Who Bears Responsibility for Glucocorticoid-Exposed Patients in a Large Health Maintenance Organization?

**OBJECTIVE:** High exposure to glucocorticoid drugs is associated with an increased risk of osteoporosis and fracture. To define the degree to which individual prescribers needed to adjust their prescribing practices and thus to prevent glucocorticoid-induced osteoporosis among their patients, this research sought to identify both the health plan members who had high exposure to glucocorticoid drugs and the physicians who prescribed these drugs.

**DESIGN:** Patient demographic characteristics, diagnoses, and medications were determined for members of the Kaiser Foundation Health Plan of Northern California who received more than two grams of prednisone (or its equivalent) during any 12-month period from 1998 through 1999.

**RESULTS:** High exposure to glucocorticoid drugs was identified in 22,444 health plan members, accounting for about 1% of adult health plan members. High exposure to glucocorticoid drugs increased sixfold from about 0.5% in members 20–30 years old to about 3% in members 70–79 years old; among these members, 3,788 physicians prescribed the glucocorticoid drugs that led to high exposure. The highest numbers of highly exposed patients were seen among rheumatologists and oncologists. Nephrologists, pulmonologists, and gastroenterologists had an intermediate number of highly exposed patients. Internists had the lowest number of highly exposed patients per physician, yet prescribed glucocorticoid drugs to the largest group (40%) of highly exposed patients in the study.

**CONCLUSIONS:** Using a pharmacy database system developed to identify patients exposed to potentially harmful amounts of glucocorticoid drugs, we identified high glucocorticoid exposure in 1%–3% of health plan members more than 50 years old. In addition, grouping prescribing physicians by medical specialty showed that the need to adjust prescribing practices to prevent glucocorticoid-related complications was unevenly distributed among specialty groups. To improve quality of care for patients in managed care organizations who have high exposure to glucocorticoid drugs, systems for preventive identification and intervention should be developed using pharmacy databases, and should be tailored to physician specialty.

**KEYWORDS:** Glucocorticoids, menopause, osteoporosis

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Prolonged exposure to high levels of glucocorticoid drugs can cause bone loss, osteoporosis, and fracture.\(^1\) Fracture ultimately occurs in about half of patients who take glucocorticoid drugs to control pulmonary, rheumatologic, autoimmune, hematopoietic, and gastrointestinal disease.\(^2\) About 18 million patients in the United States receive treatment with exogenous steroid agents, and an estimated 0.4% of one U.S. health plan’s members are exposed to glucocorticoid drugs.\(^3,4\)

Intervention for persons with high exposure to glucocorticoid drugs has been recommended by various medical specialty groups, such as the American College of Rheumatology, the United Kingdom Task Force, and the British Society for Gastroenterology.\(^5\) In the recent past, approval of bisphosphonates for prevention of glucocorticoid-induced bone loss has spurred interest in this disorder.\(^6–10\) However, the process of identifying persons with high exposure to glucocorticoid drugs has not been standardized, partly because glucocorticoid drugs are available in many formulations and doses and partly because the usual practice is to change dosage frequently or to prescribe intermittent use. Thus, only a few patients in U.S. health plans who are at risk for glucocorticoid-induced osteoporosis receive drug prophylaxis to both prevent bone loss and reduce the risk of fracture.\(^4,11\)

At Kaiser Foundation Health Plan of Northern California, a health maintenance organization (HMO) caring for approximately three million members, databases allow monitoring of all prescriptions and clinic visits. Using these databases, we identified and characterized members who had high exposure to glucocorticoid drugs to determine the care requirements they present to health care providers.

**Methods**

The study protocol was approved by the Kaiser Permanente Northern California Institutional Review Board. Using the health plan’s computerized pharmacy database (Pharmacy Information Monitoring Service [PIMS]) for the years 1998–1999, we identified prescriptions for 248 different drug items (National Drug Codes) within the oral glucocorticoid therapeutic class. Because glucocorticoid drugs are prescribed as physiologic replacement in patients diagnosed with adrenal or pituitary insufficiency, we excluded from the study 288 such cases on the basis of their outpatient diagnostic codes.

We converted all glucocorticoid values to prednisone equiv-
alents because prednisone was the glucocorticoid drug most commonly prescribed. We used standard weighting factors based on these glucocorticoid drugs' antiinflammatory effects (see Table 1, right). We then applied an algorithm that measured grams of prednisone equivalent prescribed during any consecutive 12-month period beginning in January 1998 and ending in December 1999. Patients older than 20 years who received more than two grams of glucocorticoid drugs in any 12-month period were defined as having high exposure to glucocorticoid drugs. Prescriptions for prednisone (148,568 prescriptions) and dexamethasone (12,611 prescriptions) accounted for 95% of glucocorticoid drug prescriptions issued to adult patients who had high exposure to this class of drugs (see Table 1).

During the study interval, any health care practitioner who was the first to prescribe a glucocorticoid drug to a patient with high exposure to these drugs was designated as responsible for its use; this prescriber's specialty was determined from the health plan's resource directory and from the prescriber's U.S. Drug Enforcement Agency (DEA) license number. When possible, on the basis of each outpatient visit diagnosis, we identified one of five major disease categories that could have prompted high exposure to glucocorticoid drugs: pulmonary (chronic obstructive pulmonary disease or asthma), rheumatologic, oncologic, dermatologic, or gastrointestinal. If visit codes did not allow this identification and if the prescriber of the glucocorticoid drug was a subspecialist (e.g., rheumatologist), we identified the disease category as that category typically associated with the prescribing subspecialist. For patients with multiple diagnoses, we used the diagnostic category associated with a prescribing subspecialist; patients who had no prescribing subspecialist were assigned the diagnostic category with the largest number of visit diagnoses.

### Results

We found 22,444 members who met our criteria for high exposure to glucocorticoid drugs; of these members, 9,519 (42%) were men and 12,925 (58%) were women. Gender distribution of these members by 10-year age increments (see Figures 1, right, and 2, page 230) was similar for men and women, and two thirds of users were 50 years old or older (median age, 59 years).

Prevalence of high exposure to glucocorticoid drugs increased sixfold with increasing age (see Table 2, page 231): below age 50 years, less than 1% of health plan members had high exposure to glucocorticoid drugs, but more than 3% of members had high exposure by the age of 70. Most prescriptions were issued for pulmonary (28.4%) and rheumatologic (18.3%) diagnoses; fewer prescriptions were associated with oncologic (10.4%), dermatologic (6.9%), and gastrointestinal (6.1%) diagnoses.

Patients with high exposure to glucocorticoid drugs received prescriptions for these drugs from 3,788 health care providers. The number of these patients in any individual physician's practice ranged from 1 to 207 (see Table 3, page 231). Practitioners with the highest burden were rheumatologists (median, 68 patients per provider) and oncologists (median, 45 patients per provider). Nephrologists, pulmonologists, and gastroenterologists had an intermediate level of burden; the median number

### Table 1

Prescriptions for Adult Members with High Exposure to Glucocorticoid Drugs,

<table>
<thead>
<tr>
<th>Drug Class</th>
<th>Potency Factor</th>
<th>Number (%) of Prescriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cortisone</td>
<td>0.20</td>
<td>68 (&lt;0.1)</td>
</tr>
<tr>
<td>Hydrocortisone</td>
<td>0.25</td>
<td>3,805 (2.2)</td>
</tr>
<tr>
<td>Prednisone</td>
<td>1.00</td>
<td>148,568 (87.7)</td>
</tr>
<tr>
<td>Prednisolone</td>
<td>1.00</td>
<td>1,600 (0.9)</td>
</tr>
<tr>
<td>Methylprednisolone</td>
<td>1.25</td>
<td>2,737 (1.6)</td>
</tr>
<tr>
<td>Triamcinolone</td>
<td>1.25</td>
<td>56 (&lt;0.1)</td>
</tr>
<tr>
<td>Dexamethasone</td>
<td>6.25</td>
<td>12,611 (7.4)</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>169,445 (100.0)</td>
</tr>
</tbody>
</table>

### Figure 1

Age Distribution of Male Health Plan Members with High Exposure to Glucocorticoid Drugs.

- 20–29: 9.5%
- 30–39: 8.4%
- 40–49: 13.4%
- 50–59: 17.6%
- 60–69: 21.6%
- 70–79: 21.9%
- 80+: 7.9%
- 80+: 7.9%
of patients with high exposure to glucocorticoid drugs ranged from 11–18 per physician in these specialties. In contrast, internists had a median of three such patients per physician. However, internists were the largest specialty group of prescribers; three times as many patients with high exposure to glucocorticoid drugs received these drugs from internists as from rheumatologists, the next-highest prescribing group.

We repeated these analyses using two cutpoints of annual cumulative glucocorticoid exposure: more than 1 g prednisone equivalent and more than 3 g prednisone equivalent. Compared with the results obtained using the more-than-one-gram cutpoint, use of the more-than-three-gram cutpoint yielded 71% more patients with high exposure to glucocorticoid drugs, and use of the more-than-three-gram cutpoint yielded 37% fewer patients with high exposure to glucocorticoid drugs. Results of using each cutpoint did not change the distribution of patients seen by each type of prescriber. For example, for any given cutpoint, 40%–44% of patients with high exposure to glucocorticoid drugs received prescriptions from internists, and 11%–13% of patients received prescriptions from rheumatologists.

**Discussion**

By examining a computerized database of prescriptions issued to adult health plan members, we found that approximately 1 in 100 persons in any given year was exposed to potentially harmful levels of glucocorticoid drugs. Our study showed that high exposure to glucocorticoid drugs increases sixfold with increasing age and that rheumatic and pulmonary diseases were the most common indications for prescribing these drugs; these findings are similar to those of other surveys. Our study is the first large-scale examination of prescribers of high-dosage glucocorticoid drugs. Considerable attention has been focused on the prescribing behavior of medical specialists such as rheumatologists and pulmonologists, in the belief that these specialists are the most frequent prescribers of glucocorticoid drugs. Although we did find that these medical specialists treat many patients who receive glucocorticoid drugs, we found that the larger group of generalists—not specialists—issue most prescriptions for glucocorticoid drugs.

This finding is important because it bears on the intervention systems that managed care organizations may choose to develop for reducing morbidity among patients exposed to high levels of glucocorticoid drugs. For example, now that effective drugs are available for prevention of glucocorticoid-induced osteoporosis, and with the impetus provided by new treatment guidelines, managed care organizations are likely to place a high priority on implementing interventions among these patients. Similarly, a rheumatologist—who typically cares for 60–70 patients exposed to high levels of glucocorticoid drugs—is likely to give this condition quite different priority than would a generalist, who typically has only a few such patients. Whereas the generalist can manage treatment algorithms in the office, the rheumatologist has a large burden of care that is best shared with a case manager—perhaps a pharmacist or specially trained nurse practitioner.

A strength of our study is the novel algorithm we developed for calculating cumulative exposure to glucocorticoid drugs during consecutive 12-month periods; this algorithm enables a multitude of glucocorticoid formulations and dosages to be translated, first into standard prednisone equivalents, then into cumulative 12-month exposure, and ultimately into a "flag" that alerts the practitioner to patients whose cumulative use of glucocorticoid drugs is more than two grams. This algorithm can be easily adapted by managed care organizations equipped with access to a pharmacy database. (Data on specific programming issues and prescription identification are available from the authors.) By automating this system, a managed care organization can rapidly and accurately identify patients at risk and can relay this information to clinicians responsible for initiating prophylaxis against glucocorticoid-induced osteoporosis. Currently, only 5%–14% of patients receiving glucocorticoid drugs in managed care settings receive bone-specific drugs for osteoporosis. In some cases, clinicians may fail to provide prophylaxis because they are unaware of the extent of their patients' exposure to glucocorticoid drugs; however, these health care providers may also be unfamiliar with newer, more...
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Our proposed system would address both deficiencies. Some limitations of our study are worthy of mention. Our method of flagging issuers and recipients of glucocorticoid prescriptions may not have identified the provider initially responsible for prescribing the glucocorticoid drugs. Whether the burden of preventing and managing glucocorticoid-related complications rests on the clinician who diagnoses and manages the case is arguable; another clinician may be prescribing these drugs in lieu of the responsible physician. More study is needed to identify and design systems that fairly and efficiently assign this responsibility and track a health care system's progress in increasing the proportion of patients who receive appropriate intervention against glucocorticoid-induced osteoporosis.

Another potential limitation of our study could be our choice of a 2 g prednisone cutpoint. Perhaps a more liberal alert system would be based on a 1 g prednisone cutpoint (equivalent to 100 days of 10 mg prednisone/day). Our choice of the 2 g cutoff satisfied several criteria: It is the dose which, taken throughout a five-year period, has been shown to cause adrenal suppression; it is equivalent to a year's exposure at 5.5 mg/day, a mean daily dosage associated with a statistically significant increase in both hip and spine fracture risk; and it is close to the dosage (more than 7.5 mg of prednisone per day for more than six months; equivalent to a cumulative total of more than 1.4 grams) that the American College of Rheumatology and the United Kingdom Task Force have suggested as the cutpoint indicating the need for active intervention.

In conclusion, we have developed a pharmacy database system that identifies patients exposed to potentially harmful amounts of glucocorticoid drugs. Using this system, we found that approximately 1 in 100 adult health plan members has this level of exposure and that the percentage of patients with high exposure rises with age. Nearly half these patients receive their glucocorticoid drug prescriptions from generalists who, on
average, care for only three such patients in their practice. Persons who are charged with developing managed care systems to improve the quality of care for such patients should consider identification and intervention systems built on pharmacy databases. Further, they should consider intervention strategies based on the number of highly exposed patients in each health care practitioner’s patient panel.

References