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## Diffusion of new medicines into hospital practice

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### Introduction

During the last decades, there has been increasing interest in assessing the value of drugs and other medical technologies. This should involve careful examination of the clinical value of a drug as well as monitoring its diffusion into clinical practice. This paper considers the diffusion of four selected cases into Dutch hospitals during the period 1996–2000:

- Atorvastatin versus the older cholesterol-lowering statins
- The newest selective serotonin reuptake inhibitors (SSRIs), sertraline and citalopram, versus the SSRIs that have been available longer
- The (preferential) COX-2 inhibitors (nabumetone, meloxicam and rofecoxib) versus the conventional nonsteroidal anti-inflammatory drugs
- A2 antagonists versus angiotensin-converting enzyme (ACE) inhibitors

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The objective is to compare the patterns of diffusion of these four cases, as well as the variability between hospitals.

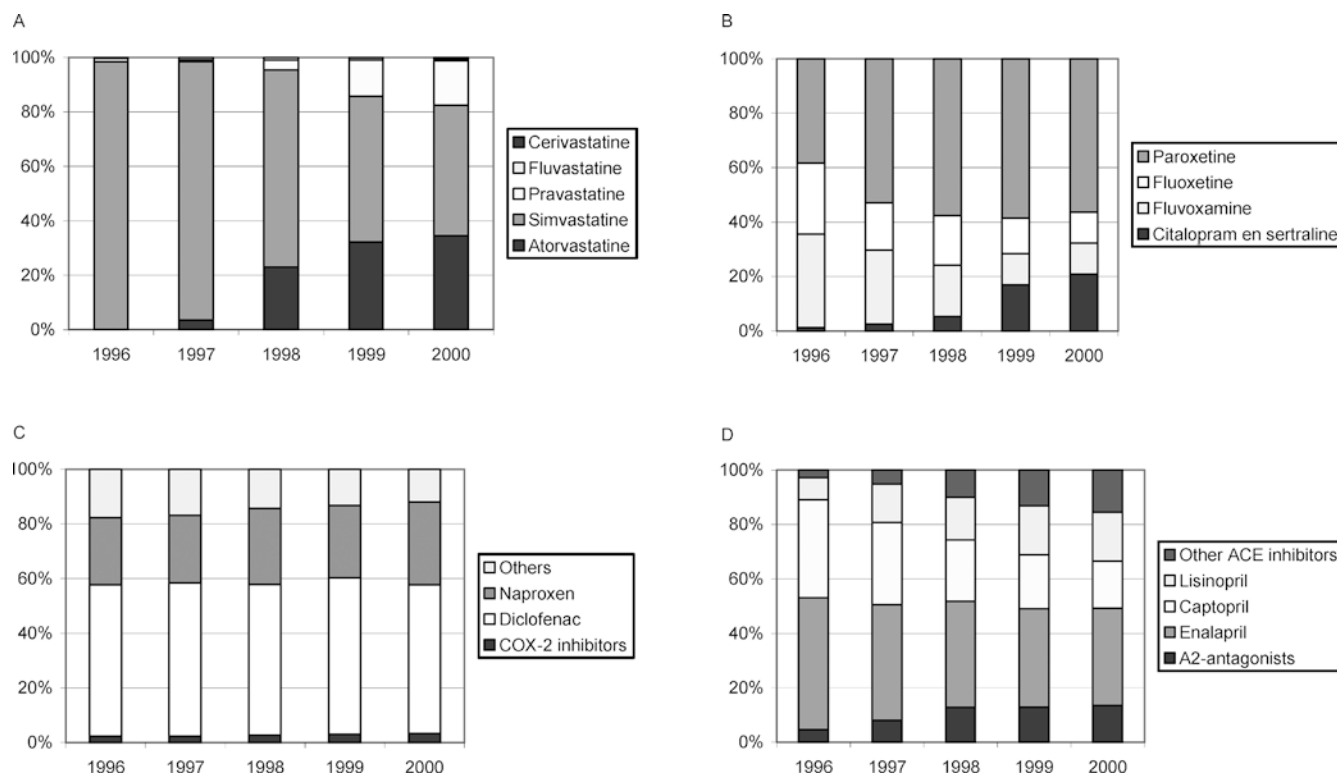
### Materials and methods

We requested drug dispensing data during the period 1996–2000 from 18 hospital pharmacies that dispensed drugs to 26 different hospitals. These represented a good mix of academic, top clinical, general and categorical hospitals of the 100 Dutch hospitals. All medicines were coded according to the Anatomical Therapeutic Chemical (ATC) classification system. For each dispensing record, we calculated the corresponding number of defined daily doses (DDDs) [1]. DDDs were summed per ATC code, per hospital, per year. We depicted the diffusion patterns of our four cases over the years (1996–2000) and calculated the variation in uptake among hospitals in the year 2000.

### Results

Co-operating in our study were 14 hospital pharmacies, supplying medications to 22 different hospitals (response 78% and 85%, respectively). Due to technical data management problems, we were able to use data from only 17 of these 22 hospitals.

The results are depicted in Fig. 1. Three years after its introduction, the youngest statin, atorvastatin, comprised 34% of all statin DDDs prescribed in the hospitals in the year 2000. The newest SSRIs, sertraline (available since 1994) and citalopram (available since 1997), together accounted for 21% of all SSRIs prescribed in 2000. In contrast, the COX-2 inhibitors, nabumetan, meloxicam and rofecoxib, diffused into the Dutch hospitals only modestly. Together they accounted for 3% of all DDDs prescribed, while the classic compounds diclofenac and naproxen made up for 85%. Similarly, the novel category of the A2 antagonists failed to gain a strong position. From 1998 to 2000, their market share became stable at an approximately 13% share of all DDDs prescribed in the category of ACE inhibitors and A2 antagonists. In the same period, the



**Fig. 1** Overall diffusion patterns

combined share of several recently introduced me-too ACE inhibitors, grew from 10% to 16%.

In the year 2000, there was substantial variability among hospitals concerning the use of the newer compounds. For example, the fraction of atorvastatin use of all statin use varied among hospitals from 1% to 56%. This variability could not be explained by hospital characteristics.

## Discussion

In our study, the use of new medicines varied substantially for the four cases studied as well as between hospitals. Remarkably, atorvastatin and the newer SSRIs, which both are new representatives within already existing therapeutic classes of drugs, showed a larger degree of uptake than the two cases representing innovative classes of drugs, the A2 antagonists and COX-2 inhibitors. It seems that hospitals are more critical towards these therapeutic innovations than in choosing among therapeutic equivalents. Does marketing pay off better than innovation? In the Netherlands, costs of drugs used within hospitals are part of the hospital's (fixed) budget. Drugs entering an overcrowded market with no clear added therapeutic value have to be priced

competitively with the existing alternatives to have a chance to be included in the hospital formulary. In contrast, innovative products often are more expensive, putting constraints on the hospital's drug budget, inducing a more critical analysis and, thereby, inducing a more critical attitude.

The pattern we observed may not be seen with all new medicines. We specifically looked at drugs that are used in the outpatient as well as in the inpatient setting. The pattern for drugs that are mainly used within hospitals, such as new oncolytic drugs, may be quite different [2]. Further research is necessary into the generalisability of these findings as well as the mechanisms behind them.

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