

# Tolerance of Uncertainty and Fears of Making Mistakes Among Fifth-year Medical Students

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**BACKGROUND AND OBJECTIVES:** Tolerance of uncertainty is an important skill among general practitioners (GPs). Our aim was to study fifth-year medical students' feelings related to facing uncertainty and fears of making mistakes in medical decisions. Further, we studied the associations of intolerance of uncertainty with demographic factors, the students' fears of making mistakes, and their views of a GP's work prior to their ultimate course in general practice.

**METHODS:** A questionnaire-based survey was carried out among the fifth-year medical students prior to their main course in general practice at the University of Helsinki. The questionnaire included demographic variables and inquired about their views of their own tolerance of uncertainty, fear of making mistakes, and of a GP's work overall.

**RESULTS:** During the years 2008–2010, 307/359 medical students (mean age 25.7 years, 64% females) responded. Of the respondents, 22% felt they had difficulty tolerating uncertainty when making medical decisions. Females reported that they tolerated uncertainty poorly more often (27%) than did males (11%). Those tolerating uncertainty more poorly were more often afraid of making mistakes (100% versus 86%). This group more often considered a GP's work too difficult and challenging than did others.

**CONCLUSIONS:** Poor self-reported tolerance of uncertainty among medical students is associated with considering a GP's work too challenging.

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**B**ecause students experience feelings of uncertainty from the very beginning of their studies and everything is new for them, they will face patients and even suffering. They also begin developing their own identities as doctors very early in the curriculum.<sup>1</sup> As soon as they enter the clinical stages,

they begin to realize that they are the ones who need to make the decisions and shoulder the responsibilities.<sup>2</sup> The first clinical years are also a time when students become more fearful of making mistakes, when they realize the potential consequences of their mistakes. Sarikaya and colleagues found in their study

that fear of making mistakes was the most important source of anxiety among medical students, poised to begin their first clinical year.<sup>3</sup>

Tolerance of uncertainty is an important issue among new doctors, especially in general practice.<sup>4-11</sup> According to Donner-Banzhoff, the broad range of unselected patients a general practitioner (GP) meets leads to a particularly heavy burden of uncertainty.<sup>11</sup>

Some studies have shown that intolerance of uncertainty is related to avoidance of specialties such as family medicine, geriatrics, or psychiatry.<sup>10,12,13</sup> Lieu and colleagues suggested that groups entering internal medicine, family medicine, pediatrics, and psychiatry ("personal care specialties") were significantly older than groups entering technology-oriented specialties (eg, different forms of surgery).<sup>14</sup>

Some articles also report on varying characteristics associated with physicians' feelings of uncertainty. For example, female doctors, junior doctors, surgical physicians/surgeons, generalists, and physicians with lower workloads show greater anxiety due to uncertainty.<sup>15,22,23</sup> Uncertainty is associated with anxiety, stress,

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and feelings of dread,<sup>4,12,15,23-25</sup> as well as ignorance or denial.<sup>6,10,15,27,28</sup>

Medical students in Helsinki attend courses closely associated with general practice during the first year (observing family physicians' practice for 1 week), second year (early patient contact in community care and students interview during 1 week people from varying age groups from small children to elderly people; several of the interviewees have faced various hardships in life), and third or fourth year of the curriculum (students hold their first patient consultations in primary health care, 1 week at a health center when they may have an opportunity to interview and examine patients on their own, and then a GP examines the patients afterward to ensure that everything has been covered). In general, the medical students in Finland have an opportunity to see and examine real patients from the beginning of their studies. Because of their practical studies, they are able to work as locum residents after their fourth year of medical studies.

The main course (5 weeks) in general practice takes place during the fifth year of medical studies. During this last course, students participate in some introductory lectures and group discussions on various themes, including, among others, the chronically ill patient, the patient with upper extremity pains and aches and back problems, and certificates in medicine. The topics include, for example: "What is the diagnostic process like that a GP uses in everyday work?" "The special features of a geriatric patient from a doctor's point of view," and "Tolerating uncertainty in everyday work."

During this course, they perform a rotation for 2 weeks at different health centers (one to four students work at a specific health center) where they follow a program that includes at least the well-baby clinic and the maternity clinic. There they are allowed to examine some patients under the supervision of a GP. During 1 day they follow the

specialist nurses on their rounds in home care. They also familiarize themselves with physiotherapy, occupational therapy, and other possible departments at the health center. In addition, the students examine some patients on their own and then present their assessments to a GP teacher with complete plans for eventual changes in medication, laboratory test suggestions, etc.

In our previous study, we found that uncertainty is a major cause of mental stress among medical students.<sup>2</sup> In the study, two of the researchers from this group (KHP and MKN) examined several learning diaries written by medical students advancing from the third to fourth course of their medical studies. In the learning diaries, the students reflected on their experiences connected to their first patient encounters. Main themes related to facing uncertainty found in the students' diaries were insecurity of professional skills, one's own credibility, facing the inexactitude of medicine, fear of making mistakes, and coping with responsibility.<sup>2</sup> Therefore, we aimed to test further how these qualitative findings can be generalized in a larger sample of medical students.

The main reason we chose to conduct a pre-rotation survey was that we sought to obtain information about the students' experiences, wishes, and needs, and about what they found to be difficult or challenging. We were also curious to know what they felt they needed to learn more about before the rotation on their last course in general practice.

We also believe that it is important to direct the thoughts of fifth-year medical students toward general practice prior to their last course, as we are then better equipped with knowledge of their attitudes. Interest in family medicine as a career choice seems to have slowly waned among Finnish medical students over the last 10 years. Many Finnish health centers lack GPs or relatively few work at health centers, especially in North-Eastern Finland.

The aim of the present study was to investigate medical students' feelings about facing uncertainty in medical decision making and feelings about making mistakes when working as a locum resident. Further, we studied the associations of tolerance of uncertainty using demographic factors, the students' fears of making mistakes, and their views of a GP's work.

## Design and Methods

An electronic survey/questionnaire was distributed to fifth-year medical students prior to their main course in general practice at the medical school of the University of Helsinki. The fifth year is the penultimate year of medical school in Finland, as the medical curriculum in Finland consists of 6 years of study. Fifth-year medical students in yearly cohorts from 2008 to 2010 participated. The survey was carried out to encourage the students to think about various questions related to the work of a GP and to activate the students to ponder the course in advance. The students responded anonymously. The questionnaire was piloted among 10 students and was found relevant and easy to understand and respond to. Questions concerning uncertainty and fear of making mistakes were drawn from our previous study.<sup>2</sup> In this qualitative study, uncertainty and fear of making mistakes were major concerns among undergraduate medical students that tended to dissipate over the course of their studies. Thus, we sought to test in a larger student sample the prevalence of these concerns and feelings. The Planning Committee for Undergraduate Medical Education of the University of Helsinki approved our study.

Of the 359 medical students participating in the general practice course during the years 2008 to 2010, 311 responded to the questionnaire. Thus, the response rate was 86%. Variables in the survey included demographic factors and the students' experiences working as a locum resident. In Finland, medical

students may, after their fourth year of study, work at a hospital during the holidays as a locum resident.

The questionnaire inquired about their views on how they felt about and tolerated uncertainty when having to make medical decisions (Table 1). Of those who responded, 307 answered the question concerning tolerance of uncertainty.

We chose to offer three alternatives in that question because offered only two alternatives it would have been much more difficult for the Finnish participants to choose between well versus poor. This way it was easier to also capture those who thought that they tolerate uncertainty quite well but not “very well.” We decided to combine in the final analyses the two alternatives mentioned in the previous sentence

under the category “tolerating uncertainty quite well or well.”

Students were also asked about their fear of making mistakes (yes/no/I have not thought about it). In addition, the questionnaire included students' views of a GP's work. In addition, students were asked what they would do if they had made a mistake in their work as a doctor and were given the following options: (1) I would try to hide it (yes/no), (2) I would inform my supervisor (yes/no), (3) I would tell the patient and offer an explanation (yes/no), (4) I would tell the patient and apologize (yes/no), and (5) I would try to attribute the error to my work community (yes/no).

We offered the students a list of eight features of varying attractiveness that were connected to a GP's

work. The students were requested to rank them in order of preference, number one being the most attractive feature (Table 1). We also offered them a list of nine features of varying attractiveness connected to a GP's work and asked them again to rank them in order of preference, number one now being the most unattractive feature (Table 1). The questions were retrieved from previous literature, and we intended to include some dimensions based on WONCA tree competences.<sup>16-21</sup> In each option, we took into account the number of responses the students chose as their first, second, or third choices (ie, the choices they considered important).

In statistical analyses, the variables appear as means with standard deviations or as percentages.

**Table 1. Questions in the Students' Survey Related to Tolerance of Uncertainty and to Attitudes Toward a GP's Work**

1. How do you evaluate your tolerance of uncertainty when making medical decisions?

- a. I have difficulties in tolerating uncertainty in diagnostics and/or medical decision making.
- b. I tolerate uncertainty quite well in diagnostics and/or medical decision making.
- c. I tolerate uncertainty very well in diagnostics and/or medical decision making.

The groups b and c were combined in the final analyses (“Tolerating uncertainty quite well or well”) and compared with group 1 (“Tolerating uncertainty poorly”).

2. Which of the following would be for you the most attractive features in a GP's work that could make you choose to work in primary health care? (Choose and put in a ranking list the features from the most to the least attractive with numbers from 1 to 5)

- |   | Ranking order |
|---|---------------|
| A. Long-term doctor-patient relationships                                     | _____         |
| B. Versatile, challenging work  | _____         |
| C. Comprehensive doctor-patient relationships                                 | _____         |
| D. A window into ordinary people's everyday life                              | _____         |
| E. Opportunity to meet people of different age groups and various backgrounds | _____         |
| F. Rewarding work, grateful patients  | _____         |
| G. Well-paid job  | _____         |
| H. Secure and respected job   | _____         |

3. Which of the following would be for you the most unattractive features in a GP's work that make you rethink the possibility of working as a GP in the future? (Choose and put in a ranking list the features from the most to the least unattractive with numbers from 1 to 5)

- A. Long-term doctor-patient relationships with demanding patients
- B. Work too challenging and difficult
- C. Too much responsibility
- D. Work too routine and tedious
- E. Too much dealing with nonmedical problems
- F. Too hasty and pressing work
- G. Poorly paid job
- H. Work too lonely
- I. Difficult to advance in one's career

GP—general practitioner

Categorical variables are compared with the  $X^2$  test or Fisher's exact test, and non-normally distributed continuous variables are compared with the Mann Whitney U-test. *P* values <.05 are considered significant.

## Results

The mean age of the students (*n*=307) was 25.7 years (*SD*=3.2), 64% (*n*=196) were females, and the average experience working as a locum resident was 3.2 months (range 0 to 240 months). Of the students, 22% (*n*=67) responded that they tolerate uncertainty poorly when making medical decisions. The mean age of the group tolerating uncertainty quite well or well was significantly higher (mean age 25.8 versus 25.3, *P*=.020), and they had been working as a locum resident for a significantly longer period of time (mean 3.6 months versus 1.9 months, *P*=.030) (Table 2).

Those tolerating uncertainty poorly were significantly more often afraid of making mistakes than were those tolerating uncertainty well (100% versus 86%, *P*=.0011).

When the students were asked what they would do if they had made a mistake in their work as a

doctor, 84% (*n*=56) of those tolerating uncertainty poorly responded that they would tell their patients and apologize, whereas the corresponding figure among the students tolerating uncertainty well was 70% (*n*=168). The difference between the groups was significant (*P*=.027). A small number in both groups (3.0% and 2.1%, respectively (*P*=.66)) responded that they would try to conceal their mistake.

We further analyzed how students felt about a GP's work based on how they felt about uncertainty. There were no differences between the two groups in how they felt about the attractive features of a GP's work (Figure 1). The majority in both groups thought that the most attractive feature in a GP's work is its challenging nature and versatility (ranked it as the first, second, or third important attractive feature): 78% (*n*=188) of those tolerating uncertainty well versus 69% (*n*=46) of those tolerating uncertainty poorly. The difference between the groups was not significant (*P*=.085).

A significantly larger number of students tolerating uncertainty poorly considered a GP's work to be too difficult and challenging (ranked it as the first, second, or

third important unattractive feature) than of those tolerating uncertainty well (48% (*n*=32) versus 20% (*n*= 48), *P*<.001). A significantly larger number of the students tolerating uncertainty poorly also felt that a GP's work contains too much responsibility than of those tolerating uncertainty well (27% (*n*=18) versus 13% (*n*=30), *P*=.0042). However, a significantly smaller number of the students tolerating uncertainty poorly felt that a GP's work includes too much dealing with social problems than of those tolerating uncertainty well (40% (*n*=27) versus 57% (*n*=136), *P*=.018) (Figure 2).

Of all female students (*n*=197), 27% (*n*=54) tolerated uncertainty poorly, whereas the corresponding figure among males (*n*=109) was 11% (*n*=12); the difference between the males and females was highly significant (*P*<.001).

## Discussion

The present study shows that one in five fifth-year medical students experience difficulty tolerating uncertainty when making medical decisions. These students were more often younger females and were also more often afraid of making mistakes. Those who tolerate

**Table 2: Students' Characteristics Divided According to How They Feel About Tolerating Uncertainty When Making Medical Decisions**

Characteristic	Tolerating Uncertainty Quite Well or Well ( <i>n</i> =240)	Tolerating Uncertainty Poorly ( <i>n</i> =67)	<i>P</i> Value*
Females, %	59.6	81.8	<.001
Mean age (SD)	25.8 (3.1)	25.3 (3.4)	.020
Mean duration being as locum doctor, months (SD)	3.6 (15.5)	1.9 (1.8)	.030
Fear of making mistakes, %	85.8	100	.0011
"If I made a mistake in my doctor work" (%)			
"I would try to hide it."	2.1	3.0	.66
"I would inform my supervisor."	65.4	61.2	.52
"I would tell the patient and offer an explanation."	71.3	64.2	.27
"I would tell the patient and apologize."	70.0	83.6	.027
"I would try to attribute the error to my working community"	7.1	6.0	.75

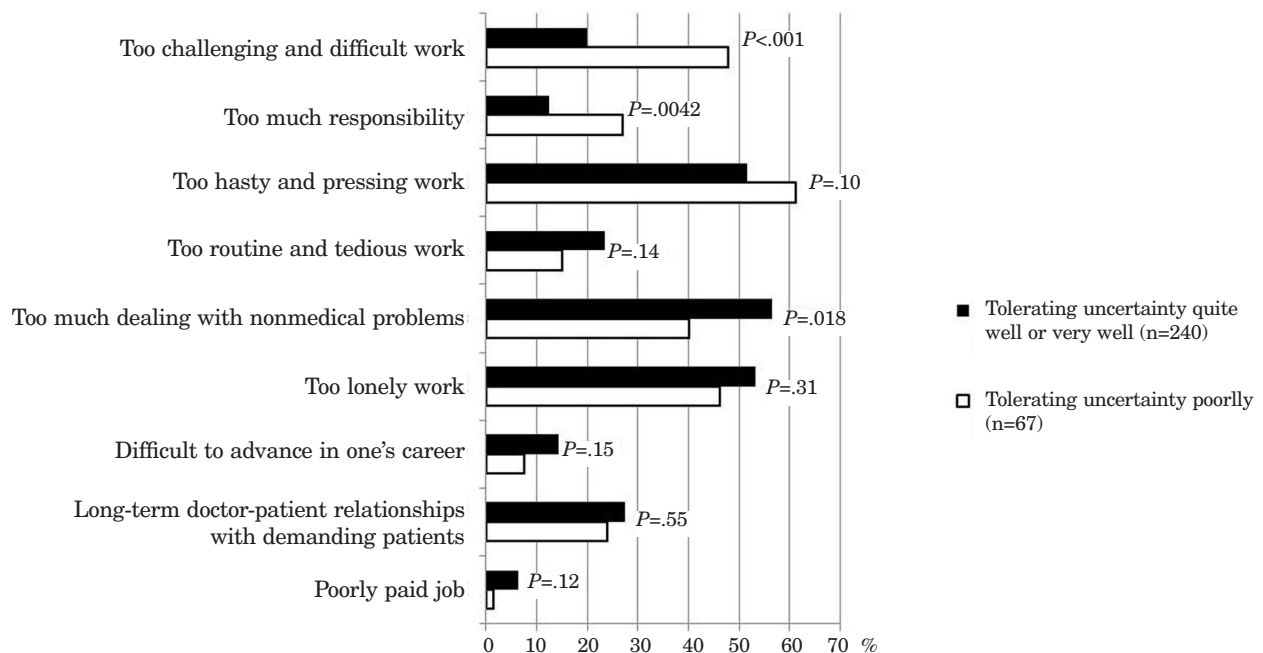
\* Differences between the groups were tested with  $X^2$  test or Fisher's exact test for categorical variables and with Mann-Whitney U-test for continuous variables.

**Figure 1: How Students Felt About the Most Attractive Features of a General Practitioner's Work**



The students were asked what features they considered the most attractive in a GP's work. The bars indicate the numbers of students who chose that feature as their first, second or third choice.

**Figure 2: How Students Felt About the Most Unattractive Features of a General Practitioner's Work**



The students were asked what features they considered the most unattractive in a GP's work. The bars indicate the numbers of students who chose that feature as their first, second or third choice.

uncertainty poorly more often considered a GP's work too difficult and challenging than did those tolerating it quite well or well. Their attitudes differed when asked how they would deal with a situation in which they had made a mistake in their work: those tolerating uncertainty poorly would more often admit it to their patients and apologize than would those tolerating uncertainty better.

The strengths of this study include its fairly large sample size of fifth-year medical students and its high response rate. The students seemed to respond honestly and openly share about their attitudes, feelings, and fears related to their work as a GP in the future. Students had spent 3 weeks in GP courses and practice in health centers during their previous medical studies. However, they had no previous experience of working as a locum resident at a health center even though they had been working for some time at a hospital as a locum resident. Therefore, consequently, their responses reflect their perceptions of a GP's work, which they have developed in their early patient contact in health centers, following GPs' consultations or developing their own consultation skills with real patients in primary care. This is a limitation of our study, and the findings are applicable only to fifth-year medical students. Another limitation of the study is that the responses are based on self-reported tolerance of uncertainty. It can be questioned whether these students can have enough insight of their own tolerance of uncertainty. However, the students did have experience in working as a locum resident. Therefore, they can reflect their feelings toward this past experience.

In our previous qualitative study,<sup>2</sup> we found that one's tolerance of uncertainty develops as a process during the course of medical studies. Thus, the findings of this study cannot be generalized to older doctors or residents, as the students beginning their fifth year of medical studies are

still relatively young; in fact, most are about 23 years old, and their abilities to reflect on their profession-related uncertainties are naturally still developing. Rather, these findings reveal a certain phase in the developmental process of medical students learning to face uncertainty.

Our findings are in line with those of previous studies, thus suggesting that female doctors and doctors with less work experience are more prone to feel intolerant of uncertainty.<sup>22-23</sup> Some prior studies suggest that intolerance of uncertainty is related to avoidance of working as a GP.<sup>10,12,13</sup> Our study suggests that the picture may be more complex. Students who tolerate uncertainty poorly possess several features that may attract them later on to work as a GP in the future. They may tolerate having to deal with patients' nonmedical problems better than the others. In addition, females tolerated uncertainty poorly more often than males. However, 75% of those specializing in general practice are females. Tolerance of uncertainty may be a feature that develops during the process when medical students grow into their role as a doctor. Fifth-year medical students are still in the middle of this process, which may last a very long time during a doctor's career.

Some researchers have suggested that training medical students and junior doctors to tolerate uncertainty would help them to find their way to primary care.<sup>4</sup> Whitehouse and colleagues reported that an integrated course that emphasized student self-direction diminished the students' fears, when beginning to work as they began working as pre-registration house officers.<sup>29</sup>

In their qualitative study, Fischer and colleagues also noticed that students are eager to learn from senior doctors who are open about their own medical errors.<sup>30</sup> In this study, nearly all of the students and residents were thinking about and afraid to make mistakes at work. In our study, 100% of those who felt

uncertain were afraid of making mistakes. They were more inclined to apologize to their patients than were those tolerating uncertainty better. This may reveal the students' reflective skills, as well as a more open attitude toward acknowledging their feelings.

Pilpel and colleagues have studied the barriers to the acceptance of medical errors, and they found that denying uncertainty is an important emotional barrier.<sup>31</sup> Hobgood and colleagues found in their study that residents in emergency medicine disclosed their errors to patients and families in only 28% of cases, even if they discussed them with their supervisors to a greater extent (in 71% of cases).<sup>32</sup> This result is interesting as it markedly differs from our results, even if the sample in their study was smaller, and our study describes the attitudes of slightly younger doctors entering their last clinical year of medical school.

Hall claims that most of the time people are seldom conscious of the presence of uncertainty or deny the fact openly,<sup>33</sup> potentially revealing a protective mechanism of the mind.<sup>28</sup> Martinez and colleagues showed that some students in their essays criticized senior doctors attempting to hide errors or avoid responsibility.<sup>34</sup> Those students who witnessed senior doctors take responsibility for their errors commented that such were the doctors to whose standards they aspired.<sup>34</sup> Muller and Ornstein found that female students were more prone to feelings of guilt, anger (at themselves), and fear of losing confidence, when they had committed a medical error.<sup>35</sup> Our findings showed when making medical decisions that females tolerated uncertainty more poorly and were more often afraid of making mistakes than were males. The reasons for this gender difference still remain unclear, however, and further research is needed. Further research is also needed to study the eventual changes in attitudes after medical students' last courses in

general practice. Training in how to handle medical errors earlier in the curriculum could also help students manage their fears and uncertainty in the future.

## Conclusions

Based on our study, those students experiencing feelings of uncertainty in medical decision-making may possess characteristics that are especially suitable to a GP's work, such as reflective skills, which help them to acknowledge their feelings, and an ability to be more open with their patients. However, a rather large number in our study were afraid of making mistakes. Therefore, tolerance of uncertainty and medical errors should be dealt with more profoundly in students' medical studies. More studies are needed to explore how tolerance of uncertainty develops during the course of medical studies and among junior doctors.

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## References

- Pitkala KH, Mantyranta T. Professional socialization revised: medical students' own conceptions related to adoption of the future physician's role—a qualitative study. *Med Teach* 2003;25(2):155-60.
- Nevalainen MK, Mantyranta T, Pitkala KH. Facing uncertainty as a medical student—a qualitative study of their reflective learning diaries and writings on specific themes during the first clinical year. *Patient Educ Couns* 2010;78(2):218-23.
- Sarikaya O, Civaner M, Kalaca S. The anxieties of medical students related to clinical training. *Int J Clin Pract* 2006;60(11):1414-8.
- Schrauth M, Weyrich P, Kraus B, Jünger J, Zipfel S, Nikendei C. Workplace learning for final-year medical students: a comprehensive analysis of student's expectancies and experiences. *Z Evid Fortbild Qual Gesundheitswes* 2009;103(3):169-74. German.
- West CP, Tan AD, Habermann TM, Sloan JA, Shanafelt TD. Association of resident fatigue and distress with perceived medical errors. *JAMA* 2009;302(12):1294-300.
- Biehn J. Managing uncertainty in family practice. *Can Med Assoc J* 1982;126(8):915-7.
- Hewson MG, Kindy PJ, Van Kirk J, Gennis VA, Day RP. Strategies for managing uncertainty and complexity. *J Gen Intern Med* 1996;11(8):481-5.
- Seaburn DB, Morse D, McDaniel SH, Beckman H, Silberman J, Epstein R. Physician responses to ambiguous patient symptoms. *J Gen Intern Med* 2005;20(6):525-30.
- DeForge BR, Sobal J. Intolerance of ambiguity among family practice residents. *Fam Med* 1991;23(6):466-8.
- van der Weijden T, van Bokhoven MA, Dinant GJ, van Hasselt CM, Grol R. Understanding laboratory testing in diagnostic uncertainty: a qualitative study in general practice. *Br J Gen Pract* 2002;52:974-80.
- Donner-Banzhoff N. Dealing with uncertainty in general medical practice. *Z Evid Fortbild Qual Gesundheitswes* 2008;102(1):13-8. German.
- Morgan M, Jenkins L, Ridsdale L. Patient pressure for referral for headache: a qualitative study of GPs' referral behaviour. *Br J Gen Pract* 2007;57:29-35.
- Merrill JM, Lorimor RJ, Thornby JI, Vallbona C. Reliance on high technology among senior medical students. *Am J Med Sci* 1998;315(1):35-9.
- Lieu TA, Schroeder SA, Altman DF. Specialty choices at one medical school: recent trends and analysis of predictive factors. *Acad Med* 1989;64(10):622-9.
- Ghosh AK. On the challenges using evidence-based information: the role of clinical uncertainty. *J Lab Clin Med* 2004;144(2):60-4.
- Van Ham I, Verhoeven AA, Groenier KH, Groothoff JW, De Haan J. Job satisfaction among general practitioners: a systematic literature review. *Eur J Gen Pract* 2006;12:174-80.
- Manca DP, Varnhagen S, Brett-MacLean PG, et al. Rewards and challenges of family practice: Web-based survey using the Delphi method. *Can Fam Physician* 2007;53:277-86.
- Jordan J, Brown JB, Russell G. Choosing family medicine. What influences medical students? *Can Fam Physician* 2003;49:1131-7.
- Wright B, Scott I, Woloschuk W, Brenneis F, Bradley J. Career choice of new medical students at three Canadian universities: family medicine versus specialty medicine. *CMAJ* 2004;170:1920-4.
- Petchey R, Williams J, Baker M. "Ending up a GP": a qualitative study of junior doctors' perceptions of general practice as a career. *Fam Pract* 1997;14:194-8.
- Grüniger U. The Wonca tree. *Prim Care* 2009;9:15. www.kollegium.ch (then choose the topic FOTOALBUM).
- Merrill JM, Camacho Z, Laux LF, Lorimor R, Thornby JI, Vallbona C. Uncertainties and ambiguities: measuring how medical students cope. *Med Educ* 1994;28:316-22.
- Gerrity MS, DeVellis RF, Earp JA. Physicians' reactions to uncertainty in patient care. A new measure and new insights. *Med Care* 1990;28(8):724-36.
- Kvale J, Berg L, Groff JY, Lange G. Factors associated with residents' attitudes toward dying patients. *Fam Med* 1999;31(10):691-6.
- Bovier PA, Perneger TV. Stress from uncertainty from graduation to retirement—a population-based study of Swiss physicians. *J Gen Intern Med* 2007;22(5):632-8.
- Ghosh AK. Dealing with medical uncertainty: a physician's perspective. *Minn Med* 2004;87:48-51.
- Epstein RM, Hundert EM. Defining and assessing professional competence. *JAMA* 2002;287:226-35.
- Johnson CG, Levenkron JC, Suchman A, Manchester R. Does physician uncertainty affect patient satisfaction? *J Gen Intern Med* 1988;3:144-9.
- Whitehouse CR, O'Neill P, Dornan T. Building confidence for work as house officers: student experience in the final year of a new problem-based curriculum. *Med Educ* 2002;36:718-27.
- Fischer MA, Mazor KM, Baril J, Alper E, DeMarco D, Pugnnaire M. Learning from mistakes. Factors that influence how students and residents learn from medical errors. *J Gen Intern Med* 2006;21(5):419-23.
- Pilpel D, Schor R, Benbassat J. Barriers to acceptance of medical error: the case for a teaching program. *Med Educ* 1998;32(1):3-7.
- Hobgood C, Hevia A, Tamayo-Sarver JH, Weiner B, Riviello R. The influence of the causes and contexts of medical errors on emergency medicine residents' responses to their errors: an exploration. *Acad Med* 2005;80(8):758-64.
- Hall KH. Reviewing intuitive decision-making and uncertainty: the implications for medical education. *Med Educ* 2002;36(3):216-24.
- Martinez W, Lo B. Medical students' experiences with medical errors: an analysis of medical students' essays. *Med Educ* 2008;42(7):733-41.
- Muller D, Ornstein K. Perceptions of and attitudes towards medical errors among medical trainees. *Med Educ* 2007;41(7):645-52.