RESEARCH ARTICLE

Dispensing glucose test materials in Dutch community pharmacies

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Pharm World Sci 2004; 26: 52–55.

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Key words
Blood glucose
Community pharmacy
Diabetes mellitus
Pharmaceutical care
Pharmacy records
Self-monitoring
The Netherlands

Abstract
Objective: To assess the proportion of diabetic patients who collect self-monitoring equipment for glucose testing in Dutch community pharmacies.
Methods: Data were used from the PHARMO-Record Linkage System, containing pharmacy dispensing records from 1991 to 1998. The study population consisted of patients who received at least two prescriptions of insulin and/or oral hypoglycemic agents. Information was collected on patient demographics, antidiabetic drug use and self-monitoring equipment (blood glucose meters and test strips). Type of diabetes was determined for all incident users of antidiabetic drugs.
Main outcome measure: The proportion of patients per community pharmacy, who were dispensed self-monitoring equipment at least once.
Results: The study population consisted of 11,358 diabetic patients. The number of incident patients was 5,050, of whom 91.7% had type 2 diabetes. Twenty-nine pharmacies were included. The mean proportion of patients per pharmacy who received test strips at least once was 30.1% (SD = 6.7%), range 19–46%. The proportion of patients who were dispensed test strips was almost three times higher among type 1 than among type 2 patients (54% vs. 17%).
Conclusion: In comparison to other countries' published data, Dutch community pharmacies dispense relatively few glucose test materials to diabetic patients. There are substantial differences between pharmacies in dispensing test strips. Further research is needed into the determinants governing the use of test strips at both patient and pharmacy level.

Accepted July 2003

Introduction

Diabetes is a chronic illness that requires continuing medical care and patient self-management education to prevent acute complications and reduce the risk of long-term complications[1]. The prevalence of diabetes in the Netherlands is estimated to be 30 patients per 1,000 population (in 2000)[2].

Normoglycemia has been shown to be an important factor in the prevention of diabetic complications[3, 4]. In the treatment of patients with diabetes, self-management is recognised as a means of improving glucose control. The guideline of the American Diabetes Association states that diabetes self-management education is an integral component of medical care for both type 1 and type 2 patients[1]. Self-monitoring of blood glucose (SMBG) is considered to be a cornerstone of diabetes care[5]. As part of the pharmaceutical care for diabetic patients, self-management and SMBG have also become an issue in pharmacy practice. Recent national and international position statements and guidelines make the role of community pharmacies in SMBG explicit[6–8].

Although the guidelines promote the pharmacist's role in SMBG, only limited data are available on the actual support that pharmacies offer diabetic patients. Remuneration data from the Dutch Health Care Insurance Board show that the costs associated with SMBG were more than 50 million euro in 2000. From reports of the Dutch Foundation of pharmaceutical Statistics (SFK), we estimated that around 60% of these costs are incurred in the community pharmacy[9]. This study has investigated the proportion of diabetic patients who collect self-monitoring equipment in the community pharmacy, using a large database of pharmacy records. This proportion may be considered an indicator of the potential role of Dutch community pharmacies in SBMG.

Methods

Setting

We used prescription data from the PHARMO-Record Linkage System (RLS) covering the period 1991–1998. The PHARMO-RLS has been described in detail elsewhere[10]. In brief, the system includes pharmacy dispensing records from community pharmacies linked to hospital discharge records of all 450,000 community-dwelling residents of nine population-defined areas in the Netherlands from 1985 onwards. Since almost all patients in the Netherlands are registered with a single community pharmacy, independent of prescriber, pharmacy records are virtually complete with regard to prescription drugs. Medical aid dispense records may be less complete, since SMBG equipment can be dispensed without a prescription. Nevertheless, a prescription is necessary for remuneration of test materials. Hence, in most cases the dispensing of blood glucose meters and test strips is recorded in the patient's medication history.

Drug use was coded according to the Anatomical Therapeutic Chemical classification index of the World Health Organization. No standard index exists for test strips and blood glucose meters. They were selected by reviewing the complete history of medical aids, based on the description in the name-field together with the number of units dispensed.

Design and study population

The study used only dispensing data from pharmacies in which data were collected from 1991 to 1998. Patients were included in the study population if they received at least two prescriptions for an oral hypoglycemic agent (OHA, ATC-code A10B), at least two prescriptions of insulin (ATC-code A10A), or one prescription of an OHA followed by one prescription of insulin in the period between January 1991 and December 1998 (n = 11,358).

The dispensing histories of drugs and diabetes testing equipment were collected for the period January 1991 to December 1998. Retrievable information per prescribed drug and medical aid included date of dispensing, drug name and dispensing pharmacy. Patient information per prescribed drug, blood glucose meter or test strip included gender and date of birth. These data were used to determine the prevalence of SMBG equipment dispensed to diabetic patients in community pharmacies. Patients were considered to belong to a pharmacy's diabetic population if they filled at least two prescriptions for insulin or an oral hypoglycemic agent in that particular pharmacy.

The type of diabetes could only be determined for incident patients, so all incident patients were selected from the total diabetic population. All patients with at least six months of drug-dispensing records available before the first prescription of insulin or an OHA were included in this selection. Type 1 was defined as at least 2 prescriptions of insulin, no more than one prescription of an OHA and not older than 50 years of age at the start of insulin therapy. Insulin-using patients older than 50 years were not included as incident patients ($n = 194$), because it was considered unlikely that type 1 diabetes was diagnosed at age 50 or older. These patients could have had a very poor glycemic control at diagnosis, requiring immediate commencement of insulin. Type 2 diabetes was defined as at least 2 prescriptions of an OHA[1, 11].

Analysis

Microsoft Visual FoxPro 6.0 was used for database management. Analyses were performed using Microsoft Excel 2000 and SPSS 10.0 for Windows.

Results

Description of patients and pharmacies

The study population consisted of 11,358 users (46,504 person-years) of antidiabetic drugs. The median age at the day of the first registered dispensing of an antidiabetic drug in the PHARMO-RLS was 66 years (interquartile range (IQR) = 22 years). The median follow-up in the database after the first dispensing of an antidiabetic drug was 3.8 years (IQR = 5.1 years). For incident patients, this was 2.7 years (IQR = 3.4 years). The proportion of men was 44.6%. There were 5,050 incident patients, of whom 4,629 (91.7 %) had type 2 diabetes.

Dispensing data from 29 pharmacies were used. Fourteen pharmacies were not included in the analysis because dispensing data were not complete from 1991 until 1998.

The characteristics of the diabetic patient population in a pharmacy are shown in Table 1. The mean number of diabetic patients per pharmacy in the eight-year period varied from 182 to 823 (mean = 439; SD = 139). The mean age of the pharmacy's patients was 62.6 y (SD = 4.0 y; range 56.7–69.9 y). The mean proportion of type 2 patients among incident diabetic patients per pharmacy was 92% (SD = 2.7%), range 84–96%.

Test strips and blood glucose meters uptake

During the observation period the pharmacies dispensed SMBG test materials on 33,464 occasions, which corresponds to 0.72 occasions per patient per year: glucose test strips were dispensed 33,020 times in total, and a blood glucose meter was dispensed 410 times (1.2%). In 34 cases (0.1%) the type of test material could not be classified. Of all test strips, dispensing of blood glucose test strips (0.70 times per patient per year; 49 test strips per patient per year) was far more frequent than urine glucose testing (0.01 times per patient per year; less than one test strip per year per patient). A total of 3,593 patients (31.6%) were dispensed test strips at least once. When stratified by type of diabetes, the proportion of type 1 patients who received test strips at least once was 54%, and 17% for type 2 patients.

The mean number of times that test strips were dispensed was 142 (SD = 62) per year per pharmacy. For blood glucose meters this was 1.8 (SD = 0.9). Figure 1 shows the time trend in dispensing test strips between 1991 and 1998.

The proportion of patients per pharmacy who received test strips at least once is shown in Figure 2. The data are stratified per pharmacy and ranked from low to high to indicate the differences in dispensing. The mean proportion is 30.1% (SD = 6.7%). The substantial variation in dispensing test strips at pharmacy level is underlined by the wide range (19%–46%).

Table 1 *Characteristics of the diabetic population per pharmacy (n = 29 pharmacies)*

	Mean (SD)	*Range*	*P-value for difference between pharmacies*
Number of patients with at least two antidiabetic drug dispensed during follow-up	439 (139)	182–823	
Number of incident patients with at least two antidiabetic drug dispensed during follow-up	189 (57)	78–353	
Age[a]	62.6 y (4.0 y)	56.7–69.9 y	$P < 0.001$[b]
Male sex	44.3% (3.8%)	38–51%	$P < 0.001$[c]
Proportion of type 2 *(only among incident patients)*	92% (2.7%)	84–96%	$P = 0.043$[c]

[a] Age at date of first recorded prescription of antidiabetic drugs.
[b] Kruskal–Wallis test.
[c] Chi-square test.

Discussion

This study has shown that 70% of all patients who received at least 2 prescriptions of antidiabetic drugs between 1991 and 1998 did not obtain any test strips from community pharmacies. Only limited comparative data are available to interpret the significance of this finding for pharmacy practice. In a study using pharmacy prescription data from Tayside, Scotland (study period January 1993 to December 1995, UK), Evans et al. reported that 16% of all type 1 patients and 21% of all type 2 patients using insulin obtained no test strips[12]. Data from the Northern California Kaiser Permanente Study (study period January 1996 to December 1996, USA), which also used pharmacy data, showed that 25% of all type 1 patients did not receive any test strips[13], the comparable figure for type 2 patient this was 43%. Our data show that the proportion of non-users in Dutch community pharmacies is higher for all patient categories. However, the organisation of the health care system in Scotland and the USA is not the same as in the Netherlands. Firstly, type 2 patients received only very limited remuneration for test strips in the Netherlands during the study period, compared to the situation in the Kaiser Permante Study. Secondly, Dutch diabetic patients can acquire their SMBG equipment from third parties, such as mail order or from diabetes nurses. In the Kaiser Permanente Study this was not very probable (A.J. Karter, personal communication).

Because of the third-party distribution, a low proportion of users of test strips in a pharmacy does not imply an unsatisfactory quality of care to diabetic patients. This non-pharmacy distribution is not recorded in the pharmacy dispensing database. Unfortunately, no data have been published on the market share of the community pharmacy, so it is impossible to extrapolate these findings to the frequency of use of test strips in all diabetic patients. Furthermore, although SMBG is widely promoted as a means of patient empowerment, the evidence for the clinical effectiveness of the practice guidelines is still limited. In a meta-analysis by Coster et al., no significant reduction in HbA1c was found in type 2 patients using SMBG compared to non-users. In type 1 patients, unconfounded studies provide no convincing evidence for an effect of SMBG on HbA1c levels[14].

The effectiveness of SMBG is also influenced by the usage patterns of test strips and the patients' compli-

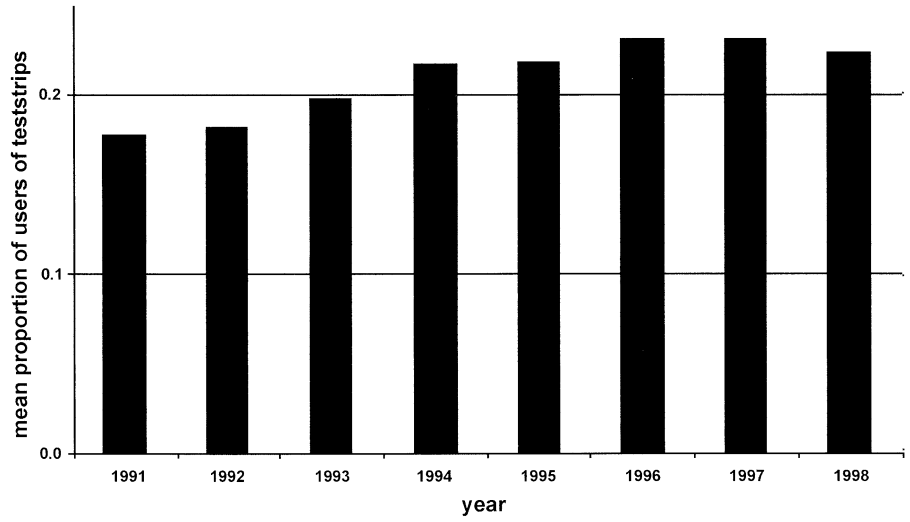

Figure 1 *Mean proportion of diabetic patients per pharmacy per year who received at least one prescription of test strips.*

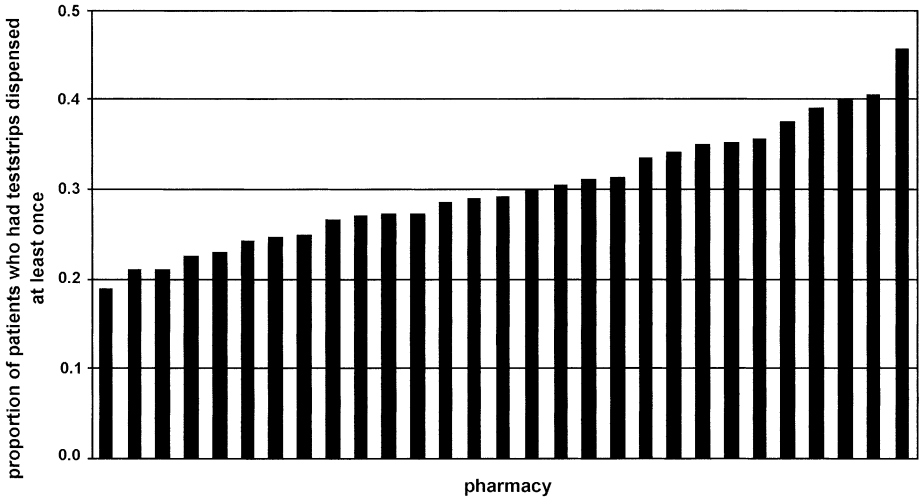

Figure 2 *Proportion of diabetic patients per pharmacy who received test strips in a community pharmacy at least once during the period from 1991 to 1998. The proportions are ranked from low to high.*

ance. Studies suggest that adherence to SMBG is low[15, 16], although the definition of adherence varies between studies. Furthermore, the optimum frequency of measurement is uncertain, especially in type 2 diabetes[5]. Some data have been published on incorrect use of test strips, potentially resulting in unreliable measurements[17–19].

Blood glucose meters were dispensed among only 11% (410 individuals) of all users of test strips. However, a meter is required to view the result of a test strip measurement, which suggests that the data are incomplete in regard to the actual number of blood glucose meters dispensed. A possible explanation for this is the industry's practice of giving away free starter kits, including a blood glucose meter, some test strips and lancets for blood sampling. These free kits are not remunerated and hence are not recorded in the patient's dispensing history. Another reason might be that in some instances patients are given a meter on loan from the pharmacy. In cases when patients only require SMBG for a short period of time, for example during changes in pharmacotherapy, the pharmacy only records the dispensing of the test strips.

Of all prevalent cases of diabetes in the Netherlands, about 10–15% has type 1 diabetes[20]. The relatively low proportion of type 1 patients in our study is due to the definition of an incident patient and the fact that we had no data on diagnosis. An incident patient is defined as at least six months of dispensing history before the first antidiabetic drug is dispensed. Because type 1 patients generally have less comorbidity at the date of diagnosis and are younger at time of diagnosis, they are less likely to be included as incident patient than type 2 patients, which reduces the proportion of type 1 patients in the study population.

However, if we had included prevalent users of antidiabetic drugs, we would have misclassified insulin users. About 25% of all type 2 patients use only insulin therapy to control their hyperglycemia. Furthermore, the underestimation of the number of type 1 patients will have only a small effect on the proportion of users of test strips per pharmacy. Based on the prevalence of type 1 in the general population, an underestimation of 50% and distribution of test strips in community pharmacy to 75% of type 1 patients would lower the proportion of users of test strips by 4%. The effect will be even less for the observed differences in dispensing of test strips between pharmacies.

The characteristics of the diabetic population varied between pharmacies, as shown by mean age, sex and to a lesser extent the proportion of type 2 patients. This might partially explain the observed differences in the prevalence of dispensing test strips per pharmacy. Further research is needed into the determinants of the use of test strips at both patient and pharmacy level.

Conclusion

Dutch community pharmacies dispense relatively few test materials to diabetic patients. Substantial differences exist between pharmacies in the prevalence of dispensing of test strips. Whether this indicates that not all pharmacies provide best practice according to current guidelines needs further investigation.

Acknowledgements

This study was supported by an unrestricted grant from the Royal Society for the Advancement of Pharmacy (KNMP), The Hague, The Netherlands.

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