

SHORT  
COMMUNICATIONPerception of risk of adverse drug reactions:  
a 3-year follow-up of a cohort of medical  
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accepted 7 September 2009\*Correspondence and reprints:  
durrieu@cict.fr**ABSTRACT**

Previous studies have pointed out the question of effective training and information to health professionals on pharmacovigilance. The lack of training is known to induce inadequate use of drugs and noncompliance of patients. Pharmacology teaching is performed in the third year of medical studies at the Toulouse Faculty of Medicine. The aim of the study was to investigate the perception of risk of adverse drug reactions (ADRs) by medical students at the end of the one year pharmacology course and two years later, after clinical training period. Sixty-seven students were interviewed in May 2005 and in October 2007. Visual analogue scales were used to define a score of perceived risk of ADRs associated with each drug class (ranking from 0 to 10) before and after pharmacology training. The drug classes evaluated were antibiotics, anticoagulants, antidepressants, aspirin, contraceptive pill, corticosteroids, drugs for arterial hypertension, drugs for diabetes (other than insulin), hypnotics, hypocholesterolaemic drugs, nonsteroidal anti-inflammatory drugs (NSAIDs), postmenopausal hormone replacement therapy and tranquilisers. After pharmacology courses (May 2005), antidepressants were ranked as the most dangerous drugs by medical students [median score (25th–75th centiles): 7.7 (6.3–8.6)], followed by anticoagulants [7.6 (6.6–8.4)] and hypnotics [7.4 (6.1–8.1)]. Contraceptive pills was listed in the last position [median score [4.7 (2.2–6.7)]. Two years later (October 2007), anticoagulants moved into the first position [8.3 (7.3–9.2)], followed by NSAIDs [6.9 (5.0–8.4)] and aspirin [6.8 (5.8–8.4)]. Contraceptive pills remained in the last position. No change was observed for NSAIDs and aspirin, still ranked as dangerous drugs by medical students after clinical training. Values of perceived risk were significantly increased for anticoagulant (+9.2%,  $P < 0.01$ ) and hypoglycemic drugs (+27.7%,  $P < 0.0001$ ). The perceived risk significantly decreased for hypocholesterolaemic (–14.3%,  $P < 0.0001$ ) and antidepressant drugs (–19.5%,  $P < 0.0001$ ), but not for hypnotics. The study shows that the perception of risk of ADRs by medical students was modified after clinical training. They were still aware of potentially serious ADRs associated with anticoagulants, aspirin or NSAIDs, but they remained less cautious for drugs such as antidepressants. Additional pharmacology training at the end of medical studies will be useful.

## INTRODUCTION

Adverse drug reactions (ADRs) are an important cause of hospital admission. ADRs may complicate up to more than 30% of hospital stays and result in prolonged hospitalization, extra cost and significantly increased risk of death [1–3]. Appreciate drug risk is complex. For most drugs, benefits are limited to few indications and, for a given patient, there is usually only a single benefit sought but the potential risks of a drug are multiple [4]. Perceptions of risk in drug therapy are also influenced to great extent by 'irrational' factors. Our group found that health and non-health professionals do not have the same perceptions about the risk of ADRs [5]. We also showed that the medical specialization could affect the perception of risk. Compared to gastroenterologists and general practitioners, rheumatologists minimized risk of gastrointestinal ADRs of nonsteroidal anti-inflammatory drugs (NSAIDs) [6]. It was also reported that the year of doctor's graduation, the place of work or their awareness of ADRs could influence the perception of the risk of ADRs [7]. In a recent study, we evaluated the perceived risk of ADR in young medical students who never studied pharmacology before and we investigated the impact of university pharmacology courses on their perception of risk [8]. This cohort of students was followed during their clinical training. The aim of the present study was to investigate the change in the perception of risk of ADRs by these medical students after a two-year period of clinical training in a university hospital.

## METHODS

A cohort of sixty-seven students from Toulouse Medical School (South Western, France) was interviewed in October 2007 after a 2-year period of clinical training in various specialties departments of a Toulouse university hospital. In a previous study [8], these students already performed two questionnaires: the first at the beginning of their third year (October 2004) when they never studied Pharmacology before, the second after taking the course (May 2005) in pharmacological training. As previously described [8], a visual analogue scale was used to define a score of perceived risk of ADRs associated with each drug class. The drug classes evaluated were antibiotics, anticoagulants, antidepressants, aspirin, contraceptive pills, corticosteroids, drugs for arterial hypertension, drugs for diabetes (other than insulin), hypnotics, hypocholesterolaemic drugs,

NSAIDs, postmenopausal hormone replacement therapy drugs and tranquillizers. For each drug class, the perceived risk of ADRs was assessed by measuring the distance between the left extremity of the scale (equal to zero) and the mark made by the student. Since each scale measured 10 cm, the perceived risk of ADRs could be considered as a quantitative score ranging from 0 to 10. Finally, when the different drug classes were taken as a whole, a total score (i.e. the mean value of the different individual values) was calculated. For the different drug classes, results are shown as median values (25th–75th centiles). In this follow-up, post-hospital training scores were compared to post-pharmacology courses scores (obtained in May 2005) using a signed ranked Wilcoxon test.

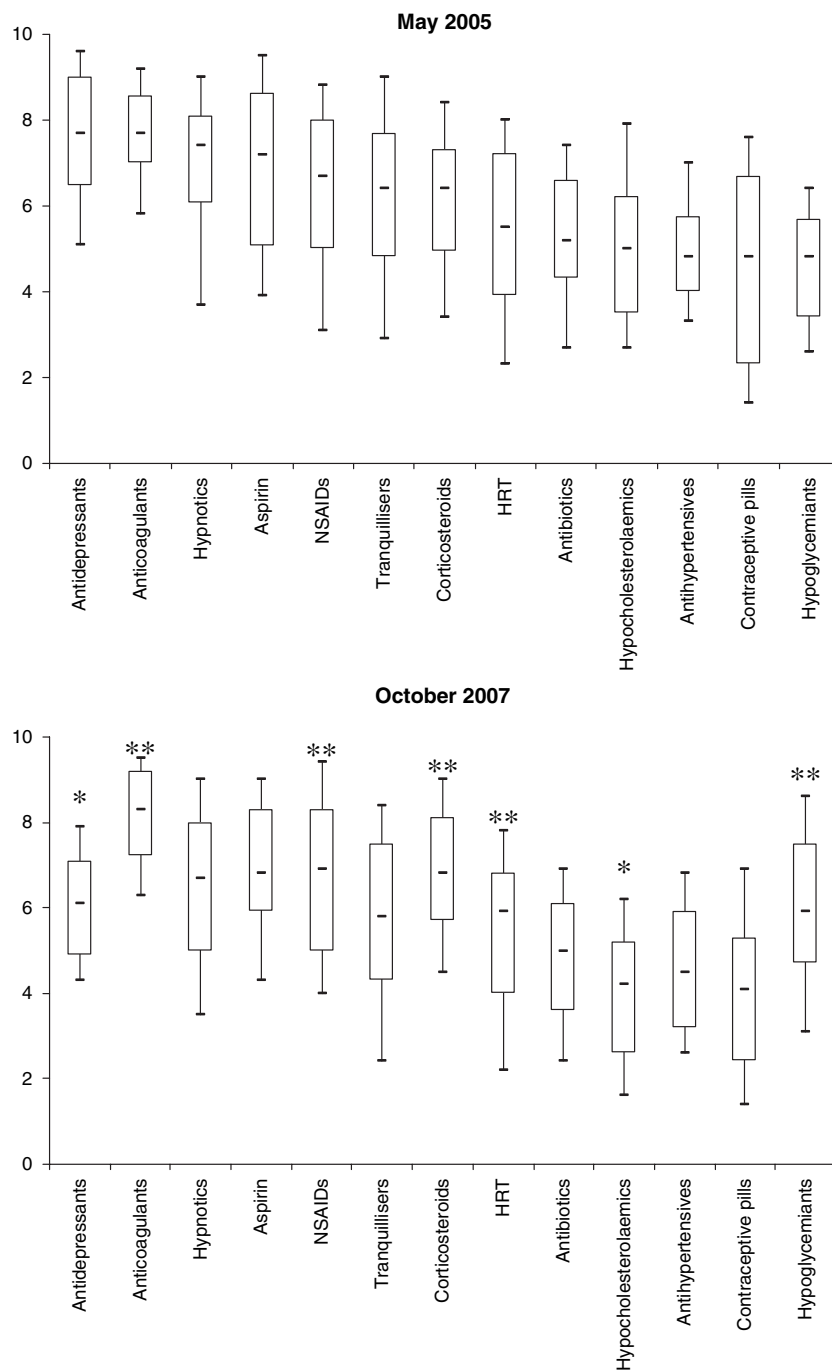
## RESULTS

When all different drug classes were taken as a whole, no difference in median values (mean  $\pm$  SD) of the perceived risk was found between the end of the university pharmacological courses [8] and 2 years later after clinical training ( $5.8 \pm 1.5$  vs.  $5.6 \pm 1.0$ ).

Table 1 lists the drugs ranked according to the median value of perceived risk of ADRs on the visual analogue scales. Figure 1 shows median scores (25th–75th centiles) of perceived risk of ADRs by the medical students after pharmacological courses and after a 2-year period of clinical training. After pharmacology courses (May 2005), antidepressants were ranked as the most dangerous drugs by medical students [median score (25th–75th centiles): 7.7 (6.3–8.6)], followed by

**Table 1** 'Hit-parade' of drugs according to the perceived risk of adverse drug reactions.

Rank	After Pharmacology courses	After clinical hospital training
1	Antidepressants	Anticoagulants
2	Anticoagulants	NSAIDs
3	Hypnotics	Aspirin
4	Aspirin	Hypnotics Corticosteroids
5	NSAIDs	Antidepressants
6	Tranquillisers Corticosteroids	Hypoglycemiants
7	Postmenopausal hormone replacement	Postmenopausal hormone replacement
8	Antibiotics	Tranquillisers
9	Hypocholesterolaemic drugs	Antibiotics
10	Antihypertensive drugs	Antihypertensive drugs
11	Contraceptive pills Hypoglycemiants	Hypocholesterolaemic drugs
12		Contraceptive pills



**Figure 1** Median scores of perceived risk of adverse drug reactions (ADRs) on visual analogue in the medical students: after pharmacological courses (May 2005) and after a 2-year period of clinical training (October 2007). \*\*Significant increase ( $P < 0.05$ ), \*significant decrease ( $P < 0.05$ ). HRT, hormone replacement therapy; NSAIDs, nonsteroidal anti-inflammatory drugs.

anticoagulants [7.6 (6.6–8.4)] and hypnotics [7.4 (6.1–8.1)]. Contraceptive pills were listed in the last position [median score [4.7 (2.2–6.7)]. Two years later (October 2007), anticoagulants moved into the first position [8.3 (7.3–9.2)], followed by NSAIDs [6.9 (5.0–8.4)] and aspirin [6.8 (5.8–8.4)]. Contraceptive pills remained in the last position. Values of perceived risk were signifi-

cantly increased for hypoglycemiants (+27.7%,  $P < 0.0001$ ), anticoagulants (+9.2%,  $P < 0.01$ ), postmenopausal hormone replacement (+7.3%,  $P < 0.05$ ) and corticosteroids (+4.7%,  $P < 0.05$ ). The perceived risk significantly decreased for antidepressant (–19.5%,  $P < 0.0001$ ) and hypocholesterolaemic drugs (–14.3%,  $P < 0.0001$ ). No change was observed for hypnotics,

tranquilizers, antihypertensive drugs, antibiotics, contraceptive pills, NSAIDs and aspirin. Nevertheless, these two last drugs still ranked as dangerous drugs by medical students after clinical training.

## DISCUSSION

This study was performed in order to investigate putative effects of clinical training in a university hospital on perceived risk of ADRs among a cohort of medical students questioned two years earlier, just after pharmacology courses [8]. Our aim was not to assess a definite level of perception of risk for the different drug classes but to assess perceived risks in different conditions and to determine possible factors that could affect this perception.

After a 2-year period of clinical training, no change in global perception of risk of ADRs was observed ( $5.8 \pm 1.5$  vs.  $5.6 \pm 1.0$ ). When the different classes were taken as a whole, medical students appeared to be still aware of potentially serious ADRs associated with drugs after clinical training. This score ranked between pharmacist and pharmacovigilance professional scores [5]. As previously reported [8], university pharmacological training dramatically increased this score (global median score: 4.8 at the beginning of the survey vs. 5.8 after the pharmacology training).

In contrast, when the different classes of drug were considered, differences in perceived risk were found. The 'hit-parade' established by medical students after the end of the pharmacological course included at the first position antidepressants followed by anticoagulant and hypnotic drugs. After their clinical training, they ranked anticoagulants, NSAIDs and aspirin as the most dangerous. Similar results were found in pharmacovigilance professionals or in medical staff [5,10]. The risk associated with NSAIDs and aspirin is commonly underestimated, specially by non-health professionals, although these drugs were found to be the pharmacological class most frequently involved in hospital admissions due to an adverse effect drug reaction [2]. These drugs are widely used without perceiving the danger since they can be easily obtained (over the counter for ibuprofen and aspirin). Drugs most commonly implicated in causing these admissions included low dose aspirin, diuretics, warfarin, and non-steroidal anti-inflammatory drugs other than aspirin, the most common reaction being gastrointestinal bleeding [1].

A significant increase in perceived risk for anticoagulants was also described in our cohort of medical

students after clinical training. A similar increase was observed after pharmacology courses. This increased perception may be explained by daily practice in hospital. This result is in accordance with a recent study reporting that oral anticoagulants were the drug the most frequently involved in hospital admission due to an ADR [3]. Other important factors, like information from various origins, have to be considered to explain the difference in the perception of risk. For example, the increase in perceived risk of hypoglycemic drugs are can also be explained by information published by Health Authorities and media about the cardiovascular risks related to glitazons [9] while the study was being conducted.

Conversely, the perception of risk can also decrease. Medical students appeared to be less cautious for antidepressants and hypocholesterolaemic drugs. This decrease is not always evidence based and can induce prescriptions at risk. Previous studies have pointed out the question of continuing training and information of health professionals on ADRs. The lack of training is known to induce inadequate use of drugs [5,6,10].

The present study suggests that perceived risk can be quickly affected in a positive or negative manner. The impact of persuasive methods of pharmaceutical firms can be presumed if doctors rely too much on the promotional information.

In conclusion, the study shows that the perception of risk of ADRs by medical students was modified after clinical training. They were still aware of potentially serious ADRs associated with anticoagulants, aspirin or NSAIDs, but they remained less cautious for drugs such as antidepressant or hypocholesterolaemic drugs. Reinforcing pharmacology training at the end of medical studies and after graduation might be useful.

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