



# Information disclosure and peer effects in the use of antibiotics



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## ABSTRACT

Mandatory information disclosure may allow sellers to observe and respond to other sellers' attributes (seller peer effects) as well as informing consumers of the sellers' attributes (consumer learning effect). Using the data from mandatory information disclosure of antibiotic prescription rates for the common cold in Korea, this paper shows that while average prescription rates decreased after the disclosure, more than 30% of the clinics increased their antibiotic prescriptions. Moreover, clinics that were prescribing relatively fewer antibiotics than other local clinics before the disclosure requirement were more likely to increase their prescription rate. The average prescription rates also declined less in markets with stronger clinic competition. These results are consistent with seller peer effects.

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## 1. Introduction

When sellers have more information than buyers on the attributes of a product, the sellers can overstate the product's quality and overcharge the buyers. Such an information asymmetry problem can lead to the collapse of markets (Stigler, 1961), distort investment decisions, and undermine the quality and safety of products and services including health care, foods, education, and the environment. Therefore, there is an increasing use of mandatory information disclosure as a regulatory mechanism to address this information asymmetry problem and to improve the quality of products and services.

However, mandatory information disclosure can reveal the attributes of products and services not only to consumers but also to other competing sellers. That is, even though the previous literature has largely focused on the effects of information disclosure to consumers, mandatory information disclosure can directly affect the interaction among sellers. In particular, when a seller learns that most other sellers were providing lower quality services, the seller may reduce its quality after the information disclosure.

In this paper, we consider a simple theoretical framework to distinguish whether (i) consumers learn the attributes of sellers from mandatory information disclosure and pressure the sellers to

improve quality (called *consumer learning effects*) or (ii) sellers learn their competitors' attributes from mandatory information disclosure and influence each other's quality (called *seller peer effects*). Even though consumer learning effects suggest that mandatory information disclosure should increase the quality of all sellers, we show that seller peer effects may *decrease* the quality of some sellers.

Therefore, when introducing mandatory information disclosure, it is important for policy makers to understand the existence and the extent of seller peer effects. For example, in markets where sellers themselves do not know the attributes of other sellers, an information disclosure policy can introduce seller peer effects as well as consumer learning effects. Moreover, if the disclosed information is difficult for consumers to find or interpret, seller peer effects can dominate consumer learning effects.

Before we proceed further, it is worth clarifying the definition of peer effects in this paper. We define peer effects as a situation where an individual's behavior or decisions are influenced by others' behavior in a relevant peer group, called "endogenous peer effects" by Manski (1993). Such peer effects can arise from an intrinsic social preference for behaving like others. Such peer effects can also arise from rational decisions to obtain higher economic payoffs. For example, following the behavior of others can be cost-efficient and rational (Bikhchandani et al., 1992). While some may argue that peer effects arising from social preference are the true peer effects, we are more interested in whether consumers learn about sellers' behavior from mandatory information disclosure or

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the competing sellers do. Therefore, in this paper, we do *not* distinguish between peer effects based on social preference and peer effects based on rational or strategic choice.

Empirically, we examine the effects of the 2006 mandatory public disclosure of the antibiotic prescription rates for the common cold of every clinic and hospital in Korea. In 2012, the director general of the World Health Organization (WHO) warned that overuse of antibiotics has led to widespread drug-resistant pathogens that are more difficult, toxic, and costly to treat.<sup>1</sup> However, antibiotics are still frequently prescribed for the common cold, often because of patient demands and hospital competition, even though they are not useful for fighting infections caused by viruses like the common cold, most sore throats, and bronchitis (Bennett et al., 2011; Robohm and Ruff, 2012). Thus, on February 9th of 2006, the Ministry of Health and Welfare in Korea began disclosing antibiotic prescription rates for the common cold online through the public disclosure website of the Health Insurance Review and Assessment Service (HIRA).

On average, we find that the antibiotic prescription rates for the common cold have decreased from 60% to 51% after the information disclosure. Surprisingly, however, we uncover a large amount of heterogeneity among the clinics. More than 30% of clinics have *increased* their antibiotic prescription rates after the information disclosure. In particular, among clinics whose antibiotic prescription rates were in the lowest quartile of local clinics before disclosure, almost half of them increased their prescription rates after disclosure. This finding is more consistent with seller (or clinic) peer effects. That is, when a clinic finds out that other clinics were prescribing relatively more antibiotics than itself, it is more likely to increase its antibiotic prescriptions.

Alternatively, consumers may prefer higher antibiotic prescription rates, and may have pressured the lower-than-average antibiotic prescribing clinics to increase their prescription rates. However, the evidence shows that for those clinics that were prescribing antibiotics relatively more than other local clinics before the information disclosure, consumers started visiting those clinics *less* after the disclosure. Moreover, in townships where consumers responded more negatively to the antibiotic prescription rates, the average antibiotic prescription rates decreased more. These results suggest not only that consumers learned from the information disclosure, but also that informed consumers prefer *lower* antibiotic prescription rates for the common cold.

We also find that in townships with relatively more clinics, the average antibiotic prescription rates after the information disclosure decreased *less*. This result suggests that stronger competition led to relatively higher antibiotic prescription rates and that the clinic peer effects triggered by mandatory information disclosure have reinforced this competition effect.

Overall, the empirical evidence supports both consumer learning effects and seller peer effects. The previous literature has implicitly assumed that sellers can observe their competitors' attributes even before mandatory information disclosure, and has focused on consumer learning effects. This paper contributes to the literature by showing that when sellers cannot observe the attributes of their competitors' products and services, mandatory information disclosure can allow the sellers to learn their competitors' attributes and potentially trigger perverse peer effects. Because the seller peer effects can cancel out some of the consumer learning effects, our results may also explain why some previous studies have found no significant effect of information disclosure.

## 2. Background and previous literature

### 2.1. Information disclosure

Most previous literature has focused on the effect of information disclosure on *consumers*, or consumer learning effects. For example, without mandatory information disclosure, consumers may not be able to observe the quality of a product. Then, as Akerlof (1970) shows, firms cannot benefit from high quality and may leave the market, which can lead to the collapse of the whole market, called the lemon problem. In this case, quality information disclosure to consumers would benefit high quality firms, and provide incentives to improve quality.

Also, quality information disclosure can allow consumers to identify high quality firms more easily, and make them more sensitive to differences in quality. Then, information disclosure can lead to more competition among firms and may improve the quality of products (see, e.g., Stigler, 1961; Butters, 1977; Salop and Stiglitz, 1977; Jin and Leslie, 2003).<sup>2</sup>

However, the empirical evidence on the effect of information disclosure on quality (or other performance measures) is generally mixed. For example, Chipty and Witte (1998) find that information availability on the quality of child care has no significant effect on the quality of the care. However, Jin and Leslie (2003) find that information disclosure on restaurants' hygiene has significantly improved their hygiene.

In the Health Care industry, Vladeck et al. (1988) do not find any significant differences in the occupancy rates between high- and low-mortality rate hospitals after the release of the HCFA (Health Care Financing Administration) data on hospital-specific mortality, while Menemeyer et al. (1997) do find a small but significant effect. Longo et al. (1977) examine the impact of an obstetrics consumer report on hospital behavior in Missouri, and find that half of the hospitals improved the quality of their hospital care. Shekelle et al. (2008) provide a systematic survey of more recent studies, but show mixed results as well. In the electricity industry, many states in the US require electricity providers to disclose price and fuel mix so that consumers can compare prices and environmental impacts. However, these disclosure policies have not induced much consumer switching (Bird, 2009).

Note that the previous literature on mandatory information disclosure has mainly focused on the changes in consumers' behavior from learning new information on product quality (*consumer learning effect*), which can induce the changes in firms' behavior. Few studies, however, have considered the direct effect of information disclosure on firms' behavior. Some exceptions include the studies on the effect of information disclosure on firms' collusion (see, e.g., Albaek et al., 1997; Njoroge, 2003).<sup>3</sup> However, these studies do not explain why firms often oppose mandatory information disclosure.<sup>4</sup> Consequently, when the effect of mandatory

<sup>2</sup> On the other hand, quality information disclosure may allow consumers to perceive the difference between firms, and increase product differentiation among firms. Then information disclosure would reduce competition (Nelson, 1974; Jin and Leslie, 2003).

<sup>3</sup> There is also a theoretical literature that shows firms would disclose their quality voluntarily if they know each others' quality, called the unraveling effect (Grossman and Hart, 1980; Milgrom, 1981). Therefore, it is a theoretical puzzle why firms in reality do not disclose their quality (see Board, 2009). Our empirical evidence suggests that firms may not know each others' quality (see also Matthews and Postlewaite, 1985; Shavell, 1994).

<sup>4</sup> For example, in 2000 the National Hospital Association opposed a proposal to impose mandatory information disclosure on fatal and other serious medical errors. (CNN News February 22, 2000) In 1998, the National Restaurant Association strongly opposed the mandatory display of hygiene "grade cards" (Food Council News, Vol. 5, Issue 1, January 2002). In 2006, the Korean Congress attempted

<sup>1</sup> Available from <http://www.cbsnews.com/8301-504763.162-57398949-10391704/who-antibiotic-overuse-so-prevalent-scraped-knee-could-be-deadly/>

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