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Principal-Agent Problems in Health Care: Evidence from Prescribing Patterns of Private Providers in Vietnam

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Principal-Agent Problems in Health Care: Evidence from Prescribing Patterns of Private Providers in Vietnam

Ha Nguyen*

Abstract

The principal-agent problem in health care asserts that providers, being imperfect agents for patients, will act to maximize their profits at the expense of the patients' interests. This problem applies especially where professional regulations are lacking and incentives exist to directly link providers' actions to their profits, such as a fee-for-service payment system. The current analysis tests for the existence of the principal-agent problem in the private health market in Vietnam by examining the prescribing patterns of the private providers. We show that (1) private providers were able to induce demand by prescribing more drugs than public providers for a similar illness and patient profile; (2) private providers were significantly more likely to prescribe injection drugs to gain trust among the patients; and (3) patients' education as a source of information and empowerment has enabled them to mitigate the demand inducement by the providers. Our hypotheses were supported with evidence from Vietnam National Health Survey 2001 and 2002, the first and, so far, only comprehensive health survey in the country.

Keywords: private sector, principal-agent problems, provider-induced demand, prescribing, Vietnam

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I. Background

This article assesses the issue of principal-agent problems in the private health care market in Vietnam as applied to drug prescription and dispensing. Principal-agent and its core problem, supplier-induced demand, in health care are widely known (Evans, 1974). Health service research literature in the developed countries has provided ample evidence supporting the presence of service inducement by the providers (Fuchs, 1978; Cromwell and Mitchell, 1986; Birch, 1988). However, little empirical evidence exists in developing countries, especially related to the private sector. Paradoxically, private health service in developing countries is where the principal-agent issue can be very salient. Often, provider regulation is weak and consumer organizations are rarely in place to protect the patients' interests. Many developing countries still rely heavily on fee-for-service as a main provider payment method, which render them susceptible to induced demand. The significant role of the private sector in service provision warrants a close look at its behaviors and their implications in quality and efficiency of services.

As in many other developing countries, private health service in Vietnam is not a recent phenomenon. Private health service provision has been officially recognized since the mid-1980s, with the country's embarkation on health sector reform (Ha, Berman, and Larsen, 2002). The legal basis for the private sector was established through a ratification of the Ordinance on Private Medical and Pharmaceutical Practice in 1993 and its subsequent revision in 2003. Throughout the years, the private sector has developed strongly in both quantity and complexity. By the end of 1998, the Ministry of Health official records showed 19,836 private practices and 14,182 pharmacies (Ha et al., 2003). Ten years later, these numbers increased to 30,000 and 21,600 for practices and

pharmacies respectively (Vietnam Ministry of Health and Health Partnership Group, 2008). While occupying a significant share of the ambulatory market, the private sector has made major steps in penetrating the hospital sector. The number of private hospitals in the country soared from 8 in 2003 to 83 in 2009, with bed capacity ranging from 20 to 500 (Vietnam Ministry of Health, 2009).

Early literature typically suggested that the private service concentrated more heavily in the urban area and served primarily patients with middle to high income (Population Council, 1999). However, mounting subsequent evidence questioned the consistency of this finding (Ha, Berman, and Larsen, 2002; Tuan et al., 2005; Thuan et al., 2008). In fact, it has been shown that a private birth attendant was the choice of less wealthy women in Vietnam (Do, 2009). In terms of interpersonal quality of care, private practitioners usually gain client satisfaction due to their caring attitude and flexibility in timing of services and in accepting deferred payment (Long et al., 1999). Their technical quality of care, however, leaves much room for improvement (Tuan et al., 2005). A national survey of private primary care practitioners revealed that less than 40 percent of the providers with the highest qualifications in the commune had sterilization equipment and only 10 percent of them scored 75 percent or above correctly on how to recognize and treat conditions relating to hypertension and pregnancy (Vietnam Ministry of Health, 2003).

Despite the existence of the legal framework, regulation of the private services in Vietnam remains weak. The Ordinance on Private Medical and Pharmaceutical Practice allows practitioners to write prescriptions but not to sell drugs. Yet 85 percent of the private practitioners interviewed in a national survey reported selling drugs during

consultations with patients (Vietnam Ministry of Health, 2003). Regulation is particularly weak in rural areas, where the public health authorities in charge do not have adequate human resources to carry out necessary inspections. In the years 2001 through 2002, while 83 percent of the private practitioners at the primary level in urban areas had licenses, the corresponding figure in rural areas was 37 percent (Vietnam Ministry of Health, 2003). Besides inspection and licensing requirements, there have been few efforts to use incentives to influence the private sector's behaviors. For example, rarely does Vietnam Social Security contract with private providers for providing services through social health insurance.

Several major differences in the incentive structure affect the behaviors of individual providers in the public versus private sectors in Vietnam. Because clinics, the most common form of private practice, are typically staffed by one or several providers, each provider's income is directly linked to the revenue of the clinics. This system creates a strong incentive for each individual to maximize the clinic profits. Coupled with fee-for-service as a form of charging the patients, this maximization means increasing the volume of services, in particular the more lucrative ones. In the public sector, health professionals are paid fixed salaries regardless of their performance. Although their bonus comes from user fees, the bonus comprises less than 30 percent of user-fee revenue, and user fees account for a small share of the facility budget (18 percent of the public hospital budget in 2005) (Lieberman and Wagstaff, 2009). Therefore, the incentive for each individual doctor to overprovide services is not as strong as in the case of the private sector. Similarly, revenue from drug sales directly benefits the individual private providers, which is not the case in the public sector.

In the following section, we discuss the agency relationship in the health care market and how it applies to provider prescription and dispensing. We next state our hypotheses, which are derived from the agency theory, and particular characteristics of the private health care market in Vietnam. That discussion is followed by a presentation of data, methods, and results. We conclude with a discussion of our findings and their implications on approaches for influencing the private sector's behaviors.

II. Agency Relationship in the Health Care Market

The relationship between provider and patient in the health care market is often characterized as a principal-agent relationship. The principal (the patient) appoints an agent (a health provider) to advise the principal in making decisions about treatment or to make decisions on the principal's behalf. The provider is expected to be a perfect agent, combining professional knowledge with the patient's preferences to determine a choice that the patient would make based on that information. The principal-agent problem arises as the provider chooses instead to maximize his or her own interests, which in many cases do not align with the patient's interests.

At the heart of the physician-patient relationship are the information issues. As Arrow (1963) pointed out, the health care market is characterized by a high degree of uncertainty. Perhaps neither the physician nor the patient is certain about the disease and the optimal treatment. More likely, the physician has a greater knowledge of the patient's condition than the patient has. Due to the complexity of health and medicine, the information asymmetry between the provider and the client in health care is more severe than in many other markets, such as markets for consumer goods. As patients become

more empowered and informed about their health conditions and possible treatment alternatives, providers are less able to deviate from their role as perfect agents.

The most often cited principal-agent problem is physician-induced demand. This dynamic occurs when the physician influences the patient's demand for care against the physician's interpretation of the best interest of the patient (McGuire, 2000). Physician-induced demand implies persuasive activity to shift the patient's demand curve in or out according to the physician's self-interest. As in any agency problems, the degree of physician-induced demand depends on the information asymmetry between the provider and the patient. In addition, physician-induced demand is particularly prone to fee-for-service payment, which provides a clear incentive linking service volume to profits.

In the case of drug prescription and dispensing, the agency problem becomes more complex. Whereas in a typical health care setting the provider that decides on the treatment would ultimately perform the treatment, prescription and dispensing can be two completely separate functions. In fact, countries can choose to either separate or integrate prescription with dispensing, and each system has its own advantages and disadvantages (Eggleston, 2008; Eggleston, 2009). In either case the variety and complexity of medicines present an ultimate testimony about the provider as the perfect agent for the patient. For example, for a mild upper-respiratory infection, the provider could choose to prescribe antibiotics or steroids, which might be an immediate remedy but over the long term could harm the patient. Alternatively, the provider could prescribe regular cough formula, which might be clinically appropriate but may not be attractive to the patient due to the slow effects. Without an appropriate knowledge of the long-term effects of the various treatment regimes, the patient may prefer the fast-cure drug and trust the provider

as “effective.” With medicines, the agency relationship is complicated by the fact that patients usually possess a perception that may not come from scientifically proved knowledge (Craig, 2000). Because medicine use embodies deep cultural aspects, the agency problem does not rest only in the immediate shifting of the demand curve (increasing quantity), but also in twisting the quality to gain trust among the patients at potential risk to the patients.

III. Hypotheses

In this article we test for the presence of the principal-agent problems in the private health market in Vietnam using the case of drug prescription and dispensing. We focus on curative outpatient care, because the private hospital sector is still relatively small. The agency relationship is examined from both the provider and patient angles. In particular, we test for the presence of provider-induced demand for medicines, the provider decision to adopt a fast-cure medicine that may not necessarily be for the sake of the patient’s health, and the effect of patient education as a source of information and empowerment in counterbalancing the demand inducement by the provider. The fast-cure medicine in our article is an injection drug, which patients have greatly favored (Mediconsult, 2003). Although it is not clear from our data, the injection drug for the most part is likely to be antibiotics, especially if it is used in a curative rather than preventive care setting.

It is noteworthy that provider-induced demand is easier to infer than to prove. The distinction among induced demand, defensive medicine, and even genuine care for the patient is not always straightforward. For the case at hand, we use the behaviors of public

providers as a benchmark for judging whether there is induced demand in the private sector. Although, as mentioned, incentives exist for public providers to induce services for their own interest, the link from an individual provider's behaviors to profits is much stronger in the case of the private sector. Thus, the potential agency problems in the private health market can be tested with the following three hypotheses:

1. For a similar patient and illness profile, private providers prescribe more drugs for each outpatient contact than do public providers.
2. For a similar patient and illness profile, private providers are more likely to prescribe injection drugs in an outpatient setting than are public providers.
3. Highly educated patients both receive fewer drugs and are less likely to receive injections than are lowly educated patients. The effect of the patient's education is stronger in the private health care market than in the public health care market.

IV. Data and Methods

We use household data from the Vietnam National Health Survey (VNHS) conducted in 2001 and 2002 to test the hypotheses. The VNHS was the first comprehensive national health survey in Vietnam, and it collected detailed information from more than 158,000 individuals on health conditions, insurance status, utilization, and expenditure on health services from public and private providers. Although Vietnam has conducted three national household surveys since the VNHS (the Living Standard Surveys 2004, 2006, and 2008), none of them is as large and rich in health information as the VNHS. Regarding the particular question at hand, VNHS is the only survey that allows for an examination of providers' prescribing and dispensing patterns.

The key information for this analysis comes from the two sections in the household survey. The first section asked whether the respondent had incurred any illness and injury during the four weeks preceding the survey, the severity and type of the illness, and whether the respondent had sought treatment for it. The second section asked about each outpatient health-seeking episode during the same period, regardless of whether or not the person was sick, as well as about the providers of services and the drugs dispensed. Within the second section, we limit our sample to curative care.

A practical complication for linking health conditions with seeking medical care is that the two sections of the survey were administered independently from each other. It is possible that people who reported being ill did not end up seeking formal care. More importantly, for those who reported having more than one health problem and seeking medical care, we do not know for which health problems they sought medical care. To address this shortcoming in the data, we constructed an analytical sample that comprises only outpatient contacts reported by people who had one health problem and sought medical care for it. For this subset, we were able to link the health condition for which the patient sought care with the provider of services. Out of 63,406 people who reported having an illness or injury over the four weeks preceding the survey, 53,229 (83 percent) had only one problem. Among these, nearly 28 percent sought formal medical care for the health problem reported. This leaves us with a final sample of 12,300 observations, which are measured in terms of contacts with health care providers. The analysis using the full set of contacts incurred regardless of health conditions provides very similar results (results are available from authors upon request).

Two outcomes of interest include the number of medicines prescribed and dispensed in an outpatient contact for curative care, and the probability that injection is administered. We are interested primarily in testing whether the outcomes vary systematically among providers, and in particular, how the private providers are compared to three categories of public providers: clinic (commonly known as commune health center or intercommunal policlinic), secondary-level hospital (district), and tertiary-level hospital (provincial and central). To test Hypothesis 3, we examine specifically the differential effects of the patient's education on the outcomes of interest for contacts in the private sector versus the public sector. For children ages 15 or younger, we use education of the mother instead. The five health conditions reported during the four weeks preceding the survey included respiratory, diarrhea, other acute illnesses, injury, and chronic health problems. In addition, we also consider whether the respondent has hypertension or a disability, as well as control for his or her sociodemographic characteristics and place of residence.

The analysis starts with a description of the sample and a bivariate analysis of drug prescription patterns with key independent variables of interest. Multivariate analysis takes the form of ordinary least squares for the number of drugs and probit for the probability of injection. All analyses apply survey sampling weights. Because each survey respondent can report more than one contact with one or more providers, standard errors are clustered at the individual respondent level.

V. Results

Sample description

Table 1 presents the summary statistics for all variables in the analytical sample. On average, providers prescribed about 3.85 drug items per contact and offered an injection in 34 out of every 100 encounters. More than 53 percent of all outpatient contacts for curative care happened in the private clinics, confirming that the private sector occupied a large market share in the ambulatory health market in Vietnam. Private providers sold medicine at their own facilities in 95 percent of all cases (table not shown). Given the regulation banning private providers from selling drugs, this finding raises a concern about the enforcement aspect of regulation. Because dispensing almost always followed prescription, in the following discussion, we will use the words *prescription* and *dispensing* interchangeably.

Table 1 reveals that most of the health problems reported during the four weeks prior to the survey were acute illness, most notably respiratory problems. Nearly 24 percent of the problems belonged to the chronic group. Twenty-two percent of the problems were perceived by the respondents as severe. There was a rather strong gradient in the representation of various wealth groups in the sample, ranging from 14.5 percent in the poorest quintile to 22.3 percent in the richest quintile. This pattern supports the common notion that poor people are left behind, compared to the rich, in seeking formal care when they are ill.

One could argue that public and private providers have different prescribing patterns because they see patients with different types and severities of health conditions. For example, private clinics in Vietnam are typically only comparable to public clinics and secondary-level hospitals in terms of technical complexity. To control for this confounding factor, we stratified the contacts by the type of health condition and its

severity as perceived by the respondent. Table 2 shows the average number of medicines prescribed for each of the five health conditions and for each severity level separately. The table reveals that, for all health conditions, private providers prescribed more medicines than any of the public categories. For example, for respiratory disease, a contact with the private providers entailed 4.11 drug items, higher than tertiary hospitals (3.88). The difference is statistically significant for all types and severity levels of the reported health condition.

Figure 1 shows the probability of prescribing injection, by type of facility and illness. Looking across providers, we can see that contacts at private clinics have a much higher probability of injection, ranging from 40 percent to 52 percent for diarrhea and injury, respectively. In fact, injury is the only category in which public clinics are more likely than private providers to prescribe injection. Interestingly, while the distinction between injury and other health conditions is clear among the three public providers, it is small as far as contacts in the private sector are concerned. In fact, the difference in the probability of having injection among five health conditions in the private clinics is statistically insignificant at the 10 percent level (figure not shown).

Figure 2 shows a similar picture broken down by self-reported severity of illness. It reveals a strong downward gradient as one goes from private clinics to public facilities with increasing levels of complexity. The likelihood of injection being administered in the private clinics is nearly four times as high as that in the tertiary public hospitals for all degrees of severity (56 percent versus 15 percent in the severe category, for example).

Do private providers prescribe more drugs per outpatient contact than do public providers?

Table 3 presents the results of the ordinary least squares estimate of the number of drugs prescribed in an outpatient contact. The three categories of public facilities are compared to private clinics, which are the reference group. The regression controls for illness type and severity, as well as all patient characteristics and other covariates (age, gender, marital status, insurance, education, wealth, poverty status, and region—figures not shown). As revealed, the coefficients for public facilities are all negative and strongly statistically significant. On average, a contact that occurred in a pubic clinic entails 0.315 less the number of drug items compared to one that occurred in a private clinic. This difference represents 8 percent of the sample mean, which is 3.849 (Table 1). The corresponding coefficients for public secondary and tertiary hospitals are 0.233 and 0.248, respectively. Thus, the results in Table 3 support our Hypothesis 1, that the private providers were able to shift out the demand for drugs among their patients.

Other results in Table 3 show expected directions of effects. For example, compared with illness at a moderate level, a contact for severe illness involves, on average, 0.301 more drug items, and a contact for mild illness involves 0.320 fewer drug items. Relative to respiratory problems, all other health conditions require a smaller number of drugs. An interesting observation in Table 3 is that “urban” has a strongly negative coefficient, suggesting that the degree of inducement in urban areas may be less due to better regulation of both the public and private sectors.

Are private providers more likely than public providers to prescribe injection drugs?

Table 4 shows the results of a probit estimate of the probability that an injection was offered during an outpatient consultation for curative care. The figures presented are

marginal effects, and their robust standard errors are clustered at the individual level. The suppressed individual control variables are similar to those in Table 3. As shown, all three categories of public providers were much less likely than private clinics to prescribe injections. For example, compared to a contact that occurred in a private clinic, a contact in a public clinic would have 13 percentage points lower probability of involving injection. Given that the sample mean of injection is 34.2 percent (Table 1), this difference represents 38 percent of the sample mean. The higher the level of the public health facilities, the less likely it is that an injection was offered, controlling for disease and patient characteristics. The difference between the private clinics and public tertiary hospitals is more than 82 percent of the sample mean. Again, these results provide strong evidence to support our Hypothesis 2, that private providers were more likely to induce injection relative to their public peers.

All other variables in Table 4 show expected signs of association. For example, a contact for a severe health problem was more likely to involve an injection than that for a moderate health problem. All acute health conditions appear to involve an injection less often than respiratory infection. However, injury invokes injection more often than any other health condition. Again, the effect of "urban" is negative and highly significant, suggesting a much higher incidence of injection in the rural areas of Vietnam.

Are there differential effects of patient education on the volume of drugs and likelihood of injection between public and private providers?

To test Hypothesis 3, we perform estimations of the two outcomes of interest, using separate samples that comprise contacts in the private and public sectors, respectively. Table 5 shows the results of four estimations: ordinary least squares

estimations for the number of drug items prescribed during a contact at private clinics (Model 1) and at all public facilities combined (Model 2); and probit estimation for the probability of injection at these two types of providers, respectively (Models 3 and 4). As always, all these models adjust for survey sampling weight and cluster the standard errors at the individual level. They all control for illness type and severity, as well as for the geographical regions in the country. For Models 3 and 4, the figures presented are marginal effects obtained from the probit models. The primary variable of interest in Table 5 is the respondent's education or that of the mother if the respondent is younger than 16.

Looking specifically at Model 1, we can see that, compared to the reference group, which are those who are illiterate or who have less than a primary education, the group with a primary education experiences no statistically significant difference. However, the two subsequent higher-education groups (secondary school and college) were prescribed a significantly smaller number of drug items. This pattern suggests that highly educated people may have been successful in influencing the private providers in a way that mitigates the provider's ability to induce drugs among them. Because the regression has controlled for the severity and type of illness, it is unlikely that this observed education effect is confounded by the fact that higher educated people are more prompt in seeking care and hence their health conditions require fewer drugs. Model 2 provides an interesting comparison from outpatient contacts in the public sector. Here none of the education groups is statistically significant, and in fact, they do not follow a consistent sign. Thus, it appears that patient education is more important in encounters with private providers than in encounters with public providers. Another interesting

difference between Models 1 and 2 is the effect of income, which is insignificant in 1 but highly significant and positive in 2.

Models 3 and 4 reveal a qualitatively similar effect of education for contacts in the private versus public sectors in the case of injection. Quantitatively and statistically, the difference is much more pronounced. Among the contacts in the private sector, the education gradient is particularly strong, with highly educated patients being much less likely to receive injections than the lowly educated ones. Among the public sector contacts, education effect is consistently negative, yet not statistically significant.

The relationship between the outcomes of interest and several other covariates in Table 5 is worth noting. For example, in terms of injection (Models 3 and 4), insurance status in adults is marginally significant in the case of the private sector but negative and strongly significant in the case of the public sector. Because social health insurance in Vietnam barely contracted with any private providers at the time of our research, one should not expect to see any effect among the contacts in the private sector. Yet in the public sector, the negative sign may be explained by the fact that insurance agencies scrutinized the providers to make sure that they could not abuse the service easily. As in Tables 3 and 4, urban effect remains negative and strongly significant in three out of four models in Table 5, suggesting that regulation could be an issue in both the public and private sectors in the rural areas.

VI. Discussion

The current study thus has found evidence supporting the presence of principal-agent problems in the private health care market in Vietnam. We showed that not only

did the private providers shift out the patients' demand curve for drugs in curative outpatient care, but they also prescribed fast-cure drugs to the patients unnecessarily. For a similar patient and illness profile, an outpatient contact in the private sector typically entails from 0.233 to 0325 more drug items than a contact in the public sector, and the probability of injection drugs is 13 to 28 percentage points higher. Given that medicines account for a major portion of health care cost and that the private sector occupies a large share of ambulatory service provision, these differences in the prescription patterns are salient.

An interesting finding from this study is that the provider's behaviors can be influenced by an array of patient characteristics, in particular education. In line with the principal-agent theory, we posit that education equips patients with information and empowerment, which they can use to bargain for a treatment alternative more in their favor. Our findings also suggest that regulation and check from a third party, whether it is an authoritative body in charge or an insurance agency, can provide another guard against provider-induced demand in the health care market in Vietnam. This suggestion is reflected in the consistent negative effect of urbanity and, to a lesser extent, of insurance status on the number of drugs and the probability of injection.

It is important to note several limitations in our study. We use the public sector as a benchmark to judge the degree of induced demand in the private sector, yet one would not rule out completely the possibility of induced demand in the public sector itself. If induced demand exists in the public sector, the magnitude detected in our study will be on a lower bound. More importantly, due to the limitation of data, we cannot affirm that injections are absolutely equivalent to antibiotics. We also cannot assess the quality of the

prescription and whether the prescribed medicines were generic or brand name, which would shed much light on the profit motivation of the providers.

Limitations notwithstanding, this study potentially makes valuable contributions to the current knowledge of the private health care market. It is one of the very few studies documenting the presence of provider-induced demand in a developing country setting. It touches upon the issue of medicines, which has major cost and sociocultural implications. Finally, the study combines provider and patient aspects, which allows for an assessment of the health care market from both the supply and the demand sides.

Bennett et al. (1994) recommended an array of regulation and incentive structures to influence the provider behaviors. In their framework, key players include not only the providers and their professional organizations, but also consumers, the state, and the third-party payers. Bennett et al.'s framework is highly applicable to the private sector in Vietnam. The case is strong for enforced regulation of the private providers through licensing and inspection. Incentive structures can be manipulated by involving the private sector in the service provision for social health insurance and by employing a different payment method. Patients should be educated on rational drug use and should be empowered through a supply of information. These are also valuable lessons not only for Vietnam, but also for other countries in their efforts to make the private provider a perfect agent for their population.

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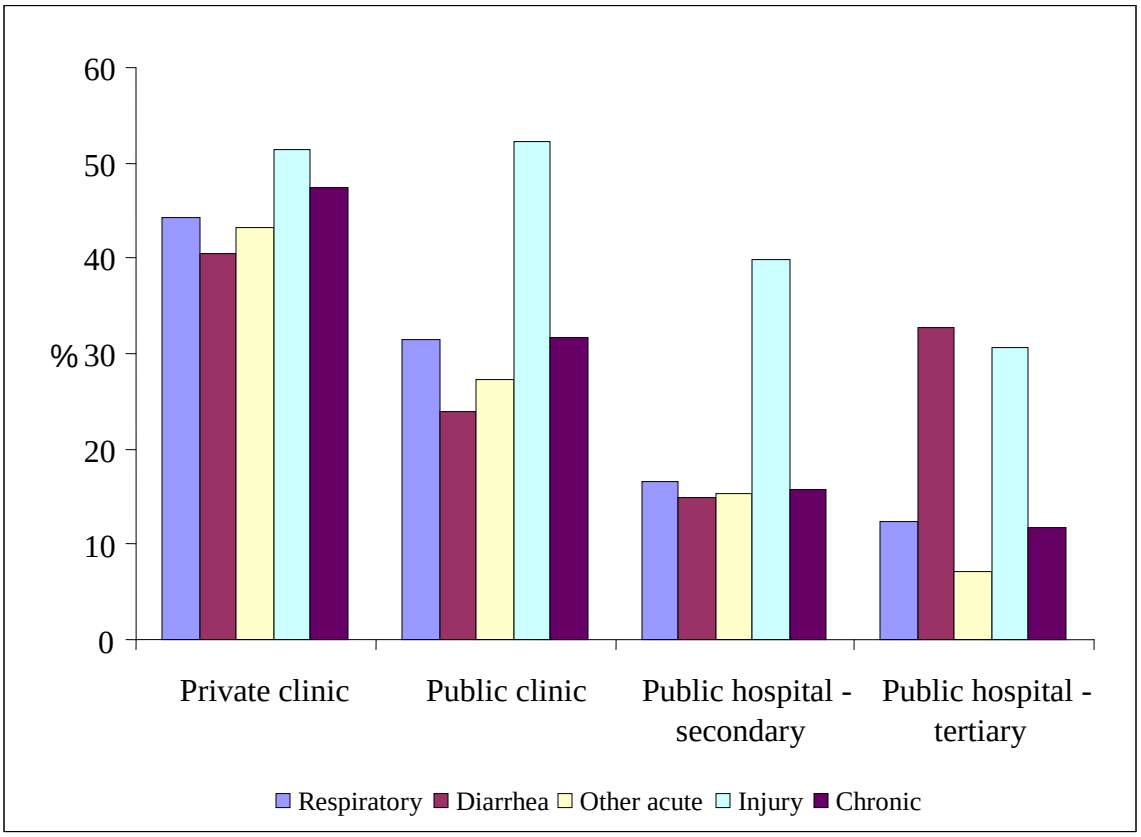
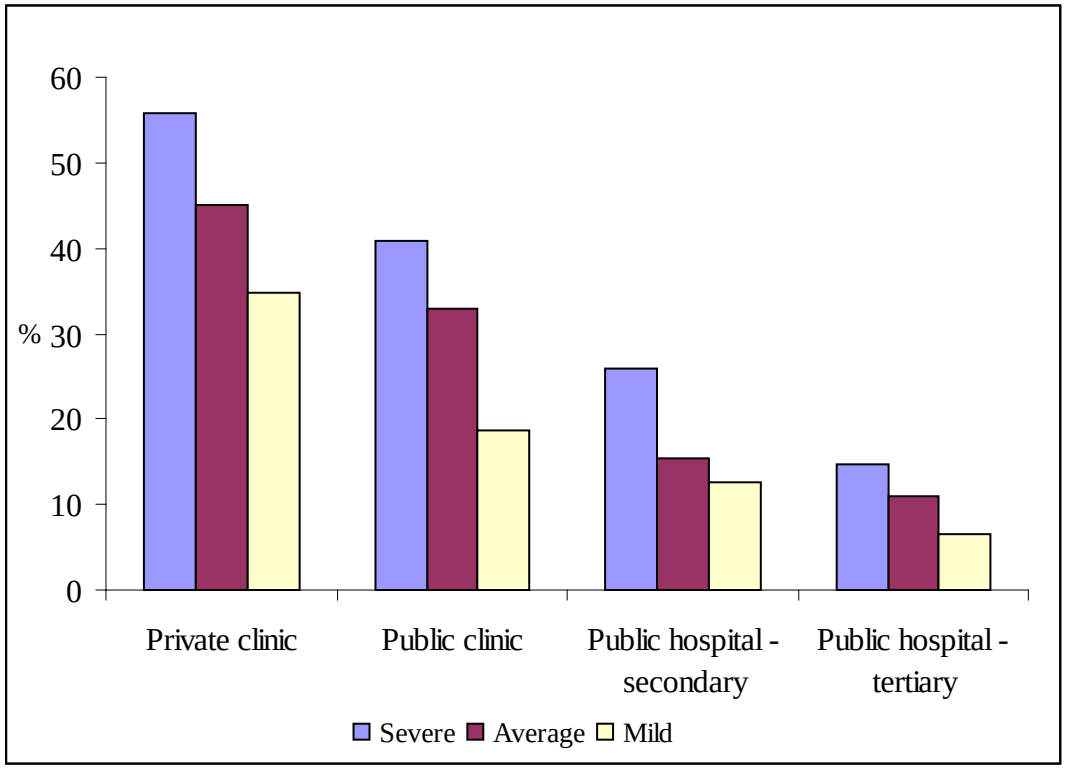
Figure 1. Probability of prescribing injection, by providers and types of illness



Note:
Unit of analysis is outpatient contact for curative care. The statistics are adjusted for sampling weights.

Figure 2. Probability of prescribing injection, by providers and severity of illness



Note:
Unit of analysis is outpatient contact for curative care. The statistics are adjusted for sampling weights.

Table 1. Summary statistics of sample

Variable	Mean	Std. Dev.
Observations (number of contacts)	12,300	
Dependent variables		
Number of drug items	3.849	1.534
Whether prescribed injection	0.342	0.475
Providers of services		
Private clinic (reference group)	0.531	0.499
Public clinic	0.237	0.436
Public hospital – secondary	0.116	0.306
Public hospital – tertiary	0.116	0.308
Health problems reported for 4 weeks preceding survey		
Respiratory (reference group)	0.173	0.379
Diarrhea	0.024	0.154
Other acute	0.523	0.499
Injury	0.043	0.202
Chronic	0.236	0.425
Severity of the health problem		
Average/moderate (reference group)	0.490	0.450
Severe	0.224	0.417
Mild	0.285	0.452
Underlying health conditions and other characteristics		
Hypertension	0.076	0.266
Disability	0.107	0.309
Male	0.452	0.498
Age	26.495	22.140
Married	0.417	0.493
Urban residence	0.215	0.411
Insurance status		
Uninsured (reference group)	0.595	0.491
Insured	0.186	0.389
Eligible for free children's insurance	0.219	0.414
Education		
Illiterate / below primary (reference group)	0.263	0.440
Education: primary	0.278	0.448
Education: secondary	0.382	0.486
Education: college and above	0.077	0.267
Wealth status		
Consumption quintile 1 (reference group)	0.145	0.352
Consumption quintile 2	0.200	0.400

Consumption quintile 3	0.211	0.408
Consumption quintile 4	0.221	0.415
Consumption quintile 5 (richest)	0.223	0.416
Regions		
Region: Red River Delta (reference group)	0.227	0.419
Region: Northeast	0.085	0.279
Region: Northwest	0.014	0.118
Region: North Central	0.095	0.294
Region: South Central	0.085	0.278
Region: Central Highlands	0.061	0.239
Region: Southeast	0.150	0.357
Region: Mekong Delta	0.283	0.451

Note: The statistics are adjusted for sampling weights. Unit of analysis is contact.

Table 2. Average number of medicines prescribed per curative outpatient contact, by illness characteristics

Illness characteristics	Private clinic (N=6,537)	Public clinic (N=2,909)	Public hospital-secondary (N=1,422)	Public hospital-tertiary (N=1,432)	P-value
Type of illness					
Respiratory	4.114	3.482	3.841	3.881	<0.001
Diarrhea	3.982	3.161	3.612	3.402	<0.001
Other acute	4.064	3.472	3.713	3.682	<0.001
Injury	3.933	3.963	3.583	3.553	<0.001
Chronic	4.104	3.681	3.614	3.781	<0.001
Severity of illness					
Severe	4.265	3.961	3.827	3.965	<0.001
Average	4.120	3.553	3.675	3.710	<0.001
Mild	3.850	3.223	3.487	3.410	<0.001

Note: P-value is from χ^2 test for equal mean number of medicines prescribed per contact with different providers.

Table 3. Multivariate analysis of number of drug items prescribed in an outpatient contact for curative care

Number of drug items	Coefficient	Clustered robust standard error
Public clinic	-0.315	(0.037)***
Public hospital - secondary	-0.233	(0.049)***
Public hospital - tertiary	-0.248	(0.050)***
Severe illness	0.301	(0.040)***
Mild illness	-0.320	(0.032)***
Diarrhea	-0.452	(0.091)***
Other acute	-0.249	(0.039)***
Injury	-0.334	(0.083)***
Chronic	-0.376	(0.053)***
Hypertension	-0.020	(0.092)
Disability	-0.074	(0.081)
Urban residence	-0.089	(0.034)***
Patient characteristics		Yes
Regions		Yes
Observations		12,300
R-squared		0.18

Notes:
Unit of analysis is outpatient contact for curative care, based on 4-week recall information.
Values presented are coefficients, and their robust standard errors (in parentheses) are clustered at the individual level. Analysis is adjusted for sampling weights.
Reference groups for shown coefficients include private clinic, moderate illness, and respiratory condition.
Patient characteristics include age, gender, marital status, wealth, education, insurance, and official poverty status.
* Significant at 10%, ** significant at 5%, *** significant at 1%.

Table 4. Multivariate analysis of whether an injection drug was prescribed in an outpatient contact for curative care

Whether injection drug was prescribed	Marginal effect	Clustered robust standard error
Public clinic	-0.130	(0.011)***
Public hospital – secondary	-0.234	(0.011)***
Public hospital – tertiary	-0.282	(0.010)***
Severe illness	0.106	(0.014)***
Mild illness	-0.102	(0.011)***
Diarrhea	-0.060	(0.034)*
Other acute	-0.057	(0.015)***
Injury	0.129	(0.031)***
Chronic	-0.082	(0.017)***
Hypertension	-0.042	(0.030)
Disability	-0.006	(0.029)
Urban residence	-0.075	(0.012)***
Patient characteristics	Yes	
Regions	Yes	
Observations	12,300	
Pseudo R-squared	0.15	

Notes:
Unit of analysis is outpatient contact for curative care, based on 4-week recall information.
Values presented are marginal effects, and their robust standard errors (in parentheses) are clustered at the individual level. Analysis is adjusted for sampling weights.
Reference groups for shown coefficients include private clinic, moderate illness, and respiratory condition.
Patient characteristics include age, gender, marital status, wealth, education, insurance, and official poverty status.
* Significant at 10%, ** significant at 5%, *** significant at 1%.

Table 5. Effects of patient's education and other characteristics on the average number of drugs and the likelihood of injection

Patient's education and other characteristics	Number of drug items		Injection prescribed	
	Private	Public	Private	Public
	(1)	(2)	(3)	(4)
Education: primary	0.011	0.051	-0.054	-0.003
	(0.053)	(0.061)	(0.020)***	(0.018)
Education: secondary	-0.143	0.021	-0.088	-0.018
	(0.061)**	(0.067)	(0.022)***	(0.018)
Education: college +	-0.317	-0.025	-0.233	-0.028
	(0.092)***	(0.090)	(0.030)***	(0.027)
Consumption quintile 2	0.065	0.275	-0.034	0.026
	(0.075)	(0.071)***	(0.028)	(0.021)
Consumption quintile 3	0.032	0.267	-0.05	-0.022
	(0.075)	(0.072)***	(0.028)*	(0.020)
Consumption quintile 4	-0.057	0.314	-0.072	-0.011
	(0.076)	(0.076)***	(0.028)**	(0.022)
Consumption quintile 5	0.055	0.225	-0.121	-0.013
	(0.083)	(0.085)***	(0.029)***	(0.025)
Male	0.101	0.116	0.035	0.03
	(0.040)**	(0.043)***	(0.015)**	(0.013)**
Age	0.023	0.019	0.010	-0.002
	(0.006)***	(0.006)***	(0.002)***	(0.002)
Married	-0.100	-0.045	0.019	0.002
	(0.069)	(0.068)	(0.024)	(0.020)
Officially designated as poor	0.025	-0.037	-0.055	-0.013
	(0.071)	(0.066)	(0.026)**	(0.019)
Insured adult	-0.024	0.065	0.039	-0.094
	(0.066)	(0.052)	(0.023)*	(0.014)***
Eligible for free children's insurance	-0.078	0.052	0.043	-0.066
	(0.071)	(0.088)	(0.029)	(0.023)***
Urban residence	-0.136	0.012	-0.088	-0.092
	(0.044)***	(0.053)	(0.016)***	(0.014)***
Disease characteristics	Yes	Yes	Yes	Yes
Region	Yes	Yes	Yes	Yes
Observations	6,537	5,763	6,537	5,763
(Pseudo) R-squared	0.18	0.17	0.12	0.10

Notes:
Unit of analysis is outpatient contact for curative care, based on 4-week recall information.

Values presented are coefficients (Models 1 and 2) and marginal effects (Models 3 and 4), and their robust standard errors (in parentheses) are clustered at the individual level. Analysis is adjusted for sampling weights.
Reference groups for shown covariates include illiterate, quintile 1 (poorest), and uninsured.
* Significant at 10%, ** significant at 5%, *** significant at 1%.