

Natural course of 500 consecutive cases of whooping cough: a general practice population study

Douglas Jenkinson

Abstract

Objective—To describe the natural course of whooping cough.

Design—Observational study of a general practice population.

Setting—Discrete semirural East Midlands practice of 11 500 patients.

Subjects—500 consecutive cases of whooping cough diagnosed clinically during 1977-92.

Main outcome measures—Incidence of vomiting, whooping, apnoea, admission to hospital, and complications; duration and frequency of paroxysms. Pattern of spread.

Results—The incidence in the practice population was 4347/100 000 population compared with a notification rate for England and Wales of 717/100 000. Most cases were relatively mild. 284 patients vomited after paroxysms, 242 whooped, and 57 had apnoea. Duration and frequency of paroxysms varied widely. Female and unimmunised patients suffered more severe disease. *Bordetella* was isolated from fewer immunised patients (24/96 v 63/122 unimmunised). Infection was usually spread through contacts with someone with clinical whooping cough. Five patients developed pneumonia, three of whom had been immunised. Three patients required hospital admission.

Conclusions—Most cases of whooping cough are relatively mild. Such cases are difficult to diagnose without a high index of suspicion because doctors are unlikely to hear the characteristic cough, which may be the only symptom. Parents can be reassured that a serious outcome is unlikely. Adults also get whooping cough, especially from their children, and get the same symptoms as children. The difficulty of early diagnosis and probability of missed cases reinforces the need to keep the incidence low through immunisation in order to protect infants, who are the most vulnerable.

Introduction

Whooping cough is caused by infection with *Bordetella pertussis* or, more rarely, *Bordetella parapertussis*. It is a highly infectious disease with a broad spectrum of clinical severity ranging from a trivial cough, through the classic picture of vomiting, whooping, and apnoea with paroxysmal coughing, to pneumonia, encephalopathy, and death.¹

Publicity given to the more severe consequences of whooping cough has created a widely held perception that the disease is always severe, debilitating, and dangerous. Such a perception helps to encourage immunisation, but if untrue it degrades diagnostic accuracy, produces inaccurate epidemiological data, and hinders the wise management of those with the disease or at risk of it.

I studied every case of whooping cough since 1977

that I could discover in the practice in which I work. This paper describes the natural course of the disease in this general practice population.

Patients and methods

The patients studied were registered with a stable, semirural, four doctor practice with around 11 500 patients, most of whom are in social classes II and III. The study started in 1977 at the start of a large outbreak of whooping cough in the practice² and nationally, and all cases since then have been studied. Many were detected at routine consultations, and inquiries were then made about possible sources of infection. Sources of infection were followed up by me or a health visitor by examination of case notes and talking to teachers and parents. I questioned and examined most of the 500 patients at least once, the remainder being seen by a health visitor or partner. Patients were thereafter examined according to clinical need and followed up, often by telephone, until the condition was no longer troublesome or had cleared.

Clinical diagnosis was based on a history of three weeks of coughing characteristic of the disease—that is, choking fits with the patient attempting to expel every bit of air from the lungs and going red or blue in the face. I also included patients with less than three weeks of paroxysms but strong alternative evidence such as a positive *bordetella* culture or a family member with clear symptomatic whooping cough.

Information recorded included vomiting, whooping, apnoea, maximum number of paroxysms in 24 hours, known contacts, culture results, immunisation, attendance at school or play group, complications, drug treatment, age, date of onset, age and immunisation status of siblings, and whether siblings were affected. Duration was recorded as accurately as possible in a disease with no clear end point. Parnasal swabs were taken whenever possible. They were often not taken, however, as the procedure is unpleasant and rendered useless by some antibiotics.

The χ^2 test was used to analyse categorical data and the *t* test for parametric data.

Results

The nature and duration of the cough alone was sufficiently distinctive for diagnosis in about 95% of cases. At about two weeks into the illness the cough was almost exclusively paroxysmal, with no coughing between episodes of severe paroxysm. Frequency of paroxysms varied from every 15 minutes to 12 hours. The diagnosis could be suspected at an earlier stage if other symptoms such as vomiting, whooping, and apnoea were present and there was a known source of infection, but sore throat, catarrhal symptoms (present in only about a third of patients), and sticky sputum were unhelpful.

Keyworth Health Centre,
Keyworth, Nottingham
NG12 5JU
Douglas Jenkinson, *general
practitioner*

BMJ 1995;310:299-302

The disease seemed to have three phases. In the first phase, which lasted 3 to 14 days, an unremarkable dry cough became paroxysmal. The second phase was characterised by paroxysms, in which the patient made repeated expiratory coughing efforts without pausing for inspiration, so that each successive burst became shorter as the breath available diminished until there was no more. The face went red and the body went tense, then often was still for a variable time, with occasional cyanosis. This was followed by a sudden inspiration, sometimes stridulant: the whoop. Several such cycles usually occurred together and lasted minutes, sometimes ending with or including vomiting. Patients able to describe the apnoea sensation said it felt as if they had "forgotten how to breathe." This phase lasted at least two weeks. In the third phase the paroxysms gradually became less frequent.

The infrequency of paroxysms even in the severe phase (mean 13.5 a day) meant that a doctor was unlikely to hear one. Most parents had no idea what a whoop was but recognised it when it was imitated. Six adults recalled having whooping cough in childhood, and one 3 year old in the study got it again at 13.

Many children had only three or four paroxysms a day, mostly at night. Their parents had not suspected whooping cough, and there were probably other cases which remained undetected. There were 24 patients whose paroxysms lasted less than three weeks but were considered to have clinical pertussis. Sixteen of these had positive swab cultures. The remainder had convincing symptoms for under three weeks and close contact with the disease.

TABLE I—No of cases and annual incidence of whooping cough in Keyworth and national incidence figures

	Keyworth		England and Wales
	No of cases	Cases/100 000	(cases/100 000)
1977	163	1417	35
1978	59	513	134
1979	13	113	62
1980	3	43	42
1981	40	347	39
1982	22	191	132
1983	3	26	38
1984	0	0	11
1985	55	473	44
1986	40	347	72
1987	40	347	30
1988	1	8	10
1989	17	147	22
1990	30	260	30
1991	8	69	10
1992	4	34	4.6

TABLE II—Incidence of whooping cough by age and sex, 1977-92

Age (years)	Males	Females	Total
0	8	7	15
1	15	20	35
2	22	21	43
3	28	58	86
4	31	28	59
5	27	26	53
6	24	27	51
7	16	14	30
8	10	7	17
9	5	16	21
10	3	10	13
11	7	3	10
12	1	1	2
13	0	5	5
14	1	2	3
15	2	1	3
16	2	0	2
17	1	1	2
18	0	0	0
19	0	0	0
20-30	3	6	9
30-40	6	17	23
40-50	6	8	14
50-60	1	1	2
≥60	0	2	2

DISTRIBUTION AND SYMPTOMS

Five hundred cases of whooping cough were diagnosed between 1977 and 1992, with almost half occurring in the first three years. Table I shows the number of cases, annual incidence in the practice, and the notification rates in England and Wales. The ratio of practice incidence to the notification rate for the years 1977-92 was about 6 to 1 (4347 per 100 000 to 717 per 100 000).

Table II shows the age and sex distribution of the cases. The peak incidence was in 3 year olds, but there was another small peak in those in their 30s. Of the 500, 219 (44%) were male and 281 (56%) female. Of 50 adults affected, 16 (32%) were men and 34 (68%) women.

The duration of paroxysmal coughing was recorded in 351 cases. Mean duration was 51.7 days (range 2 to 164; 95% confidence interval 46 to 57). The duration correlated indirectly with age ($r = -0.11$, $P = 0.04$; 95% confidence interval -0.006 to -0.21) and directly with the number of paroxysms a day (170 patients, $r = 0.27$, $P = 0.0004$; 0.12 to 0.40). The number of paroxysms a day was known for 186 patients and ranged from 2 to 100 (mean 13.5; 95% confidence interval 11.5-15.4).

A total of 284 (57%) patients vomited after some paroxysms, 242 (49%) whooped at some stage, and 57 (11%) stopped breathing long enough to cause anxiety or go blue; 51 of those who stopped breathing also whooped. The pattern in adults was similar to that overall, with 22 (44%) vomiting, 23 (50%) whooping, and 6 (12%) developing cyanosis. Compared with males, females vomited more (174 (62%) v 112 (51%), $P = 0.02$), whooped more (149 (53%) v 96 (44%), $P = 0.05$) and had more frequent paroxysms (data on 186; $15.1/day$ v $11.5/day$, $P = 0.04$; 95% confidence interval for difference 0.2 to 6.9).

One hundred and eighty two of the patients had been immunised, 277 had not, and no immunisation data were available for 41. Those who had been immunised experienced fewer symptoms: 89 (49%) v 179 (65%) vomited ($P = 0.001$), 70 (39%) v 155 (56%) whooped ($P = 0.0002$), and 14 (8%) v 41 (15%) had apnoea

($P = 0.02$). The mean duration was 55 days in unimmunised patients and 49 days in immunised patients (data on 351: $P = 0.05$; 95% confidence interval -0.17 to 12.4). The mean number of paroxysms a day was 15 in unimmunised patients and 11 in immunised patients (data on 186: $P = 0.02$; 95% confidence interval 0.7 to 7.5).

Culture information was obtained for 239 patients. One hundred were positive for *B pertussis* and two for *B parapertussis* (43%). The immunisation status was known for 218 of the 239 patients: 63 of 122 unimmunised patients had positive cultures (52%) compared with 24 of 96 (25%) immunised ($\chi^2 = 15.9$, $df = 1$; $P = 0.0001$).

The pattern of spread was usually traceable from case to case in the early stages of an outbreak. Schools were the main centres of clustering. The figure shows the probable pattern of spread at the start of an outbreak in 1985. Thirty adults acquired infection from their children.

Systematic upset was uncommon and usually confined to infants or toddlers, in whom feeding would precipitate a paroxysm. The greatest distress was often suffered by parents who, when dealing with a child with severe paroxysms, experienced weeks of sleepless nights.

Five children developed pneumonia but all fully recovered. Four of these children were aged 5-7 and three were immunised. The fifth child was 5 weeks old and presented with pneumonia. Swabs subsequently grew *B pertussis*. She required hospital admission. Two other children were admitted to hospital, one after a two minute apnoea attack and another with poor home circumstances. Otitis media was seen but not specifically recorded. I did not see a subconjunctival haemorrhage caused by whooping cough or any similar traumatic phenomenon.

Although many asthmatic patients got whooping cough, it did not seem to exacerbate asthma. Indeed, during and after whooping cough asthma was less troublesome and often remained so for many months.

Discussion

This study gives a general practice perspective of the natural course of whooping cough at a time when the consequences of a fall and rise in immunisation became clear. It has the advantage of being by a single observer in a stable and discrete practice, although it was too small to measure rare events such as convulsions and death. The overall impression was of a disease much less severe than suggested by textbook descriptions or parents' fears.

OTHER STUDIES

Most population based studies of whooping cough have relied on notified cases either exclusively or as a basis for further case finding, and they show widely differing results. Vesselinova-Jenkins *et al* found that 8.3% developed pneumonia, 7% had convulsions, and 22% were admitted to hospital.³ A study based on notified cases in a similar area found a much lower rate of complications and a hospital admission rate of 2.8%,⁴ while another study of 8000 notified cases showed a hospital admission rate of 10%.⁵ Grob *et al* looked at cases diagnosed clinically by 68 general practitioners and found a pattern similar to that in this study, observing, "The classical picture of whooping cough as typified by a moderately ill child with paroxysmal cough and characteristic whoop was not often encountered."⁶

The range of severity in this study, from two paroxysms a day to a critically ill 5 week old baby with pneumonia, is consistent with standard accounts of this disease,¹ but the relatively mild course of most

cases with a mean of 13.5 paroxysms a day, half of patients never whooping, and less than 1% with significant complications is not. The differences are probably due to the fact that case finding was by consulting room diagnosis, and possibly that most patients came from higher social classes.

IDENTIFYING WHOOPING COUGH

The only reliable distinguishing characteristic of whooping cough was the exclusively paroxysmal cough. This, however, was rarely observed by a doctor, so the initial diagnosis was usually made on history alone and could be easily missed without a high index of suspicion. Staff sometimes heard the characteristic cough in the waiting room and diagnosed it. Similarly, experienced parents pointed out the possible diagnosis to other parents.

If my practice was typical, the incidence of whooping cough was about six times greater than the national notification rate during the study period. This suggests that most cases of whooping cough that occur are either not notified or not recognised, other previous work indicates that cases are probably not being notified.⁷

DISTRIBUTION

The disease was most common in 3 year olds, with a small peak in those in their 30s. This reflected the age of parents of children with whooping cough. Most were surprised when told they also had it, believing it to be a childhood condition. Six adults had a childhood history of the disease.

The duration of coughing illustrates the variability of the condition. The mean duration was 52 days, but the range was 2 to 164. The duration of coughing correlated with decreasing age in line with the disease being more serious in the young. The duration of illness correlated with the frequency of paroxysms, although duration of coughing, frequency, vomiting, or whooping did not seem related to severity in individual cases. On the other hand, apnoea and the duration of individual paroxysms did. In many of the most distressing cases the patient had infrequent severe paroxysms whereas in some of the least distressing paroxysms were frequent but short.

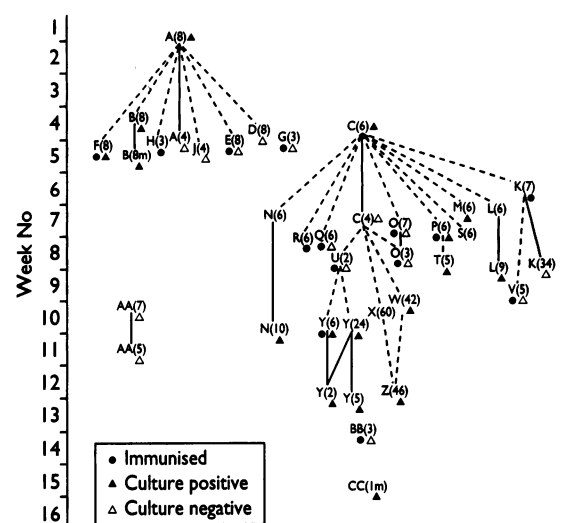
The sex ratio of patients is consistent with previous findings that females are more susceptible, and in adults twice as many females were affected, possibly reflecting more contact with children. Adults displayed similar symptoms to children, although a different clinical picture has been reported by some.¹⁸ Females also had more vomiting, whooping, and paroxysms.

PROTECTING THE VULNERABLE

The effects of immunisation on prevention in this population have been reported,^{2,9} but if prevention fails this study confirms that the disease is less severe in those who have been immunised. Isolation of bordetella was also less common in immunised patients, suggesting that immunised children are less infectious.

This finding provides evidence that herd immunity plays a part in the efficacy of pertussis vaccine.

Plotting routes of spread from case to case is a helpful way of strengthening clinical diagnosis.¹⁰ The example shown in the figure demonstrates the highly infectious nature of the disease, with two patients probably infecting many others. The unconnected cases suggest the existence of subclinical or missed cases.



Connections between all cases of whooping cough occurring between July and October 1985. Lines show presumed routes of transmission; solid for family contact, broken for other. Each family is represented by a letter (A to Z) then two letters (AA, BB, etc) and ages in brackets

Most of the adults and parents did not think that they or their children were particularly ill. They did not suspect whooping cough, and often took considerable persuading of the diagnosis. Many cases were detected while searching for the source of another patient's infection. Those identified in this way often said that they would never have considered going to a doctor since, although the cough was severe, it was infrequent. These cases would normally have been overlooked.

If whooping cough is commonly a mild disease and likely to be missed, what are the implications for clinical practice? If whooping cough were perceived as a less severe disease it might have an adverse effect on immunisation uptake. Since early diagnosis is difficult, and neither isolation nor treatment with antibiotics is sufficiently effective, it is important to emphasise the vaccine's major role in maintaining herd immunity. Information for professionals and the public should give a more balanced view of the natural course of whooping cough, recognising the high prevalence of mild cases as well as the continued seriousness for infants.¹¹ Parents of children with the disease or in contact with it should be reassured that serious illness with complications is unlikely, but education should ensure that parents understand that a high immunisation rate is the only practical means of reducing damage and deaths in those too young to be immunised.

I thank Drs Manson Russell, Rowan Stevenson, Erl Annesley, Clive Ledger, Andrew Wood, and Andy Watson for their help and support; Gwen Burgess and Jackie Pepper for help with case finding and follow up; and Dr Ian Johnston for criticism of the manuscript.

1 Christie AB. Whooping cough. In: *Infectious diseases: epidemiology and practice*. Edinburgh: Churchill Livingstone, 1980:726-58.
 2 Jenkinson D. Outbreak of whooping cough in general practice. *BMJ* 1978;iii:577.
 3 Vesselinova-Jenkins CK, Newcombe RG, Gray OP, Skone JF, Howells CHL, Lennox M, et al. The effects of immunisation upon the natural history of pertussis. A family study in the Cardiff area. *J Epidemiol Community Health* 1978;32:194-9.

Key messages

- Whooping cough is widely thought of as a serious disease
- In this study of 500 cases, most were mild and half the patients did not whoop
- An exclusively paroxysmal cough is the most reliable diagnostic indicator
- Low frequency of such coughs means that the diagnosis may be missed without a high index of suspicion
- Herd immunity must be maintained by immunisation programmes in order to protect those too young to be immunised

- 4 Royal College of General Practitioners. Report from the Swansea research unit. *BMJ* 1981;282:23-6.
- 5 Miller C, Fletcher WB. Severity of notified whooping cough. *BMJ* 1976;iii:117-9.
- 6 Grob PR, Crowder MJ, Robbins JF. Effect of vaccination on severity and dissemination of whooping cough. *BMJ* 1981;282:1925-8.
- 7 Jenkinson D. Whooping cough: what proportion of cases is notified in an epidemic? *BMJ* 1983;287:185-6.
- 8 Marcovitch H. Recognising whooping cough. *BMJ* 1986;292:360-1.

- 9 Jenkinson D. Duration of effectiveness of pertussis vaccine: evidence from a ten year community study. *BMJ* 1988;296:612-4.
- 10 Kendrick PL, Eldering G. Study in active immunization against pertussis. *Am J Hyg* 1939;29:133-53.
- 11 Miller E, Vurdien JE, White JM. The epidemiology of pertussis in England and Wales. *Communicable Disease Report* 1992;2:152-4.

(Accepted 25 November 1994)

Drug users' views on general practitioners

Charles Hindler, Irwin Nazareth, Michael King, John Cohen, Roger Farmer, Clare Gerada

See Personal View on p 337

Academic Department of Psychiatry, Royal Free Hospital, London NW3 2QG

Charles Hindler, research fellow
Michael King, reader

Department of Primary Care, University College London Medical School, Whittington Hospital, London N19 5NF

Irwin Nazareth, lecturer
John Cohen, senior lecturer

St George's Hospital Medical School, London SW17 0RE

Roger Farmer, senior lecturer in psychiatry

Hurley Clinic, London SE11 4HJ

Clare Gerada, general practitioner

Correspondence to: Dr Hindler.

BMJ 1995;310:302

General practice is a key resource in the treatment of drug misuse.¹ The relationship between drug users and general practitioners is unsatisfactory, and a change in attitude is needed to encourage drug users to seek treatment in primary care.² One study found that most drug users preferred their general practitioner to prescribe maintenance drugs for them, although general practitioners' negative attitudes and lack of interest in drug users' problems were common complaints.³ In a later study drug users perceived general practitioners to be accessible but unsympathetic and lacking in knowledge.⁴ We report drug users' views on primary health care. This study formed part of a larger survey of the primary medical care received by drug users.

Subjects, methods, and results

One of us (CH) interviewed drug users attending a private drug clinic, a community drug team, a drug dependency unit, and a street agency. The interview was piloted before final modification. The semi-structured format covered demography, users' views about general practitioners and history of drug use. We used content analysis to categorise answers to open ended questions as positive, negative, or neutral.

One hundred and forty five (92%) of the 157 users approached agreed to be interviewed. They had a mean age of 33 years (SD 6.6) and were predominantly male (114), British born (133), single (86), living in local authority accommodation (93), and unemployed (105). One hundred and thirty eight users had a history of opioid use. The mean duration of use of illicit drugs was 18 years. One hundred and twenty three users were registered with their general practitioner (113 permanently, 10 temporarily). No significant dif-

ferences were found demographically between subjects attending the four centres.

When asked which services they wanted from general practitioners, most drug users preferred detoxification programmes, maintenance prescriptions, general medical care, and counselling (table). Services suggested by smaller numbers of drug users were a greater role in preventive medicine through the provision of needles, syringes, and condoms and education on the medical problems resulting from drug use. Some users felt that general practitioners should change their attitudes to drug use and should regard dependency on drugs as a medical disorder. Others believed that more widespread prescribing of maintenance drugs by general practitioners would lead to a decline in the market of illicit drugs, which would consequently reduce the level of crime.

Respondents preferred general practitioners' services to outpatient drug dependency services for prescriptions for maintenance and detoxification (table). Content analyses of a range of views (159) on this issue revealed that 23 respondents found it difficult to travel to hospital drug services, preferring the closer proximity of their general practice. Fifty two respondents said that general practitioners established a better rapport with drugs users, and 12 claimed that general practitioners provided a more holistic approach to their problems. On the subject of hospital based services 19 respondents regarded them as inflexible, 14 complained that their waiting lists were too long, eight found them impersonal, and seven thought that they were stigmatising. Eight drug users commented, however, that they preferred to attend a hospital for treatment, regarding its service as specialist.

Most users preferred a negotiable approach to an agreed contract for reducing methadone (table). When asked to consider what a general practitioner might reasonably do when a patient breaks a contract, 119 users thought that the doctor should allow up to three relapses before regarding a detoxification programme as a failure.

Comment

Drug users expressed an overwhelming preference for detoxification or maintenance prescribing to be undertaken in general practice. They perceived primary care services to be more accessible and responsive to their needs than hospital based services. These views lend further support to the central role of the general practitioner in the management of drug misuse, with important implications for the training of general practitioners.

We thank the Stapleford Centre, the Angel Project, the RESPONSE Community Drug Team, and the Royal London Hospital's drug dependence unit for their help in this study. We especially thank Katrina Walker for her secretarial help. CH was supported by a grant from the Mental Health Foundation.

- 1 Advisory Council on the Misuse of Drugs. *Report. Aids and drug misuse update*. London: Department of Health, 1993:16-8.
- 2 Richards T. Drug addicts and the general practitioner. *BMJ* 1988;296:1082.
- 3 Bennett T, Wright R. Opioid users' attitudes towards use of NHS clinics, general practitioners and private doctors. *British Journal of Addiction* 1986;81:757-63.
- 4 Telfer I, Clulow G. Heroin misusers: what they think of their general practitioners. *British Journal of Addiction* 1990;85:137-40.

(Accepted 1 November 1994)

Summary of main results of interviews with 145 drug users about their expectations of general practitioners

	No of respondents		No of respondents
Should general practitioners prescribe maintenance drugs for users?		Drugs preferred by drug users:	
Yes	131	For maintenance*:	
No	14	Methadone mixture	62
General practice services regarded as useful by drug users*:		Benzodiazepines	44
Detoxification programme	135	Heroin ampoules	40
Prescription of maintenance drugs	126	Methadone ampoules	29
Regular general medical care	125	Non-general practice services used in past month*:	
Counselling service	119	Community drug team	52
Are general practices preferred to hospitals for detoxification and prescription of maintenance drugs?		Private doctor	51
Yes	121	Drug dependency unit	47
No	24	Needle exchange	41
Drugs preferred by drug users:		Accident and emergency or outpatient department of a hospital	7
For detoxification and reduction*:		Family planning, antenatal, or child clinic	2
Methadone mixture	71	Preferred approach for reducing methadone:	
Benzodiazepines	64	Contract	25
Heroin ampoules	27	Flexible	120
Methadone ampoules	19		

*Respondents were allowed to give more than one reply.