Students and Doctors are Unaware of the Cost of Drugs they Frequently Prescribe

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Abstract: Given the increasing healthcare costs of an ageing population, there is growing interest in rational prescribing, which takes costs of medication into account. We aimed to gain insight into the attitude to and knowledge of medication costs of medical students and doctors in daily practice. This was a cross-sectional electronic survey among medical students (bachelor/master) and doctors (consultants/registrars). Attitude to costs was evaluated using a cost-consciousness scale. In open questions, the participants estimated the cost of commonly prescribed (generic/non-generic) drugs (including separate pharmacy dispensing costs). They were asked where they could find information about drug costs. Overall, a reasonable cost-consciousness was found. Students were less conscious of the cost than were doctors (15.56 SD 3.25 versus 17.81 SD 2.25; scale 0–24; p = 0.001). In contrast to this consciousness, actual estimated drug costs were within a 25% margin for only 5.4% of generic and 13.7% of proprietary drugs (Wilcoxon signed-rank, p < 0.001). The price of generic drugs was frequently overestimated (77.5%) and that of proprietary drugs was underestimated (51.4%). The dispensing costs were estimated correctly for 30% of the drugs. Most doctors (84%) and a minority of students (40%) were able to identify at least one source of information about drug costs. While doctors and students considered it important to be aware of the cost of drugs, this attitude is not reflected in their ability to estimate the cost of frequently prescribed drugs. Cost awareness is important in therapeutic reasoning and cost-effective prescribing. Both should be better addressed in (undergraduate) pharmacotherapy education.

Approximately €200 billion is spent on medicines and drugs annually, about 16–17% of the total healthcare expenditure in the EU [1]. These costs must be controlled to keep health care affordable, especially in today’s ageing society with its increased care consumption [2]. Besides the importance of pharmacoeconomics to society in general, it is becoming increasingly important for hospitals, doctors and individual patients. Depending on the country and type of medical insurance, patients have to pay certain costs (i.e. deductible excess in the Netherlands) [3], and doctors and hospitals are under pressure from health insurance companies and governmental institutions to take medication costs into consideration, for instance, by prescribing generic rather than proprietary drugs [4]. The drive to contain costs is focused not only on therapeutics, but also on reducing, often unnecessary, diagnostics. In this diagnostic field, studies have shown that doctors who are aware of test costs order fewer tests [5,6].

Rational prescribing includes comparing the efficacy, safety, suitability and cost of treatment options, according to the WHO guide to good prescribing [7]. The WHO guide to good prescribing and the associated six-step guideline are internationally used to teach pharmacotherapy to future prescribers [8]. Currently, pharmacotherapy teaching and training in prescribing focus on drug safety and suitability, to prevent prescribing errors [9], but given the need to contain healthcare costs, medication costs should also be taken into account in therapeutic decision-making, but not at the expense of efficacy, safety or suitability. Earlier research showed that practising doctors estimated 31% of drug costs within a 20–25% range of the true costs [10]. Doctors indicated that the inaccessibility of information about drug costs was a major factor contributing to this inability to estimate costs [10]. In the Netherlands, information about the cost of medical drugs (individual drugs and pharmacy dispensing costs) is available via the national formulary and directly on a website and app [11,12]. Although medical schools are paying more attention to rational prescribing and efforts are being made to improve the accessibility of information on drug costs, it is not known how cost-conscious medical students are compared with registrars and consultants. Therefore, the primary aim of this study was to gain insight into the attitudes towards (medication) costs of students and doctors. A secondary aim was to assess their awareness of medication costs (estimations of costs) and knowledge of where they would find information about the cost of drugs.

Methods

Setting. To explore attitudes and knowledge about cost-conscious prescribing, an anonymous cross-sectional electronic survey was held among medical students and doctors of the VU University Medical Center, a secondary and tertiary care facility in Amsterdam, the Netherlands. The STROBE (STrengthening the Reporting of OBservational studies in Epidemiology) guidelines were followed where possible [13].

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Population. Medical students (bachelor and master, years 1–5), doctors [registrars (n = 65) and consultants (n = 30)] from various subdisciplines of the Department of Internal Medicine of VUmc were invited by e-mail to participate in this anonymous e-survey.

Instrument. Survey questions were organized in three sections: attitude to costs, cost awareness/cost estimations and prescribing habits regarding drug costs in daily practice. Attitude to costs was measured with a validated cost-consciousness scale that probed attitudes towards cost in general, and more specifically on medication and diagnostics (table 1) [14,15]. Two items investigate doctors’ opinions about healthcare costs in general, and three items investigate their attitudes regarding the costs of tests and procedures (the last item probes the importance of out-of-pocket payments). All statements were answered on a five-point Likert scale, scored 0–4. The maximum attainable score was 24. Four negatively formulated items were reverse scored, so a higher score would mean greater cost awareness.

Cost awareness was measured with 25 open questions on drug costs (of which three questions were about pharmacy dispensing costs), a method that has been used in previous studies [10]. Participants were asked to estimate the annual cost, excluding dispensing costs, of 22 drugs prescribed in the Internal Medicine outpatient clinic the most often in the year preceding the study. Open questions were used to investigate insight into the cost of drugs prescribed in daily practice. For instance, participants were asked how often they checked drug costs, how sure they were about their accuracy and whether they could name sources where they could obtain information about drug costs. The face validity of the questionnaire was assessed by means of a pretest with four doctors; their feedback was used to adjust the questionnaire, where necessary.

Analysis. All data were collected through Survey Monkey® and imported into SPSS version 20.0. Cost-consciousness scores were analysed with one-way ANOVA (when appropriate). Differences in imported into SPSS version 20.0. Cost-consciousness scores were additional open questions were recoded and classified into main and ordered, categorical variables) and Spearman distributed data. Correlations between overall correctness scores and four participant groups using the Jonckheere Wallis tests for non-normally distributed data. Correlations between overall correctness scores and habits in daily practice were analysed using the Jonckheere–Terpstra test (ordered, categorical variables) and Spearman’s correlation (continuous variables) both for non-normally distributed data. For all statistical tests, a p-value <0.05 was considered statistically significant. The answers to additional open questions were recoded and classified into main and subcategories, based on the Grounded Theory from Glaser and Strauss [16]. Two review authors independently derived main and subcategories, and scored answers. Discrepancies in scores for subcategories and total numbers were resolved by a third review author.

Ethical considerations. The Institutional Review Board of the VU University Medical Center reviewed the research protocol (ID 2014/157). This study did not fall under the scope of the Dutch Medical Research Involving Human Subjects Act (WMO). All participants were informed in advance and provided informed consent based on provided information. Participation was voluntary and anonymous. Participants did not receive credit or other (financial) incentives to participate.

Results
A total of 232 participants responded to the survey – 117 bachelor students, 86 master students, 19 registrars and 10 consultants. Registrars had graduated 5 (SD 2.2) years earlier, and consultants had graduated 16.5 (SD 9.1) years earlier.

Cost consciousness. The cost-consciousness score was computed for participants who completed all the statements (n = 199). High scores reflected high cost consciousness. The cost-consciousness score of students was significantly lower (mean 15.6, SD 3.2) than that of doctors (17.8, SD 2.3; scaled 0–24; p = 0.001 one-way ANOVA) (table 1). Cost consciousness was not significantly different within the student (bachelor/master) and doctor (registrar/consultant) groups.

Cost estimations. Cost awareness was assessed by asking participants to estimate drug and pharmacy dispensing costs. These annual drug cost estimations were considered correct if they were within 25% of the real cost. Thus, an estimation of amlodipine (tablet, 5 mg, once daily) was considered correct if the estimated cost was between 75% and 125% of the actual €5.83/365 days. Overall, 15.56 (3.25)**

17.81 (2.25)**

*Negatively reverse scored; **Statistical significant difference (p = 0.001) between students and physicians.

Table 1.
Cost-consciousness of students and doctors on cost-consciousness scale (with separate scores on the 6 items).

|                      | Students                  | Physicians             |
|----------------------|---------------------------|------------------------|
|                      | Bachelor student          | Master student         | Registrar   | Consultant |
|                      | (n = 95)                  | (n = 77)               | (n = 18)    | (n = 9)    |
| 1. Trying to contain costs is the responsibility of every doctor | 2.86 (0.75)               | 3.04 (0.79)            | 3.22 (0.43) | 3.22 (0.44) |
| 2. There is currently too much emphasis on the costs of tests and procedures* | 1.99 (0.83)               | 2.27 (0.85)            | 2.78 (0.94) | 2.67 (0.71) |
| 3. Doctors need to take a more prominent role in limiting the use of unnecessary tests | 3.05 (0.64)               | 2.92 (0.72)            | 3.11 (0.58) | 3.11 (0.60) |
| 4. Doctors are too busy to worry about the costs of tests and procedures* | 2.20 (0.88)               | 2.25 (0.89)            | 2.61 (0.92) | 2.33 (1.12) |
| 5. The cost of a test or medication is only important if the patient has to pay for it out-of-pocket* | 3.09 (0.99)               | 3.13 (0.94)            | 3.39 (0.50) | 3.67 (0.50) |
| 6. It is unfair to ask doctors to be cost conscious and still keep the welfare of their patients foremost in their minds* | 2.12 (1.04)               | 2.25 (0.99)            | 2.78 (0.55) | 2.67 (0.87) |

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few participants correctly estimated drug costs, and in general participants were significantly worse at estimating the cost of generic drugs (overall mean 5.4%) than the cost of proprietary drugs (13.7%; Wilcoxon signed-rank test, \( p < 0.001 \)). Participants were better in correctly estimating dispensing costs (30%; Wilcoxon signed-rank test, \( p < 0.001 \) compared with the estimated cost of generic drugs and \( p < 0.001 \) compared with the estimated cost of proprietary drugs, respectively) (fig. 1). The subgroups differed in overall accuracy (Kruskal–Wallis \( p = 0.025 \)) and seemed to differ especially in the estimates of proprietary drugs and dispensing costs, but neither were statistically significant (Kruskal–Wallis \( p = 0.057 \), and \( p = 0.179 \), respectively). The estimated cost of the separate items is displayed in Supplemental digital content 1.

Given the limited number of correct estimations within the 25% range, we analysed the estimated cost of generic and proprietary drugs further. The price of generic drugs was frequently overestimated (77.5%) and that of proprietary drugs was overestimated (34.9%). The cost of 51.4% of the proprietary drugs frequently overestimated (77.5%) and that of proprietary drugs, was underestimated (fig. 2). To investigate this tendency to overestimate the cost of generic drugs compared with proprietary drugs, we compared the estimated cost of proprietary and generic formulations of metoprolol and pantoprazole. The difference between the generic and proprietary formulations of the two drugs was estimated to be higher (mean 129.1%) than it actually was (absolute overestimation of €134.52 and €147.93, respectively).

**Current practice.**

When asked how often the participants knew the actual cost of medicines, bachelor students indicated that they sometimes knew the cost, whereas most consultants indicated that they often knew the cost. Participants with higher self-perceived cost awareness were marginally better at estimating drug costs (14.7% items correct) than participants who sometimes (10.6%) or never (8.8%) knew drug costs; however, this difference was not statistically significant (Jonckheere–Terpstra test \( p = 0.147 \)). Most doctors (84%) were able to identify at least one source of information about medication costs, compared with only 40% of students (chi-square test \( p < 0.001 \)). Almost all participants (97.4%) who knew a source mentioned either the specific website ‘medicijnkosten.nl’ [12] or the national drug formulary that has a link to the first site. Furthermore, the specific app ‘App receptprijs’ [11] was mentioned by 9.1% of participants. When asked how often (in a month) they checked these costs, 72.2% indicated that they did not. The consultants checked cost information a mean 1.6 (SD 1.4) times a month; the other participants checked this information less than once a month (table 2). The participants who checked cost information more often were not more accurate in estimating drug costs (Spearman’s correlation 0.100, \( p = 0.376 \)).

**Discussion**

Doctors and students consider cost awareness important, but this attitude is not reflected in their ability to correctly estimate the cost of frequently prescribed drugs. They tended to underestimate the cost of proprietary drugs and to overestimate the cost of generic drugs. Although the doctors knew where they could find information regarding drug costs, they checked these costs less than twice a month.

Rational prescribing includes comparing the efficacy, safety, suitability and cost of different treatment/drug options, according to the WHO guide to good prescribing [7]. This rational prescribing, and taking into account medication costs, is attracting more attention given the rise in available expensive drugs and the increasing care consumption [2]. For (future) prescribers, cost awareness and cost conscious is relevant given that doctors who are aware of costs appear to order fewer diagnostic tests [5,6] and prescribe less expensive drugs [17].

In the cost-consciousness survey, participants agreed they had the responsibility to contain costs and considered it a duty to be cost conscious while keeping the welfare of their patients. When asked how often the participants knew the actual cost of medicines, bachelor students indicated that they sometimes knew the cost, whereas most consultants indicated that they often knew the cost. Participants with higher self-perceived cost awareness were marginally better at estimating drug costs (14.7% items correct) than participants who sometimes (10.6%) or never (8.8%) knew drug costs; however, this difference was not statistically significant (Jonckheere–Terpstra test \( p = 0.147 \)).

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![Figure 1. Distribution of correct, overestimation and underestimation of the costs of generic drugs (n = 15 items) proprietary drugs (n = 7 items) and pharmacy dispensing (n = 3 items). Statistically significant differences are indicated with an asterisk (*).](image-url)

![Figure 2. Differences in the proportion of correct estimates of the cost in total, of generic drugs (n = 15 items), proprietary drugs (n = 7 items) and pharmacy dispensing (n = 3 items) made by bachelor/master students, registrars and consultants. Statistically significant differences are indicated with an asterisk (*), Kruskal–Wallis test), non-significant differences are indicated with n.s.; the plus sign after the number of participants indicates this number differs; not all participants did estimate all costs, see supplemental digital content.](image-url)
patients foremost in their minds. Cost consciousness has not been evaluated previously among medical students, and although the importance of cost consciousness among doctors has been reported earlier, it has only been measured twice with a validated instrument [14,15]. With this validated cost-consciousness scale, we found that doctors had a mean score of 17.8 (SD 2.3), which was slightly higher than that reported in previous studies from Switzerland (Geneva; 16.8, SD 3.6) [14] and the USA (Ann Arbor, Michigan; 17.2, SD 3.1) [15]. The students had lower scores (15.6, SD 3.2) than the doctors in the current and two earlier studies [14,15]. Although cost consciousness is considered important, previous studies did not find an association between the acknowledged importance of costs and awareness of actual costs [18,19].

Neither students nor doctors estimated the costs of commonly used drugs correctly; their overall estimations of costs improved with increasing level of medical training/experience. However, this difference was statistically insignificant for the separate estimations of proprietary drugs, generic drugs and dispensing costs. We found only one study, from 1986, that compared students and doctors in the different stages of their careers [20] and which reported correct estimations as being 40% for medical students, 52% for paediatric residents and 62% for paediatricians. The percentage of correct estimations was much higher than that reported in a large systematic review of cost estimations among practising doctors, in which 31% of estimated drug costs were within a 20–25% range of the true costs [10]. The proportion of doctors and students who correctly estimated drug costs in our study was lower. Analysis revealed a trend in how the costs deviated from true costs, with the cost of proprietary drugs being underestimated and the cost of generic drugs being overestimated. This was comparable with the results of earlier studies that also reported underestimation of high- and overestimation of low-cost drugs [10].

Students and doctors were not only able to correctly estimate drug costs, but doctors considered themselves competent in estimating drug costs. This false sense of correctness has important consequences for clinical and educational practice.

In clinical practice, taking drug costs into account is part of the therapeutic reasoning paradigm [7] and has been described as the result of a non-conscious reasoning process of pattern recognition that takes place rapidly and at an automatic level in experts [21,22]. While prescribing, an expert would thus automatically take the incorrect drug price into consideration. Even the incorporation of drug costs into a digital prescribing system has not been found to improve cost-conscious prescribing [23,24].

In educational practice, as none of the participant groups accurately estimated drug costs, it is unlikely that medical students will learn this before they graduate, and so it would seem appropriate to include cost awareness in the undergraduate curriculum. The WHO six-step guideline is internationally used as tool to teach rational pharmacotherapy [25,26]. In the current version of the WHO guide to good prescribing [7], ‘cost’ is mentioned 47 times, predominantly in the section regarding the selection of a P-drug (personal drug; step 3, part 1, the standardized therapy, which one has to personalize based on patient characteristics in step 3 part 2) [7]. We think that the upcoming revisions of the WHO six-step guideline, the guide to good prescribing and the teacher’s guide to good prescribing, all should address the role of cost in the relevant six steps, by including topics such as selecting a P-drug from (sponsored) guidelines, the difficulties in estimating drug costs, universal mechanisms that influence drug costs, pharmacy dispensing costs and how to address drug costs in daily teaching practice. For example, drug prices change over time, with drugs becoming cheaper after their patent has expired [27,28]. The cost difference between generic and proprietary drugs is substantial, and generic drugs are relatively inexpensive. As a rule of thumb, many generic drugs cost about €10 for 1 year of therapy. Therefore, it would be wise to check the cost of frequently prescribed drugs once a year, and whether the patent of a P-

| Table 2. Knowledge of students and doctors about the cost of drugs they prescribe in daily practice and where they can find this information. |
|-----------------------------------|-----------------|-----------------|-----------------|-----------------|
|                                    | Bachelor students | Master students | Registrar | Consultant |
| Where do you find information regarding drug costs? | (n = 73) | (n = 67) | (n = 16) | (n = 9) |
| No | 52 (71.2%) | 29 (47.8%) | 3 (18.8%) | 1 (11.1%) |
| Yes | 21 (28.8%) | 35 (52.2%) | 13 (81.3%) | 8 (88.9%) |
| Fk.cvz.nl | 5 (23.8%) | 16 (45.7%) | 12 (92.3%) | 4 (50.0%) |
| Medicijnkosten.nl | 13 (61.9%) | 18 (51.4%) | 2 (15.4%) | 3 (37.5%) |
| App | 3 (14.3%) | 1 (2.9%) | 2 (15.4%) | 1 (12.5%) |
| Other | 2 (9.5%) | 1 (2.9%) | 1 (8.3%) | 1 (12.5%) |

| How often do you know the cost (within a 25% margin) of a drug when prescribing it in clinical practice? |
|-----------------------------------|-----------------|-----------------|-----------------|-----------------|
|                                    | n = 73 | n = 66 | n = 16 | n = 9 |
| Never | 37 (50.7%) | 23 (34.3%) | 2 (12.5%) | – |
| Sometimes | 31 (42.5%) | 39 (58.2%) | 13 (81.3%) | 4 (44.4%) |
| Regularly | 5 (6.8%) | 5 (7.5%) | 1 (6.3%) | 3 (33.3%) |
| Often | – | – | – | 2 (22.2%) |

| Frequency of checking medication costs per month |
|-----------------------------------|-----------------|-----------------|-----------------|-----------------|
|                                    | N (Range) | Mean (SD) | N (Range) | Mean (SD) |
|                                    | 71 (0–10) | 0.44 (1.34) | 66 (0–10) | 0.77 (1.74) |
|                                    | 16 (0–2) | 0.56 (0.73) | 9 (0–4) | 1.56 (1.42) |

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drug (alternative) has terminated. Further suggestions for improving cost awareness among prescribers could encompass a multifactorial approach with (educational) interventions, feedback and reflection on current prescribing habits including discussions with clinical pharmacologists, mentorship of junior doctors and availability of information on drug costs [6,29].

The major limitation to this study was the limited number of doctors, especially consultants, who participated. The responders to the questionnaire are probably the ones most interested in the topic of cost of drugs and would plausibly do better compared to the less interested (non-responders). Our results might therefore be an overestimation of the cost consciousness and awareness in general. Due to the limited sample size of doctors, in some of the analyses, between-group differences were not significant and had a limited effect size. The single-centre and monospecialism setting urges us to be careful about generalizing our findings. Cost estimates would probably be better in disciplines in which deductible costs are more important (e.g. in general practitioners). Furthermore, the 25%-margin definition of a correct estimation leaves larger absolute margins of error for expensive drugs.

In conclusion, students and doctors seem unaware of the costs of drugs they frequently prescribe. The cost of generic drugs tends to be overestimated and that of proprietary drugs underestimated. In this era of increasing healthcare budget constraints, we think cost awareness is important to therapeutic reasoning and cost-effective prescribing. Both should be addressed in medical (pharmacotherapy) curricula and postgraduate education.

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Conflict of Interest

The authors declare that they have no conflict of interest.

Author contributions

All authors contributed to all parts of this study.

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Supporting Information

Additional Supporting Information may be found online in the supporting information tab for this article:

Table S1. Cost of drugs estimated by students and doctors and actual costs with the 25%-interval for a correct estimation.