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Competitive bidding for health insurance contracts: lessons from the online HMO auctions

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Abstract Healthcare is an important social and economic component of modern society, and the effective use of information technology in this industry is critical to its success. As health insurance premiums continue to rise, competitive bidding may be useful in generating stronger price competition and lower premium costs for employers and possibly, government agencies. In this paper, we assess an endeavor by several Fortune 500 companies to reduce healthcare procurement costs for their employees by having HMOs compete in open electronic auctions. Although the auctions were successful in generating significant cost savings for the companies in the first year, i.e., 1999, they failed to replicate the success and were eventually discontinued after two more years. Over the past decade since the failed auction experiment, effective utilization of information technologies have led to significant advances in the design of complex electronic markets. Using this knowledge, and data from the auctions, we point out several shortcomings of the auction design that, we believe, led to the discontinuation of the market after three years. Based on our analysis, we propose several actionable recommendations that policy makers can use to design a sustainable electronic market for procuring health insurance.

Keywords Electronic market design · Auctions · Health insurance procurement · HMO

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Introduction

The healthcare sector is a crucial and socially challenging component of modern economies. Policy makers and healthcare leaders are faced with the dual challenges of increasing access to quality healthcare services while also limiting the rate of growth in healthcare spending. The recent passage of the Patient Protection and Affordable Care Act (PPACA) in 2010 is intended to both increase insurance coverage and slow the healthcare expenditures. Insurance coverage is projected by the Centers for Medicare and Medicaid (CMS) Office of the Actuary to be expanded by 34 million citizens by 2019.[1] This expansion is planned to be accomplished using competitive bidding of private insurers to offer a set of public insurance options that will be available with the private insurance offered to employers and individuals.[2] The Obama Administration is currently following the example of Massachusetts in setting up a brokered exchange for insurance contracts as part of comprehensive health reform strategy implemented in 2006. In addition, the use of electronic medical records and information technology (IT)-enabled systematic reforms are part of the administration's economic stimulus package of 2009.

Increasingly, IT is becoming a critical success factor in improving the quality and access of healthcare services, and also in managing the rapidly escalating costs. As healthcare organizations increasingly adopt IT across a broad range of functions and processes, information systems (IS) research can contribute to the effective development, application, and use of information technologies to manage and coordinate health services. One such avenue is the design of market mechanisms, such as electronic auctions, for the procurement of health insurance.

Auctions are a commonly used negotiation mechanism that account for an enormous volume of economic activity throughout the world. Auctions are regularly used for the exchange of products ranging from specialized mining equipment to office supplies; from flowers and livestock to antiques and artwork; and from publishing and pollution rights to stamps and wine (Klemperer 1999; Milgrom and Weber 1982; Wolfstetter 1996). There are several economic advantages of auctions over posted price trading, including more efficient allocation of resources, more transparency, and the ability to discover equilibrium prices quickly (Rothkopf and Harstad 1994). With the advent of the internet, auctions have become a popular mechanism for exchanging a wide range of goods and services. Online auctions offer several benefits over traditional auctions, including: (i) lower transaction, and participation costs, (ii) increased convenience, (iii) ability for asynchronous bidding, and (iv) greater market liquidity (Lucking-Reiley 2000).

In the context of industrial procurement, online auctions have been reported to generate cost reductions of 20–30 % for many commodities in some industries (Carbone 2003; Mayhew-Smith 2004). The cost savings have accrued through effective cost discovery and savings in negotiation and contracting costs. Consequently, today most large industrial buyers are using electronic auctions to procure a variety of goods and services from suppliers (Tunca and Wu 2009). Electronic procurement auctions deliver a number of other benefits as well, including an increase in supplier base, faster negotiations and increased transparency,

[1] https://www.cms.gov/ActuarialStudies/downloads/PPACA_2010-04-22.pdf; last accessed on January 15, 2012.

[2] http://housedocs.house.gov/energycommerce/ppacacon.pdf; last accessed on January 15, 2012.

which is especially important in government auctions (Engelbrecht-Wiggans and Katok 2006; Shugan 2005).

In 1999, the use of internet-based procurement auctions was extended to the traditional process of health benefit negotiations by the leading benefits consulting firm Hewitt Associates. Almost all large to medium health maintenance organizations (HMOs) in the United States (US) participated in online auctions intermediated by Hewitt to secure health insurance contracts for employees of Fortune 500 companies in various markets throughout the country. The auctions were motivated primarily to lower health care costs of private employers but also to accelerate the negotiation process.

In the US, about three-fifths of all Americans have employer-sponsored health insurance. The popularity of employer provided insurance in the US partly stems from the fact that employer contributions to health insurance premiums are exempt from income and payroll taxes. However, employers are concerned that increasing premiums for health insurance can erode their profitability as do rising energy costs and broader economic trends.[3] When the HMO online auctions were conceived, the employers were experiencing steep health care cost increases, and were actively seeking new cost-management strategies. In addition, surveys by Hewitt revealed rising consumer dissatisfaction with managed care—due primarily to poor customer service but also high costs. Thus, there was significant motivation in the market to create a new process that would lower prices without sacrificing clinical quality. A secondary goal was to provide participating health plans with accurate and consistent market data so that they had a better sense of their competition.

The auctions were piloted in 1999, when more than 50 health plans (*sellers*) competed over several weeks for the business of three employers—IBM, Morgan Stanley, and Ikon Office Solutions (*buyers*)—in 14 markets across US. The overall reduction in annual rates ranged from 2 to 8 %, which translated into a combined savings of $1.1 million for the three participating employers.[4] This reduction occurred in an environment where annual increases in health insurance contract paid by employers were at 4–6 % above the general rate of inflation. Furthermore, the rate negotiation time was reduced from five weeks to only one week. Following this successful pilot study, the auctions were launched nationwide in July 2000. That year, more than 100 health plans and nine employers representing over 60,000 employees participated in the online auctions. However, the following year, only four of those nine employers returned to the market. The auctions in 2001 failed to generate appreciable cost savings for the employers, and were subsequently discontinued. A market that showed immense promise in its first year could be only sustained for two more years. Based on an examination of the recent advances in electronic market design and analysis of the data from the failed auctions, we believe the fault lay in the design and implementation of the market.

Competitive bidding can result in large cost reductions without sacrificing quality but it needs to be done right. For instance, while the spectrum auctions used by the Federal Communications Commission (FCC) to allocate electromagnetic spectra in US have been one of the biggest success stories of market design, similar allocations in other countries such as New Zealand and India have met with failure, primarily due to poor design choices. Over the past ten years since the failed HMO auction experiment, the theory on designing economic mechanisms has significantly advanced as the use of auctions has proliferated in public and private enterprises. Compared to a decade ago, when complex auction mechanisms were still in their infancy, now we have a much better understanding of the effects of even seemingly

[3] CEO Economic Survey (December 2004) released by Business Roundtable (www.businessroundtable.org).

[4] Business Wire article titled "Hewitt's HMO Internet Auction Saves Millions in Health Care Costs for Participating Companies," September 20, 2000.

trivial design choices (e.g., duration, ending rule, reserve price etc.) on the dynamics and outcomes of auctions. In fact, such studies have received considerable attention in the IS literature in recent years (Adomavicius et al. 2012b; Bapna et al. 2008; Dellarocas and Wood 2008; Easley et al. 2010-11; Greenwald et al. 2010; Strecker 2010).

In this paper, our goal is to exploit the advances in electronic market design to identify the design flaws in the HMO online auctions and suggest ways to address those flaws. To do so, we have acquired the policy documents, auction website files as well as the complete dataset of the auctions for the three years (1999–2001) from Hewitt Associates. This study is motivated by the need to develop sustainable mechanisms for reducing health care costs borne by firms without sacrificing quality. As employee health insurance premiums continue to soar, the rising employee costs are prompting employers to reduce benefits, change health care providers, and move to high deductible, consumer-driven health plans. Following the advances in electronic market design, complex online auctions such as the procurement of health insurance contracts can be designed to achieve the dual objectives of low cost and high quality with little implementation risk. Since open procurement auctions are relatively unknown in the healthcare industry, our study can provide insights on designing a health insurance market that is sustainable, unlike the HMO online auctions run by Hewitt. We can learn valuable lessons from the mistakes, so that they are not repeated.

The study is also motivated by the fact that the employers that participated in these online auctions were all Fortune 500 companies.[5] Maxwell and Temin (2002) note that, understanding healthcare purchasing among Fortune 500 firms is important because these organizations are central to the nation's economy, and they provide coverage for more than twenty million employees and tens of millions more dependents and retirees. The companies provide influential models that other purchasers of healthcare can emulate. Small and medium-size employers, as well as public purchasers, have already adopted some of the methods introduced by their larger counterparts. Finally, through their innovative purchasing practices, large companies can drive downstream reform in the entire healthcare system (Maxwell et al. 2001).

Background of procurement auctions

Keeping pace with the advances in IT, the procurement function in companies has undergone much transformation over the past decade. Decentralized, factored purchasing processes have been replaced with uniform, centralized purchasing, with worldwide procurement decisions being centrally coordinated by firms (Engelbrecht-Wiggans and Katok 2006). The proliferation of the internet has also reshaped the procurement processes both within and between organizations. The creation of electronic marketplaces, or exchanges has resulted in market liquidity and reduction in transaction costs. Market liquidity, in this context, results from the power of the internet to bring together a critical mass of buyers and sellers who can communicate in real-time.

[5] The employers participating in this study were self-insured employers. This is the dominant form of insurance in the United States. Recent estimates from the Employer Health Benefits Annual Survey conducted by the Kaiser Family Foundation suggest that 60% of covered workers are in self-insured plans. For the firms in the study, the premiums bid where the actuarial price equivalent of premiums for the plans. However, the employer only used those premium bids for identifying the provider reimbursement rates necessary to make the premium bid fit actual expenditure experience as best as possible.

An important transformation in the procurement process that has taken place over the past decade has been the use of auctions to automate the negotiations between the buyers and the suppliers. When executed properly, auctions demonstrated that they can help buyers procure more efficiently and can produce considerable cost savings (Elmaghraby 2007). Not surprisingly, in 2006, based on a survey of almost 200 companies, the center for strategic supply research reported that over 60 % of the companies regularly use online procurement auctions. Such auctions have been used to procure billions of dollars worth of parts and services in the public and private sectors (Jap 2007).

Jap (2002) suggests three reasons for the popularity of the online procurement auctions. First, these auctions result in cost savings for the buyer of the magnitude of 5–40 %, and typically around 15 %. Since major manufacturing firms procure billions of dollars of goods annually, a 15 % cost saving can result in a large amount of monetary benefit. Further, the online auctions are also generally cheaper and easier for buyers and auction providers to organize than manual auctions. Secondly, auctions create process efficiencies by automating the whole negotiation process. With traditional processes, firms usually spent six weeks from the creation of a request for proposal (RFP) to the receipt of bids from suppliers. With the advent of the internet-based auctions, this process could be sped up to a few hours. Rapid and efficient forms of communication enabled by IT allow buyers to invite more suppliers to auctions events and also require less time to notify these suppliers of rules of interaction. Finally, the emergence of technologies to enable these auctions allowed firms (e.g., Ariba, Emptoris, Oracle, Perfect Commerce) to offer procurement auctions as part of their sourcing solutions or software. Thus, participating suppliers could place bids without any temporal or geographic constraints, i.e., they could submit bids anytime from anywhere.

The auctions used for procurement are typically referred to as *reverse* auctions because, in these auctions, sellers submit bids to obtain contracts from buyers. For the rest of the paper, we use the terms sellers, suppliers, and bidders interchangeably in the context of procurement auctions.

During the early 1990s, reverse auctions were predominantly price-only events (Elmaghraby 2007). While price-based auctions were appropriate for commodity type products, procurement for complex products and systems (such as health insurance, advanced weaponry etc.) required consideration of attributes in addition to price. Over the past decade, auctions have expanded to account for the non-price attributes of products as well. Some of the attributes considered by industrial firms while selecting suppliers are quality, delivery time, reputation of the supplier and worldwide supply capability, in addition to price (Narasimhan et al. 2008).

Although online reverse auctions are not common in the healthcare industry, there have been a few initiatives to implement competitive bidding to increase efficiency and reduce costs. For example, to bring the sky-rocketing Medicare costs under control, Congress passed the 1997 Balanced Budget Act authorizing the investigation of competitive bidding as a means of selecting Medicare providers. Following this congressional push, CMS ran pilot auctions in two cities in 1999 and then again in 2002. The pilot runs revealed serious problems in design (see Katzman and McGeary 2008 for details), which led CMS to make changes to the rules before introducing them again in nine cities in 2008. But the auctions had to be cancelled again due to complaints about unfair qualification procedures and unsustainably low prices. After further changes, the auctions were reintroduced in November 2009; however, Cramton and Katzman (2008) have pointed out several fatal flaws in the mechanism that may prevent it from generating competitive market prices and high service quality. The Medicare auctions case emphasizes the significance of making the right design choices in complex auctions in

order to ensure that the intended objectives (e.g., high participation, lower costs, efficient allocation) are met, motivating our current study.

Designing procurement auctions

In designing procurement auctions buyers face many strategic choices, which should be effectively managed in order to ensure the best possible outcome.

The implications of several design choices, including winner determination (Engelbrecht-Wiggans et al. 2007), information feedback (Adomavicius et al. 2012a; Jap 2003; Strecker 2010), ending rules (Brown and Morgan 2009; Roth and Ockenfels 2002), minimum bid increments (Bapna et al. 2003a,b; Easley and Tenerio 2004; Kwasnica and Katok 2007), shipping costs and reserve prices (Hossain and Morgan 2006), auction duration (Mithas and Jones 2007), and reputation systems (Dellarocas and Wood 2008; Rice 2012) have been thoroughly examined in the literature.

Following a thorough examination of the online auctions conducted by Hewitt (described in detail in "Description of the HMO internet-based auctions" section), we believe that the two major design flaws lay in the nature of *information feedback* and the procedure for *winner determination*. Information feedback refers to the extent and nature of information revealed to the bidders during an auction, and has been shown to have significant influence on auction outcomes (Adomavicius et al. 2012a,b; Arora et al. 2007; Chen-Ritzo et al. 2005; Elmaghraby 2007; Elmaghraby et al. 2012; Greenwald et al. 2010; Jap 2003; Mithas and Jones 2007; Strecker 2010). Information revelation policies affect not only buyer surplus but also supplier participation and long term buyer-supplier relationships. Winner determination refers to the rules for determining winners in an auction, and have been shown to have profound impact on the cost savings achieved in the auction and the extent to which the mechanism is considered fair (Engelbrecht-Wiggans et al. 2007; Haruvy and Katok 2012; Haruvy et al. 2008; Jap 2002, 2007; Millet et al. 2004). Unlike in consumer auctions, in procurement auctions non-price attributes such as product quality, supplier responsiveness etc. play a major role in the buyer's decision making. Thus the process of winner determination is more complex and many variations exist.

In the following two subsections, we provide a detailed review of these two topics—information feedback and winner determination—with the goal of identifying the critical elements that affect auction outcomes. Our focus will be only on the elements that are relevant in the context of the HMO online procurement auctions.

Information feedback

Information feedback in auctions can range from full price visibility, where all bids are disclosed to all bidders, to no price visibility, where winners are determined based on a single bid submitted by each bidder that is not disclosed to the other competitors. Auctions with full price visibility are a form of *open-bid* auction, where a supplier can observe other bids, and submit new bids in real time. A significant difference between manual open auctions and online open auctions is that the identity of suppliers in online auctions is typically anonymous (Jap 2002), i.e., the identity of the supplier corresponding to each bid is not revealed to other suppliers. Auctions with zero price visibility are a form of *sealed-bid* auctions, where a bid submitted by a supplier is not available for viewing by the other suppliers participating in the auction. The buyer makes a decision after bids have been received from all the suppliers.

Many variations between these two extreme cases exist. For example, some sealed auctions proceed in discrete rounds, where the buyer receives all the bids placed in a round and then offers the suppliers a chance to revise their bids. Variations of the open bid format include revelation of only the lowest bid or the rank of the bidder with respect to the other bidders participating in the auction.

A significant body of literature has studied the impact of information feedback schemes on buyer surplus. The results indicate that when bidders have *common values*, the open-bid format produces greater cost savings for the buyer (Milgrom and Weber 1982). Jap (2003) suggests that the characteristics of industrial auctions make them the common value type since each contract has a true value that may be estimated differently by different bidders. Open-bid common value auctions generate lower prices because the iterative nature of the auctions allow bidders to revise their reservation price. Even when costs are correlated across suppliers, open-bid auctions are known to outperform sealed-bid auctions (Cramton 1998). Further, with the advances in IT and especially the proliferation of the internet, running online open-bid procurement auctions have become reasonably simple. As a result, most industrial procurement auctions are open-bid and not sealed-bid.

An important design choice in open-bid auctions is the extent of price visibility, i.e., the amount of information regarding the competitor's bids that is disclosed to each bidder. Full-price visibility, where every bidder can see every other bid placed in the auction (although typically not the identity of the bidder associated with a bid), has several drawbacks: (i) Bidders can use the transparent format to signal to other bidders, leading to collusion, (ii) Bidders may not bid as low as their private valuations if they observe that most bids are high, and (iii) The format is detrimental to buyer-supplier long term relationships as suppliers view the format as stressful (Jap 2007) and opportunistic (Carter and Stevens 2007) as it reveals their cost information to their competitors. As a result, partial price visibility has become a "popular intermediate option" (Jap 2007, p. 148) between full price visibility and no price visibility.

Partial price visibility consists of feedback regarding the competition without the complete disclosure of all bids. Such feedback can include information on the current lowest bid or the current rank of a supplier's bid. Carter et al. (2004) suggest that, rank feedback generates more aggressive bidding particularly from second or third place bidders. In contrast, with full disclosure, if the initial bid is sufficiently low, further competition may be dampened. Further, rank feedback generates competition even with a small number of suppliers. Another partial feedback scheme often used in procurement auctions is the disclosure of only the lowest bid. Based on empirical observations of over 14,000 online procurement auctions, Millet et al. (2004) found that revealing both the lowest bid and the rank can yield greater cost savings for the buyer than revealing either the lowest bid or the rank.

Aside from the benefits accrued to the buyer, suppliers also prefer partial feedback as it allows them to maintain a level of confidentiality around their prices. When suppliers are sensitive to disclosure of their cost information, partial feedback might be the only way to obtain adequate supplier participation. As stated earlier, suppliers are often wary about revealing their cost information to their competitors and "may not participate in auctions that do not adequately respect this concern" (Elmaghraby 2007, p. 416). Jap (2007) shows that partial feedback schemes are better for preserving buyer-supplier relationship than full feedback schemes. Due to its numerous advantages over full-disclosure schemes, the popularity of partial feedback is increasing and its use has surpassed the use of full disclosure feedback (Elmaghraby 2007).

Winner determination

A key aspect of reverse auction design is the rules to determine the auction winner. Jap (2007) classifies the rules into two groups: (i) auction-determined and (ii) buyer-determined. In an auction-determined mechanism, the bidder with the lowest bid is awarded the contract whereas in buyer-determined auctions, the buyer decides the winner based on the final bids as well as other information about the suppliers. Auctions with buyer-determined rules are also called nonbinding auctions while those with auction-determined rules are referred to as price-based or binding auctions. Binding auctions are typically used for commodity like products that are fairly comparable, with price being the primary decision variable for procurement. On the other hand, nonbinding auctions are used when, apart from the price of the product, its non-price attributes, such as quality, delivery time, supplier reputation, past performance etc. are also important to the buyer. Using an exploratory survey of buying organizations, Jap (2002) reports that the vast majority of online procurement mechanisms use the buyer-determined approach, where the auctions are price-based but the buyer reserves the right to select a winner on any basis at the end of the auction. Consequently, in some cases, suppliers do not have a clear understanding of how competitive their final offer was or in case they lost, why they failed to secure the purchase contract. There is usually little feedback as to how the contract was eventually allotted.

Such ambiguity around the allocation of resources can promote strategic bidding behavior that undermines the value of the auction to the buyer. Katok and Wambach (2012) show, through analytical modeling and laboratory experiments, that when bidders are uncertain about the criteria for winner determination, buyer-determined auctions can lead to collusions among suppliers, resulting in higher prices for the buyer. The central idea is that, since the suppliers have no clear indication on how the buyer is going to make the final decision, they will place a high bid and stick to it. No bidder will have a reason to lower her price because she will be no more certain of winning the auction at a lower price as she will be at the current price. In contrast, in a price-based open-bid auction, all bidders, other than the one who is offering the lowest price, have an incentive to reduce the ask-price in order to secure the contract.

The phenomenon of collusion in different types of auction formats, including procurement auctions have been extensively studied in the literature (see for example, Bajari and Ye 2003; Graham and Marshall 1987; Pesendorfer 2000). Bajari and Summers (2002, p. 1) define collusion as "an agreement among a group of firms, called a cartel, designed to limit competition among the participants". Although detecting cartel activity is difficult in practice, several researchers have demonstrated its existence in specific auction formats. For example, Porter and Zona (1993) detected collusion in Long Island highway construction auction using a test they devised based on the rank distribution of cartel and non-cartel bids. Baldwin et al. (1997) developed structural models for collusive and competitive behavior in the context of forest timber sales, and found the collusive model to be a better fit than the competitive one. Bajari and Ye (2003) developed a general test that is based on the deviation of the actual bidding behavior from the theoretically predicted competitive bidding behavior. An important assumption of these studies is that the auction winner is predetermined by the cartel along with an agreement to divide the profits among the bidders.

The possibility of collusion in nonbinding auctions, however, stems from the rules of the auction rather than the presence of cartels. That is, in case of buyer-determined auctions where the selection criteria is not clearly articulated, collusion is endogenously generated as a strategic behavior. Rational bidders have no incentive to lower their bids because they are

not sure whether lowering the prices will improve their chances of winning the contract. As a result tacit collusion emerges as the equilibrium behavior.

One plausible option to circumvent the problem of buyer-determined auctions, while also accounting for the non-financial attributes of the product, is to conduct *multiattribute* auctions, which allow multiple dimensions of the product to be simultaneously negotiated (see for example, Bichler 2000; Chen-Ritzo et al. 2005). Also known as multidimensional auctions, these are binding auctions, where the relevant attributes of the product (e.g., price, quality, delivery time) are assigned weights to compute a score, which is then used to compare the bids. Among the non-price attributes, some are endogenous (i.e., bidder controllable), such as lead time and quality, while some are exogenous, such as a bidder's reputation at the time of the auction. Multiattribute auctions have been shown to result in better allocative efficiency compared to the negotiation of each dimension separately (Bichler 2000; Chen-Ritzo et al. 2005). Although it is often difficult to quantify qualitative attributes, electricity reserve supply auctions (Wilson 2002), highway construction works in US (Herbsman et al. 1995), and Department of Defense contracts (Che 1993) allow multidimensional bidding. In these auctions, the approach taken to evaluate multidimensional bids is to assign weights to all the attributes—price as well as non-price—to compute a value score for the buyer. The score reflects the utility derived by the buyer from the bid. Bidders compete to improve this score (as they do with prices in price-only auctions) by modifying one or more of the bid-attributes.

Engelbrecht-Wiggans et al. (2007) compare the two commonly used procurement formats—auction-determined and buyer-determined—in contexts where the buyer derives value from some exogenous non-price attributes of the suppliers. They find that the buyer-determined auctions result in higher bids and lower cost savings for the buyers relative to the multiattribute price-determined format. However, they suggest that, in auctions with many bidders the flexibility that buyer-determined auctions affords a buyer in picking a supplier other than the lowest-bid one may more than compensate for the lower surplus. Based on their analysis, they recommend the use of multiattribute auctions in markets with few bidders. Katok and Wambach (2012) report that few organizations, such as NegoMatrix and TWS Partners, have started moving from nonbinding auctions to binding auctions only.

The use of partial revelation schemes have been considered in the literature for multiattribute auctions as well (Adomavicius et al. 2012b; Chen-Ritzo et al. 2005; Koppius and van Heck 2003; Strecker 2010). Although the suppliers' ranks based on the utility score and/or the lowest score could still be provided as feedback as in the case of price-only auctions, Adomavicius et al. (2012b) and Chen-Ritzo et al. (2005) have argued that such feedback may not be sufficient for the bidders to formulate effective bids in a complex multidimensional setting. Thus, both Adomavicius et al. (2012b) and Chen-Ritzo et al. (2005) have developed and experimentally tested several partial feedback schemes aimed at assisting bidders in optimally improving their bids along multiple dimensions. The schemes consist of marginal values of the price and non-price attributes that can enable lower ranked suppliers to optimally improve their ranks at any given state of the auction. The schemes serve the dual purpose of preserving the cost information of the individual suppliers and assisting them in a formulating complex multiattribute bids.

Description of the HMO internet-based auctions

In March 1999, Hewitt Associates LLC, a Chicago-based global management consulting and employee benefits delivery firm, introduced a market for health insurance, where health plans

competed directly against each other for securing health insurance contracts from corporate clients. The three primary stakeholders in these auctions were: (i) Employers (e.g., IBM, Morgan Stanley), who were the buyers, (ii) Health Plans (e.g., Humana, Kaiser), who were the sellers, and (iii) Hewitt Associates, who hosted the auctions and also played the role of benefits negotiator.

The purpose of the auctions was to stimulate more direct competition among plans, without sacrificing clinical quality, in a fair and dynamic environment. The goal was to help the buying firms by: (i) screening auction participants based on employer specified criteria, (ii) saving money through real-time negotiations, and (iii) offering employees the best health care option for the best cost; and the health plans by: (a) simplifying the negotiation process, and (b) attracting more clients. Through the intermediation of Hewitt, the auctions allowed the employers to select only high-performing health plans in terms of clinical quality, administrative effectiveness ratings, and employee satisfaction. Interested providers were pre-screened by Hewitt, with only the health plans that met certain minimum standards of quality allowed to participate in the auctions. The use of the web-enabled environment allowed companies to save time and effort in negotiating with the providers online rather than over telephone or in person. The cycle time to complete the negotiation process was reduced from five weeks to one week.

The pre-auction phase consisted of the following steps: (i) Hewitt and the employers developed an RFP and sent it to the desired health plans, (ii) interested plans responded to the RFP, (iii) employers selected the plans they wanted to proceed into the auction, based on review criteria, (iv) selected plans were informed and educated regarding the auction mechanism, and (v) dates for the auctions were set and communicated to all the parties.

Each auction took place over the course of a week in a secured website administered by Hewitt. The auctions were client and market-specific, i.e., a health plan could bid in several auctions for the same employer, each meant for different markets. The markets were defined by the clients; the name of each market roughly correlated with a metropolitan statistical area. Each competing plan was asked to submit initial rates in advance of the online auction. To avoid shadow pricing concerns, plans were not allowed to increase their rates during the auction; only reductions by coverage category were allowed. Further, unlike the Medicare auctions, where bids are nonbinding, i.e., suppliers are not bound by their bids,[6] the bids in the HMO auctions were binding on the health plans.

Participating insurers were required to bid for three to four (depending on the buyer) coverage tiers: *employee*, *employee+spouse*, *employee+child(ren)*, and *employee+family*. The buying firms specified the number of tiers (either three or four) as well as the projected number of employees expected to be covered in each tier. Based on this expected demand, a *composite score*, i.e., a weighted average of the bids submitted by each provider for each of the three tiers, was calculated. Since the price quotes submitted by the bidders were required to be per-employee per-month (PMPP), the composite score was referred to as the *cost-per-employee*. A potential problem with using a composite score to evaluate bids is that it creates strong incentives for *bid skewing*, a phenomenon wherein bidders distort their bids away from their costs (Athey and Levin 2001). That is, plans may bid lower on tiers where the buyer has overestimated demand and higher on tiers where the buyer has underestimated demand, resulting in prices for individual tiers that may not align with costs. To mitigate this problem, Hewitt Associates reserved the right to "re-slope the tiers" (i.e., modify the weights of the individual tiers that resulted in the composite score) for pricing purposes if a health

[6] Cramton and Katzman (2008) identify the nonbinding nature of the bids in Medicare auctions as a fatal flaw of the market design.

plan submitted a bid that displayed an inappropriate (in the opinion of Hewitt Associates) relation of prices in tiers, e.g., a price of $100 for *employee+family* and $600 for *employee*.

Non-price attributes of the product

As stated above, the objective of the auctions was to reduce costs without sacrificing quality. As a result, the participating health plans were evaluated on a number of quality related attributes, explained below:

(i) *Plan Performance Score.* A quality score calculated by Hewitt for each plan through the previous year's Hewitt Health Value Initiative™ (HHVI). The score was a single number—a composite for clinical quality, administrative effectiveness, and organizational stability. Parameters included healthcare effectiveness data and information set (HEDIS)[7] prevention performance (e.g., immunization, mammogram rates), member services (e.g., telephone response and claim turnaround times), quality improvement programs, medical loss ratio etc. According to Hewitt's records, the national average for HMOs in year 2000 was 243.

(ii) *Satisfaction score* an overall satisfaction measure developed by Hewitt based on HHVI satisfaction survey. The survey used 750,000 employees from 44 employers to determine, for each plan, whether the enrollees were satisfied with their health plans. Employee satisfaction scores were expressed as a percentage of the employees who were satisfied with their coverage.

(iii) *Significant plan design variations* additional benefits—such as disease management for chronic conditions or maintenance of personal health records—offered by the health plans.

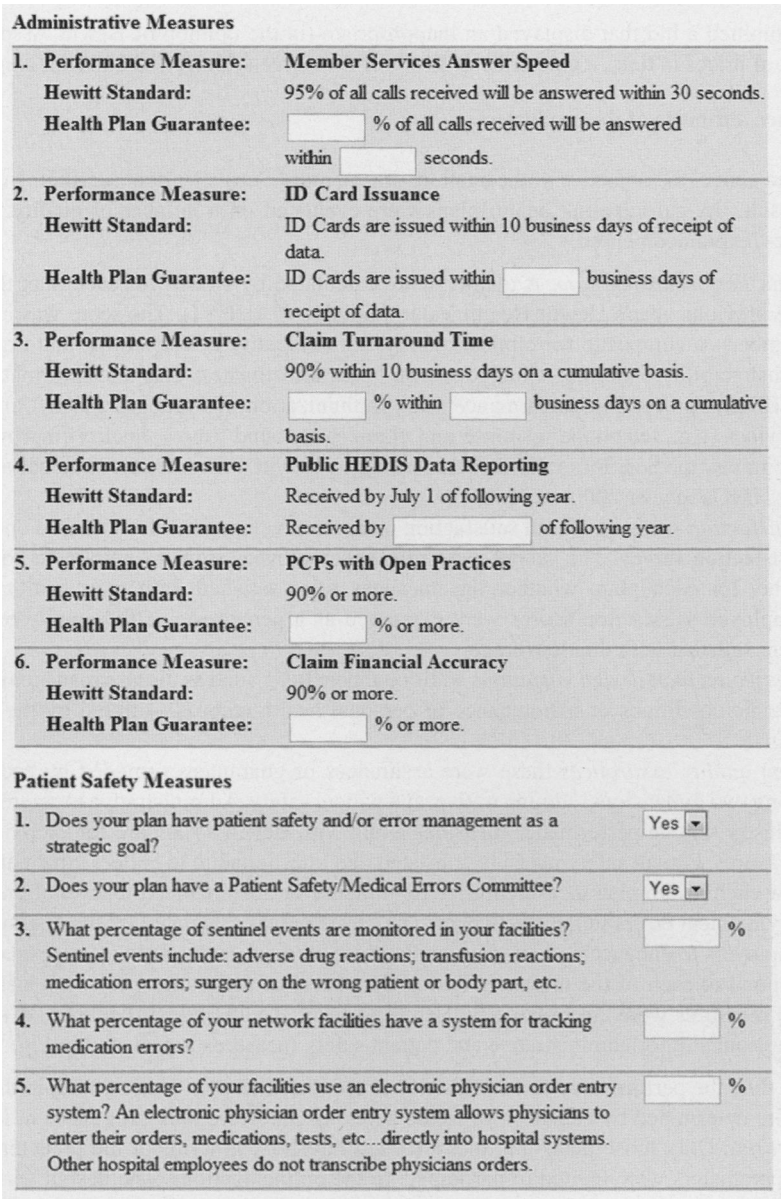
(iv) *Plan quality assurances* these were assurances or guarantees provided by each plan along two dimensions: administrative, and patient safety. Administrative measures were industry service performance measures along with Hewitt's standard for each of those measures. Patient safety measure consisted of a questionnaire to collect information on how each health plan measured, tried to influence or documented the level of unnecessary medical errors in their networks. The measure was motivated by the goal of large employers to enhance patient safety and reduce medical errors. Plans were expected to respond to each of the measures during the course of the auction. In some instances, the measures were customized by Hewitt to meet specific client demands. A sample questionnaire for administrative and patient safety measures is provided in Fig. 1.

Note that, the performance and satisfaction scores for each plan participating in the auctions were determined by Hewitt prior to the auctions, and were thus exogenous at least in the short run. Only those plans that met a certain threshold in terms of the predetermined quality parameters were invited to participate in the online auctions. The design variations and quality assurances were entered by the plans during the auction.

Information feedback

The auctions were open-bid with full price visibility. Each participating plan could view all bids placed in the auction, although, as is customary in online procurement auctions, the identity of the companies corresponding to the bids were not disclosed. Along with the bids

[7] The HEDIS is a widely used set of performance measures in the managed care industry, developed and maintained by the National Committee for Quality Assurance (NCQA). HEDIS was designed to allow consumers to compare health plan performance to other plans and to national or regional benchmarks.



Administrative Measures

1.	**Performance Measure:**	**Member Services Answer Speed**
	Hewitt Standard:	95% of all calls received will be answered within 30 seconds.
	Health Plan Guarantee:	[ ] % of all calls received will be answered within [ ] seconds.
2.	**Performance Measure:**	**ID Card Issuance**
	Hewitt Standard:	ID Cards are issued within 10 business days of receipt of data.
	Health Plan Guarantee:	ID Cards are issued within [ ] business days of receipt of data.
3.	**Performance Measure:**	**Claim Turnaround Time**
	Hewitt Standard:	90% within 10 business days on a cumulative basis.
	Health Plan Guarantee:	[ ] % within [ ] business days on a cumulative basis.
4.	**Performance Measure:**	**Public HEDIS Data Reporting**
	Hewitt Standard:	Received by July 1 of following year.
	Health Plan Guarantee:	Received by [ ] of following year.
5.	**Performance Measure:**	**PCPs with Open Practices**
	Hewitt Standard:	90% or more.
	Health Plan Guarantee:	[ ] % or more.
6.	**Performance Measure:**	**Claim Financial Accuracy**
	Hewitt Standard:	90% or more.
	Health Plan Guarantee:	[ ] % or more.

Patient Safety Measures

1.	Does your plan have patient safety and/or error management as a strategic goal?	Yes
2.	Does your plan have a Patient Safety/Medical Errors Committee?	Yes
3.	What percentage of sentinel events are monitored in your facilities? Sentinel events include: adverse drug reactions; transfusion reactions; medication errors; surgery on the wrong patient or body part, etc.	[ ] %
4.	What percentage of your network facilities have a system for tracking medication errors?	[ ] %
5.	What percentage of your facilities use an electronic physician order entry system? An electronic physician order entry system allows physicians to enter their orders, medications, tests, etc...directly into hospital systems. Other hospital employees do not transcribe physicians orders.	[ ] %

Fig. 1 Sample questionnaire for plan quality assurances

on each tier, the composite cost-per-employee score was also computed and displayed. The bids were displayed in ascending order of the composite score.

For each bidder, its best offer (i.e., its lowest bid based on the composite score) was indicated on its screen using an arrow, as shown in Fig. 2. Apart from the prices, the plan performance score, the satisfaction score, and the significant plan design variations were also listed. Even if a plan had not submitted any bid during the auction, its initial rate that was submitted to Hewitt in response to the RFP was displayed. Thus, each bidder knew the exact

Auction Start Date	2000-05-01 11:00:00 (EDT)
Auction End Date	2000-05-05 19:00:00 (EDT)
Current Time	Fri May 04 13:30:30 2000 (EDT)
	This auction is open

		Current Bids							
Position	UPC	EE	EE + 1	EE + Family	Cost per Employee	Plan Perf.	Percent Satisfied	Plan Design Variations & Customer Service Offer	Date of Bid
▲	123456	$180.00	$360.00	$540.00	$369.00	361.0	89%	$5/$10 Rx Copay	2000-05-01 14:18:02
····> ●	123456	$200.00	$400.00	$600.00	$410.00	310.0	84%		2000-05-01 16:17:01
●	123456	$220.00	$440.00	$660.00	$451.00	219.0	88%	Chiropractic Rider	2000-04-29 12:44:08
■	123456	$255.00	$470.00	$705.00	$482.00	285.0	83%		2000-04-28 16:04:13

Fig. 2 A snapshot of an ongoing auction

number of participating plans in the auction. In a separate summary screen, the number of bids that had been placed in each auction the plan was participating were also displayed along with the plan's rank in those auctions (Fig. 3).

Winner determination

Bids were evaluated on the basis of their composite scores. A winning bidder was required to serve all the categories of the program. At the conclusion of the auctions, the final bids were considered by the employers in making allocation decisions but the lowest score did not guarantee a contract for the corresponding health plan, i.e., the winner determination was buyer-determined. The final price generated by the auction was one of the elements of the company's final contracting decision. Other elements were the non-financial measures discussed in "Non-price attributes of the product" section, of which the plan performance score was only used when two plans submitted identical bids. In such cases, the plan with the higher plan performance score was ranked higher. It was made clear to the participating plans that the auctions were only a supplement to the manual negotiation process and did not replace it.

Analysis of HMO internet-based auctions

Table 1 lists the number of auctions conducted, and the buyers and sellers in each of the three years that the auctions were run including the pilot year.

In all subsequent data analyses, we exclude the 14 pilot auctions conducted in 1999 because the data are not clean. Technical issues interrupted a few of the auctions during the pilot study in 1999. Further, some test bids placed by Hewitt employees to ensure that the system works properly are not distinguishable from the actual bids placed in the auctions in 1999.

As described in "Winner determination" section, the auctions were nonbinding, i.e., the winners were post-auction buyer-determined. The exogenous non-price attributes, and the specific performance levels guaranteed by the plans were evaluated along with the final prices submitted through the auction. The plans were reminded that "both tools are used to assess

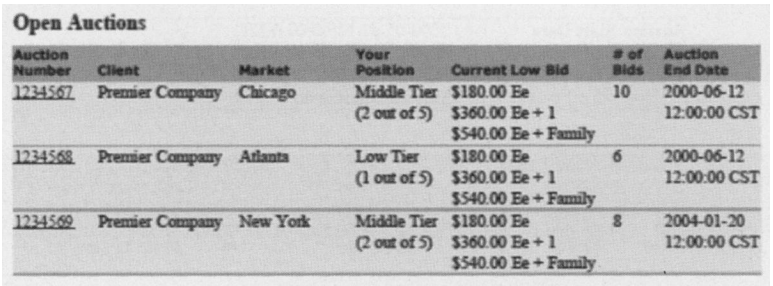


Fig. 3 A snapshot of the summary of ongoing auctions visible to each health plan

Table 1 Summary of the HMO online auctions

Year	Number of auctions conducted	Number of participating employers	Number of participating health plans	Number of potential enrollments
1999 (Pilot)	14	3	41	47,000
2000	30	9	122	61,789
2001	14	4	67	46,730

plans by reviewing a mix of qualitative and quantitative information to help guide our clients' decisions, however, they are two distinct and separate tools." In other words, the auction was a supplement to the traditional RFP and not exclusive to it.

As can be observed in Fig. 2, the exogenous quality scores (i.e., the plan performance and satisfaction scores) along with the significant plan design variations of all the participating bidders were transparent to each participant. However, the quality assurances of the competitors were not known to the plans. Even for the revealed quality attributes, the plans had no explicit knowledge on how the different attributes will be weighed in the buyer's decision making. Overall, the plans did not have a clear idea of how the winners will be chosen. Our analysis of the auction literature indicates that such a situation results in a reluctance of the bidders to revise their bids. Analyzing the bids of the 44 auctions conducted in 2000 and 2001, we find that, in over 18 % (8 of 44) of the auctions, the initial rates submitted by the plans in response to the RFP were never revised, and in two-third of the remaining auctions only a single plan revised its initial rate during the auction. That is, multiple bids were revised in only about a quarter of the auctions. The maximum number of bid revisions in any auction was four, in only one auction, where three of the five participating plans revised their bids with one plan revising its bid twice. The number of auctions with different numbers of bid revisions are shown in Fig. 4.

The data clearly supports the equilibrium behavior predicted by auction theory in cases where the weight of the quality parameters in the final decision making is ambiguous. The insurers appear to have believed that their likelihood of winning the auction would not significantly improve by improving their initial rates. Even though all of the competitors' bids were disclosed, the lower ranked bidders rarely revised their initial submitted rates, exactly as the theory predicted.

Since all the 68 health plans who participated in 2001 had also participated in 2000, we hypothesized that plans would further learn about the equilibrium strategy of tacit collusion during the first year, resulting in even higher bids in 2001. We found eight instances of

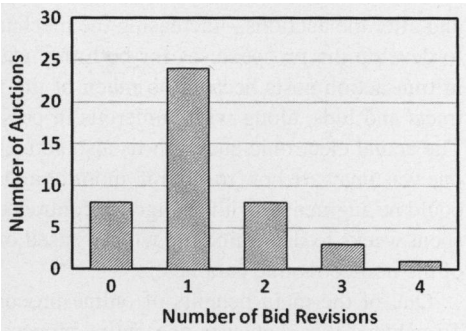


Fig. 4 Number of auctions with certain number of bid revisions

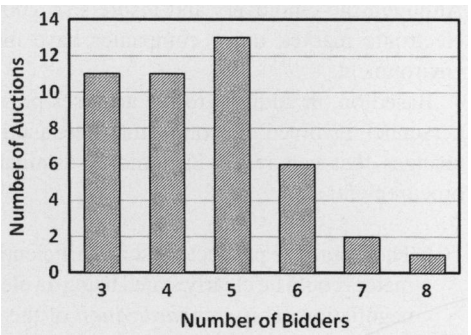


Fig. 5 Number of auctions with certain number of bidders

auctions that were conducted in both the years, i.e., auctions for the same employer and for the same market. The average winning price for these equivalent auctions was 7.4 % higher in 2001 than in 2000 when the average rate of inflation in 2001 was only 2.83 % according to the Bureau of Labor Statistics. Even considering the 7 % average rate of growth of health care costs at that time, six out of these eight auctions, exceeded that. Not surprisingly, the auctions did not generate as much cost savings for the employers as was expected, leading to their demise after 2001.

As discussed in "Winner determination" section, multiattribute auctions, which extends the traditional auction setting to allow bids over price as well as non price attributes, offer a plausible alternative to buyer-determined auctions.

Engelbrecht-Wiggans et al. (2007) have shown—through theoretical analysis and laboratory experiments—that, multiattribute binding auctions can generate greater cost savings for the buyer compared to nonbinding auctions, especially when the number of suppliers participating in the auctions is low. As shown in Fig. 5, 50 % (22 of 44) of the HMO auctions were conducted with only three or four prequalified bidders, and nearly 80 % (35 of 44) with five or fewer bidders. This makes the multiattribute auction mechanism a strong candidate for use in HMO online auctions.

Discussion and recommendations

Our analysis of the auctions reveals that, while the nonbinding nature of the HMO auctions offered more flexibility to the buyers, it also contributed to its failure by discouraging competitive bidding, leading to lower than expected cost savings for the employers. Furthermore, the format added to the transaction cost borne by Hewitt and the buyers—before, during

and after the auctions—increasing the mechanism's unsustainability. It took Hewitt months to develop the prospectuses for both the insurers and the employers with no true savings in transaction costs because so much of the work remained as an exchange of paper contracts and bids, along with numerous in person meetings, conference calls and site visits. The actual electronic auction was also actively monitored by Hewitt staff to insure that no one was unaware how to submit, monitor and revise their bids. Further, the bids themselves could be augmented with changes in contracts after the bidding was concluded. Finally, they spent weeks to determine the winner based on the results of the auction and the evaluation of the non-economic parameters.

One of the main benefits of online procurement auctions is reduced transaction costs. To achieve that, however, the entire process needs be allowed to proceed electronically. Although the employers and insurers of 2000 and 2001 were not ready for a completely electronic market, today companies have moved to a much more electronic transaction environment.

Based on, in addition to the analyses presented so far, our discussions with the Hewitt personnel involved in conducting the auctions, we propose the following five design changes that can result in a more sustainable market mechanism for health insurance procurement:

(i) The insurance product must be sufficiently converted into a commodity so that its parameters could be clearly stated using an electronic interface without any paper or personal negotiation. This *standardization* of the elements of insurance benefits design (e.g., a deductible not greater than $5,000 for a family contract) would greatly reduce the transaction cost experienced by Hewitt and enable a more sustainable model. The advances in IT since the HMO auctions were last conducted allows for such automation, as has been demonstrated in the high profile FCC spectrum auctions (see Milgrom 2008 for details).

(ii) Insurers offering additional benefits such as disease management for chronic conditions or personal health records should provide separate al a carte prices for easily identifiable standard products that are complementary to basic medical and pharmacy insurance coverage. This would allow greater transparency of pricing differences and most likely invite greater competition because insurers with comparative advantage in niche health insurance markets could compete over small points of distinction without unnecessarily inflating or deflating their total bid to cover interesting add-ons or respond to cut-throat *black-box* pricing of total insurance package by other insurers.

(iii) Insurers should be asked to submit the plan quality assurances prior to the auctions—not during. This would enable buyers to assign a score to the guarantees provided by the plans in the same way that they assigned plan performance and satisfaction scores. Further, the guarantees submitted prior to the auctions could be included in the qualifying criteria (along with the past performance scores) for auction participation.

(iv) The brokered prices must be allowed to remain the final price paid. The plan performance, satisfaction, and plan assurances scores should be integrated with the composite score of the rate quotes (i.e., the cost-per-employee) to develop a utility function, which would generate a score for each bid. The bids should then be evaluated based on this score and not just the ask price. While it is challenging to quantify the subjective quality attributes, Hewitt already calculated the plan performance score based on several quality related attributes.

(v) Full disclosure of all the bids should be avoided in order to develop a sufficiently competitive and sustainable mechanism. Given the relatively small number of potential

Table 2 Summary of the analyses and recommendations

Design parameter	Theoretical insight	Design choices made in the HMO online auctions	Recommendations
Winner determination	In buyer-determined auctions that do not clearly articulate the selection criteria, tacit collusion may emerge as the equilibrium behavior. Binding multiattribute auctions can lead to greater competition and higher allocative efficiencies compared to separate negotiations of each attribute.	Winners were post-auction buyer-determined using the final price in the auction as well as the non-price attributes. How the different attributes would be weighed in the buyer's decision making were not explicitly indicated to the sellers.	1. Standardize the elements of benefits design. 2. Require sellers (i.e., insurers) to submit the plan quality assurances prior to the auctions. 3. Require the buyers (i.e., employers) to quantify the quality parameters and then compute scoring functions using both price and non-price attributes of the product. 4. Conduct binding auctions based on the utility score.
Information feedback	Full disclosure of bids may hinder bidder participation and hurt competition. Partial feedback schemes protect supplier interests, while also assisting bidders in bid revision.	Auctions were open-bid with full price visibility, i.e., participants could view bids of other suppliers.	1. Avoid full disclosure of bids and utility scores. Disclose only the ranking of suppliers based on the utility scores. In addition, provide marginal feedback on all the negotiable attributes to facilitate bid revisions.

bidders in each auction, only the rank based on utility score should be revealed to each supplier. Further, the buyers should not disclose their exact scoring functions to the suppliers, rather, they should provide marginal feedback on all the negotiable attributes to assist bid revision (Table 2).

Conclusions

The United States has the highest per capita spending on healthcare compared to other industrialized nations, with the total healthcare expenditures nearing two trillion dollars per year. With an aging population and soaring costs, healthcare has become one of the most important and controversial social issues in the US. The information-intensive nature of the healthcare industry and the perception of IT as a key enabler of costs reduction as well as quality improvements have led to increased use and experiments with IT-based innovations. These activities offer interesting research opportunities to IS researchers. A case in point

is the open online auctions conducted by Hewitt over a period of three years where health plans across US competed to secure health insurance contracts from Fortune 500 companies. While this was an innovative venture that initially generated cost savings for the employers, the design of the mechanism had several fatal flaws that led to its discontinuation.

Ten years after the use of this auction, the advances in electronic market design, coupled with the changes in healthcare industry landscape motivated us to consider this auction mechanism again. Further, the cost of health insurance for Americans continue to soar. A new study by the Kaiser Family Foundation, a nonprofit research group that tracks employer-sponsored health insurance on a yearly basis, shows that the average annual premium for family coverage through an employer increased by 9% in 2011 over the previous year.[8] Well-designed procurement auctions can play an important role in fostering a competitive insurance industry. Apart from direct cost savings, buyers and sellers can both benefit through accelerated transaction time. By 2014, health insurance reform as prescribed by 2010 PPACA legislation will create a multi-state as well as a federal insurance exchange to enable expanded insurance coverage. The states as well as the federal government will likely use a competitive bidding process for the provision of private and public insurance contracts. Our study provided valuable insights on possible enhancements to the design of—the product as well as the auction mechanism—that can lead to a more sustainable market for private health insurance. We see no reason why these results could not be used for public insurance bidding as well as for Medicaid contracts. As health insurance premiums continue to rise, online auctions may be useful in achieving the overarching goal of providing high quality affordable healthcare.

For health insurance contracts, a further reason to go electronic is to provide an interface for all US consumers to arrange their health insurance contracts, once prices are brokered by the private or public sector. In the coming years, the employers, the federal government, and the states will be engaged in renegotiating insurance contracts. A reasonable look at the future of consumer engagement is eHealthInsurance (http://www.ehealthinsurance.com), where consumers can purchase health insurance based on data they input on the internet. There are still medical records that need to be reviewed before a final premium is set, but the human interface question of how multiple insurance contracts could be displayed to consumers is addressed by that site's example. To make a more electronic process with less transaction costs will require consumers to utilize the National ID code proposed as part of future health reform to aggregate prior insurance claims for imputation in a predictive model for a customized insurance premium, given a base insurance premium negotiated through a competitive bidding process. Elements of this model are currently being used by the Netherlands and Switzerland in cooperation with private insurers operating in a federally regulated market. In both countries, the government operates a high risk insurance pool that compensates a private insurer with supplemental premium payments if a high risk consumer has chosen their plan. If this approach were applied in the US, an auction mechanism could be designed for differential premiums paid to insurer by a set of high risk categories based on age, gender, and major disease state (e.g., diabetes, heart disease and asthma).

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