Vietnamese patients' choice of healthcare provider: in search of quality information

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Vietnamese patients' choice of healthcare provider: in search of quality information

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Abstract: This paper communicates results from a statistical investigation into questions of relationships between sources of healthcare information, data sufficiency and final outcomes of Vietnamese patients' choice of healthcare provider. The study employs a dataset of 1,459 observations collected from a survey in the Hanoi region in the fourth quarter of 2015. Significant relationships among these factors are identified following categorical data modelling 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 healthcare provider In addition, empirical probabilities for different conditions patients face are provided together with insights and policy implications. Final suggestions emphasise 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 underutilised 115 Emergency Service could also be transformed to function as a call centre that helps coordinate and channel requests for information across a broad network of healthcare professionals for better public use.

Keywords: healthcare provider; quality of information; data sufficiency; Vietnam; consumer behaviour.

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Trong-Khang Nguyen has been the Founder and CEO of MK Group – a major technology firm in Vietnam specialised smartcard production and ICT solutions for management and business applications, including healthcare and social security MIS. MK Group has been entering the phase of globalisation and actively pursuing international market expansions over the past five years, including the most recent smartcards and ICT solutions contracts in Myanmar. MK Group was among the first awarded Vietnamese Ministry of Science and Technology qualification 'hi-tech corporation' in Vietnam; and he has been widely viewed as among the most successful entrepreneurs in Southeast Asia.

1 Introduction

Healthcare 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 healthcare information has changed since the birth of the internet (Haux et al., 2002), and the healthcare sector has to adapt to the rising need for health information. In a developing country with a weak healthcare 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 healthcare provider to choose to meet their needs. Thus, Stiglitz 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 healthcare 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 healthcare 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; Rains, 2007; Thompson and Brailer, 2004; Tumlinson et al., 1997). In advanced healthcare systems, the role of information has been undisputed, and administrators, scientists, and practitioners continue to find ways to improve the healthcare information system (Edgman-Levitan and Cleary, 1996; Isaacs, 1996). In the age of information we live in, healthcare 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 and 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 healthcare (Bundorf et al., 2004; Haux et al., 2002; Mittman and Cain, 2000; Rains, 2007) and how to fully benefit from health service (Mor, 2005; Tang and 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 (ICTs). Lee et al. (2010) confirm the important role of healthcare portals for internet users in North America and Asia, and they report different behaviours of the internet-based portals in accessing, creating, and transferring healthcare knowledge. There exists the problem of rising inequality regarding the use of ICT in seeking healthcare information (Brodie et al., 2000; Damman et al., 2009).

In Vietnam, the information infrastructure is in its nascent stage, and at the turn of the millennium, 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 et al., 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 and Diepgen, 2001; Nguyen et al., 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 (Rains, 2007; Tu and Lauer, 2008).

Research studies such as Thuan et al. (2008) regarding choice of healthcare providers in Vietnam do not deal with the issues that this article emphasises. 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 centralised and professionals show good awareness of EHR's roles and values in delivering better e-health services to patients (Detmer, 2003; Goldzweig et al., 2009; Hochwarter et al., 2014) and improving doctor-patient relationships (Tang and Lansky, 2005).

Last but not least, the importance of the variables used in the coming analysis – as described in each dataset – 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 healthcare professionals remains an obstacle to better healthcare 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 healthcare information have also emerged as part of the social trends in integrating ICT into the social life of e-patients (Evers, 2006; Lober and Flowers, 2011; Miller, 1998).

Trust in health and healthcare information is not obvious (Rains, 2007) due to the nature of the mixed quality of internet information (Mittman and 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 et al., 2005; Rains, 2007). The trust and credibility of information determines behaviours and the propensity of users to use the internet in the long term (Lemire et al., 2008; Mittman and Cain, 2000; Vuong and 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 and Lauer, 2008). Quality and credibility of information sources appear to determine the outcome of the patient's choice of healthcare provider (Ellins et al., 2006; Lemire et al., 2008; Victoor et al., 2012).

3 Research questions and method

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 healthcare provider.

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 healthcare experts) on patients' perception of information sufficiency when having to make a choice regarding a healthcare 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 healthcare 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 Hotline counselling 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 behaviours of predictor variables on response (dependent) variables are examined. A full account of the technical treatments following the BCL modelling is provided in Agresti (2013), and an alternative to the BCL for analysing categorical data is the log-linear model with practical analysis provided in Vuong et al. (2013).

3.2.1 The BCL method

The BCL framework that is used to examine the survey data of this study will estimate a multivariate generalised 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 $\mathbf{y}_i = (y_{i1}, y_{i2}, \ldots)$; 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 $\pi_j(\mathbf{x}) = P(Y = j \mid \mathbf{x})$ represent a fixed setting for independent variables, with $\Sigma_j\pi_j(\mathbf{x}) = 1$, categorical data are distributed over J categories of Y as either binomial or multinomial with corresponding probabilities $\{\pi_1(\mathbf{x}), \ldots, \pi_J(\mathbf{x})\}$. 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 $j = 1, \ldots, J-1$.

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:

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

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 healthcare 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 counselling, 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.

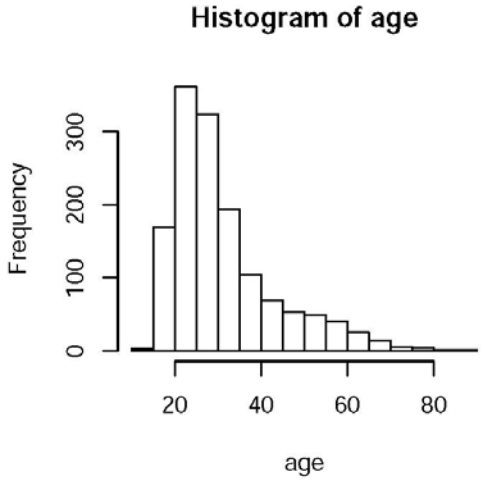
A total number of nearly 3,000 patients were asked randomly for their opinions, and they were provided with questionnaires and necessary clarification. About half of them agreed to answer the questionnaires. In total, the dataset contains 1,459 answers collected from the survey. The statement of research 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 (provided by the author at Mendeley free data server: DOI: 10.17632/gbz9z72c3r.1).

The data are categorical by both research nature and design, provided in Vuong (2016). 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, datasets that are constructed following the categories used in subsequent estimations are presented, with proper explanations of the variables involved in the modelling 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



4.1 Data for RQ1

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

1 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'

2 advice from healthcare expert counselling ('x12.convexp'): easy access 'hi.convexp', somewhat difficult 'med.convexp', and difficult 'low.convexp'

3 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 healthcare 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 healthcare provider for subsequent treatment. Thus, the empirical probabilities that we can determine using the dataset are ex ante.

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

'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 healthcare 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 (323/1,459).

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) are provided in Appendix A.

4.2 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 dataset in Table 2 for this question consists of:

1 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').

2 The labour cost for acquiring information ('x42.labor'), which takes the value of: 'low.cost', 'med.cost' and 'hi.cost'.

3 these inputs will be expected to have some impact on patients' perception on how sufficient their information is, regarding the decision of choosing a healthcare 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 Distribution of patients against levels of time consumption, labour cost and information sufficiency (data for RQ2)

'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 1,459) patients reported that they were not able to make a well-informed decision regarding choosing a healthcare 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 310/1,459 people who did not find it time-consuming or labour-costly to acquire sufficient information in order to make their decision.

4.3 Data for RQ3

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

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

2 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)

3 the aforementioned factor 'x43.info' represents information sufficiency.

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

'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

4.4 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 dataset for investigation. Factors involved consist of:

1 'x12.convexp' (described above)

2 patients' trust in expert information 'x22.belfexp', taking the following values: 'bel' (believe) or 'ref' (only for reference when needed)

3 'x6.valid' that represents a post-treatment assessment of whether a patient's choice was the best available ('optimal') or not ('nonopt').

Table 4 Distribution of patients against access to expert counselling, trust, and outcome assessment (data for RQ4)

'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 (999/1,459), including a not insignificant portion of patients who reported that they had sufficient information ex ante to make a right choice regarding healthcare provider (165/1,459).

4.5 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:

1 labour and related costs for acquiring information ('x42.labor'), corresponding to values: 'hi.cost', 'med.cost' or 'low.cost'

2 degree of importance of provider's professional reputation in patient's choice 'x52.profess': either 'decisive' or 'indecisive'.

Table 5 Outcomes of choice against costliness and reputation of healthcare provider (data for RQ5)

' 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 healthcare provider's reputation in treatment capacity and expertise as the decisive factor in making a choice (1,168/1,459). It is also noteworthy that nearly 43% (499/1,168) of this portion had spent a significant effort but still failed to make the best available choice.

4.6 Data for RQ6

The last effort is made to understand the value of the 115 Emergency hotline service, in conjunction with residency status, in determining patients' choice outcomes (optimal vs. non-optimal), using the dataset in Table 6. The new factor in this table is 'x3.ser115' (answering if a patient uses 115 hotline phone counselling to make a choice), having value of 'yes' or 'no'.

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

'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 dataset 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 dataset (Tables 1–6), and grouped into:

a issues regarding need for information (RQ1–RQ3)

b efficiency of information use (RQ4–RQ6).

5.1 Factors influencing patients' need for information

5.1.1 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 counselling' 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***	–1.098***	–0.531***	–1.253***	–1.027***
	[8.412]	[–5.568]	[–4.472]	[–8.182]	[–6.634]

Notes: 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 equation (1), in which the two sources of information have significant effect on the chance of acquiring sufficient information for decision making.

$$\ln\left(\frac{\pi_{\text{suff}}}{\pi_{\text{insuff}}}\right) = 1.092 - 1.09\text{low.convrel} - 0.531\text{med.convrel} - 1.253\text{low.convexp} - 1.027\text{med.convexp} \quad (1)$$

According to equation (1), difficulty in accessing expert counselling and support from friends/relatives significantly reduces the chance of data sufficiency for patients in decision making, as $\beta_3 = -1.253$ (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 reports the full empirical distributions of probabilities over different categorical values of factors 'x12.convexp' and 'x11.convrel'.

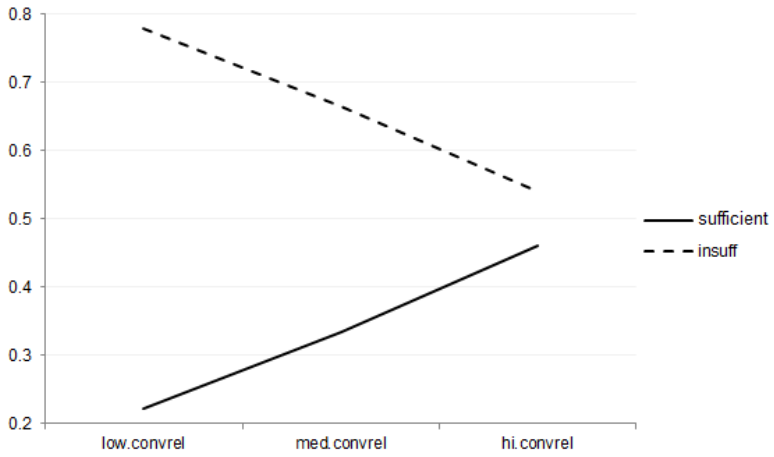
Table 8 Empirical probabilities computed for RQ1

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

An example of how to read Table 8 is as follows. When a patient can easily acquire healthcare 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.

As a familiar practice, when facing difficulty in accessing expert counselling, 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 counselling are always higher than those with information sufficiency.

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



Looking at changes in probabilities given in Tables 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%.

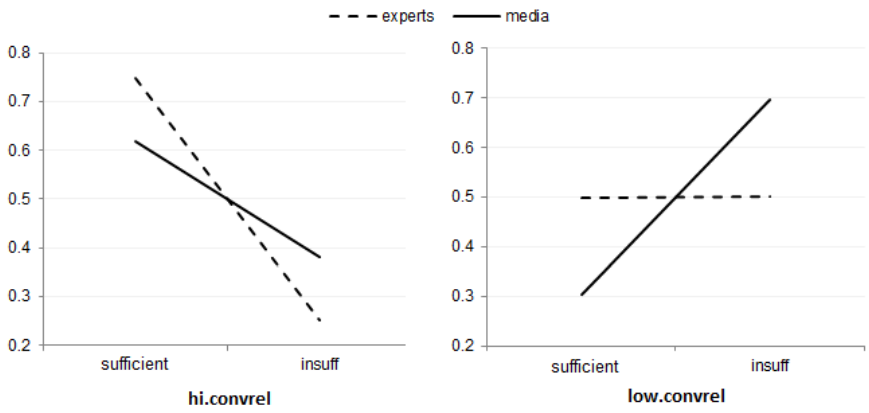
Likewise, computed probabilities show the effects of both informations from friends/relatives and from mass media/internet on patients' data sufficiency. Such empirical probabilities are provided in Table 9, using the relationships established in the estimated results of Appendix C.

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

'x43.info'	*'sufficient'*		
'x11.convrel'|'x13.convint'	*'low.convint'*	*'med.convint'*	*'hi.convint'*
'low.convrel'	0.228	0.231	0.303
'med.convrel'	0.364	0.369	0.458
'hi.convrel'	0.524	0.528	0.619
'x43.info'	*'insufficient'*		
'x11.convrel'|'x13.convint'	*'low.convint'*	*'med.convint'*	*'hi.convint'*
'low.convrel'	0.772	0.769	0.697
'med.convrel'	0.636	0.631	0.542
'hi.convrel'	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 counselling with mass media/internet, controlling for 'sufficient' and 'insuff'; although the absolute values are slightly lower. Figure 2 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 counselling is stronger than that of mass media/internet, and friends/relatives information source is apparently critical (also refer to Appendix E for additional results).

5.1.2 Estimations and results for RQ2

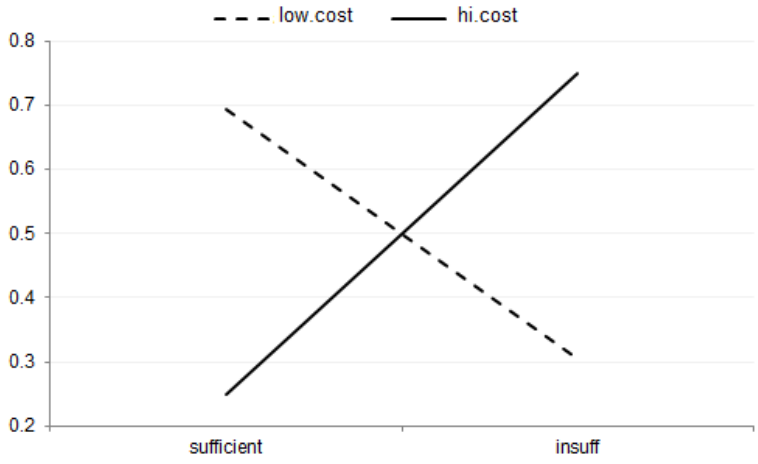
Estimations are provided in Appendix F. Distributions of empirical probabilities of data sufficiency ('x43.info') against time consumption ('x41.time') and efforts ('x42.labor') are in Table 10.

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 controlling for 'non-time-consuming'



5.1.3 Estimations and results for RQ3

Estimation for RQ3 is 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'*			
'x8.place'|'x7.SES'	*'nonres.urb'*	*'res'*	*'rurdelta'*	*'remarea'*
'nonpoor'	0.523	0.472	0.489	0.342
'poor'	0.422	0.374	0.389	0.258
'x43.info'	*'insuff'*			
'x8.place'|'x7.SES'	*'nonres.urb'*	*'res'*	*'rurdelta'*	*'remarea'*
'nonpoor'	0.477	0.528	0.511	0.658
'poor'	0.578	0.626	0.611	0.742

The empirical computations in Table 11 show that the difference in probabilities of having sufficiency between non-poor 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

5.2.1 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***	1.783***	1.168***	0.429**
	[–10.816]	[10.427]	[7.426]	[2.141]

Notes: 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 equation (2) is also established through the coefficients of Table 12.

$$\ln\left(\frac{\pi_{\text{optimal}}}{\pi_{\text{nonopt}}}\right) = -2.236 + 1.783\text{hi.convexp} + 1.168\text{med.convexp} + 0.429\text{belExp} \qquad (2)$$

Equation (2) enables the computing of probabilities of having different outcome categories based on conditions of access to expert counselling and corresponding level of trust. The following computation, using equation (2), 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 counselling:

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

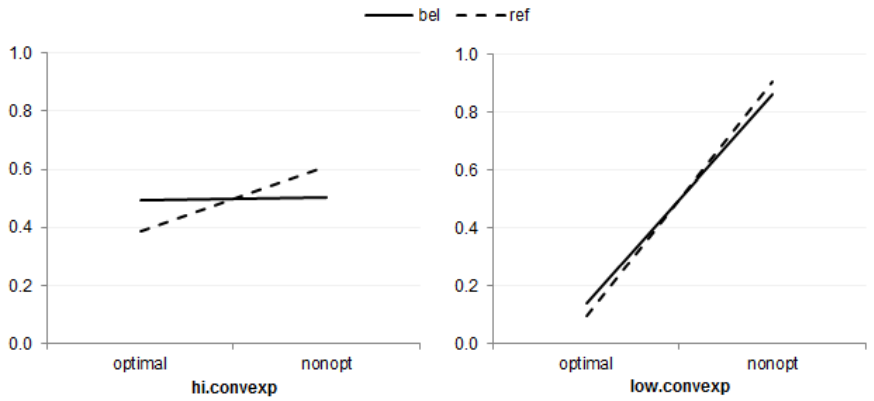
This result is unexpected as the probability is almost like flipping a coin, despite having good access to an expert source. Table 13 provides computed empirical probabilities.

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

Figure 4 visualises two situations of (in)accessibility to expert counselling 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 healthcare expert. In the latter case, the probability of making a non-optimal 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).

5.2.2 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)*		
'x52.profess'|'x42.labor'	*'low.cost'*	*'med.cost'*	*'hi.cost'*
'decisive'	0.394	0.313	0.211
'indecisive'	0.278	0.213	0.137
'x6.valid'	*'nonopt' (b)*		
'x52.profess'|'x42.labor'	*'low.cost'*	*'med.cost'*	*'hi.cost'*
'decisive'	0.606	0.687	0.789
'indecisive'	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.

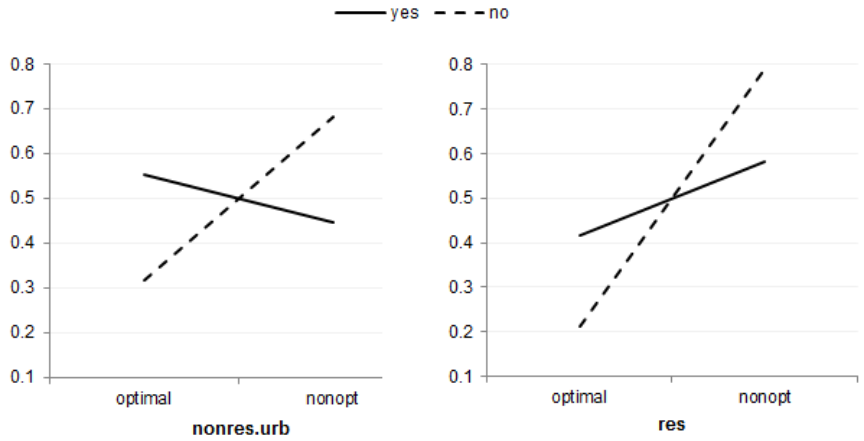
5.2.3 Estimations and results for RQ6

In this last model, the response variables follow the factor 'x6.valid' (outcome of choice) with the predictor variables reflecting the behaviour 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)*			
'x3.ser115'|'x8.place'	*'nonres.urb'*	*'remarea'*	*'rurdelta'*	*'res'*
'yes'	0.554	0.582	0.642	0.418
'no'	0.316	0.342	0.401	0.211
'x6.valid'	*'nonopt' (b)*			
'x3.ser115'|'x8.place'	*'nonres.urb'*	*'remarea'*	*'rurdelta'*	*'res'*
'yes'	0.446	0.418	0.358	0.582
'no'	0.684	0.658	0.599	0.789

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 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 healthcare 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 non-resident patients coming from adjacent urban areas.

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.

6.1 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 healthcare 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.

Non-optimal choices appear to have been popular especially when facing a shortage of expert counselling. 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 sceptical of experts' advice, and those who make good decisions have their reasons for that scepticism.

Combining the results of RQ4 with RQ1, expert counselling represents an obstacle for patients, as only 22% have access to good counselling. 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 healthcare 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 healthcare 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 healthcare information system.

6.2 Policy implications

6.2.1 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 healthcare provider as the reported empirical results suggest.

6.2.2 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 healthcare counselling 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 centre, this service will likely have a far reaching effect on society and reorganising it will be feasible with today's ICT developments.

6.2.3 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 centralised health counselling system administered and authorised by the Ministry of Health. Also, the development of smartphone apps for health information and healthcare providers' portals should be highly possible and practical innovations, facilitating the search and exchange of information about healthcare providers, their reputation and performance records, medical records, online counselling, etc.

This analysis has some limitations:

1 a geographical concentration on healthcare providers in Hanoi

2 its focus is on the nexus between information-related factors and the decision to choose a healthcare 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 modelling efforts.

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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 counselling

'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***	–1.317***	–0.652***	–0.388**	–0.370**
	[5.036]	[–6.860]	[–5.595]	[–2.696]	[–2.976]

Notes: 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:

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

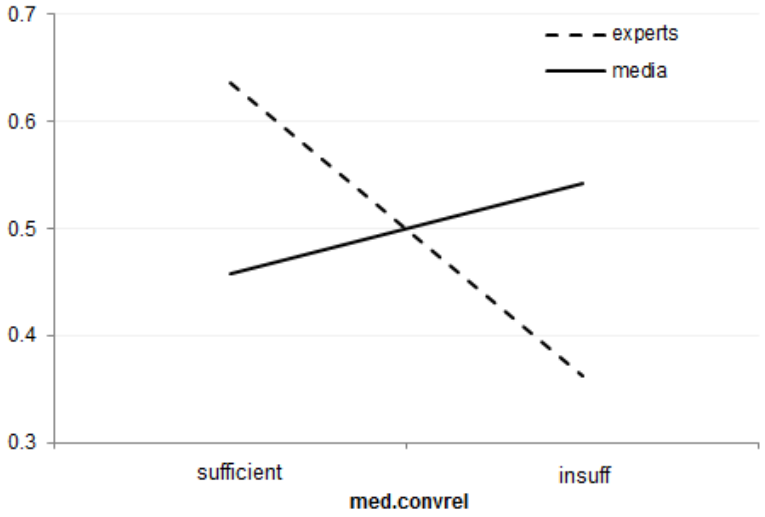
Appendix D

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***	0.565***	–0.246	0.859***	–1.059***
	[–7.576]	[3.729]	[–0.894]	[5.778]	[-3.452]

Notes: 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***	0.405**	0.745*	0.542 .	0.608*
	[–3.718]	[2.872]	[2.459]	[1.802]	[2.003]

Notes: 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 counselling

'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***	0.082	–0.053
	[–6.495]	[0.541]	[–0.352]

Notes: 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***	0.354**	-0.530*	0.523
	[-1.309]	[1.460]	[2.906]	[4.078]

Notes: 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***	0.985***	0.547***	0.664*	0.917***
	[–13.632]	[5.744]	[3.883]	[2.364]	[6.244]

Notes: 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 healthcare provider following use of 115 Emergency Service (solid line) for patients coming from remote ('remarea') and rural areas ('rurdelta')