

# The “Hassle Factor”

## What Motivates Physicians to Manipulate Reimbursement Rules?

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**Background:** Some physicians are willing to misrepresent clinical information to insurance companies to circumvent appeals processes. Whether characteristics of appeals processes affect the likelihood of misrepresentation is unknown. This study sought to determine the relationship between the likelihood of a successful appeal, appeals process length, and severity of the health condition and physicians' willingness to sanction deception.

**Methods:** A random sample of 1617 physicians was surveyed by mail to assess their willingness to accept an insurance company restriction, to appeal the restriction, or to misrepresent the facts to an insurance company to obtain coverage for a patient.

**Results:** Most respondents would appeal (77%) rather than accept (12%) or misrepresent (11%) regarding a restriction on medically necessary care. Physicians' decisions were related to the likelihood of a successful ap-

peal ( $\chi^2=7.56$ ;  $P=.02$ ), the appeals process length ( $\chi^2=8.53$ ;  $P=.01$ ), and the severity of the medical condition ( $\chi^2=71.10$ ;  $P<.001$ ). A small but significantly larger number of physicians chose to misrepresent the facts to an insurer as the appeals process became more cumbersome. Among physicians asked about severe angina, their decisions were particularly affected by the hassle associated with appealing, being more likely to choose to misrepresent the facts to the insurer than to appeal as the hassle increased.

**Conclusions:** Physicians are more willing to sanction deception when the appeals process is longer, the likelihood of a successful appeal is lower, and the health condition is more severe. Changes in the difficulty of appeals processes may ease the tensions physicians face regarding patient advocacy and honesty.

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**I**N AN EFFORT TO CONTROL health care costs, many third-party payers have developed mechanisms to limit physicians' abilities to order expensive tests, treatments, or referrals for their patients. In many cases, these restrictions are used to guide physicians away from unnecessary medical services, such as expensive interventions that bring no more benefit than less expensive ones. In other cases, restrictions encourage physicians to make cost-quality tradeoffs, such that expensive services that bring marginal benefits are foregone in favor of less expensive services.

Third-party payer restrictions can impede physicians' abilities to provide what they deem to be medically necessary health care for their patients. In recognition that reimbursement rules are imperfect, third-party payers have developed appeals mechanisms, whereby physicians can attempt to obtain important services that have been de-

nied to their patients. For appeals processes to effectively reduce health care costs, they must be burdensome enough to keep physicians from pursuing wasteful health care services but not so burdensome that they cause physicians to let patients go without important services.

Previous research<sup>1-3</sup> reveals that physicians are willing to “game the system” and use deception on behalf of their patients to obtain specific health care benefits. As many as 39% of physicians report having manipulated reimbursement rules on behalf of their patients within the past year (by exaggerating condition severity, changing billing diagnosis, or reporting factitious signs or symptoms).<sup>2</sup> Such willingness to deceive third-party payers may be related to the arduousness of appeals processes. If appeals processes become too difficult, they may inadvertently encourage physicians to misrepresent the facts.

## PARTICIPANTS AND METHODS

### PARTICIPANTS

In the summer of 2000, we conducted an anonymous mail survey of 1617 physicians (general internists, family practitioners, general practitioners, and internal medicine subspecialists) in the United States. Participants were selected randomly from the American Medical Association master file, which is the most comprehensive available mailing list of physicians, as it includes American Medical Association members and nonmembers. Each physician received a \$5 bill in the first mailing to encourage participation.<sup>4</sup> Approximately 2 months after the first mailing, nonresponders were sent a second mailing without financial incentive.

### SURVEY INSTRUMENT

Each physician was given 1 of 2 scenarios describing a hypothetical patient who was denied a medical service by his or her insurance company (see boxed text on page 1136). Each scenario was pretested for clarity and clinical accuracy. One scenario involved a relatively severe medical condition—angina caused by triple-vessel coronary artery disease. This scenario was modified from a previously published study.<sup>1</sup> The second scenario was written to reflect a less severe clinical condition—moderate low back pain.

After each scenario was presented, respondents were asked whether, based on the limited clinical information available in the scenarios, the physician in the scenario should (1) accept the insurance company's decision, (2) appeal the insurance company's decision, or (3) misrepresent

the facts to the insurance company and report that the patient is having worsening symptoms.

Across questionnaire versions, we varied our description of the appeals process. We differed the amount of time required for the appeal (10 minutes vs 60 minutes) and the likelihood of a successful appeal (50% success vs 95% success). This yielded a 2 (severe angina vs back pain)  $\times$  2 (10 minutes vs 60 minutes)  $\times$  2 (50% vs 95% success) design. Physicians were randomized to receive 1 of the 8 questionnaires.

### STATISTICAL ANALYSES

$\chi^2$  Tests were used to examine the relationship between physician choice and categorical participant (eg, race and sex) and scenario (severity of the health condition, length of the appeals process, and the likelihood of a successful appeal) characteristics, and analysis of variance was used to compare physician decisions across continuous variables (eg, age). Multinomial logistic regression models were constructed to study the independent effects of the severity of the health condition ("severity"), the likelihood of a successful appeal ("success"), and the length of time required for an appeal ("time") on physicians' hypothetical treatment decisions (eg, misrepresent patient's health condition and accept or appeal insurance company's decision). The 3 factors (severity, success, and time) were entered into the model simultaneously. We hypothesized that physicians' willingness to appeal the insurance company's decision would differ as a function of severity, success, and time. Therefore, comparisons were made against a decision to appeal. Analyses were first conducted by collapsing across scenarios (angina and low back pain) and then separately for each health condition. Data were analyzed using statistical software (SPSS version 10.0; SPSS Inc, Chicago, Ill).

Little research has examined whether characteristics of the appeals process increase the likelihood that physicians will resort to deception. In this study, we examined several factors that affect the likelihood that physicians will sanction deception: (1) the likelihood that an appeal will be successful, (2) the time burden of the appeals process, and (3) the severity of the medical condition.

## RESULTS

Of the 1617 surveys mailed, 50 were undeliverable because of incorrect addresses. We received returned questionnaires from 890 physicians, for an overall response rate of 57%. Fifteen physicians who completed questionnaires were excluded because they indicated that they were not general internists, family practitioners, general practitioners, or internal medicine subspecialists. Sixteen surveys were excluded for having incomplete information, leaving a total of 859 responses. Physicians were predominantly men (77%) and white (75%) (**Table 1**). Most respondents were family practitioners (48%) or general internists (43%). Most respondents worked in solo or small group practices (58%) or in large multispecialty practices (14%), and 5% worked in managed care organizations. On

average, respondents spent 82% of their time in direct patient care. There were no differences in response rates ( $\chi^2=7.18$ ;  $P=.41$ ) or in respondent demographics (gender,  $P=.58$ ; race,  $P=.39$ ; and medical specialty,  $P=.42$ ) across questionnaire versions. Responders did not differ from nonresponders in age ( $P=.31$ ), sex ( $P=.06$ ), or medical specialty ( $P=.06$ ).

### RELATIONSHIP BETWEEN PHYSICIANS' DECISIONS AND CHARACTERISTICS OF THE APPEALS PROCESS

Overall, most respondents chose to appeal (77%) rather than to accept (12%) a restriction on medically necessary health care or to misrepresent by reporting that a patient is having factitious symptoms (11%). Physicians' decisions were related to the likelihood of having a successful appeal ( $\chi^2=7.56$ ;  $P=.02$ ), the length of the appeals process ( $\chi^2=8.53$ ;  $P=.01$ ), and the severity of the medical condition ( $\chi^2=71.10$ ;  $P<.001$ ) (**Table 2**). As the hassle of the appeals process increased, more physicians were willing to misrepresent the truth to insurance companies and fewer were willing to appeal the insurance company decision. For instance, physicians' reported that willingness to misrepresent was affected by

the likelihood of having a successful appeal. When the likelihood of success was 50%, 13% of physicians reported they would misrepresent. When the likelihood of success increased to 95%, 9% of physicians reported that they would misrepresent. In addition, the likelihood of appeal was greater in the setting of a higher likelihood of a successful appeal (81% vs 73%). The time required to appeal also influenced physicians' decisions, with only 9% willing to misrepresent when the process took 10 minutes vs 14% when a 60-minute appeals process was required. More physicians were willing to appeal with a shorter appeals process (81% vs 73%). Finally, 16% of physicians chose to misrepresent the facts when the patient had severe angina, whereas only 7% chose to misrepresent when the patient had moderate low back pain. Similarly, 20% of physicians accepted a restriction in the moderate low back pain scenario vs only 3% in the severe angina scenario.

The effect of the "hassle factor" on physicians' decisions was also explored by adjusting for the 3 characteristics using multinomial logistic regressions (**Table 3**). The relationship between physicians' willingness to

misrepresent patients' symptoms and the hassle factor remained true, although our study was not powered to detect these differences when adjusting for all 3 vari-

### Survey Instrument

#### Scenarios Included in Questionnaires Used to Assess Physician Willingness to Accept an Insurance Company Restriction, to Appeal the Restriction, or to Misrepresent Condition Severity to Obtain Coverage for a Patient

##### Severe Angina

A 55-year-old woman who just moved to a new city comes to her new doctor. She asks to be referred to a surgeon for heart bypass surgery. She is homebound because of chest pains. Before moving, she had an angiogram and it showed that she had triple-vessel disease. She is on maximal medical therapy, but continues to have severe chest pain when she walks up a flight of stairs or tries to carry groceries in from the car. Based on the medical literature and the degree of stenosis in her coronary arteries, her new doctor believes that bypass surgery is needed. However, the patient's insurance company will not pay for bypass surgery for this preexisting condition because her chest pain has been stable for several months. The insurance company will pay for bypass surgery in this woman only if her chest pain gets worse.

##### Moderate Low Back Pain

A 55-year-old man who has just moved to a new city comes to his new doctor. He asks whether he can receive an MRI to evaluate his low back pain. He says that four months ago he injured his back while doing some heavy lifting. Since then, he has continued to have low back pain that limits him from doing many of his normal daily activities. He has undergone conservative therapy for 4 months, but has had no significant relief from his pain. Based on the medical literature, the doctor believes that after four months of continuous low back pain, the patient needs to be evaluated for surgery by receiving an MRI. However, the patient's new insurance company will not pay for an MRI until he has had 6 months of conservative medical therapy, unless the patient develops leg weakness.

**Table 1. Characteristics of 890 Survey Respondents**

Characteristic	%
Ethnicity	
White	75
Nonwhite	25
Male	77
Mean age, y (range)	48 (28-89)
Training	
General internal medicine	43
Family practice	48
General practice	3
Medicine subspecialty	7
Practice type (more than one may apply)	
Solo or small group private practice	58
Large multispecialty practice or group	14
Managed care organization	5
Other	28
Professional time spent	
Direct patient care	82
Teaching	6
Research	2
Other	10

**Table 2. Physicians' Willingness to Accept an Insurance Company Restriction, Appeal the Restriction, or Misrepresent Patient Symptoms Based on Condition Severity and Characteristics of the Appeals Process**

Variable	Physicians, No. (%)				$\chi^2$	P Value
	Total (N = 859)	Accept Restriction (n = 99)	Appeal (n = 662)	Misrepresent Symptoms (n = 98)		
Likelihood of successful appeal, %					7.56	.02
95	427	41 (10)	346 (81)	40 (9)		
50	432	58 (13)	316 (73)	58 (13)		
Time required to appeal, min					8.53	.01
10	431	42 (10)	350 (81)	39 (9)		
60	428	57 (13)	312 (73)	59 (14)		
Severity of condition					71.10	<.001
Low back pain	442	87 (20)	325 (74)	30 (7)		
Angina	417	12 (3)	337 (81)	68 (16)		

**Table 3. Adjusted Odds Ratios of Physicians' Willingness to Misrepresent Patient Symptoms or to Accept an Insurance Company Restriction vs Appeal (N = 859)\***

	Odds Ratio (95% CI)	
	Misrepresent Symptoms	Accept Restriction
Likelihood of successful appeal (50% vs 95%)	1.53 (0.99-2.36)	1.62 (1.04-2.52)†
Time required to appeal (60 min vs 10 min)	1.64 (1.06-2.54)‡	1.59 (1.02-2.47)‡
Severity of condition (angina vs low back pain)	2.13 (1.34-3.36)§	0.13 (0.07-0.24)

\*Each characteristic is adjusted for the other 2 characteristics. For example, the odds ratio of 1.53 means that the number of physicians willing to misrepresent vs appeal was 1.53 times higher for those receiving scenarios indicating a 50% likelihood of successful appeal than those receiving scenarios indicating a 95% likelihood after adjusting for time required to appeal and severity of condition. CI indicates confidence interval.

†P = .03.

‡P = .04.

§P = .001.

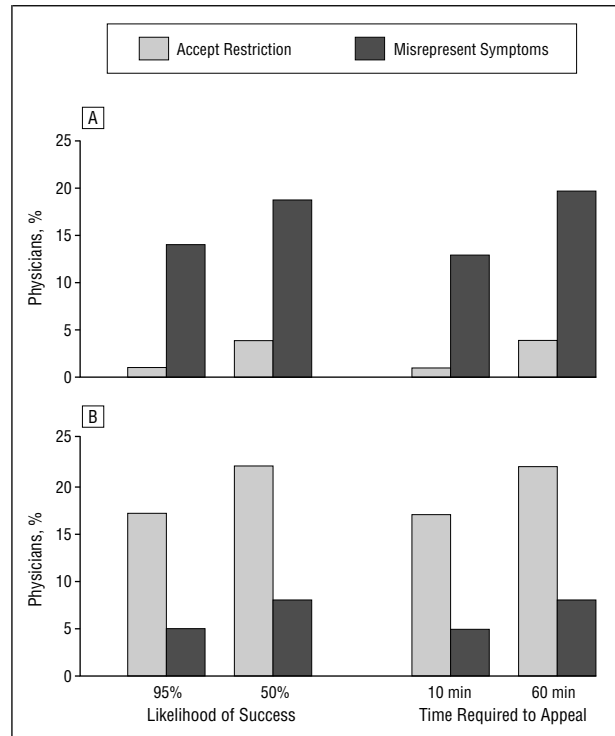
||P < .001.

ables. As the appeals process became more difficult, physicians were less likely to appeal the restriction, choosing instead to misrepresent the facts to the insurance company. When the likelihood of success dropped from 95% to 50%, physicians seemed more likely to misrepresent the facts to the insurance company than to appeal the decision (odds ratio [OR], 1.53; 95% confidence interval [CI], 0.99-2.36). When the amount of time required for appealing increased from 10 minutes to 1 hour, physicians were more likely to misrepresent than to appeal (OR, 1.64; 95% CI, 1.06-2.54). As the severity of the health condition increased, the odds of misrepresenting rather than appealing to third-party payers more than doubled (OR, 2.13; 95% CI, 1.34-3.36). At the same time, the odds of accepting the decision declined dramatically (OR, 0.13; 95% CI, 0.07-0.24).

#### ANALYSIS STRATIFIED ACCORDING TO CONDITION SEVERITY

The **Figure** shows the proportion of physicians willing to misrepresent patients' symptoms to the insurance company or to accept the insurance company's decision to deny coverage, stratified by condition severity. A small but significant proportion of physicians chose to misrepresent symptoms, and physicians were more likely to misrepresent, regardless of condition severity, as the appeals process becomes less likely to succeed or takes more time. Physicians were more sensitive to the hassle associated with the appeals process in the more severe angina scenario than in the less severe low back pain scenario.

**Table 4** gives the likelihood of physicians choosing to misrepresent or accept (vs appeal) the insurance company's decision, stratified by condition severity. Because these analyses divide our sample in half, we have less power to make definite conclusions. Nevertheless, among those receiving the severe angina scenario, the



Proportion of physicians willing to accept an insurance company restriction or to misrepresent patient symptoms to the insurance company in the severe angina scenario (A) and the moderate low back pain scenario (B).

**Table 4. Adjusted Odds Ratios of Physicians' Willingness to Misrepresent Patient Symptoms or to Accept an Insurance Company Restriction vs Appeal, by Condition Severity\***

	Odds Ratio (95% CI)	
	Misrepresent Symptoms	Accept Restriction
<b>Angina (n = 417)</b>		
Likelihood of successful appeal (50% vs 95%)	1.45 (0.85-2.47)	2.98 (0.79-11.24)
Time required to appeal (60 min vs 10 min)	1.74 (1.02-2.97)†	3.13 (0.83-11.81)
<b>Low Back Pain (n = 442)</b>		
Likelihood of successful appeal (50% vs 95%)	1.73 (0.81-3.71)	1.49 (0.92-2.40)
Time required to appeal (60 min vs 10 min)	1.51 (0.71-3.22)	1.42 (0.88-2.29)

\*Each characteristic is adjusted for the other 2 characteristics (see the first footnote to Table 3 for an example). CI indicates confidence interval. †P = .04.

amount of time to appeal had a significant effect on physicians' willingness to misrepresent the facts to the insurance company, with almost a doubling of such willingness when the appeal took 60 minutes (OR, 1.74; 95% CI, 1.02-2.97). No other associations were statistically significant. However, the table suggests a general trend: physicians' responses to the more severe angina scenario seemed to be more sensitive to the arduousness of the appeals process than were responses to the more moderate low back pain scenario, with ORs ranging from 1.45 to 3.13 for the former and 1.42 to 1.73 for the latter.

Physicians were more likely to misrepresent a patient's medical condition when the appeals process was longer or less likely to succeed. As in previous studies,<sup>1</sup> physicians' willingness to misrepresent a patient's medical condition was also affected by the severity of the condition. In our study, the effect of the hassle factor was greater for the high-stakes angina scenario than for the relatively low-stakes back pain scenario. These results show that when the appeals process becomes unduly burdensome, physicians can either throw up their hands and accept third-party payer restrictions or they can resort to deception. When the stakes are relatively high, it seems that deception becomes the preferable option.

There are many reasons physicians may chose to deceive third-party payers. As physicians seek a balance between patient advocacy and honesty, some may feel a greater sense of loyalty to their patients than to insurance companies. As such, some physicians may believe that it is more ethical to exaggerate on behalf of a patient than to have that patient go without a test or procedure that is perceived as necessary. Other physicians may be influenced to deceive insurance companies based on patients' expectations that a certain test or procedure is needed or because patients ask them to deceive the insurance company.

The results of our study, along with those of other recent studies, suggest that the likelihood of misrepresentation is significantly related to time pressures. One recent survey of physicians found that during the preceding 2 years, almost 9 of 10 physicians had experienced health plan denials of coverage for health services.<sup>3</sup> Between one third and two thirds of physicians who have experienced such denials say that the insurance company decision resulted in a decline in the health of their patients. In addition, most physicians indicated that the increase in managed care penetration in the health care market increased the amount of time spent on paperwork, which adversely affected the amount of time spent directly with patients. Increasing time pressures have been linked to manipulation of reimbursement systems.<sup>6</sup> In one survey,<sup>2</sup> physicians who believed that they were under greater time pressure were more likely to have manipulated the reimbursement rules. Our findings support this association.

Is there ever a time when manipulation of the reimbursement rules is justified? Recent surveys<sup>6-8</sup> of physicians have indicated that in the era of cost-containment in health care, physicians' ethics may be compromised. More than a decade ago, 70% of surveyed physicians said that they would hypothetically lie to an insurance company to secure coverage for a mammogram. Most of these physicians cited 2 reasons for lying: the insurance company was unreasonable or physicians have a stronger obligation to patients than to insurance companies.<sup>7</sup> More than 80% of physicians in another survey<sup>6</sup> believed that changes in the health care system during the past 10 years have diminished physicians' commitment to an ethic of undivided loyalty to patients.

Despite this sentiment, the American Medical Association, the American College of Physicians, and other organizations have consistently opposed manipulation of reimbursement rules,<sup>9,10</sup> and most physicians sur-

veyed find the practice unethical.<sup>2</sup> Nevertheless, in the era of cost-containment, physicians continue to misrepresent the facts to secure reimbursement from insurers. Physicians do not have limitless time to advocate for their patients' interests. When their backs are against the wall, the easiest solution for some physicians may be to manipulate reimbursement rules.

Our study has several limitations. The primary limitation is that we asked how physicians would behave under certain conditions rather than how they actually behave. In the context of our survey, this limitation has several implications. The survey presented physicians with clinical scenarios that contained a limited amount of information and gave physicians few options for treatment and for responding to insurance company denials. However, pilot testing had shown that physicians were comfortable with these scenarios and were able to choose from the alternatives presented to them. In addition, the severe angina scenario had been used in a previous study.<sup>1</sup> Another limitation of our survey is that physicians may report that their behavior is more in keeping with insurance company requirements in hypothetical scenarios than it actually is when presented with sick patients in a busy office practice. However, our results are consistent with those of previous studies<sup>1,2</sup> demonstrating that a substantial minority of physicians admit they have deceived insurance companies in the past.

There are several advantages to using hypothetical scenarios. It would be difficult to obtain information on physicians' willingness to misrepresent from direct observations because such observations could change physician behavior. In addition, by administering a survey we can vary specific factors, such as the difficulty of the appeals process, and compare how physicians respond to different degrees of difficulty, a comparison that would be difficult to make in the real world.

Our results could also be affected by a response bias. However, our response rates were similar to those of other recent surveys of physicians,<sup>1,2,11</sup> and we found no significant differences in response rates across the 8 survey versions or in the demographic characteristics between responders and nonresponders. Therefore, it is unlikely that the main conclusions of this study are substantially affected by a response bias.

Further research is needed to explore the variety of reasons that physicians may misrepresent cases to insurance companies. Physician behavior may be affected by financial incentives<sup>12</sup> and by patient expectations.<sup>13</sup> However, it seems clear that time and the burden of the appeals process play an important role in physicians' decisions to manipulate the reimbursement system. As physicians struggle to balance their roles as patient advocate and gatekeeper, some ultimately sacrifice honesty in favor of advocacy.

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## REFERENCES

- Freeman VG, Rathore SS, Weinfurt KP, Schulman KA, Sulmasy DP. Lying for patients: physician deception of third-party payers. *Arch Intern Med.* 1999;159:2263-2270.
- Wynia MK, Cummins DS, VanGeest JB, Wilson I. Physician manipulation of reimbursement rules for patients: between a rock and a hard place. *JAMA.* 2000;283:1858-1865.
- Morreim EH. Gaming the system: dodging the rules, ruling the dodgers. *Arch Intern Med.* 1999;151:443-447.
- Asch D, Cristakis NA, Ubel PA. Conducting physician mail surveys on a limited budget: a randomized trial comparing \$2 bill versus \$5 bill incentives. *Med Care.* 1998;36:95-99.
- The Kaiser Family Foundation/Harvard University School of Public Health. *Survey of Physicians and Nurses.* Washington, DC: Kaiser Family Foundation; 1999.
- Sulmasy DP, Bloche MG, Mitchell JM, Hadley J. Physicians' ethical beliefs about cost-control arrangements. *Arch Intern Med.* 2000;160:649-657.
- Novack DH, Detering BJ, Arnold R, Forrow L, Ladinsky M, Pezzullo JC. Physicians' attitudes toward using deception to resolve difficult ethical problems. *JAMA.* 1989;261:2980-2985.
- Connelly JE, DalleMura S. Ethical problems in the medical office. *JAMA.* 1988;260:812-815.
- Health Care Fraud and Abuse: Report of the Council on Ethical and Judicial Affairs and the Council on Medical Service of the American Medical Association.* Chicago, Ill: American Medical Association; 1997.
- American College of Physicians. Ethics manual, fourth edition. *Ann Intern Med.* 1998;128:576-594.
- Asch D, Jedziewski MK, Cristakis NA. Response rates to mail surveys published in medical journals. *J Clin Epidemiol.* 1997;50:1129-1136.
- Grumbach K, Osmond D, Vranizan K, Jaffe D, Bindman AB. Primary care physicians' experience of financial incentives in managed-care systems. *N Engl J Med.* 1998;339:1516-1521.
- Wilson I, Dukes K, Greenfield S, Kaplan S, Hillman B. Patients' role in the use of radiology testing for common office practice complaints. *Arch Intern Med.* 2001;161:256-263.

## Correction

**Error in Figure 2.** In the Original Investigation by Ross et al titled "Risk of Hepatitis C Virus Transmission From an Infected Gynecologist to Patients: Results of a 7-Year Retrospective Investigation" published in the April 8 issue of the ARCHIVES (2002;162:805-810), an error occurred in Figure 2 on page 809. The last line in the figure was inadvertently dropped. The corrected figure appears below. The journal regrets the error.

Gynecologist	<u>GTTGACGGCCACGACATCAGAACACCCGCACGATCGGGCAGGGGTGGG</u>
Index Patient	.....TA.....
Patient 1	.....C-----C.....A.....CA.....GC.....T.....C.....
Patient 2	.....-----GGG.....ATGT.....CG.....G.....C.....CA.....
C 1	.....-----GGG.....A.....GT.....TCG.....GG.....C.....CA.....C.....
C 2	.....T.....A-----GT.....ATGT.....CG.....AGG.....AC.....A.....C.....
M58335	.....-----G.....T.....A.....GT.....CA.....GG.....C.....CAA.....C.....
X61596	.....A-----CT.....TA.....GT.....TCA.....T.....GG.....CAT.....CAA.....
Gynecologist	<u>CGCACTGTGTCAGCGGGGTGCGTCCATCTTACACCTGGGGCGGTCAGA</u>
Index Patient	.....
Patient 1	.....TC.....C.....CAC.....T.....T.....T.....GG.....C.....TT.....TTT.....TC.....
Patient 2	.....TA.....C.....CGC.....A.....CC.....G.....A.....TC.....AC.....ACA.....C.....TC.....
C 1	.....CAC.....TT.....T.....T.....A.....T.....G.....AAAA.....
C 2	.....T.....A.....C.....TAT.....C.....TA.....T.....TT.....C.....GC.....A.....
M58335	.....AAA.....CAC.....A.....A.....C.....T.....G.....G.....AG.....C.....TC.....
X61596	.....AG.....CAC.....C.....GC.....C.....T.....T.....GT.....CT.....GC.....
Gynecologist	<u>ACCTCCAGCTT</u>
Index Patient	.....
Patient 1	.....A.....
Patient 2	.....AA.....C.....
C 1	.....A.....
C 2	.....A.....T.....G.....
M58335	.....AA.....
X61596	.....AA.....A.....

**Figure 2.** Alignment of hepatitis C virus (HCV) subtype 1b hypervariable region 1 (HVR 1) sequences and flanking regions from the gynecologist, the index patient infected by him, patients 1 and 2 identified during the retrospective investigation, and selected controls (C 1, C 2, M58335, and X61596). The HVR 1 is indicated by underscore.