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The impact of price transparency on consumers and providers: A scoping review

Abstract

Escalating levels of healthcare spending and price variation in the healthcare market have driven government and insurer interest in price transparency tools that are intended to help consumers shop for services and reduce overall healthcare spending. However, it is unclear whether the objectives of price transparency are being achieved. We conducted a scoping review to synthesize the impact of price transparency on consumer, provider, and purchaser behaviours and outcomes.

Price transparency tools had weak impact overall on consumers due to low uptake, and mixed effects on providers. Price-aware patients chose less costly services that led to out-of-pocket cost savings and savings for health insurers; however, these savings did not translate into reductions in aggregate healthcare spending. Disclosure of "chargemaster" prices had no effect however disclosure of negotiated prices prompted supply-side competition which led to decreases in prices for shoppable services.

Introduction

In the United States, healthcare spending has grown faster than Gross Domestic Product (GDP) in the past 60 years (1) and is expected to represent 19.4% of GDP by 2027. An ageing population, increased demand for healthcare, and lack of price regulation by policymakers has increased utilization and prices, driving growth in healthcare spending (2, 3). In addition to rising healthcare prices, research indicates that a large degree of price variation exists for the same healthcare service (4-6) and that there is little correlation between price and quality (7-9). Pricing failure, resulting from prices being "too high," is the largest source of waste in US healthcare spending (10). Further, consumers are bearing larger portions of their healthcare expenses as medical premiums increase and high-deductible plans become increasingly prevalent (11).

In an effort to slow the growth in healthcare spending and promote consumer sovereignty, policymakers and insurance companies are increasingly requiring price disclosure from hospitals and offering price transparency tools to consumers. As of January 2019, providers have been required under a federal mandate to post chargemaster prices online, and in June 2019, President Donald Trump signed an

executive order proposing regulation that would require medical providers to disclose insurance-negotiated prices (12). Additionally, more than half of the states have passed price transparency legislation (13) and a number of insurance companies and self-insured employers (who offer health insurance to eligible employees) offer their enrollees access to a price comparison tool via a website, mobile app, or telephone. Price transparency efforts are not limited to the United States: in the UK, private healthcare providers are required to disclose price information via the Private Healthcare Information Network (PHIN) under a 2014 mandate from the Competition & Markets Authority (14). Further, in March 2019 the Australian federal government pledged to create a searchable online website where individual practitioners can opt to disclose their fees for services (15), and three major Australian private health insurers have begun providing online out-of-pocket cost estimators to their enrollees (16).

Characteristics of price transparency tools vary, however they generally allow users to compare prices or charges for a given procedure across facilities via a website, mobile app, or telephone. Some tools allow consumers to obtain personalized prices for a procedure that consider their health insurance and facilities in their area. Price transparency tools in the healthcare market can be categorized as : 1) tools provided by insurance companies to enrollees (e.g. Aetna Member Payment Estimator (17)); 2) commercial tools (e.g. Truven Treatment Cost Calculator (18); Castlight Health (19)) purchased by self-insured employers for use by insured employees; 3) mandatory state disclosure websites (e.g. New Hampshire HealthCost (20)); and 4) voluntary disclosure by individual facilities.

Price information and price transparency tools are intended to benefit consumers, health insurance companies (purchasers), and governments. On the demand side, they encourage consumers to compare prices in the healthcare market and select lower-cost providers, translating into lower costs for consumers and purchasers. On the supply side, they are intended to prompt competition amongst providers to lower prices and increase the ability of insurers to bargain with providers for lower negotiated prices (21). However, price transparency may increase the level of healthcare prices if providers use it as a coordinating mechanism for collusion in raising prices, or if providers face pressure from insurers to standardize negotiated rate across insurers (22). Further, increased consumer access to

price information may not improve consumer sovereignty unless it is also accompanied by reliable and relevant information about service quality.

Price transparency tools are designed for "shoppable" services for which consumers are able to schedule when they will receive care and compare multiple providers (7), and are not likely to be used for emergency services. Shoppable services include services such as Magnetic Resonance Imaging (MRI) scans and laboratory tests, which account for over 40% of healthcare services (7). Additionally, consumer interest in price shopping may be influenced by whether information about service quality is available: when quality is difficult to observe, there is a risk that consumers will take high prices as a proxy for high quality.

Despite the growth in price transparency tools and investments by insurance companies and governments, it is unclear whether the objectives of price transparency to facilitate price shopping and drive lower healthcare spending are being achieved. To our knowledge, there have not been any prior scoping reviews that have attempted to map the literature with regards to the effects of price transparency in the healthcare market. The aim of this study is to conduct a scoping review to synthesize the impact of price transparency on consumer, provider, and purchaser behaviours and outcomes.

Methods

We conducted a scoping review to map the literature in this emerging area. This scoping review was conducted following the guidelines of the Joanna Briggs Institute Handbook methodology for conducting scoping studies (23) and our review was reported according to the PRISMA-ScR. This methodology draws on the Arksey & O'Malley (24) framework: 1) identifying the research question; 2) identifying relevant studies; 3) study selection; 4) charting the data; and 5) collating, summarising and reporting the results. The objectives, inclusion criteria and methods for this scoping review were specified in advance and documented in a protocol (unpublished). The protocol was strictly followed with no deviation and is available upon request.

Search Strategy

Six databases were searched from their dates of inception to 12th July 2019: Medline; PsycINFO; SCOPUS; Embase; EBSCOHost; and EconLit. Search terms were refined with the assistance of a librarian (see Appendix 1 for example of search strategy) and focused on price transparency for health services. Subsequently, references from relevant articles were surveyed to identify relevant articles that were not identified in our database searches. Results of searches were imported into Endnote X9 and duplicate articles were excluded. One author (AZ) screened all titles and abstracts for relevance. Full-text articles were screened for relevance by two authors (AZ and KP). Discrepancies between authors were discussed between them and if they remained unsolved, a third author (MK) determined final inclusion.

Study Selection

Articles were included if 1) they examined the effect of price transparency on behaviour and outcomes (i.e. usage, selection and costs) among consumers, purchasers (e.g. insurers), or providers; 2) they examined prices for medical services charged by physicians or hospitals; and 3) the study design was observational or experimental. Articles were excluded if they 1) examined the impact of prices not publicly available to consumers; 2) reported hypothetical choices; 3) were reviews/perspectives; 4) were qualitative studies; 5) were published in a language other than English; 6) reported price variation without price transparency; 7) evaluated the introduction of price transparency in conjunction with other interventions (e.g. reference pricing); 8) reported characteristics of price transparency tools.

Data Extraction and Synthesis

The following information was extracted from the articles: year of publication; authors; study location; study design; population; sample size; type of price transparency tool; services covered; outcomes measured; findings. An evidence synthesis was conducted.

Results

Study selection

A total of 7,065 articles were identified from six databases. After removing 2,830 duplicates, 4,235 articles remained. Following titles and abstracts screening, 4,161 articles were excluded, and 74 articles remained. Five articles were additionally identified from reference lists. Of the 79 full-text articles screened, 61 were excluded and 18 were included in our final synthesis (Appendix 2). Articles were categorized into three groups: 1) consumer behaviour and outcomes; 2) provider behaviour; 3) insurer outcomes. Behaviours included usage of price transparency tool, selection of providers, and pricing of services. Outcomes included cost savings.

Study characteristics

Characteristics of the 18 studies are described in Appendix 3. Fifteen studies examined consumer behaviours and outcomes (7-9, 11, 25-35). Of those, 10 examined usage of price transparency tools (7, 8, 11, 25, 27, 28, 30, 31, 33, 34), seven examined selection of healthcare services (11, 25, 26, 29, 30, 32, 35), and eight examined cost of healthcare services (8, 9, 11, 25, 30, 32, 34, 35). Five studies examined provider pricing behaviours (21, 25, 35-37). One study examined impact on cost for purchasers (25). The total number of outcomes does not equate to the total number of studies as seven studies examined multiple outcomes (Appendix 3).

All 18 studies were conducted in the United States and published between 2009-2019. Fourteen studies were published in peer-reviewed academic journals, and four studies were published in grey literature.

Study designs included quasi-experimental (n = 12) and cross-sectional (n = 6) studies. Quasi-experimental studies were interrupted time series with/without control group (n = 4) and before/after with/without control group (n=8). Study populations involved consumers (n = 14) and providers (n = 4). Types of price transparency tools included commercial tools for which access was purchased by self-insured employers (n = 7), tools provided by an insurance company for enrollees (n = 4), tools developed and mandated by state (n = 4), and voluntary disclosure by facilities (n =2). One study (n = 1) surveyed consumers regarding the range of price transparency tools they had used.

Studies assessed outcomes for a variety of healthcare services. The most frequently examined services were imaging (n = 14), office visits (n = 8), lab tests (n = 7), orthopaedic procedures (n = 6), obstetric

procedures (n = 4), colonoscopies (n = 4), ophthalmologic procedures (n = 3), emergency department visits (n = 3), otolaryngologic procedures (n = 3), uterine procedures (n = 2), hernia repairs (n = 2), sleep studies (n = 2), and gastrointestinal endoscopies (n = 2). Eight studies assessed outcomes for other services (e.g. appendectomies).

Impact of Price Transparency on Consumers

Fifteen studies examined the impact of price transparency on consumers with regards to use of a price transparency tool, selection of healthcare services, and cost. These studies can be further categorized as 1) studies that examined behaviours and outcomes for all consumers with access to a price transparency tool, and 2) studies that examined behaviours and outcomes for patients that had consulted a price transparency tool before receiving care. The first group includes all consumers who may have 1) not required healthcare services in the study period; 2) required healthcare services but did not use the tool they had access to; 3) used the tool to obtain price information however did not subsequently obtain services; or 4) used the tool and received services. The second group includes only consumers who used the tool and received services. The distinction is critical as the proportion of consumers with access to the tool who used it to shop for subsequently received services is low.

Group 1: Consumers with access to price transparency tool

Usage of Price Transparency Tool

Six studies evaluated usage of a price transparency tool amongst consumers who were offered access over various time periods (8, 11, 28, 30, 31, 33). Lieber (11) found that 12% of employees with access to a tool via their employer had searched for price information within the first 3 months of the tool's introduction. Similarly, Desai, Hatfield (30) and Gourevitch, Desai (28) reported that rates of usage within the first year that tools were available to employees via employer access were 10% and 11%, respectively. Over a longer time period, Desai, Hatfield (8) found that 12.3% of members in a retired employee insurance plan had searched within the first 15 months, Sinaiko & Rosenthal (31) found that 3.5% of Aetna insurance enrollees had searched within the first 2 years, and Mehrotra, Brannen & Sinaiko (33) found that 1% of the population of the state of New Hampshire had accessed the state-

wide price transparency tool in the first 3 years the tool was available. Sinaiko & Rosenthal (31) and Mehrotra, Brannen, & Sinaiko (33) additionally concluded that the proportion of the population who had used the available tool increased over time, with Sinaiko & Rosenthal (31) noting that use of the Aetna Member Payment Estimator in the second year had increased by 43% over the first year, and Mehrotra, Brannen & Sinaiko (33) recording an upward trend in monthly usage of the New Hampshire HealthCost website. Overall, rates of usage varied between the six studies depending on study population but remained consistently low.

Selection of Healthcare Facilities

Four studies examined the impact of a price transparency tool on consumer selection of healthcare facilities (11, 25, 26, 30). Two studies found that consumers are attracted to facilities that make their prices known: Mehta et al. (26) found that both patient volume (proxy of consumer selection) and satisfaction had increased at facilities that had voluntarily made prices available online, and Brown (25) found that the introduction of a mandatory state-wide price transparency tool in New Hampshire meant that consumers were significantly more likely to select a provider in New Hampshire where prices are known instead of choosing a provider in neighbouring states where prices are not publicly known. Two studies found that consumers with access to a price transparency tool alter their selection of health providers, perhaps in order to receive services at lower priced providers. Brown (25) found that the introduction of a price transparency tool reduced the probability of returning to the same provider as their previous visit by 6%. Similarly, Lieber (11) found that access to a price transparency tool increased the probability of seeing a new physician by 16%. Additionally, Brown (25) found that individuals drove further to receive services after the introduction of the price transparency tool.

While consumers with access to price information may switch to lower priced providers, they may not necessarily switch to lower-priced types of facilities. Desai et al. (30) found that a group of consumers with access to a price transparency tool was no more likely to switch from hospital-based outpatient facilities to typically less expensive non-hospital based facilities (e.g. ambulatory surgery centers), compared to a control group without access to the tool.

Overall, two studies found that consumers are attracted to facilities that make prices known (25, 26), and two studies found that consumers alter their selection of healthcare facility when prices are known (11, 25). However, one study found no evidence that consumers were more likely to switch from hospital-based facilities to typically less costly non-hospital based facilities (30).

Impact on Cost

Four studies examined impact on cost for consumers with access to a price transparency tool (8, 11, 25, 30). Studies examined four types of impact on cost: 1) total spending (insurer and consumer out of pocket) over a period of time; 2) total consumer out-of-pocket spending over a period of time; 3) total visit price (insurer and consumer out of pocket); and 4) total consumer out-of-pocket visit price. Desai et al. (8) examined total quarterly and annual spending and found that access to a price transparency tool did not have an effect on total quarterly spending growth for shoppable services compared to a control group. Further, Desai et al. (30) found that a group with access to a price transparency tool had small but statistically significant increases in annual outpatient spending and annual out-of-pocket spending compared to a control group. For visit prices, Brown (25) and Lieber (11) found that access to a price transparency tool lowered average total visit prices. Brown (25) found that average visit prices over a five-year period for imaging services declined by 3.1%, while Lieber (11) found that access to price information reduced prices paid by 1.6%. Further, Brown (25) found a decrease in patient out-of-pocket visit prices, concluding that the average out-of-pocket visit price for imaging services over a five-year period declined by 5.4%, and that by the fifth year, out-of-pocket prices were 11% lower relative to the control group. Overall, two studies found no effect on average consumer spending over a period of time, but two studies found decreases in average total and out-of-pocket visit prices.

Group 2: Patients who accessed price transparency tool and received care

Usage of Price Transparency Tool

Five studies examined the proportion of claims that had been preceded by search amongst a population with access to a price transparency tool (7, 8, 25, 27, 34). All five studies found that a small proportion of claims were preceded by search. Mehrotra et al. (27) found that 13% of patients had actively searched

for out-of-pocket spending prior to receiving care, of these 25% had consulted a website that was either publicly accessible or accessible through their health insurer or employer insurance. Brown (25), Chernew et al. (7), Desai et al. (8) and Whaley et al. (34) examined usage for medical imaging services, finding that 8%, 0.74%, 1%, and 6.9% of patient claims had been preceded by search, respectively. Whaley et al. (34) and Desai et al. (8) additionally examined lab test and office visit claims, finding that 5.9% and 0.3% of laboratory tests and 26.8% and 1% of office visits had been preceded by search, respectively. Overall, the proportion of claims preceded by search varied across service types and studies but remained low.

Selection of Healthcare Facility

Three studies examined the provider selection behaviour of patients who had accessed a price transparency tool prior to booking a procedure (29, 32, 35). Two studies (32, 35) found that price-aware patients were more likely to book services at relatively less costly facilities. Sinaiko et al. (32) found that price-aware patients booked less costly imaging services and sleep services compared to non-price aware patients (services priced in the 46th and 42nd percentiles compared to the 54th and 47th percentiles, respectively). Further, Wu et al. (35) found that following the implementation of a price transparency tool, 45% of price-aware patients booked imaging services at hospital-based facilities compared to 53% pre-intervention. In comparison, the proportion of patients in the non-price aware control group who booked imaging services at hospital-based facilities remained constant at around 50%. Hospital-based facilities are significantly more costly than non-hospital based facilities, and a shift away from hospital-based facilities indicates a decrease in costs. One study (29) found that price-aware patients were 41% more likely to book cosmetic surgery services than non price-aware patients following a consultation at a given surgeon's practice in California. Overall, studies indicate that price-aware patients book relatively less costly services, choose to receive them at less costly types of facilities, and are more likely to book services for elective cosmetic surgery.

Impact on Cost

Six studies examined the impact on cost for price-aware patients compared to non price-aware patients (8, 9, 11, 32, 34, 35). Impacts on cost included total visit price (insurer and consumer out of pocket). All six studies examined total visit price and found an effect for at least some services. Imaging, lab tests, and office visits were the most common services investigated. For imaging, search was associated with price reductions ranging from 12% to 18.7% across five studies (8, 9, 32, 34, 35). For lab tests, Whaley et al. found that search was associated with a price reduction of 15.6% (9) and 13.93% (34), however, Desai et al. (8) found no effect. Search had limited effect on price reductions for office visits, with Desai et al. (8) finding no effect and Whaley et al. (9, 34) finding a price reduction of 1%. Further, Sinaiko et al. (32) found that search was associated with a 6% price reduction for sleep services, and Lieber estimated that price awareness reduced prices paid across a variety of services by 17%. Across included studies, search was associated with price reductions across all services examined except for office visits.

Impact of Price Transparency on Providers

Five studies examined the impact of price transparency on providers (21, 25, 35-37). In terms of prices, Whaley (36) found that increased diffusion of access to price transparency led to decreases in laboratory test prices, but not office visits. Brown (25) found that the long-run effects of price transparency decreased imaging principal procedure prices by 3%. Christensen et al. (37) found that public disclosure of charges prompted hospitals to lower charges by 5%, however, there was no effect on actual prices paid as hospitals were able to adjust discounts to negate patient and insurance savings. Three studies examined and compared the effects of price transparency on hospital and non-hospital providers. Wu et al. (35) found that prices for Magnetic Resonance Imaging (MRI) services decreased by 11.7% in hospital-based facilities, but that prices for MRIs in non-hospital based facilities did not decrease, resulting in a 30% reduction in price variation between hospital and non-hospital based facilities. However, Brown (25) found that hospital-based providers did not decrease prices while non-hospital providers decreased prices by 2.4%, which accounted for the majority of the long-run supply-side impact on prices. Additionally, Tu & Lauer (21) found that the introduction of the New Hampshire HealthCost tool had no impact on the persistent price gap between hospital and non-hospital facilities

over the substantial range of services that the tool provides prices for. Overall, the effect of price transparency varies depending on service: studies suggest that price transparency decreases prices for lab tests and imaging, but not office visits. Further, public charge disclosure lowers provider charges but does not impact final prices paid. Finally, there is inconclusive evidence regarding price variation between hospital-based providers and less costly non-hospital based providers, with one study finding no effect, one study implying increased variation, and one study finding decreased variation.

Impact of Price Transparency on Purchasers

One study examined the impact of price transparency on purchasers of health services, such as insurance companies and self-insured employers (25). When patients select lower-priced services, cost savings may additionally accrue to purchasers who are responsible for a portion of the total cost. Brown (25) found that total procedure price selected by patients decreased, and that it translated into savings of 3.7% on the visit price of imaging services for insurers.

Discussion

The aim of this scoping review is to synthesize the literature regarding the impact of healthcare price transparency on consumer, provider, and purchaser behaviours and outcomes. There were weak effects on consumer usage (7, 8, 11, 25, 27, 28, 30, 31, 33, 34), and some effects on consumer selection (11, 25, 26, 29, 30, 32, 35). Impacts on consumer costs were strong within the subset of price-aware patients (8, 9, 11, 32, 34, 35), however weak amongst all consumers with access to the tool due to low usage (8, 11, 25, 30). There was some effect on provider pricing behaviour (21, 25, 35-37). For purchasers, price transparency resulted in cost savings due to consumers selecting lower-cost services (25); however, as only one study examined purchaser outcomes, our ability to draw a conclusion is limited.

Usage amongst consumers offered a price transparency tool was low, and only a small proportion of services had been received by price-aware patients who searched for prices prior to receiving services. tool. Studies that examined consumer selection of facilities showed that the subset of price-aware patients, as well as overall consumers offered a price transparency tool, altered their choice of healthcare facility. The introduction of a price transparency tool resulted in price reductions across all services

examined except for office visits among the subset of price-aware patients. However, this did not translate into overall lower annual and out-of-pocket spending for those with access to a price transparency tool due to low usage. Providers reduced prices for lab and imaging services but not for office visits upon public disclosure of negotiated prices, however disclosure of chargemaster prices did not impact final prices paid. There was mixed evidence of the effects of price transparency on price differentials between hospital-based facilities and non-hospital-based facilities.

Variation between study findings can be partially explained by the following factors: 1) low usage of price transparency tools resulting in limited population-wide effects for a group with access to a price transparency tool; 2) different methods of introducing the price transparency tool; and 3) differences in services evaluated. Low usage of price transparency tools can be partially attributed to consumers being unaware that they have access to price comparison tools, consumers not requiring healthcare services for a given time period, or consumers being aware of their access to a tool but not using it before booking a healthcare service. Consumers aware of their access to a price transparency tool may opt not to use it due to perceived or actual lack of cost savings available (e.g. if a consumer has exceeded their annual deductible or if the service is relatively inexpensive), if the tool is difficult to use or does not provide relevant information, or if their choice of facility is constrained by the lack of facilities in non-metro areas or by their insurer network. Older consumers and consumers with lower incomes are less likely to use price transparency tools (25, 28, 31), perhaps due to lower internet access and literacy; in this sense, price transparency tools have the potential to increase health inequality. Amongst consumers who do access the tool, not all subsequently receive care: Sinaiko & Rosenthal (31) found that over half of patients who searched for price information about a service did not end up receiving the service, hypothesizing that searchers may decide not to book a service after finding out the price, may be searching for prices out of general interest, or may be searching for prices on behalf of family and friends. Low rates of usage and low subsequent receipt of services help explain why the savings realized by price-aware patients (8, 9, 11, 32, 34, 35) are larger than average savings for consumers with access to a price transparency tool (11, 25) and do not translate into reductions in total quarterly or annual spending for a group of patients with access to a price transparency tool (8, 30). As Lieber (11)

concludes, "although searching appears to reduce the prices paid considerably, a relatively small amount of search occurs." Low consumer search for healthcare information has also been noted in the UK, where less than 5% of patients consulted the NHS Choices website for information on hospital performance prior to choosing a provider (38).

The way that a price transparency tool is introduced to consumers affects its impact; price information is most effective when presented in an actionable manner at the point of consumer decision-making. Wu et al. (35) made targeted phone calls to a subset of patients booked for MRI scans at "low-value facilities" who could save over $400 by switching to an alternative facility and helped the patients who accepted their recommendation to reschedule an appointment at the higher-value facility. That the cost savings found by Wu et al. (35) far exceed cost savings found by other authors may be because Wu et al. (2014) offered patients targeted, personalized, and actionable price information instead of a referral to a static website. No studies conducted an economic evaluation that included the costs of price transparency tools and patient search costs.

The potential impact of price transparency varies by type of service: studies found little or no impact on consumer costs for office visits (8, 9, 34) despite finding cost reductions for other services. Whaley (9) attributes this finding to the heterogeneity of office visits compared to other services, noting that "personal relationships [are] inherent to physician visits, [while] imaging and lab tests are conducted by a machine." Additionally, Whaley (9) notes that the comparatively low degree of price variation for office visits limits the potential savings from switching providers. Services such as office visits that have heterogeneity in service offerings and low levels of price variation may have limited applicability to the objectives of price transparency tools.

Limitations

To our knowledge, this scoping review is the first review to synthesize the effects of healthcare price transparency tools on consumer, provider, and purchaser behaviours and outcomes. However, it has limitations. First, we were not able to fully disentangle the effects of price transparency on consumer out of pocket and insurer costs, as six out of eight studies that examined impact on cost only looked at

the combined insurer and consumer out of pocket effect. Second, our conclusions may have limited generalizability outside the United States as all of our included articles evaluated price transparency in the United States. Third, we did not evaluate the characteristics of the price transparency tools themselves, which undoubtedly affect user experiences. Fourth, we did not conduct a full systematic review that examined the quality of the studies and risk of bias. The range of study designs used imply low to moderate quality studies, and there have been no randomised trials. Finally, we were not able to evaluate whether price transparency tools reduce healthcare spending by discouraging price-aware consumers from obtaining health services.

Policy Implications

Price transparency tools have the potential to help consumers, insurers, and governments reduce healthcare spending. It has been demonstrated that search preceding receipt of selected services reduces prices paid, however usage remains low. To make price transparency tools more salient at the point of consumer decision-making, consumers can be further incentivized to receive care from less expensive facilities via initiatives such as bonuses for choosing less expensive facilities or reference pricing programs (30). Reference pricing programs, under which consumers are responsible for paying for the entirety of the gap between the price of their chosen procedure and the "reference" price their insurer has set, have been extremely effective in diverting consumers to lower-cost facilities and reducing overall spending (39-41). With regards to legislating mandatory price transparency, policymakers that pursue publicizing hospital charges to spur supply-side competition must consider that hospital charges are of little use to consumers as they do not reflect the prices consumers are liable for after insurer-negotiated discounts and insurance plan coverage, and that reductions in charges do not translate into reductions in prices paid due to the ability of hospitals to reduce existing discounts (37).

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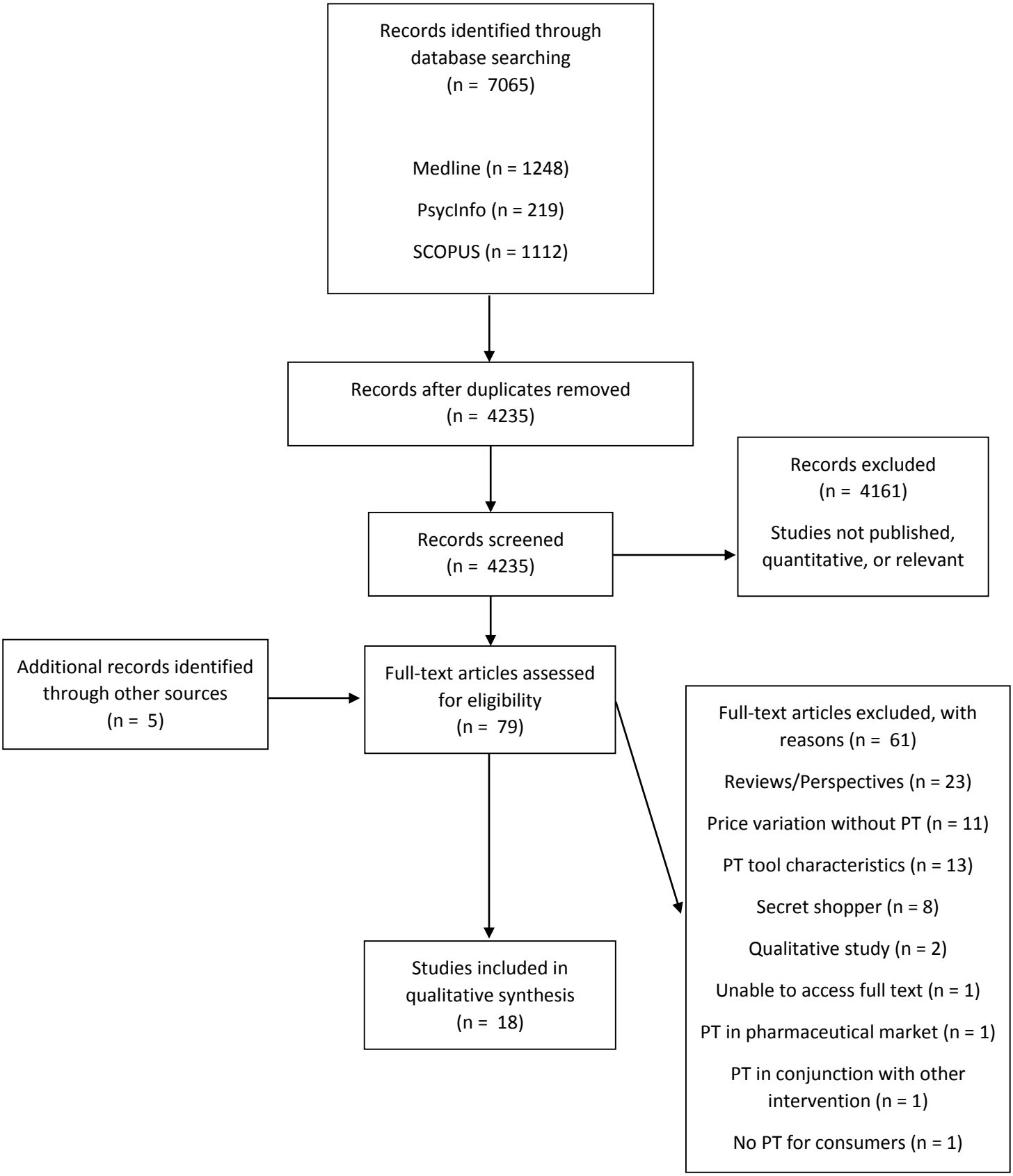
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Appendix 1: MEDLINE search strategy

	Searches	Results
1	(pric* adj2 (transparen* or report* or information or compar* or estimat* or tool* or variation or disclos*)).mp.	1680
2	public pric*.mp.	28
3	(transparen* adj2 (bill* or cost* or pric* or fee*)).mp.	431
4	or/1-3	1913
5	(hospital* or specialist* or doctor* or physician* or outpatient* or surger* or procedure* or medical practitioner* or practitioner* or health*).mp.	7608588
6	4 and 5	1248

Appendix 2: PRISMA flow diagram for article selection
PT = price transparency



Appendix 3: Study Characteristics

US = United States; NH = New Hampshire; CT = computed tomography; MRI = magnetic resonance imaging; ASC = ambulatory service center; CA = California; ECG = electrocardiogram; ER = emergency room

Author	Country	Study Design	Population	Sample Size	Type of PT Tool	Services	Outcomes	Findings
Whaley 2019	US	Quasi-experimental (interrupted time series without control group)	Office visit and lab test providers	110,476 providers	Commercial (unspecified via employer insurance access)	Lab tests Office visits	<u>Providers</u> Cost	 Effect (lab tests) No effect (office visits)
Brown 2018	US (NH)	Quasi-experimental (controlled before-after)	Users of medical services in New Hampshire with claims submitted between 2005-2011	2,100,000 claims	State Mandatory (NH HealthCost)	Imaging (x-ray, CT, MRI)	<u>Patients</u> Cost Selection Usage <u>Providers</u> Cost <u>Purchasers</u> Cost	 Effect Effect Effect Effect Effect
Chernew et al. 2018	US	Cross-sectional	Patients covered by large national insurer who received a lower extremity MRI (no contrast) in 2013	50,484 claims	Insurer (unspecified)	Imaging (MRI)	<u>Patients</u> Usage	 Some effect
Christensen et al. 2013	US (34 states)[1]	Quasi-experimental	States that had mandated price	2,145,926 charges	State Mandatory	Other[2]	<u>Providers</u> Cost	

[1] Arkansas, California, Colorado, Florida, Illinois, Iowa, Kentucky, Louisiana, Maine, Massachusetts, Minnesota, Montana, Nebraska, Nevada, New Jersey, Ohio, Oklahoma, Oregon, South Dakota, Tennessee, Texas, Utah, Vermont, Virginia, Washington, West Virginia, Wisconsin

[2] C-section, knee replacement, hip replacement, appendectomy, uterine procedures

		(interrupted time series without control group)	transparency website disclosure by July 2013	244,962 payments	(various websites by states)			Effect (all services)
Mehta et al. 2018	US (6 states – unspecified)	Cross-sectional	ASCs in the Free Market Medical Association database that list prices online	6 providers	Other (ASC's websites)	Other[3]	<u>Patients</u> Selection	Effect
Mehrotra et al. 2017	US	Cross-sectional	Noninstitutionalized adults (18-64) in the US who had received care in the past 12 months involving some out-of-pocket spending	1,904 patients	Called provider for information, used website, called health insurance company	All Lab tests Office visits Other (physical therapy)	<u>Patients</u> Usage	Effect
Desai et al. 2017	US (CA)	Quasi-experimental (controlled before-after)	Enrollees of the California Public Employees' Retirement System (CalPERS) in the Anthem Blue Cross PPO plan	233,004 patients	Commercial (Castlight via employer insurance access)	Lab tests Imaging (advanced imaging) Office visits	<u>Patients</u> Cost Usage	 No effect (lab tests, office visits) Effect (imaging) Effect
Lieber 2017	US	Quasi-experimental (before-after without control group)	Employees of a large self-insured corporate employer	387,774 claims	Commercial (Compass via employer insurance access)	Other[4]	<u>Patients</u> Cost Selection Usage	 Effect Effect Effect

[3] Centres specialized in orthopaedics (n = 3), ophthalmology (n = 2), and otolaryngology (n = 1)

[4] Services performed in the following settings: hospital inpatient, hospital outpatient, hospital imaging, physician imaging, physician's office, and global imaging facility

Gourevitch et al. 2017	US	Cross-sectional	Employees and family of 2 large companies who purchased access to Truven Treatment Cost Calculator	70,408 families	Commercial (Truven via employer insurance access)	Lab tests Imaging Other[5]	<u>Patients</u> Usage	Effect
Kaplan & Mills 2016	US (CA)	Cross-sectional	Patients who requested quote from plastic surgeon in San Francisco	208 prospective patients	Other (physician's own website)	Other (plastic surgery)	<u>Patients</u> Selection	Effect
Desai et al. 2016	US	Quasi-experimental (controlled before-after)	Employees and dependents of 2 large companies (1 national employer, 1 western US)	148,655 enrolled employees	Commercial (Truven via employer insurance access)	Other[6]	<u>Patients</u> Cost Selection Usage	 No effect No effect Effect
Sinaiko, Joynt, & Rosenthal 2016	US	Quasi-experimental (before-after without control group)	Adult (19-64) Aetna enrollees in the US who received at least one of the selected services between 2010-2012	181,563 enrollees	Insurer (Aetna)	Imaging (MRI, CT) Other[7]	<u>Patients</u> Cost Selection	 Effect (imaging, sleep studies) No effect (all other services) Effect (imaging, sleep studies) No effect (all other services)

[5] Outpatient procedures, evaluation and management services, and maternity care

[6] Outpatient services performed by physician, hospital, laboratory, imaging centre, or other clinicians such as nurse practitioners and physician assistants

[7] Carpal tunnel release, cataract removal, colonoscopy, ECG, mammogram, sleep studies, upper endoscopy

Sinaiko & Rosenthal 2016	US	Quasi-experimental (before-after without control group)	Nonelderly patients insured by Aetna in the US, 2011-2012	616,779 enrollees	Insurer (Aetna)	Lab tests Imaging (ECG, MRI, CT) Other[8] (24 services)	Patients Usage	Some effect
Whaley 2015	US	Quasi-experimental (interrupted time series without control group)	Employees and dependents from several self-insured employers who had access to the platform for varying amounts of time beginning in 2010	1,250,811 claims	Commercial (unspecified via employer insurance access)	Lab tests Imaging (advanced imaging) Office visits	Patients Cost	Effect (lab tests, imaging services) No effect (office visits)
Mehrotra, Brannen, & Sinaiko 2014	US (NH)	Cross-sectional	Visitors to NH HealthCost website with a NH IP address	15,150 visitors	State Mandatory (NH HealthCost)	Other (all services searched for by visitors e.g. imaging (MRI and CT), emergency department visits)	Patients Usage	Effect
Whaley et al. 2014	US	Quasi-experimental (before-after without control group)	Employees, spouses, and dependents from 18 national self-insured employers who purchased access	502,949 claims	Commercial (Castlight via employer insurance access)	Lab tests Imaging (advanced imaging) Office visits	Patients Cost	Effect (lab tests, imaging)

[8] Services chosen because they were amongst the most-commonly searched for services on the tool or because they were non-emergency shoppable services. Services include preventive services (colonoscopy, flu shot, and mammogram), imaging services (echocardiogram; magnetic resonance imaging [MRI] of brain with or without dye, neck without contrast, lower back without dye, and lower extremity joint without dye; and computed tomography [CT] scan of abdomen and pelvis without dye and abdomen, pelvis, and chest with dye), procedures (carpal tunnel release, cataract or lens procedures, cesarean section, inguinal herniorrhaphy [hernia repair], sleep study, tonsillectomy with or without adenoidectomy, total hip replacement, total knee replacement, upper gastrointestinal endoscopy, and vaginal delivery), and physician office visits (new patient primary care office visit, new patient gynecological visit, established patient primary care office visit, and established patient gynecological visit).

			to Castlight between 2010-2013				Usage	Some effect (office visits) Effect
Wu et al. 2014	US (NE, MW, SE Regions)	Quasi-experimental (controlled before-after)	Patients (18+ years old) enrolled in commercial Blue Cross and Blue Shield plans in the Northeast, Midwest, and Southeast regions of the US who had at least one outpatient MRI during 2010 or 2012	105,637 claims	Insurer (Blue Cross/Blue Shield)	Imaging (MRI)	<u>Patients</u> Cost Selection <u>Providers</u> Cost	 Effect Effect Effect
Tu & Lauer 2009	US (NH)	Quasi-experimental (interrupted time series without control group)	All hospitals and ASCs in the state of New Hampshire	26 hospitals, unknown number of ASCs	State Mandatory (NH HealthCost)	Imaging (MRI) Other[9]	<u>Providers</u> Cost	No effect

[9] Arthroscopic knee surgery, colonoscopy, ultrasound, ER visit

Title Page (showing Author Details)

Title: The impact of price transparency on consumer and provider behaviours: A scoping review

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