MEPS sample weights, but the observation counts are based on actual (unweighted) observation counts.

Supplemental material

BMJ Publishing Group Limited (BMJ) disclaims all liability and responsibility arising from any reliance placed on this supplemental material which has been supplied by the author(s)

BMJ Open

C2 – Joining Office Based and Outpatient Visits

One may be concerned with the separation of office based and outpatient visits as MEPS survey participants may have trouble distinguishing between office based and outpatient visit events. To this end, we here provide a robustness check to see whether our results are dependent upon this visit categorization. This is done by pooling together office based and outpatient visit events and performing the estimation as outlined across Tables 3 – 4 within the main text. The results from this exercise are reported within Table S3. Here we again note qualitatively similar results to those of Tables 3 and 4 of the main text.

Table S3: Estimates Based on Pooling of Office Based and Outpatient Visits.

Specification:	Table 3 Linear Regression	Table 4 Logit
	(1) Total Payment	(2) Pr(Default)
Charged Amount		
Charge ($100s)	10.90***	1.04***
	(0.91)	(0.00)
Race/Ethnicity		
NHB		2.24***
		(0.33)
Hispanic		1.48***
		(0.21)
Observations	41,587	41,587
Controls Included	YES	YES
Year FEs	YES	YES
Region FEs	YES	YES

Note: Standard errors are reported within parentheses. Significance is denoted as: *** $p<0.01$, ** $p<0.05$, * $p<0.1$. Control variables included are: race/ethnicity, predisposing factors, enabling factors, need factors and the visit contextual factors from Table 1. Reported estimates are based on using the MEPS sample weights, but the observation counts are based on actual (unweighted) observation counts.

C3 – Partial Payments Analysis

To better understand the potential payment decisions by individuals, and how they may vary across different medical events, Table S4 provides details on: (i) the average percentage payment (of total charge) across office based, outpatient, ER and inpatient events. We also provide percentages of medical events with: (i) partial payment; (ii) default; and (iii) full payment. Table S4 indicates that as we move from lower charge events (office based) to higher charge events (ER, inpatient), the percentage of reimbursement decreases. From examination of the individual (event specific) payment decisions/outcomes, we see that this appears to reflect the following dynamics: as charges increase, we see that (1) more people negotiate bills (or in other ways attain discounts off of charges); (2) more people choose to default on payment all together; and (3) fewer individuals are able to pay in full.

Table S4: Payment Decisions/Outcomes by Medical Event.

Sample:	OB Visits	ER Visits	OP Visits	IP Stays
	(1)	(2)	(3)	(4)
Percent Payment (of total charge)	70.7%	17.5%	37.0%	10.9%
	(1.2)	(0.7)	(2.4)	(0.8)
Partial Payment Rate (%)	12.8%	24.1%	31.8%	20.5%
	(0.8)	(1.1)	(4.5)	(1.4)
Default Rate (%)	22.9%	68.5%	43.5%	75.5%
	(1.1)	(1.2)	(3.7)	(1.6)
Payment in Full Rate (%)	64.2%	7.5%	24.7%	4.0%
	(1.3)	(0.5)	(2.2)	(0.4)
Observations	39,711	3,244	1,702	336

Note: Standard errors are reported within parentheses. Reported mean estimates are based on using the MEPS sample weights, but the observation counts are based on actual (unweighted) observation counts.

Supplemental material

BMJ Publishing Group Limited (BMJ) disclaims all liability and responsibility arising from any reliance placed on this supplemental material which has been supplied by the author(s)

BMJ Open

C4 – Inpatient Logit Results for Smaller Charge Events

Within Table 4 of the main text we find no significant association between the amount charged and the individual's probability of default. We note that our small sample size for these types of events is a potential problem, however, another might pertain to the level differences across the various medical events. That is, given that inpatient stays tend to be very expensive, small changes in charging for large bills may not cause a notable behavioral response as defaulting patients may be unable to pay in either scenario. However, with that noted, patients may still be responsive to charges at lower levels of inpatient billing. To explore this possibility, we impose three sets of charge cutoffs, which yields three samples: (i) events with charges < 30,000; (ii) events with charges < 20,000; and (iii) events with charges < 10,000. Logit estimation results (in terms of odds ratios) for each of these inpatient event samples are reported within Table S5. Here we note that at lower charge levels the association is significant ($p<0.01$), with an increasing marginal effect estimate noted with more moderate charges.

Table S5: Logit (Odds Ratio) Regression Estimates for Inpatient Payment Defaults for Smaller Charge Events Among Uninsured US Adults 2002-2017.

Sample:	IP Stays Charge < 30,000	IP Stays Charge < 20,000	IP Stays Charge < 10,000
	(2) Pr(Default)	(3) Pr(Default)	(4) Pr(Default)
Charge ($100s)	1.006*** (0.002)	1.011*** (0.003)	1.012*** (0.002)
Observations	268	250	184
Controls Included	YES	YES	YES
Year FEs	YES	YES	YES
Region FEs	YES	YES	YES
Reason for Visit FEs	YES	YES	YES

Note: Odds Ratios are reported. Standard errors are reported within

parentheses. Significance is denoted as: *** p<0.01, ** p<0.05, * p<0.1. Control variables included were: race/ethnicity, predisposing factors, enabling factors, need factors and the visit contextual factors from Table 1. Reported estimates are based on using the MEPS sample weights, but the observation counts are based on actual (unweighted) observation counts.

C5 – Correlation between default measure and patient reporting difficulty paying medical bills.

For a limited number of years (2014 through 2017) the consolidated datafiles contain

individual responses to questions pertaining to their difficulty of paying medical bills. We

combine this data with each of our samples across office-based visits, ER visits,

outpatient visits, and inpatient stays, in order to explore whether individual reporting of

payment difficulties correlate with our default measure.

It should be noted that responses pertaining to payment hardship is only

recorded for a limited subset of individuals (as such, we report observation counts

below each correlation measure), and this issue is most prominent for our inpatient stay

sample where we only have sufficient observations for the second (Family having

trouble paying medical bills) variable. With this noted, the results within Table S6

indicate broad qualitative support for there existing a positive association between our

default measure and individuals expressing payment hardship.

Table S6: Pairwise correlations between default decision and patients reporting (i) being unable to pay family medical bills and (ii) family having trouble paying medical bills.

Sample:	OB Visits	ER Visits	OP Visits	IP Stays
Unable to pay family medical bills	0.14***	0.40***	0.65***	-
Number of observations	1965	287	167	-
Family having trouble paying medical bills	0.22***	0.22***	0.09*	0.4**
Number of observations:	7087	515	408	36

Note: Significance is denoted as: *** p<0.01, ** p<0.05, * p<0.1. Reported estimates are based on using the MEPS sample weights, but the observation counts are based on actual (unweighted) observation counts.

C6 – Systematic Adding of Controls for Office Based Visit Sample

Table S7 provides the results from successive addition of health care utilization factors pertaining to: (i) predisposing factors; (ii) enabling factors; (iii) need factors; and (iv) visit contextual factors; for office-based visits (the medical event type with the largest sample within our analyses). It should be noted that all specifications adjust for year, region and visit type fixed effects. At large, we note that Race/ethnicity estimates appear to be overstated in specification (1) compared to that in (2) through (4).

Table S7: Office Based Visits -- Logit (Odds Ratio) Regression Estimates for Payment Defaults by Race/Ethnicity Among Uninsured US Adults 2002-2017.

Sample: Office Based Visits	(1) Pr(Default)	(2) Pr(Default)	(3) Pr(Default)	(4) Pr(Default)	(5) Pr(Default)
Charged Amount					
Charge ($100s)	1.039***	1.040***	1.040***	1.038***	1.041***
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
Race/Ethnicity					
NHB	2.559***	2.383***	2.180***	2.187***	2.232***
	(0.384)	(0.364)	(0.320)	(0.328)	(0.337)
Hispanic	1.537***	1.533***	1.394**	1.403**	1.488***
	(0.192)	(0.211)	(0.203)	(0.205)	(0.212)
Predisposing Factors					
Age		1.002	1.003	0.995	0.995
		(0.005)	(0.005)	(0.005)	(0.005)
Female		0.907	0.873	0.898	0.902
		(0.096)	(0.089)	(0.090)	(0.090)
Married		0.608***	0.628***	0.635***	0.634***
		(0.075)	(0.078)	(0.075)	(0.076)
Family Size		1.060	1.044	1.047	1.051
		(0.043)	(0.042)	(0.040)	(0.041)
Midwest	0.891	0.926	0.885	0.872	0.846
	(0.181)	(0.188)	(0.178)	(0.177)	(0.172)
South	0.731*	0.786	0.684**	0.648**	0.665**
	(0.133)	(0.141)	(0.124)	(0.118)	(0.121)
West	0.598**	0.647**	0.635**	0.638**	0.614**
	(0.133)	(0.139)	(0.136)	(0.132)	(0.125)
Enabling Factors					
Bachelor's Degree			0.789	0.860	0.851
			(0.135)	(0.143)	(0.142)
Employed			0.756***	0.844*	0.848*
			(0.071)	(0.080)	(0.081)
Near Poor			1.110	1.143	1.150

			(0.187)	(0.188)	(0.189)
Low Income			0.959	1.009	1.005
			(0.139)	(0.140)	(0.140)
Middle Income			0.633***	0.667***	0.652***
			(0.088)	(0.091)	(0.089)
High Income			0.595**	0.665**	0.656**
			(0.120)	(0.132)	(0.132)
Delayed Care			1.047	0.962	0.967
			(0.196)	(0.173)	(0.174)
Unable to Get Care			0.905	0.865	0.833
			(0.193)	(0.181)	(0.177)
Need Factors					
Comorbidity Count				1.163**	1.176***
				(0.071)	(0.074)
ADL				0.799	0.765
				(0.319)	(0.308)
IADL				1.532	1.584
				(0.452)	(0.480)
Self-Health (poor or fair)				1.302**	1.333**
				(0.167)	(0.169)
Self-Mental (poor or fair)				1.269*	1.291*
				(0.173)	(0.175)
Visit Contextual Factors					
Saw Doctor					0.704***
					(0.076)
Observations	39,711	39,711	39,711	39,711	39,711
Year FEs	YES	YES	YES	YES	YES
Visit Type FEs	YES	YES	YES	YES	YES

Note: Odds Ratios are reported. NHW is the omitted reference category for race/ethnicity, the Northeast Census region is the reference category for our geographic categories, and Poor is the omitted reference category for the Poverty Category Variable. Standard errors are reported within parentheses. Significance is denoted as: *** p<0.01, ** p<0.05, * p<0.1. Reported estimates are based on using the MEPS sample weights, but the observation counts are based on actual (unweighted) observation counts.

Supplemental material

BMJ Publishing Group Limited (BMJ) disclaims all liability and responsibility arising from any reliance
placed on this supplemental material which has been supplied by the author(s)

BMJ Open

***C7 – Imposing Further Restrictions on the Office Based Visit Sample to Ensure
Greater Homogeneity of Visit Type and Costs***

To ensure greater homogeneity of visit type, and likely costs, we firstly focus on office-
based visits as the medical complexity of these events are the lowest. Second, since
care and cost may vary based on facility type, the type of care received, and the type of
provider seen during the visit, we further restrict our sample to: (1) only visit events that
took place at a doctor's office / group practice, (2) where the care received by the
patient was recorded as a diagnosis or treatment, and (3) where patient report having
seen/talked to a doctor. It should be noted that information on the kind of place where
the patient saw the provider was only collected by the MEPS (Office-Based Medical
Provider Visit files) up until 2012, as such our sample is here based on data from 2002
through 2012 only. Table S8 provides logit (odds ratio) regression estimates for this
restricted, and more uniform, sample. These results show estimates that are very
similar to our main results within Table 4 of the main text – that is, the likelihood of
default is positively (and statistically significantly) associated with medical event charges
and patient race/ethnicity.

Table S8: Office Based Visits at Doctor's Office / Group Practice where -- Logit (Odds
Ratio) Regression Estimates for Payment Defaults by Race/Ethnicity Among Uninsured
US Adults 2002-2012.

	(1) Pr(Default)	(2) Pr(Default)	(3) Pr(Default)	(4) Pr(Default)
Charged Amount				
Charge ($100s)	1.036***	1.037***	1.036***	1.037***
	(0.014)	(0.014)	(0.013)	(0.012)
Race/Ethnicity				
NHB	2.542***	2.469***	2.575***	2.898***
	(0.711)	(0.772)	(0.776)	(0.862)
Hispanic	2.027**	2.034**	2.137**	2.196**
	(0.640)	(0.672)	(0.709)	(0.718)

Predisposing Factor Controls	-	YES	YES	YES
Enabling Factor Controls	-	-	YES	YES
Need Factor Controls	-	-	-	YES
Observations	5,863	5,863	5,863	5,863
Year FEs	YES	YES	YES	YES
Region FEs	YES	YES	YES	YES

Note: Odds Ratios are reported. NHW is the omitted reference category for race/ethnicity, the Northeast Census region is the reference category for our geographic categories, and Poor is the omitted reference category for the Poverty Category Variable. Standard errors are reported within parentheses. Significance is denoted as: *** $p<0.01$, ** $p<0.05$, * $p<0.1$. Reported estimates are based on using the MEPS sample weights, but the observation counts are based on actual (unweighted) observation counts.