

Financial Burden of Advanced Imaging in Radiology (FAIR Study)

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DESCRIPTION OF THE PROBLEM

One in three Americans experience medical cost distress, and more fear the cost of a serious illness more than getting seriously ill [1]. Individuals vulnerable to financial burden may decline care or take on debt, intensifying cost distress. Advanced imaging remains one of the most frequently ordered diagnostic tests, yet the financial burden associated with advanced imaging is rarely evaluated. Furthermore, identification of patients suffering from medically induced financial burden, regardless of the source of burden, is further hampered by heterogeneously implemented routine screening for financial fragility at the health system level. Radiology practices are potentially well positioned to integrate patient-level screening for financial fragility to standardize this care process.

Financial burden consists of three domains: actual material conditions (eg, income, medical debt, domain 1), psychological response to medical expenditure (eg, financial worry, domain 2), and subsequent coping mechanisms (eg, increased cost-related care nonadherence, domain 3). Financial burden decreased quality of life and decreased survival [2,3]. High out-of-pocket (OOP) expenses result in delay or forgoing of care, including imaging, in 12% to 75% of chronically ill patients [4]. Increasing cost sharing and unexpected medical bills lead to greater

financial worry and medical debt [5]. Factors such as financial self-efficacy (ie, confidence in managing money), household income, employment, and insurance type predict financial worry and cost-related care non-adherence [6].

Individual encounters (eg, imaging examinations) may contribute to the three domains of financial burden. Patients often incur higher OOP cost for advanced imaging than other common essential health benefits [7]. Imaging encounters suffer from lack of price transparency for patient cost share, resulting in sticker shock from unexpectedly high medical bills, or surprise billing from inadvertent care by out-of-network providers. Patients may use coping strategies such as taking on more debt or reducing nonmedical spending. They may also delay or forgo testing, filling of prescriptions, or doctor visits.

Therefore, we sought to assess the (1) prevalence of financial worry as related to advanced imaging OOP costs (ie, imaging OOP worry); (2) relationship between imaging OOP worry and the three domains of financial burden, including (a) general financial worry about medical care, (b) financial coping mechanisms, and (c) self-reported cost-related care non-adherence; and (3) feasibility of using the imaging encounter as a financial fragility screening encounter among patients attending advanced imaging in an outpatient setting.

WHAT WE DID

We conducted an anonymous cross-sectional survey (University of Michigan Institutional Review Board approval number HUM00149249) using a convenience sample of patients 21 years or older undergoing CT or MRI examinations at five outpatient imaging facilities in a large midwestern academic medical center between September 4, 2018, and October 16, 2018. Target number of completed surveys was a minimum of 100 and a maximum of 125 per site. To assess sample representativeness, we compared demographics of patients receiving advanced imaging in the same clinics during the same period with survey respondents (Table 1).

Imaging OOP worry was measured with a single four-point Likert scale item. General care financial worry was measured using a modified Comprehensive Score for Financial Toxicity (COST) score [8]. Higher COST scores indicate less financial burden (response range, 0-40, median, 22 in a cancer survivor population [8]). Financial coping (ie, decreasing household spending, using savings, increasing debt) and care nonadherence (ie, declined getting a test, delayed or only partially filled a prescription) because of medical costs in the prior 3 months were queried (yes or no).

To assess feasibility of screening for financial fragility, we queried participant comfort in answering questions about their financial well-being in the

Table 1. Characteristics of study participants and clinic patients over the same period

Characteristics	Study Participants, n (%)	Clinic Patients, n (%)
Age, y		
<40	57 (8.21)	753 (14.5)
40-64	263 (37.9)	2,373 (45.6)
≥65	374 (53.9)	2,078 (39.9)
Female	278 (54.8)	2,831 (54.4)
Married or partnered	349 (69.1)	—
Full-time employment	168 (35.3)	—
College graduate or higher	271 (57.4)	—
Race or ethnicity		
African American	25 (5.0)	423 (8.2)
American Indian or Alaskan Native	4 (0.8)	11 (0.2)
Asian or Pacific Islander	19 (3.8)	243 (4.7)
Hispanic	8 (1.6)	100 (2.0)*
Other	14 (3.0)	163 (3.2)
White, non-Hispanic	427 (84.5)	4,132 (84.2)
Prefer not to say	8 (1.6)	18 (0.3)
Insurance		
Medicare or Tricare (VA or military)	179 (37.1)	2,536 (48.7)
Private (employer provided or purchased directly)	256 (53.0)	2,247 (43.2)
ACA	9 (1.9)	13 (0.3)
Medicaid or uninsured (underinsured)	39 (8.1)	408 (7.8)
Income, \$ (annual household)		—
<15,000	39 (10.0)	
15,000-24,999	38 (9.7)	
25,000-49,999	86 (22.0)	
50,000-69,999	86 (22.0)	
≥70,000	142 (36.3)	
Imaging test		
CT	498 (78.9)	2,322 (44.6)
MRI	121 (19.2)	2,880 (55.4)
Both	12 (1.0)	†
Any chronic illness	325 (69.6)	—
Chronic lung disease	36 (7.7)	
Chronic heart disease	61 (13.1)	
Stroke	12 (2.6)	
Cancer other than skin cancer	199 (42.6)	
Other chronic condition	64 (18%)	
Self-efficacy (“How confident do you feel that you can do things other than just taking medication to reduce how much your illness affects your everyday life?”), mean (SD) (n = 508)	2.5 (1.3)	
Recall of OOP notification	111 (17.4)	—
Imaging OOP worry	126 (22.2)	—

(continued)

Table 1. Continued

Characteristics	Study Participants, n (%)	Clinic Patients, n (%)
General financial worry (COST), mean (SD)	26.4 (11.1)	—
Financial coping behavior due to medical costs [‡]	168 (34.9)	—
Decreasing household spending	108 (22.4)	
Using savings for medical expenses	71 (14.8)	
Increasing debt	76 (15.8)	
Care nonadherence due to medical costs [‡]	70 (14.7)	—
Declining any diagnostic test	22 (4.8)	
Delaying filling prescriptions	41 (8.6)	
Taking fewer pills than prescribed	33 (6.9)	

ACA = plans purchased through the Affordable Care Act Marketplace; COST = Comprehensive Score for Financial Toxicity; OOP out-of-pocket; VA = Veterans Affairs.

*Ethnicity collected separate from race for clinic patients.

[†]Could not be determined.

[‡]Respondents can endorse more than one choice.

outpatient imaging clinic (four-point response scale) and participant interest in discussing imaging OOP with a health care system member on the same day (five-point response scale).

Outcome covariates included imaging OOP notification recall (yes, no, don't know), interaction between imaging OOP worry and notification recall, self-efficacy (five-point response scale), any chronic condition, and sociodemographics. Logistic and linear models described effects of covariates on binomial and continuous outcomes, respectively. At a predetermined target sample size of 500 (100 responses per outpatient imaging clinic), we would be able to detect a two-sided 95% confidence interval of 0.09 for one proportion. Analyses were conducted using Stata SE (College Station, Texas), and $P < .05$ represented statistical significance.

OUTCOMES AND LIMITATIONS

Participant Characteristics

We collected 671 surveys across the five outpatient imaging clinics. Demographic characteristics of participants are summarized in Table 1. Compared with the patient population attending outpatient CT or MRI in the same facilities

during the same period, study participants were more frequently 65 years and older, were insured by a private insurer or by plans purchased through the Affordable Care Act Marketplace, and were undergoing a CT examination.

Imaging OOP Worry and Recall of OOP Notification

Of those who responded, 126 (22.2%) reported worry about CT or MRI OOP; 111 (17.4%) remembered being told about their OOP costs. There was no correlation between imaging OOP worry and recall of OOP notification ($P > .05$).

General Financial Worry (COST)

As a global measure of financial worry due to medical care, median COST score was 28 (interquartile range, 19-35) in a population presenting for imaging. In multivariable regression models after controlling for demographic characteristics (Table 2), higher financial worry due to medical care (lower COST score) was associated with higher imaging OOP worry (coefficient -12.7 , 95% confidence interval [CI] -15.4 to -10.0) and lower self-efficacy (coefficient 1.4 , 95% CI 0.6 to -2.2). Although patients

remembering if they were told of their imaging test cost share alone was not independently associated with the general financial worry, this variable (OOP recall) interacted with imaging OOP worry to further increase the general financial worry (coefficient -9.1 , 95% CI -14.6 to -3.7). Demographic characteristics that significantly correlated with financial well-being included income \$75,000 or greater (coefficient 8.1 , 95% CI 3.5 - 12.7) and having Medicaid insurance or being uninsured compared with Medicare (coefficient -7.2 , 95% CI -11.9 to -2.5) correlated with higher financial worry. Having any chronic illness increased financial worry (coefficient -5.4 , 95% CI -7.7 to -3.0).

Use of Financial Coping Mechanisms

Of those who responded, 168 participants (34.9%) endorsed at least one financial coping mechanism: decreasing household spending (22.4%), using savings for medical expenses (14.8%), or increasing debt due to medical expenses (15.1%). Participants were able to endorse more than one coping mechanism. In multivariable regression models (Table 2), after adjusting for other covariates, imaging OOP worry exerted

Table 2. Multivariable regression models of three domains of financial burden including general financial worry using the COST, in which higher scores indicate worse financial burden, any financial coping mechanism, and any care nonadherence episode

Variable	General Financial Worry (COST)			Financial Coping			Care Nonadherence		
	Coefficient	95% CI		aOR	95% CI		aOR	95% CI	
Imaging OOP worry	-12.66	-15.36	-9.96	7.39	3.26	16.76	4.90	2.04	11.73
Remember OOP notification (OOP recall)	1.05	-1.85	3.96	0.93	0.37	2.32	0.74	0.14	3.76
Imaging OOP worry × OOP recall*	-9.18	-14.62	-3.74	4.19	0.93	18.91	1.32	0.18	9.33
Self-efficacy	1.40	0.59	2.22	0.99	0.78	1.26	0.58	0.41	0.82
Age, y									
<40	REF			REF			REF		
40-64	-2.83	-6.29	0.62	1.88	0.66	5.29	1.35	0.40	4.57
≥65	0.88	-3.68	5.46	1.21	0.3	4.74	0.28	0.04	1.71
Female	0.17	-1.92	2.25	1.44	0.78	2.65	1.84	0.76	4.46
Married or partnered	0.22	-2.18	2.63	1.17	0.57	2.4	0.50	0.20	1.25
Non-White	-0.74	-3.50	2.02	—	—	—	1.75	0.63	4.81
Income, \$ (annual household)									
<15,000	REF			REF			REF		
15,000-24,999	-1.58	-6.35	3.18	2.01	0.48	8.37	0.614	0.12	3.14
25,000-49,999	1.68	-2.58	5.95	0.85	0.23	3.09	1.20	0.28	5.07
50,000-69,999	3.84	-0.63	8.33	0.75	0.19	2.85	0.55	0.1	2.81
≥70,000	8.08	3.49	12.67	0.34	0.08	1.37	0.7	0.13	3.65
College graduate	0.95	-1.18	3.09	0.92	0.49	1.74	—	—	—
Insurance									
Medicare	REF			REF			REF		
Private	-2.14	-5.36	1.06	1.73	0.67	4.49	0.53	0.15	1.89
ACA	-3.18	-12.88	6.51	0.33	0.01	6.66	0.9	0.03	21.77
Medicaid	-7.19	-11.86	-2.52	2.42	0.55	10.58	1.21	0.23	6.24
Any chronic illness	-5.38	-7.72	-3.03	3.56	1.65	7.70	1.64	0.60	4.51

Model population n = 288. Numbers in bold were statistically significant ($P < .05$). ACA = plans purchased through the Affordable Care Act Marketplace; aOR = adjusted odds ratio; CI = confidence interval; COST = Comprehensive Score for Financial Toxicity; OOP, out of pocket cost; REF = reference.

*Interaction between worry about OOP and remember OOP notification.

the largest effect on use of financial coping (adjusted odds ratio [aOR] 7.4, 95% CI 3.3-16.8). Being told of their imaging test cost share did not independently correlate with use of coping mechanisms. Although remembering being told their imaging test cost share was not independently associated with the outcome, interaction between imaging OOP worry and remembering being told about OOP trended toward a

significant effect (aOR 4.2, 95% CI 0.9-18.9, $P = .06$). Having a chronic illness increased the likelihood of the financial coping mechanisms. No other covariates remained significant correlates.

Care Nonadherence

Among the respondents, 70 (15.0%) endorsed at least one episode of care

nonadherence in the last 3 months due to the cost of care, defined as declining any diagnostic test (4.8%), delaying filling prescriptions (8.6%), or taking fewer pills than prescribed (6.9%). Participants may have chosen more than one type of nonadherence. In multivariable regression models (Table 2), after adjusting for other covariates, imaging OOP worry exerted the largest effect on care

nonadherence (adjusted odds ratio [aOR], 4.9, 95% CI 2.0-11.7). Self-efficacy reduced the likelihood of this outcome (aOR, 0.5, 95% CI 0.4-0.8). Having a chronic illness increased the likelihood of the financial coping mechanisms. No other covariates remained significant correlates.

Feasibility of Screening for Financial Burden in an Outpatient Imaging Setting

Of the 671 respondents, 330 (66.8%) and 336 (68.8%) were comfortable answering questions about their general financial situation and discussing the impact of the cost of care on their finances, respectively. A similar proportion of respondents were comfortable discussing their financial well-being in an outpatient imaging setting (324, 66.1%), with their physicians (301, 63.18%), or with financial counselors (318, 65.3%). However, only 100 (17.6%) somewhat or strongly agreed to a desire to discuss their imaging test OOP on the same day as their imaging visit.

In summary, financial coping strategies are common among respondents to the imaging OOP worry query (35%); self-reported care nonadherence (15%), less so. Imaging OOP worry highly correlated with both outcomes, suggesting that screening for imaging OOP worry may identify patients with

medical cost burden risk. OOP notification recall likely magnifies the effect of imaging OOP worry on general financial worry and financial coping, suggesting that price transparency interventions may have unintended consequences, for example, cost anxiety and sticker shock.

Our study has several limitations. The retrospective nature and convenience sampling method may limit generalizability of the study. The study was conducted before the coronavirus disease 2019 pandemic, which may have underestimated the frequency of the outcomes evaluated. A large minority declined to answer financial questions, which may have incompletely captured financial burden in this population; however, we suggest that nonresponders may experience higher rates of financial burden and our estimates represent the minimum. Participants may have recall bias with those experiencing OOP worry or existing financial distress, preferentially remembering notification of test OOP; however, we did not demonstrate a correlation between OOP worry and recall.

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