Centre Emile Bernheim
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Information and efficiency in Vietnamese patients' choice of health-care provider: a short report

Quan-Hoang Vuong

This paper communicates results from a statistical investigation into questions of relationships between sources of health-care information, data sufficiency, and final outcomes of Vietnamese patients' choice of health-care provider. The study employs a data set of 1459 observations collected from a survey in Hanoi in the fourth quarter of 2015. Significant relationships among these factors are identified following categorical data modeling employing the baselinecategory logit (BCL) method. Among the significant results reported, sources of information, cost, and amount of time for seeking information are found to have significant influences on data sufficiency. The quality of information and health professionals' credibility are critical factors in helping patients choose a health-care provider In addition, empirical probabilities for different conditions patients face are provided together with insights and policy implications. Final suggestions emphasize an upgrade of the knowledge base and an increase in public access to information with Internet-based innovations such as smartphone apps and data storage with the participation of healthcare providers and the Ministry of Health's ICT units. The underutilized 115 Emergency Service could also be transformed to function as a call center that helps coordinate and channel requests for information across a broad network of health-care professionals for better public use.

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JEL Classifications: D12, D83, I12

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Information and efficiency in Vietnamese patients' choice of health-care provider: a short report

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Abstract: This paper communicates results from a statistical investigation into questions of relationships between sources of health-care information, data sufficiency, and final outcomes of Vietnamese patients' choice of health-care provider. The study employs a data set of 1459 observations collected from a survey in Hanoi in the fourth quarter of 2015. Significant relationships among these factors are identified following categorical data modeling employing the baseline-category logit (BCL) method. Among the significant results reported, sources of information, cost, and amount of time for seeking information are found to have significant influences on data sufficiency. The quality of information and health professionals' credibility are critical factors in helping patients choose a health-care provider In addition, empirical probabilities for different conditions patients face are provided together with insights and policy implications. Final suggestions emphasize an upgrade of the knowledge base and an increase in public access to information with Internet-based innovations such as smartphone apps and data storage with the participation of health-care providers and the Ministry of Health's ICT units. The underutilized 115 Emergency Service could also be transformed to function as a call center that helps coordinate and channel requests for information across a broad network of health-care professionals for better public use.

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1. Introduction

Health-care information is an important arena of research and is positively related to patients' informed consent in today's increasingly connected world (Miller, 1998). The landscape of health-care information has changed since the birth of the Internet (Haux, Ammenwerth, Herzog, & Knaup, 2002), and the health-care sector has to adapt to the rising need for health information. In a developing country with a weak health-care infrastructure and capacity like Vietnam, the issue has become even more acute as patients face numerous obstacles in obtaining quality information and data for making a decision about which health-care provider to choose to meet their needs. Thus, Stiglitz's stated problem of information asymmetries continues to create market failures and hinder progress in solving economic inequalities (Stiglitz, 1999).

This short report aims to communicate new results from a survey conducted in the fourth quarter of 2015. It has five main parts, beginning with a brief literature section with an emphasis on the role of, functions of, and need for information in order to create a well-functioning health-care system. Then the paper describes the main research method and states the research questions. The survey data and its subsets for analysis are presented next, followed by a section detailing the key results. The paper

closes with a conclusion section pointing to noteworthy insights and practical implications toward the improvement of the health-care information system.

2. A brief literature review

Information is important for service providers to improve the quality of long-term care and for patients to make decisions regarding their health plans (Brodie et al., 2000; Haux et al., 2002; Miller, 1998; Mor, 2005; Rain, 2007; Thompson & Brailer, 2004; Tumlinson, Bottigheimer, Mahoney, Stone, & Hendricks, 1997). In advanced health-care systems, the role of information has been undisputed, and administrators, scientists, and practitioners continue to find ways to improve the health-care information system (Edgman-Levitan & Cleary, 1996; Isaacs, 1996). In the age of information we live in, health-care information has become even more important in addressing persistent problems of high costs, medical errors, variable quality, administrative inefficiencies, and lack of coordination (Isaacs, 1996; Miller, 1998; Thompson & Brailer, 2004).

Hardey (1999) predicts that the Internet as an emerging source of expertise will transform the public use of health information. The Internet has become a main vehicle for individuals in poor health to search for and exchange information about health and health care (Bundorf, Baker, Singer, & Wagner, 2004; Haux et al., 2002; Mittman & Cain, 2000; Rain, 2007) and how to fully benefit from health service (Mor, 2005; Tang & Lansky, 2005).

Detmer (2003) points out that poor quality due to inaccessible data and information results in shortcomings, but better health and health systems are within reach thanks to fast developing information and communications technologies (ICT). Lee, Goh, & Chua (2010) confirm the important role of health-care portals for Internet users in North America and Asia, and they report different behaviors of the Internet-based portals in accessing, creating, and transferring health-care knowledge. There exists the problem of rising inequality regarding the use of ICT in seeking health-care information (Brodie et al., 2000; Damman, Hendriks, Rademakers, Delnoij, & Groenewegen, 2009).

In Vietnam, the information infrastructure is in its nascent stage, and at the turn of the millenium, most patients and households still followed their habits of consulting with friends and relatives about health issues (Khe et al., 2002). In hospitals, manual methods of medical data storage are still widely used (Nguyen, Hai, Webster, & Nimunkar, 2011). The knowledge base and skills of both professionals and patients need critical updates to be able to reap the benefits of e-health (Brodie et al., 2000; Damman et al., 2009; Eysenbach & Diepgen, 2001; Nguyen, Naguib, Tawfik, & Phuong, 2012). Apart from friends/relatives, Vietnamese patients also refer to similar sources as observed everywhere else in the world: mass media (including the Internet) and health professionals/experts (Rain, 2007; Tu & Lauer, 2008).

Research studies such as Thuan, Lofgren, Lindholm, and Chuc (2008) regarding choice of health-care providers in Vietnam do not deal with the issues that this article emphasizes. The good news is that Vietnam has the potential to develop a functioning electronic health records (EHR) system in the future as the system is centralized and professionals show good awareness of EHR's roles and values in delivering better e-health services to patients (Detmer, 2003; Goldzweig, Towfigh, Maglione, & Shekelle, 2009; Hochwarter, Chuc, & Larsson, 2014) and improving doctor-patient relationships (Tang & Lansky, 2005).

Last but not least, the importance of the variables used in the coming analysis—as described in each data set—is justified because they represent a subset of the key elements of a quality health information system (Detmer, 2003; Ellins et al., 2006), and the high cost of obtaining information from health-care professionals remains an obstacle to better health-care service (Bundorf et al., 2004;

Detmer, 2003). In addition, research findings indicate that the demand for health information is related to the expected benefits from the information and the price of information substitutes (Goldzweig et al., 2009). The issues of data sufficiency and efficient use of health-care information have also emerged as part of the social trends in integrating ICT into the social life of e-patients (Evers, 2006; Lober & Flowers, 2011; Miller, 1998).

Trust in health and health-care information is not obvious (Rain, 2007) due to the nature of the mixed quality of Internet information (Mittman & Cain, 2000). In addition, the issue of trustworthiness and credibility of information sources emerges as the volume of information surges while the quality becomes difficult to determine (Damman et al., 2009; Gray, Klein, Noyce, Sesselberg, & Cantrill, 2005; Rain, 2007). The trust and credibility of information determines behaviors and the propensity of users to use the Internet in the long-term (Lemire, Paré, Sicotte, & Harvey, 2008; Mittman & Cain, 2000; Vuong & Napier 2015).

It is also noteworthy from the extant literature that although online information is important, when it comes to making a critical decision, patients care more about the quality of information and data rather than the volume, so they tend to consult with health professionals (Tu & Lauer, 2008). Quality and credibility of information sources appear to determine the outcome of the patient's choice of health-care provider (Ellins et al., 2006; Lemire et al., 2008; Victoor, Delnoij, Friele, & Rademakers 2012).

The brief review above helps us to determine key questions regarding issues such as determinants and sufficiency of information for making a decision on choosing a health-care provider.

3. Research questions and method

3.1. Research questions

RQ1. What are the effects of accessibility to information (through various sources: friends/relatives, mass media—with a focus on the Internet, —and health-care experts) on patients' perception of information sufficiency when having to make a choice regarding a health-care provider? How are these sources of information different in terms of their influence on patients' perception?

RQ2. What are the measured effects of time and costs spent by patients on *ex ante* probabilities of acquiring sufficient information for decision-making?

RQ3. What are the effects of socioeconomic status (SES) and residency status on data/information sufficiency for patients' decision making?

RQ4. Are the *ex post* probabilities of making an optimal decision conditional upon accessibility to expert information regarding health care and the level of trust in the expertise provided? Is the effect of mass media/Internet use significant?

RQ5. In what ways do the costliness of information and trust in expertise affect the outcome of a patient's choice?

RQ6. Are the use of 115 Emergency Hot-line counseling and the status of residency having significant impacts on patients' choice outcomes (optimal vs. non-optimal impacts)?

3.2. Research method

To address the above research questions, using the set of categorical data obtained from the survey (described in Section 4), the subsequent investigation employs the research framework of baseline-category logits (BCL). The subsection below briefly presents key ideas of the analytical framework and the way in which the effects of measured data that reflect behaviors of predictor variables on response (dependent) variables are examined. A full account of the technical treatments following the BCL modeling is provided in Agresti (2013), and an alternative to the BCL for analyzing categorical data is the log-linear model with practical analysis provided in Vuong, Napier, and Tran (2013).

The BCL method:
The BCL framework that is used to examine the survey data of this study will estimate a multivariate generalized linear model (GLM) in the following form:

$$\mathbf{g}(\boldsymbol{\mu}_i) = \mathbf{X}_i\boldsymbol{\beta},$$

where, $\boldsymbol{\mu}_i = \mathrm{E}(\mathbf{Y}_i)$, corresponding to $\mathbf{y}_i = (y_{i1}, y_{i2}, \dots)'$; row h of the model matrix $\mathbf{X}_i$ for observation i contains values of independent (also, predictor) variables for y_{ih}.

Following this method, as $\pi_j(\mathbf{x}) = P(Y = j|\mathbf{x})$ represent a fixed setting for independent variables, with $\sum_j \pi_j(\mathbf{x}) = 1$, categorical data are distributed over J categories of Y as either binomial or multinomial with corresponding probabilities $\{\pi_1(\mathbf{x}), \dots, \pi_j(\mathbf{x})\}$. Thus, the BCL model aligns each dependent (response) variable with a baseline category: $\ln[\boldsymbol{\pi}_j(\mathbf{x})/\boldsymbol{\pi}_J(\mathbf{x})]$, with $j = 1, \dots, J-1$.

As $\ln[\boldsymbol{\pi}_a(\mathbf{x})/\boldsymbol{\pi}_b(\mathbf{x})] = \ln[\boldsymbol{\pi}_a(\mathbf{x})/\boldsymbol{\pi}_J(\mathbf{x})] - \ln[\boldsymbol{\pi}_b(\mathbf{x})/\boldsymbol{\pi}_J(\mathbf{x})]$, the set of empirical probabilities from binomial/multinomial logits $\{\boldsymbol{\pi}_j(\mathbf{x})\}$ can be computed from the formula:

$$\boldsymbol{\pi}_j(\mathbf{x}) = \frac{\exp(\alpha_j + \beta_j^{\mathrm{T}}\mathbf{x})}{1 + \sum_h^{J-1} \exp(\alpha_h + \beta_h^{\mathrm{T}}\mathbf{x})}.$$

The categorical variables used in our models are both dichotomous (e.g., "optimal" or "non-optimal" with a factor "x6.valid" indicating if a patient's choice of health-care provider is the best available; "yes" or "no" for "x3.ser115" indicating if a patient uses 115 emergency service or not) and multinomial (e.g., factor "convexp" that represents access to expert counseling, taking the value of either "hi,""med," or "low"). Their coded names and categorical values are stated in each data subset. The actual analysis that is provided in Section 5 (Estimations and results) follows the practice employed for the same type of data analysis in Vuong (2015).

4. Data

The survey was conducted in the fourth quarter of 2015, by a six member data team. All team members fully understood, agreed to, and observed the written rules and standards of research ethics. Team members acted as interviewers who approached patients individually.

A total number of nearly 3000 patients were asked randomly for their opinions, and they were provided with questionnaires and necessary clarification. About half of them agreed to answer the questionnaires. In total, the data set contains 1459 answers collected from the survey. The statement of research ethics appears on the questionnaire, and respondents all read and signed the statement to show that they participated in the survey with informed consent. The written statement of research ethics signed by all data team members and some samples of questionnaires answered and signed by patients are provided in Supplement 1.

The data are categorical by both research nature and design. This sample size is not very large but proves to be sufficient, and the random selection appears to have represented the population fairly well.

Below, data sets that are constructed following the categories used in subsequent estimations are presented, with proper explanations of the variables involved in the modeling efforts.

Breakdown of observations by hospitals and a histogram showing the empirical distribution of surveyed patients are provided below:

Healthcare provider	Obs	Healthcare provider	Obs
Bach Mai	231	Military 198	15
Viet Duc	108	Hospital E	28
Polyclinic 125 Thai Thinh	61	Military 103	13
Hospitals of Obstetrics and Gynecology	53	Ministry of Construction Hospital	13
Military 108	39	Hospital of Geriatrics	13
Hanoi University of Health Hospital	30	Ministry of Transport Hospital	11
Saint Paul Hospital	28	Ha Dong Polyclinic	11
Thanh Nhan Hospital	27	Hospital of Pediatrics	9
Post Hospital	24	Hospital of Tropical Diseases	6
Institute of Dermatology	18	Others	721

Data for RQ1:

Regarding the question of the effects of accessibility to information sources on patients' information sufficiency for making a choice regarding a health-care provider, data are provided in Table 1. In this data set, three major categories are:

i) Information source from friends/relatives (coded: "x11.convrel"), having one of the values: highly convenient "hi.convrel", somewhat convenient "med.convrel" or inconvenient "low.convrel";
ii) Advice from health-care expert counseling ("x12.convexp"): easy access "hi.convexp," somewhat difficult "med.convexp," and difficult "low.convexp"; and,
iii) The Internet source: easy and convenient "hi.convint," somewhat limited but still available "med.convint"; and, limited and difficult "low.convint."

The perceived value of information (i.e., subjective assessment of sufficiency) for choosing a health-care provider is recorded in the binary variable coded: "x43.info"; each takes either "sufficient" or "insuff." If a patient's x43.info takes "insuff," that means the patient considers the information he/she acquires to be insufficient for making a good decision on his/her choice of a health-care provider for subsequent treatment. Thus, the empirical probabilities that we can determine using the data set are ex ante.

Table 1 (Data for RQ1). Patients' perception regarding information sufficiency following their access to experts and friends/relatives

"x11.convrel"	"x12.convexp"	"x43.info"	
		"sufficient"	"insuff"
"low.convrel"	"low.convexp"	27	99
	"med.convexp"	8	25
	"hi.convexp"	9	6
"med.convrel"	"low.convexp"	67	164
	"med.convexp"	112	169
	"hi.convexp"	58	23
"hi.convrel"	"low.convexp"	125	123
	"med.convexp"	109	108
	"hi.convexp"	162	65

The sum of the last six cells of Table 1 shows a high ratio of people (~47.4%) who assessed their access to health-care information from friends and relatives to be highly ready and convenient. Only 22% reported that they can easily access experts for acquiring information to make a decision (323/1459).

In the same way, a contingency table for the distribution of patients who relied on information from friends/relatives and mass media sources (especially the Internet) is provided in Appendix A.

Data for RQ2:

As to RQ2, I investigate the possible effects of time and costs spent on the probabilities of acquiring sufficient information for decision-making. The data set in Table 2 for this question consists of:

i) The factor "x41.time"—representing level of time consumption—with three categorical values: non time-consuming ("no.timecons"), somewhat time-consuming but acceptable ("sw.timecons"), and highly time-consuming ("hi.timecons");

ii) The labor cost for acquiring information ("x42.labor"), which takes the value of: "low.cost," "med.cost," and "hi.cost"; and

iii) These inputs will be expected to have some impact on patients' perception on how sufficient their information is, regarding the decision of choosing a health-care provider. The factor information sufficiency ("x43.info") is thus dependent on the preceding two factors, and takes the values of "sufficient" and "insuff" (insufficient).

Table 2 (Data for RQ2). Distribution of patients against levels of time consumption, labor cost, and information sufficiency

"x41.time"	"x42.labor"	"x43.info"	
		sufficient	insuff

"sw.timecons"	"med.cost"	227	400
	"low.cost"	71	62
	"hi.cost"	5	36
"non.timecons"	"med.cost"	37	47
	"low.cost"	310	131
	"hi.cost"	1	2
"hi.timecons"	"med.cost"	11	30
	"low.cost"	3	3
	"hi.cost"	12	71

Seven hundred eighty-two (out of 1459) patients reported that they were not able to make a well-informed decision regarding choosing a health-care provider; although the majority of patients had spent significant amounts of time and effort in seeking information from various sources (~13%). On the other hand, there were 310/1459 people who did not find it time-consuming or labor-costly to acquire sufficient information in order to make their decision.

Data for RQ3:

Regarding the question on the effects of SES and residency status on patients' information sufficiency, the three factors that enter the modeling work are:

i) "x7.SES" that represents patients' socio-economic status (SES) and takes the values "poor" or "nonpoor";

ii) The residency status of a patient ("x8.place"): "res" (resident), "nonres.urb" (non-resident from other urban areas), "rurdelta" (from a rural area in the northern rivers delta regions), or "remarea" (remote areas, e.g., mountainous regions); and

iii) The aforementioned factor "x43.info" represents information sufficiency.

Table 3 (Data for RQ3). Distribution of patients against factors SES, residency, and information sufficiency.

"x7.SES"	"x8.place"	"x43.info"	
		"sufficient"	"insuff"
"nonpoor"	"nonres.urb"	172	153
	"res"	284	315
	"remarea"	7	14
	"rurdelta"	98	109
"poor"	"nonres.urb"	35	53
	"res"	19	35
	"remarea"	11	31
	"rurdelta"	51	72

Data for RQ4:

As for the next question on empirical probabilities (ex post) that patients can make a best available decision given their accessibility to and trust in expert information, and any possible difference between expert information and mass media (Internet) use, Table 4 provides a data set for investigation. Factors involved consist of:

i) "x12.convexp" (described above);

ii) Patients' trust in expert information "x22.belfexp," taking the following values: "bel" (believe) or "ref" (only for reference when needed); and
iii) "x6.valid" that represents a post-treatment assessment of whether a patient's choice was the best available ("optimal") or not ("nonopt").

Table 4 (Data for RQ4). Distribution of patients against access to expert counseling, trust, and outcome assessment

"x12.convexp"	x22.belfexp	"x6.valid"	
		"optimal"	"nonopt"
"low.convexp"	"bel"	67	353
	"ref"	5	127
"med.convexp"	"bel"	150	309
	"ref"	27	45
"hi.convexp"	"bel"	153	155
	"ref"	5	10

According to Table 4, approximately 68.5% assessed that their choices were not the best available (999/1459), including a not insignificant portion of patients who reported that they had sufficient information ex ante to make a right choice regarding health-care provider (165/1459).

Data for RQ5:
As to how the costliness of information and trust in expertise will affect the outcome of choice in which ways (optimal vs. non-optimal), apart from the outcome factor "x6.valid" as described above, two other factors in Table 5 are as follows:

i) Labor and related costs for acquiring information ("x42.labor"), corresponding to values: "hi.cost," "med.cost," or "low.cost"; and
ii) Degree of importance of provider's professional reputation in patient's choice "x52.profess": either "decisive" or "indecisive."

Table 5 (Data for RQ5). Outcomes of choice against costliness and reputation of health-care provider

" x42.labor"	"x52.profess"	"x6.valid"	
		"optimal"	"nonopt"
"med.cost"	"decisive"	188	421
	"indecisive"	33	110
"low.cost"	"decisive"	180	277
	"indecisive"	34	89
"hi.cost"	"decisive"	24	78
	"indecisive"	1	24

Over 80% of respondents regarded their health-care provider's reputation in treatment capacity and expertise as the decisive factor in making a choice (1168/1459). It is also noteworthy that nearly 43% (499/1168) of this portion, had spent a significant effort but still failed to make the best available choice.

Data for RQ6:
The last effort is made to understand the value of the 115 Emergency hot-line service, in conjunction with residency status, in determining patients' choice outcomes (optimal vs. non-optimal), using the

data set in Table 6. The new factor in this table is "x3.ser115" (answering if a patient uses 115 hotline phone counseling to make a choice), having value of "yes" or "no."

Table 6 (Data for RQ6). Distribution of patients against residency, use of 115 Emergency, and outcomes

"x3.ser115"	"x8.place"	"x6.valid"	
		"optimal"	"nonopt"
"no"	"nonres.urb"	105	235
	"res"	124	466
	"remarea"	21	36
	"rurdelta"	125	182
"yes"	"nonres.urb"	43	30
	"res"	27	36
	"remarea"	2	4
	"rurdelta"	13	10

The portion of patients in our data set who used 115 Emergency was small, ~11.3%, of whom the majority lived in urban areas (> 82.4%).

5. Estimations and results

The following results are obtained from estimations corresponding to each research question and data set (Tables 1–6), and grouped into: a) issues regarding need for information (RQ1–3) and b) efficiency of information use (RQ4–6).

5.1. Factors influencing patients' need for information

Estimations and results for RQ1:
In the coming estimations, independent variables are "x11.convrel", "x12.convexp," and the dependent variable is: "x43.info." Estimated coefficients and associated statistics are reported in Table 7, with all p-values < 0.0001.

Table 7. Estimating impacts of "relatives/friends" and "expert counseling" on information sufficiency

	intercept	"x11.convrel"		"x12.convexp"	
		"low.convrel"	"med.convrel"	"low.convexp"	"med.convexp"
	β_0	β_1	β_2	β_3	β_4
logit(sufficient|insuff)	1.092*** [8.412]	-1.098*** [-5.568]	-0.531*** [-4.472]	-1.253*** [-8.182]	-1.027*** [-6.634]
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1, z-value in square brackets; baseline category for: "x11.convrel": "hi.convrel"; and, "x12.convexp": "hi.convexp". Residual deviance: 8.79 on 4 d.f.					

The above results have empirically established relationships provided in Eq. (RQ1), in which the two sources of information have significant effect on the chance of acquiring sufficient information for decision-making.

$$\ln\left(\frac{\pi_{\text{suff}}}{\pi_{\text{insuff}}}\right) = 1.092 - 1.098\text{low. convrel} - 0.531\text{med. convrel} - 1.253\text{low. convexp} - 1.027\text{med. convexp} \quad \text{Eq. (RQ1)}$$

According to Eq. (RQ1), difficulty in accessing expert counseling and support from friends/relatives significantly reduces the chance of data sufficiency for patients in decision-making, as β_3 = -1.253 (p-value < 0.0001), so that the conditional probability becomes:

$$\pi_{\text{suff}} = \frac{e^{(1.092-1.098-1.253)}}{1+e^{(1.092-1.098-1.253)}} = 0.221$$

Using the same way for computing the above probability, Table 8 shown below reports the full empirical distributions of probabilities over different categorical values of factors "x12.convexp" and "x11.convrel."

Table 8. Empirical probabilities computed for RQ1

"x43.info"	"sufficient" (a)			"insuff" (b)		
"x11.convrel"| "x12.convexp"	"low.convexp"	"med.convexp"	"hi.convexp"	"low.convexp"	"med.convexp"	"hi.convexp"
"low.convrel"	0.221	0.263	0.499	0.779	0.737	0.501
"med.convrel"	0.334	0.386	0.637	0.666	0.614	0.363
"hi.convrel"	0.460	0.516	0.749	0.540	0.484	0.251

An example of how to read Table 8 is as follows. When a patient can easily acquire health-care information from both sources (friends/relatives and experts), the chance of having sufficient data for decision-making is very high: 74.9% ($a_{ij} = a_{33} = 0.749$ in Table 8.a "sufficient"), leaving roughly 1/4 having a shortage of information for making a decision despite full access to information from both experts and relatives ($a_{33} = 0.251$ in Table 8.b "insuff"). I also produce Figure 1 using computed probabilities in Appendix B.

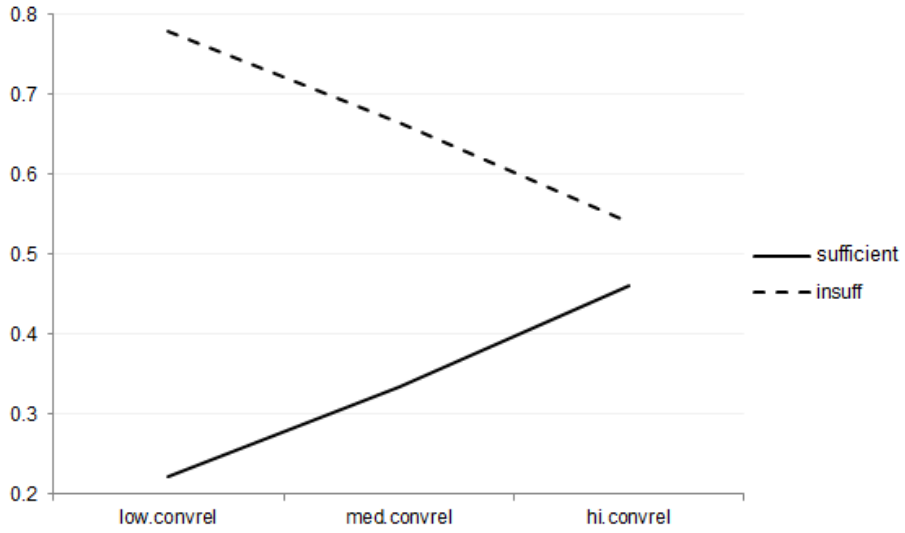

Figure 1. Changing probabilities of having sufficient data for decision-making, controlling for difficulty of access to expert information, against the information source of friends/relatives.

As a familiar practice, when facing difficulty in accessing expert counseling, Vietnamese patients choose to consult with family members and close friends. Figure 1 shows why this act is rational. Those patients have a chance of increasing their ex ante probabilities of acquiring sufficient information for their decision-making, from 22% to 46% (solid line). This habitual practice helps decrease the probability of lacking information from 78% to 54% (dash line). Still, it is seen that the solid line is below the dash line, thus the probabilities that patients will face data insufficiency due to inaccessibility to expert counseling are always higher than those with information sufficiency.

Looking at changes in probabilities given in Table 8.a and 8.b is also useful. For patients perceiving their data to be sufficient, moving from "low.convrel"×"low.convexp" to "hi.convrel"×"hi.convexp" helps increase the probability from 22% to 75%. But moving from "hi.convrel"×"hi.convexp" to "low.convrel" ×"low.convexp" for patients facing insufficiency makes the probability jump from 25% to 78%.

Likewise, computed probabilities show the effects of both information from friends/relatives and from mass media/Internet on patients' data sufficiency. Such empirical probabilities are provided in Table 9, using the relationships established in the estimated results of Appendix C.

Table 9. Empirical probabilities of data sufficiency following access to friends/relatives and mass media/Internet sources

"x43.info"	"sufficient"			"insufficient"		
"x11.convrel"| "x13.convint"	"low.convint"	"med.convint"	"hi.convint"	"low.convint"	"med.convint"	"hi.convint"
"low.convrel"	0.228	0.231	0.303	0.772	0.769	0.697
"med.convrel"	0.364	0.369	0.458	0.636	0.631	0.542
"hi.convrel"	0.524	0.528	0.619	0.476	0.472	0.381

Changes of numerical values in Table 9 show a similar trend as is shown in Table 8, replacing expert counseling with mass media/Internet, controlling for "sufficient" and "insuff"; although the absolute values are slightly lower. Figure 2 below is drawn using computed values in Appendix D to help make the case for the value of mass media/Internet information in decision-making.

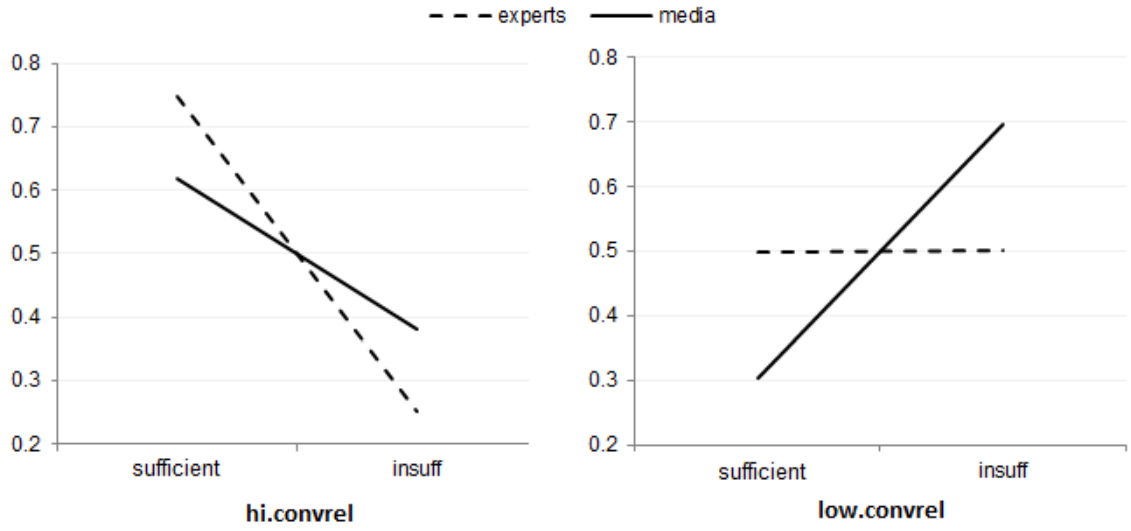

Figure 2. Probabilities of data sufficiency for patients with good access to expert (dash) and to mass media/Internet (solid), with(out) access to friends/relatives

The changing shapes of the graphs in Figure 2 show that the positive effect of expert counseling is stronger than that of mass media/Internet, and friends/relatives information source is apparently critical. (Also refer to Appendix E for additional results.)

Estimations and results for RQ2

Estimations are provided in Appendix F. Distributions of empirical probabilities of data sufficiency ("x43.info") against time consumption ("x41.time") and efforts ("x42.labor") are in Table 10.

Table 10. Empirical probabilities from RQ2 estimations

"x43.info"	"sufficient"			"insuff"		
"x42.labor"| "x41.time"	"low.cost"	"med.cost"	"hi.cost"	"low.cost"	"med.cost"	"hi.cost"
"non.timecons"	0.694	0.490	0.250	0.306	0.510	0.750
"sw.timecons"	0.563	0.353	0.159	0.437	0.647	0.841
"hi.timecons"	0.502	0.299	0.129	0.498	0.701	0.871

Results from Table 10 are unexpected. Probabilities of information sufficiency jumps from "hi.cost" × "hi.timecons" (13%) to "low.cost"×"non.timecons" (69%). These results indicate that spending more time and cost does not improve data sufficiency. Using Appendix G, Figure 3 presents the probabilities of having (in)sufficiency with low cost (dash) and high cost (solid).

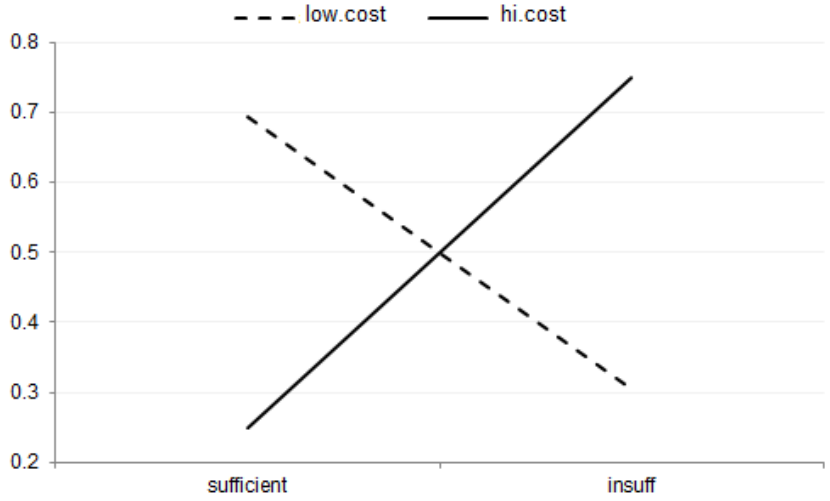

Figure 3. Empirical probabilities of sufficiency controling for "non time-consuming"

Estimations and results for RQ3:
Estimation for RQ3 are performed with dependent variables being factor "x4.info" and independent ones from factors SES ("x7.SES") and residency ("x8.place"). Established relationships are obtained through significant coefficients and statistics, provided in Appendix H. Empirical probabilities are presented in Table 11.

Table 11. Data sufficiency against SES and residency

"x43.info"	"sufficient"				"insuff"			
"x8.place"| "x7.SES"	"nonres.urb"	"res"	"rurdelta"	"remarea"	"nonres.urb"	"res"	"rurdelta"	"remarea"
"nonpoor"	0.523	0.472	0.489	0.342	0.477	0.528	0.511	0.658
"poor"	0.422	0.374	0.389	0.258	0.578	0.626	0.611	0.742

The empirical computations in Table 11 show that the difference in probabilities of having sufficiency between nonpoor and poor is almost 10 percentage points for patients, no matter where they come from. The reverse also holds, for those with "insufficiency." Also, patients with residency are not necessarily better informed. The disadvantageous group of patients comes from remote areas.

(Data in Appendix I show the difference between "nonpoor" and "poor," against levels of data sufficiency.)

5.2. Factors that influence efficiency of patients' information use

Estimations and results for RQ4:
Dependent variable: "x6.valid"; independent variable: factors "x12.convexp" and "x22.belfexp."
Estimation results are reported in Table 12.

Table 12. Impacts of access to information and trust in expert value on outcomes of choice

	intercept	"x12.convexp"		"x22.belfexp"
		"hi.convexp"	"med.convexp"	"bel"
	β_0	β_1	β_2	β_3
logit(optimal|nonopt)	-2.236*** [-10.816]	1.783*** [10.427]	1.168*** [7.426]	0.429** [2.141]
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1, z-value in square brackets; baseline category for: "x12.convexp": "low.convexp"; and, "x22.belfexp": "ref". Residual deviance: 13.64 on 2 degrees of freedom.				

Although the strongest influence from good access to expert sources is shown in Table 12 ($\beta_1 = +1.783$; $p < 0.0001$), the trust level for that source is both highly significant and strong ($\beta_3 = +0.429$; $p < 0.0001$). The relationship Eq. (RQ4) is also established through the coefficients of Table 12.

$\ln\left(\frac{\pi_{\text{optimal}}}{\pi_{\text{nonopt}}}\right) = -2.236 + 1.783\text{hi. convexp} + 1.168\text{med. convexp} + 0.429\text{belExp}$	Eq. (RQ4)

Eq. (RQ4) enables the computing of probabilities of having different outcome categories based on conditions of access to expert counseling and corresponding level of trust. The following computation, using Eq. (RQ4), shows the probability of a patient making a best available choice of provider with good access to an expert source and placing trust in expert counseling:

$$\pi_{\text{optimal}} = \frac{e^{(-2.236+1.783+0.429)}}{1 + e^{(-2.236+1.783+0.429)}} = 0.494$$

This result is unexpected as the probability is almost like flipping a coin, despite having good access to an expert source. Table 13 provides computed empirical probabilities.

Table 13. Probabilities of best choice ex-post against values of access to an expert source and trust in the source

"x6.valid"	"optimal" (a)			"nonopt" (b)		
"x22.belfexp"| "x12.convexp"	"hi.convexp"	"med.convexp"	"low.convexp"	"hi.convexp"	"med.convexp"	"low.convexp"
"bel"	0.494	0.345	0.141	0.506	0.655	0.859
"ref"	0.389	0.256	0.097	0.611	0.744	0.903

Figure 4 visualizes two situations of (in)accessibility to expert counseling and level of trust in the expert.

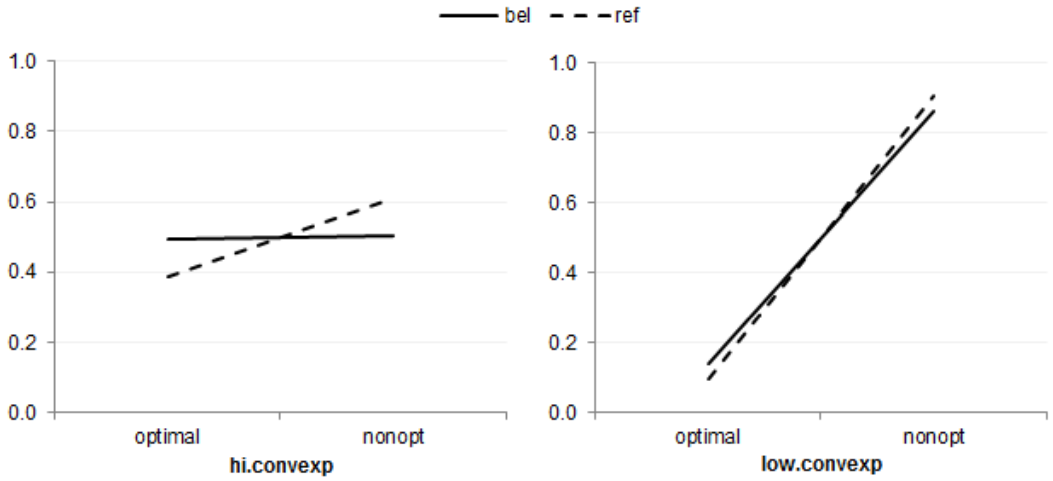

Figure 4. Probabilities of optimal choice

For those without access to an expert ("low.convexp"), the two lines of probabilities are almost identical. But the distinction becomes clear for those with access to a health-care expert. In the latter case, the probability of making a nonoptimal choice appears to be higher if a patient does not have trust in the expert.

Regarding the influence of a mass media/Internet source, additional results that are reported in Appendix K point to the fact that this source appears to have no significant impact on the ex post assessment of choice, with $p > 0.1$ for both "med.convint" and "hi.convint" (0.589 and 0.725, respectively).

Estimations and results for RQ5:
The results for RQ5 are provided in part in Table 14, using statistically significant coefficients estimated in Appendix L. The response variables are the factor "x6.valid," and the predictor variables are the factors "x42.labor" and "x52.profess." The cost of information seeking and the evaluation of a provider's capabilities influence the ex post assessment of the choice made (optimal vs. non-optimal).

Table 14. Probabilities of optimal outcome aligned to level of cost and evaluation of provider

"x6.valid"	"optimal" (a)			"nonopt" (b)		
"x52.profess"|"x42.labor"	"low.cost"	"med.cost"	"hi.cost"	"low.cost"	"med.cost"	"hi.cost"
"decisive"	0.394	0.313	0.211	0.606	0.687	0.789
"indecisive"	0.278	0.213	0.137	0.722	0.787	0.863

Taking element a_{13} ("decisive" × "hi.cost") of the probabilities matrix 14(b) as an example, a patient who spends a large effort on information seeking and stresses the evaluation of the technical capacity of the provider as the most decisive may still face a high risk of making a non-best choice, $\pi_{13} = 0.789$. Also from matrix 14(a), declining probabilities of making an optimal choice following the increasing effort (cost to patients) appear to indicate some major issue with the efficiency of patients' information use.

Estimations and results for RQ6:
In this last model, the response variables follow the factor "x6.valid" (outcome of choice) with the predictor variables reflecting the behavior of 115 Emergency use ("x3.ser115") and patients'

residency status. Results reported in Appendix M all show strong significance of the estimated coefficients (most p's < 0.0001). The empirical probabilities are provided in Table 15 for this estimation.

Table 15. Probabilities of (non)optimal choice following use of 115 Emergency and patients' residency status

"x6.valid"	"optimal" (a)				"nonopt" (b)			
"x3.ser115"| "x8.place"	"nonres.urb"	"remarea"	"rurdelta"	"res"	"nonres.urb"	"remarea"	"rurdelta"	"res"
"yes"	0.554	0.582	0.642	0.418	0.446	0.418	0.358	0.582
"no"	0.316	0.342	0.401	0.211	0.684	0.658	0.599	0.789

The 115 service appears to be more efficient for people in rural areas and in remote areas, with the probabilities of making a good choice of health-care provider better than flipping a coin, 58% and 64%, respectively. Also from Table 15(b), non-use of 115 appears to correspond to a jump in the risk of making a non-optimal choice, e.g., by 20% for patients with residency, and by ~24% for those without residency. Figure 5 shows different shapes for resident patients and nonresident patients coming from adjacent urban areas.

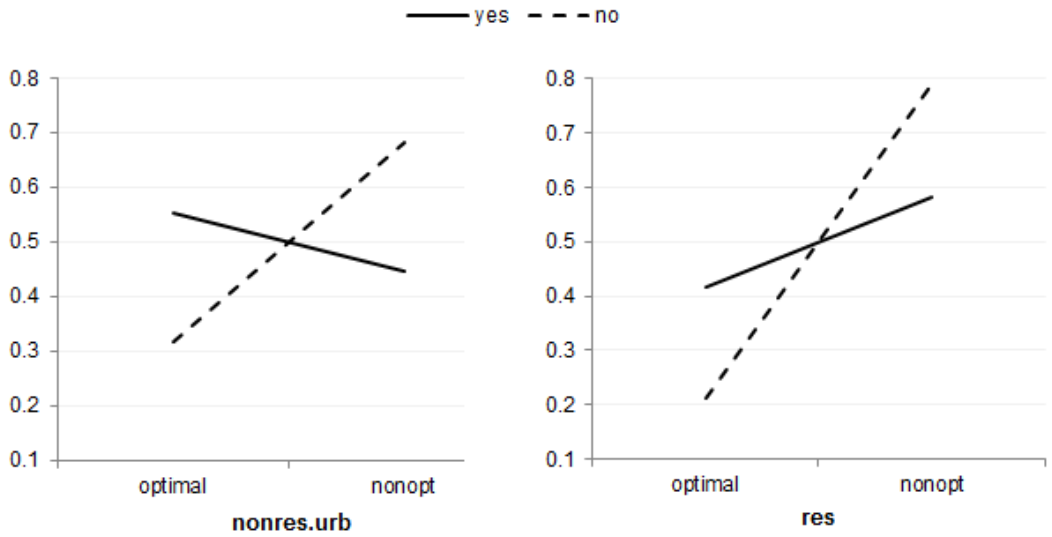

Figure 5. Probabilities of optimal choice for (non)use of 115, controlling for patients without residency from adjacent urban regions and those with residency

The left-hand-side graph of Figure 5 exhibits a similar shape as those in the Figure in Appendix N, indicating that the use of 115 Emergency has a similar effect on optimal decision-making for all non-resident patients.

6. Conclusions

This part concludes the report with some striking points learned from the survey and analysis, and it also includes some policy implications.

Striking points:

One striking result (from Figure 3) shows some problems with the quality of information and/or the efficiency of information, which appear to lead to further consumption of time and effort without meeting the actual demand for making a good decision regarding a health-care provider. On the other hand, those who spend less time and effort appear to have sought and used information/data more efficiently and trusted the advice they received.

Another striking result is that resident patients who are supposed to have been better informed appear to show a propensity for weaker data sufficiency than patients coming from other regions.

Nonoptimal choices appear to have been popular especially when facing a shortage of expert counseling. In addition, the probability of optimal for "ref" × "hi.convexp" is quite high, ~39% (element a_{21} in matrix Table 13.a). This suggests that Vietnamese patients are somewhat skeptical of experts' advice, and those who make good decisions have their reasons for that skepticism.

Combining the results of RQ4 with RQ1, expert counseling represents an obstacle for patients, as only 22% have access to good counseling. Patients tend to trust this source. In contrast, the mass media/Internet, which is basically available to almost everyone (80%), appears to have a weaker influence. This result can be explained by the empirical probabilities that show that 50% do not trust mass media/Internet sources of advice.

One more unexpected result is as follows. While RQ2 indicates that increasing effort and time will lead to patients' assessment of better data sufficiency, the RQ5 results show that increasing effort in information seeking does not lead to an optimal choice of health-care provider. Thus, there is a significant gap between data sufficiency (perceived by patients) and actual outcome of their choice of provider. This finding reconfirms the issue of health information quality and patients' skills in accessing and using relevant health-care data in the age of information.

Although the use of the 115 Emergency Service is seen as limited among all patients, evidence on the more efficient use of the 115 service by non-resident patients is worth considering and possibly leads to some policy implications regarding improving the health-care information system.

Policy implications:

Educating patients on the use of information and caveats. Patients need skills, especially computer literacy, in the age of the Internet and in the use of smartphone apps. The knowledge base is critical as we learn from the above analysis that data sufficiency is a debatable issue and perceived sufficiency does not necessarily lead to an optimal choice of health-care provider as the reported empirical results suggest.

User of 115 Emergency. This service has been used mainly for emergencies, with the particular need of an ambulance. This service should have the potential of becoming a full-fledged health-care counseling system as the hot line 115 has for decades been known by most Vietnamese to be the phone number for critical health matters. When becoming the information center, this service will likely have a far reaching effect on society and reorganizing it will be feasible with today's ICT developments.

Going digital and e-health matters. Going online is a must and an unavoidable trend as it helps reduce cost and improve capacity of providing public goods. Unfortunately, this trend in the health sector has been very slow compared to other sectors in Vietnam. One suggestion is a centralized health counseling system administered and authorized by the Ministry of Health. Also, the development of smartphone apps for health information and health-care providers' portals should be highly possible

and practical innovations, facilitating the search and exchange of information about health-care providers, their reputation and performance records, medical records, online counseling, etc.

This analysis has some limitations: i) a geographical concentration on health-care providers in Hanoi; ii) its focus is on the nexus between information-related factors and the decision to choose a health-care provider. In the future, when dealing with these limitations, surveys will need to expand the scope of the research questions as well as other types of data related to patients' decisions as new quantitative variables will need to be introduced into future modeling efforts.

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Author's contribution: QHV: collection and preparation of data, analysis and interpretation of data, statistical analysis, drafting of manuscript.

Competing interests: The author declares that he has no competing interests.

Ethical approval: All procedures performed in this study were in accordance with ethical standards of the 1964 Helsinki declaration and its later amendments or comparable ethical standards and of Vuong & Associates' written decision on research ethics No. V&A/15#01 agreed and signed by all members of the data team and the author of this research.

Informed consent: Informed consent was obtained from all individual participants included in the research.

References

Agresti, A. (2013). Categorical Data Analysis (3rd ed.). Hoboken, NJ: Wiley.

Brodie, M., Flournoy, R. E., Altman, D. E., Blendon, R. J., Benson, J. M., & Rosenbaum, M. D. (2000). Health information, the Internet, and the digital divide. Health Affairs, 19(6), 255-265.

Bundorf, M. K., Baker, L., Singer, S., & Wagner, T. (2004). Consumer demand for health information on the Internet. National Bureau of Economic Research, Paper No. w10386.

Damman, O. C., Hendriks, M., Rademakers, J., Delnoij, D. M., & Groenewegen, P. P. (2009). How do healthcare consumers process and evaluate comparative healthcare information? A qualitative study using cognitive interviews. BMC Public Health, 9(1), #423.

Detmer, D. E. (2003). Building the national health information infrastructure for personal health, health care services, public health, and research. BMC medical informatics and decision making, 3(1), #1. DOI: 10.1186/1472-6947-3-1.

Edgman-Levitan, S., & Cleary, P. D. (1996). What information do consumers want and need?. Health Affairs, 15(4), 42-56.

Ellins, J., Swain, D., Clarke, A., Heron, P., Rasul, F., Magee, H., & Sheldon, H. (2006). Assessing the quality of information to support people in making decisions about their health and healthcare. Oxford: Picker Institute Europe.

Evers, K. E. (2006). eHealth promotion: the use of the Internet for health promotion. American Journal of Health Promotion, 20(4), 1-7.

Eysenbach, G., & Diepgen, T. L. (2001). The role of e-health and consumer health informatics for evidence-based patient choice in the 21st century. Clinics in Dermatology, 19(1), 11-17.

Goldzweig, C. L., Towfigh, A., Maglione, M., & Shekelle, P. G. (2009). Costs and benefits of health information technology: new trends from the literature. Health Affairs, 28(2), 282-293.

Gray, N. J., Klein, J. D., Noyce, P. R., Sesselberg, T. S., & Cantrill, J. A. (2005). Health information-seeking behaviour in adolescence: the place of the internet. Social Science & Medicine, 60(7), 1467-1478.

Hardey, M. (1999). Doctor in the house: the Internet as a source of lay health knowledge and the challenge to expertise. Sociology of Health & Illness, 21(6), 820-835.

Haux, R., Ammenwerth, E., Herzog, W., & Knaup, P. (2002). Health care in the information society. A prognosis for the year 2013. International Journal of Medical Informatics, 66(1), 3-21.

Hochwarter, S., Chuc, N. T. K., & Larsson, M. (2014). Towards an electronic health record system in Vietnam: a core readiness assessment. Journal of Health Informatics in Developing Countries, 8(2), 93-103.

Isaacs, S. L. (1996). Consumer's information needs: results of a national survey. Health Affairs, 15(4), 31-41.

Khe, N. D., Toan, N. V., Xuan, L. T. T., Eriksson, B., Höjer, B., & Diwan, V. K. (2002). Primary health concept revisited: Where do people seek health care in a rural area of Vietnam?. Health Policy, 61(1), 95-109.

Lee, C.S., Goh, D.H., and Chua, A. (2010). An analysis of knowledge management mechanisms in healthcare portals. Journal of Librarianship and Information Science, 42(1), 20-44.

Lemire, M., Paré, G., Sicotte, C., & Harvey, C. (2008). Determinants of Internet use as a preferred source of information on personal health. International Journal of Medical Informatics, 77(11), 723-734.

Lober, W. B., & Flowers, J. L. (2011). Consumer empowerment in health care amid the Internet and social media. Seminars in Oncology Nursing, 27(3), 169-182.

Miller, F. H. (1998). Health care information technology and informed consent: computers and the doctor-patient relationship. Indiana Law Review, 31(4), 1019-1042.

Mittman, R., & Cain, M. (2000). The future of the Internet in healthcare: a five-year forecast. Hospital Quarterly, 3(4), 63-65.

Mor, V. (2005). Improving the quality of long-term care with better information. Milbank Quarterly, 83(3), 333-364.

Nguyen, Q. T., Naguib, R. N. G., Tawfik, H., & Phuong, N. H. (2012). Strategic challenges facing user-and patient-centred e-health in Vietnam. International Journal of Healthcare Technology and Management, 13(5-6), 378-394.

Nguyen, T., Hai, V. U., Webster, J., & Nimunkar, A. (2011). A Web-based electronic medical records and hospital information system for developing countries. Journal of Health Informatics in Developing Countries, 5(1), 155-170.

Rains, S. A. (2007). Perceptions of traditional information sources and use of the world wide web to seek health information: findings from the health information national trends survey. Journal of Health Communication, 12(7), 667-680.

Stiglitz, J. (1999, June 7). Incentives and institutions in the provision of health care in developing countries: Toward an efficient and equitable health care strategy. International Health Economics Association Meetings, Rotterdam, the Netherlands. URL: <http://citeseerx.ist.psu.edu/viewdoc/summary?doi=10.1.1.201.2035>

Tang, P. C., & Lansky, D. (2005). The missing link: bridging the patient–provider health information gap. Health Affairs, 24(5), 1290-1295.

Thompson, T. G., & Brailer, D. J. (2004). The decade of health information technology: delivering consumer-centric and information-rich health care. Washington, DC: US Department of Health and Human Services.

Thuan, N. T., Lofgren, C., Lindholm, L., & Chuc, N. T. (2008). Choice of healthcare provider following reform in Vietnam. BMC Health Services Research, 8(1), #162. DOI: 10.1186/1472-6963-8-162

Tu, H. T., & Lauer, J. R. (2008). Word of mouth and physician referrals still drive health care provider choice. Research Brief, No. 9, 1-8, Center for Studying Health System Change.

Tumlinson, A., Bottigheimer, H., Mahoney, P., Stone, E. M., & Hendricks, A. (1997). Choosing a health plan: what information will consumers use?. Health Affairs, 16(3), 229-238.

Victoor, A., Delnoij, D. M., Friele, R. D., & Rademakers, J. J. (2012). Determinants of patient choice of healthcare providers: a scoping review. BMC Health Services Research, 12(1), #272.

Vuong, Q. H. (2015). Be rich or don't be sick: estimating Vietnamese patients' risk of falling into destitution. SpringerPlus, 4(1), #529. DOI:10.1186/s40064-015-1279-x.

Vuong, Q. H., & Napier, N. K. (2015). Acculturation and global mindsponge: An emerging market perspective. International Journal of Intercultural Relations, 49, 354-367.

Vuong, Q. H., Napier, N. K., & Tran, T. D. (2013). A categorical data analysis on relationships between culture, creativity and business stage: The case of Vietnam. International Journal of Transitions and Innovation Systems, 3(1), 4-24.

Appendixes

Appendix A. (Data for RQ1). Distribution of patients who rely on information from friends/relatives and mass media/Internet sources, with respect to data sufficiency.

"x11.convrel"	"x13.convint"	"x43.info"	
		"sufficient"	"insuff"
"low.convrel"	"low.convint"	11	54
	"med.convint"	10	43
	"hi.convint"	23	33
"med.convrel"	"low.convint"	27	66
	"med.convint"	97	192
	"hi.convint"	113	98
"hi.convrel"	"low.convint"	95	66
	"med.convint"	110	76
	"hi.convint"	191	154

Appendix B. Probabilities of data sufficiency for patients with high access to friends/relatives and difficulty in accessing expert counseling.

"x11.convrel"	"x43.info"	
	"sufficient"	"insuff"
"low.convrel"	0.221	0.779
"med.convrel"	0.334	0.666
"hi.convrel"	0.460	0.540

Appendix C. Estimating impacts of friends/relatives and mass media/Internet on data sufficiency.

	intercept	"x11.convrel"		"x13.convint"	
		"low.convrel"	"med.convrel"	"low.convint"	"med.convint"
	β_0	β_1	β_2	β_3	β_4
logit(sufficient|insuff)	0.484*** [5.036]	-1.317*** [-6.860]	-0.652*** [-5.595]	-0.388** [-2.696]	-0.370** [-2.976]
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1, z-value in square brackets; baseline category for: "x11.convrel": "hi.convrel"; and, "x13.convint": "hi.convint". Residual deviance: 25.45 on 4 degrees of freedom.					

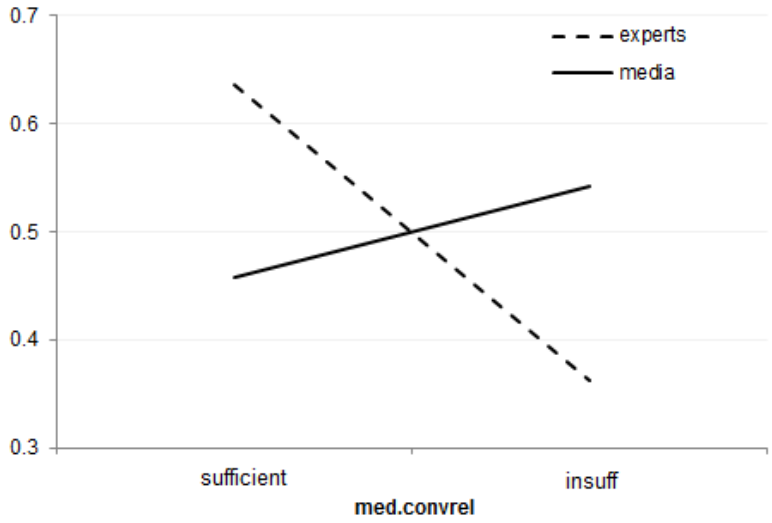
The above coefficients imply the following empirical relationship:

$$\ln\left(\frac{\pi_{\text{suff}}}{\pi_{\text{insuff}}}\right) = 0.484 - 1.317\text{low. convrel} - 0.652\text{med. convrel} - 0.388\text{low. convint} - 0.370\text{med. convint}$$

Appendix D. Probability of data sufficiency for patients with good access to expert and mass media/Internet, controlling for access to friends/relatives.

"x11.convrel"	"hi.convrel"		"low.convrel"	
"x43.info"	"sufficient"	"insuff"	"sufficient"	"insuff"
"experts"	0.749	0.251	0.499	0.501
"media"	0.619	0.381	0.303	0.697

Appendix E. Probabilities of sufficient information for patients with good access to expert and mass media/Internet, controlling for the case of having average access to friends'/relatives' advice.



Appendix F. Estimating impacts of time and effort on data sufficiency.

	intercept	"x41.time"		"x42.labor"	
		"non.timecons"	"hi.timecons"	"low.cost"	"hi.cost"
	β_0	β_1	β_2	β_3	β_4
logit(sufficient|insuff)	-0.604*** [-7.576]	0.565*** [3.729]	-0.246 [-0.894]	0.859*** [5.778]	-1.059*** [-3.452]
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1, z-value in square brackets; baseline category for: "x41.time": "sw.timecons"; and, "x42.labor": "med.cost". Residual deviance: 2.60 on 4 degrees of freedom.					

Empirical relationship:

$$\ln\left(\frac{\pi_{\text{suff}}}{\pi_{\text{insuff}}}\right) = -0.604 + 0.565\text{non. Time} - 0.246\text{hi. Time} + 0.859\text{low. Cost} - 1.059\text{hi. Cost}$$

Appendix G. Probabilities of data sufficiency against levels of effort, controlling for "non time-consuming."

"x42.labor"	"x43.info"	
	"sufficient"	"insuff"
"low.cost"	0.694	0.306
"hi.cost"	0.250	0.750

Appendix H. Estimating impacts of SES and residency status on data sufficiency.

	intercept	"x7.SES"	"x8.place"		
		"nonpoor"	"nonres.urb"	"res"	"rurdelta"
	β_0	β_1	β_2	β_3	β_4
logit(sufficient|insuff)	-1.059*** [-3.718]	0.405** [2.872]	0.745* [2.459]	0.542 . [1.802]	0.608* [2.003]
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1, z-value in square brackets; baseline category for: "x7.SES": "poor"; and, "x8.place": "remarea". Residual deviance: 0.93 on 3 degrees of freedom.					

Established relationship:

$$\ln\left(\frac{\pi_{\text{suff}}}{\pi_{\text{insuff}}}\right) = -1.059 + 0.405 \times \text{nonpoor} + 0.745 \times \text{nonres.urb} + 0.542 \times \text{res} + 0.608 \times \text{rurdelta}$$

Appendix I. Probabilities of data sufficiency conditional upon SES for patients with residency.

"x7.SES"	"x43.info"	
	"sufficient"	"insuff"
"nonpoor"	0.472	0.528
"poor"	0.374	0.626

Appendix J. Probabilities of optimal choice with trust in an expert source for patients with/out access to expert counseling.

"x12.convexp"	"hi.convexp"		"low.convexp"	
"x22.belfexp"|"x6.valid"	"optimal"	"nonopt"	"optimal"	"nonopt"
"bel"	0.494	0.506	0.141	0.859
"ref"	0.389	0.611	0.097	0.903

Appendix K. Frequency distribution of patients following access to mass media/Internet and (non)optimal choice.

"x13.convint"	"x6.valid"	
	"optimal"	"nonopt"
"low.convint"	100	219
"med.convint"	175	353
"hi.convint"	185	427

The data is used to explore a possible relationship; none is found to be significant in the table below.

	intercept	"x3.convint"	
		"med.convint"	"hi.convint"
	β_0	β_1	β_2
logit(optimal|nonopt)	-0.784*** [-6.495]	0.082 [0.541]	-0.053 [-0.352]
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1, z-value in square brackets; baseline category for: "x13.convint": "low.convint". Residual deviance: -9.68 on 0 degrees of freedom.			

Appendix L. Estimation of the impacts of patient effort and emphasis on technical capabilities of the provider on (non)optimal choice

	intercept	"x42.labor"		"x52.profess"
		"low.cost"	"hi.cost"	"decisive"
	β_0	β_1	β_2	β_3
logit(optimal|nonopt)	-1.309*** [-1.309]	0.354** [1.460]	-0.530* [2.906]	0.523 [4.078]
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1, z-value in square brackets; baseline category for: "x42.labor": "med.cost"; and, "x52.profess": "indecisive". Residual deviance: 3.32 on 2 degrees of freedom.				

Established relationship:

$$\ln\left(\frac{\pi_{\text{optimal}}}{\pi_{\text{nonopt}}}\right) = -1.309 + 0.354 \times \text{low.Cost} - 0.530 \times \text{hi.Cost} + 0.523 \times \text{decProfess}$$

Appendix M. Estimation of impacts of 115 service and residency on (non)optimal choice ex post.

	intercept	"x3.ser115"	"x8.place"		
		"yes"	"nonres.urb"	"remarea"	"rurdelta"
	β_0	β_1	β_2	β_3	β_4
logit(optimal|nonopt)	-1.317*** [-13.632]	0.985*** [5.744]	0.547*** [3.883]	0.664* [2.364]	0.917*** [6.244]
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1, z-value in square brackets; baseline category for: "x3.ser115 ": "no"; and, "x8.place": "res". Residual deviance: 2.80 on 3 degrees of freedom.					

Empirical relationship:

$$\ln\left(\frac{\pi_{\text{optimal}}}{\pi_{\text{nonopt}}}\right) = -1.317 + 0.985\text{yesSer115} + 0.547\text{nonres.urb} + 0.664\text{remarea} + 0.917\text{rurdelta}$$

Appendix N. Probabilities of optimal choice of health-care provider following use of 115 Emergency Service (solid line) for patients coming from remote ("remarea") and rural areas ("rurdelta").