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Incentives for Voluntary Disclosure of Quality Information in HMO Markets

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Abstract

This study examines incentives for voluntary disclosure of quality information by health maintenance organizations (HMOs). Economic theory predicts complete voluntary disclosure without mandatory rules. This article introduces plans' selection motives to avoid high-risk consumers as a deterrent of full unraveling; if disclosure is expected to attract high-risk members, plans have incentives to withhold information. The empirical analysis shows that while market unraveling was an important mechanism to bring disclosure, it was not complete, and plans in markets with high-risk consumers were less likely to disclose. This study suggests that market unraveling may not arise if risk selection incentives are prevalent.

Introduction

Imperfect information has long been identified in health care markets (Arrow, 1963): consumers do not have as much information about health care needs as providers do and consumers cannot easily observe quality of individual providers. As potential problems associated with imperfect information are recognized, policies that disclose relevant information have been promoted. The information disclosed often includes quality measures that would otherwise be unobservable, such as hospital mortality rates or the extent to which appropriate care is provided. Based on the expectation that provision of such information helps mitigate asymmetry in information and achieve efficient quality outcomes, information disclosure in general is desirable.[1]

Currently, disclosure programs are expanding to varied health care settings, including health insurance markets. In most markets, the main function of insurance is to protect

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[1] Dranove et al. (2003) and Werner et al. (2005) report undesirable effects of information provision.

consumers from financial risks. However, in health insurance markets, it is common that health plans provide health care services to consumers as well as insurance, and quality of health services provided by a health plan is an important feature of the plan. Disclosure of quality information in health plan markets is intended to help consumers identify the quality differences among individual health plans and make an informed choice of a plan.

While information disclosure is promoted in several settings in health care markets, there has been little discussion of whether disclosure should be mandated or voluntary. Mandatory disclosure programs were started in hospital markets in the late 1980s by the Health Care Financing Administration (currently the Centers for Medicare and Medicaid Services [CMS]). Most disclosure programs implemented by regulatory bodies have been mandatory, but a few remain voluntary.[2]

Economic theory predicts that mandatory disclosure of quality information is not necessary because market mechanisms will lead all providers except the poorest quality to voluntarily disclose if disclosure costs are negligible (Grossman, 1981; Milgrom, 1981). The main idea of this theory is that if consumers are rational and they treat undisclosed information as the worst, markets will "unravel" because providers are better off by disclosing than by remaining silent. It has also been argued that mandatory disclosure rules are not necessarily welfare improving, suggesting that government's role be confined to creating environments that facilitate voluntary disclosure (Easterbrook and Fishcel, 1984; Fishman and Hagerty, 2003). However, empirical studies that examined whether unraveling took place in markets as diverse as salad dressings and health plans reported that unraveling was not complete in either market (Mathios, 2000; Jin, 2005).

Since the welfare effects of mandatory rules are not always positive and evidence suggests that market unraveling is incomplete, any study that provides information to help guide the development of policy about disclosure is desirable. This study examines incentives for disclosure of quality information by health maintenance organizations (HMOs) using a unique data set available from a voluntary disclosure program. All the HMOs in the data set collected costly quality information; however, after collecting the data, some plans declined to disclose the information to the public. The availability of information about plans that collected but did not disclose quality data provides a novel research opportunity to examine public disclosure incentives while controlling for data collection costs. Further, the availability of quality information for nondisclosing plans allows me to directly test the unraveling effect in HMO markets and to examine how incentives for voluntary disclosure vary with the level of quality.

During the first 4 years of the voluntary program, about 75 percent of the HMOs that collected the quality data disclosed the information to the public. If all disclosers provide higher quality services than any nondiscloser, unraveling is complete in this market. However, a prior study reported that there was considerable overlap in

[2] The disclosure program for Medicare participating hospitals, "Hospital Compare," is voluntary legally; however, by imposing financial penalties for nondisclosing hospitals, the program is de facto mandatory.

quality scores between disclosers and nondisclosers, suggesting that unraveling was not fully occurring in HMO markets (Jin and Sorensen, 2006).

To explain the potential incomplete unraveling in HMO markets, I introduce plans' selection incentives. Adverse selection in insurance markets results from insurers having imperfect information about consumers' health risk, and thus, insurers seek ways to avoid high-risk members. In HMO markets where plans provide services, a plan receives a fixed premium irrespective of enrollees' actual resource use. Therefore, if releasing quality information is likely to attract high-risk consumers, some high-quality plans may not disclose (Cutler and Zeckhauser, 1997). In other cases, low-quality plans may voluntarily disclose if they expect gains from favorable selection after disclosure. While providers' selection incentives are prevalent in health care markets, it has not been extensively discussed in the information disclosure literature. Incorporating selection incentives in the model, this study investigates under what circumstances voluntary disclosure is encouraged.

In a recent study, Jin (2005) looked at incentives for HMOs to obtain accreditation from a certification agency and to release quality information to a public magazine. This earlier work is different from my study in that the reference group in Jin's study is HMOs that did not collect quality data, and thus the model for disclosure incentives identifies variables that capture disclosure costs. Additionally, by stating that HMOs use the disclosure decision itself as a differentiation strategy, Jin implicitly made two assumptions: that all disclosers offered better quality than any plan that did not collect the data and that there was not much variation in quality among disclosers. However, quality was not assessed in her study and those assumptions were not examined.

By using data that provide quality information for both disclosers and nondisclosers, I directly examine whether unraveling occurred in HMO markets and investigate incentives for disclosure while controlling for data collection costs. As quality information is available for all plans, disclosure decisions of plans are also analyzed separately by quality. Further, this study incorporates an important yet unexplored factor—selection incentives—to analyze plans' decisions on disclosure.

The rest of the article is organized as follows. The second section describes the disclosure program in HMO markets. The third section analyzes a model of plans' disclosure decisions, and the fourth section outlines empirical specifications and data sources. The fifth section presents results of the analysis, and the sixth section discusses implications of the study.

HEDIS BACKGROUND

Since the U.S. health care system experienced rapid growth of managed care plans in the late 1980s, the quality of care provided in managed care systems has been an important policy issue. While HMOs provide comprehensive health services for a fixed and relatively lower annual premium than traditional fee-for-service insurance, they brought concerns about low quality of care and limited access. This increased the attention devoted to assessing and disclosing information on the quality of care offered by managed care plans (Romano, 1993).

The demand for disclosure of quality information also came from HMOs themselves who wished to demonstrate their quality improvement efforts to the public (Jin, 2005). Although individual managed care plans had developed several approaches to quality improvement, such as disease management programs, the entire HMO industry was criticized for providing low quality of care, and thus some HMOs looked for ways to generate information and present their commitment to quality (Siren and Laffel, 1996).

Therefore, National Committee for Quality Assurance (NCQA), an independent, not-for-profit organization, took the lead by accrediting HMOs and releasing performance data about HMOs. Working with health plan representatives, quality experts, and employers, the NCQA developed a set of standardized quality measures known as the Health Plan Employer Data and Information Set (HEDIS). HEDIS encompasses several dimensions of plan quality and provides particularly rich information on clinical care indicators, which would otherwise be unobservable to consumers. HEDIS is now the most widely used tool by researchers and large purchasers to evaluate health plan quality.

The NCQA has been collecting and disseminating HEDIS data since 1996. Unlike other disclosure programs, it was initiated by a nongovernmental agency, and participation in the program remains voluntary in two ways: first, collecting HEDIS quality information and reporting it to NCQA is voluntary, and second, after submitting quality data to NCQA, disclosure of the HEDIS scores also remains voluntary. Therefore, some plans decline to publicly disclose quality information after participating in the costly data collection process. The sample for this study consists of HMOs that collected the information and submitted it to NCQA. For plans that agree to publicly disclose, HMO-specific quality scores are presented in the *Quality Compass* that NCQA publishes each year. Quality scores of nondisclosing HMOs are only used to calculate national average quality scores without being released to the public.

MODEL OF HEALTH PLANS' DISCLOSURE DECISIONS

The model to analyze health plans' disclosure decisions is developed from the general theory of profit maximization: health plans choose to disclose if the expected profit under disclosure is greater than that with nondisclosure. I first discuss the assumptions about consumers' expected quality and then examine a model of plans' disclosure decisions.

Consumers' Expected Quality

I assume that plans know the quality of their services and consumers know the true level of quality once it is revealed.[3] I also assume that without public disclosure, information to differentiate individual health plans with respect to clinical quality is

[3] Since all plans in this study collect HEDIS data and submit them to NCQA, plans are aware of their quality scores. I view the HEDIS disclosure program by NCQA as a mechanism to provide credible information to consumers and exclude any possibility of misrepresentation of quality by plans.

not available and consumers form an expectation of plan quality.[4] Consumers' beliefs prior to the date when information is disclosed are denoted as $\hat{q}_p$.

When a voluntary disclosure program is introduced, some plans release their information to the public while some remain silent. Consumers thus receive a set of messages that consist of quality scores for disclosers and the message of nondisclosure for plans that reveal no information. After receiving the messages, consumers update their beliefs about plan quality (Hirshleifer and Riley, 1979). If plans disclose, consumers observe their true level of quality (q) and replace their prior beliefs ($\hat{q}_p$) with q. For nondisclosers, consumers continue to form an expectation of quality. Observing that some plans voluntarily disseminate quality information, consumers become skeptical about nondisclosers. That is, the message of nondisclosure implies poor quality, and consumers revise their beliefs toward lower levels of quality. Let $\hat{q}$ denote the posterior belief on quality for nondisclosing plans. I assume that the updated belief is determined by exogenous factors, independent of the distribution of quality among nondisclosers.

This assumption is different from the assumption of the classic disclosure studies that consumers' updated beliefs are based on quality distribution and providers' disclosure strategy. I use this assumption for several reasons. First, since most consumers use medical care infrequently, it is not likely that consumers have a general sense of the distribution of quality, which is estimated from repetitive experience. Second, the quality measures used in the study capture the extent to which appropriate care (defined by medical experts) is provided by a health plan. This type of quality information is difficult for consumers to obtain or assess, even after using the care.[5] Further, the status of quality for those measures is hardly known even among the medical community during the study period.[6] It is very unlikely that consumers understand the concept of such quality and have good knowledge of its distribution in the market. It is thus expected that consumers rely on other sources of information to form their beliefs on quality of nondisclosers. It may not be reasonable, in health care markets, to use the assumption in the disclosure literature that consumers know the degree of the dispersion of quality, understand plans' strategic disclosure decisions, and update their beliefs accordingly.

Instead of assuming the updated belief is based on strategic disclosure process by plans, I follow Hirshleifer and Riley (1979) and view that the revised belief depends on the level of prior belief ($\hat{q}_p$) and consumers' confidence in that prior. The confidence

[4] This assumption may appear restrictive; however, it is likely to hold in health care markets where it is hard for consumers to obtain information about quality of services. Particularly, when it comes to clinical quality that is the focus of HEDIS data, consumers do not have sufficient knowledge to evaluate quality.

[5] In this sense, health care quality may be considered as a "credence good," where the consumer cannot fully evaluate quality even after consuming it and must obtain information on quality using other external sources (Darby and Karni, 1973; Abraham et al., 2006).

[6] The development of HEDIS clinical indicators (the data set of this study) in the late 1990s is an earlier effort to identify and measure this type of quality. The subsequent highly publicized reports (Institute of Medicine, 2001; McGlynn et al., 2003), which documented the nation's state of quality of care, invited wide attention to such type of quality in health care.

in the initial belief affects the extent to which consumers respond to the message of nondisclosure. With high confidence in the prior, consumers do not place much value on new information. Thus, the degree of revision of the belief will be small when new messages arrive. For the level of the prior, if consumers believe plans have offered high quality before a disclosure program, holding the strength in the prior belief constant, the revised belief will be relatively high. This study identifies external factors that influence the revised belief by determining the level and variance of prior beliefs.

Under this approach, disclosure equilibrium depends on where the revised belief lies, and this study estimates disclosure patterns by the level of the revised belief. First, following the assumption of the classic unraveling theory, I examine disclosure equilibrium when the revised belief falls to the lowest level. Second, I explore the possibility that the revised belief is above the lowest level. Thus, this approach complements the classic unraveling theory and helps us identify circumstances where complete market unraveling may not arise and where some type of interventions may be necessary to encourage information disclosure.

Health Plans' Disclosure Decisions

Let Π_D and Π_{ND} represent the HMO's expected profit with and without public disclosure, respectively. Profit is revenue minus production cost, and revenue is premium times quantity (enrollment). Assuming that the market is competitive, the demand function is independent of quantity.[7] Since plans receive a fixed premium irrespective of enrollees' actual use of resources, premium is also independent of the risk type of an enrollee. Therefore, I set premium as a function of quality only: $P = P(q)$ for disclosers, and $P = P(\hat{q})$ for nondisclosers.

Production costs of a plan depend on who enrolls because sicker people use more resources than the healthier (Fleishman et al., 2006). Cost is thus a function of health risk (s) of enrollees as well as quality (q). I assume that there are no economies of scale and average cost does not depend on enrollment (Q). The health risk (s) of enrollees in a plan in turn depends on quality because high-risk people are likely to gain greater benefits from high-quality care and seek high quality providers more than low risks (Dranove et al., 2003). For disclosers, health risk of enrollees increases with quality: $s = s(q)$, but that for nondisclosers is a function of expected quality independent of true quality: $s = s(\hat{q})$. Assuming the cost function is separable,[8] a profit function of

[7] Relaxing the competitive market assumption does not make a difference in the prediction of the model. I will discuss a model with a downward-sloping inverse demand function in the next section. I use the assumption of a competitive market because the main idea of the model can be clearly stated with this assumption and shown using a graphical presentation.

[8] With the separability assumption, I can focus on how selection incentives affect disclosure because the net gain from disclosure becomes the difference between premiums and only selection costs. It is reasonable to assume that the increase in the cost of treating a patient with given health risk does not depend on the level of plan quality. When this assumption is relaxed, the cost function is $C(q, s(q))$, and the prediction of the model holds by adding one assumption about the curvature of the cost function (see footnote 10).

disclosers is then written as

$$\Pi_{\mathrm{D}} = P(q)Q - C(q)Q - C(s(q))Q$$

and profits of nondisclosers are

$$\Pi_{\mathrm{ND}} = P(\hat{q})Q - C(q)Q - C(s(\hat{q}))Q.^{9}$$

Given the profit functions, plans will decide to disclose if

$$P(q) - C(s(q)) \geq P(\hat{q}) - C(s(\hat{q})). \tag{1.1}$$

This condition indicates that for disclosers, costs from selection increase as quality increases, which implies that full unraveling among high-quality plans may be deterred in this market. At disclosure equilibrium, the equality of the disclosure condition—Equation (1.1)—is satisfied at certain level(s) of quality, which is denoted q^*. That is,

$$P(q^*) - C(s(q^*)) = P(\hat{q}) - C(s(\hat{q})),$$

where q^* is the critical level of quality above or below which plans choose to voluntarily disclose at equilibrium.

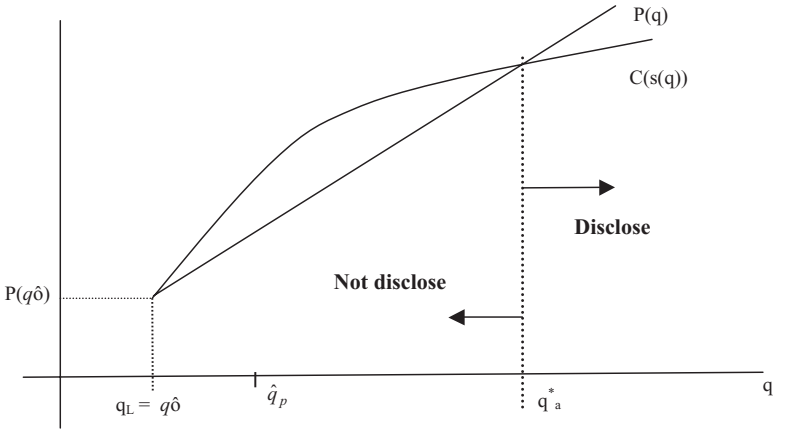
Patterns of Disclosure Equilibrium

I next examine disclosure equilibrium patterns by the level of the posterior belief ($\hat{q}$). As discussed earlier, it is assumed that the updated belief ($\hat{q}$) is determined by external factors, which are determinants of the level of prior beliefs ($\hat{q}_p$) and the confidence in that prior belief. First, I examine disclosure equilibrium when $\hat{q}$ falls to the lowest possible quality (q_{L}); i.e., consumers treat nondisclosers as providing the worst quality. This is the same as the conventional assumption used in the disclosure literature (Grossman, 1981; Milgrom, 1981; Jovanovic, 1982). Second, relaxing this assumption, I estimate disclosure patterns when $\hat{q}$ is above q_{L}. While not implausible, the assumption and the prediction of complete unraveling that follows from the assumption have not been fully supported (Mathios, 2000; Jin, 2005). Not imposing the assumption, this study identifies factors that influence the updated belief and examines how they affect plans' disclosure decisions.

Suppose that consumers' revised quality for nondisclosers degenerates to the lowest possible quality: $\hat{q} = q_L$. This will be the case if consumers strongly respond that the

[9] If there is any cost associated with generating and/or disclosing quality information, it should also be considered in the profit function: i.e., $\Pi_{\mathrm{D}} = P(q)Q - C(q)Q - C(s(q))Q - D$, where D is costs related to information acquisition or disclosure. HEDIS reporting is costly because HMOs have to collect data on many quality measures complying with instructions by NCQA, which often involve medical records review. I leave the term (D) out because it applies equally to both disclosers and nondisclosers in this study.

FIGURE 1
Disclosure Equilibrium When the Expected Quality for Nondisclosers Is q_L



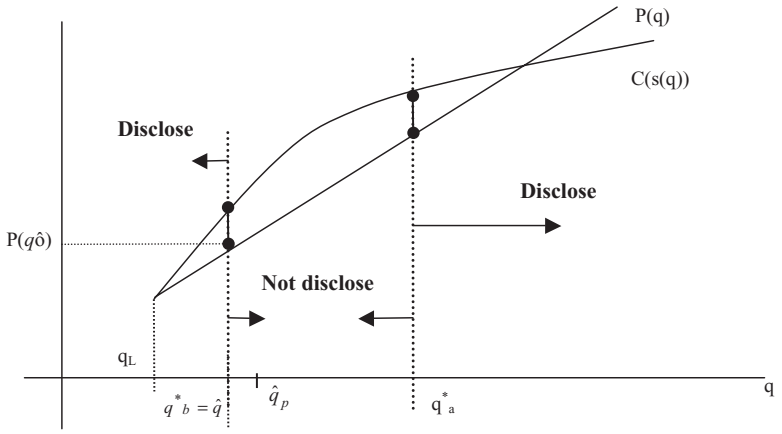
message of "nondisclosure" implies "poor quality." If there is no selection cost associated with disclosure, the market will unravel. However, when costs from selection increase with quality after disclosure, plans will disclose only if the gain from a high premium is large enough to exceed the loss from selection. A pattern of disclosure equilibrium that represents this case is shown in Figure 1.

The line $P(q)$ is the premium function, and the cost curve represents losses from selection.[10] $\hat{q}_p$ is consumers' beliefs on plan quality prior to the date when the information is posted. $\hat{q}$ indicates consumers' updated quality for nondisclosers, which is assumed to equal q_L in this case. I set the difference between premium and selection cost to be zero at this point ($\hat{q}$). Then, the distance between two curves represents relative gains and losses of plans when consumers observe plans' true level of quality. Because selection costs increase with quality, some plans with quality above the lowest level do not disclose because the net gain is smaller than that from being treated as a plan with the poorest quality. Relatively high-quality plans still disclose if the gain from a high

[10] The premium function is assumed to be linear. Regarding the curvature of the cost function, $C(s(q))$, I assume that that $C_s > 0$ and $C_{ss} = 0$; the cost increase from one unit increase in health risk is positive and constant. I also assume that $s_q > 0$ and $s_{qq} < 0$; the marginal increase in health risk by quality is decreasing. Thus, concavity follows from the assumption of diminishing marginal attractiveness of quality for selecting high risks, not from concavity of the cost function per se. This is a weaker and more intuitively plausible assumption than directly imposing $C_{ss} < 0$. In addition, it is very unlikely that "the real curve" is convex. If so, no high-quality plans will disclose, which we know is not the case from the pattern of disclosure reported in a prior study using the HEDIS data (Jin and Sorensen, 2006).

Without the separability assumption, the cost function is $C(q, s(q))$ and $C'' = C_{qq} + 2C_{sq}C_q + C_s s_{qq}$. I can obtain the same curvature of the cost function as Figure 1 if $C'' < 0$. It is reasonable to assume that $C_{qq} > 0$ and $2C_{sq}C_q > 0$. The condition that $C'' < 0$ is satisfied if the negative effect of the last term ($C_s s_{qq}$) dominates the sum of the positive effects from the first (C_{qq}) and the second term ($2C_{sq}C_q$).

FIGURE 2
Disclosure Equilibrium When the Expected Quality Is Above q_L



premium outweighs the cost. At equilibrium, there will be one level of quality that satisfies the equilibrium condition (1.1), q_a^*. Plans with quality above q_a^* will disclose.

Next, I explore the possibility that the revised belief for nondisclosers ($\hat{q}$) is above the lowest possible quality (q_L). Figure 2 shows a pattern of disclosure equilibrium when $\hat{q}$ is above q_L. There are two levels of quality that satisfy the equilibrium condition (1.1): q_a^* is a level of quality above which plans disclose, and $q_b^*(=\hat{q})$ is a level of quality below which plans disclose. Plans with quality between q_a^* and q_b^* will not disclose. Note that some low-quality plans may disclose if they expect gains from favorable selection.

Hypotheses

Based on the model presented above, I develop the following hypotheses on disclosure incentives. First, regarding selection factors, if consumers in the market area are relatively healthy, and thus, the increase in illness severity of enrollees is small as quality increases, plans will be less concerned about unfavorable selection after disclosure. This will lead to more disclosure. Therefore, I hypothesize:

H_1: *There will be more disclosure in markets where consumers are healthier and the loss from risk selection is smaller, when all other factors are equal.*

The model also indicates that the location of consumers' updated quality for nondisclosers is a determinant of disclosure decisions. The level of the updated expected quality depends on both the level of the prior belief and the confidence in that prior.

First, stronger confidence in initial beliefs implies a smaller response to a new message (Hirshleifer and Riley, 1979). For example, if consumers are experienced with plans and develop firm beliefs on plan quality, the value of the message of nondisclosure will not be large to them, and their updated quality is unlikely to deteriorate down to the lowest level (Figure 2). An increase in disclosure is then expected, compared with

the case shown in Figure 1, where consumers have weak initial beliefs and possibly shift their belief to the lowest level. An increase in disclosure when $\hat{q}$ is above q_L is expected particularly among low-quality plans because they may expect gains from favorable selection. Based on this discussion,

H_2: *Health plans, particularly low-quality plans, are more likely to disclose in markets where consumers are more experienced and have stronger prior beliefs, when all else is equal.*

Second, the level of consumers' prior beliefs ($\hat{q}_p$) also contributes to the location of the revised belief. With high prior beliefs, holding the confidence in the prior belief constant, the updated belief for nondisclosers will also be high. When the expected quality does not deteriorate to the lowest level, an increase in disclosure is expected particularly among low-quality plans, as shown in Figure 2. This suggests:

H_3: *Health plans, particularly low-quality plans, are more likely to disclose in markets where consumers believe plans offered high quality, when all else is equal.*

Extensions: A Model With an Inverse Demand Function

In this section, I relax the assumption of a competitive market and analyze a model with an inverse demand function. It is possible that disclosing high-quality information shifts the demand curve up and a plan's enrollment (Q) is determined by quality (q). In such markets, the profit function of disclosers is written as

$$\Pi_D = P(Q,q)Q - Q\{C(q) + C(s(q))\}$$

and profits of nondisclosers are

$$\Pi_{\text{ND}} = P(Q,\hat{q})Q - Q\{C(q) + C(s(\hat{q}))\}.$$

Facing a downward-sloping demand curve, disclosing plans choose the optimal level of quantity (Q^*) that maximizes their profits at the point where marginal revenue is equal to marginal cost: $P^*_Q Q^* + P = C(q) + C(s(q))$. Profit of a disclosing plan varies by the level of quality that the plan produces. To see how profit changes *across health plan*s with different levels of quality, obtain the derivative of the profit function of disclosers with respect to quality at optimal level of quantity (i.e., $\frac{\partial \pi}{\partial Q^*} = 0$), which is written as follows:[11]

$$\frac{\partial \pi}{\partial q} = (P_q - C_q - C_s S_q)Q^*.$$

[11] Note that this exercise is to examine how profit changes with quality *across health plans* that produce different levels of quality, assuming quality of a plan is exogenous. The objective of the model is to identify the critical level(s) of quality at which a plan with given quality is indifferent between disclosure and nondisclosure, not to find the optimal level of quality for a plan.

The sign of this derivative (i.e., whether profit increases by quality) depends on the relative magnitudes of P_q, C_q, and $C_s S_q$ at given quality. Profit of a disclosing plan may not be necessarily increasing with quality. High-quality plans may earn less profit than low-quality plans if the increase in selection costs is greater than that in premiums. When the gain from a premium is large enough to exceed selection cost, profit of disclosers will increase with quality.

For nondisclosers, profit is always decreasing with quality because premium and selection costs are a function of consumers' beliefs, independent of the true level of quality.

Plans will decide to disclose if their expected profit after disclosure is greater than that with nondisclosure. Whether plans will gain or lose after disclosure depends on the location of consumers' updated beliefs ($\hat{q}$) and the curvature of premium and cost functions (P_q, C_q, and $C_s S_q$). If the same conditions as the previous section ($P_q > 0$, $C_s > 0$, $S_q > 0$, and $S_{qq} < 0$) are used, the same predictions about plans' disclosure decisions are drawn from this model with an inverse demand function.

EMPIRICAL SPECIFICATION AND DATA

This study takes a reduced form approach to examine plans' disclosure incentives. While quality is an important determinant of disclosure decisions, it is endogenous with respect to the dependent variable, disclosure status. The reduced-form disclosure equation therefore identifies exogenous factors that determine quality instead of directly including plan quality scores. To examine disclosure incentives among plans with a certain level of quality (Hypothesis 2 and Hypothesis 3), the model is estimated separately by different levels of quality (quality quartiles). The empirical specification is written as

$$\mathrm{DISC}_{it} = \beta_0 + \beta_1 \mathrm{RISK}_{it} + \beta_2 \mathrm{EXP}_{it} + \beta_3 \mathrm{MKT}_{it} + \beta_4 \mathrm{OTHER}_{it} + T_t + \mu_i + \varepsilon_{it}.$$

DISC_{it} is a dummy variable that indicates whether the ith plan publicly discloses the information at time t. RISK_{it}, EXP_{it}, and MKT_{it} represent risk selection factors, the level of consumers' expected quality, and market environments, respectively. OTHER_{it} includes demand shifters and marginal cost factors that influence disclosure decisions by determining quality. Interaction effects between these factors and quality are examined through separate regression analyses by quality quartile. Plan fixed effects, μ_i, are included to control for time-invariant plan-specific incentives to disclose that are not observed by the investigator.[12] Time dummies (T_t) capture year-specific effects that are common to all plans. The model is estimated using a linear probability approach because the use of fixed effects is not feasible in a probit regression.[13] Standard errors are corrected for clustering at the plan level to address

[12] Some plans may consider public disclosure of information as the providers' responsibility regardless of financial gains, or some plans may make disclosure decisions based on their physicians' preferences on disclosure. Information on these factors is unavailable and plan fixed effects capture all unobserved time-invariant plan characteristics associated with disclosure decisions.

[13] One might consider a hazard model for this analysis, which estimates "time to event" (a plan's decision on disclosure is an event). However, this approach is not a good choice

a possible serial correlation. The following subsections discuss the measures used in each category.

Risk Selection Factors

To capture factors that influence losses from risk selection, health risk of a market is considered. In markets with a relatively large proportion of sick people, plans are more concerned about unfavorable selection and are likely not to disclose. Health risk of a market is measured by death rates among the population under age 65 and death rates from cardiovascular diseases (CVD) or diabetes mellitus (DM). Since the study sample consists of commercial plans, their target population is under age 65 and overall death rates among the target population are expected to measure general health risk of a market. Death rates from CVD/DM are used because both diseases are common chronic conditions and leading causes of death, and the death rate from both diseases represents cost burdens to plans as well as health risk of a market.

Consumers' Expected Quality

Consumers' updated beliefs on quality for nondisclosers are expected to depend on the strength and level of their prior beliefs about plan quality. To capture the strength of prior beliefs, I use the extent to which consumers have experience with plans because consumers' confidence in their beliefs is likely to increase with experience. Based on the literature (Pauly and Satterthwaite, 1981; Wholey et al., 1992), I include the proportion of residents who moved in a market within 5 years (resident mobility) and the number of new counties that a plan started to serve within the past 4 years. Having new counties or serving markets with high resident mobility implies that plans have inexperienced consumers who are likely to strongly respond that the message of nondisclosure indicates poor quality since their prior beliefs are weak. The model predicts less disclosure among plans with inexperienced consumers because such plans do not have selection costs when they are treated as poor quality plans. A decrease in disclosure is expected among relatively low-quality plans that will not be able to charge a premium above selection cost. Without selection, more disclosure will occur in markets with weak and poor prior beliefs because plans have no gain when considered as the worst quality. This implies an interaction effect between selection and prior beliefs. I examine this possibility by including interaction terms between risk selection factors and consumers' expected quality.

Variables that measure the level of consumers' prior beliefs about quality include the number of state mandates regarding plan benefits or open access, HMO penetration, and whether an HMO offers Medicare or Medicaid products.[14] First, the number of state mandates on plan benefits or open access is used because consumers may have

because the disclosure pattern of the plans in the data set is not unidirectional but somewhat random. Among the plans whose disclosure status varied during the study period, only 30 percent changed from "nondisclosure (N)" to "disclosure (D)."

[14] I use annual values of these variables, assuming that consumers do not retain the messages of disclosure status and/or quality scores disclosed in the previous year. In other words, consumers refresh their memory every year, forgetting the information available in the previous year. To evaluate whether this approach influences the results, I perform a sensitivity analysis and discuss it in the next section. Specifically, I estimate a model that includes lagged

developed favorable prior beliefs on plan quality when state regulations intended to improve benefits are more stringent.[15] HMO penetration represents how much consumers accept HMO plans in a market relative to other types of health insurance. High penetration implies consumers' general evaluation of HMOs' performance is relatively high. Offering Medicare products is expected to have positive effects on expected quality and disclosure because quality improvement activities initiated by Medicare may have spillover effects on quality for commercial enrollees and enhance their evaluation of plan quality. Medicare participating plans may also have certain characteristics that commercial consumers like (Chernew et al., 2004). As for offering a Medicaid product, the effect is not certain. Medicaid quality control programs can affect quality of commercial products and have positive effects on consumers' expected quality, however, having Medicaid products may be interpreted as providing low quality.

Market Environments

Several variables are included to control for market environments including competition, disclosure rates among competitors, quality of competitors, and the proportion of large employers. Competition is measured by the number of HMOs in a market rather than the Herfindahl Hirschman Index (HHI) because it better represents competitiveness in HMO markets and is less likely than the HHI to be endogenous (Wholey, Feldman, and Christianson, 1995). The effect of competition on disclosure is not clear. If intense competition increases demand elasticity and it becomes harder for a premium to outweigh selection costs even with high quality, there will be less disclosure in more competitive markets. However, information availability enables plans to compete through quality differentiation, suggesting that competition will encourage public disclosure. The evidence from empirical studies is mixed (Wholey et al., 1992; Jin, 2005).

Competitors' disclosure rate is included to capture plans' responses to competitors' behavior in terms of disclosure. Some suggest that as average disclosure rates increase, the probability that a plan discloses increases because nondisclosure is a strong signal that its quality is lower than that of others (Wholey et al., 1992). However, Jin (2005) argues that if disclosure decisions are used as a strategy to differentiate, plans tend not to disclose as disclosure rates among competitors increase. To mitigate a potential endogeneity problem, lagged values of competitors' disclosure rates are used.

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values of quality scores and disclosure status. I expect those variables to capture consumers' updated beliefs formed based on the quality information available in the prior year.

[15] During the study period, there was a substantial increase in the number of state mandates, which was motivated by the "backlash" against managed care in the 1990s (Laugesen et al., 2006). A 1997 national survey showed that a majority of the public was in favor of some type of regulation to address the "backlash" (Blendon et al., 1998). The survey reported that people were concerned about restrictive treatments practice by managed care plans. This study uses mandates that are intended to discourage such practice and improve service coverage, and I expect strict state mandates have enhanced consumers' perceptions about managed care plans. State mandates used in the study include emergency care services, inpatient care after childbirth, inpatient care after mastectomy, osteoporosis, mental health parity, breast reconstruction, newborn hearing screening, anesthesia/hospital charges for dental procedures, and free choice of pharmacists, obstetricians, and gynecologists.

Plans may make disclosure decisions based on relative rankings within their own markets rather than absolute scores. To address this possibility, I include the average level of quality among competitors, which controls for differences in the quality distribution across markets. This allows me to examine whether plans, particularly low-quality plans, tend to disclose when they are relatively highly ranked in their markets.

Finally, the percent of large establishments (> 500 employees) in a market is used to capture the degree of market pressure about information disclosure. Large employers with purchasing power are in a better position to demand quality information than small firms and have taken the lead on information disclosure in health care markets. Health plans in markets with a greater proportion of large employers are more likely to be required to disclose the information.

Demand Factors

Consumers' income, education, and race, measured at the market level, influence the demand for quality. To control for these demand factors, I include per capita income, percent of population below the poverty line, percent unemployed, percent whites, and percent college educated. Previous studies reported that HMOs in markets with large proportions of higher income, more educated, and whites show better quality of care performance measured with HEDIS than their counterparts (Zaslavsky et al., 2000; Scanlon et al., 2005; McBean, Jung, and Virnig, 2005).

Marginal Cost Factors

Several variables are included to control for time-varying market or plan characteristics that may be related to a plan's marginal cost. Plan age is included because older plans may be more efficient in performing organizational activities than newer plans. To control for input prices, I use wage rates for registered nurses (RNs). Medicare Part A and Part B payment rates capture both medical input prices and the intensity of health care utilization. Intense utilization is likely to increase marginal costs of a plan. Population density is also used; however, its effect on marginal costs is uncertain. In markets with dense population, input prices such as wages rates and rents are likely to be high, increasing costs of a plan. However, the variable may also measure costs of insuring a certain number of consumers within a geographic boundary (Wholey, Feldman, and Christianson, 1995). In sparsely populated markets, it may be costly for a plan to develop provider networks at convenient locations for its enrollees. If population density captures this effect, marginal cost would be low in densely populated markets.

Data

The data for the study come from several sources. The first source is HEDIS data supplied by NCQA, which provides the information on each HMO's disclosure status and quality. The study samples consist of commercial HMOs that submitted HEDIS data to NCQA in any year between 1997 and 2000. A plan's HEDIS scores reported in a given year represent the quality that the plan experienced in the previous calendar year. HMOs that did not disclose HEDIS scores after submitting them to NCQA are the reference group for the study. The second source is InterStudy's Competitive Edge data sets for the information on HMO characteristics. The third source is the Area Resource File, which contains market characteristics for each county. The 2000 U.S.

Census provides information on the percentage of residents who moved in a market within 5 years (in-migration). Annual reports from Health Policy Tracking Services are used for the information on state-mandated benefits and access laws. Medicare payment rates in a market (Adjusted Average per Capita Cost [AAPCC]) are obtained from the CMS website.

To construct analytic files, the HEDIS data set was first merged with the InterStudy data. Since the two data files did not have common plan identifiers, the merging process relied on plan names and service areas. The match rate was 92 percent. The number of HMOs included in the study (HEDIS submitting plans) represented about half of all HMOs in the InterStudy data; however, they account for three fourths of the total commercial enrollment in InterStudy HMOs.

Next, variables from other data sources were added to the merged file. While the unit of analysis of the study is a plan year, many variables are available only at the county level. For those variables, weighted averages across all markets where the HMO operates were created. The weight was the share of the HMO's total enrollment in each market. Markets were defined using "health service areas" (HSAs), which are based on inpatient hospital admissions (Makuc et al., 1991). This definition has an advantage over using other geographic boundaries because it includes at least one hospital and captures patient flows, which is necessary for an HMO to form provider networks (Feldman and Wholey, 2001).

Plan quality is measured using a composite score derived from the multitude of HEDIS quality indicators. Since quality indicators reported in HEDIS differ slightly by year, I used 13 indicators that are commonly measured across all 4 years. Four domain groups were first identified from the 13 HEDIS indicators based on the results of exploratory factor analysis and the previous literature (Scanlon et al., 2005).[16] They include childhood immunizations, cancer screening tests, maternity services, and treatments for chronic illnesses. Domain scores were obtained from the average of the measures included in a domain. Each domain score was standardized (subtracted by the mean of the domain scores in the sample and divided by the standard deviation of the domain scores for each year) to enable comparisons across domains. The composite quality score was then calculated as a weighted average of the four standardized domain scores. The proportion of enrollees who are eligible for the measures in each domain is used as a weight (weights are normalized to sum to one). Plans may direct their quality improvement efforts toward the types of services that a majority of their enrollees use. Thus, it may be informative to use the composition of enrollees as a weight to summarize overall quality of a plan when the plan produces several types of services. The mean of the composite score is 0.004, and the standard deviation is 0.85.

RESULTS

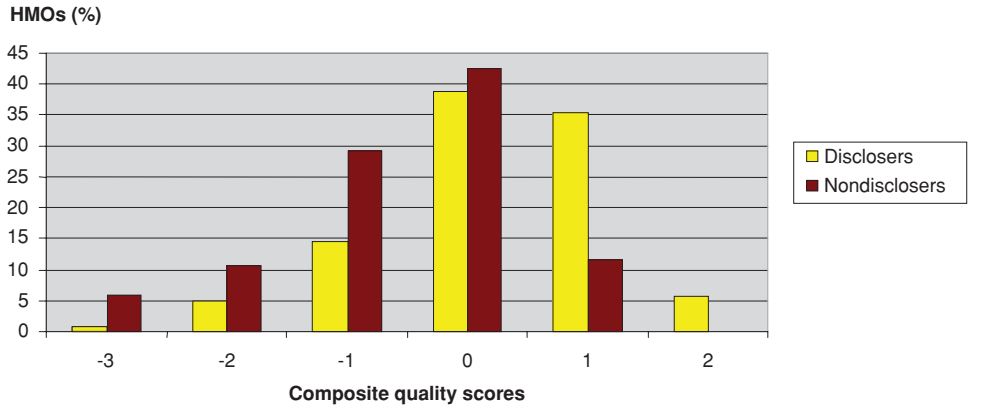
Table 1 presents the number of HMOs included in the study by disclosure status. There were 382 HMOs, and the number of observations is 1,062 (HMO-years). About

[16] The 13 HEDIS measures are breast cancer screening, cervical cancer screening, beta-blocker treatment after a heart attack, eye exam for diabetics, prenatal care, check-ups after delivery, and seven measures of child immunization that include DTP (diphtheria, tetanus, pertussis), MMR (measles, mumps, rubella), polio, and hepatitis, and so on.

TABLE 1
Number of HMOs by Disclosure

HEDIS Reporting Year	Number of Plans		Total (%)
	Disclosers (%)	Nondisclosers (%)	
1997	194 (87.8)	27 (12.2)	221 (100.0)
1998	174 (66.4)	88 (34.0)	262 (100.0)
1999	209 (69.7)	92 (30.3)	300 (100.0)
2000	220 (78.8)	59 (21.2)	279 (100.0)
Total	797 (75.1)	265 (24.9)	1,062 (100.0)

FIGURE 3
Distribution of Composite Quality Scores



75 percent of the total observations voluntarily disclosed information. Depending on year, about 12–34 percent of plans declined to disclose HEDIS quality information after collecting the data. The disclosure rate declined between 1997 and 1998, and since 1998, the disclosure rates increased every year in the study.

Since the empirical model includes plan fixed effects, the identification of the model comes from changes in disclosure status within a plan. About 30 percent of HMOs changed their disclosure status during the study period. There was no uniform pattern of the change. Among the HMOs with varying disclosure decisions, more than 40 percent of the plans moved from disclosers (D) to nondisclosers (N), and about 30 percent changed from nondisclosure to disclosure. The rest 30 percent showed a mixed pattern, changing their disclosure status more than once (N-D-N or D-N-D).

Figure 3 shows the distribution of composite quality scores between disclosers and nondisclosers. The distribution of quality scores is symmetric. In general, high-quality plans tend to disclose and a large proportion of low-quality plans is nondisclosers. All plans with the highest quality scores (above two standard deviations) voluntarily disclosed, and about 80 percent of plans with relatively high quality (average and above) disclosed. This appears to partially support the prediction of the unraveling that high-quality plans are more likely to voluntarily disclose than low-quality plans.

While the data clearly show that market unraveling is an important mechanism to bring voluntary disclosure, it also shows variation in quality both within disclosers and within nondisclosers. Not all high-quality plans disclosed and not all low-quality plans remained silent. More than half of the plans with relatively low quality (below average) voluntarily disclosed. About 12 percent of high-quality plans (those with scores above one standard deviation) did not disclose. Unraveling was not complete in HMO markets.

I compared the mean values of the mortality rates that measure the loss from selection between disclosers and nondisclosers: the death rate among people under 65 and the death rate from CVD/DM. Nondisclosers with high-quality (above one standard deviation) served markets with higher death rates for both measures than disclosers with high quality. This suggests that some high-quality plans may not disclose if disclosure is likely to attract high-risk patients. Among low-quality plans, nondisclosers tended to operate in markets with higher death rates, but the difference was not significant.

Distribution of Quality Rank Percentiles

Figure 3 presents the distribution of quality for all markets. High-quality nondisclosers may be relatively poorly ranked in their own markets and low-quality disclosers may be highly ranked in their markets. In other words, plans may consider relative rankings in their markets rather than absolute quality scores in making disclosure decisions. To check this possibility, I obtain the rank percentile of each plan in its market and compare the average rank percentile between disclosers and nondisclosers by the level of quality. No significant difference was found in any level of quality. Plans with high quality (first quality quartile) ranked in the top 20 percent in their own markets regardless of their disclosure status, and plans with low quality (fourth quality quartile) were poorly ranked in both groups. The distribution of quality rank percentiles by disclosure status is presented in Figure 4.

FIGURE 4
Distribution of Quality Rank Percentiles

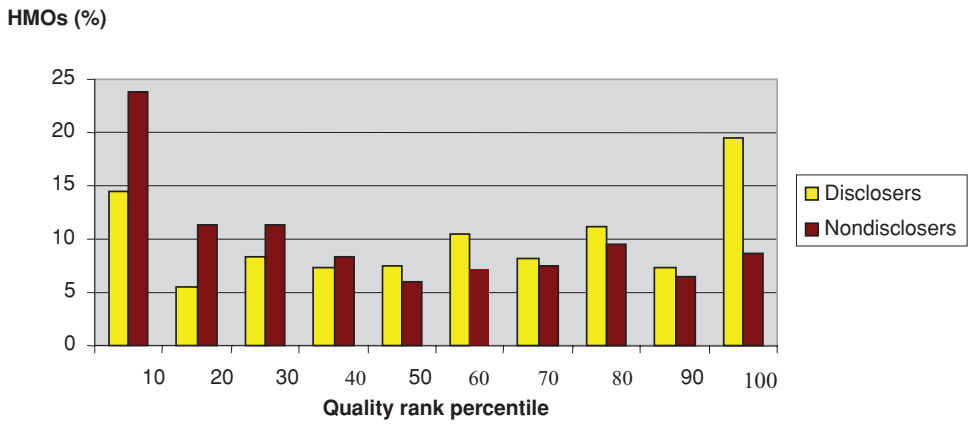


TABLE 2
Descriptive Statistics of Explanatory Variables

Variable	Disclosing HMOs ($N = 797$) Mean (Standard Deviation)	Nondisclosing HMOs ($N = 265$) Mean (Standard Deviation)
Risk selection factors		
Death rates of population under age 65 (per 100,000)	231.62 (34.27)	239.38 (38.03)
Death rates from cardiovascular diseases or diabetes (per 100,000)	82.77 (13.63)	81.40 (15.46)
Consumers' expected quality		
HMO penetration (%)	26.02 (8.56)	23.43 (8.22)
Medicare HMO	0.63 (0.48)	0.58 (0.50)
Medicaid HMO	0.44 (0.50)	0.32 (0.47)
Number of state mandates on health plan benefits or open access	4.56 (2.54)	5.49 (2.65)
Percent of population who moved in a market within 5 years (in-migration)	20.83 (4.90)	22.60 (5.07)
Number of new counties that an HMO started to serve within 4 years	19.52 (27.02)	26.77 (31.86)
Market environments		
Number of competing HMOs	11.88 (4.62)	12.88 (5.02)
Competitors' disclosure rates (lagged)	39.86 (20.43)	31.88 (16.82)
Quality among competitors	0.10 (0.76)	−0.31 (0.73)
Percent of large establishments (> 500)	4.85 (0.68)	4.77 (0.78)
Demand factors		
Percent college educated	24.57 (4.47)	24.22 (4.76)
Per capita income ($1,000)	27.13 (42.21)	26.70 (44.86)
Percent of people below the poverty line	11.10 (2.63)	12.14 (3.21)
Percent white	84.46 (9.73)	82.24 (9.56)
Percent unemployed	4.31 (1.08)	4.46 (1.24)
Marginal cost factors		
RN wage ($ per hour)	20.30 (2.03)	20.06 (2.16)
Medicare Part A payment rates ($ per beneficiary)	278.50 (48.36)	286.11 (42.55)
Medicare Part B payment rates ($ per beneficiary)	179.83 (36.66)	185.50 (37.87)
Population density (per 100 square miles)	0.90 (2.28)	0.72 (1.81)
Plan age	15.19 (9.19)	12.69 (6.51)

Table 2 reports the means of explanatory variables included in the regression by disclosure status. Disclosing plans tend to be in markets with low resident mobility, suggesting that the variable may capture consumers' experience with plans and that plans with inexperienced consumers are less likely to disclose. Disclosers are likely to serve markets with fewer state mandates, low death rates among people under age 65, high per capita income, a large percentage of college educated, and a small

TABLE 3
Descriptive Statistics of Selected Variables by Year

	Mean (Standard Deviation)			
Year	Number of State Mandates	Number of New Counties	Death Rates Among People Under Age 65 (per 100,000)	Death Rates From Cardiovascular Diseases or Diabetes (per 100,000)
1996	2.5 (1.4)	13.3 (20.1)	235.3 (35.1)	83.5 (13.5)
1997	3.5 (1.6)	19.9 (30.8)	231.6 (34.2)	82.6 (13.8)
1998	5.2 (2.3)	22.7 (25.3)	234.0 (36.8)	82.5 (14.4)
1999	6.1 (2.6)	27.7 (33.1)	233.5 (35.2)	81.4 (14.6)

proportion of people who are below the poverty line. Disclosers also serve markets with low Medicare payment rates, high population density, high RN wage rates, less competition, high disclosure rates, high quality, and a large proportion of large firms.

Due to the inclusion of plan fixed effects, the identification of the empirical model relies on the extent to which variables change over time. Table 3 presents the descriptive statistics of selected variables by year. The numbers of state mandates and new counties continuously increased, which suggests that the study period experienced the growth of both managed care and states' legislative efforts to regulate managed care industry. While this trend is a nationwide phenomenon, there was substantial variation in the changes of the variables across states and plans. The average of the annual change in the mortality variables was small; however, when the distribution of the change across plans was examined, there was large variation. This suggests that the variation in mortality comes from the changes in a plan's markets during the study period since the mortality rate of a plan is obtained from aggregating values of all the markets that the plan served.

Table 4 reports the results of the regression analysis using a linear probability model. First, I found negative effects of the variables that capture the loss from risk selection, indicating that HMOs were less likely to disclose in markets with high death rates. The effect of the death rate from CVD/DM was significant and larger than that of the overall death rate among people under 65. The marginal effect of the death rate from CVD/DM on disclosure was −0.014; one additional death per 100,000 would decrease the probability of voluntary disclosure by 1.4 percentage points. When the results were converted to elasticity measures, this variable had the largest elasticity among all variables, −1.58, which implies that a 1 percent decrease in the death rate from CVD/DM results in an increase of 1.58 percent in the disclosure probability.[17] This result supports the hypothesis that health plans in markets with high-risk consumers have incentives to withhold information.

The coefficients of the variables that measure consumers' expected quality showed mixed results. Plans serving many new counties were less likely to disclose. The

[17] Elasticities of other significant variables ranged between 0.05 and 0.55.

TABLE 4
Regression Results of the Disclosure Model

Dependent Variable: Disclosure Status (a Binary Variable)	
Variables	Coefficient (Robust Standard Error)
Risk selection factors	
Death rates of population under age 65	−0.001 (0.003)
Death rates from cardiovascular diseases or diabetes	−0.014 (0.00)**
Consumers' expected quality	
HMO penetration	0.001 (0.003)
Medicare HMO	0.060 (0.046)
Medicaid HMO	−0.041 (0.044)
Number state mandates on plan benefits or open access	−0.036 (0.016)**
Number of new counties within 4 years	−0.002 (0.001)**
Percent of move-in population within 5 years	0.003 (0.022)
Market environments	
Number of competing HMOs	−0.003 (0.006)
Competitors' disclosure rates (lagged)	0.0013 (0.001)
Competitors' quality	−0.074 (0.061)
Percent of large firm employees (> 500)	0.039 (0.057)
Demand factors	
Percent college educated	−0.035 (0.023)
Per capita income ($1,000)	0.007 (0.018)
Percent of population below the poverty line	0.031 (0.026)
Percent white	0.007 (0.012)
Percent unemployed	−0.096 (0.040)**
Marginal cost factors	
RN wage rates	−0.018 (0.014)
Medicare Part A payment rates	−0.0003 (0.001)
Medicare Part B payment rates	0.001 (0.001)
Population density	−0.046 (0.024)*
Plan age	−0.016 (0.036)
Time dummies	
Year 2	−0.181 (0.040)**
Year 3	−0.154 (0.044)**
Constant	2.819 (1.900)
R^2	0.1106
N	1,062

Note: Plan fixed effects are included in the model, and standard errors are adjusted for clustering at the plan level.
*$p < 0.1$; **$p < 0.05$.

negative effect of the variable suggests that plans with inexperienced consumers are less likely to disclose. This finding appears to speak for the argument that disclosure will be lower with weak prior beliefs and low revised beliefs, if selection exists, because they do not have selection costs when they are treated as poor quality plans. However, inconsistent with the prediction, the number of state mandates that measure

favorable prior beliefs had a negative effect on disclosure. The magnitude of the effect was relatively large, −0.036, implying that the probability of voluntary disclosure decreases by 3.6 percentage points with an additional state mandate on benefits or access. This finding speaks against the prediction of the model that some low-quality plans in markets with better prior beliefs will voluntarily disclose to enjoy favorable selection.[18] Whether these variables have strong effects among low-quality plans is examined through separate analyses by quality quartile. All other coefficients in this category were insignificant.

Table 4 also reveals that no variables that measure competition or competitors' behavior had significant effects. The interaction terms among the variables were also examined but excluded from the model because all were insignificant. This finding is inconsistent with prior research. Jin (2005) reported that disclosure rates were lower in more competitive markets and the interaction between competition and competitors' disclosure rates also had a negative effect on disclosure. This difference may be because plan fixed effects were not included in her model. In other words, Jin's finding of the negative effect of competition may be due to unobserved plan heterogeneity. It may also result from the fact that risk selection was not controlled in her model, while selection incentives are likely to be high in a competitive market (Newhouse, 1996; Ellis, 1998). Finally, serving markets with a greater proportion of large firms did not increase the probability of voluntary disclosure.

Among the other covariates, only a few have significant effects. Serving markets with a large proportion of unemployed decreased the likelihood of disclosure. The effect was large: a 9.6 percentage point decrease in voluntary disclosure for a percent increase in the unemployment rate. Serving markets with high population density had a negative effect on disclosure suggesting that marginal cost is high in densely populated markets.

To examine different disclosure incentives depending on quality, the model was estimated separately by quality quartile. Table 5 presents the selected coefficients from the separate analyses. All the models include plan fixed effects and time dummies, and standard errors were clustered at the plan level to address a potential serial correlation. Each column reports the results of the analysis of the corresponding quartile. The analysis for the highest quality quartile is not reported because 93 percent of the group disclosed so the regression results are not likely to be reliable.

The death rate from CVD/DM on disclosure had a negative effect on disclosure in the analyses for the lowest quality plans and relatively high-quality plans. This confirms the finding of the overall analysis and supports the hypothesis that plans choose not to disclose if releasing quality information is likely to incur costs from risk

[18] The expectation that more disclosure will occur if prior beliefs are high is based on the assumption that selection incentives exist in a market. Without selection, better prior beliefs will lead to less disclosure. I examined an interaction effect between selection and prior beliefs in empirical analysis by including interaction terms but found them insignificant. In the model with the interaction terms, the variable of prior beliefs was also insignificant. Since it may be due to correlations among the variables, I attempted to use only the interaction term and found it significant. While significant, the interaction effect was negative, suggesting that the possibility of favorable selection is unlikely.

TABLE 5
Selected Coefficients from the Separate Regression by Quality Quartile

Dependent Variable: Disclosure Status (a Binary Variable)			
	1st Quartile (Lowest Quality)	2nd Quartile	3rd Quartile
Variables	Coefficient (SE)	Coefficient (SE)	Coefficient (SE)
Risk selection factors			
Death rates of population under age 65	0.006 (0.015)	−0.024 (0.014)*	0.006 (0.005)
Death rates from cardiovascular diseases or diabetes	−0.041 (0.023)*	0.018 (0.026)	−0.022 (0.009)**
Consumers' expected quality			
Number of state mandates on plan benefits or open access	−0.106 (0.051)**	−0.029 (0.038)	0.004 (0.037)
Number of new counties within 4 years	−0.005 (0.003)*	−0.0004 (0.002)	−0.003 (0.003)
Market environments			
Number of competing HMOs	−0.005 (0.010)	0.040 (0.015)***	−0.017 (0.016)
Competitors' disclosure rates	0.005 (0.004)	−0.002 (0.004)	−0.0003 (0.003)
Competitors' quality	−0.269 (0.153)*	−0.247 (0.134)*	0.029 (0.150)
Percent of large firms (> 500)	0.016 (0.161)	0.268 (0.167)*	0.041 (0.168)
R^2 (within)	0.2268	0.3174	0.2725
N	267	263	266

Note: Plan fixed effects and year dummies are used in all models. The models also control for offering Medicare or Medicaid products, HMO penetration, percent of recently move-in population, percent college educated, percent whites, percent of population below the poverty line, percent unemployed, per capita income, plan age, population density, Medicare Part A and Part B payment rates, and wages rates for registered nurses. Standard errors are adjusted for clustering at the plan level.
$^{*}p < 0.1$; $^{**}p < 0.05$; $^{***}p < 0.01$.

selection. I found significant effects for the number of state mandates and the number of new counties only among the lowest quality plans, suggesting that those variables capture consumers' experience with plans or prior beliefs about plan quality. This finding is consistent with the prediction that variables of consumers' beliefs affect disclosure decisions among low-quality plans and suggests that consumers do not always interpret nondisclosure as the worst quality.

However, the negative sign of the state regulation variable is not supportive for the hypothesis that low-quality plans choose to disclose in markets where consumers believe plans have offered good quality, expecting gain from favorable selection. The coefficient of the number of new counties had the expected sign, implying that there is less disclosure among low-quality plans if plans have more inexperienced consumers. However, it is possible that this variable captures plans' decisions to expand markets, so its negative effect may reflect the increased cost related to the entry process. Other variables measuring prior beliefs were all insignificant.

The separate analysis reveals that market forces contribute to voluntary disclosure under certain circumstances. First, low-quality plans are more likely to disclose when their competitors provide lower quality, suggesting that even among low-quality plans, offering relatively high quality is an important factor that leads to voluntary disclosure. Second, market competition increased the probability of voluntary public disclosure. Although the effect was significant only in the analysis for relatively low-quality plans, it suggests that competition serves as a force for voluntary information disclosure. Finally, the percentage of large firms had positive effects on disclosure among the relatively low-quality plans, indicating that large purchasers are likely to request plans to disclose information and that high demand for information leads to voluntary disclosure.

Exploration of Consumers' Expected Quality

As a sensitivity analysis to check whether the measurements of consumers' beliefs influence the results, I examine an empirical model where consumers form their beliefs about plan quality based on the information available in the prior year.

The empirical approaches in the previous section build on the assumption that consumers refresh their memory about plan quality every year without retaining any messages from the previous year. Therefore, I used annual values of the external sources that influence consumers' beliefs about plan quality to capture consumers' expectation. However, consumers may rely on the information disclosed in the past year to update their expectations on plan quality. In other words, consumers may use prior quality scores or the message of nondisclosure to form their current-year expectation. I examine this possibility by including lagged values of quality scores. If a plan did not disclose and its quality information was not available to the public, I create a dummy variable to indicate that quality scores are missing (i.e., "prior-year nondiscloser"). I also use the difference in quality scores between 2 subsequent years because if consumers are not forgetful, plans decide on disclosure based on relatively better performances between the 2 years.

For this analysis, the study sample has to be limited to plans that reported the HEDIS scores for subsequent 2 years. After excluding observations that did not have quality or disclosure information in the prior year, the total number of observations used in the analysis was 645 HMO-years (307 HMOs). To examine if the variables measuring consumers' expectation have a strong impact on disclosure among low-quality plans, I also conducted separate analysis by quality.

Table 6 presents the results from the analyses. In the analysis of the whole sample (first column), the lagged quality scores had negative effects on disclosure, indicating that plans with higher quality in the previous year tend not to disclose. This effect is clearly seen in the analysis that uses the difference in quality scores between the 2 years. The positive sign of the variable suggests that plans having better performance this year than the past year are more likely to disclose. The negative effect of the dummy variable (missing indicator) that indicates a "prior-year nondiscloser" implies that there is inertia in disclosure decisions.

The second column of Table 6 reports the result from the analysis for low-quality plans. The effect of prior-year information became stronger and more significant in

TABLE 6
Results of Regression Analysis with Prior-Year Information

Dependent Variable: Disclosure Status (a Binary Variable)				
	Coefficient (Robust Standard Error)			
Variables of Consumers' Expected Quality	All Samples	1st Quartile (Lowest Quality)	2nd Quartile	3rd Quartile
Lagged values				
Missing indicator (1 = prior nondiscloser)	−0.141 (0.392)	−1.317 (0.707)*	−0.283 (0.892)	−0.516 (0.735)
Lagged quality scores	−0.004 (0.006)	−0.023 (0.011)**	−0.005 (0.013)	−0.007 (0.010)
Quality differences				
Missing indicator (1 = prior nondiscloser)	−0.551 (0.262)**	−0.815 (0.349)**	0.386 (0.809)	−0.894 (0.714)
Quality Differences between 2 years	0.010 (0.004)**	0.015 (0.005)***	−0.005 (0.012)	0.012 (0.009)
R^2 (within)	0.1425	0.5285	0.4641	0.4064
N	645	135	161	167

Note: Plan fixed effects and year dummies are used in all the models. Standard errors are adjusted for clustering at the plan level.
*$p < 0.1$; **$p < 0.05$; ***$p < 0.01$.

the analysis for low-quality plans. This is consistent with the finding in the previous section: plans are less likely to disclose when good prior beliefs exist. It also suggests a possibility that consumers use the information obtained previously to update their expectation.

DISCUSSION AND CONCLUSION

While public disclosure of quality information has been increasingly promoted in health care markets, the issue of whether it should be mandatory has not been resolved. Using a data set that provides quality information for both disclosers and nondisclosers, this study directly tested the unraveling effect in HMO markets and examined incentives for voluntary disclosure by the level of quality. The main findings are as follows.

First, the analysis showed that market unraveling serves as an important mechanism to bring voluntary disclosure in HMO markets. High-quality plans that will be better off with disclosure tend voluntarily to release quality information to the public. However, complete unraveling did not occur, and there was variation in quality among both disclosers and nondisclosers. Some high-quality plans did not disclose, suggesting that there may be additional costs following disclosure in HMO markets.

Second, this study explored the possibility that the cost from risk selection increased after disclosure, and the empirical analysis found that HMOs in markets with

high-risk consumers, measured by the death rate from CVD/DM, were less likely to disclose. This finding supports the argument that some high-quality plans have an incentive to withhold information if costs are likely to increase from risk selection after disclosure.

Third, the number of state mandates, which is used to capture consumers' prior beliefs, had a significant effect for low-quality plans. This indicates consumers' beliefs about plan quality for nondisclosers is a determinant of plans' disclosure decisions and confirms the conjecture that consumers may not necessarily infer that nondisclosers are the worst quality. However, the negative effect of the state mandates variable is inconsistent with the prediction of the model that low-quality plans voluntarily disclose to enjoy favorable selection in markets with good prior beliefs. While it is plausible that disclosure incentives are also related to favorable selection, this study does not provide evidence for that possibility. Rather, the results suggest that low-quality plans are less likely to disclose when good prior information exists, indicating that selection incentives associated with disclosure may be considered only to avoid high-risk consumers.

A possible reason for the finding that does not support favorable selection incentives is that plans may not consider HEDIS-type quality as a useful tool to attract healthy consumers. Tightly managing utilizations of high-cost procedures or restricting provider networks may be a better mechanism to do so than providing poor quality in HEDIS measures. Alternatively, given current attention to quality of care as a national agenda, plans may face some penalties after releasing low-quality information that are not captured in this study. It is also possible that the variables I used to measure prior beliefs are not good indicators of consumers' expected quality.

Fourth, I found a positive association between market competition and disclosure among relatively low-quality plans. This result is different from Jin's (2005) study that showed disclosure rates were lower in more competitive markets. Since her model included neither plan fixed effects nor selection factors, her finding may be due to unobserved plan heterogeneity or uncontrolled selection incentives in competitive markets. Further investigation of this issue in future research will help better understand the role of competition in disclosure.

A few limitations of the study should be noted. First, this study uses data from the earlier years of the HEDIS disclosure program, and thus the result may not be generalized to disclosure trends in recent years. Analysis of data from a longer time period could be informative to understand whether market unraveling evolves as the only dominant incentive for disclosure or if selection incentives remain as a determinant of disclosure decisions over the long run.

Second, since the estimation is based on a reduced form approach, the coefficients of the regression analyses do not represent the direct effect of the variables on disclosure. For example, in case of the death rate from CVD/DM, its effect on disclosure may work through quality, which is a determinant of disclosure decisions; plans in markets with high death rates may offer low quality to avoid sick consumers or they may provide high quality responding to high demand for quality from high-risk consumers.

Third, health plans' premiums are not included in this study. Premiums are an important determinant of consumers' health plan choices and it is possible that consumers use premium as a signal for quality. Health plans may make joint decisions on premium, quality, and disclosure. In future research, a structural approach that incorporates premium, quality, and disclosure will better inform us about plans' decision-making mechanisms.

In conclusion, this study finds that market mechanisms play an important role in voluntary disclosure of quality information. However, it also shows that full voluntary disclosure is not likely to emerge in HMO markets where selection incentives are prevalent. Separate analyses by quality suggest that consumers' beliefs on plan quality are a determinant of disclosure among low-quality plans and that consumers do not always respond that nondisclosure implies the poorest quality.

The results of the study do not necessarily imply that mandatory disclosure should be implemented. Disseminating quality information is a costly process, and some HMOs, while not included in the study, do not disclose because of the cost associated with collecting quality data. Furthermore, it has been shown that mandatory disclosure programs for hospitals involved unexpected results—turning away patients who are not favorable to quality outcomes (Dranove et al., 2003; Werner et al., 2005). Mandatory disclosure may encourage such type of undesirable behaviors. To estimate the welfare effect of a mandatory disclosure policy, all those effects should be taken into account. The purpose of this study was to identify conditions that facilitate voluntary disclosure, and the analysis suggests that in developing policies to encourage public disclosure of quality information, characteristics of market environment such as state regulation, competition, and consumers' health risk should be considered.

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