

- 17 Coste J, Fermandian J, Venot A. Methodological and statistical problems in the construction of composite measurement scales: a survey of six medical and epidemiological journals. *Stat Med* 1995;14:331-45.
- 18 Hart A, Wyatt J. Evaluating black boxes as medical decision-aids: issues arising from a study of neural networks. *Med Inf (Lond)* 1990;15:229-36.
- 19 Franklin RCG, Spiegelhalter DJ, Macartney F, Bull K. Evaluation of a diagnostic algorithm for heart disease in neonates. *BMJ* 1991;302:935-9.
- 20 Heathfield HA, Wyatt IC. Philosophies for the design and development of clinical decision-support systems. *Methods Inf Med* 1993;32:1-8.
- 21 Sackett D, Haynes R, Guyatt G, Tugwell P. *Clinical epidemiology: a basic science for clinical medicine*. 2nd ed. Boston, MA: Little Brown, 1991:173-85.
- 22 Wasson JH, Sox HC, Neff RK, Goldman L. Clinical prediction rules: applications and methodological standards. *N Engl J Med* 1985;313:793-9.
- 23 Harrell FE, Lee KL, Matchar DB, Reichert TA. Regression models for prognostic, prediction: advantages, problems and suggested solutions. *Cancer Treatment Reports* 1985;69:1071-7.
- 24 Wyatt J, Spiegelhalter D. Evaluating medical expert systems: what to test and how? *Med Inf (Lond)* 1990;15:205-17.
- 25 Murray GD, Murray LS, Barlow P, Teasdale GM, Jennett WB. Assessing the performance and clinical impact of a computerised prognostic system in severe head injury. *Stat Med* 1986;5:403-10.
- 26 Medical Research Council Antiepileptic Drug Withdrawal Study Group. Prognostic index for recurrence of seizures after remission of epilepsy. *BMJ* 1993;306:1374-8.
- 27 Pilkington SN. APACHE scoring and prediction of survival in intensive care. *BMJ* 1995;310:1197.
- 28 Centor AM, Yarbrough B, Wood JP. Inability to predict relapse in acute asthma. *N Engl J Med* 1984;310:577-80.
- 29 Phillips AN, Thompson SG, Pocock SJ. Prognostic scores for detecting a high risk group: estimating the sensitivity when applied to new data. *Stat Med* 1990;9:1189-98.
- 30 Arnbjornsson E. Scoring system for computer-aided diagnosis of acute appendicitis: the value of prospective versus retrospective studies. *Ann Chir Gynaecol* 1985;74:159-66.
- 31 Wyatt JC. Acquisition and use of clinical data for audit and research. *Journal of Evaluation in Clinical Practice* 1995;1:15-27.
- 32 Wyatt J, Spiegelhalter D. Field trials of medical decision-aids: potential problems and solutions. In: Clayton P, ed. *Proceedings of the 15th symposium on computer applications in medical care, Washington 1991*. New York: McGraw Hill, 1991:3-7.
- 33 Spiegelhalter DJ. Evaluation of medical decision-aids, with an application to a system for dyspepsia. *Stat Med* 1983;2:207-16.
- 34 Simon R, Altman DG. Statistical aspects of prognostic factor studies in oncology. *Br J Cancer* 1994;69:979-85.
- 35 Murray LS, Teasdale GM, Murray GD, Jennett B, Miller JD, Pickard JD, et al. Does prediction of outcome alter patient management? *Lancet* 1993;341:1487-91.
- 36 Goldman L, Cook EF, Brand DA, Lee TH, Rouan GW, Weisberg MC, et al. A computer protocol to predict myocardial infarction in emergency room patients. *N Engl J Med* 1988;318:797-803.
- 37 Knaus WA, Harrell FE, Lynne J, Goldman L, Phillips RS, Connors AF, et al. The SUPPORT prognostic model: objective estimates of survival for seriously ill, hospitalised patients. *Ann Intern Med* 1995;122:191-203.
- 38 Van Houwelingen H, Thorogood J. Construction, validation and updating of a prognostic model for kidney graft survival. *Stat Med* 1995;14:1999-2008.

Prescribing of quinine and cramp inducing drugs in general practice

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Quinine is widely prescribed as the treatment of choice for nocturnal leg cramps despite doubts about its clinical efficacy. Several commonly prescribed agents, including nifedipine, cimetidine, salbutamol, terbutaline, and diuretics in general, may also cause leg cramps as a side effect.^{1,2} In addition, quinine may cause severe visual problems in acute self poisoning.³

We examined the prescribing of quinine by general practitioners in the Greater Glasgow Health Board. In addition, the age and sex profiles of patients given quinine and the proportion of these patients concurrently prescribed other drugs associated with leg cramps were determined in a sample of practices.

Patients, methods, and results

By using the Scottish prescribing analysis database provided by the pharmacy practice division in Edinburgh we established the quantity of quinine prescribed by the 221 practices operating within the Greater Glasgow Health Board conurbation. The top 5% of quinine prescribing practices had their overall prescribing reviewed in terms of the average cost per patient and number of prescription items issued per 100 patients and were compared with practices in the Greater Glasgow Health Board as a whole. Permission was sought from a sample of three of these practices (eight general practitioners) to access individual case notes of those patients prescribed quinine. Details of age, sex, and treatment histories at the time of diagnosis of leg cramps were obtained for some 70 patients.

During 1992 only 11 (5%) of the 221 practices in the Greater Glasgow Health Board did not prescribe quinine. The median number of tablets dispensed per 1000 patients a year was 1770 (table). Of the 14 practices prescribing more than 3500 tablets per 1000

patients, two closed and the remaining 12 formed the basis for this study.

Of the 12 practices, six had average annual prescribing costs of £75 or more per patient. Practices prescribing more than 90 individual items per 100 patients were considered high volume prescribers. Seven of the 12 high quinine prescribers were among this group of high volume prescribers. Three of the 12 practices had individual patient case notes accessed. Prescriptions for quinine were predominantly issued to women patients aged over 65. Of the 70 patients identified as receiving quinine, 37 (53%) were taking other agents known to be associated with leg cramps before a diagnosis of leg cramps was made.

Comment

In 1992 virtually all general practitioners in the Greater Glasgow Health Board prescribed quinine sulphate. Quinine is prescribed predominantly by practices that may be regarded as high cost, high volume prescribers with regard to the Greater Glasgow Health Board as a whole. Our study highlighted that most patients prescribed quinine may have had another pharmacological cause for their leg cramps. A review of the need for and dosage of current drugs may be all that is required to alleviate the problem.

Controversy surrounds the efficacy of quinine in the treatment of nocturnal leg cramps. A recent meta-analysis concluded that quinine was effective for this condition.⁴ The authors, however, did not fully explore publication bias as a possible problem when interpreting their findings and the original trials did not investigate other pharmacological causes for the leg cramps in study subjects. Only if other cramp inducing agents cannot safely be stopped might a trial of quinine be indicated.

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Quinine prescribed per 1000 patients in 221 Greater Glasgow Health Board general practices, 1992

	No of tablets per 1000 patients ($\times 10^3$)								
	5	10	15	20	25	30	35	40	≥ 40
No of practices	12	32	52	36	45	21	9	11	3

1 Eaton JM. Is this really a muscle cramp? *Postgrad Med J* 1989;86:227-32.

2 McGee SR. Muscle cramps. *Arch Intern Med* 1990;150:511-8.

3 Bateman DN, Dyson EH. Quinine toxicity. *Adverse Drug Reactions and Acute Poisoning Review* 1986;4:215-33.

4 Man-Son-Hing M, Wells G. Meta-analysis of efficacy of quinine for treatment of nocturnal leg cramps in elderly people. *BMJ* 1995;310:13-6.

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