

Skin infections and antibiotic prescribing:

a comparison of surveillance and prescribing data

Douglas M Fleming, Alex J Elliot and Helen Kendall

ABSTRACT

Background

Reductions in the number of dispensed antibiotics and the incidence of respiratory infections presented to GPs and have been reported. Whether this trend applies to skin infections requires further investigation.

Aim

To examine trends in the incidence of skin infections in relation to trends in dispensed prescriptions for flucloxacillin, topical fusidic acid, mupirocin, and corticosteroids with fusidic acid.

Design of study

Population-based analysis of patients presenting to GPs (1999–2005) contrasted with national prescribing data.

Setting

A sentinel practice network covering a population of 700 000 in England and Wales.

Method

Quarterly incidence rates of skin infections and of impetigo reported over the years 1999–2005 were compared with quarterly data on dispensed prescriptions reported by the Prescription Pricing Authority for England.

Results

In children (aged 0–14 years) the incidence of skin infections decreased slightly between 1999 and 2003 and more sharply from 2004 to 2005. In adults (aged ≥15 years) incidence was reasonably constant from year to year. In every year examined, and in both age groups, there were autumnal incidence peaks. There were annual increases in dispensed prescriptions for flucloxacillin capsules, but there was little change in the use of flucloxacillin syrups and topical antibiotic prescriptions. All prescribing data sets showed increases in the third quarter: topical corticosteroids with fusidic acid were prescribed more frequently in summer than winter.

Conclusion

In spite of slight reductions in the incidence of skin infections, flucloxacillin capsule-dispensed prescriptions have increased, suggesting that doctors have not limited their antibiotic prescribing behaviour for skin conditions.

Keywords

flucloxacillin; fusidic acid; mupirocin; sentinel surveillance; skin infections.

INTRODUCTION

The appropriate use of antibiotics is important in limiting the encouragement of resistant organisms. Understanding what is happening in general practice is critical when interpreting data on antibiotic prescribing. Prescription of antibiotics by GPs has been previously examined in the context of the incidence of respiratory tract infections, using prescribing analysis and cost (PACT) data on dispensed antibiotics.¹ A well-recognised positive association has been found between prescriptions for antibiotics and the number of persons presenting to GPs with acute respiratory infections.^{2,3} Trends in the prescribing of flucloxacillin are not consistent with those for the majority of commonly prescribed antibiotics. The aim of the current study was to examine relevant national prescribing data in relation to the available data on the incidence and seasonality of skin infections, for which flucloxacillin is commonly prescribed.

Skin conditions are a major cause for consultation in primary care. In the Fourth National Morbidity Survey in England and Wales conducted in 1991–1992 (MSGP4), 2.8% of children aged 0–4 years and 1.6% of those aged 5–15 years consulted with a skin condition.⁴ It was estimated that nationally there were more than 10 million consultations for skin conditions in general practice,

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How this fits in

Reductions in the number of dispensed antibiotics and the incidence of respiratory infections presented to GPs and have been reported. This study on skin infections complements earlier work on respiratory infections and clarifies current understanding of the way GPs are responding to pressures to reduce antibiotic prescribing. In spite of slight reductions in the incidence of skin infections, flucloxacillin capsule-dispensed prescriptions have increased, suggesting that doctors have not limited their antibiotic prescribing behaviour for skin conditions.

of which 2.4 million were initiated because of infection.⁴ Doctors, however, are only consulted on a minority of occasions: Bruijnzeels and colleagues, using parent diary cards of 1805 Dutch children, estimated that 28% of all skin problems prompted consultation with a GP.⁵ These figures are all numerically similar to those observed in the Weekly Returns Service (WRS) of the Royal College of General Practitioners (RCGP) recorded up to 2003.^{6,7} A two-point comparison made of the Dutch national morbidity surveys in 1987 and 2001, suggested that the overall incidence of skin conditions was lower in 2001, although the incidence of skin infections had increased.⁸

Loffeld *et al* reported a study of seasonality in attendees for impetigo at a paediatric Accident and Emergency (A&E) department. The study found increased attendance in late summer and highlighted the significance of higher temperatures.⁹ Similar findings have been noted using data from the WRS. Researchers concluded that this seasonal peak was probably due to increased insect activity.¹⁰

In recent years the treatment of common skin infections has been largely based on the use of topical antibiotic creams (mupirocin, fusidic acid, and steroid/antibiotic combinations). Oral antibiotics, notably flucloxacillin and erythromycin, have also been used, sometimes in combination with topical preparations. The evidence supporting their use is not strong, and in a recent Cochrane Review of treatment, no advantage was found for erythromycin as compared with topical antibiotics; there has not been a separate evaluation of flucloxacillin.¹¹

The majority of skin infections are caused by *Staphylococcus aureus* and a few by *Streptococcus pyogenes*.¹² Serious complications from infection are currently rare but there is some concern about increased likelihood of antibacterial resistance, most notably to fusidic acid.^{13–19} The significance of this increased resistance is difficult to establish because conventional antibacterial assays do not measure dose in usual topical use, which has a much higher local concentration of antibiotic than is used in laboratory assays.

METHOD

Weekly incidence data from the RCGP WRS for skin and subcutaneous skin infections (ICD9 680–686; subsequently referred to as skin infections) and impetigo (ICD9 684) were assembled into quarterly data sets over the years 1999–2005. Individual diagnoses within the group ‘skin infections’ include: carbuncle and furuncle (ICD9 680); cellulitis and abscess of finger and toe (681); other cellulitis and abscess (682); acute lymphadenitis (683); impetigo (684); pilonidal cyst (685); and other local infections of skin and subcutaneous tissue (686). Infected wounds are classified elsewhere. Incidence in each quarter is described as a mean weekly rate per 100 000 persons monitored. The WRS is a sentinel practice monitoring network involving approximately 75 practices and 700 000 persons at the midpoint of this study. Participating GPs summarise all consultations according to the disease/problem concerned using Read Codes, and determine the appropriate episode type to distinguish new episodes of illness from ongoing consultations. These data are routinely analysed by age group and sex.

PACT data were provided by the Prescription Pricing Authority (PPA) covering quarterly numbers of items of the selected antibiotics: flucloxacillin (*British National Formulary* [BNF] classification 5.1.1.2) available as a syrup, capsule, or as an injection; and topical preparations including mupirocin (BNF 13.10.1.1), fusidic acid (BNF 5.1.7), and corticosteroids with fusidic acid (BNF 13.4). Data for erythromycin, available as capsule or tablet and separately as a syrup, was also examined as a potential confounder.

These data were examined separately in children aged 0–14 years and in adults aged ≥15 years. Flucloxacillin capsules were compared with adult incidences and flucloxacillin syrups with children. Where appropriate, trends in incidence and prescribing were investigated by regression analysis.

RESULTS

The quarterly incidence of skin infections and impetigo, and prescriptions of the selected antibiotics in children and adults are described in Figures 1 and 2. Episodes of impetigo were more common in children than in adults, but when all skin infections were examined together the difference was less marked. The same seasonal trends were evident in all the quarterly datasets with the peak of clinical incidence occurring in the third quarter (July–September). In children, but not in adults, there were slight decreasing linear trends of diagnosed skin infections and impetigo between 1999 and 2003; the regression coefficient was -0.67 (95% confidence interval [CI] = -2.01 to 0.67) for children and -0.08

(95% CI = -0.54 to 0.38) for adults, which equated to annual reductions (1999–2003) of 2.4% and 0.5%, respectively, in the incidence rate of skin infection. During 2004 and 2005 there were more pronounced reductions in the incidence, especially for children.

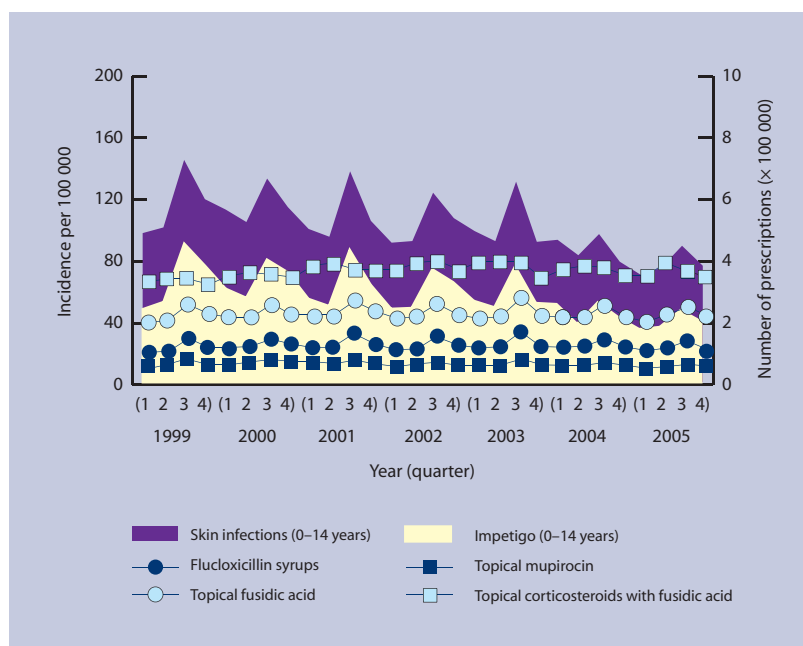
In 1999 there were a total of 2.7 million flucloxacillin prescriptions issued (7.7% of all antibiotic prescriptions), and in 2005 this figure rose to 3.3 million (9.8%). Quarterly prescribing data presented for flucloxacillin syrups and topical antibiotics (mupirocin, fusidic acid, and corticosteroids with fusidic acid) are presented in Figure 1; these are contrasted with incidence data for skin infections and impetigo in children aged 0–14 years. Prescriptions dispensed for flucloxacillin syrups were relatively constant over the 7 years: there was a quarterly peak each year during the third quarter. Prescribing data for flucloxacillin capsules and data for topical antibiotics (as above, Figure 1) are contrasted with incidence data in adults (aged ≥ 15 years) in Figure 2. There was a gradually increasing linear trend for prescriptions dispensed for flucloxacillin capsules from 1999 to 2003, which levelled off during 2004 and 2005. Prescriptions for topical mupirocin and fusidic acid were relatively constant but demonstrated a similar seasonal trend. The seasonal pattern of topical corticosteroids with fusidic acid prescriptions was less well defined: more prescriptions were dispensed in quarterly periods 2 (April–June) and 3 (July–September) than quarters 1 (January–March) and 4 (October–December). Over the years 1999 to 2002 there was a slight upward trend in the number of dispensed prescriptions for topical corticosteroids with fusidic acid.

Overall, the number of erythromycin prescriptions is broadly similar to that of flucloxacillin. The seasonality of erythromycin prescriptions differed from that of flucloxacillin (data not shown). Peak prescribing was evident in the winter quarters, and was consistent with the winter increase in the incidence of respiratory tract infections.¹

DISCUSSION

Summary of main findings

The incidence of total skin infections and of impetigo showed seasonal variation with a peak in the third quarter.¹⁰ In the years 1999–2005 the incidence as reported in the WRS decreased slightly, especially over the last 2 years. Dispensed prescriptions for flucloxacillin capsules increased gradually from 1999 to 2003 and then levelled off, but for flucloxacillin syrups and topical antibiotics there was little overall change. Thus, although the incidence of skin infections in adults was less in 2003 than in 1999, there has not been a decrease in prescriptions dispensed for flucloxacillin capsules. Prescribing



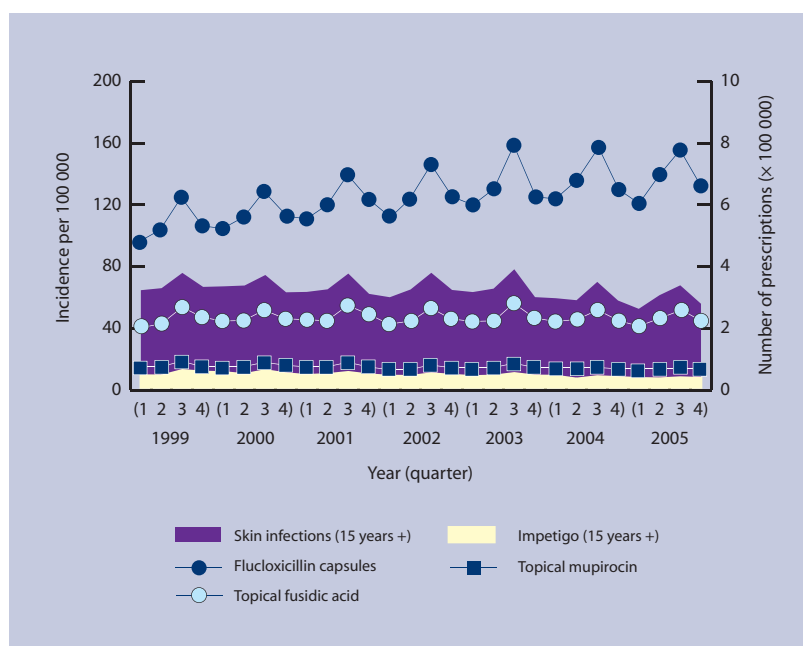
patterns of erythromycin did not suggest any shift in doctor prescribing preference from erythromycin to flucloxacillin.

Strengths and limitations of the study

These morbidity episode data are based on persons presenting to GPs in a sentinel practice surveillance scheme specifically designed to capture all morbidities and the relevant episode type reported at every consultation. The discipline of data recording was established for the purpose of undertaking national morbidity surveys. Routine capture using patient electronic medical records was established for the fourth survey in 1991.⁴ In a comparison of

Figure 1. Mean weekly incidence per 100 000 population per quarter of skin and subcutaneous tissue infections and impetigo in children (0–14 years) and prescriptions for flucloxacillin syrups and topical antibiotics.

Figure 2. Mean weekly incidence 100 000 population per quarter of skin and subcutaneous tissue infections and impetigo in adults (≥ 15 years) and prescriptions for flucloxacillin capsules and topical antibiotics.



annual prevalence rates reported in the WRS in 2001 with equivalent data from MSGP4 in 1991, an approximate 25% increase in the numbers of persons presenting with skin infections was noted during a 1-year period.²⁰ A similar survey in the Netherlands also noted an increase.⁸ Episode incidence data for skin infections have been recorded in the WRS since 1994; there was very little change between 1994 and 1999, and from 2000 onwards the recorded incidence of skin infections has fallen slightly.^{10,21}

Over the last 5 years GPs have made increasing use of deputising services for out-of-hours work and by 2004 very few were providing these services. While it is now a requirement of the WRS that records are continuously updated with out-of-hours consultation diagnoses, these were commonly not entered in time to be included in the relevant weekly return. This is likely to have caused a small reduction in the number of consultations for these conditions, especially among children where consultations often take place as an emergency, at short notice because of the anxiety that a new rash may be something serious. The recent report from Birmingham Children's Hospital suggested that the incidence of skin infections was increasing, but data were based on hospital attendances for impetigo in the A&E department, a group which could formerly have visited their GP.⁹

Flucloxacillin and topical antibiotics are only available on prescription. PACT data provided by the NHSBSA PPD are particularly important because they measure what has been dispensed and not simply what has been reported as prescribed. Practice reported prescribing may underestimate true prescribing because of failure to report, but may overestimate because it includes prescriptions that are never dispensed. PACT data include all prescriptions dispensed by retail pharmacists thus providing the most accurate and comprehensive estimate of drugs available in the community. They are not available in age-specific form although inferences can be made from the presentation and dose details as shown here with regard to flucloxacillin.

Comparison with existing literature

In previous and current analyses of the seasonal trends in incidence of skin infections and impetigo,¹⁰ no evidence was found of the increased incidence reported by both Loffeld *et al* and Koning *et al*.^{9,22}

The Koning *et al* study was a two-point comparison, which is not an adequate basis to describe trends: both the WRS and prescribing data presented here are from continuous surveillance programmes. The increase in A&E department attendance for impetigo reported by Loffeld *et al* in

1552 children over an 8-year period (less than 200 a year) was not based on a known denominator. Additionally, the study was conducted during a period of major change in the provision of out-of-hours services.²³⁻²⁶ Therefore the slightly reduced incidence seen in the last 2 years in general practice should be interpreted with caution.

Implications for future research and clinical practice

The changes in incidence of skin infections and flucloxacillin prescribing are diametrically opposed, which can only mean that adults are more likely to receive a flucloxacillin prescription than previously. However, speculation remains about the reasons that lie behind these changes. The incidence data together with the relative constancy of topical prescriptions and flucloxacillin syrup suggest there has been no recent underlying change in the incidence of skin infections. It is possible that, at least in adults, doctors are treating skin infections more aggressively. It is also possible that flucloxacillin is more widely used for conditions other than skin infections; for example, prophylactically following the suture of wounds, or after dog bites. However, if this were the case the same trends would be expected in children as in adults.

This report emphasises the importance of careful and disciplined data capture of simple and minor infections to understand antibiotic use. In many practices these minor infections are recorded in the free text section of the electronic notes and are often not coded as diagnostic Read Codes. These findings provide no support for the view that doctors are prescribing fewer antibiotics for skin infections: in adults there appears to be an increase despite an overall decrease in the incidence of skin infections. A decreasing incidence of acute respiratory infections and a smaller reduction in the number of dispensed antibiotics has been previously shown, suggesting that the rate of prescribing antibiotics for diagnosed cases may even be increasing.¹ Using data on morbidity reported and prescriptions issued from the General Practice Research Database, Ashworth and colleagues demonstrated similar downward trends of both respiratory infections and antibiotic prescribing, but found evidence of reduced prescribing per consultation reported.²⁷ Smith *et al*, also found reductions in diagnosis-related prescribing episodes for 'cough/cold' and sore throat, although there was variation in prescribing across different regions of the UK.²⁸

GPs should not become complacent about antibiotic prescribing. This analysis supports the view that doctors have increased their likelihood of prescribing flucloxacillin capsules to adults but there

has been little change in the use of flucloxacillin syrups in children and of topical antibiotics (which are probably equally effective).¹¹ While some comparisons have been made with antibiotic prescribing for respiratory infections, these are mostly viral and therefore issues of appropriateness of prescribing are quite different.

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Ethics committee

Not applicable

Competing interests

The authors have stated that there are none

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REFERENCES

- Fleming DM, Ross AM, Cross KW, Kendall H. The reducing incidence of respiratory tract infection and its relation to antibiotic prescribing. *Br J Gen Pract* 2003; **53**(495): 778–783.
- Ashworth M, Charlton J, Ballard K, *et al.* Variations in antibiotic prescribing and consultation rates for acute respiratory infection in UK general practices 1995–2000. *Br J Gen Pract* 2005; **55**(517): 603–608.
- Nyquist AC, Gonzales R, Steiner JF, Sande MA. Antibiotic prescribing for children with colds, upper respiratory tract infections, and bronchitis. *JAMA* 1998; **279**(11): 875–877.
- McCormick A, Fleming D, Charlton J. *Morbidity statistics from general practice. Fourth National Study 1991–1992*. London: HMSO, 1995.
- Bruijnzeels MA, Foets M, van der Wouden JC, *et al.* Everyday symptoms in childhood: occurrence and general practitioner consultation rates. *Br J Gen Pract* 1998; **48**(426): 880–884.
- RCGP Birmingham Research Unit. *Weekly Returns Service annual report*. Birmingham: Royal College of General Practitioners, 2003.
- RCGP Birmingham Research Unit. *Weekly Returns Service annual prevalence report*. 2004. Royal College of General Practitioners. http://www.rcgp.org.uk/bru/_bru_home/annual_prevalence.aspx (accessed 21 May 2007).
- Mohammedamin RS, van der Wouden JC, Koning S, *et al.* Increasing incidence of skin disorders in children? A comparison between 1987 and 2001. *BMC Dermatol* 2006; **6**: 4.
- Loffeld A, Davies P, Lewis A, Moss C. Seasonal occurrence of impetigo: a retrospective 8-year review (1996–2003). *Clin Exp Dermatol* 2005; **30**(5): 512–514.
- Elliot AJ, Cross KW, Smith GE, *et al.* The association between impetigo, insect bites and air temperature: a retrospective 5-year study (1999–2003) using morbidity data collected from a sentinel general practice network database. *Fam Pract* 2006; **23**(5): 490–496.
- Koning S, Verhagen AP, van Suijlekom-Smit LW, *et al.* Interventions for impetigo. *Cochrane Database Syst Rev* 2004; CD003261.
- Resnick SD. Staphylococcal and streptococcal skin infections: pyoderma and toxin-mediated syndromes. In: Harper JI, Oranje AP, Prose NS, (eds). *Textbook of pediatric dermatology*. Oxford: Blackwell Science, 2000: 369–383.
- Brown EM, Wise R. Fusidic acid cream for impetigo. Fusidic acid should be used with restraint. *BMJ* 2002; **324**(7350): 1394.
- Owen SE, Cheesbrough JS. Fusidic acid cream for impetigo. Findings cannot be extrapolated. *BMJ* 2002; **324**(7350): 1394.
- Ravenscroft JC, Layton A, Barnham M. Observations on high levels of fusidic acid resistant *Staphylococcus aureus* in Harrogate, North Yorkshire, UK. *Clin Exp Dermatol* 2000; **25**(4): 327–330.
- Stoddart B, Collins T, Denton M. Fusidic acid cream for impetigo. Problem may be clinically important. *BMJ* 2002; **324**(7350): 1394.
- Sule O, Brown N, Brown DF, Burrows N. Fusidic acid cream for impetigo. Judicious use is advisable. *BMJ* 2002; **324**(7350): 1394.
- Weston VC, Boswell TC, Finch RG, Perkins W. Fusidic acid cream for impetigo. Emergence of resistance to fusidic acid limits its use. *BMJ* 2002; **324**(7250): 1394.
- Zadik P, Young N. Fusidic acid cream for impetigo. Resistance trends must be monitored. *BMJ* 2002; **324**(7350): 1394.
- Fleming DM, Cross KW, Barley MA. Recent changes in the prevalence of diseases presenting for health care. *Br J Gen Pract* 2005; **55**(517): 589–595.
- Fleming DM, Elliot AJ. Changing disease incidence: the consulting room perspective. *Br J Gen Pract* 2006; **56**(532): 820–824.
- Koning S, Mohammedamin RS, van der Wouden JC, *et al.* Impetigo: incidence and treatment in Dutch general practice in 1987 and 2001 — results from two national surveys. *Br J Dermatol* 2006; **154**(2): 239–243.
- Chalder M, Sharp D, Moore L, Salisbury C. Impact of NHS walk-in centres on the workload of other local healthcare providers: time series analysis. *BMJ* 2003; **326**(7388): 532.
- Department of Health. *Up to £30 million to develop 20 fast access walk-in centres*. London: Department of Health, 1999. http://www.dh.gov.uk/en/Publicationsandstatistics/Pressreleases/DH_4025471 (accessed 22 May 2007).
- Munro J, Sampson F, Nicholl J. The impact of NHS Direct on the demand for out-of-hours primary and emergency care. *Br J Gen Pract* 2005; **55**(519): 790–792.
- Salisbury C, Chalder M, Scott TM, *et al.* What is the role of walk-in centres in the NHS? *BMJ* 2002; **324**(7334): 399–402.
- Ashworth M, Latinovic R, Charlton J, *et al.* Why has antibiotic prescribing for respiratory illness declined in primary care? A longitudinal study using the General Practice Research Database. *J Public Health* 2004; **26**(3): 268–274.
- Smith S, Smith GE, Heatlie H, *et al.* Reducing variation in antibacterial prescribing rates for 'cough/cold' and sore throat between 1993 and 2001: regional analyses using the general practice research database. *Public Health* 2006; **120**(8): 752–759.