

Overuse and underuse of diagnostic upper gastrointestinal endoscopy in various clinical settings

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Abstract

Objectives. To describe and compare both overuse and underuse of diagnostic upper gastrointestinal endoscopy in different settings.

Design. Merging of data from three prospective observational studies. The appropriateness and necessity of indications for gastroscopy were evaluated using explicit criteria developed by a standardized expert panel method (RAND-UCLA). Inappropriate endoscopies represent overuse. Necessary indications not referred for the procedure constitute underuse.

Setting. Three primary care outpatient clinics, 20 general practices, three gastroenterology practices, two district and one university hospitals.

Subjects. A third of the collective were consecutive ambulatory patients with upper abdominal complaints, whereas the other two-thirds were ambulatory and hospitalized patients referred for the procedure.

Main outcome measures. Proportions of overuse and underuse in the different settings.

Results. A total of 2885 patients were included (mean age, 49 years, 52% male, 2442 outpatients), 1858 patients underwent ≥ 1 endoscopy. Among 2086 endoscopies, 805 (39%) were inappropriate, most of which were performed for dyspepsia (83%). Overuse was higher in young, foreign, female patients and lower in inpatient settings, the latter reflecting a different distribution of presenting symptoms. Among 1646 patient visits in primary care, overuse represented 148 endoscopies (9%). Underuse was identified in 104 of the same patient visits (6%) and was higher as patient age increased; there were no significant differences between men and women.

Conclusions. Rates of overuse and underuse depend mainly on case presentation and patient characteristics. Both over- and underuse should be addressed to maintain and improve quality of care.

Keywords: appropriateness of care, delivery of health care, gastroscopy, primary health care, quality of health care

In many developed countries, increasing health care costs have led to financial constraints and to fundamental reforms in health care systems [1] aimed at more optimal use of scarce health care resources. Recent reforms in Switzerland specify that the care reimbursed by the basic coverage must be 'effective, appropriate and economical'. Many studies have shown that medical procedures are not infrequently used for indications that are inappropriate [2]. There is concern, however, that the emphasis on 'appropriate and economical care,' while creating more efficiency, may compromise equity

in health care delivery, as it has been documented in health care systems in other prosperous countries, [3,4].

The RAND appropriateness method (RAM), which combines information from medical literature and systematic expert opinion, was developed to determine appropriateness of medical procedures, aimed at reducing their overuse, i.e. the provision of care delivered for inappropriate reasons. A more recent development is the extension of the method to determine underuse of necessary care, i.e. care that should be offered or used, but which is not [5].

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Most published studies using this method have examined hospitalized patients. However, it is important to assess the appropriateness of care in ambulatory settings as well, because it accounts for a major part of health care provided. In addition, it is only through reaching out towards the general population that a grip can be obtained on the difficult question of underuse.

The aim of the present study was to investigate, with the RAND method, the patient characteristics associated with the over- and underuse of diagnostic upper gastrointestinal endoscopy (UGE) in three different clinical settings: general practice, specialist consultation and in-patients. This may lead to a better understanding of the sources of over- and underuse, so that practice guidelines could put emphasis on crucial situations in which the risk of inappropriateness is particularly high. It may also reveal inequalities in health care provision, that should be addressed further to optimize health care quality.

Patients and methods

The data for this study were collected between 1995 and 1997, within the context of three studies conducted in various regions of Switzerland, investigating the appropriateness of indications for UGE based on criteria that had been developed in 1994 by a multidisciplinary expert panel (see below). The appropriateness and the necessity of the indication for endoscopy in each patient were evaluated with the list of 598 criteria from that panel which had used the RAND-UCLA appropriateness method which is described in detail elsewhere [5–7]. The notion of inappropriate care, used to determine overuse, is defined as care where the expected health benefits (i.e. increased life expectancy, relief of pain or anxiety) are outweighed by the potential negative consequences (i.e. morbidity, mortality, pain or anxiety produced by the procedure or even time lost from work). Monetary cost does not enter into the definition. Underuse means that endoscopy is not performed although judged necessary for a given indication. To be necessary an indication had to meet all of the following criteria: (i) it is appropriate; (ii) it would be considered negligent not to offer the procedure; (iii) expected benefits must be great; and (iv) the probability of benefit must be great.

The 1994 Swiss panel

Based on an extensive literature review summarizing existing knowledge on efficacy, effectiveness, risks and costs concerning use of UGE, a comprehensive list of detailed theoretical clinical indications for UGE was prepared. The main elements that entered into the criteria of appropriateness and necessity were type and duration of symptoms, drug consumption, age, previous diagnostic or therapeutic measures and results of these measures.

The multidisciplinary panel was composed of nine national experts: five gastroenterologists, two internists, one general practitioner and one surgeon. Panelists were provided with

the literature review and the list of indications and asked to rate each indication on a 9-point scale from 1, very inappropriate to 9, very appropriate. Their ratings were based on the evidence derived from the literature review as well as on their personal experience, especially in cases where evidence was poor or lacking. Ratings of the first round were presented to the panelists during the meeting, intensively discussed and re-rated. The method does not force consensus, but rather aims at facilitating free exchange of opinions. Indications were then classified into categories of appropriate, uncertain or inappropriate, using the median rating (1–3 = inappropriate; 4–6 = uncertain; 7–9 = appropriate) and the degree of agreement of the panelists (i.e. all indications with disagreement are considered uncertain). During a third round, experts voted on the necessity of all appropriate indications, rating these from 1 to 9, according to the degree of necessity. Median ratings for this third round in the 7–9 range, without disagreement were considered necessary.

The three studies

Study 1 was conducted in three primary care teaching outpatient clinics situated in the three different language regions of Switzerland. All patients ($n=911$) presenting with upper abdominal symptoms between April 1995 and September 1996 were included in the study. These patients were examined by physicians training as general practitioners or internists; 260 patients were referred for an endoscopy [8].

In study 2, patient visits in 20 general practices in the French- and Italian-speaking regions of Switzerland were examined. Screening 8135 visits, in May and June 1995, 445 patients presented with upper gastrointestinal symptoms and participated in the study. Of these, 63 underwent endoscopy [3,9].

Study 3 was performed between May 1996 and January 1997 in two district hospitals, one university-based hospital, and three gastro-enterology practices. It comprised 1773 patients who all had an UGE [10].

All endoscopies in the three studies were performed by gastro-enterologists. In Switzerland, general practitioners and internists, even those who work in a hospital or outpatient clinic, do not generally perform endoscopies, but refer their patient to a specialist.

Variables

Variables common to the three studies which were used for the current study include: clinical setting (general practice, gastroenterology practice, outpatient clinic or hospital), number of visits per patient, sex, date of birth, nationality, presenting symptoms, unique indication identifier based on the 1994 expert panel on the appropriateness of endoscopy and its corresponding appropriateness category, as well as endoscopic findings. Data were anonymous and matching sex and date of birth were used to determine if a patient had had more than one consultation during the study period.

Exclusion criteria were: age less than 16 years, AIDS, patients with transplants or on chemotherapy, patients with

Table 1 Characteristics of patient visits by clinical setting and study [number (%)]

Characteristics	Study 1 Outpatient clinic ²	Study 2 Primary care physician ²	Study 3 Specialist ¹	Study 3 Hospital ²	Total
Number of patients	<i>n</i> = 911	<i>n</i> = 445	<i>n</i> = 1056	<i>n</i> = 443	<i>n</i> = 2885
Number of visits	<i>n</i> = 1186	<i>n</i> = 450	<i>n</i> = 1176	<i>n</i> = 551	<i>n</i> = 3363
Age < 35 years	502 (42)	78 (17)	252 (21)	52 (9)	884 (26)
Age 35–54 years	440 (37)	150 (33)	445 (38)	165 (30)	1200 (36)
Age ≥ 55 years	244 (21)	222 (49)	479 (41)	334 (61)	1279 (38)
Males	643 (54)	176 (39)	635 (54)	308 (61)	1762 (52)
Swiss nationality	437 (37)	349 (78)	794 (68)	417 (76)	1997 (59)
Number of consultations per patient					
1	911 (79)	445 (99)	1056 (90)	443 (80)	2885 (85)
2	189 (16)	5 (1)	73 (6)	67 (12)	334 (10)
3	54 (5)	0 –	23 (2)	27 (5)	104 (3)
4	32 (3)	0 –	24 (2)	14 (3)	70 (2)
Endoscopy performed	324 (27)	35 (8)	1176 (100)	551 (100)	2086 (62)

¹Performers of UGE.²Non-performers of UGE.

symptoms that did not correspond to any indication of the 1994 panel and non-diagnostic endoscopies.

Analyses

Analyses of over- and underuse were based on the consultation as the unit of analysis, i.e. for a specific patient–physician encounter, we examined whether an endoscopy was performed for an inappropriate reason (overuse) or was not ordered/performed although it would have been considered necessary or crucial (underuse). The statistical tests used were the χ^2 test to compare categorical variables, and the *t*-test and the analysis of variance to compare means. To describe independent effects of various patient and setting characteristics on overuse, sex, age, nationality, clinical setting and number of endoscopies were entered in a logistic regression model. Similarly, underuse was examined in relation to sex, age, nationality, clinical setting and number of consultations.

Results

By merging the three initial data sets, a database of 2885 eligible patients was obtained. Patients coming from the two types of hospital settings were similar and were combined into one category. The mean age was 49 years (SD = 18 years, range, 16–93 years), 52% were male, 60% were Swiss. Other frequent nationalities were: inhabitants of ex-Yugoslavia, Italy, Turkey and Portugal. Patients from study 1, who consulted in outpatient clinics, were about 10 years younger than

patients from studies 2 and 3 ($P < 0.001$). The proportion of visits involving foreign patients was also significantly higher in study 1 (72% versus 37%, $P < 0.001$).

The 2885 patients corresponded to 3363 consultations and 2086 endoscopies with a maximum of 11 consultations/endoscopies per patient (one patient). Because of differences in study design, the proportion of patients who had an endoscopy varied from 8 to 100%, depending on the study considered. Patients from studies 1 and 2 consulted because of abdominal complaints and a minority of them underwent an endoscopy. On the other hand, patients from study 3 were included only if referred for UGE.

The patients came from the different clinical settings in the following proportions: 911 patients (33%) consulted in an outpatient clinic, 445 (16%) in a general practice, 1056 (38%) in a gastro-enterology practice and 443 (16%) in a district or university hospital. Table 1 illustrates the main characteristics of patient visits by clinical setting and shows the important heterogeneity among the four settings, with significant differences for age, sex and nationality.

Table 2 shows the distribution of presenting symptoms in patients who underwent endoscopy in the different settings. There were large variations, especially between inpatient and outpatient settings. Whereas haematemesis and melena were frequent indications in hospitalized patients, dyspepsia was a frequent presenting symptom in all settings.

Except for normal findings (33%), the most frequent endoscopic diagnoses were: reflux-associated oesophagitis (12%) and duodenal ulcer (10%). We considered hiatal hernia and non-erosive gastritis to be non-significant findings from

Table 2 Categories of presenting upper gastrointestinal symptoms in patients who underwent endoscopy ($n = 2086$ endoscopies performed)

Symptoms	Setting							
	Outpatient clinic		Primary care physician		Specialist		Hospital	
	<i>n</i>	(%)	<i>n</i>	(%)	<i>n</i>	(%)	<i>n</i>	(%)
Dyspepsia	229	(71)	20	(57)	664	(56)	126	(23)
Dysphagia	16	(5)	3	(9)	100	(8)	49	(9)
Haematemesis	8	(2)	1	(3)	36	(3)	137	(25)
Anaemia	13	(4)	1	(3)	66	(6)	51	(9)
Melena	9	(3)	0	(0)	31	(3)	82	(15)
Unexplained weight loss	22	(7)	4	(11)	31	(3)	26	(5)
Reflux-associated esophageal lesion	9	(3)	1	(3)	60	(5)	5	(1)
Assessment of healing of benign gastric ulcer	4	(1)	2	(6)	44	(4)	8	(1)
Atypical chest pain	3	(1)	0	(0)	16	(1)	5	(1)
Occult bleeding	2	(1)	0	(0)	4	(1)	9	(2)
Abnormal findings in UGI Series	0	(0)	1	(3)	3	(1)	1	(1)
Others	9	(3)	2	(6)	121	(10)	52	(9)
Total	324	(100)	35	(100)	1176	(100)	551	(100)

Table 3 Findings at endoscopy for all performed endoscopies (some patients underwent more than one endoscopy)

Diagnostic	Setting							
	Outpatient clinic		Primary care		Specialist		Hospital	
	<i>n</i>	(%)	<i>n</i>	(%)	<i>n</i>	(%)	<i>n</i>	(%)
Total non-significant and normal findings	155	(48)	15	(44)	540	(46)	145	(26)
Normal findings	111	(34)	10	(29)	445	(38)	113	(20)
Hiatal hernia	14	(4)	3	(9)	95	(8)	32	(6)
Non-erosive gastritis	30	(8)	2	(6)	—	—	—	—
Total significant findings	169	(52)	20	(56)	636	(54)	406	(74)
Oesophagitis	32	(10)	5	(14)	155	(13)	66	(12)
Duodenal ulcer	52	(16)	2	(6)	79	(7)	70	(13)
Erosive gastritis	15	(5)	2	(6)	51	(4)	39	(7)
Gastric ulcer	9	(3)	1	(3)	37	(3)	51	(9)
Oesophageal varices	1	(1)	1	(3)	44	(4)	50	(9)
Erosive duodenitis	7	(2)	1	(3)	16	(1)	4	(1)
Barrett's oesophagus	3	(1)	—	—	36	(3)	7	(1)
Cancer	—	—	—	—	14	(1)	6	(1)
Oesophageal ulcer	—	—	—	—	5	(1)	9	(2)
Others	50	(15)	8	(23)	201	(17)	105	(19)
Total	324	(100)	35	(100)	1176	(100)	551	(100)

a clinical point of view. Table 3 illustrates the endoscopic findings by setting. There were more significant endoscopic findings in hospitalized patients than in outpatients (74% versus 52%, $P < 0.001$). Duodenal ulcer and oesophagitis were more frequent in outpatient clinics; in addition to these diagnoses, gastric ulcer and esophageal varices were frequent in hospitalized patients.

Considering all clinical indications that led to an endoscopy, 41% inappropriate indications were found in outpatient clinics, 46% in general and gastroenterology practices and 21% in hospital settings ($P < 0.001$, if we compare in-patient with ambulatory settings). Table 4 shows characteristics associated with overuse, that is with inappropriate indications for which endoscopy was performed (or ordered). Overuse was inversely

Table 4 Proportion of overuse according to setting and patient's characteristics

Characteristics	Setting								χ^2 test
	Primary care ^{1,2}		Specialist ³		Hospital ²		Total		
	<i>n</i>	(%)	<i>n</i>	(%)	<i>n</i>	(%)	<i>n</i>	(%)	
Males	89/220	(40)	278/635	(44)	54/308	(18)	421/1163	(36)	$P < 0.001$
Females	59/139	(42)	264/541	(49)	61/243	(25)	384/923	(42)	
Age < 35 years	67/141	(48)	143/252	(57)	21/52	(40)	231/445	(52)	$P < 0.001$
Age 35–54 years	61/142	(43)	230/445	(52)	40/165	(24)	331/752	(44)	
Age \geq 55 years	20/76	(26)	169/479	(35)	54/334	(16)	243/889	(27)	
Swiss nationals	43/127	(34)	321/794	(40)	77/417	(18)	441/1338	(33)	$P < 0.001$
Foreigners	105/232	(45)	221/382	(58)	38/134	(28)	364/748	(49)	
First UGE	130/295	(44)	510/1056	(48)	108/443	(24)	748/1794	(42)	$P < 0.001$
Second UGE	10/41	(24)	27/73	(37)	4/67	(6)	41/181	(23)	
Third UGE or more	8/23	(35)	5/47	(11)	3/41	(7)	16/111	(14)	
Total	148/359	(41)	542/1176	(46)	115/551	(21)	805/2086	(39)	$P < 0.001$

¹This category includes outpatient clinics and general practices.

²Non-performers of UGE

³Performers of UGE

Table 5 Proportion of underuse in primary care¹ and patient's characteristics

Characteristics	Outpatient clinic		General practice		Total		χ^2 test
	<i>n</i>	(%)	<i>n</i>	(%)	<i>n</i>	(%)	
Males	20/438	(5)	29/161	(18)	49/599	(8)	$P < 0.001$
Females	13/424	(3)	42/254	(17)	55/678	(8)	
Age < 35 years	11/371	(3)	7/68	(10)	18/439	(4)	$P < 0.001$
Age 35–54 years	11/307	(4)	19/141	(13)	30/448	(7)	
Age \geq 55 years	11/184	(6)	45/206	(22)	56/390	(14)	
Swiss nationals	12/335	(4)	55/324	(17)	67/659	(10)	$P < 0.01$
Foreigners	21/527	(4)	16/91	(18)	37/618	(6)	
First consultation	28/651	(4)	71/410	(17)	99/1061	(9)	$P < 0.001$
Second consultation	4/148	(3)	0/5	(0)	4/153	(3)	
Third consultation or more	1/63	(2)	0/0	(0)	1/63	(2)	
Total	33/862	(4)	71/415	(17)	104/1277	(8)	$P < 0.001$

¹Underuse can only be described for these two settings, as patients in this study coming from the other two settings always underwent endoscopy.

associated with age, representing 52% in patients aged less than 35 years and only 27% in patients aged 55 years or more. Overuse was slightly higher in women than in men and in foreign patients in comparison with Swiss nationals. Overuse was mostly encountered in patients presenting with dyspepsia (83% of inappropriate UGE). Inappropriate endoscopies resulted more often in normal and non-significant diagnoses (52% versus 48% in appropriate UGE, $P < 0.001$). Our data show a shift of appropriateness depending on whether one considers the first endoscopy or the subsequent ones: 42% of the first UGE corresponded to inappropriate

indications, while this proportion was 23% for the second endoscopy and 14% for the subsequent ones ($P < 0.001$).

Among 1277 consultations not resulting in endoscopy, 104 (8%) concerned an indication for UGE that was judged necessary, representing underuse. Characteristics associated with underuse in primary care are illustrated in Table 5. Underuse was more frequent in older patients, especially if aged more than 55 years (6% versus 3% before 55 years). Swiss patients had slightly more underuse than foreigners. Only a very small number of patients had more than one consultation in primary care, especially in general practices,

Table 6 Characteristics associated with overuse: results of logistic regression

Determinants	Odds ratio	95% CI
Female ¹	1.0	
Male	0.74	0.61–0.89
Foreign ¹	1.0	
Swiss	0.65	0.53–0.80
Age (by 10 years)	0.82	0.77–0.87
Primary care setting ¹	1.0	
Specialist	1.66	1.28–2.14
Hospital	0.60	0.43–0.82
First UGE ¹	1.0	
Second UGE	0.51	0.33–0.78
Three or more UGE	0.18	0.08–0.39

¹Reference group.

Table 7 Characteristics associated with underuse in the two settings that form primary care, results of logistic regression

Determinants	Odds ratio	95% CI
Female ¹	1.0	
Male	1.34	0.88–2.05
Foreign ¹	1.0	
Swiss	0.76	0.47–1.27
Age (by 10 years)	1.21	1.06–1.36
Outpatient clinic ¹	1.0	
General practice	3.93	2.38–6.49
First consultation ¹	1.0	
Second consultation	0.49	0.17–1.41
Three or more consultations	0.31	0.04–2.29

¹Reference group.

precluding analysis of a possible trend of underuse with multiple consultations. There were no significant differences between males and females. Proportion of underuse was significantly higher in primary care practice compared with outpatient clinic. Frequent indications associated with underuse were dyspepsia resistant to therapeutic trial (53%) and uninvestigated dysphagia (28%).

To be able to compare overuse with underuse, inappropriate endoscopies were also related to the number of patients visits motivated by gastrointestinal symptoms and not only to patients referred for the procedure. Considering the 1646 patient visits in primary care (study 1 and 2 only, because patients from study 3 were all referred for the endoscopy), 148 inappropriate endoscopies were observed (9%).

The significant variables associated with overuse and underuse were entered into logistic regression models to obtain the odds ratios shown in Tables 6 and 7. Male sex, Swiss nationality, increasing age and number of endoscopies were inversely related to overuse (Table 6). Clinical setting was also associated with overuse: it was generally higher in cases seen by specialists and lower in hospital patients, compared with primary care patients.

A similar multivariate analysis on endoscopies performed for dyspepsia only ($n=1039$) gave similar odds ratios for age, sex, and nationality. Specialized practices and hospital setting were associated with a higher probability of overuse (odds ratio, 2.28 and 3.09 respectively).

Table 7 shows odds ratios for underuse in outpatient clinics and gastroenterology practices (primary care). Age and clinical setting were associated with underuse, whereas sex, nationality and number of consultations showed no significant relationship to it. Probability of underuse increased with age and was higher in general practices.

Discussion

This study examined the rates of overuse and underuse of diagnostic UGE in different clinical settings. Determining factors for overuse were lower age, female sex and foreign (non-Swiss) nationality. Overuse was lowest in the hospital setting and highest in the ambulatory specialist care. Increasing age was the most striking characteristic associated with underuse.

Overuse

Overall, 39% of endoscopies in our population were performed for inappropriate indications. Overuse varied significantly according to clinical setting: overuse rates were the lowest in hospital setting and the highest in specialized practices. Data from other studies indicate similar rates if comparable categories are examined. For example, in a study on patients aged 65 years and over, most of whom were hospitalized, Kahn found 17% inappropriate indications [2], as we did in the equivalent group in this study. This low proportion of inappropriate in-hospital endoscopies is explained by the severity of symptoms encountered in inpatients, especially upper gastrointestinal bleeding, for which endoscopy was always judged appropriate.

Overuse was higher in patients seen in gastroenterology practices in comparison with those seen in general practices or in outpatient clinics. However, in an open-access endoscopy system as in Switzerland, gastroenterologists perform most endoscopies upon request of general practitioners, without putting into question the appropriateness of the procedure, unless there are contraindications. In addition, the lower rate of overuse in the general practices may reflect the selection of generalists who were interested in appropriateness of care, unlike the other generalists who referred patients to the specialists involved in these studies. Although the comparison is not identical, examining appropriateness of referrals for endoscopy in various medical specialties, Mahajan found that primary care physicians were more likely to schedule their patients for appropriate indications than (non-gastroenterologist) internal medicine subspecialists and surgeons [11]. Other studies showed that specialists who perform a procedure considered it more frequently appropriate than non-performers [12,13]. In our study, proportionally fewer patients with dyspepsia seen by gastroenterologists had had

an adequate empirical treatment, i.e. more than 13 days: this was a major reason for inappropriate indications. There is, however, no hard scientific evidence behind criteria requiring prior empirical treatment for 13 days before proceeding to endoscopy and the question of how uncomplicated dyspepsia should best be managed is still unanswered. Symptoms of dyspepsia show a poor predictive value for endoscopic diagnoses [14,15], but recent studies observed that prompt endoscopy in patients with dyspepsia seemed to be more cost-effective [16], reducing work loss and medical care consumption, even if there is no significant endoscopic finding [17,18].

This item of need of empirical treatment prior to endoscopy was introduced in the 1994 criteria based on a generally approved statement from the American College of Physicians [19] and the American Society of Gastrointestinal Endoscopy [20], that recommended 14 days empirical anti-secretory treatment in all patients with uncomplicated dyspepsia and endoscopy for those who did not respond to therapy or whose symptoms recurred on cessation of treatment. Some more recent publications indicate that empirical treatment is not a sufficient selection criterion for endoscopy [21]. This element of criteria may need to be re-evaluated in light of new evidence.

It was observed that overuse diminished as age increased. Age plays a significant role in several digestive pathologies and some studies have shown that the probability of finding an endoscopic lesion is higher in patients aged >40–50 years [22,24]. Reflecting evidence from the literature, indications for gastroscopy developed by the 1994 panel took age into account and similar indications were more often rated appropriate in patients aged 45 years and above.

Sex was also a determining factor for overuse: clinical indications were more frequently inappropriate in women than in men (42% versus 36%) and we also found a smaller proportion of significant lesions in women (48% versus 61%). In a study on dyspepsia, Williams found more normal endoscopies in women than in men (54% versus 42%). Adang, who examined the diagnostic yield of UGE mentioned that 58% of relevant diseases were found among men. A possible explanation is that the prevalence of functional abdominal troubles is higher among women who also seek health care for gastrointestinal disorders more often than men [25].

Swiss patients had lower rates of overuse than foreigners and this difference persisted in stratified analyses and logistic regression controlling for age (Swiss patients were generally older than foreigners). Foreign patients suffered more frequently from dyspepsia (64% versus 42% in patients who underwent UGE). As this symptom was frequently inappropriate, this explains, in part, the difference in overuse proportions, although limiting the regression model to dyspepsia still gave a higher rate of overuse for foreigners. Possible communication difficulties between patient and physicians may be responsible for this, in that in the absence of the ability to take a reliable case history, the physician may be more inclined to proceed directly to endoscopy. Furthermore, the higher prevalence of *Helicobacter pylori* infections in foreign people increases the probability of finding a gastro-intestinal lesion.

We also observed an overall decrease in overuse as the number of endoscopy per patient increased. Patients who underwent two or more endoscopies probably had severe or unclear disease or recurrent symptoms (recurrent haematemesis for example) that justified another endoscopy.

Underuse

Because of study design, underuse could be determined only in studies 1 and 2; there was no information on patients who did not undergo endoscopy in specialized practice and inpatient settings. In primary care settings, patients who were not referred for an endoscopy presented, in a vast majority, with dyspepsia (88%) and many of these cases were inappropriate indications for endoscopy (87%).

Underuse rate in primary care was more frequent in patients aged 55 years. This reflects, in part, the inclusion of age in appropriateness criteria (a similar indication can be inappropriate under 45 years and appropriate, or even necessary over 45 years because of the increased risk of detecting a serious pathology). In unadjusted and stratified analyses, underuse appeared higher in Swiss patients than in foreigners, but the logistic regression gave a non-significant result. Contrary to other studies [26,27], we did not find more underuse in foreign patients, who may be considered as underprivileged in the Swiss context. We did not find any difference in underuse rates between males and females, although variations in use of procedures in males and females have been mentioned in several studies [28–30].

Conclusion

What are the implications of this work for promoting optimal use of diagnostic UGE?

First of all, the identification of important determinants of appropriateness indicates inequalities in health care provision that need to be addressed, particularly in terms of differences in process of care according to age or sex. The development and the implementation of practice guidelines that would take these elements into account could help to reduce the inappropriate use of UGE and lead to more equity in provided health care.

In addition, our study illustrates that analyses of overuse and underuse of medical procedures cannot be divorced from the clinical settings, because of large differences in distribution of presenting symptoms. Examining comparable populations, that is patients presenting with abdominal complaints, we found similar rates of over- and underuse. Both should be addressed and reduced to improve quality of health care provided.

Acknowledgments

We thank C. Schneider, RN, for the data collection, and all physicians and clinical services that participated in this study.

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Accepted for publication 9 April 1999