

EUVAC – NET

Pertussis surveillance

Final report

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Index

Introduction	4
Methods	4
Data sources	4
Case definition	4
Definition of a minimal dataset	5
Creation of the EUVAC-NET database	5
Database structure (minimal dataset)	5
Operation of the EUVAC-NET database	7
Denominators used for the analysis by geopolitical units and year	8
Denominators used for the analysis by age-group and year	15
Country profiles	20
Austria	21
Denmark	24
France	32
Germany	40
Greece	47
Iceland	51
Ireland	56
Italy	61
Malta	68
The Netherlands	71
Norway	79
Portugal	87
Spain	92
Sweden	97
Switzerland	102
UK	110
General comments and recommendations	115
Comments	115
Recommedations	118

Introduction

The EUVAC-NET project, for the part relevant to pertussis, aimed to collect information to describe the epidemiology of pertussis in different EU countries and to better assess the burden of disease in adolescents and adults. Secondary objectives were to collect information on vaccine coverage and methods for estimating these figures and favouring the establishment of a collection of *Bordetella pertussis* strains in each EU country from cases of pertussis in order to allow a microbiological surveillance of circulating strains.

This report describes the findings of a five year surveillance period, discusses the data, and proposes recommendations for surveillance of pertussis in the EU.

Methods

A project coordinator and a pertussis coordinator were appointed at the SSI in Denmark and ISS in Italy respectively, and each of the central surveillance institutions in the participating countries has appointed one contact person to EUVAC-NET, the so-called gatekeeper. The gatekeepers functioned as communication nodes for the network and were familiar with their national surveillance systems, vaccination programmes, and methods used for estimation of vaccination coverage. Communication between the coordinators and gatekeepers was done mainly through email and annual or focused meetings with stakeholders (i.e. gatekeepers and other national representatives as well as members of related organisations and projects working within the same field).

Data sources

For the scope of this project routine surveillance systems were considered suitable for feeding the EUVAC-NET database. In some countries sentinel systems (or systems focused on particular age groups) are in place and were used as a data source for EUVAC-NET. There was no preclusion to use data from sentinel systems, provided they are based on defined denominators. It was proposed that, whenever possible, every participating country provided individual records of cases. When local surveillance systems were able to provide aggregated data only, they will be used instead.

Case definition

Either the case definition suggested in the "WHO Recommended Surveillance Standards, 1999" or any other case definition routinely used in national surveillance systems was accepted.

Definition of a minimal dataset

The definition of a minimal data set of pertinent variables common to most countries was defined as a way to initiate common EU data-base. To inquire about the type of information routinely recorded in national pertussis surveillance systems, an 18 item questionnaire was mailed out to contacts in the participating countries.

Information was requested on the following subjects.

Surveillance methods:

- type of reporting;
- case definition;
- type of laboratory tests used for case confirmation.

Information recorded for cases of pertussis:

- personal information;
- clinical characteristics and disease outcome; and
- vaccination status.

Information regarding country specific policies and regulations:

- vaccination schedule;
- type of vaccine used;
- methods used for estimation of vaccination coverage.

All questionnaires were returned during the last trimester of 2000.

The results of the questionnaire survey reflected national surveillance systems and control strategies for pertussis as of late 2000. They also highlighted changes that have occurred since the publication of a report describing pertussis vaccination practices in Europe in late 1999.

Creation of the EUVAC-NET database

The EUVAC-NET database was designed for case based data with the possibility of entering aggregate data from some countries until individual reporting systems were established. The EUVAC-NET prototype database was compatible with the WHO EURO Computerized Information System for Infectious Diseases (CISID) and a close collaboration was established with the joint aims of avoiding double reporting and minimising the workload for participating countries. The exchange of know-how and experience with WHO EURO has been beneficial in the process of establishing this new surveillance network. The collaboration was in accordance with the approved agreement between the WHO and the EU to strengthen and intensify cooperation in the development of methods for surveillance, strengthening communicable disease surveillance, and improving responses.

Database structure (minimal dataset)

The structure of the dataset was agreed among gatekeepers. This structure was used for the analysis of data. The database structure is illustrated in the next page.

Table 1 – Minimal dataset used for the collection of pertussis data

Data	Code in Excel/Access	Subject/comment	Field type
EUVAC IDENTIFIER	2 letter ISO 3166 code + YYYY+ consecutive no.	e.g DK199800001 Unique number	Text
DATE OF ENTRY IN EUVAC	DDMMYYYY	in EUVAC database	Date field
NATIONAL IDENTIFIER	Country's own		Text
DATE OF NOTIFICATION	DDMMYYYY 08-08-8000= no data 09-09-9000= unknown	or data entry in country	Date field
GEOPOLITICAL UNIT	WHO CISID code 8= no data	Subnational units Code list available	Text
DATE OF BIRTH	DDMMYYYY 08-08-8000= no data 09-09-9000= unknown	If DD missing = use 15 th . If age only= use July 1 (= mid-year)	Date field
GENDER	1= male, 2= female, 8= no data 9= unknown		Number (byte)
DATE DISEASE ONSET	DDMMYYYY 08-08-8000= no data 09-09-9000= unknown	WHO definition If no date, use date of specimen collection (# 16)	Date field
DIAGNOSE CLASSIFICATION (CONFIRMED)	1= Laboratory 2= Clinically 3= epidemiol. link. 4= confirmed without specification 7= discarded 8= no data 9= unknown	WHO If 7 then discard the case from database	Number (byte)
PATIENT HOSPITALISED	1= yes 2= no 8= no data 9= unknown		Number (byte)
DISEASE OUTCOME	1= death 2= alive 8= no data 9= unknown		Number (byte)

HAS RECEIVED PERTUSSIS VACCINATION	1= yes 2= no 8= no data 9= unknown		Number (byte)
NUMBER OF PERTUSSIS VACCINES RECEIVED	1= 1 2= 2 3= 3 4= >3 5= fully vaccinated acc. to age and country programme, number of vaccines received unknown 7= 0 8= no data 9= unknown		Number (byte)

Operation of the EUVAC-NET database

The final target of the program was to obtain data from single countries quarterly with a timely updated database. However it was necessary to take into account the performance of each individual system and wait for a practical test to judge the feasibility of this periodicity. In practice gatekeeper were asked to provide national data at least every year to the coordinating group of EUVAC-NET.

Denominators used for the analysis, by Geopolitical units and year

Austria: not available

Denmark

Regions	1998	1999	2000	2001	2002
Århus Amt	631.586	634.435	637.122	640.637	644.666
Bornholm	44.786	44.529	44.337	44.126	44.197
Frederiksberg	89.507	90.227	90.327	91.076	91.322
Frederiksborg Amt	359.839	363.098	365.306	368.116	370.555
Fyns Amt	471.873	471.732	471.974	472.064	472.504
København	487.969	491.082	495.699	499.148	500.531
Københavns Amt	610.261	612.053	613.444	615.115	617.336
Nordjyllands Amt	493.114	493.816	494.153	494.833	495.548
Ribe Amt	223.818	224.348	224.345	224.446	224.444
Ringkøbing Amt	271.978	272.644	272.857	273.517	274.385
Roskilde Amt	228.202	229.794	231.559	233.212	234.820
Sønderjyllands Amt	253.836	253.771	253.482	253.249	253.166
Storstrøms Amt	258.295	258.761	259.106	259.691	260.498
Vejle Amt	344.507	346.182	347.542	349.186	351.328
Vestsjællands Amt	292.146	293.709	295.086	296.875	298.731
Viborg Amt	233.143	233.396	233.681	233.921	234.323

France: not available

Germany

Regions	1998	1999	2000	2001	2002
Brandenburg	2.590.375	2.601.207	2.601.962	2.593.040	2.582.379
MecklenburgVorpommern	1.798.689	1.789.322	1.775.703	1.759.877	1.744.624
Sachsen	4.489.415	4.459.686	4.425.581	4.384.192	4.349.059
Sachsen-Anhalt	2.674.490	2.648.737	2.615.375	2.580.626	2.548.911
Thüringen	2.462.836	2.449.082	2.431.255	2.411.387	2.392.040

Greece

Regions	1998	1999	2000	2001	2002
Anatoliki Makedonia Thraki	587.606	588.960	590.017	590.768	591.204
Attiki	3.629.083	3.637.446	3.643.976	3.648.612	3.651.303
Dytiki Ellada	728.909	730.589	731.900	732.831	733.372
Dytiki Makedonia	301.803	302.498	303.041	303.427	303.650
Ionia Nisia	199.545	200.005	200.364	200.619	200.767
Ipeiros	349.916	350.723	351.352	351.799	352.059
Kentriki Makedonia	1.760.231	1.764.287	1.767.455	1.769.703	1.771.008
Kriti	557.280	558.564	559.567	560.279	560.692
Notio Agaio	265.205	265.816	266.293	266.632	266.829
Peloponnisos	625.645	627.086	628.212	629.011	629.475
Stereia Ellada	599.287	600.668	601.746	602.512	602.956
Thessalia	756.881	758.625	759.987	760.954	761.515
Voreio Aigaio	205.208	205.681	206.050	206.312	206.464

Iceland: not available

Ireland

Regions	1998	1999	2000	2001	2002
Eastern Health Board	1.330.010	1.344.798	1.359.195	1.372.906	1.386.047
Midland Health Board	210.946	213.291	215.575	217.750	219.834
Mid Western Health Board	325.406	329.024	332.547	335.901	339.116
North Eastern Health Board	314.204	317.698	321.099	324.338	327.442
North Western Health Board	216.417	218.823	221.166	223.397	225.535
South Eastern Health Board	401.812	406.280	410.630	414.772	418.742
Southern Health Board	561.013	567.251	573.324	579.107	584.650
Western Health Board	361.616	365.636	369.551	373.279	376.851

Italy

Regions	1998	1999	2000	2001	2002
Abruzzo	1.274.789	1.275.311	1.275.300	1.274.705	1.273.514
Basilicata	609.728	609.977	609.972	609.688	609.118
Calabria	2.068.960	2.069.807	2.069.789	2.068.824	2.066.891
Campania	5.791.207	5.793.580	5.793.528	5.790.827	5.785.417
Emilia Romagna	3.943.227	3.944.843	3.944.807	3.942.968	3.939.285
Friuli Venezia Giulia	1.183.491	1.183.975	1.183.965	1.183.413	1.182.307
Lazio	5.237.562	5.239.708	5.239.661	5.237.218	5.232.326
Liguria	1.640.225	1.640.897	1.640.883	1.640.118	1.638.586
Lombardia	8.980.126	8.983.805	8.983.724	8.979.536	8.971.148
Marche	1.449.455	1.450.049	1.450.036	1.449.360	1.448.006
Molise	329.572	329.707	329.704	329.550	329.242
Piemonte	4.287.226	4.288.983	4.288.944	4.286.945	4.282.940
Puglia	4.086.055	4.087.729	4.087.692	4.085.787	4.081.970
Sardegna	1.659.797	1.660.477	1.660.462	1.659.688	1.658.137
Sicilia	5.103.053	5.105.144	5.105.098	5.102.718	5.097.951
Toscana	3.523.842	3.525.286	3.525.254	3.523.611	3.520.319

Trentino Alto Adige	923.474	923.852	923.844	923.413	922.550
Umbria	830.899	831.239	831.232	830.844	830.068
V. d'Aosta	119.495	119.544	119.543	119.487	119.376
Veneto	4.464.773	4.466.602	4.466.562	4.464.480	4.460.309

Malta: not available

Netherlands

Regions	1998	1999	2000	2001	2002
Dreuthe	260.709	261.964	263.138	264.229	265.234
Flevoland	296.842	298.270	299.607	300.850	301.993
Friesland	648.626	651.748	654.669	657.384	659.883
Gelderland	1.989.097	1.998.669	2.007.629	2.015.955	2.023.619
Groningen	588.600	591.433	594.084	596.548	598.816
Limburg	1.181.261	1.186.946	1.192.267	1.197.211	1.201.762
Noord-Brabant	2.116.115	2.126.298	2.135.830	2.144.688	2.152.841
Noord-Holland	2.609.884	2.622.444	2.634.200	2.645.124	2.655.180
Overijssed	1.115.710	1.121.079	1.126.105	1.130.775	1.135.074
Utrecht	1.138.367	1.143.845	1.148.973	1.153.738	1.158.124
Zeeland	340.746	342.385	343.920	345.346	346.659
Zuid-Holland	3.431.355	3.447.868	3.463.324	3.477.687	3.490.908

Norway

Regions	1998	1999	2000	2001	2002
Akershus	445.423	447.555	449.573	451.466	453.232
Aust-Agder	101.616	102.102	102.562	102.994	103.397
Buskerud	234.036	235.156	236.216	237.211	238.139
Finnmark	75.220	75.579	75.920	76.240	76.538
Hedmark	186.972	187.867	188.714	189.508	190.250
Hordaland	430.885	432.946	434.899	436.730	438.438
Moere og Romsdal	243.077	244.241	245.342	246.375	247.339

Nordland	240.380	241.530	242.619	243.641	244.594
Nord-Troendelag	127.369	127.978	128.556	129.097	129.602
Oestfold	244.702	245.873	246.982	248.022	248.992
Oppland	182.997	183.873	184.702	185.479	186.205
Oslo	501.986	504.388	506.662	508.795	510.786
Rogaland	365.995	367.746	369.404	370.960	372.411
Soer-Troendelag	260.366	261.611	262.791	263.898	264.930
Sogn og Fjordane	108.282	108.800	109.290	109.751	110.180
Telemark	164.608	165.396	166.142	166.841	167.494
Troms	150.974	151.697	152.381	153.022	153.621
Vest-Agder	153.253	153.986	154.681	155.332	155.940
Vestfold	209.642	210.645	211.595	212.486	213.317

Portugal

Regions	1998	1999	2000	2001	2002
Acores	244.175	244.699	245.187	245.620	245.997
Alentejo	515.664	516.772	517.802	518.717	519.512
Algarve	347.967	348.715	349.410	350.028	350.564
Lisboa e Vale do Tejo	3.325.491	3.332.635	3.339.277	3.345.181	3.350.308
Madeira	259.710	260.268	260.787	261.248	261.648
Portugal Norte	3.567.859	3.575.524	3.582.650	3.588.984	3.594.485
Potugal Centro	1.713.291	1.716.972	1.720.393	1.723.435	1.726.077

Spain

Regions	1998	1999	2000	2001
Andalucia	7,270,870	7,275,565	7,278,809	7,280,705
Aragón	1,193,453	1,194,224	1,194,756	1,195,067
Asturias	1,093,297	1,094,003	1,094,491	1,094,776
Cantabria	530,060	530,403	530,639	530,777
Castilla La Mancha	1,721,049	1,722,160	1,722,928	1,723,377

Castilla y León	2,520,974	2,522,602	2,523,726	2,524,384
Cataluna	6,120,343	6,124,294	6,127,025	6,128,621
Ceuta	69,136	69,180	69,211	69,229
Comunidad De La Rioja	266,259	266,431	266,550	266,619
Comunidad de Madrid	5,047,274	5,050,533	5,052,785	5,054,101
Comunidad De Murcia	1,102,703	1,103,415	1,103,907	1,104,195
Comunidad De Navarra	523,161	523,499	523,732	523,868
Comunidad Valenciana	4,029,273	4,031,875	4,033,673	4,034,723
Extremadura	1,075,571	1,076,265	1,076,745	1,077,026
Galicia	2,756,268	2,758,048	2,759,277	2,759,996
Islas Baleares	764,164	764,657	764,998	765,197
Islas Canarias	1,614,525	1,615,568	1,616,288	1,616,709
Melilla	59,870	59,908	59,935	59,951
Pais Vasco	2,108,494	2,109,856	2,110,796	2,111,346

Sweden: not available

Switzerland

Regions	1998	1999	2000	2001	2002
Aargau	54.558	54.570	54.570	54.564	54.547
Basel	244.024	244.080	244.079	244.052	243.975
Basel-City	232.291	232.345	232.344	232.318	232.245
Bern	948.213	948.431	948.428	948.323	948.025
Fribourg	39.127	39.136	39.136	39.132	39.119
Geneva	308.701	308.772	308.771	308.737	308.640
Glarus	37.612	37.621	37.621	37.617	37.605
Graubunden	74.493	74.510	74.510	74.502	74.478
Jura	614.350	614.492	614.490	614.422	614.229
Lucerne	346.410	346.490	346.489	346.451	346.342
Neuchatel	227.691	227.744	227.743	227.718	227.646
Nidwalden	32.154	32.161	32.161	32.157	32.147
Schaffhausen	195.022	195.067	195.066	195.044	194.983
Schwyz	126.426	126.455	126.455	126.441	126.401
Solothurn	96.065	96.087	96.087	96.076	96.046
St.Gallen	257.904	257.964	257.963	257.934	257.853
Thurgau	15.042	15.045	15.045	15.043	15.039
Ticino	448.400	448.503	448.502	448.452	448.312
Uri	36.133	36.141	36.141	36.137	36.126
Valais	539.468	539.593	539.591	539.531	539.362
Vaud	187.423	187.467	187.466	187.445	187.386
Zurich	1.193.652	1.193.926	1.193.923	1.193.791	1.193.416

UK: not available

Denominators used for the analysis, by age-group and year

Population are derived from CISID web-site or from gatekeepers when not available on-line.

Austria: not available

Denmark

	POPULATION				
age group	1998	1999	2000	2001	2002
<1	67.642	66.205	66.302	67.090	65.470
<2	68.130	67.983	66.603	66.726	67.562
tot	135.772	134.188	132.905	133.816	133.032

France: not available

Germany

	POPULATION				
age group	1998	1999	2000	2001	2002
< 1	93.606	96.978	100.901	97.771	96.204
1-4	331.264	352.084	370.342	382.990	388.359
5-14	1.560.744	1.441.309	1.322.010	1.212.482	1.108.392
> 14	12.030.191	12.057.663	12.056.623	12.035.879	12.024.058
tot	14.015.805	13.948.034	13.849.876	13.729.122	13.617.013

Greece: not available

Iceland

	POPULATION				
age group	1998	1999	2000	2001	2002
< 1	4.000	4.000	4.000	4.000	4.000
1-4	17.833	17.362	16.926	16.543	16.198
5-14	43.559	43.875	44.101	44.230	44.267
> 14	209.349	211.836	214.264	216.610	218.899
tot	274.741	277.073	279.291	281.383	283.364

Ireland

	POPULATION				
age group	1998	1999	2000	2001	2002
< 1	52.000	53.000	55.000	56.000	58.000
1-4	204.777	206.803	209.049	213.438	217.775
5-14	579.017	566.546	555.653	546.522	539.266
> 14	2.885.629	2.936.453	2.983.383	3.025.490	3.063.176
tot	3.721.423	3.762.802	3.803.085	3.841.450	3.878.217

Italy

	POPULATION				
age group	1998	1999	2000	2001	2002
< 1	521.000	516.000	511.000	505.000	499.000
1-4	2.165.271	2.136.550	2.109.270	2.085.391	2.062.224
5-14	5.675.813	5.632.415	5.595.613	5.563.993	5.533.576
> 14	49.144.872	49.245.553	49.314.115	49.348.797	49.354.660
tot	57.506.956	57.530.518	57.529.998	57.503.181	57.449.460

Malta: not available

Netherlands

	POPULATION				
age group	1998	1999	2000	2001	2002
< 1	187.000	183.000	180.000	176.000	172.000
1-4	778.215	768.958	757.131	745.043	731.751
5-14	1.929.421	1.949.292	1.964.673	1.974.810	1.979.400
> 14	12.822.674	12.891.699	12.961.943	13.033.683	13.106.942
tot	15.717.310	15.792.949	15.863.747	15.929.536	15.990.093

Norway

	POPULATION				
age group	1998	1999	2000	2001	2002
< 1	58.000	57.000	55.000	54.000	52.000
1-4	240.848	237.453	234.300	229.475	225.034
5-14	576.068	585.598	593.519	599.539	603.564
> 14	3.552.865	3.568.917	3.586.211	3.604.834	3.624.806
tot	4.427.781	4.448.968	4.469.030	4.487.848	4.505.404

Portugal

	POPULATION				
age group	1998	1999	2000	2001	2002
< 1	112.000	112.000	112.000	112.000	112.000
1-4	449.524	449.091	448.915	449.025	448.839
5-14	1.132.431	1.119.047	1.110.777	1.107.698	1.109.373
> 14	8.280.202	8.315.447	8.343.813	8.364.490	8.378.379
tot	9.974.157	9.995.585	10.015.505	10.033.213	10.048.591

Spain

	POPULATION				
age group	1998	1999	2000	2001	2002
< 1	362.000	359.000	358.000	358.000	356.000
1-4	1.510.700	1.481.601	1.458.219	1.442.842	1.435.901
5-14	4.245.243	4.144.700	4.057.940	3.985.338	3.926.556
> 14	33.748.802	33.907.185	34.036.115	34.134.488	34.205.131
tot	39.866.745	39.892.486	39.910.274	39.920.668	39.923.588

Sweden

	POPULATION				
age group	1998	1999	2000	2001	2002
< 1	86.000	82.000	79.000	76.000	74.000
1-4	421.280	389.320	361.189	339.447	322.263
5-14	1.146.794	1.163.030	1.168.378	1.161.743	1.144.036
> 14	7.203.218	7.216.050	7.233.527	7.256.135	7.282.975
tot	8.857.292	8.850.400	8.842.094	8.833.325	8.823.274

Switzerland

	POPULATION				
age group	1998	1999	2000	2001	2002
< 1	73.000	71.000	68.000	66.000	63.000
1-4	317.616	307.352	297.781	287.185	277.561
5-14	825.556	828.365	828.427	825.611	819.817
> 14	5.952.605	5.963.710	5.976.199	5.990.815	6.006.983
tot	7.168.777	7.170.427	7.170.407	7.169.611	7.167.361

UK

	POPULATION				
age group	1998	1999	2000	2001	2002
< 1	702.000	687.000	672.000	657.000	642.000
1-4	2.968.706	2.910.563	2.850.411	2.789.749	2,729,134
5-14	7.710.040	7.741.630	7.749.797	7.732.535	7.690.409
> 14	47.746.542	47.937.270	48.142.435	48.362.375	48.595.559
tot	59.127.288	59.276.463	59.414.643	59.541.659	59,657,102

COUNTRY PROFILES

Country Profile -----AUSTRIA

Pertussis case notifications, 1998-2002

Type of data:	Aggregated
Type of notification system:	Universal, statutory
Denominator:	general population
Minimum requirement for case notification	laboratory confirmation
Recommended case definition:	a person with a cough lasting at least 2 weeks with at least one of the following: paroxysm of coughing, inspiratory "whooping", post-tussive vomiting, without other apparent cause and laboratory confirmation. (WHO)
Laboratory procedure for case confirmation:	Serology
Other surveillance systems in place	No
Current vaccination schedule:	3, 4, 5 months; 12-24 months, 6-7 years; 14-15 years
Type of vaccine used:	Acellular
Year of introduction of acellular vaccine:	1998
Number of components of the vaccine:	2

Quality of data received from the gatekeeper

Data provided for the period: 1998-2002. The completed figures were available for the period 1998-2002.

Information not recorded among those of the minimum dataset: The data are available in a aggregate format. Only the number of cases in each year was recorded. The other variables, among those of the minimal dataset, were not available.

Epidemiology

Total number of reported cases: 736

Male/female ratio: not calculated

Incidence

Table 1 - Incidence of reported pertussis cases by year

Year	Number of cases	Incidence rate (per 100.000)	Laboratory confirmation
1998	113	1,4	not calculated
1999	103	1,3	not calculated
2000	117	1,4	not calculated
2001	253	3,1	not calculated
2002	157	1,8	not calculated

The incidence rate was low during the whole period. The highest rate was observed in 2001. Information on laboratory confirmation of cases was not available.

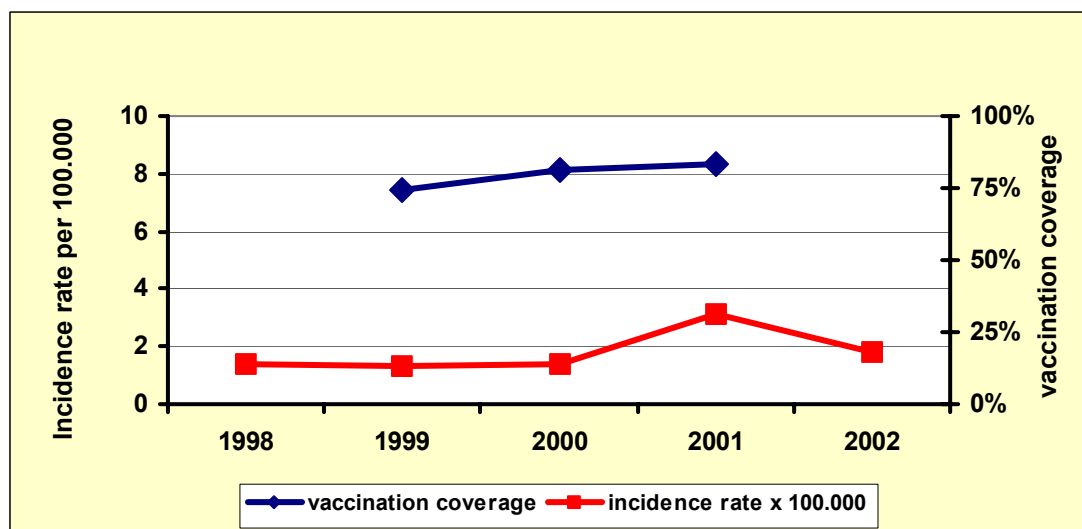


Figure 1 - Pertussis incidence rate by year and vaccination coverage

Vaccine coverage was available only from 1999 to 2001 and it slightly increased with time. Apparently the peak in notification observed in 2001 was not related to a fall in immunisation of the population.

Incidence of reported pertussis cases by year and age-group: not calculated.

Vaccination status by age-group: not calculated

Incidence by sub-national area: not calculated

Seasonality: not calculated

Case-fatality rate: not calculated

Case-fatality rate < 1 year: not calculated

Specific mortality rate < 1 year: not calculated

Hospitalisation rate: not calculated

Comments and interpretations

The lack of information on all variables, among those of the minimal dataset, allows only the description of the overall incidence rate by year. Based on these information Austria can be considered a low incidence country.

Country Profile -----DENMARK

Pertussis case notifications, 1998-2002

Type of data:	Case based
Type of notification system:	Universal, statutory
Denominator:	Population under 2 years of age
Minimum requirement for case notification	laboratory confirmation
Recommended case definition:	a person with a cough lasting at least 2 weeks with at least one of the following: paroxysm of coughing, inspiratory "whooping", post-tussive vomiting, without other apparent cause and laboratory confirmation (WHO)
Laboratory procedure for case confirmation:	Culture, PCR (1998-)
Other surveillance systems in place	No
Current vaccination schedule:	3,5,12 months
Type of vaccine used:	Acellular
Year of introduction of acellular vaccine:	1997
Number of components of the vaccine:	1

Quality of data received from the gatekeeper

Data provided for the period: 1998-2002. The completed figures were available for the period 1998-2002. In Denmark pertussis is a notifiable disease only in children aged less than two years. Therefore, the data shown in this Report are not representative for the population as whole.

Information not recorded among those of the minimum dataset: none.

Missing data: Disease outcome in 34% of records in 1999, the range in the other years is 0,3-3%; Date of last pertussis vaccine received in 35% of records in 2000, the range in the other years is 1-5%; Has received pertussis vaccination in 0,5-3% of records.

Table 1 - Summary of available information and completeness by year, number of cases (%)

Year	1998	1999	2000	2001	2002
Number of records	124 (100)	182(100)	166 (100)	196 (100)	329 (100)
Date of notification	124 (100)	182 (100)	166 (100)	196 (100)	329 (100)
Who cisid code	124 (100)	182 (100)	166 (100)	196 (100)	329 (100)
Date of birth	124 (100)	182 (100)	166 (100)	196 (100)	329 (100)
Gender	124(100)	182(100)	166 (100)	196 (100)	329 (100)
Date of disease onset	124 (100)	182(100)	166 (100)	196 (100)	329 (100)
Diagnose classification	124 (100)	182 (100)	166 (100)	196 (100)	329 (100)
Hospitalization	124 (100)	182 (100)	166 (100)	196 (100)	329 (100)
Disease outcome	120 (96,77)	121 (66,48)	165 (99,40)	196 (100)	328 (99,70)
Has received pertussis vaccination?	120 (96,77)	177 (97,25)	165 (99,40)	195 (99,49)	324 (98,48)
Number of p.v. received	49 (100)	92 (100)	89 (100)	94 (100)	199 (100)
Date of last p.v. received	47 (95,92)	88 (95,65)	58 (65,17)	89 (94,68)	197 (98,99)
Age	124 (100)	182 (100)	166 (100)	196 (100)	329 (100)

Inconsistencies: two cases (0,2%) have an inconsistent date of notification

Reporting delay: the median of notification delay was 33 days (IQR 21-48)

Epidemiology

Total number of reported cases: 997

Male/female ratio: 0.86

Incidence

Table 2 - Incidence of reported pertussis cases by year

Year	Number of cases	Incidence rate (per 100.000)	Laboratory confirmation
1998	124	91,3	100%
1999	182	135,6	100%
2000	166	124,9	100%
2001	196	146,5	100%
2002	329	247,3	100%

The incidence of whooping cough increased considerably from 1998 to 2002. The highest figures were observed in 2002. All cases were laboratory confirmed.

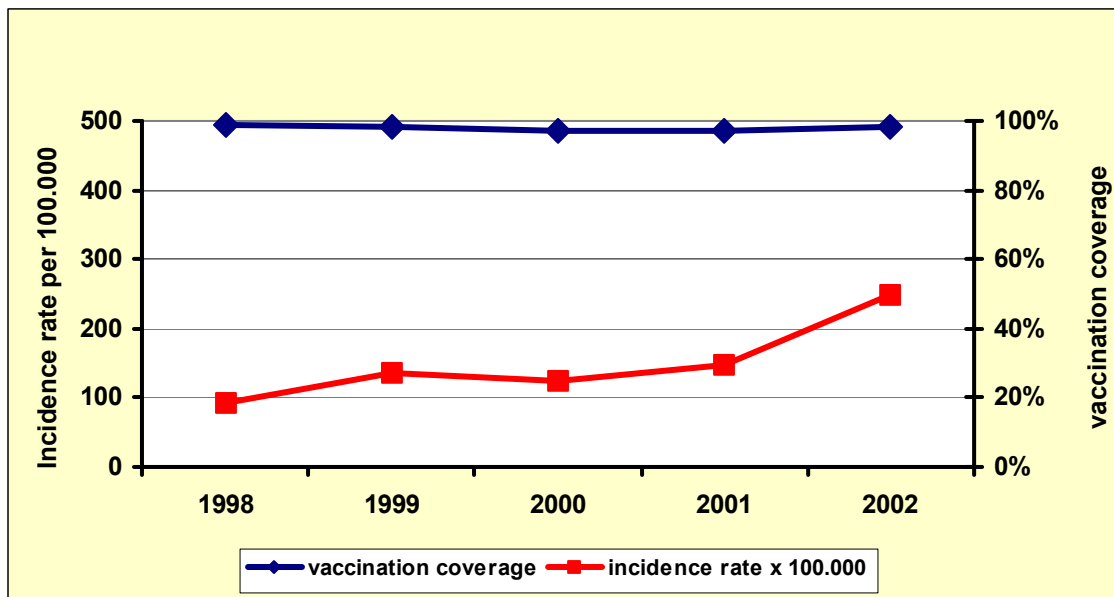


Figure 1 - Pertussis incidence rate by year and vaccination coverage

The observed increasing trend in incidence did not correspond to any apparent decrease in vaccination coverage; indeed vaccination coverage was always above 97%.

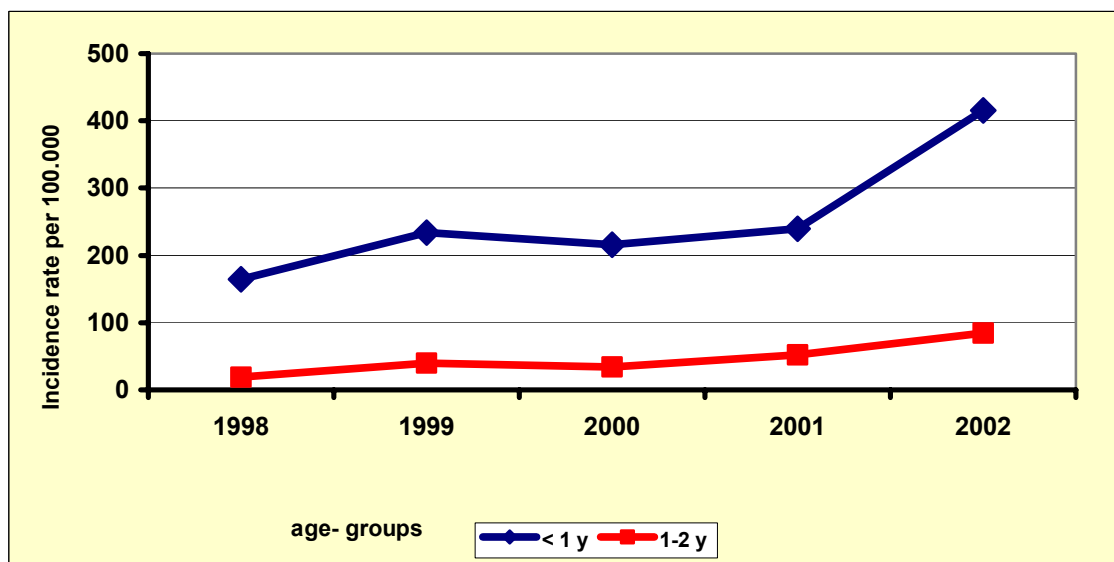


Figure 2 – Pertussis incidence rate by year and age-group

Among infants aged less than 1 year, the incidence rate increased from 1998 to 1999 and levelled off until 2001; in 2002 it increased sharply again. Infants aged ³ 1 year, even though showed a lower incidence rate, experienced a slightly increase through the 5 years period. Infants aged £ 12 months accounted for 23 % of cases (lowest 18% - highest 29%). Children aged > 12 months experienced the lowest number of cases (15%; lowest 7% - highest 17%), showing a modest increase during the five years period.

Table 3 - Vaccination status by age-groups and year

Age groups	Year	1998	1999	2000	2001	2002
<1	CASES	107	150	142	160	268
	% VACCINATED	35,5%	46, 7%	48, 6%	40,6%	55,2%
	% UNVACCINATED	64,5%	53,3%	51,4%	59, 4%	44, 8%
<2	CASES	13	27	23	35	56
	% VACCINATED	84,6%	81, 5%	87,0%	82, 9%	91,1%
	% UNVACCINATED	15, 4%	18,5%	13,0%	17,1%	8,9%
Total	CASES	120	177	165	195	324
	% VACCINATED	40,8%	52,0%	54,0%	48,2%	61,4%
	% UNVACCINATED	59,2%	48,0%	46,0%	51, 8%	38, 6%

Throughout the 5 years period, half of cases occurred among unvaccinated subjects. The proportion of vaccinated cases among infants < 1 year increased over time, ranging from 35% in 1998 to 55% in 2002. In children aged ³ 1 year, the proportion of vaccinated cases was above 80% during the whole period and was stable over time.

Incidence by sub-national area

Table 4 - Incidence rate (cases per 100.000) by year and region

Region	1998	1999	2000	2001	2002
Århus Amt	134,0	129,7	155,7	249,9	249,6
Bornholm	106,5	0,00	0,00	0,00	123,6
Frederiksberg	42,2	163,0	155,6	111,9	145,8
Frederiksborg Amt	84,2	136,7	107,4	162,3	302,,0
Fyns Amt	111,5	168,0	53,9	141,2	298,4
København	166,5	159,5	51,6	155,7	207,5
Københavns Amt	77,7	104,0	59,7	145,3	126,12
Nordjyllands Amt	65,7	150,2	187,4	154,6	121,9
Ribe Amt	83,4	85,5	52,2	103,5	249,0
Ringkøbing Amt	27,7	206,0	211,2	169,8	477,3
Roskilde Amt	81,2	115,1	50,2	83,0	271, 9
Sønderjyllands Amt	15,9	31,5	32,8	16,5	118, 7
Storstrøms Amt	55,5	74,6	222,8	202,7	224,0
Vejle Amt	140,1	111,8	212,8	100,1	234, 6
Vestsjællands Amt	71,1	189,9	159,3	116,2	335, 2
Viborg Amt	33,6	207,1	293,1	103,8	551,6

There was a marked difference in incidence rates between and within regions. The majority of regions showed an increase in incidence in 1999 compare with 1998. Bornholm did not record cases during the period 1999-2001. The highest incidence was observed in Viborg Amt in 2002. In most of the regions the highest incidence rate was notified in 2002.

Seasonality:

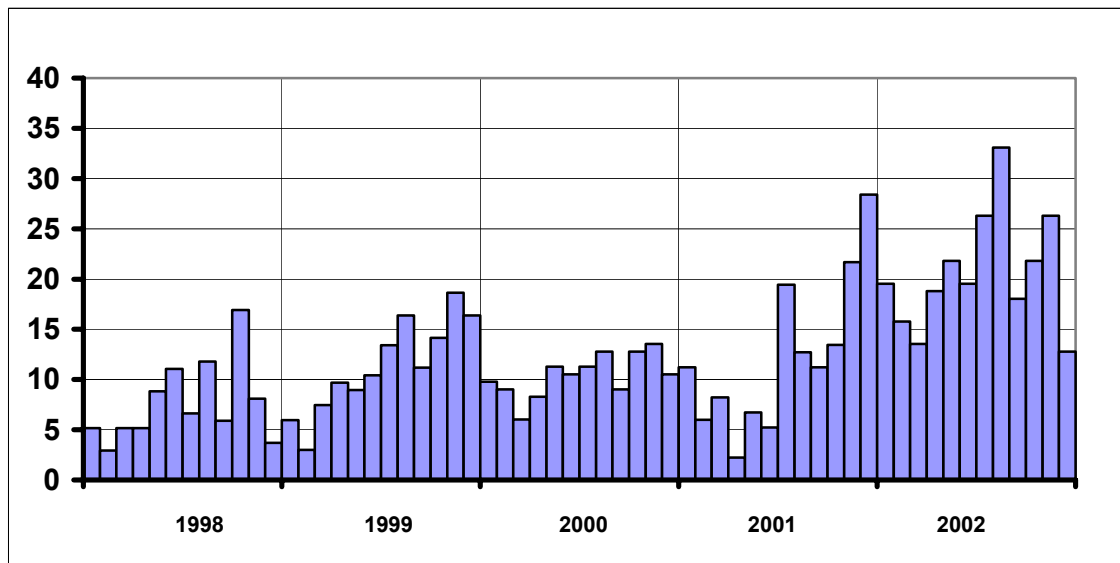


Figure 3 – Pertussis incidence rate by date of onset

The incidence rate by month of onset showed a periodic seasonality in October- November during the 1998-2000 period. In 2001 as well as in 2002, a peak in notification was recorded also in summer.

Case-fatality rate: 1,06 per 1000. One death was recorded, in an infant aged less than 3 months, in 1999.

Case-fatality rate < 1 year: 1,25 per 1000

Specific mortality rate < 1 year: 3/1.000.000.

Hospitalisation rate:

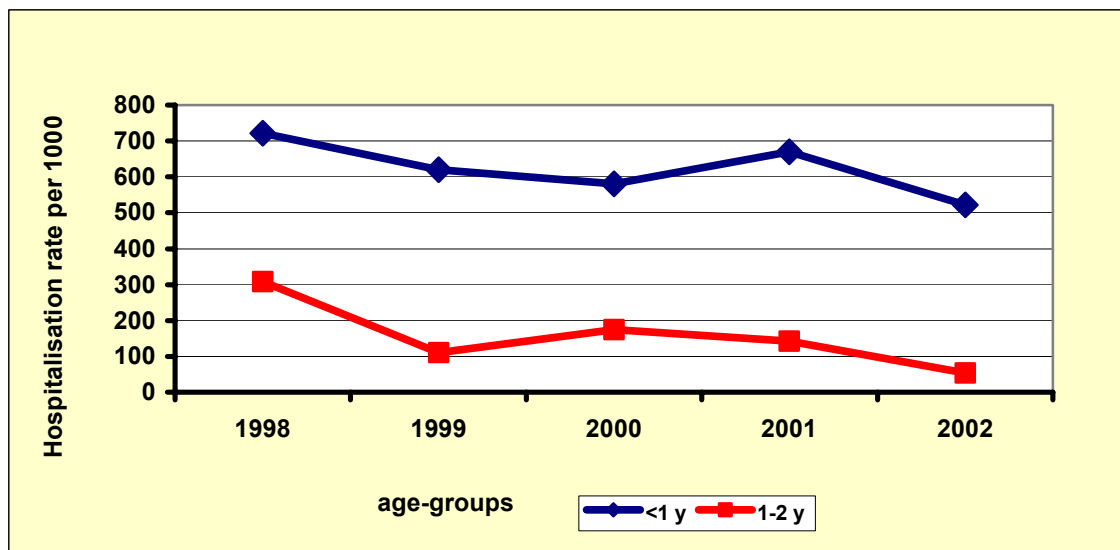


Figure 4 - Hospitalization rate by year and age-group

The annual hospitalization rate, even though was fairly high throughout the whole period, showed a considerable decline with time, ranging from 677 per 1000 in 1998 to 441 per 1000 in 2002. Infants below 1 year of age were more likely to be hospitalised than children above 1 year of age.

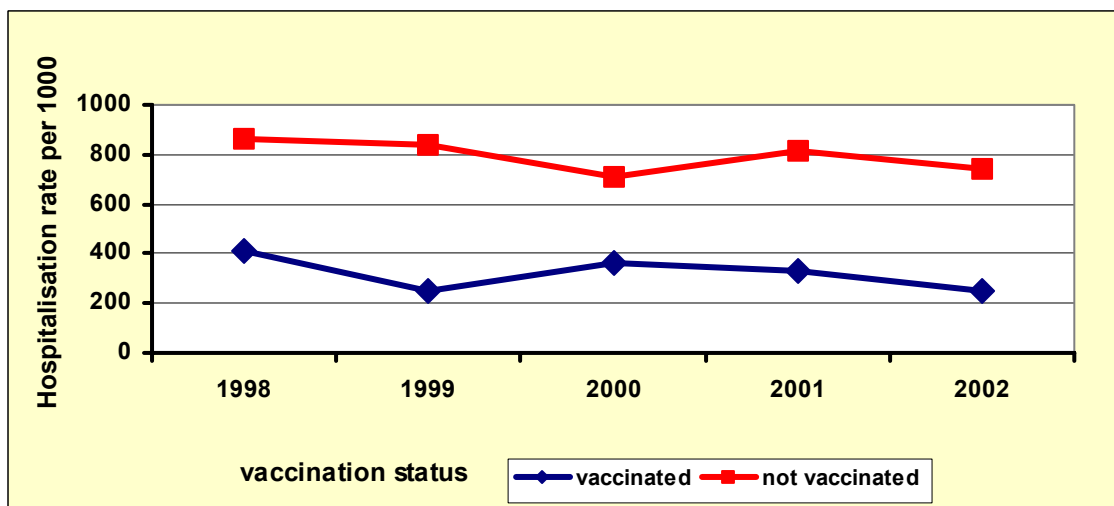


Figure 5 - Hospitalization rate by year and vaccination status

Unvaccinated children were more likely to be hospitalised than vaccinated ones.

The hospitalisation rate in vaccinated children aged < 1 years ranged from 286 per 1000/per year in 1999 to 415 per 1000/per year in 2001, while that in unvaccinated individuals was much higher, ranging from 740 per 1000/per year in 2000, to 887 per 1000/per year in 1999.

Comments and interpretations

As mentioned above, in Denmark pertussis is a notifiable disease only in children aged less than two years. Therefore, the real burden of the disease cannot be estimated on the basis of these findings. The information provided with the database were incomplete for disease outcome. The high proportion of missing information for that variable suggests caution in some interpretation of the analysis. Except for disease outcome, the database includes accurate information and only a few inconsistencies were found. Reporting delay was reasonably short and stable. The incidence rate was very high during the five years period, showing a significant peak in 2002. As PCR was increasingly used since 1998 the increase in 1999-2001 could be at least partly due to this more sensitive diagnostic method. Apparently, the peak in 2002 could be interpreted as an outbreak. The reasons for the high incidence rates observed remained to be investigated. This phenomenon seems not related to a decline in vaccine coverage which is stable over time. In addition, the percentage of cases among vaccinated individuals seems to increase with time. Infants below 1 year of age were the most affected age group. However, information on the incidence rate among older subjects is not available. Analysis of the annual incidence rate by region suggests that Ringkøbing Amt and Viborg Amt were likely to have had an outbreak in 2002. The case fatality rate was very low. Hospitalisation rate was remarkable in children below 1 year of age. This could reflect, however, also a possible selection bias towards severe cases in this age group. Vaccinated patients were less likely to be hospitalised suggesting that vaccine protects against severe disease.

Country Profile -----FRANCE

Pertussis case notifications, 1998-2001

Type of data:	Case based
Type of notification system:	Sentinel surveillance system (paediatric hospital network), voluntary
Denominator:	Not determined
Minimum requirement for case notification	Clinical symptoms and physician examination
Recommended case definition:	A person with a cough lasting at least 3 weeks with at least one of the following: paroxysm of coughing, inspiratory "whooping", post-tussive vomiting, without other apparent cause or typical cough lasting 1 week with laboratory confirmation or epidemiological link
Laboratory procedure for case confirmation:	Culture, Serology, PCR
Other surveillance systems in place	No
Current vaccination schedule:	2, 3, 4 months; 15-18 months; 11-13 years
Type of vaccine used:	Whole cell, acellular
Year of introduction of acellular vaccine:	1998
Number of components of the vaccine:	2 or 3

Quality of data received from the gatekeeper

Data provided for the period: 1998-2001. The completed figures were available for the period 1998-2001. Data for 2002 were not available.

Information not recorded among those of the minimum dataset: none

Missing data: The percentage of missing data was negligible for most variables. However date of notification was missing in 30% of cases (highest 47%– lowest 13%); hospitalisation in 28% (highest 45% – lowest 11%); disease outcome in 34% (highest 52,4% - lowest 18,2%); Vaccination status in 32% (highest 47% - lowest 17,5%); number of pertussis vaccine received in 6% (highest 13% - lowest 2%); date of last dose of vaccine in 36% (highest 89% - lowest 7%).

Table 1 - Summary of available information and completeness by year, number of cases (%)

Year	1998	1999	2000	2001
Number of records	297 (100)	407 (100)	645 (100)	347 (100)
Date of notification	259 (87,2)	322 (79,1)	398 (61,7)	184 (53)
Who cisid code	289 (97,3)	407 (100)	645 (100)	347 (100)
Date of birth	296 (99,7)	402 (98,8)	641 (99,4)	340 (98)
Gender	297 (100)	407 (100)	644 (99,8)	345 (99,4)
Date of disease onset	297 (100)	406 (99,8)	645 (100)	345 (99,4)
Diagnose classification	297 (100)	407 (100)	645 (100)	347 (100)
Hospitalization	263 (88,6)	329 (80,8)	406 (62,9)	192 (55,3)
Disease outcome	243 (81,8)	304 (74,7)	382 (59,2)	165 (47,6)
Has received pertussis vaccination?	245 (82,5)	317 (77,9)	383 (59,4)	184 (53)
Number of p.v. received	83 (96,5)	134 (97,8)	126 (94)	61 (87,1)
Date of last p.v. received	80 (93)	106 (77,4)	101 (75,4)	8 (11,4)
Age	296 (99,7)	402 (98,8)	641 (99,4)	340 (98)

Inconsistencies: none

Reporting delay: 75 days (IQR 30-188). Calculation was done on 68.3% of data.

Epidemiology

Total number of reported cases: 1696

Male/female ratio: 0.97

Incidence

Table 2 - Incidence of reported pertussis cases by year

Year	Number of cases	Incidence rate (per100.000)	Laboratory confirmation
1998	297	not calculated	66,3%
1999	407	not calculated	81,8%
2000	645	not calculated	91,3%
2001	347	not calculated	92,2%

The number of cases rose considerably from 1998 to 2000 and then it declined in 2001. The majority of cases (645, 38%) were notified in 2000. The number of laboratory confirmed cases increased significantly with time.

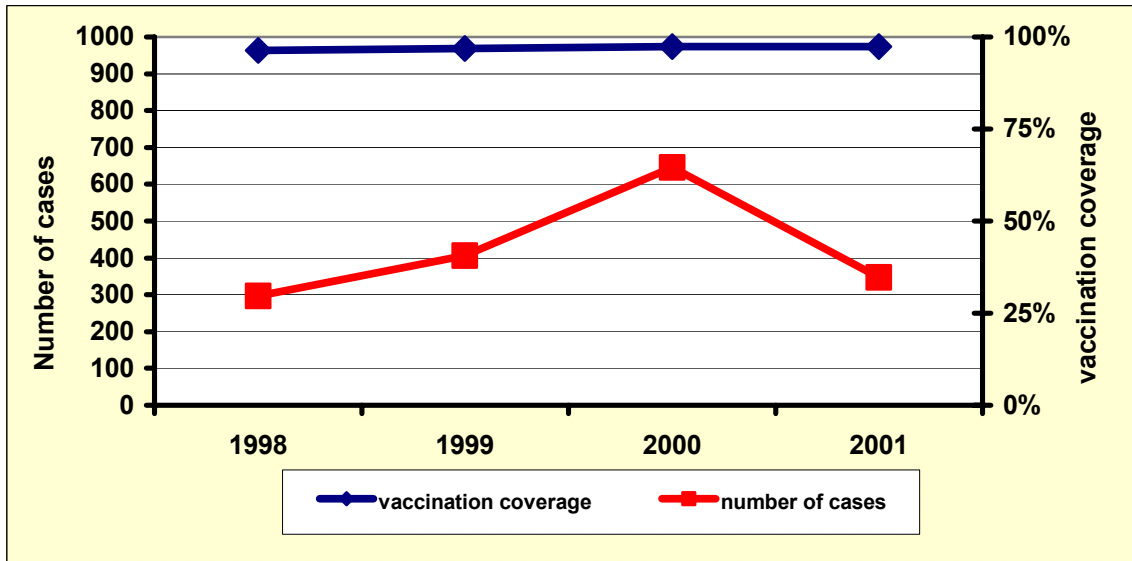


Figure 1 – Number of cases by year and vaccination coverage

The dataset provided does not allow calculating any incidence figure since denominators were not provided. The number of notified cases peaked in 2000 and vaccine coverage was always above 95%.

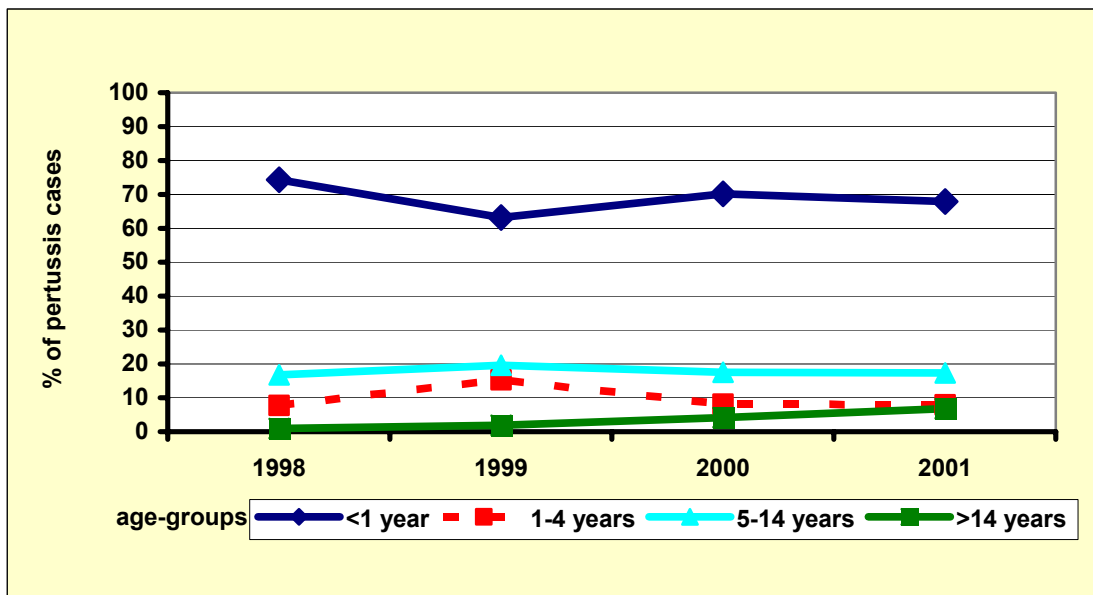


Figure 2 - Proportion of cases by year and age-group

The majority of cases was reported among infants < 1 year with 69% of cases (lowest 63% -highest 74%). Children aged 5-14 years accounted for 18% of cases (lowest 17% - highest 20%) while those in the 1-4 years group were 10% (lowest 8% - highest 15%). Persons > 14 years old

accounted for the lowest percentage of cases (4%; lowest 1% - highest 7%).

Vaccination status by age-group:

Table 3 - Vaccination status by age-groups and year

Age-groups	Year	1998	1999	2000	2001
<1	CASES	192	201	295	133
	% VACCINATED	27,0	28,3	22,4	26,3
	% UNVACCINATED	73,0	71,7	77,6	73,3
1-4	CASES	17	43	24	11
	% VACCINATED	64,7	60,4	66,6	54,5
	% UNVACCINATED	35,3	39,6	33,4	45,5
5-14	CASES	35	66	57	30
	% VACCINATED	62,8	75,7	84,2	80,0
	% UNVACCINATED	37,2	24,3	15,8	20,0
> 14	CASES	1	4	7	6
	% VACCINATED	100	0	42,8	66,6
	% UNVACCINATED.	0	100	57,2	33,4
Total	CASES	245	314	383	180
	% VACCINATED	35,1	43,6	34,9	38,3
	% UNVACCINATED	64,9	56,4	65,1	61,7

The overall proportion of vaccinated cases was low and did not increase with time. However this proportion was higher in the 1-4 year age group and in the 5-14 year age group.

Table 4 - Proportion of cases by year and region

Region	1998	1999	2000	2001
Alsace	6%	3%	3%	2%
Aquitaine	2%	1%	0%	1%
Auvergne	1%	2%	1%	2%
Basse Normandie	3%	2%	1%	1%
Bourgogne	1%	1%	0%	0%
Bretagne	4%	1%	2%	1%
Centre	2%	1%	1%	1%
Champ.Ardennes	0%	0%	1%	1%
Fr.Comte	1%	0%	1%	1%
Haute Normandie	1%	1%	1%	2%
Ile France	15%	14%	10%	13%
Languedoc Rousillon	2%	2%	0%	0%
Limousin	0%	0%	0%	0%
Lorraine	1%	1%	1%	0%
Midi Pyrennes	1%	0%	0%	0%
Nord Pas De Calais	3%	5%	5%	1%
Paca	4%	2%	0%	0%
Pays Loire	4%	7%	9%	7%
Picardie	4%	3%	4%	2%
Poitou Charente	1%	1%	1%	1%
Rhone Alpes	6%	8%	4%	4%

Ile de France reported the highest proportion of cases. The area Pays de la Loire ranked second in the proportion of notified cases. There was a marked variability in the proportion of notified cases for each geographical area.

Seasonality

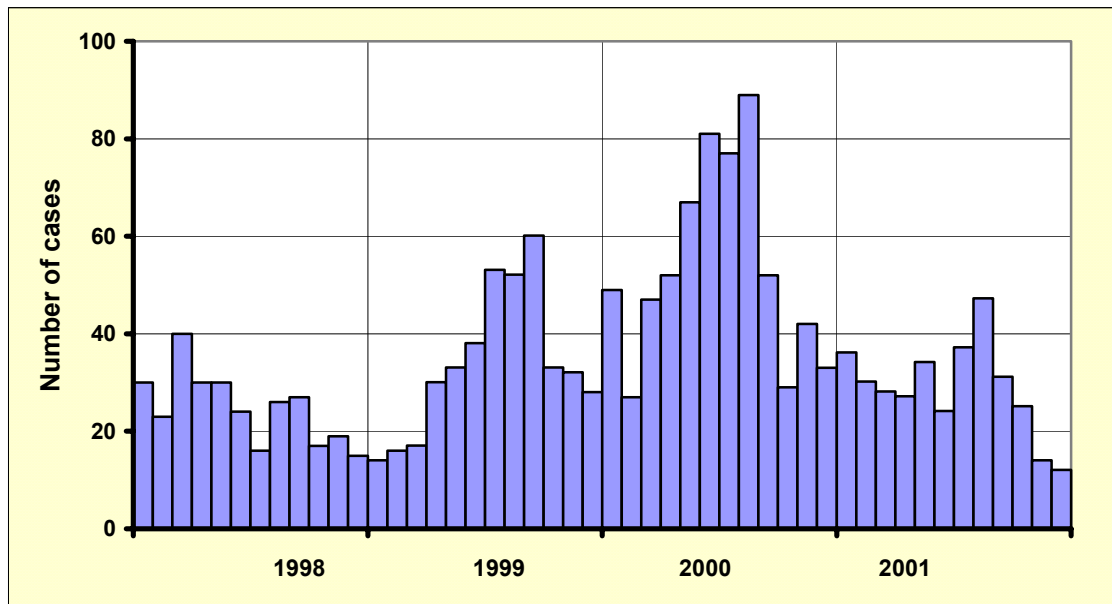


Figure 3 - Number of cases by date of onset

The number of cases by month showed a periodic seasonality in summer except in 1998 when the curve was flat.

Case-fatality rate: 14,7 per 1000.

Sixteen deaths were recorded during the four year period, the majority of them in 2000 (56,2%, 9/16). All of them were infants < 1 year of age. Eighty-one percent (13/16) were not immunized.

Case -fatality rate < 1 year: 20,4 per 1000

Specific mortality rate < 1 year: 5.5/1.000.000 during the entire period.

Hospitalisation rate

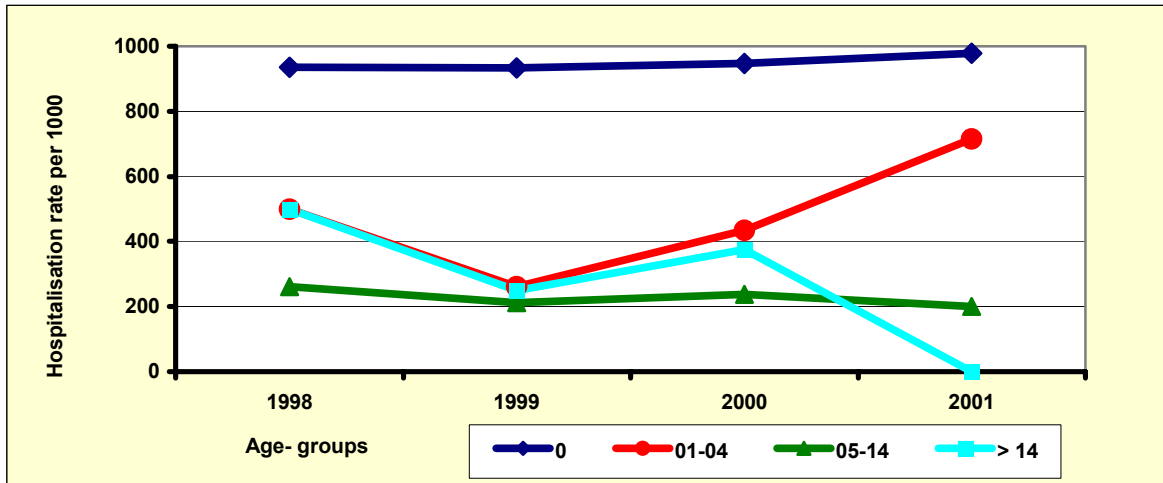


Figure 4 - Hospitalization rate by year and age-group

The hospitalisation rate was 762,1 per 1000 with an annual incidence which ranged from 683,8 in 1999 to 796,8 in 2001. The rate of hospitalised cases decreased with age. Indeed nearly 100% of infants below 1 year of age were hospitalised. Since 1999, an increase in the hospitalisation rate was observed among children aged 1 to 4 years while the hospitalisation rate among children aged >14 years decreased in 2001. Those aged 5 to 14 showed a rate low and constant over time compared with that of the other age-groups.

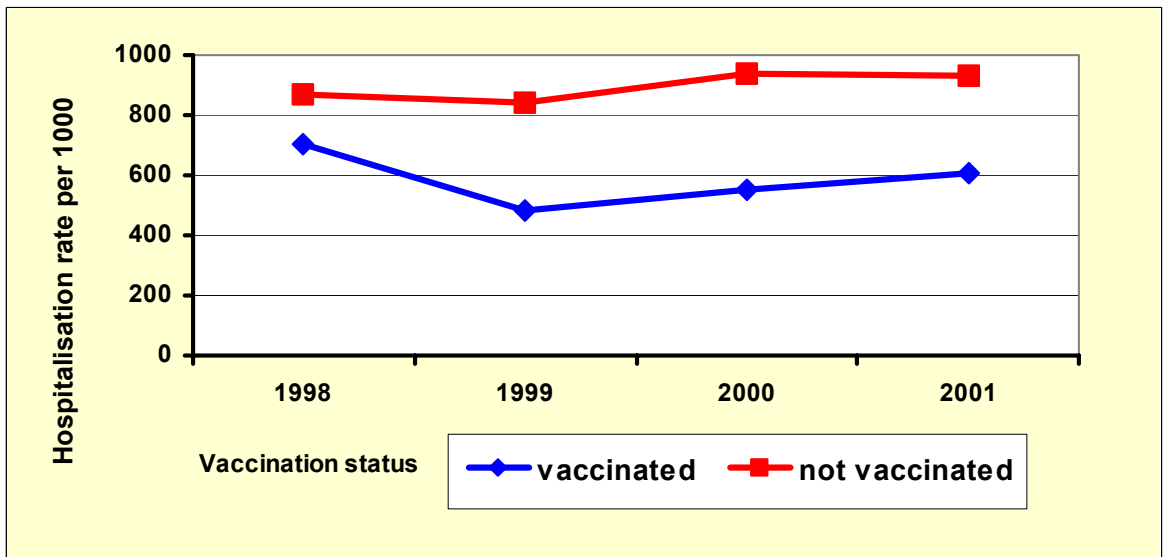


Figure 5 - Hospitalization rate by year and vaccination status

Vaccinated children were less likely to be hospitalised than unvaccinated ones.

Comments and Interpretation

The informations provided with the database were difficult to analyze since denominators were not provided. The surveillance system was based on a hospital network. Therefore all data must be interpreted taking into account the selection bias of this system. The number of cases peaked in 2000, but this observation was not associated to any decrease in vaccination coverage. The most represented group in this dataset was infants below one year of age. In fact nearly 70% of cases were in this age group. The highest number of cases was observed in Ile de France with a proportion above 20% after 1998. The case-fatality rate was high. This observation may reflect the selection toward most severe cases. The hospitalization rate was highest for infants below one year of age. Variations in hospitalization rates in persons 1-4 years and persons > 14 years diverged in 2001. This may be due to casual variations of rates associated with a low number of cases.

Country Profile -----GERMANY

Pertussis case notifications, 1998-2002

Type of data:	Case based, aggregated in 2001
Type of notification system:	Universal, statutory (FEG only)
Denominator:	General population (FEG only)
Minimum requirement for case notification	Clinical symptoms and physician examination
Recommended case definition:	A person with a cough lasting at least 2 weeks with at least one of the following: paroxysm of coughing, inspiratory "whooping", post-tussive vomiting, without other apparent cause (WHO)
Laboratory procedure for case confirmation:	Serology, Culture
Other surveillance systems in place	No
Current vaccination schedule:	2, 3, 4; 11-14 months; 10-17 years
Type of vaccine used:	Whole cell (-1998) Acellular
Year of introduction of acellular vaccine:	1995
Number of components of the vaccine:	3-5

Quality of data received from the gatekeeper

Data provided for the period:1998-2002. Data on 2001 are available in an aggregate format. Pertussis data provided to EUVAC.NET are obtained only from the statutory notification in place in Former East Germany (FEG), where reporting remained mandatory after reunification of the Country. Viceversa, in Former West Germany (FWG), Pertussis is still a non notifiable disease. Therefore, the data shown in this Report are not representative for the Country as a whole.

Information not recorded among those of the minimum dataset: Who cisid code in 2001, Date of notification in 2001, Date of birth in 2001, Date of disease onset in 2001, Diagnose classification in 2001, Gender in 2001; Date of disease onset in 2001; Diagnose classification in 2001; Hospitalisation in 1998-2001; Disease outcome in 1998-2001; Has received pertussis vaccination in 2001-2002; Number of pertussis vaccine received in 2001-2002; Date of last pertussis vaccine received in the entire period.

Missing data: Date of notification, Who cisid code, Date of birth, Gender, Number of pertussis vaccine received are missing in 23,5% of records in 2000; Date of disease onset is missing in 7,2% (0,3-24%) of records; Diagnose classification is missing 23,8% of records in 2000; has received pertussis vaccination is missing in 10,2% (0,4-25,6%) of records.

Table 1 - Summary of available information and completeness by year, number of cases (%)

Year	1998	1999	2000	2001	2002
Number of records	865 (100)	977 (100)	2851 (100)	1034	1318 (100)
Date of notification	865 (100)	977 (100)	2180 (76.5)	---	1318 (100)
Who cisid code	865 (100)	977 (100)	2180 (76.5)	---	1318 (100)
Date of birth	865 (100)	977 (100)	2180 (76.5)	---	1317 (99.9)
Gender	865 (100)	977 (100)	2180 (76.5)	---	1318 (100)
Date of disease onset	830 (96.0)	974 (99.7)	2168 (76,0)	---	1285 (97.5)
Diagnose classification	864 (99.9)	976 (99.9)	2172 (76.2)	---	1318 (100)
Hospitalization	0 (0)	0 (0)	0 (0)	---	1315 (99.8)
Disease outcome	0 (0)	0 (0)	0 (0)	---	1317 (99.9)
Has received pertussis vaccination?	857 (99.1)	963 (98.6)	2121 (74.4)	---	0 (0)
Number of p.v. received	301 (100)	366 (100)	935 (76.5)	---	0 (0)
Date of last p.v. received	0 (0)	0 (0)	0 (0)	---	0 (0)
Age	865 (100)	977 (100)	2180 (76.5)	---	1317 (99.9)

Inconsistencies: In 43 records (0,27%) date of disease onset precedes date of birth.

Date of birth is only given as month and year. It is always July 1st in 1998, 1999 and 2000, when Age in years was the originally submitted information leading to a rather rough estimation of the date of birth. In 2002 it is always 15th of each month due to submitted month and year of birth.

No inconsistent codes were found.

Reporting delay: not calculated.

Epidemiology

Total number of reported cases: 7045

Male/female ratio: not calculated

Incidence

Table 2 - Incidence of reported pertussis cases by year

Year	Number of cases	Incidence rate (per 100.000)	Laboratory confirmation
1998	865	6,2	98%
1999	977	7,0	98,2%
2000	2851	20,6	not calculated
2001	1034	7,5	not calculated
2002	1318	9,7	95%

The incidence rate was below 10 per 100.000 except in 2000 when a peak in notification was observed.

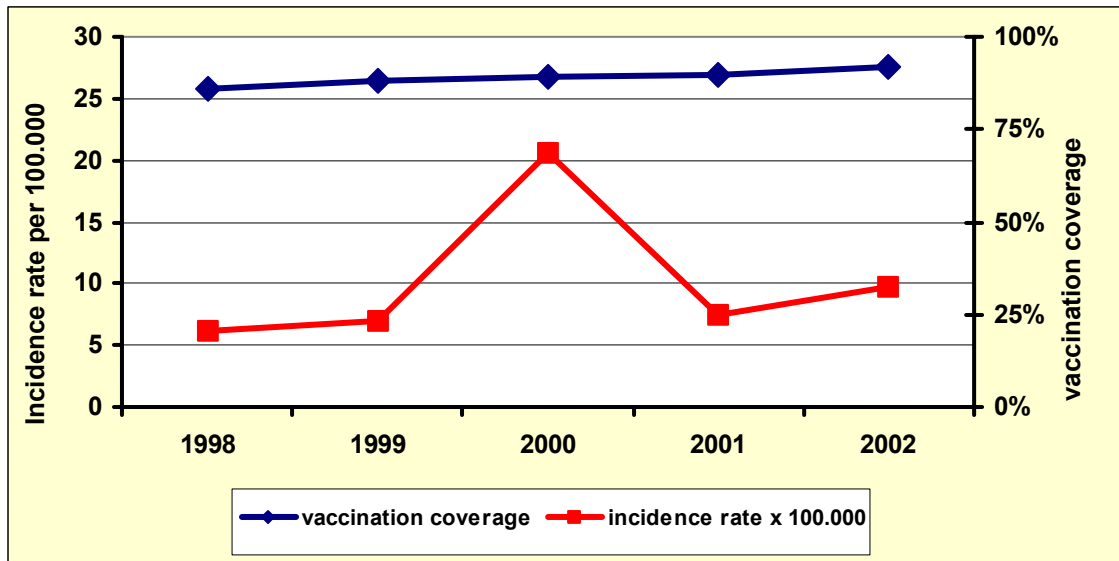


Figure 1 - Pertussis incidence rate by year and vaccination coverage (calculated at the school entry)

In 2000 was observed a peak in notification compare to the other years. Vaccination coverage increased with time going from 86% in 1998 to 92% in 2002.

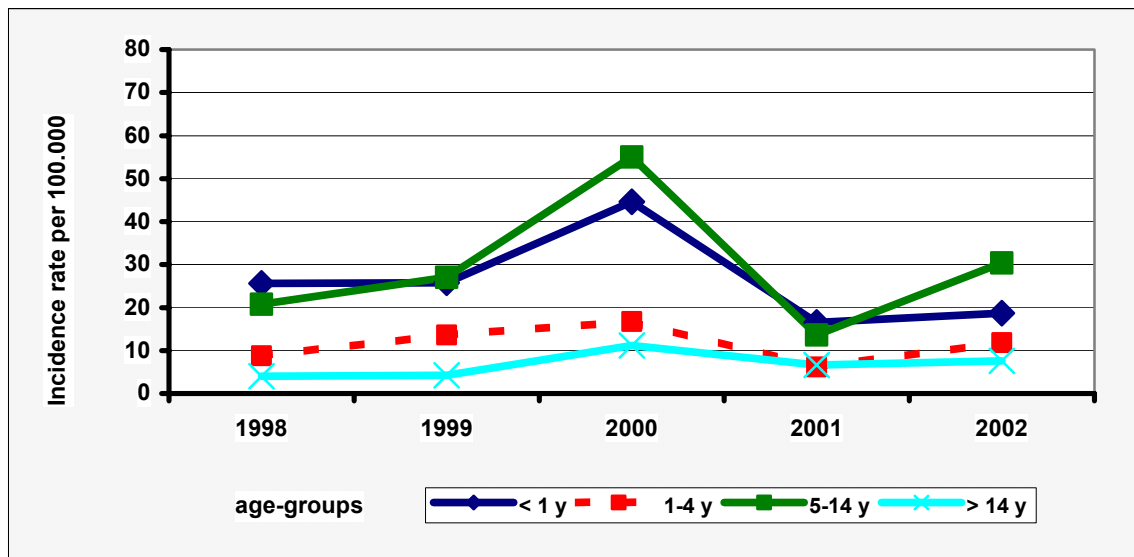


Figure 2 – Pertussis incidence rate by year and age-group

The incidence rate increased steadily from 1998 to 2000 among all age groups and then declined in 2001. During the 5 years period, children aged 5-14 years and infants below 1 year of age experienced the highest incidence, with a peak in 2000. Children aged 1-to 4 years ranged from 8.2 per 100.000 in 1998 to 21.3 per 100.000 in 2000. Persons above 14 years even though had the lowest incidence rate, showed a peak in notification in 2000 as the other age-groups.

The majority of cases was reported among persons > 14 years of age (61%, lowest 53% - highest 70%). Children aged 5-14 years accounted for 33.% of cases (lowest 25% - highest 40%). Children aged 1 to 4 years and those below 1 year of age accounted for the lowest proportion of cases (3.4% and 2.1% respectively) during the entire period.

Table 3 - Vaccination status by age-groups and year

Age-groups	Year	1998	1999	2000
<1	CASES	24	25	45
	% VACCINATED	33,3%	4,0%	22,2%
	% UNVACCINATED	66,7%	96,0%	77,8%
1-4	CASES	28	48	62
	% VACCINATED	60,7%	56,3%	56,5%
	% UNVACCINATED	39,3%	43,8%	43,5%
5-14	CASES	320	383	720
	% VACCINATED	38.4%	47%	57.5%
	% UNVACCINATED	61.6%	53%	42.5%
> 14	CASES	485	507	1294
	% VACCINATED	31,5%	31,2%	36,8%
	% UNVACCINATED.	68,5%	68,8%	63,2%
Total	CASES	857	963	2121
	% VACCINATED	35.1	38%	44.1%
	% UNVACCINATED	64.9%	62%	55.9%

The proportion of vaccinated cases increased with time, especially among those aged 5-14 years. Among the other age groups older than 1 year, it was below 60% during the whole period and was stable over time.

Incidence by sub-national area

Table 4 - Incidence rate (cases per 100.000) by year and region

Region	1998	1999	2000	2001	2002
Brandenburg	9,5	14,8	32,6	15,8	12,2
Mecklenburg-Vorpommern	3,3	2,0	17,5	4,4	6,8
Sachsen	7,5	7,2	15,7	9,8	11,5
Sachsen-Anhalt	3,9	6,3	6,7	3,2	12,9
Thüringen	4,8	2,8	6,2	1,3	2,4

The annual regional specific incidence showed a peak in incidence rates in 2000 in all regions except in Sachsen-Anhalt, where the peak was in 2002. Brandenburg showed the highest incidence, in 2000.

Seasonality

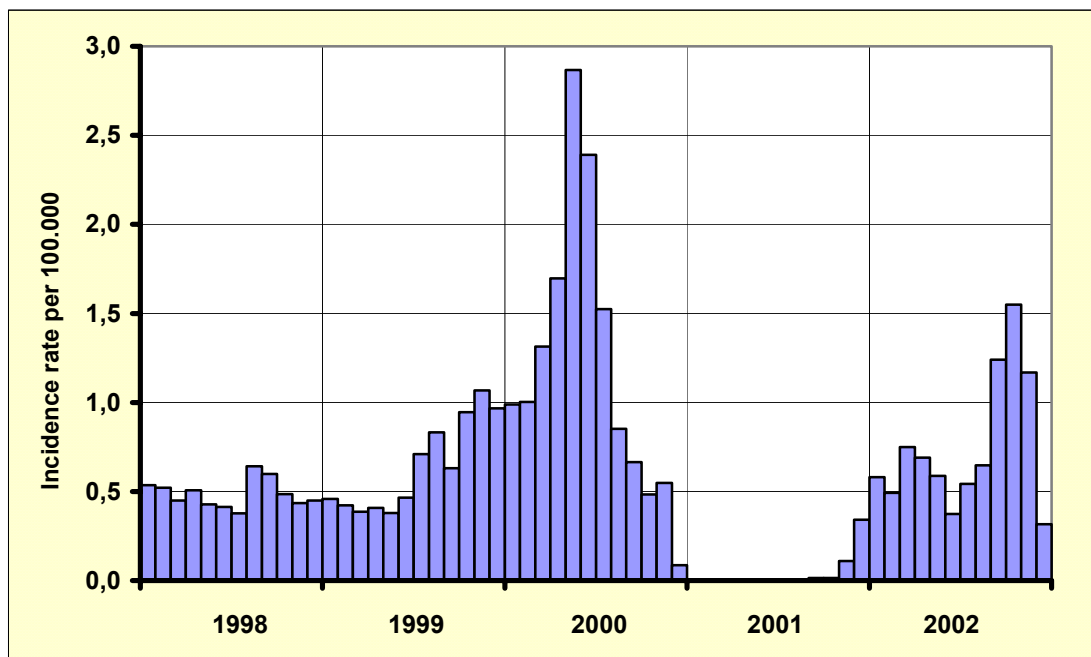


Figure 3 – Pertussis incidence rate by date of onset

The number of notified cases by month of onset did not show a periodic seasonality during the years. In addition, a peak was noted in spring-summer of 2000.

Case-fatality rate: 0.76 per 1000. One death was recorded, in a subject aged >60 years in 2002.

Case-fatality rate < 1 year: 0

Specific mortality rate < 1 year : 0

Hospitalisation rate

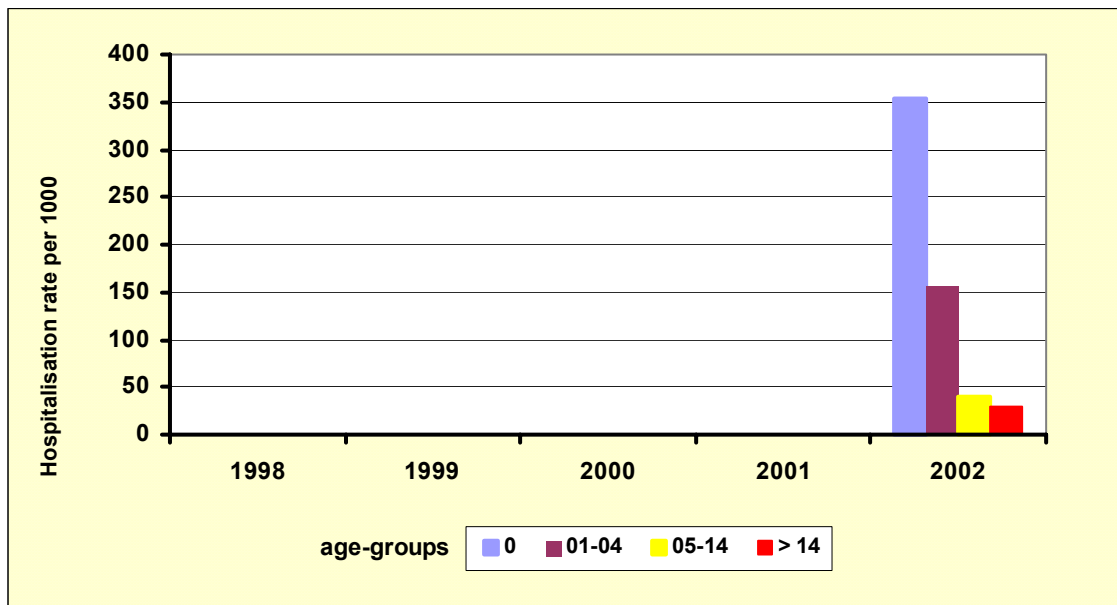


Figure 4 - Hospitalisation rate by year and age group

In 2002, the rate of hospitalised cases decreased with age. Infants below 1 year of age were more likely to be hospitalised than children above 1 year of age. Vaccination status among hospitalised subjects could not be examined.

Comments and Interpretation

Although the percentage of missing data is negligible for most of the variables, the lack of information on hospitalisation, disease outcome and vaccination status, does not allow epidemiological inferences about the severity as well as the role of the vaccine in reducing the number of hospitalisation due to pertussis. As mentioned above, 11/16 regions (Former West Germany) have not a mandatory notification system for pertussis. Therefore, on the basis of these findings, the burden of pertussis can be estimated in FEG (Former East Germany) only. The incidence rate remained moderate during the five years period, showing a small peak in 2000.

Infants below 1 year of age and children aged 5 to 14 years were the most affected age groups.

Analysis of the annual incidence rate by region suggests that Brandenburg was likely to have had an outbreak in 2000. Apparently, no regular temporal patterns were observed.

The severity of the disease can be investigated in 2002 only. The case fatality rate due to pertussis was very low. No deaths were recorded among

infants below 1 year of age; vice versa, hospitalisation rate was fairly high among them. This confirms that infants are more likely to have a severe disease than adults, or indicate a possible selection bias towards severe cases (i.e. hospitalised cases) in notification.

Country Profile -----GREECE

Pertussis case notifications, 1998-2002

Type of data:	Case based
Type of notification system:	Universal, statutory
Denominator:	General population
Minimum requirement for case notification	Clinical symptoms and physician examination
Recommended case definition:	A person with a cough lasting at least 2 weeks with at least one of the following: paroxysm of coughing, inspiratory "whooping", post-tussive vomiting, without other apparent cause (WHO)
Laboratory procedure for case confirmation:	Serology
Other surveillance systems in place	Yes
Current vaccination schedule:	2, 4, 6 months;18 months; 4-6 years
Type of vaccine used:	Whole cell, acellular
Year of introduction of acellular vaccine:	1997
Number of components of the vaccine:	Information not available

Quality of data received from the gatekeeper

Data provided for the period: 1998-2002. The completed figures were available for the period 1998-2002.

Information not recorded among those of the minimum dataset: Who cisid code in 1998 - 1999; date of disease onset in 2000-2002; has received pertussis vaccination in 2000 and 2002; number of pertussis vaccine received in the entire period; date of last pertussis vaccine received in the entire period.

Missing data: Date of birth and gender are missing in 62% (25-92%) of cases. Date of disease onset in 1998-1999 is missing in 86-95% of cases. Diagnose classification is missing in 95% of cases recorded in 1998 and in 86% of cases in 1999. Hospitalisation status is missing in 71% (32-95%) of cases. Disease outcome is missing in 70% (25-95%) of cases. Has received pertussis vaccination is missing in 82-95% of cases.

Table 1 - Summary of available information and completeness by year, number of cases (%)

Year	1998	1999	2000	2001	2002
Number of records	85 (100)	36 (100)	13 (100)	93 (100)	16 (100)
Date of notification	85 (100)	36 (100)	13 (100)	93 (100)	16 (100)
Who cisid code	0 (0)	0 (0)	13 (100)	93 (100)	16 (100)
Date of birth	7 (8,24)	16 (44,44)	2 (15,38)	45 (48,39)	12 (75,00)
Gender	7 (8,24)	14 (38,89)	2 (15,38)	47 (50,54)	12 (75,00)
Date of disease onset	4 (4,71)	5 (13,89)	0 (0)	0 (0)	0 (0)
Diagnose classification	4 (4,71)	5 (13,89)	13 (100)	93 (100)	16 (100)
Hospitalization	4 (4,71)	6 (16,67)	13 (100)	93 (100)	11 (68,75)
Disease outcome	4 (4,71)	4 (11,11)	13 (100)	93 (100)	12 (75,00)
Has received pertussis vaccination?	4 (4,71)	4 (11,11)	0 (0)	17 (18,28)	0 (0)
Number of p.v. received	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Date of last p.v. received	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Age	7 (8,24)	16 (44,44)	2 (15,38)	45 (48,39)	12 (75,00)

Inconsistencies: none

Reporting delay: not calculated

Epidemiology

Total number of reported cases: 243

Male/female ratio: not calculated

Incidence

Table 2 - Incidence of reported pertussis cases by year

Year	Number of cases	Incidence rate (per 100.000)	Laboratory confirmation
1998	85	0,8	not calculated
1999	36	0,3	not calculated
2000	13	0,1	15,3%
2001	93	0,9	39,7%
2002	16	0,2	not calculated

The incidence rate was very low during the entire period. Laboratory confirmation of cases was carried out in a small percentage of cases notified in 2000. However the proportion of laboratory confirmed cases was more than doubled in 2001.

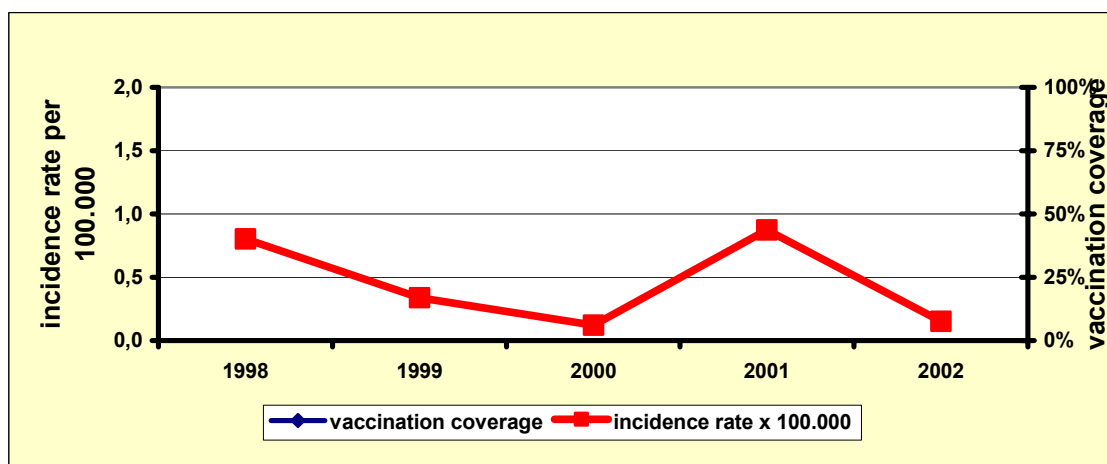


Figure 1 - Pertussis incidence rate by year and vaccination coverage

Information on vaccine coverage was not available in the entire period.

Incidence of reported pertussis cases by year and age-group: not calculated.

Vaccination status by age-group: not calculated

Incidence by sub-national area

Table 3 - Incidence rate (cases per 100.000) by year and region

Region	1998	1999	2000	2001	2002
Anatoliki Makedonia Thraki	---	---	0,2	0,3	0,0
Attiki	---	---	0,0	0,5	0,1
Dytiki Ellada	---	---	0,0	0,0	0,0
Dytiki Makedonia	---	---	0,1	0,1	0,0
Ionia Nisia	---	---	0,0	0,0	0,0
Ipeiros	---	---	0,3	0,8	0,0
Kentriki Makedonia	---	---	0,3	2,3	0,1
Kriti	---	---	0,2	0,4	0,2
Notio Agaio	---	---	0,0	0,0	0,0
Peloponnisos	---	---	0,0	0,0	0,1
Sterea Ellada	---	---	0,5	0,5	0,2
Thessalia	---	---	0,1	2,9	0,4
Voreio Aigaio	---	---	0,0	0,0	0,5

All regions have an incidence rate below 1 per 100.000 except Kentriki Makedonia and Thessalia, in which a rate between 2 and 3 per 100.000 was observed in 2001.

Seasonality: not calculated

Case-fatality rate: not calculated

Case-fatality rate < 1 year: not calculated

Specific mortality rate < 1 year: not calculated

Hospitalisation rate: not calculated

Comments and interpretations

The majority of variables of the minimum dataset were missing. Moreover data on vaccination coverage were not available. Based on the available information Greece is a low incidence country with minor variations over time. The slightly higher incidence observed in 2001 corresponds to a peak in incidence particularly in Kentriki Makedonia and Thessalia.

Country Profile -----ICELAND

Pertussis case notifications, 1998-2002

Type of data:	Aggregated 1998- March 2001; case based 2001-
Type of notification system:	Universal, statutory
Denominator:	General population
Minimum requirement for case notification	Clinical symptoms and physician examination
Recommended case definition:	None
Laboratory procedure for case confirmation:	Information not available about the type of lab confirmation
Other surveillance systems in place	No
Current vaccination schedule:	3, 5, 12 months; 5 years
Type of vaccine used:	Acellular
Year of introduction of acellular vaccine:	2000
Number of components of the vaccine:	Information not available

Quality of data received from the gatekeeper

Data provided for the period: 1998-2002. The completed figures were available for the period 1998-2002.

Information not recorded among those of the minimum dataset: Date of notification in the period 1998-2001, Who cisid code in the entire period; hospitalisation status in 1998, 2000-2002.

Missing data: Date of notification is missing in 18% of cases recorded in 2002. Gender is missing in 4% of cases recorded in 1999. Hospitalisation status is missing in 96% of cases recorded in 1999. Disease outcome is missing in 4% of cases recorded in 1999. Has received pertussis vaccination is missing in 63% (37-73%) of cases.

Table 1 - Summary of available information and completeness by year, number of cases (%)

Year	1998	1999	2000	2001	2002
Number of records	3 (100)	22 (100)	8 (100)	3 (100)	11 (100)
Date of notification	0 (0)	0 (0)	0 (0)	0 (0)	9 (81,82)
Who cisid code	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Date of birth	3 (100)	22 (100)	8 (100)	3 (100)	11 (100)
Gender	3 (100)	21 (95,45)	8 (100)	3 (100)	11 (100)
Date of disease onset	3 (100)	22 (100)	8 (100)	3 (100)	11 (100)
Diagnose classification	3 (100)	22 (100)	8 (100)	3 (100)	11 (100)
Hospitalization	0 (0)	1 (4,55)	0 (0)	0 (0)	0 (0)
Disease outcome	3 (100)	21 (95,45)	8 (100)	3 (100)	11 (100)
Has received pertussis vaccination?	1 (33,33)	6 (27,27)	5 (62,50)	1 (33,33)	3 (27,27)
Number of p.v. received	---	---	---	---	---
Date of last p.v. received	---	---	---	---	---
Age	3 (100)	22 (100)	8 (100)	3 (100)	11 (100)

Inconsistencies: none

Reporting delay: not calculated

Epidemiology

Total number of reported cases: 47

Male/female ratio: 0.84

Incidence

Table 2 - Incidence of reported pertussis cases by year

Year	Number of cases	Incidence rate (per 100.000)	Laboratory confirmation
1998	3	1,1	100%
1999	22	7,9	100%
2000	8	2,9	100%
2001	3	1,1	100%
2002	11	3,9	100%

The incidence rate was moderately low during the entire period with a peak in 1999. All cases were laboratory confirmed.

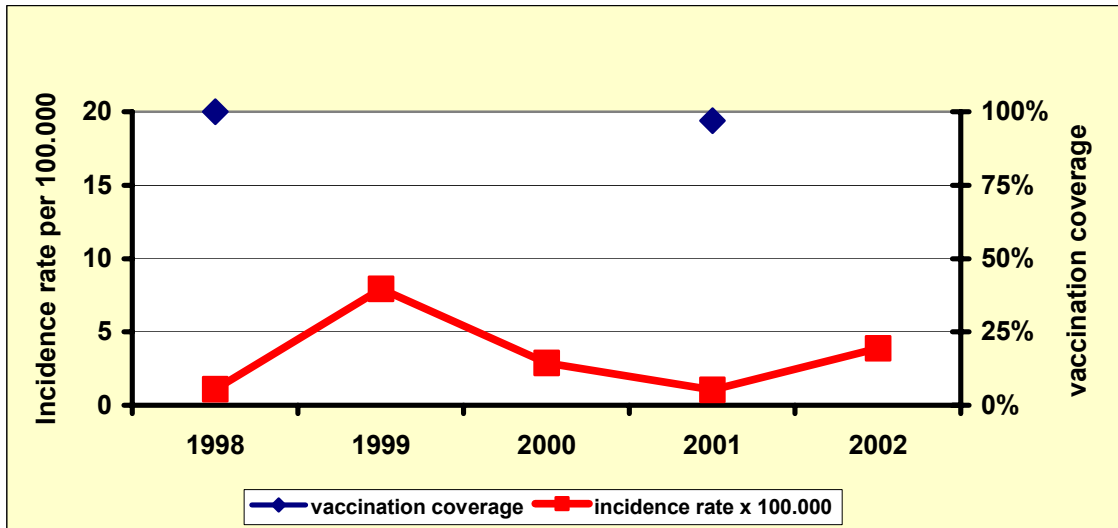


Figure 1 - Pertussis incidence rate by year and vaccination coverage

Vaccination coverage was available only in 1998 and 2001 and was fairly high. No relationship between incidence rates and vaccination coverage was observed.

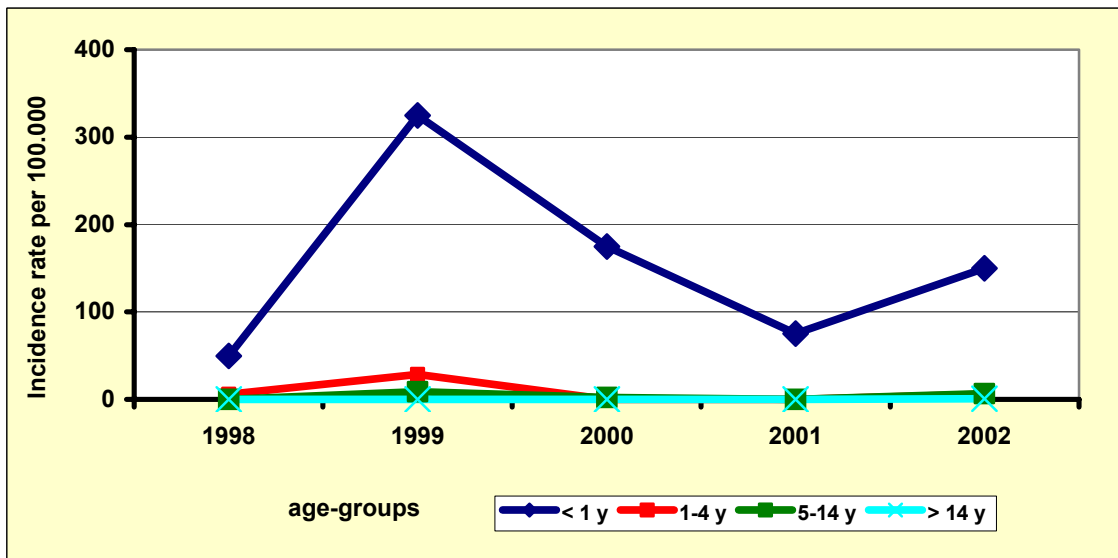


Figure 2 – Pertussis incidence rate by year and age-group

Infants below 1 year of age experienced the highest incidence, with a peak in 1999. Children aged 1-to 4 years as well as those aged 5 to 14 years also showed a peak in notifications in 1999. Persons above 14 years showed the lowest incidence rate.

The majority of cases was reported among infants < 1 year (66%; lowest 54% - highest: 100%) Children aged 5 to 14 years accounted for 17% of cases (lowest 0% - highest: 27%). Children aged 1 to 4 years accounted for 15% of cases (lowest 0% - highest: 33%) Among persons > 14 years only 1 case was recorded, in 2002.

Vaccination status by age-group: not calculated

Incidence by sub-national area: not calculated

Seasonality

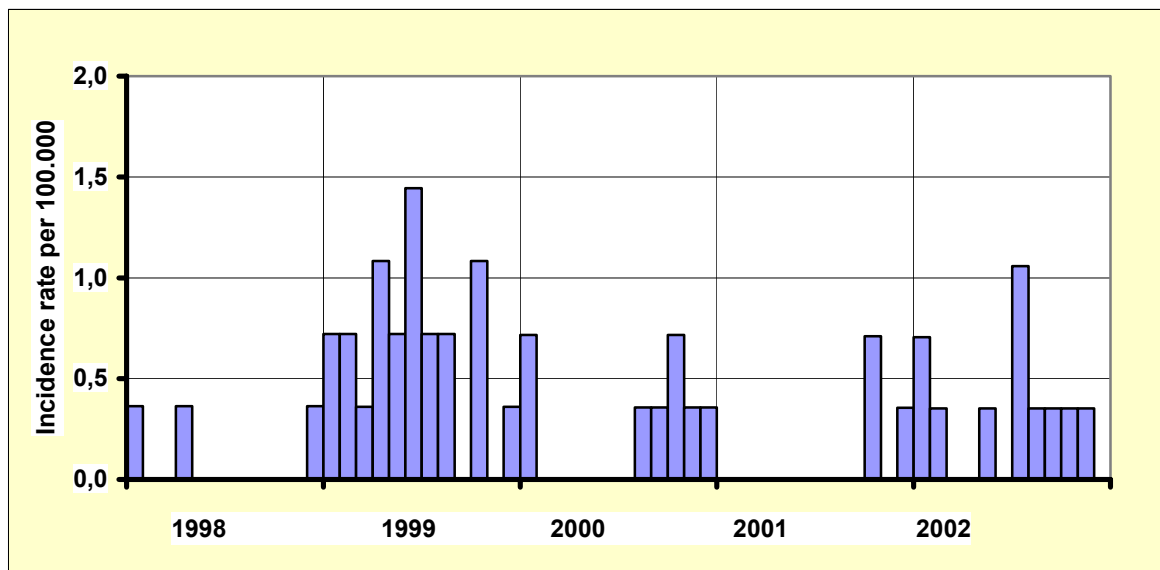


Figure 3 – Pertussis incidence rate by date of onset

The incidence rate by month of onset did not show a periodic seasonality in the occurrence of cases during the years. In addition, a higher incidence was noted in 1999 with a peak in June.

Case-fatality rate: 0

Case-fatality rate < 1 year: 0

Specific mortality rate < 1 year: 0

Hospitalisation rate: not calculated

Comments and interpretations

According to the available information Iceland is a low incidence country. It has to be noticed that all cases are laboratory confirmed. The highest incidence in this country has been observed in children below one year of age. Information on vaccination status was available for all cases in this

age-group: all of them were not vaccinated. A peak in incidence has been observed in 1999, mostly in children < 1 year of age. Rates in the other age groups are much lower. This may be due to an underestimation of incidence in individuals > 1 year.

Country Profile -----IRELAND

Pertussis case notifications, 1998-2002

Type of data:	Aggregated (1998-1999) Case based (July 2000-2002)
Type of notification system:	Universal, statutory
Denominator:	General population
Minimum requirement for case notification	Clinical symptoms and physician examination
Recommended case definition:	None
Laboratory procedure for case confirmation:	No
Other surveillance systems in place	No
Current vaccination schedule:	2, 4, 6 months; 4-5 years
Type of vaccine used:	Acellular
Year of introduction of acellular vaccine:	1996
Number of components of the vaccine:	Information not available

Quality of data received from the gatekeeper

Data provided for the period: 1998-2002. The completed figures were available for the period 1998-2001. Data reported for 2002 are provisional.

Information not recorded among those of the minimum dataset: Diagnose classification, hospitalisation, disease outcome, has received pertussis vaccination, number of pertussis vaccine received and date of last dose of pertussis vaccine received were not recorded in the entire period. Date of birth, gender and date of disease onset were not recorded in 1998 and 1999.

Missing data: In 2000-2002, date of birth is missing in 20% of cases (1-46%); date of disease onset is missing in 47% of cases (31-55%) and gender is missing in 16% of cases (2-48%).

Table 1 - Summary of available information and completeness by year, number of cases (%)

Year	1998	1999	2000	2001	2002
Number of records	248 (100)	179 (100)	152 (100)	142 (100)	131 (100)
Date of notification	248 (100)	179 (100)	152 (100)	142 (100)	131 (100)
Who cisid code	248 (100)	179 (100)	152 (100)	142 (100)	131 (100)
Date of birth	0 (0)	0 (0)	83 (54,61)	140 (98,59)	113 (86,26)
Gender	0 (0)	0 (0)	79 (51,97)	139 (97,89)	128 (97,71)
Date of disease onset	0 (0)	0 (0)	68 (44,74)	97 (68,31)	60 (45,80)
Diagnose classification	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Hospitalization	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Disease outcome	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Has received pertussis vaccination?	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Number of p.v. received	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Date of last p.v. received	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Age	0 (0)	0 (0)	83 (54,61)	140 (98,59)	113 (86,26)

Inconsistencies: none

Reporting delay: not calculated.

Epidemiology

Total number of reported cases: 852

Male/female ratio: not calculated

Incidence

Table 2 - Incidence of reported pertussis cases by year

Year	Number of cases	Incidence rate (per 100.000)	Laboratory confirmation
1998	248	6,6	Not Known
1999	179	4,8	Not Known
2000	152	4,0	Not Known
2001	142	3,7	Not Known
2002	131	3,4	Not Known

The incidence rate declined steadily from 1998 to 2002. The highest incidence was observed in 1998.

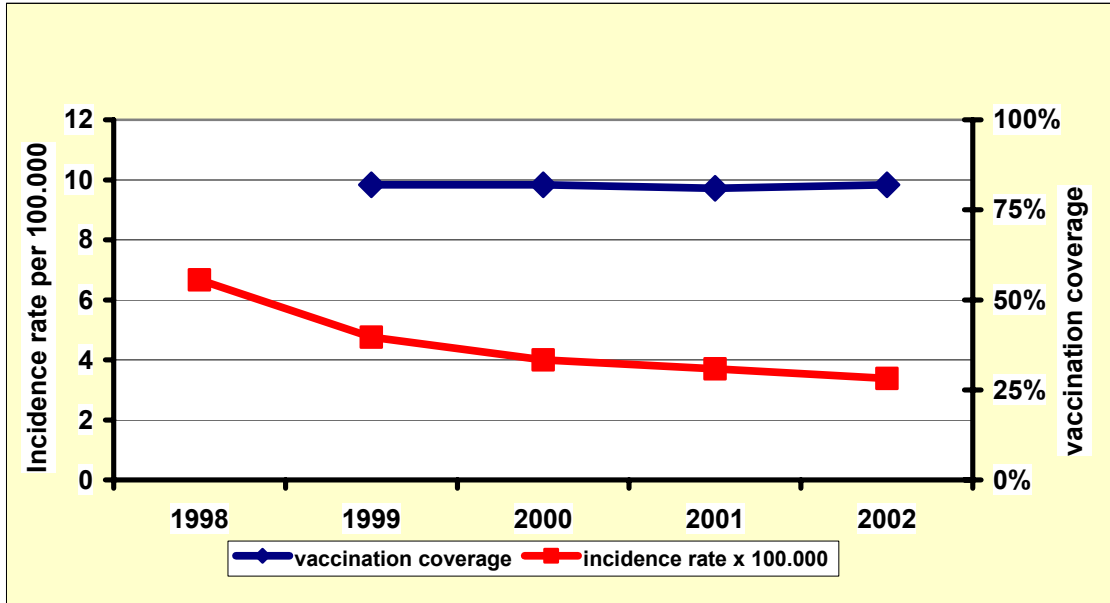


Figure 1 –Pertussis incidence rate by year and vaccination coverage

Vaccine coverage was stable during the entire period, while, as noted before, incidence decreased during the entire period.

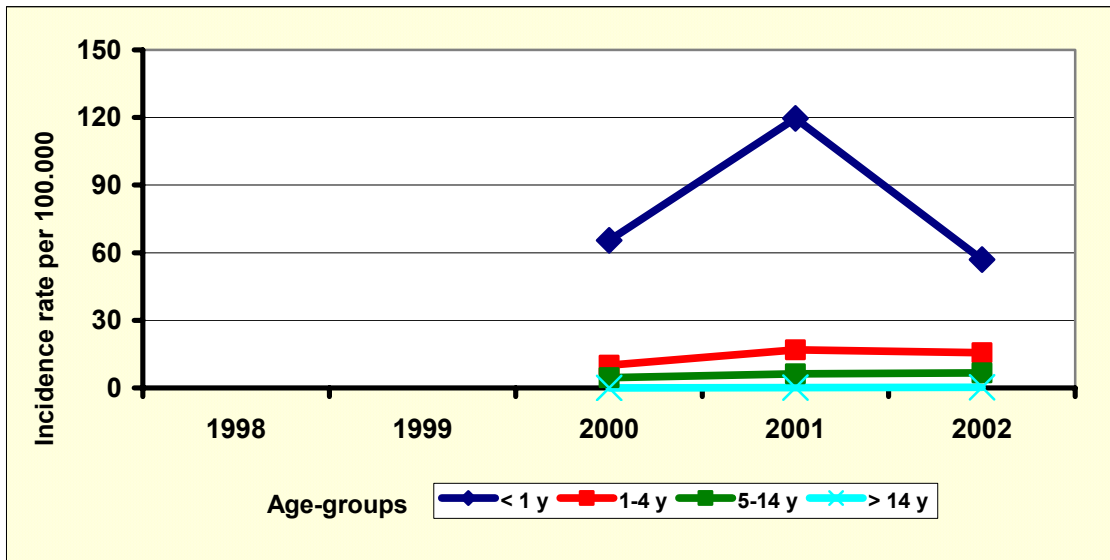


Figure 2 – Pertussis incidence rate by year and age-group

Infants aged less than 1 year experienced the highest incidence rate. In 2001 an incidence peak was observed in this age group with a figure twice as high as the other years. Children aged 1 to 4 year showed a modest

increase in incidence during the period 2000-2002. Among children aged 5 to 14 years, the rate was stable during the entire period. Persons > 14 years experienced the lowest incidence rate.

The majority of cases was recorded in infants below 1 year of age (40%; lowest 29% - highest 48%). Children aged 5-14 year accounted for 28% of cases (lowest 24% - highest 32%). Children aged 1-4 year accounted for 27% of cases (lowest 25% - highest 30%). Persons > 14 year of age accounted for 4% of cases (lowest 1% - highest 8%).

Vaccination status by age-group: not calculated

Incidence by sub-national area:

Table 3 - Incidence rate (cases per 100.000) by year and region

Regions	1998	1999	2000	2001	2002
Eastern Health Board	7,5	5,4	5,0	5,4	2,3
Midland Health Board	6,0	0,4	2,3	0,4	6,0
Mid Western Health Board	13,0	7,7	1,2	0,3	3,0
North Eastern Health Board	2,1	1,8	4,0	2,1	2,4
North Western Health Board	1,8	4,9	1,8	0,0	0,9
South Eastern Health Board	2,4	3,6	2,6	6,0	7,9
Southern Health Board	4,3	6,0	7,0	4,0	2,0
Western Health Board	10,9	2,6	1,6	2,6	5,6

Most of the regions showed a decrease in incidence during the 5 years period except South Eastern which showed a regular increase in incidence rate with time. Apparently, the highest incidence has been recorded in Western Health Board in 1998. The lowest incidence has been recorded in North Western Health Board in 2001 (no cases reported) and in Midland Health Board in 1999. The classification of pertussis case (clinical definition or laboratory diagnosis) is not, however, homogeneous across the regions. This factor may lead to the observed differences.

Seasonality: not calculated

Case-fatality rate: not calculated

Case-fatality rate < 1 year: not calculated

Specific mortality rate < 1 year: not calculated

Hospitalisation rate: not calculated

Comments and interpretations

The dataset from Ireland includes provisional information for cases in 2002 and the majority of variables of the minimum dataset were missing. Based on the available data Ireland is a low incidence country. Though no evident outbreaks were observed in the period under study a significant peak in incidence was evident in 2001 in children < 1. Infants remained the most affected age group in the entire period. This may indicate a selection bias in notification. Analysis of the annual incidence rate by region shows differences in incidence figures between health boards. These figures need to be interpreted with caution because some regions report both clinical and laboratory notifications whereas others just report clinical notifications.

Country Profile -----ITALY

Pertussis case notifications, 1998-2002

Type of data:	Case based
Type of notification system:	Universal, statutory
Denominator:	General population
Minimum requirement for case notification	Clinical symptoms and physician examination
Recommended case definition:	No
Laboratory procedure for case confirmation:	No
Other surveillance systems in place	Yes
Current vaccination schedule:	primary immunization 3, 5, 12 months; 5 year
Type of vaccine used:	Acellular
Year of introduction of acellular vaccine:	1995
Number of components of the vaccine:	2- 3

Quality of data received from the gatekeeper

Data provided for the period: 1998-2002, completed.

Information not recorded among those of the minimum dataset: diagnose classification in 1998; date of birth, disease outcome, and number of pertussis vaccines received in the entire period.

Missing data: hospitalisation in 9% of cases (4-23%); has received pertussis vaccination in 29% of cases (25-31%); date of last pertussis vaccine received in 16% of cases (12-20%).

Table 1 - Summary of available information and completeness by year, number of cases (%)

Year	1998	1999	2000	2001	2002
Number of records	6981 (100)	3798 (100)	2542 (100)	1805 (100)	2576 (100)
Date of notification	6981 (100)	3798 (100)	2542 (100)	1805 (100)	2576 (100)
Who cisid code	6981 (100)	3798 (100)	2542 (100)	1805 (100)	2576 (100)
Date of birth	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Gender	6976 (99.9)	3795 (99.9)	2539 (99.9)	1804 (99.9)	2568 (99.7)
Date of disease onset	6790 (97.3)	3687 (97.1)	2461 (96.8)	1761 (97.6)	2500 (97.0)
Diagnose classification	0 (0)	3798 (100)	2542 (100)	1805 (100)	2576 (100)
Hospitalization	6708 (96.1)	3615 (95.2)	2106 (82.8)	1384 (76.7)	2267 (88.0)
Disease outcome	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Has received pertussis vaccination?	4890 (70.0)	2630 (69.2)	1910 (75.1)	1351 (74.8)	1863 (72.3)
Number of p.v. received	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Date of last p.v. received	1089 (84.5)	432 (79.6)	476 (87.8)	383 (85.3)	476 (80.4)
Age	6903 (98.9)	3754 (98.8)	2526 (99.4)	1790 (99.2)	2559 (99.3)

Inconsistencies: In 5,2% of records Date of notification precedes Date of disease onset

Reporting delay: not calculated

Epidemiology

Total number of reported cases: 17.702

Male/female ratio: 0,87

Incidence

Table 2 - Incidence of reported pertussis cases by year

Year	Number of cases	Incidence rate (per 100.000)	Laboratory confirmation
1998	6981	12,1	Not known
1999	3798	6,6	Not known
2000	2542	4,4	Not known
2001	1805	3,1	Not known
2002	2576	4,5	Not known

The incidence of pertussis decreased significantly until 2001 and then increased again in 2002. The highest figures were observed in 1998. None of the recorded cases was laboratory confirmed.

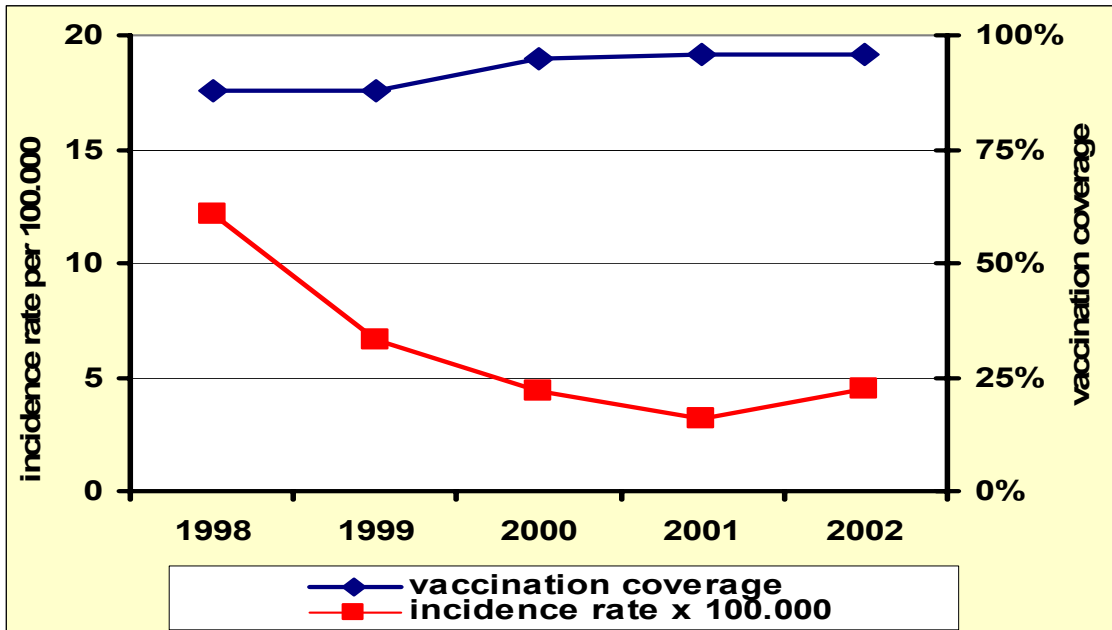


Figure 1 - Pertussis incidence rate by year and vaccination coverage

Vaccination coverage increased since 1998 when it was 88%. The small increase in incidence observed in 2002 was not apparently related to a fall in immunisation coverage, which was 96% during this year.

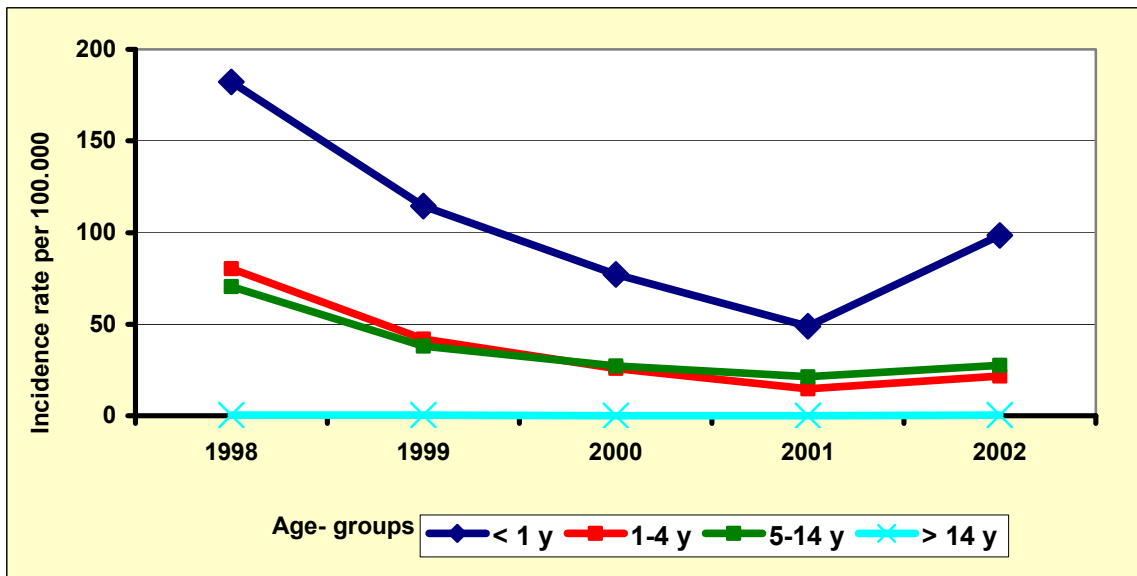


Figure 2 - Pertussis incidence rate by year and age-group

Incidence rates decreased in all age groups over time until 2001. Infants aged < 1 year experienced the highest incidence rate while persons > 14 years had the lowest one. In 2002 incidence in children < 1 year doubled

after a period of constant decrease. A similar increase was not observed in the other age-groups.

The majority of cases was recorded in the 5-14 year age group with 58,6% of cases (lowest 57,4% - highest 65,4%). Children 1-4 years old accounted for 22,2% of cases (lowest 16,9% - highest 24,9%). 15,1% of cases were in infants below 1 year of age (lowest 13,6% - highest 19,1%). Persons > 14 years old accounted for 3,2% of cases (lowest 2,9% - highest 3,8%).

Table 3 - Vaccination status by age-groups and year

Age- groups	Year	1998	1999	2000	2001	2002
<1	CASES	543	354	277	157	292
	% VACCINATED	21,5	22,9	20,9	24,2	27,7
	% NOT VACCINATED	78,5	77,1	79,1	75,8	72,3
1-4	CASES	1200	610	389	230	332
	% VACCINATED	30,8	26,4	36,0	48,3	61,1
	% NOT VACCINATED	69,2	73,6	64,0	51,7	38,9
5-14	CASES	2980	1567	1192	915	1170
	% VACCINATED	26,7	18,9	28,6	32,1	25,6
	% NOT VACCINATED	73,3	81,1	71,4	67,9	74,4
>14	CASES	127	78	46	44	63
	% VACCINATED	2,4	2,6	4,3	9,1	12,7
	% NOT VACCINATED	97,6	97,4	95,7	90,9	87,3
Total	CASES	4890	2630	1910	1351	1863
	% VACCINATED	26,4	20,6	28,4	33,2	31,8
	% NOT VACCINATED	73,6	79,4	71,6	66,8	68,2

Though the number of missing observations is too high to draw definitive interpretations, the proportion of vaccinated cases increased over time in children aged 1-4. This finding is in agreement with the continuing increase in vaccine coverage.

Incidence by sub-national area

Table 4 - Incidence rate (cases per 100.000) by year and region

Region	1998	1999	2000	2001	2002
Abruzzo	14,0	8,1	4,2	1,0	5,4
Basilicata	6,9	8,9	3,4	0,3	2,7
Calabria	5,9	5,0	1,0	1,8	1,3
Campania	14,3	8,3	3,5	2,0	6,4
Emilia Romagna	18,2	6,4	7,0	4,7	5,4
Friuli Venezia Giulia	8,7	4,0	3,4	1,5	1,2
Lazio	10,1	8,0	3,5	2,7	3,5
Liguria	1,0	2,7	1,5	2,1	2,1
Lombardia	10,0	3,0	3,4	3,7	2,4
Marche	14,3	9,4	6,1	4,7	4,1
Molise	3,7	6,4	1,5	4,0	5,2
Piemonte	15,5	4,8	5,5	5,2	5,8
Puglia	11,3	10,4	8,1	1,7	6,4
Sardegna	4,1	2,2	2,0	0,6	0,7
Sicilia	10,1	7,8	3,6	1,5	4,3
Toscana	9,1	7,0	3,4	2,5	4,4
Trentino Alto Adige	53,7	32,4	19,0	15,4	14,0
Umbria	8,3	6,6	0,6	0,6	1,6
V.d'Aosta	36,8	7,5	1,7	5,9	3,3
Veneto	15,4	4,1	5,0	5,3	7,1

The breakdown of incidence rates by region shows a great variability of rates between different geographic areas over time. Most regions experienced a continuous decrease of rates over time. However, a resurgence of pertussis was evident in 2002 in some Southern regions (i.e. Abruzzo, Campania, Puglia, Basilicata, Sicilia). The highest incidence has been observed in 1998 in two small regions in Northern Italy (V. d'Aosta and Trentino Alto Adige). The lowest rates were observed in 2002 in Friuli V.G. (North East) and Sardinia.

Seasonality

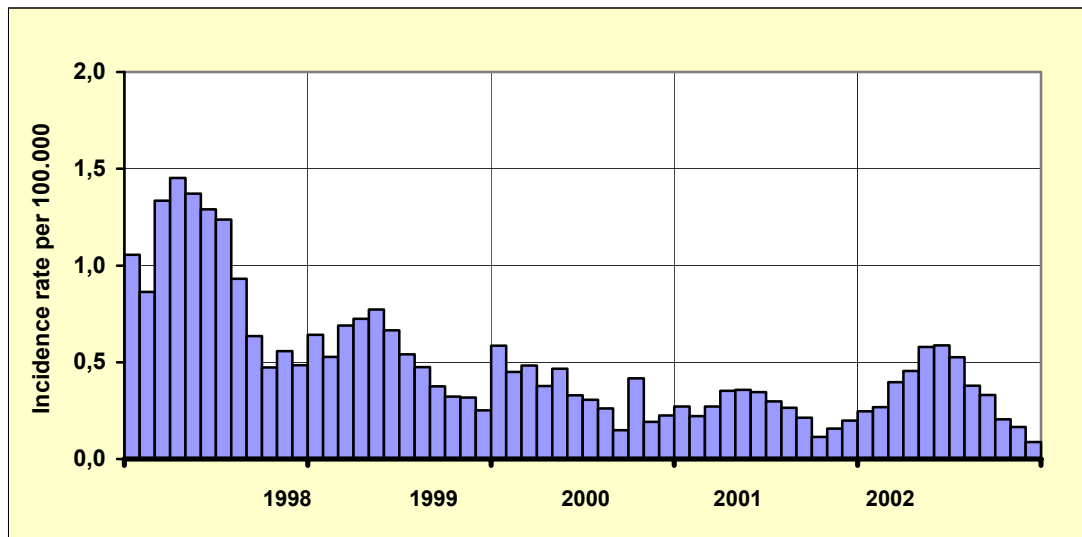


Figure 3 - Pertussis incidence rate by date of onset

In the entire period under study cases were more frequent in the April-May period. However, in 2000 rates were highest in January and decreased thereafter with a peak in October.

Case-fatality rate: not calculated

Case-fatality rate < 1 year: not calculated

Specific mortality rate < 1 year: not calculated

Hospitalisation rate

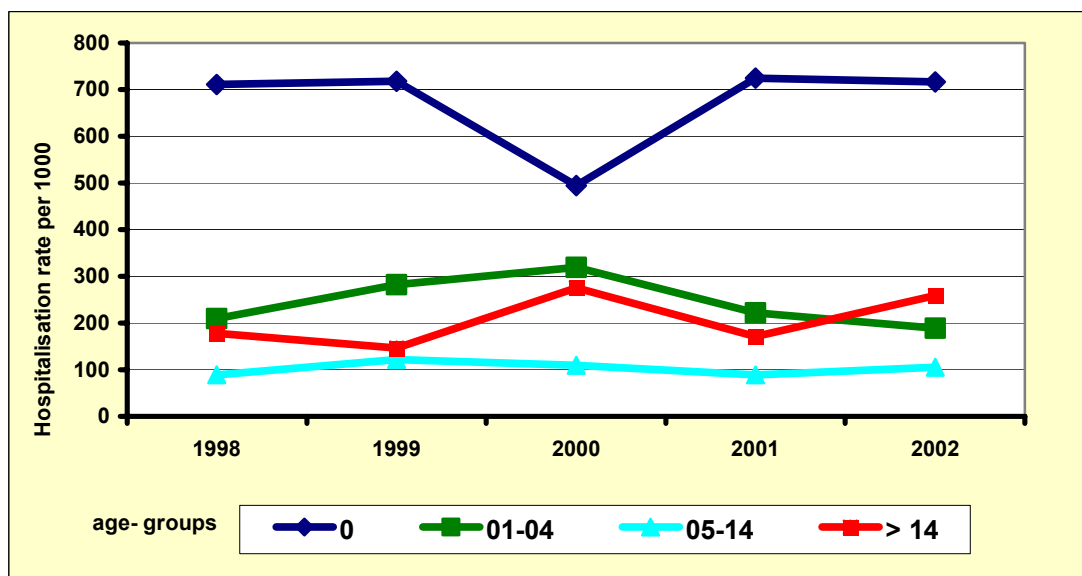


Figure 4 - Hospitalization rate by year and age group

The highest hospitalisation rate was observed in children below 1 year of age. Hospitalisation rates were fairly stable over time in all age-groups.

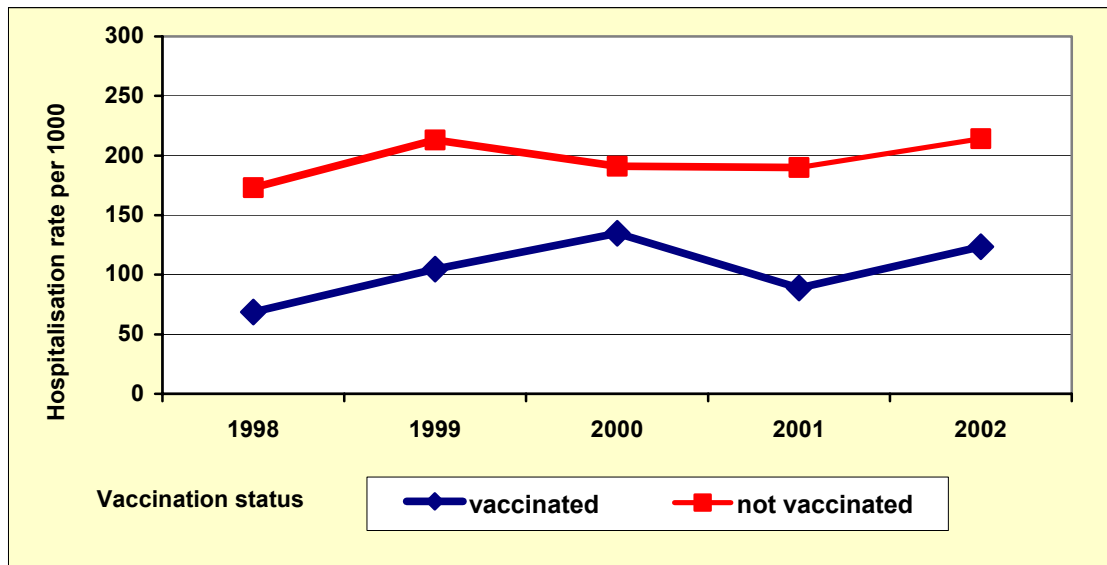


Figure 5 - Hospitalization rate by year and vaccination status

During the entire period under study, vaccinated patients required hospitalisation less frequently than unvaccinated.

Comments and Interpretation

Italy experienced a constant decrease of the annual incidence rate since 1998 toward a rate $< 5/100.000$ which is clearly associated with a stable increase in vaccination coverage. Though no epidemic years have been observed in the period of observation of this study, incidence in 1998 was the highest since the introduction of acellular vaccines (1995). The main observation in this Country is the resurgence of pertussis in 2002 in children < 1 year of age after a period of constant decline. This phenomenon has been observed in other countries with a constant increase in vaccination coverage. The differences in incidence observed among regions may be the result of a differential sensitivity of the notification system. Disease severity was assessed by examining the hospitalisation rates assuming that the more severe cases required hospital treatment. Hospitalisation rates are fairly high indicating that there is a potential bias toward selection of severe cases in notification. Vaccinated patients have a lower risk to be hospitalised suggesting that vaccine protects against severe disease.

Country Profile -----MALTA

Pertussis case notifications, 1998-2002

Type of data:	Case based
Type of notification system:	Universal, statutory
Denominator:	General population
Minimum requirement for case notification	Clinical symptoms and physician examination
Recommended case definition:	No
Laboratory procedure for case confirmation:	No
Other surveillance systems in place	No
Current vaccination schedule:	2, 4, 6 months; 15 months; 3-4 years; 16 years
Type of vaccine used:	Whole cell, acellular
Year of introduction of acellular vaccine:	Information not available
Number of components of the vaccine:	Information not available

Quality of data received from the gatekeeper

Data provided for the period: 1998-2002. The completed figures were available for the period 1998-2002.

Information not recorded among those of the minimum dataset: Date of birth in 1998; gender in 1998-1999; date of disease onset in the entire period; hospitalisation in 1998-1999; disease outcome in 1998-1999; has received pertussis vaccination in 1998-1999; number of pertussis vaccine received and date of last dose of pertussis vaccine received" in the entire period.

Missing data: Date of notification was missing in 25% of cases notified in 1998 and 1,7% of cases in 1999. Date of birth was missing in 1998, in 90% of cases notified in 1999, in 33,4% of cases notified in 2000. Has received pertussis vaccination was missing in 66,7% of cases notified in 2000 and in 75% of cases notified in 2002.

Table 1 - Summary of available information and completeness by year, number of cases (%)

Year	1998	1999	2000	2001	2002
Number of records	4 (100)	60 (100)	3 (100)	1 (100)	4 (100)
Date of notification	3 (75,0)	59 (98,3)	3 (100)	1 (100)	4 (100)
Who cisid code	4 (100)	60 (100)	3 (100)	1 (100)	4 (100)
Date of birth	0 (0)	6 (10,0)	2 (66,6)	1 (100)	4 (100)
Gender	0 (0)	0 (0)	3 (100)	1 (100)	4 (100)
Date of disease onset	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Diagnose classification	4 (100)	60 (100)	3 (100)	1 (100)	4 (100)
Hospitalization	0 (0)	0 (0)	3 (100)	1 (100)	4 (100)
Disease outcome	0 (0)	0 (0)	3 (100)	1 (100)	4 (100)
Has received pertussis vaccination?	0 (0)	0 (0)	1 (33,3)	1 (100)	1 (25,0)
Number of p.v. received	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Date of last p.v. received	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Age	0 (0)	6 (10,0)	2 (66,6)	1 (100)	4 (100)

Inconsistencies: No inconsistent dates were found. For diagnose classification an inconsistent code was used in all records and the information could not be analysed.

Reporting delay: not calculated.

Epidemiology

Total number of reported cases: 72

Male/female ratio: not calculated

Incidence

Table 2 - Incidence of reported pertussis cases by year

Year	Number of cases	Incidence rate (per 100.000)	Laboratory confirmation
1998	4	1,0	not known
1999	60	15,5	not known
2000	3	0,8	not known
2001	1	0,3	not known
2002	4	1,0	not known

The incidence rate was very low during the whole period, except in 1999 when an incidence peak was observed. Laboratory confirmation of cases was not carried out.

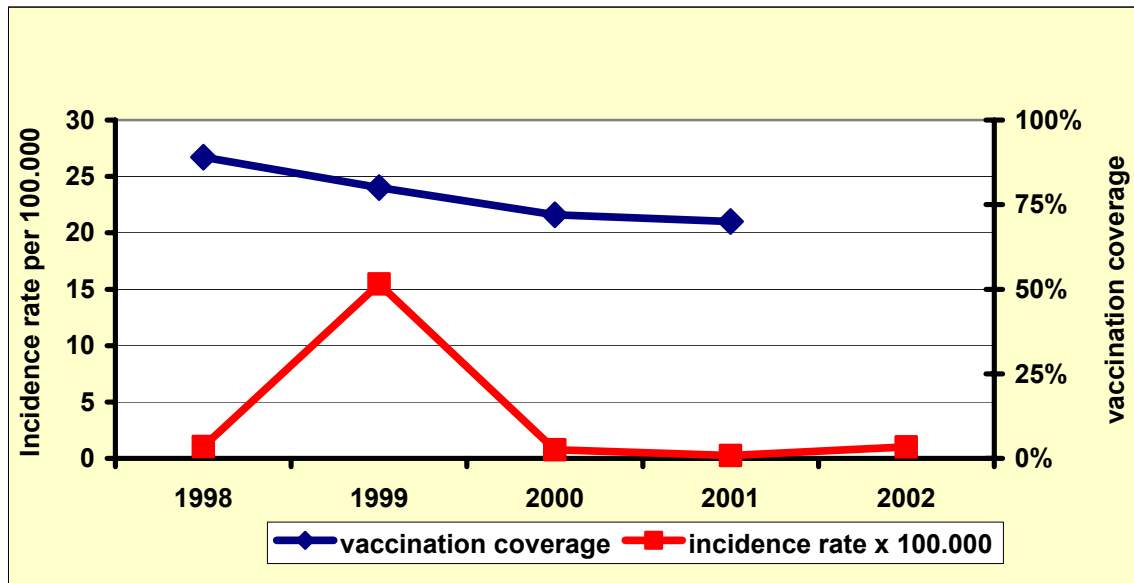


Figure 1 - Pertussis incidence rate by year and vaccination coverage

Vaccine coverage decreased with time from 1998 to 2001. Information on vaccine coverage of 2002 was not available.

Incidence of reported pertussis cases by year and age-group: not calculated

Vaccination status by age-group: not calculated

Incidence by sub-national area: not calculated

Seasonality: not calculated

Case-fatality rate: not calculated

Case-fatality rate < 1 year: not calculated

Specific mortality rate < 1 year: not calculated

Hospitalisation rate: not calculated

Comments and interpretations

According to the available data Malta can be considered a low incidence country. An outbreak occurred in 1999. Of particular concern is the regular trend in vaccination coverage which decreases over time.

Country Profile -----THE NETHERLANDS

Pertussis case notifications, 1998-2002

Type of data:	Case based
Type of notification system:	Universal, statutory
Denominator:	General population
Minimum requirement for case notification	Clinical symptoms and physician examination
Recommended case definition:	a person with a cough lasting at least 2 weeks with at least one of the following: paroxysm of coughing, inspiratory "whooping", post-tussive vomiting, without other apparent cause and laboratory confirmation or epidemiological link (WHO)
Laboratory procedure for case confirmation:	Culture, Serology (one and two samples), PCR
Other surveillance systems in place	No
Current vaccination schedule:	2-3-4-11 months; 4 years
Type of vaccine used:	Whole cell, acellular
Year of introduction of acellular vaccine:	
Number of components of the vaccine:	

Quality of data received from the gatekeeper

Data provided for the period:1998-2002. The completed figures were available for the period 1998-2002.

Information not recorded among those of the minimum dataset: hospitalisation and disease outcome in 1998; diagnosis classification in 2000; number of pertussis vaccines received in 1998-2000; date of last pertussis vaccine received in the entire period.

Missing data: Who CISID code in 15.2-26.2% of records; Date of disease onset in 6.8-9.5%; Diagnose classification in 85% of cases in 1999, the range in the other years is 0.7-15%; Hospitalisation in 19-40.8%; Disease outcome in 16.9-41.7%; Vaccination status in 2.3-14.7%; Number of pertussis vaccine received in 37.1-44.8%.

Table 1 - Summary of available information and completeness by year , number of cases (%)

Year	1998	1999	2000	2001	2002
Number of records	2223 (100)	6279 (100)	4835 (100)	6986 (100)	5909 (100)
Date of notification	2223 (100)	6279 (100)	4835 (100)	6986 (100)	5909 (100)
Who cisid code	2223 (100)	4847 (77,2)	3568 (73,8)	5921 (84,8)	4603 (77,9)
Date of birth	2219 (99,8)	6267 (99,8)	4831 (99,9)	6984 (100)	5907 (100)
Gender	2223 (100)	6279 (100)	4835 (100)	6986 (100)	5909 (100)
Date of disease onset	2044 (91,9)	5685 (90,5)	4437 (91,8)	6294 (90,1)	5510 (93,2)
Diagnose classification	2208 (99,3)	978 (15,6)	0 (0)	5343 (76,5)	4434 (75)
Hospitalization	0 (0)	3716 (59,2)	3374 (69,8)	5658 (81)	4175 (70,7)
Disease outcome	1(0,04))	3663 (58,3)	3433 (71)	5804 (83,1)	4323 (73,2)
Has received pertussis vaccination?	2172 (97,7)	5591 (89)	4193 (86,7)	5957 (85,3)	5042 (85,3)
Number of p.v. received	0 (0)	0 (0)	0 (0)	4400(62,9)	3299 (55,8)
Date of last p.v. received	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Age	2040 (91,8)	5661 (90,2)	4425 (91,5)	6257 (89,6)	5493 (93)

Inconsistencies: date of birth is approximated in most cases (88% of cases were born the first day of month); 84 cases (0.3%) have an inconsistent date of disease onset; 345 cases (1,3%) had inconsistencies between vaccination status and number of vaccine received.

Reporting delay: the median notification delay was 63 days (IQR: 47-86 days).

Epidemiology

Total number of reported cases: 26.232

Male/female ratio: 0.83

Incidence

Table 2 - Incidence of reported pertussis cases by year

Year	Number of cases	Incidence rate (per 100.000)	Laboratory confirmation
1998	2223	14,1	95,4%
1999	6279	39,8	97,3%
2000	4835	30,5	Not available
2001	6986	43,9	96%
2002	5909	37,0	98%

The incidence of whooping cough was high in each of the five years studied. There was an increase from 14.1 in 1998 to 39.8 in 1999, and then incidence remained over 30 per 100.000/per year in the following period. The highest figures were observed in 1999 and 2001. The vast majority of cases were laboratory confirmed.

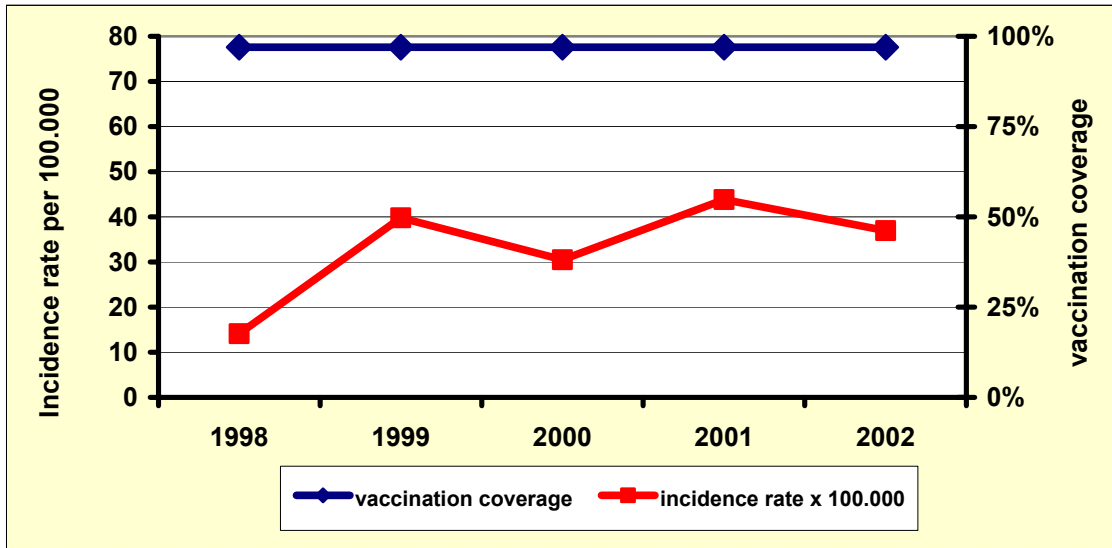


Figure 1 - Pertussis incidence rate by year and vaccination coverage

The increase in pertussis incidence was not apparently related to a decrease in immunization coverage; indeed vaccination coverage was always over 97%.

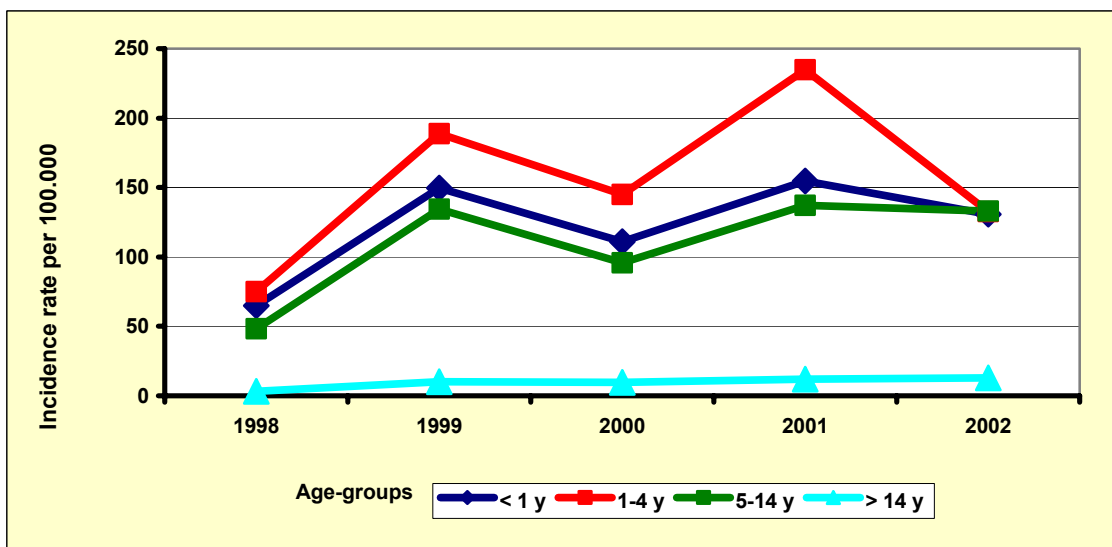


Figure 2 – Pertussis incidence rate by year and age-group

Incidence rates were high among children below 14 years of age throughout the whole period. The highest figures were recorded in children 1-4 years old, followed by children below 1 year of age, and those 5-14 years old. In 2001 incidence of pertussis in the 1-4 year age group peaked to over 250/100.000, and decreased in 2002. Persons > 14 years showed the lowest incidence. However, incidence in this age-group increased gradually during the years and peaked in 2002.

The majority of cases was recorded in the 5-14 year age group with 45% of cases (lowest 42% -highest 48%). Persons > 14 years accounted for 26% of cases (lowest 20% - highest 30%) while those in the 1-4 year age group were 24% (lowest 18% - highest 29%). Five percent of cases were in children below one year of age.

Table 3 - Vaccination status by age-groups and year

Age group	Year	1998	1999	2000	2001	2002
<1	CASES	120	257	187	263	211
	% VACCINATED	65,8%	60,0%	69,0%	68,0%	74,0%
	% UNVACCINATED.	34,2%	40,0%	31,0%	32,0%	26,0%
1-4	CASES	573	1382	1036	1661	931
	% VACCINATED	95,6%	95,3%	95,2%	96,3%	94,0%
	% UNVACCINATED	4,40%	4,7%	4,8%	3,7%	6,0%
5-14	CASES	926	2446	1765	2513	2494
	% VACCINATED	97,7%	97,0%	98,0%	98,0%	98,3%
	% UNVACCINATED.	2,3%	3,0%	2,0%	2,0%	1,7%
> 14	CASES	371	1025	916	990	1129
	% VACCINATED	71,2%	76,4%	70,7%	77,4%	75,3%
	% UNVACCINATED.	28,8%	23,6%	29,3%	22,6%	24,7%
Total	CASES	1990	5110	3904	5427	4765
	% VACCINATED	90,3%	90,5%	89,4%	92,3%	91,0%
	% UNVACCINATED.	9,7%	9,5%	10,6%	7,7%	9,0%

Throughout the 5 years period, almost all cases occurred among children aged 1 to 14 years, were vaccinated. The proportion of vaccinated cases among infants < 1 year increased over time, ranging from 66% in 1998 to 74% in 2002. The proportion of vaccinated cases was high also in persons > 14 years of age, ranging from 71% to 77%.

Incidence by sub-national area

Table 4 - Incidence rate (cases per 100.000) by year and region

Region	1998	1999	2000	2001	2002
Dreuthe	45,6	116,9	37,7	68,6	42,2
Flevoland	39,1	17,2	0,0	27,2	32,1
Friesland	4,2	30,3	35,0	24,5	26,5
Gelderland	16,2	29,8	12,6	30,0	18,7
Groningen	11,5	24,0	24,5	23,7	35,1
Limburg	7,7	33,5	37,4	48,8	33,0
Noord-Brabant	15,9	32,0	21,1	44,2	32,6
Noord-Holland	6,7	21,9	13,6	36,9	17,8
Overijssed	10,0	27,3	11,6	15,4	31,9
Utrecht	11,3	35,8	36,9	42,2	27,6
Zeeland	11,8	35,2	11,2	77,3	29,7
Zuid-Holland	19,0	29,1	27,9	37,1	36,5

There was a marked difference in incidence rates between and within regions during the period 1998 through 2001. Incidence increased in most regions after 1998 and levelled off in the subsequent years. The highest incidence was recorded in Dreuthe in 1999, followed by Zeeland in 2001. No cases were recorded in Flevoland in 2000. The lowest incidence rates have been recorded in Friesland, Noord-Holland and Limburg in 1998.

Seasonality:

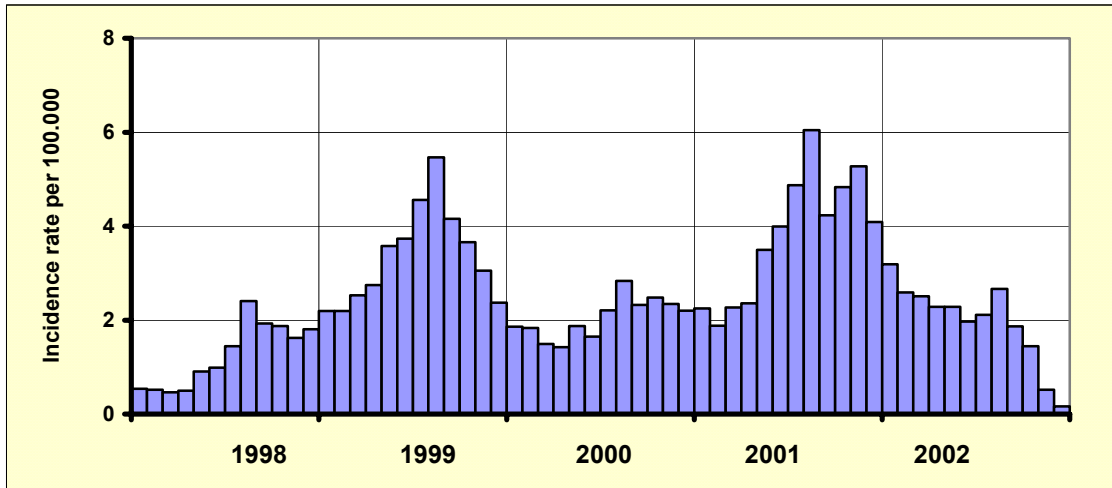


Figure 3 – Pertussis incidence rate by date of onset

The incidence rate showed a periodic seasonality in summer except for 2002 when the highest figures were recorded in November and December.

Case-fatality rate: 0.13 per 1000. Two deaths were recorded during the five years: one in a unvaccinated infant < 1 year, in 1998, and one in a vaccinated child 9 years old in 2002.

Case fatality-rate < 1 year: 0,91 per 1000.

Specific mortality rate <1 year: 1,1/1.000.000

Hospitalisation rate

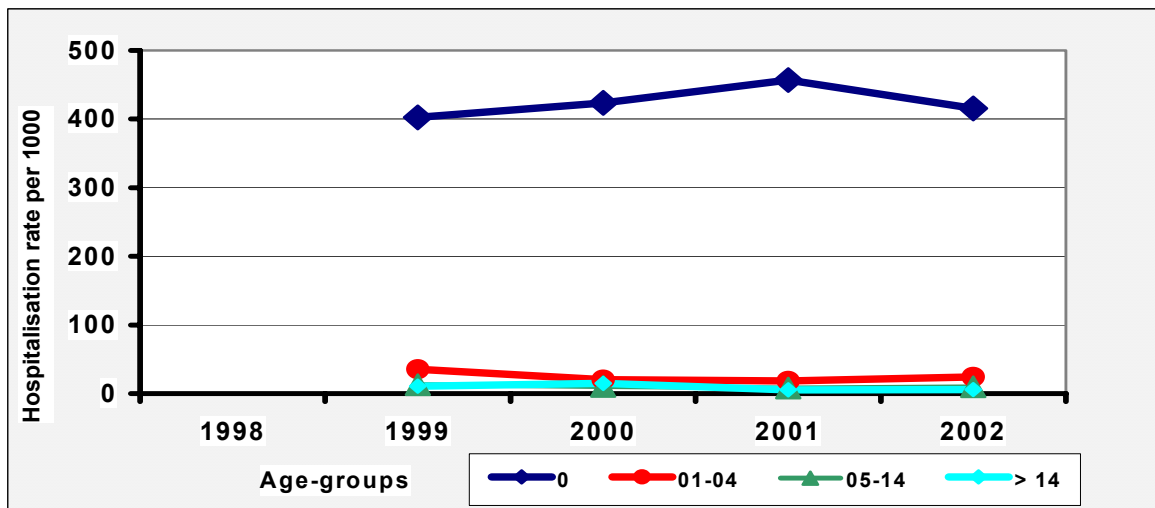


Figure 4 - Hospitalization rate by year and age group

The annual hospitalization rate showed a moderate decline during the five years period, ranging from 36,9 per 1000 in 1999 to 29,2 per 1000 in 2002. The highest hospitalisation rate was observed in children below 1 year of age, ranging from 402 per 1000 in 1999 to 457 per 1000 in 2001. The rate in the other age groups was much lower, ranging from 36 per 1000 in 1999 to 18 per 1000 in 2001 among those aged 1 to 4 years, and from 8 per 1000 in 2001 to 13 per 1000 in 1999 among those 5-14 years old.

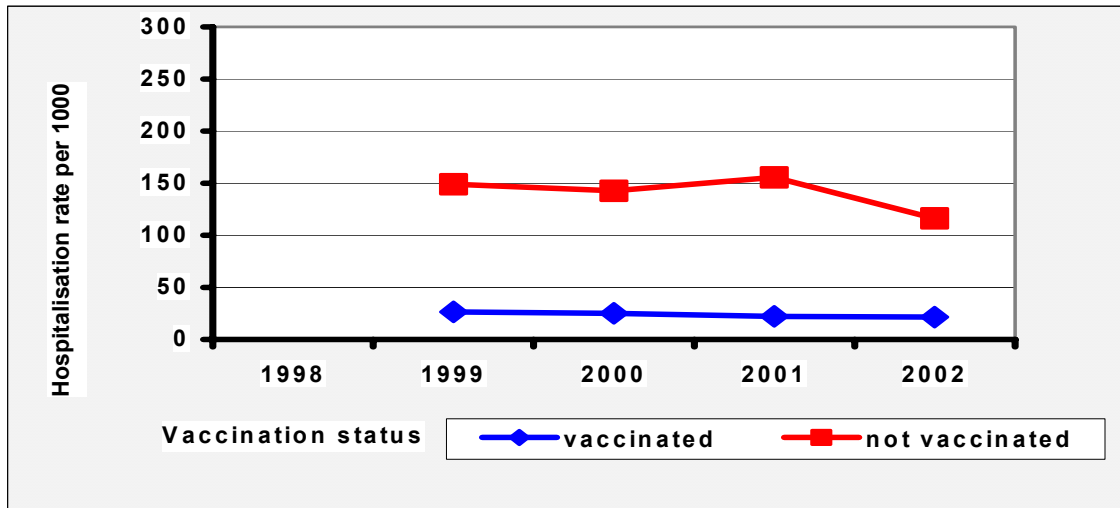


Figure 5 - Hospitalization rate by year and vaccination status

Vaccinated patients required hospitalisation less frequently during the entire period under study.

The hospitalisation rate in vaccinated children aged < 1 years ranged from 262 per 1000/per year in 1999 to 343 per 1000/per year in 2001, while that in unvaccinated individuals was much higher, ranging from 651 per 1000/per year in 2002, to 800 per 1000/per year in 2000. Likewise, the hospitalisation rate in vaccinated children aged 1-4 years ranged from 31 per 1000 /per year in 1999 to 18 per 1000/per year in 2000 and 2001, while that in unvaccinated individuals was higher, ranging from 96 per 1000/per year in 1999, to 30 per 1000/per year in 2000. Similarly, the hospitalisation rate in vaccinated children 5-14 years old ranged from 7 per 1000/per year in 2001 to 13 per 1000/per year in 1999, while that in unvaccinated individuals was higher, ranging from 30 per 1000/per year in 2001 to 40 per 1000/per year in 2000.

Comments and Interpretations

The informations provided with the database were incomplete for hospitalisation, disease outcome and vaccination outcome. The high proportion of missing information for these variables suggests caution in some interpretation of the analysis. The database included accurate information and only a few inconsistencies were found. Reporting delay was

reasonably short and stable. Despite vaccine coverage has been very high, Netherlands has been experiencing a continuous increase in pertussis incidence since 1998. Children aged 1 to 4 years experienced the highest incidence rate. Such data, together with the high proportion of vaccinated cases, suggest that vaccine efficacy has been lower than expected. In addition there is evidence of an outbreak in Drenthe in 1999 and in Zeeland in 2001. Moreover, the temporal pattern suggests that a new outbreak occurred at the end of 2002. The case fatality rate was very low. Hospitalisation rate was remarkable in children below 1 year of age. This could reflect, however, also a possible selection bias towards severe cases in this age group. Vaccinated patients are less likely to be hospitalised suggesting that vaccinated subjects have a higher probability to develop a mild disease than those unvaccinated.

Country Profile -----**NORWAY**

Pertussis case notifications, 1998-2002

Type of data:	Case-based
Type of notification system:	Universal, statutory
Denominator:	General population
Minimum requirement for case notification	Laboratory confirmation or epidemiological link
Recommended case definition:	a person with a cough lasting at least 2 weeks with at least one of the following: paroxysm of coughing, inspiratory "whooping", post-tussive vomiting, without other apparent cause and laboratory confirmation or epidemiological link (WHO)
Laboratory procedure for case confirmation:	Serology; PCR (2002-); occasionally culture
Other surveillance systems in place	No
Current vaccination schedule:	3,5,12 months
Type of vaccine used:	Acellular
Year of introduction of acellular vaccine:	1998
Number of components of the vaccine:	2 (1998-); 5 (2001-)

Quality of data received from the gatekeeper

Data provided for the period: 1998-2002. The completed figures were available for the period 1998-2002.

Information not recorded among those of the minimum dataset: date of notification and date of last pertussis vaccine received in the entire period.

Missing data: Gender in 12,4% of cases recorded in 2001, the range in the other years is 01-1,2%. Diagnose classification in 39% of cases recorded in 2001-2002 (35-42%). Hospitalisation in 21% of cases recorded in 2001, the range in the other years is 2,3-4,3%. Disease outcome in 33% of cases (19,5-50%). Has received pertussis vaccination in 46% of cases (36-57%). Number of pertussis vaccine received in 3% of cases (2-4%).

Table 1 - Summary of available information and completeness by year, number of cases (%)

Year	1998	1999	2000	2001	2002
Number of records	2310 (100)	1241 (100)	3445 (100)	2578 (100)	3174 (100)
Date of notification	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Who cisid code	2310 (100)	1241 (100)	3445 (100)	2578 (100)	3174 (100)
Date of birth	2310 (100)	1241 (100)	3445 (100)	2578 (100)	3174 (100)
Gender	2307 (99,87)	1238 (99,76)	3403 (98,78)	2258 (87,59)	3160 (99,56)
Date of disease onset	2310 (100)	1241 (100)	3445 (100)	2578 (100)	3174 (100)
Diagnose classification	2310 (100)	1241 (100)	3395 (98,55)	1668 (64,70)	1832 (57,72)
Hospitalization	2211 (95,71)	1201 (96,78)	3364 (97,65)	2039 (79,09)	3101 (97,70)
Disease outcome	1806 (78,18)	999 (80,50)	2673 (77,59)	1291 (50,08)	1477 (46,53)
Has received pertussis vaccination?	1445 (62,55)	795 (64,06)	1937 (56,23)	1129 (43,79)	1340 (42,22)
Number of p.v. received	1147 (96,79)	610 (96,06)	1513 (96,86)	936 (98,01)	1175 (97,43)
Date of last p.v. received	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Age	2310 (100)	1241 (100)	3445 (100)	2578 (100)	3174 (100)

Inconsistencies: none

Reporting delay: not calculated

Epidemiology

Total number of reported cases: 12748

Male/female ratio: 0.81

Incidence

Table 2 - Incidence of reported pertussis cases by year

Year	Number of cases	Incidence rate (per 100.000)	Laboratory confirmation
1998	2310	52,2	99,6%
1999	1241	27,9	99,9%
2000	3445	77,1	99,9%
2001	2578	57,4	99,7%
2002	3174	70,4	99,9%

The incidence of whooping cough was high over the five years, showing a decline from 1998 to 1999 but with a new significant increase in the following years. The highest peaks were observed in 2000 and 2002.

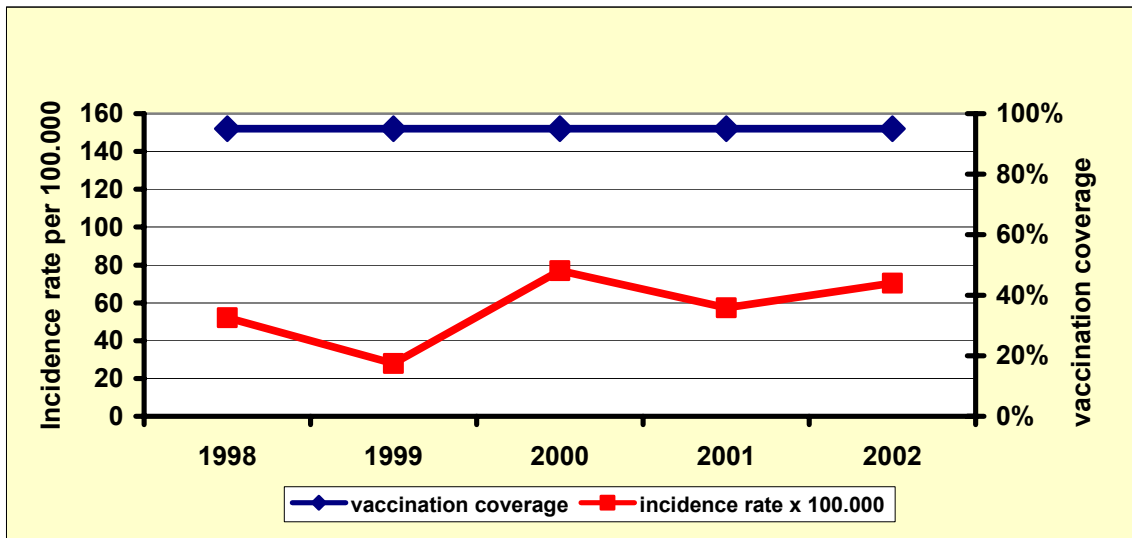


Figure 1 - Pertussis incidence rate by year and vaccination coverage

Variation in incidence rates was not apparently related to any decrease in immunization coverage; indeed vaccination coverage was always towards 95%.

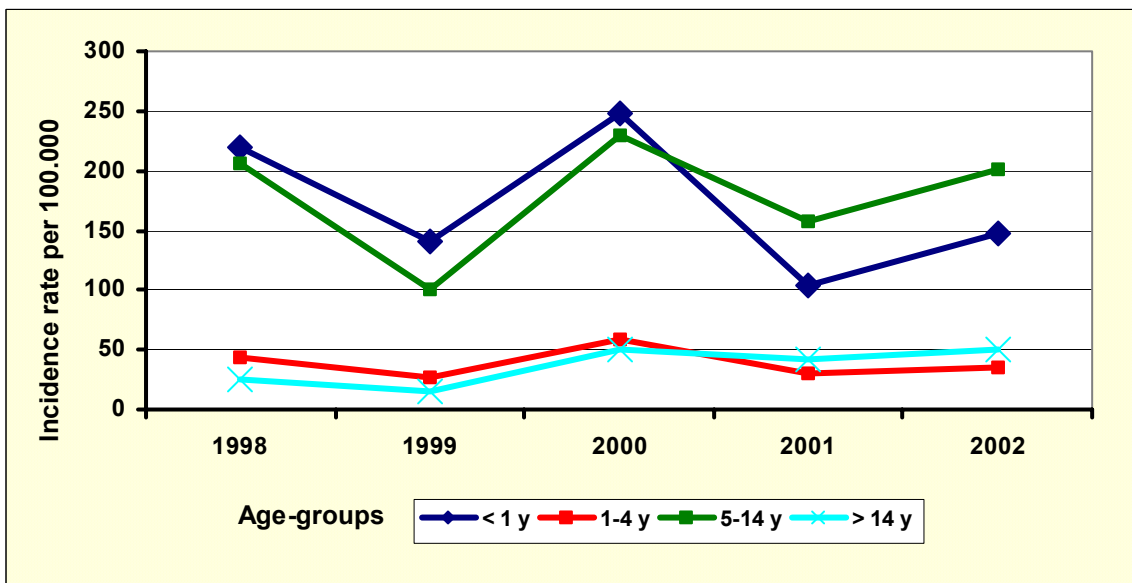


Figure 2 – Pertussis incidence rate by year and age-group

Infants < 1 year of age and children aged 5 to 14 years had the highest incidence and showed similar figures throughout the years. Children aged 1 to 4 years and persons > 14 years showed a rate below 50/100.000 during the entire period and had also comparable figures.

The majority of cases were recorded among persons > 14 years with 51% of cases (lowest 39% - highest 58%). Children aged 5-14 years accounted for 41% of cases (lowest 37% - highest 51%). Infants below 1 year of age accounted for 3,7% of cases (lowest 2,2% - highest 6,4%). Children aged 1 to 4 years represented 3,6% of cases (lowest 2,5% - highest 5,1%).

Table 3 - Vaccination status by age-groups and year

Age-groups	Year	1998	1999	2000	2001	2002
<1	CASES	108	68	123	52	63
	% VACCINATED	35,2	28,0	31,7	36,5	39,7
	% UNVACCINATED	64,8	72,0	68,3	63,5	60,3
1-4	CASES	82	52	109	53	60
	% VACCINATED	80,5	69,2	89,0	81,0	90,0
	% UNVACCINATED	19,5	30,8	11,0	19,0	10,0
5-14	CASES	849	426	914	663	874
	% VACCINATED	93,6	92,3	94,5	94,1	96,2
	% UNVACCINATED	6,4	7,7	5,5	5,9	3,8
> 14	CASES	406	249	791	361	343
	% VACCINATED	70,4	75,1	71,0	74,5	83,4
	% UNVACCINATED	29,6	24,9	29,0	25,5	16,6
Total	CASES	1445	795	1937	1129	1340
	% VACCINATED	82,0	79,9	80,6	84,6	90,0
	% UNVACCINATED	18,0	20,1	19,4	15,4	10,0

Throughout the 5 years period, the great majority of cases in children aged 1 to 14 years were vaccinated. The proportion of vaccinated cases among infants < 1 year was below 40% and stable over time.

Incidence by sub-national area

Table 4 - Incidence rate (cases per 100.00) by year and region

Region	1998	1999	2000	2001	2002
Akershus	51,9	27,9	82,5	64,9	75,7
Aust-Agder	104,3	78,3	234,0	352,4	364,6
Buskerud	15,8	19,6	23,7	17,3	25,6
Finmark	195,4	72,8	58,0	18,4	5,2
Hedmark	22,0	34,1	38,1	38,0	49,9
Hordaland	25,5	7,2	31,5	22,0	37,4
Moere og Romsdal	51,8	11,0	26,1	21,5	27,5
Nordland	88,6	15,3	52,8	42,7	29,0
Nord-Troendelag	81,6	24,2	88,7	32,5	83,3
Oestfold	37,2	39,0	30,0	22,2	14,5
Oppland	16,4	26,7	45,5	15,1	91,8
Oslo	35,7	20,6	42,6	45,4	46,2
Rogaland	12,0	17,4	97,7	22,1	31,4
Soer-Troendelag	146,7	75,3	129,8	53,4	112,1
Sogn og Fjordane	30,5	16,5	66,8	36,4	11,8
Telemark	37,7	17,0	101,1	73,7	81,2
Troms	133,8	50,1	156,8	30,1	9,1
Vest-Agder	81,6	33,8	332,3	431,3	277,0
Vestfold	22,4	27,5	70,4	39,5	202,0

A marked difference in incidence rates was observed between and within regions during the 5 years period. In the majority of the regions the highest peaks were recorded in 2000 and 2002, in agreement with the annual general incidence showed above. However there are some exceptions to this trend. In fact, in two regions (Oestfold and Finmark) incidence decreased over time as well as in other two regions (Aust-Agder and Vest-Agder) the highest peak was observed in 2001. Three regions (Soer-Troendelag , Nord-Troendelag and Finmark) experienced a peak in notification also in 1998.

Seasonality

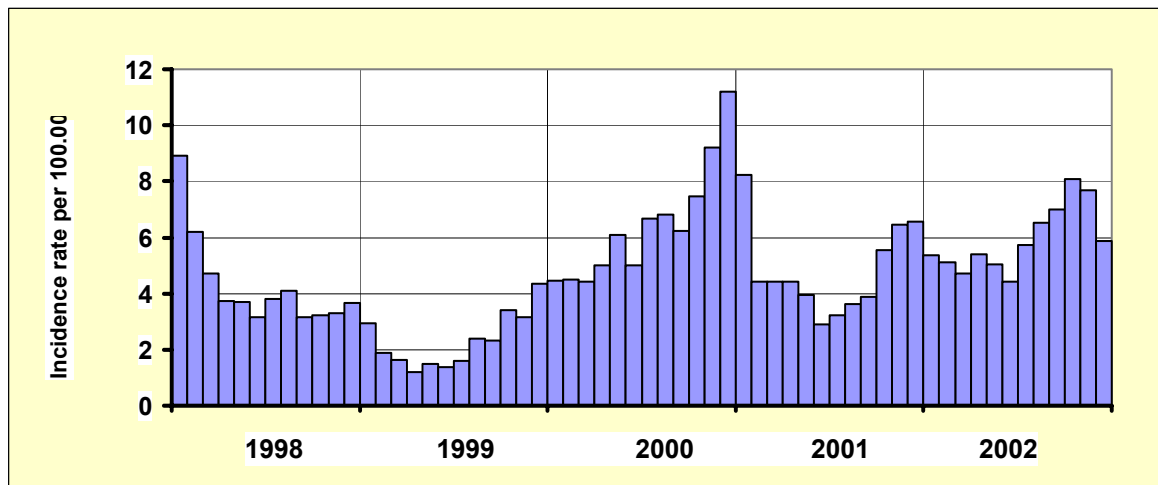


Figure 3 – Pertussis incidence rate by date of onset

The incidence rate by month of onset showed a periodic seasonality during winter in the occurrence of cases. The highest incidence was observed in 2000 (3345 cases) and in particular in December (500/3345, 15%). The age distribution of cases did not vary even during the incidence peaks.

Case-fatality rate: 0.12 per 1000. One death was recorded in an infant aged < 1 year not completely vaccinated, in 1999.

Case- fatality rate < 1 year: 2,39 per 1000

Specific mortality rate < year: 3,6/1.000.000

Hospitalisation rate

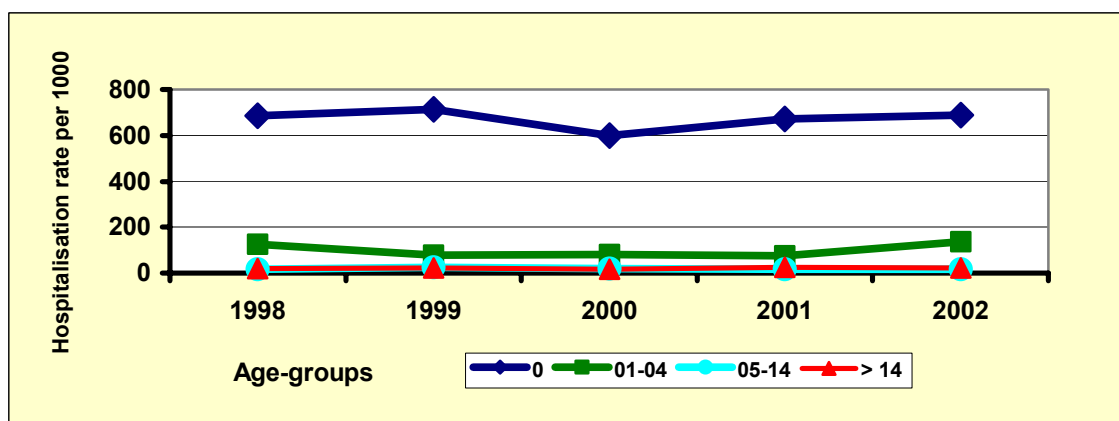


Figure 4 - Hospitalization rate by year and age group

The hospitalization rate was 48 per 1000 in the entire period. It decreased with time, ranging from 72 per 1000 in 1999 to 39 per 1000 in 2002. The highest hospitalisation rate was observed in children below 1 year of age, ranging from 600 per 1000 in 2002 to 713 per 1000 in 1999. The other age-groups showed an hospitalisation rate much lower than infants and stable with time.

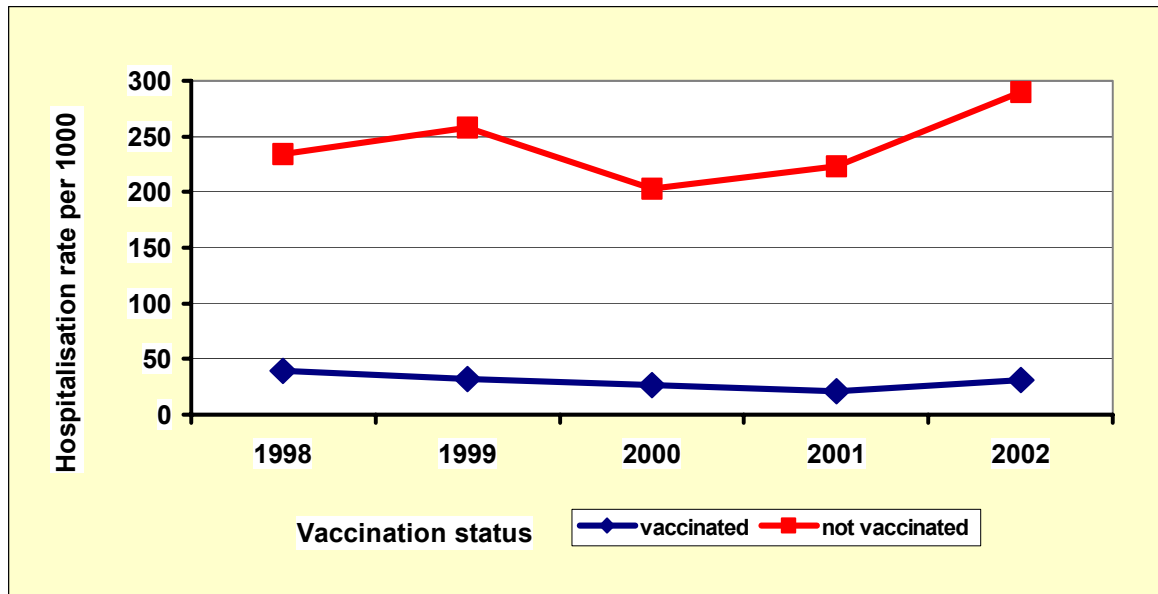


Figure 5 - Hospitalization rate by year and vaccination status

The hospitalisation rate by year and vaccination status showed a lower incidence of hospitalisation in vaccinated subjects than in unvaccinated ones.

Comments and Interpretation

Norway experienced a sharp increase in notifications of whooping cough in the last decade. Indeed, the incidence increased from 2.1 per 100.000 in 1996 to 52.2 per 100.000 in 1998 and it rose further in the following years. Even if coverage has been very high for a long period, *Bordetella pertussis* is still circulating and epidemics still occur. The exact cause of this complex phenomenon has to be identified. However, since about 72% of cases was over 10 years of age, this could be mainly because vaccine induced immunity is lost in older children in absence of boosting. In fact, children aged 5 to 14 years and infants were the most affected age groups.

Although most of the regions experienced an epidemic in 2000 and 2002, some of them had the highest peak in notification in 2001. The characteristic seasonality of pertussis (summer) has not been observed and the highest incidence peaks have been observed in winter. The percentage of vaccinated cases is high, in particular in older age groups because of waning immunity among vaccinated children. However, inference from the number of vaccinated cases in each age group by year has to be done with

caution because of the high number of missing values. Only one death was recorded (partly vaccinated infant) during the 5 years period. Hospitalisation rate was fairly high in the data provided to EUVAC-NET. This could reflect the true rate or, more likely, indicate a possible selection bias towards severe cases in notification. Indeed, 70% of the cases below 1 year of age were hospitalised. Vaccinated patients were less likely to be hospitalised suggesting that vaccine protects against severe disease. The completeness of information about some variables recorded in the dataset decreased since 2001 because of the change in notification rules. It should be taken into account that missing data affects mainly cases over twenty years of age.

Country Profile -----PORTUGAL

Pertussis case notifications, 1998-2002

Type of data:	Case Based
Type of notification system:	Universal, Statutory
Denominator:	General population
Minimum requirement for case notification	Clinical symptoms and physician examination
Recommended case definition:	a person with a cough lasting at least 2 weeks with at least one of the following: paroxysm of coughing, inspiratory "whooping", post-tussive vomiting, without other apparent cause (WHO)
Laboratory procedure for case confirmation:	Culture, PCR, Serology
Other surveillance systems in place	No
Current vaccination schedule:	2, 4, 6 months, 15-18 months, 5-6 years
Type of vaccine used:	Whole cell
Year of introduction of acellular vaccine:	-
Number of components of the vaccine:	-

Quality of data received from the gatekeeper

Data provided for the period: 1998-2002. The completed figures were available for the period 1998-2002.

Information not recorded among those of the minimum dataset: Who cisid code in 1998-1999; Date of disease onset in 1998-1999; Has received pertussis vaccination in 1998-1999; number of pertussis vaccine received in 1998, 1999 and 2001; date of last pertussis vaccine received in 1998, 1999 and 2001.

Missing data: Who cisid code is missing in 44% of cases recorded in 2002. Date of disease onset is missing in 44% of cases recorded in 2002. Disease outcome is missing in 50% of cases in 2001 and 3% of cases in 2002. Has received pertussis vaccination is missing in 9% of cases in 2000 and in 48% Of cases in 2002. Date of last dose of vaccine received is missing in 14% of cases in 2000.

Table 1 - Summary of available information and completeness by year, number of cases (%)

Year	1998	1999	2000	2001	2002
Number of records	9 (100)	12 (100)	22 (100)	2 (100)	2 (100)
Date of notification	9 (100)	12 (100)	22 (100)	2 (100)	2 (100)
Who cisid code	9 (100)	12(100)	22 (100)	2 (100)	2 (100)
Date of birth	9 (100)	12 (100)	22 (100)	2 (100)	2 (100)
Gender	9 (100)	12 (100)	22 (100)	2 (100)	2 (100)
Date of disease onset	9 (100)	12 (100)	22 (100)	2 (100)	2 (100)
Diagnose classification	9 (100)	12 (100)	22 (100)	2 (100)	2 (100)
Hospitalization	9 (100)	12 (100)	22 (100)	2 (100)	2 (100)
Disease outcome	9 (100)	12 (100)	22 (100)	2 (100)	2 (100)
Has received pertussis vaccination?	4 (44,4)	6 (50)	22 (100)	2 (100)	2 (100)
Number of p.v. received	2 (50)	6 (100)	7 (100)	0 (0)	1 (100)
Date of last p.v. received	1 (50)	2 (33,3)	7(100)	0 (0)	1 (100)
Age	9 (100)	12 (100)	22 (100)	2 (100)	2 (100)

Inconsistencies: none

Reporting delay: The median notification delay was 31.8 (ds 27.9)

Epidemiology

Total number of reported cases: 47

Male/female ratio: 1,4

Incidence

Table 2 - Incidence of reported pertussis cases by year

Year	Number of cases	Incidence rate (per 100.000)	Laboratory confirmation
1998	9	0.09	Not available
1999	12	0.12	Not available
2000	22	0.22	81,8%
2001	2	0.02	Not available
2002	2	0.02	Not available

The incidence rate was extremely low during the entire period.

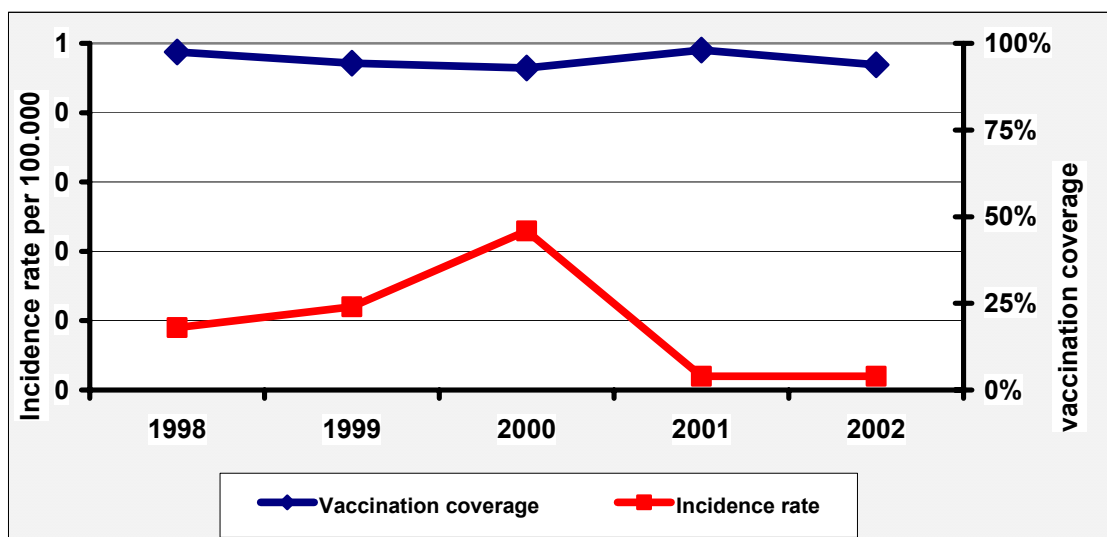


Figure 1 - Pertussis incidence rate by year and vaccination coverage

Vaccination coverage was high but declined slightly from 1998 to 2000, when a peak in notification was observed.

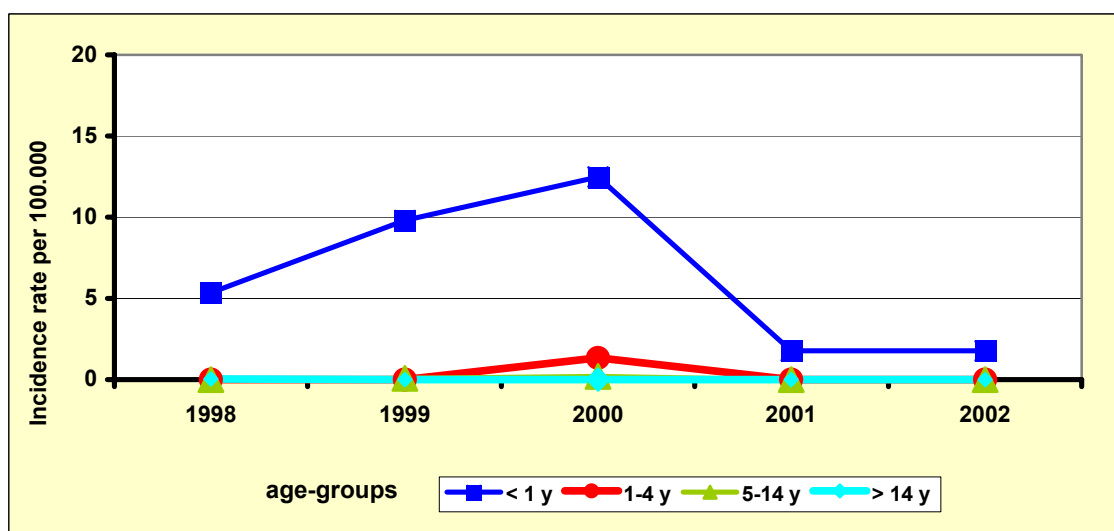


Figure 2 – Pertussis incidence rate by year and age-group

Infants below 1 year of age experienced the highest incidence rate, showing an increase from 1998 to 2000 and then a decrease in 2001 and 2002. Only sporadic cases were recorded among the other age-groups.

Infants below 1 year of age accounted for 73% of cases, followed by children aged 1 to 4 year who accounted for 12,5% of cases. Only few cases were observed among children aged 5 to 14 as well as those above 14.

Vaccination status by age-group: not calculated

Incidence by sub-national area:

Table 3 - Incidence rate (cases per 100.000) by year and region

Region	1998	1999	2000	2001	2002
Portugal Norte	---	---	0,1	0,0	0,0
Potugal Centro	---	---	0,2	0,0	0,1
Lisboa e Vale do Tejo	---	---	0,1	0,0	0,0
Alentejo	---	---	1,7	0,0	0,0
Algarve	---	---	0,3	0,0	0,0
Acores	---	---	0,0	0,0	0,0
Madeira	---	---	0,0	0,0	0,0

Alentejo in 2000 experienced a higher incidence rate compared with that of the other regions.

No cases were recorded in Alentejo and Algarve in 2001 and 2002, as well as in Portugal centro in 2001 and in Lisboa e Vale do Tejo in 2002. No cases were recorded in Acores and Madeira during the period 2000-2002.

Seasonality

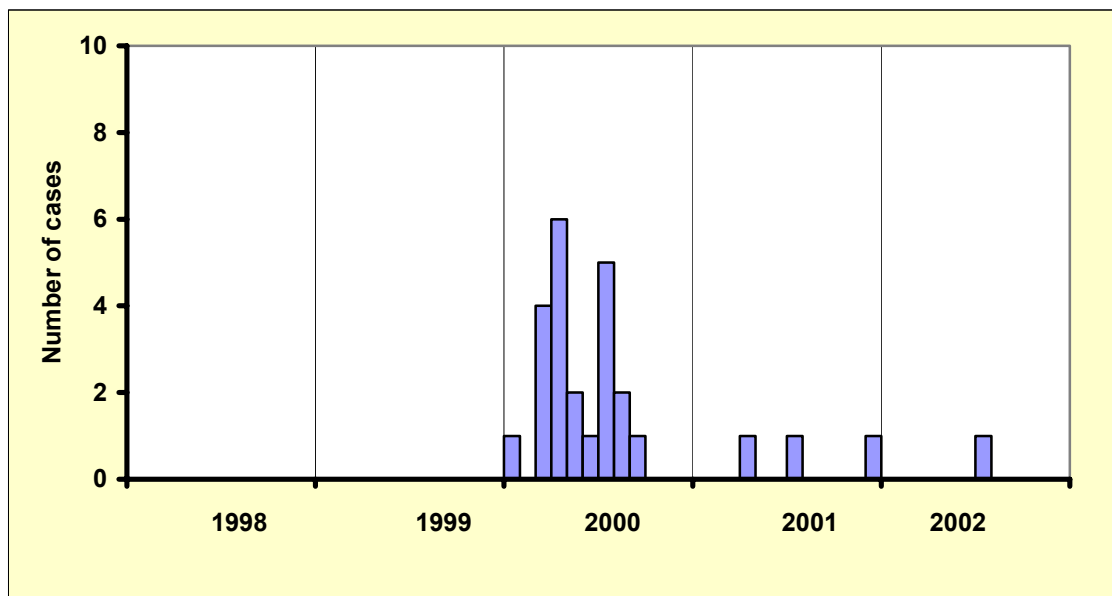


Figure 3 - Number of cases by date of onset

Most cases were observed in 2000, with the highest peaks in April and in July.

Case fatality rate: 21,3 per 1000. One death was recorded in 2000, in an infant below 1 year of age.

Case fatality rate < 1 year: 29,4 per 1000.

Specific mortality rate < 1 year: 1,8/1.000.000

Hospitalisation rate: The hospitalisation rate was 54.2% per 1000, ranging from 0 in 1998 and 1999 to 84.6% per 1000 in 2000. Almost all cases (84,6%) occurred in 2000 were hospitalised.

Hospitalization rate by year and age group: In 2000-2002, all infants below 1 year were hospitalised. In 2000, children aged 1-4 year and persons > 14 years were all hospitalised. In those aged 5 to 14 years the hospitalisation rate was 500 per 1000.

Hospitalization rate by year and vaccination status: In 2000, the hospitalisation rate of vaccinated cases was lower than unvaccinated ones (830/1000 versus 1000/1000). Both cases occurred in 2001, as well as that of 2002, were unvaccinated.

Comments and Interpretations

Portugal showed an extremely low incidence of pertussis during the entire period. The observed figures stand for a selection toward hospitalised cases. For this reason the real incidence of pertussis may be underestimated. The preponderance of infants below 1 year of age may be due to a larger number of susceptibles in this age group or to a lower sensitivity of the surveillance system in the other age groups. No hospitalised cases were recorded in 1998-1999. Viceversa almost all cases recorded in 2000-2002 were hospitalised. The region in which was notified the highest number of cases was Alentejo.

Country Profile -----SPAIN

Pertussis case notifications, 1998-2001

Type of data:	Aggregate (1998-2000) Case based (2001-)
Type of notification system:	Universal, statutory
Denominator:	General population
Minimum requirement for case notification	Clinical symptoms and physician examination
Recommended case definition:	a person with a cough lasting at least 2 weeks with at least one of the following: paroxysm of coughing, inspiratory "whooping", post-tussive vomiting, without other apparent cause (WHO)
Laboratory procedure for case confirmation:	Information not available
Other surveillance systems in place	No
Current vaccination schedule:	2,4,6 months; 18 months; 6 years
Type of vaccine used:	Whole cell vaccine, Acellular
Year of introduction of acellular vaccine:	1997
Number of components of the vaccine:	Information not available

Quality of data received from the gatekeeper

Data provided for the period: 1998-2001. The completed figures were available for the period 1998-2001. Data for 2002 were not available.

Information not recorded among those of the minimum dataset: Date of birth in 1998-2000; Date of disease onset in the entire period; hospitalisation in the entire period; disease outcome in the entire period; date of last dose of pertussis vaccine received in the entire period.

Missing data: Date of birth in 7% of cases in 2001; Gender in 2% of cases (1,4 -2,3%) in 1998-2000; Has received pertussis vaccination in 70% of cases (68-85%) in 1998-2001; Number of pertussis vaccine received in 56% of cases in 2001 and in 6% (3-8,5%) of cases in 1998 and 2000. Hospitalisation in 71% (32-95%) of cases. Disease outcome in 70% (25-95%) of cases. Has received pertussis vaccination in 82-95% of cases.

Table 1 - Summary of available information and completeness by year, number of cases (%)

Year	1998	1999	2000	2001
Number of records	106 (100)	220 (100)	587 (100)	271 (100)
Date of notification	106 (100)	220 (100)	587 (100)	271 (100)
Who cisid code	106 (100)	220 (100)	587 (100)	271 (100)
Date of birth	0 (0)	0 (0)	0 (0)	253 (93,4)
Gender	104 (98,1)	215 (97,7)	579 (98,6)	271 (100)
Date of disease onset	0 (0)	0 (0)	0 (0)	0 (0)
Diagnose classification	106 (100)	220 (100)	587 (100)	271 (100)
Hospitalization	0 (0)	0 (0)	0 (0)	0 (0)
Disease outcome	0 (0)	0 (0)	0 (0)	0 (0)
Has received pertussis vaccination?	34 (32,1)	32 (14,5)	149 (25,4)	128 (47,2)
Number of p.v. received	97 (91,5)	220 (100)	568 (96,7)	119 (43,9)
Date of last p.v. received	0 (0)	0 (0)	0 (0)	0 (0)
Age	104 (98,1)	210 (95,5)	569 (96,9)	253 (93,4)

Inconsistencies: in 64% of records vaccination status is unknown or not vaccinate but the number of dose of vaccine received is available. No inconsistent dates were found.

Reporting delay: not calculated.

Epidemiology

Total number of reported cases: 1184

Male/female ratio: 0,77

Incidence

Table 2 - Incidence of reported pertussis cases by year

Year	Number of cases	Incidence rate (per 100.000)	Laboratory confirmation
1998	106	0,3	Not available
1999	220	0,5	Not available
2000	587	1,5	Not available
2001	271	0,7	43,5%

The incidence rate was very low during the whole period with the highest number of observations recorded in 2000. Laboratory confirmation of cases was carried out only in 2001, in less than half of cases.

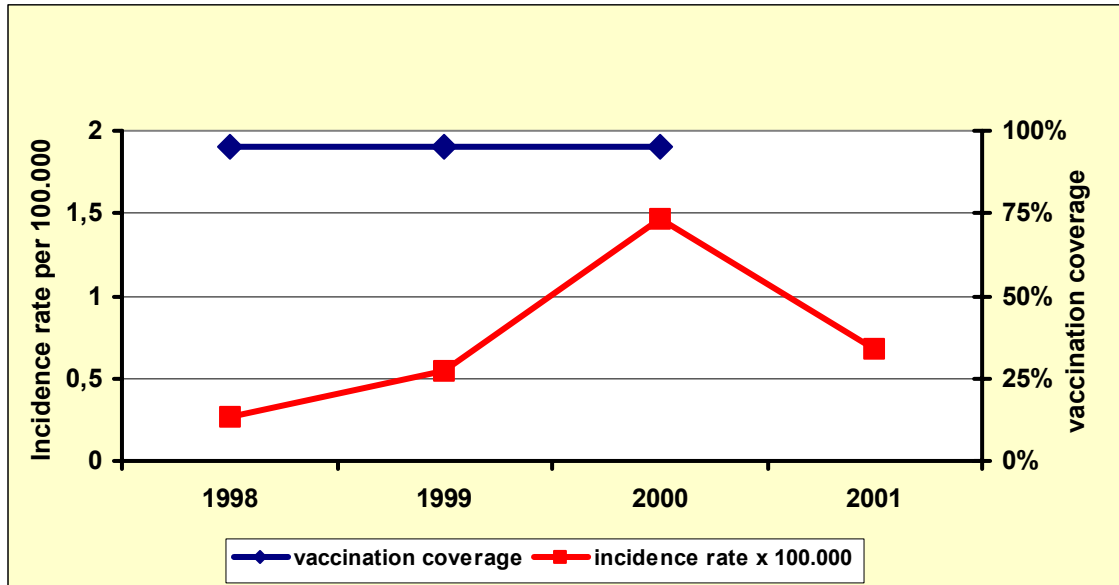


Figure 1 - Pertussis incidence rate by year and vaccination coverage

Until 2000 vaccine coverage was toward 95% and stable over time. It was not available in 2001. No relationship between coverage and variation in incidence rate was observed.

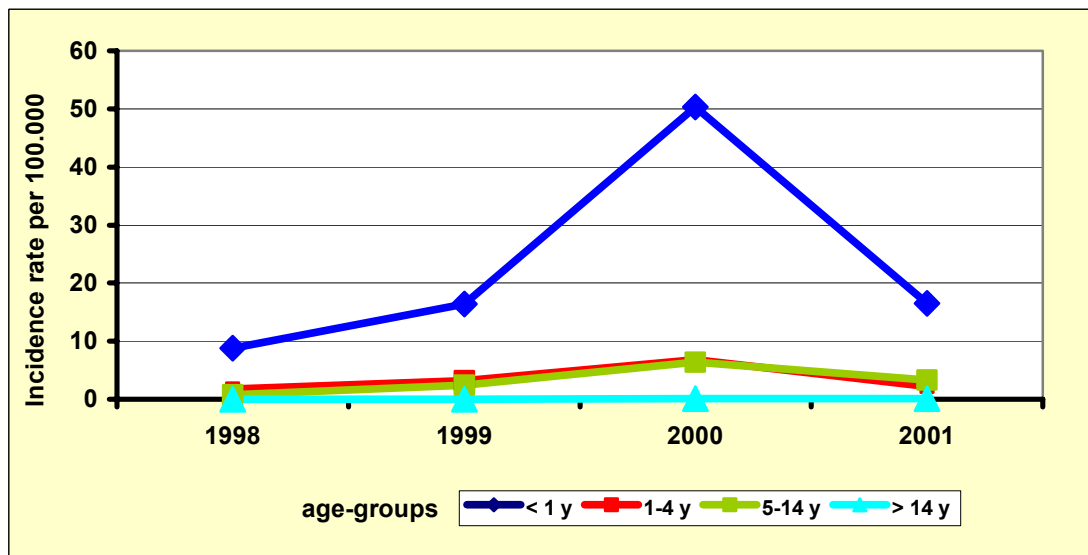


Figure 2 – Pertussis incidence rate by year and age-group

Infants less than 1 year experienced the highest incidence rate. A significant peak in notification was observed in 2000 in this age-group. Children aged 1 to 4 year as well as those aged 5 to 14 year showed a gradual increase in

incidence from 1998 to 2000 and then decrease in 2001. Children aged > 14 years experienced the lowest incidence rate.

The majority of cases was reported among children aged 5 to 14 years of age (46%, lowest 30% - highest 52%). Infants aged < 1 year accounted for 29% of cases (lowest 23% - highest 32%). Children aged 1 to 4 years accounted for 18% of cases (lowest 13% - highest 26%). Persons aged > 14 years accounted for the lowest number of cases (7 %, lowest 2% - highest 13%).

Vaccination status by age-group: not calculated

Incidence by sub-national area

Table 3 - Incidence rate (cases per 100.000) by year and region

Region	1998	1999	2000	2001
Andalucia	0,2	0,4	2,1	1,1
Aragón	1,0	0,3	4,8	1,2
Asturias	0,9	0,9	0,5	0,3
Cantabria	0,2	0,0	4,3	0,0
Castilla La Mancha	0,3	0,3	0,5	0,9
Castilla y León	0,0	0,0	0,1	0,1
Cataluna	0,0	0,0	0,0	0,0
Ceuta	0,0	0,0	0,0	0,0
Comunidad De La Rioja	4,1	0,7	0,0	0,0
Comunidad de Madrid	0,0	0,0	0,0	0,0
Comunidad De Murcia	1,3	1,5	1,2	2,1
Comunidad De Navarra	1,9	2,3	3,4	1,5
Comunidad Valenciana	0,0	0,5	5,0	0,0
Extremadura	0,6	0,1	1,2	9,4
Galicia	0,5	1,0	1,0	0,2
Islas Baleares	0,3	0,0	0,3	1,2
Islas Canarias	0,0	0,1	1,2	0,7
Melilla	0,0	0,0	0,0	0,0
Pais Vasco	0,3	4,1	2,0	0,0

The majority of regions showed an annual incidence rate below 1. However, Pais Vaisco in 1999 as well as Aragon, Cantabria, and Comunidad

Valenciana in 2000 had a peak in notification. The highest rate was observed in Extremadura in 2001.

Seasonality: not calculated

Case-fatality rate: not calculated

Case-fatality rate < 1 year: not calculated

Specific mortality rate < 1 year: not calculated

Hospitalisation rate: not calculated

Comments and interpretations

The incidence rate was very low during the whole period. A low sensitivity of surveillance may explain this finding. A peak in notification was observed in 2000, especially in infants < 1 year of age in Aragon, Cantabria, and Comunidad Valenciana. However, incidence rates by year need to be compared with caution because of the change in the type of data provided (aggregated until 2000 and then case based). In addition, the lack of information on the majority of the variables, among those of the minimal dataset, does not permit epidemiological inferences about the burden, the severity of the disease and the impact of vaccination strategy.

Country Profile -----SWEDEN

Pertussis case notifications, 1998-2001

Type of data:	Case based
Type of notification system:	Universal, statutory
Denominator:	General population
Minimum requirement for case notification	Clinical symptoms and physician examination
Recommended case definition:	a person with a cough lasting at least 2 weeks with at least one of the following: paroxysm of coughing, inspiratory "whooping", post-tussive vomiting, without other apparent cause and laboratory confirmation or epidemiological link (WHO)
Laboratory procedure for case confirmation:	Culture, PCR
Other surveillance systems in place	No
Current vaccination schedule:	3-5-12 months
Type of vaccine used:	Acellular
Year of introduction of acellular vaccine:	1996
Number of components of the vaccine:	1-3-5

Quality of data received from the gatekeeper

Data provided for the period: 1998-2001. The completed figures were available for the period 1998-2001. Data relative to 2002 were not available.

Information not recorded among those of the minimum dataset: WHO CISID code, date of disease onset, hospitalisation, disease outcome, number of pertussis vaccines received, date of last dose of pertussis vaccine received.

Missing data: vaccination status is missing in 38.8-45.1% of records.

Table 1 - Summary of available information and completeness by year, number of cases (%)

Year	1998	1999	2000	2001
Number of records	1769 (100)	2426 (100)	2704 (100)	979 (100)
Date of notification	1769 (100)	2426 (100)	2704 (100)	979 (100)
Who cisid code	0 (0)	0 (0)	0 (0)	0 (0)
Date of birth	1769 (100)	2426 (100)	2704 (100)	979 (100)
Gender	1769 (100)	2426 (100)	2704 (100)	970 (100)
Date of disease onset	0 (0)	0 (0)	0 (0)	0 (0)
Diagnose classification	1769 (100)	2426 (100)	2704 (100)	979 (100)
Hospitalization	0 (0)	0 (0)	0 (0)	0 (0)
Disease outcome	0 (0)	0 (0)	0 (0)	0 (0)
Has received pertussis vaccination?	970 (54,8)	1466 (60,4)	1641 (60,7)	599 (61,2)
Number of p.v. received	0 (0)	0 (0)	0 (0)	0 (0)
Date of last p.v. received	0 (0)	0 (0)	0 (0)	0 (0)
Age	1612 (91,1)	2259 (93,1)	2680 (99,1)	979 (100)

Inconsistencies: in 2001, gender was always "male". In 4,4% of cases "date of notification" precedes "date of birth"

Reporting delay: not calculated

Epidemiology

Total number of reported cases: 7878

Male/female ratio: not calculated

Incidence

Table 2 - Incidence of reported pertussis cases by year

Year	Number of cases	Incidence rate (per 100.000)	Laboratory confirmation
1998	1769	20,0	100%
1999	2426	27,4	81,7%
2000	2704	30,6	86,2%
2001	979	11,1	99,8%

The incidence rate increased steadily from 1998 to 2000 and then declined significantly in 2001. The highest peak was in 2000. The majority of cases was laboratory confirmed.

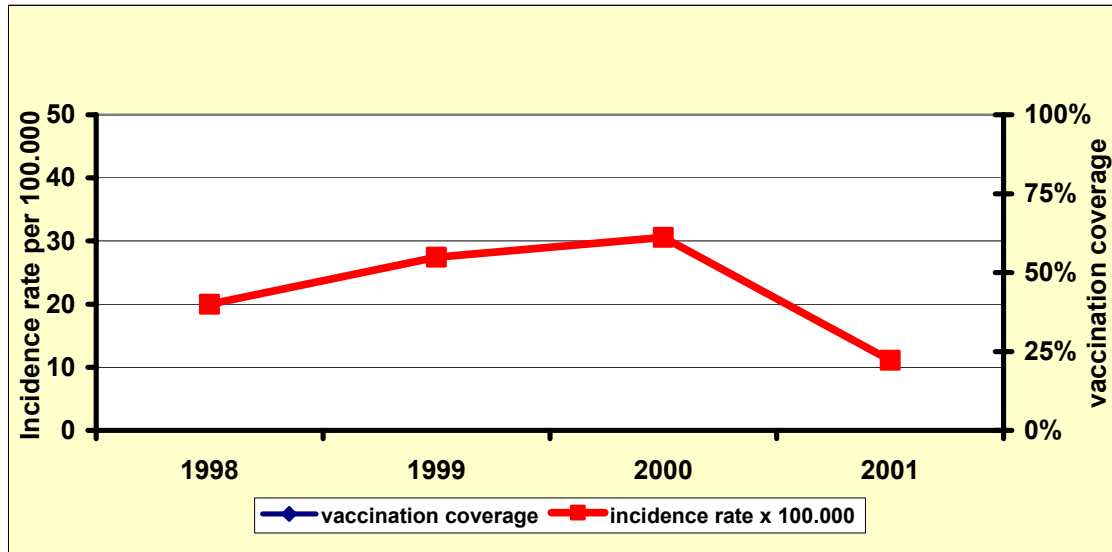


Figure 1 - Pertussis incidence rate by year and vaccination coverage
 Information on vaccination coverage was not available.

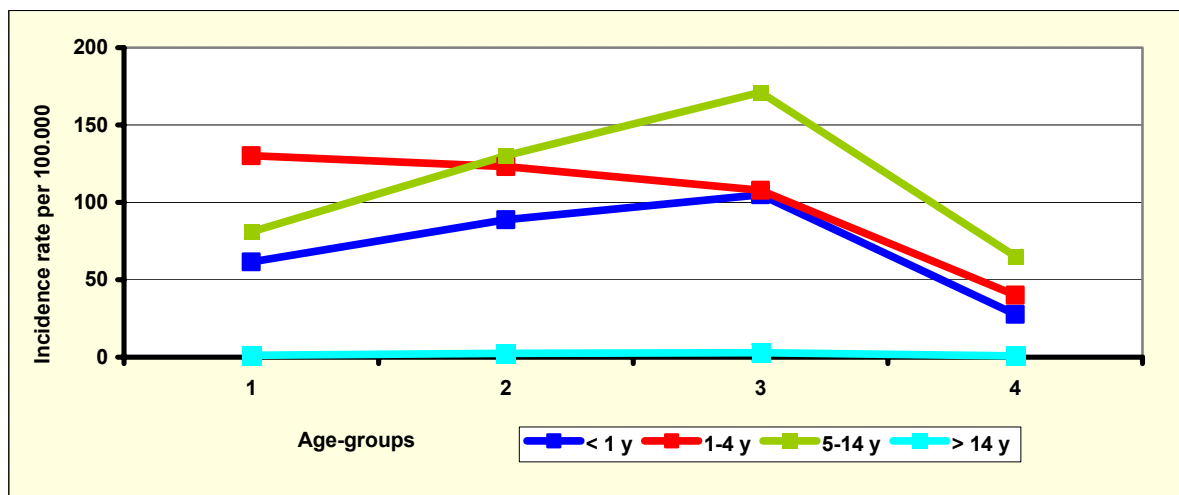


Figure 2 – Pertussis incidence rate by year and age-group

The incidence rate increased from 1998 to 2000 in all age groups except in children 1-4 years old and adults. On the contrary those in the 1-4 year age group experienced a decline in incidence over the whole period. The highest incidence peak was observed in children 5-14 years old, while those > 14 years had the lowest incidence rate. Pertussis incidence decreased sharply in 2001 in all age groups.

The majority of cases was reported among children 5-14 years (69% in the whole period; lowest 57.7%– highest 77.6%). Children 1-4 years accounted

for 20,6% of cases (lowest 13.8%– highest 34%). Persons > 14 years represented 7,2 % of cases (lowest 4.9%– highest 8.5%). Infants < 1 accounted for the lowest proportion of cases (3% in the whole period; lowest 2.1%– highest 3.1%).

Table 3 - Vaccination status by age-groups and year

Age- groups	Year	1998	1999	2000	2001
< 1	CASES	27	43	56	2
	% VACCINATED	11,1%	25,6%	10,7%	0
	% UNVACCINATED	88,9%	74,4%	89,3%	100%
1-4	CASES	283	291	217	64
	% VACCINATED	11,6%	17,2%	24,4%	29,7%
	% UNVACCINATED	88,4%	82,8%	75,6%	70,3%
5-14	CASES	569	921	1216	496
	% VACCINATED	14%	15,1%	21,9%	30,6%
	% UNVACCINATED	86%	84,9%	78,1%	78,1%
> 14	CASES	44	107	134	37
	% VACCINATED	9,1%	17,7%	24,6%	24,3%
	% UNVACCINATED	90,9%	82,3%	75,4%	75,7%
Total	CASES	923	1362	1623	599
	% VACCINATED	13%	16%	22,1%	30%
	% UNVACCINATED	84%	84%	77,9%	70%

The proportion of vaccinated cases was low in all age groups and increased with time.

Incidence by sub-national area: not calculated

Seasonality: not calculated

Case-fatality rate: not calculated

Case-fatality rate < 1 year: not calculated

Specific mortality rate < 1 year: not calculated

Hospitalisation rate: not calculated

Comments and interpretations

The dataset from Sweden did not include information for cases in 2002 and many variables of the minimum dataset were missing. Moreover data on vaccination coverage were not available from WHO. The only finding that can be pointed out is the decrease of incidence in the 1-4 years age group in contrast with the pattern of the other age groups. This may reflect an increase in vaccination coverage during the period under study. Moreover the highest incidence figures were observed in the 5-14 years age group in the year 2000, suggesting that a large number of susceptible persons was present in this age group. Incidence figures in children below 1 year of age were lower than those in 1-4 and 5-14 years age groups. Since usually this age group has the highest incidence of pertussis because children are too young to be vaccinated, this finding may reflect a lower sensitivity of the surveillance system in this age group. Information on deaths and hospitalisations would be useful to support this hypothesis. Sweden has experienced a sharp decrease of pertussis incidence rate in 2001. Information on cases in 2002 and vaccination coverage may be useful for analysing the impact of vaccination strategy in this country.

Country Profile -----SWITZERLAND

Pertussis case notifications, 1998-2002

Type of data:	Case Based
Type of notification system:	Sentinel surveillance system
Denominator:	Information not available
Minimum requirement for case notification	Clinical symptoms and physician examination
Recommended case definition:	a person with a cough lasting at least 2 weeks with at least one of the following: paroxysm of coughing, inspiratory "whooping", post-tussive vomiting, without other apparent cause (WHO)
Laboratory procedure for case confirmation:	PCR
Other surveillance systems in place	Information not available
Current vaccination schedule:	2,4,6 months; 15-24months; 4-7 years
Type of vaccine used:	Acellular
Year of introduction of acellular vaccine:	1996
Number of components of the vaccine:	2-3

Quality of data received from the gatekeeper

Data provided for the period: 1998-2002. The completed figures were available for the period 1998-2002.

Information not recorded among those of the minimum dataset:
None

Missing data: Gender in 0,5-0,9% of records; Date of disease onset in 12-31%; Diagnose classification in 4-22%; Has received pertussis vaccination in 13-26%; Number of doses of vaccine received in 15-26%; Date of last dose of vaccine received in 31-77%.

Table 1 - Summary of available information and completeness by year, number of cases (%)

Year	1998	1999	2000	2001	2002	Total
Number of records	0	443 (100)	0	222 (100)	180 (100)	845 (100)
Date of notification	---	443 (100)	---	222 (100)	180 (100)	845 (100)
Who cisid code	---	443 (100)	---	222 (100)	180 (100)	845 (100)
Date of birth	---	443 (100)	---	222 (100)	180 (100)	845 (100)
Gender	---	439 (99.1)	---	221 (99.5)	180 (100)	840 (99.4)
Date of disease onset	---	304 (68.6)	---	196 (88.3)	147 (81.7)	647 (76.6)
Diagnose classification	---	346 (78.1)	---	213 (95.9)	155 (86.1)	714 (84.5)
Hospitalization	---	443 (100)	---	222 (100)	180 (100)	845 (100)
Disease outcome	---	443 (100)	---	222 (100)	180 (100)	845 (100)
Has received pertussis vaccination?	---	361 (81.5)	---	194 (87.4)	133 (73.9)	688 (81.4)
Number of p.v. received	---	226 (74.1)	---	126 (100)	106 (100)	458 (85.3)
Date of last p.v. received	---	151 (49.5)	---	87 (69.0)	82 (77.4)	320 (59.6)
Age	---	443 (100)	---	222 (100)	179 (99.4)	844 (99.4)

Inconsistencies: in 9,3% of cases Date of last dose of vaccine received is inconsistent with Has received pertussis vaccination. In 6% of records Date of last dose of vaccine received precedes Date of birth. In 1,3% of records Date of notification precedes Date of disease onset

Reporting delay: The median reporting delay was 26 days (IQR: 19-36)

Epidemiology

Total number of reported cases: 845

Male/female ratio: 0.76

Incidence

Table 2 - Incidence of reported pertussis cases by year

Year	Number of cases	Number of estimated cases *	Incidence rate (per 100.000)	Laboratory confirmation
1998	0	0	---	
1999	443	14916	208,0	21,0%
2000	0	0	---	
2001	222	7450	103,9	25,8%
2002	180	6000	83,7	20,6%

* Since data are derived from a sentinel surveillance system, they are not representative of the whole population. The real number of cases is estimated from the proportion of the population under surveillance each year. This proportion varied from 2.98% to 3%.

The incidence of whooping cough was very high over the entire period. The highest peak was recorded in 1999. Laboratory confirmation of cases was carried out in a small percentage of cases.

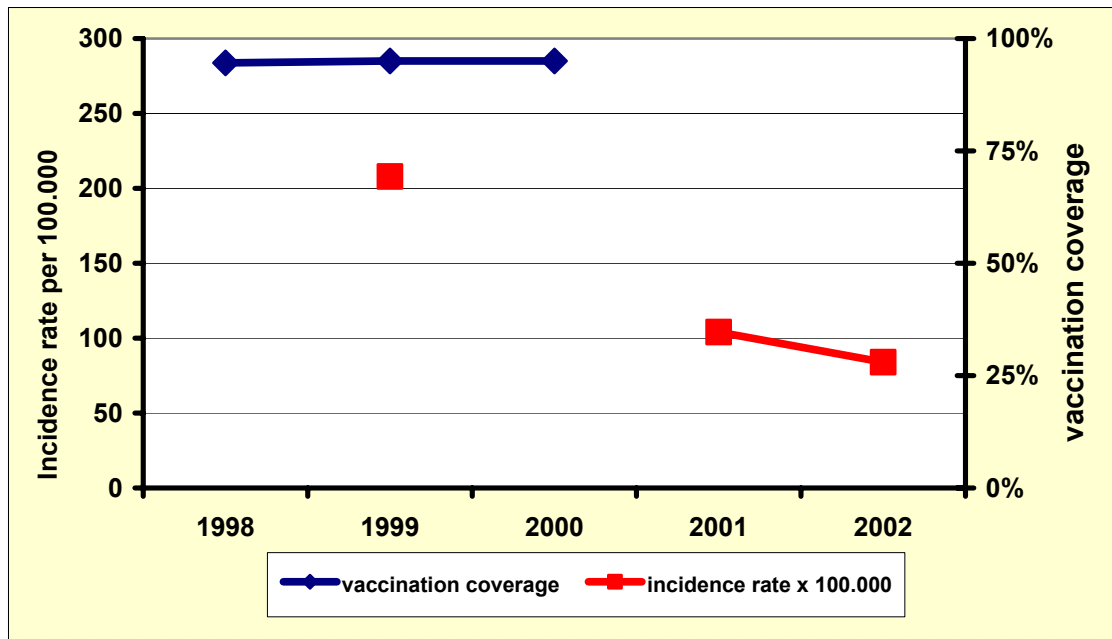


Figure 1 - Pertussis incidence rate by year and vaccination coverage

Information on vaccine coverage was available only in the period 1998-2000. It was high and stable over time. Apparently the peak observed in 1999 was not related to a fall in immunisation coverage.

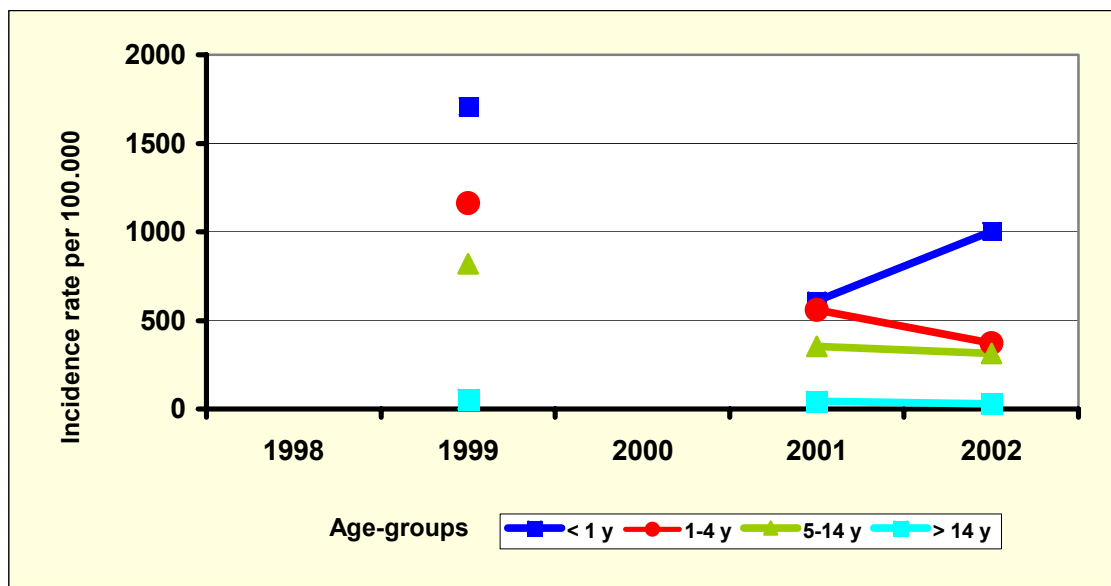


Figure 2 – Pertussis incidence rate by year and age-group

Infants < 1 year of age showed the highest incidence followed by children aged 1 to 4 years and those aged 5 to 14 years. Persons > 14 years showed the lowest incidence.

The majority of cases were reported in children aged 5 to 14 years of age (43%, lowest 39% - highest 46%).

Persons >14 years accounted for 27% of cases (lowest 22% - highest 34%). Children aged 1 to 4 years accounted for 22% of cases (lowest 17% - highest 24%). Infants below 1 year of age accounted for the lowest proportion of cases (8%; lowest 5% - highest 10%).

Vaccination status by age-group: not calculated

Incidence by sub-national area

Table 3 - Incidence rate (cases per 100.000) by year and region

Region	1998	1999	2000	2001	2002
Aargau	---	50,0	---	31,1	6,3
Appenzel A.Rh.	---	0,0	---	0,0	0,0
Appenzel I.Rh.	---	0,0	---	0,0	0,0
Basel	---	442,3	---	208,1	286,4
Basel-City	---	34,0	---	0,0	0,0
Bern	---	272,6	---	141,4	110,2
Fribourg	---	332,5	---	58,1	0,0
Geneva	---	142,3	---	42,5	42,7
Glarus	---	86,4	---	0,0	171,2
Graubunden	---	447,6	---	411,2	232,1
Jura	---	96,3	---	0,0	0,0
Lucerne	---	290,1	---	97,4	48,2
Neuchatel	---	140,1	---	20,5	140,2
Nidwalden	---	356,4	---	0,0	89,1
Obwalden	---	0,0	---	0,0	0,0
Schaffhausen	---	0,0	---	90,2	0,0
Schwyz	---	132,4	---	0,0	53,3
Solothurn	---	288,1	---	192,4	179,2
St.Gallen	---	291,5	---	164,4	120,2
Thurgau	---	250,5	---	206,3	59,2
Ticino	---	184,1	---	65,5	76,2
Uri	---	93,1	---	0,0	0,0
Valais	---	291,3	---	97,4	121,1
Vaud	---	142,5	---	76,4	33,2
Zug	---	0,0	---	0,0	0,0
Zurich	---	177,4	---	104,2	98,3

There was a marked difference in incidence rates between and within regions.

The majority of regions experienced the highest rate in 1999. Some regions did not record cases during the whole period. Other areas provided notifications irregularly over time.

The annual rate showed a decrease with time. The highest incidence rate was observed in Graubunden and Basel in 1999.

Seasonality

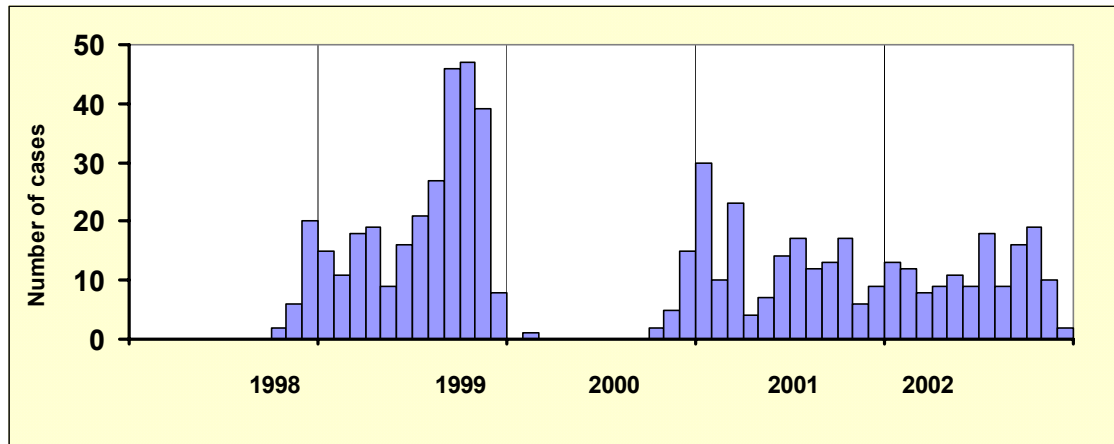


Figure 3 - Number of cases by date of onset

The incidence rate by month of onset did not show a regular periodic seasonality in the occurrence of cases over the years. The highest peak was observed in winter in 1999.

Case-fatality rate: 0

Case fatality rate < 1 year: 0

Specific mortality rate < 1: 0

Hospitalisation rate

Infants below 1 year of age showed in 1999 as well as in 2002 the highest

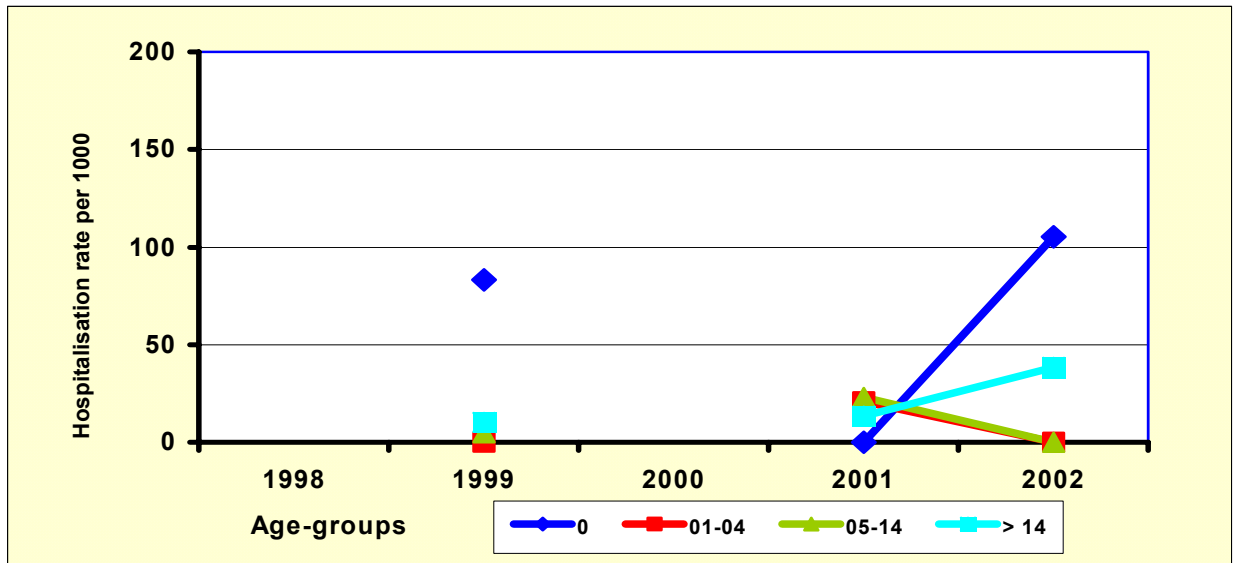


Figure 4 - Hospitalization rate by year and age group

hospitalisation rate. Apparently, no cases were notified in 2001 in this age-group. Children aged 1 to 4 year had a moderately rate in 2001. Apparently, no cases were notified in 1999 as well as in 2002 among this age-group.

In children aged 5 to 14 years the hospitalisation rate was very low during the entire period, while in persons aged >14 years, it peaked in 2002.

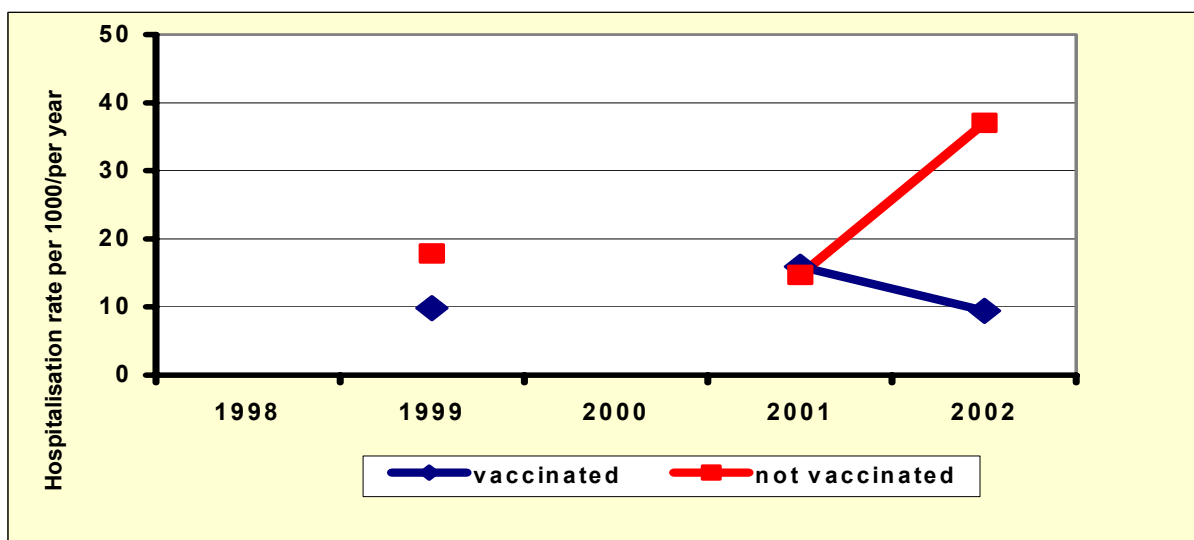


Figure 5 - Hospitalization rate by year and vaccination status

In 1999 as well as in 2002, unvaccinated children were more likely to be hospitalised than vaccinated ones. No differences were found in 2001.

Comments and Interpretation

The incidence of Pertussis in Switzerland is high compared to that observed in other European Countries. The data provided to EUVACNET by Switzerland must be interpreted with caution since incidence figures were extrapolated from a surveillance system with low coverage. Moreover, notifications for 1998 and 2000 were not provided to EUVAC.NET and sub-national areas did not report regularly cases over time. Information regarding hospitalisation, disease outcome and vaccination status are largely incomplete. Vaccine coverage is provided only in the 1998-2000 period. Consequently the impact of vaccination strategy on the epidemiology of disease can not be analysed. Infants below 1 year of age were the most affected age group in terms of incidence and severity of disease. The analysis of the annual incidence rate by region suggests that the most affected area during the incidence peak of 1999 were St. Gallen and Vaud. No deaths were recorded among infants below 1 year of age. Vaccinated patients had a lower risk to be hospitalised suggesting that vaccine protected against severe disease.

Country Profile -----UK

(England, Wales, Northern Ireland)

Pertussis laboratory confirmed cases, 1998-2002

Type of data:	Case- based
Type of notification system:	Laboratory based
Denominator:	General population
Minimum requirement for case notification	Laboratory confirmation
Recommended case definition:	No case definition
Laboratory procedure for case confirmation:	Yes, Culture, Serology and /or PCR since 2002
Other surveillance systems in place	Yes, statutory notification, hospital episodes statistics, sentinel GP reporting, death certification
Current vaccination schedule:	2,3,4months; 3-5 years
Type of vaccine used:	Whole cell vaccine: for the primary vaccination schedule Acellular vaccine – combined: for booster dose
Year of introduction of acellular vaccine:	2001 for booster dose only
Number of components of the vaccine:	4

Quality of data received from the gatekeeper

Type of surveillance system: laboratory reports.

Data provided for the period: 1998-2002.

Information not recorded among those of the minimum dataset: Diagnosis classification is by definition 'laboratory' for all years, disease outcome only recorded if known to have died and is therefore incomplete and cannot be used to estimate case-fatality rates. Date of last pertussis vaccine received in 2000-2002 only. Date of notification is not recorded by the surveillance system as it is laboratory based data, but specimen date has been provided for all years and used as proxy date for "date of notification".

Missing data: Who cisid code is missing in 0.9-1.4% of cases recorded in 1999-2000; Hospitalization is missing in 18% (14%-21%) of records; Disease outcome is missing in 1998-1999 and in 96% (93-99%) of records in the other years; Has received pertussis vaccination is missing in 12% (5%-20%) of records; Number of pertussis vaccine received is missing in 1.6% of cases (0.81-3.9%). Date of last pertussis vaccine received is

missing in 1998-1999 and in 35% of records (18.5-60%) in the other years. Date of onset not available – only date is specimen date.

Table 1 - Summary of available information and completeness by year, number of cases (%)

Year	1998	1999	2000	2001	2002
Number of records	386 (100)	342 (100)	211 (100)	310 (100)	380 (100)
Date of notification	386 (100)	342 (100)	211 (100)	310 (100)	380 (100)
Who cisid code	386 (100)	339 (99,1)	208 (98,6)	310 (100)	380 (100)
Date of birth	385 (99,7)	342 (100)	211 (100)	310 (100)	371 (97,6)
Gender	386 (100)	342 (100)	211 (100)	307 (99,0)	376 (98,9)
Date of disease onset	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Diagnose classification	386 (100)	342 (100)	211 (100)	310 (100)	380 (100)
Hospitalization	333 (86,3)	279 (81,6)	174 (82,5)	244 (78,7)	314 (82,6)
Disease outcome	0 (0)	0 (0)	15 (7,1)	16 (5,1)	2 (0,5)
Has received pertussis vaccination?	368 (95,3)	315 (92,1)	184 (87,2)	265 (85,5)	306 (80,5)
Number of p.v. received	122 (96,1)	123 (99,2)	64 (98,5)	92 (100)	152 (98,1)
Date of last p.v. received	0 (0)	0 (0)	26 (40,0)	75 (81,5)	113 (72,3)
Age	385 (99,7)	342 (100)	211 (100)	310 (100)	371 (97,6)

Inconsistencies: none

Reporting delay: not calculated

Epidemiology

Total number of reported cases: 1629

Male/female ratio: 0.86

Incidence

Table 2 - Incidence of reported pertussis cases by year

Year	Number of cases	Incidence rate (per 100.000)	Laboratory confirmation
1998	386	0,7	100%
1999	342	0,6	100%
2000	211	0,4	100%
2001	310	0,6	100%
2002	380	0,7	100%

The incidence rate was low due to selection of laboratory confirmed cases and relatively stable, ranging from 0.4/100.000/per year in 2000 to 0.7/100.000/per year in 1998 and 2002.

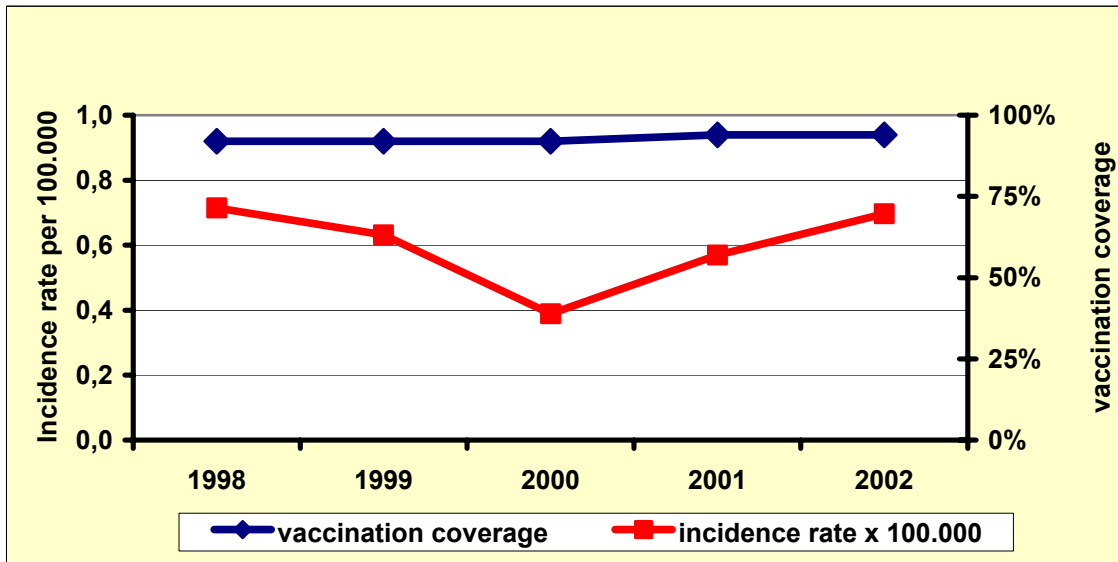


Figure 1 - Pertussis incidence rate by year and vaccination coverage

Vaccination coverage was always high, ranging from 92% in 1998 to 94% in 2002.

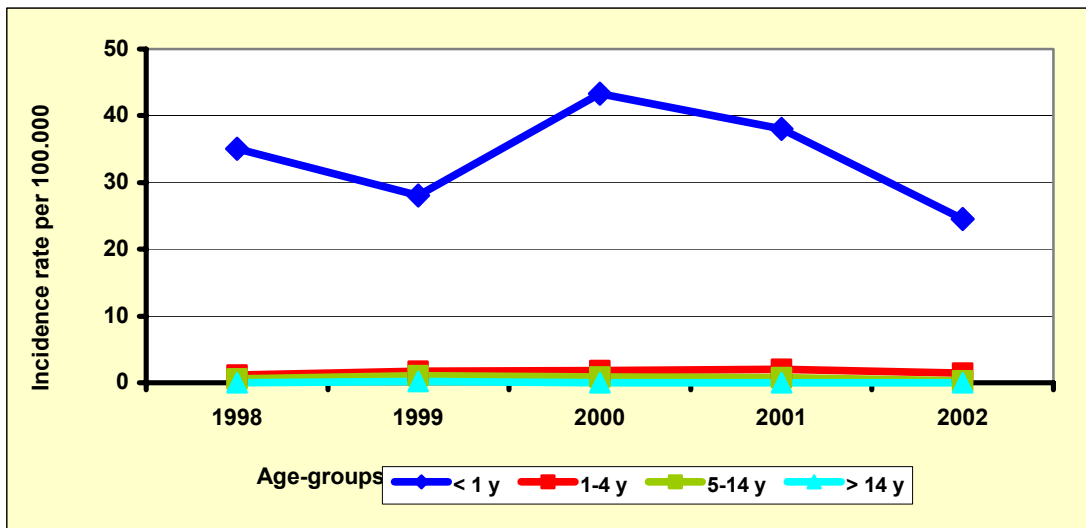


Figure 2 – Pertussis incidence rate by year and age-group

The highest figures were recorded in infants below 1 year of age. The incidence rate among this age group decreased from 1998 to 1999 and then peaked again.

Among the other age groups the incidence rate was much lower and stable during the whole period.

The majority of cases was recorded among infants below 1 year of age with 64% of cases (lowest 46%; highest 73%). Children aged 5-14 years accounted for 16% of cases (lowest 10%, highest 20%). Children 1-4 years old accounted for 13% of cases (lowest 10%; highest 18%).

Persons > 14 years represented 7% of cases (lowest 2%; highest 19%).

Incidence by sub-national area: not calculated

Seasonality

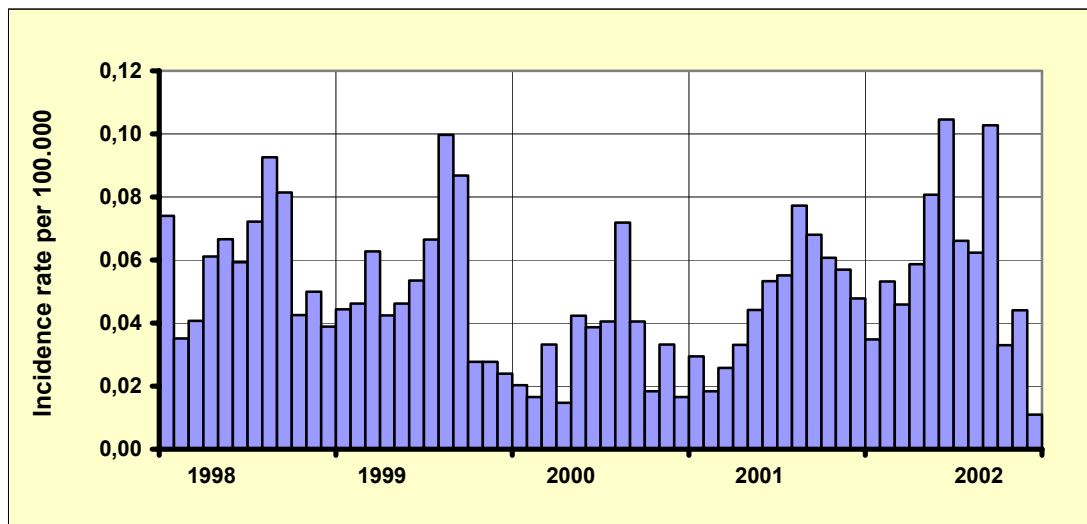


Figure 3 – Pertussis incidence rate by date of onset

The proportion of cases by date of onset showed a periodic seasonality in summer in the occurrence of cases during the years. In 1998 a peak in notification was also observed in January.

Comments and Interpretation

According to data reported to EUVAC-NET, the incidence of pertussis in England, Wales and Northern Ireland has remained low through the five-year period and no outbreaks were observed. However, these data underestimate the real burden of the disease in these countries because the cases recorded are only those laboratory confirmed. Infants below 6 months of age are the most affected age-group.

The significant peak in reporting observed in 2002 in subjects > 14 years was probably due to serology testing being offered to adults with a cough persisting for > 21 days and children with a cough persisting > 14 days since 2002. These cases are likely to have been culture negative and testing with serology has increased case ascertainment.

The characteristic seasonality of pertussis (summer) has been observed.

General comments and recommendations

Comments

This extended surveillance system which has worked for 5 years allows to draw a comprehensive picture of a large area of Europe relevant to the epidemiology of pertussis.

The general overview of national surveillance systems reveals a very disomogeneous situation. Of the 19 countries included in the project, 3 were not able to provide any data (Finland, Belgium, Luxembourg), 12 provided data in a case-based format, Austria had only aggregated data available, while 3 countries switched from aggregated to case-based data during the period under study (Ireland, Iceland, Spain). In presence of aggregated data a breakdown of cases by other variables is not possible.

Most data came from surveillance systems working on the general population. However 2 countries provided data from sentinel surveillance systems without a precise estimate of denominators (Switzerland and France). Moreover Denmark provided data only on population 0-2 years of age, and Germany provided data for the East Germany (FEG) only. In addition, the data source provided to EUVAC-NET is not the only source of pertussis surveillance data in a Country. For instance, UK uses national data sets of hospital admissions and clinically diagnosed cases as well as identification of pertussis deaths from a national death certificates and other sources. All these factors limited the calculation of reliable incidence rates and figures representative of the entire area under surveillance.

As already known, diagnosis and case definition for surveillance of pertussis are very diverse throughout Europe. Four countries over the 16 which provided data applied the clinical case definition recommended by WHO, and 6 countries applied the WHO case definition plus laboratory confirmation or epidemiological link. The other countries either applied a local case definition or relied on the clinical diagnosis of physicians.

The use of laboratory for case confirmation is limited and includes various methods. Only a minority of countries requires a laboratory confirmation by culture, serology, or PCR for qualifying cases of pertussis. In other countries the laboratory procedures are available but they are not requested for case notification.

The vaccination strategies used throughout Europe include several options. Despite many countries switched to acellular vaccines after the demonstration of their efficacy and safety, several countries (7/16) still use whole cell vaccines, and eventually use acellular vaccines for booster doses. Vaccination schedules varied with time in most of the countries. Currently, vaccination schedules include the administration of primary immunization in the first year of life only (Denmark, Norway, Sweden), or primary

immunization in the first year of life plus one or two booster doses with the last dose at 4-7 years (Greece, UK, Ireland, Iceland, Italy, the Netherlands, Portugal, Spain, Switzerland), or administration of primary immunization and a booster dose during adolescence (Austria, France, Germany, Malta).

A prerequisite of the project was to reach an agreement on a minimal dataset which would have served as a base for describing the epidemiology of pertussis in each country. Not all participants were able to provide a complete set of data for the most recent period of surveillance or the complete datasets were not sent on time. In particular complete data for 2002 were not available for 3 countries. This observation underlines how timeliness of surveillance for pertussis, a disease with a relatively high number of cases notified in most countries, is not ensured in the entire area participating in the study. The median reporting delay was available only for 5 countries and varied between 33 and 75 days. Moreover, among countries which provided case based records, many were not able to provide information on hospitalisation, outcome, and number of pertussis vaccine doses received.

In all countries except Portugal, females were more affected than males with a male/female ratio between 0.76 and 0.97. Incidence figures by year were very different when countries were compared. Most countries showed an overall incidence over the five years period below 5 per 100.000. A moderate incidence (> 5 and < 12 per 100.000) was recorded in Italy, Ireland, and Germany. High incidence countries were Switzerland (> 80 per 100.000), Sweden (> 12 per 100.000; in 2001 11.1 per 100.000), the Netherlands (> 12 per 100.000), Norway (> 25 per 100.000). Denmark showed a high incidence rate in population under two (> 100 per 100.000). The comparison of these figures is not straightforward. Some of the low incidence countries (Spain, Portugal, UK, Greece) showed a very low incidence rate likely due to selection of cases or low sensitivity of the system. On the other hand very high figures as those recorded in Switzerland may be due to an underestimation of denominators, and in Denmark, obviously, to the selection of population under two.

When looking at the relationship between vaccination coverage and incidence rate, most countries showed constant high vaccination coverage over time. Malta had a slight decrease during the period under study while Italy and Germany increased vaccination uptake.

However, we cannot draw a comprehensive picture of the relationship between vaccination coverage and incidence of pertussis because information on vaccination coverage was not available for all countries and in some cases; the figures posted on the CISID web-site were not updated. Accurate information on current and historical vaccination coverage are essential to interpret the epidemiology of pertussis in each country.

When looking at peaks in incidence rates by year, Iceland, Switzerland, and Malta had a peak in 1999, Sweden, Norway, Germany, France, Spain, and Portugal had a peak in 2000, Austria and Greece in 2001, and Denmark in 2002.

Many interesting features were observed when calculating incidence rates by age group. In the majority of the countries children < 1 year of age had the highest incidence, followed by those 1-4 years. This pattern however had some exceptions. Sweden showed a decreasing trend of incidence in all age groups but those aged 1-4 years had a higher incidence than those < 1 year. Norway and Germany had the highest incidence in infants aged < 1 year and children aged 5-14 years while only few cases were recorded in children aged 1-4 years.

In most of the countries the proportion of cases in each age-group showed a shift towards children aged 5- 14 years and adults > 14 years.

The trends showed in this analysis may depend on the preferential sensitivity of the system toward cases in the first year of life (i.e. the most severe) in most of the countries; the trend in vaccination coverage and the resulting susceptible cohorts, and the vaccination schedule in place. In addition, in some countries the observed increase of pertussis cases in children in secondary school could be due to different methods used in case ascertainment and a higher sensitivity of the system towards cases in older age-groups, in particular in 2001-2002.

Most cases occurred in unvaccinated persons in each country. Exceptions were the Netherlands, Norway, and Switzerland, where a notable proportion of cases occurred in vaccinated individuals in all age groups. Though the information on vaccination status is largely incomplete, this observation may depend on very high vaccination coverage or on a sub-optimal vaccine efficacy. A low vaccine efficacy is apparently the case of the Netherlands where a high proportion of vaccinated cases corresponds to a relatively high incidence rate in most age groups.

The seasonality of pertussis with peaks in late spring and summer was not observed in every country. A peak during autumn and winter was observed in Norway and Denmark during the whole period of surveillance.

Many countries do not report the information on death due to pertussis. For the majority of countries, in which information about disease outcome was recorded, no deaths associated with pertussis were reported. Portugal had a case fatality rate of 21.3 per 1000 (1 case only), France 14.6 per 1000, UK 6.14 per 1000, Denmark 0.99 per 1000, Germany 0.75 per 1000 (1 case only), Norway 0.12 per 1000, the Netherlands 0.07 per 1000. Obviously, it is likely that variations in case-fatality rates mostly depend on selection of cases reported to surveillance systems.

When looking at the specific mortality rate in children below 1 year France reported a rate of 5.5 per 1.000.000, Norway 3.6, UK and Denmark 3.0, Portugal 1.8, the Netherlands 1.1 and the other countries reported a rate of 0. Since it is unlikely that severity of pertussis varies in the area included in this surveillance program, it may be that some pertussis cases leading to death are misdiagnosed and therefore not reported even in children less than 1 year of age.

In some countries, the disease outcome was not recorded by the surveillance system and additional sources of information on deaths due to pertussis should be identified in order to estimate the severity of the disease.

Another way to describe severity of pertussis is looking at the hospitalization rates. The highest rates are observed in infants below 1 year of age. Among countries for which the hospitalization rate was available, Portugal, and France showed a rate close to 100% particularly for children below 1 year of age. This observation clearly reflects the nature of the specific surveillance system and the selection of hospitalised cases. The lowest rates in children below 1 year were observed in the Netherlands (nearly 40%), Italy (35%), and Germany (35%).

In the majority of countries vaccinated children were less likely to be hospitalised than unvaccinated ones suggesting a role of vaccine in reducing severity. In all countries, the role of vaccine in protecting against severe disease was observed in particular in children < 1 year of age.

Recommendations

The creation of an uniform approach to pertussis surveillance should be further promoted. EUVAC-NET represented a strong support to harmonization of pertussis surveillance. Given the type of surveillance systems used by countries participating in EUVAC-NET, the following actions should be promoted:

- encourage the implementation of surveillance systems on the general population where they do not exist yet;
- encourage the collection of case based information following the minimum dataset identified by EUVAC-NET;
- estimate/measure accurate denominators for sentinel surveillance systems where systems on general population are not in place;
- support the use of the standard WHO clinical case definition.

The use of laboratory methods for diagnosis of pertussis is not homogeneous throughout the area which participated in the project. Standardization of laboratory diagnosis is relevant to qualification of diagnosis for surveillance and should be promoted. In particular, the use of serology deserves ad hoc studies which could be coordinated in European countries:

- The use of serology should be diffused and standardized;
- The diffusion of PCR methods for diagnosis of pertussis should be promoted.

Different countries exhibited specific mortality rates under 1 year of age equal to 0. Since several countries reported some deaths due to pertussis in

the population under one, it may be that pertussis is misdiagnosed especially in infants in the first three months of age:

- a study should be performed with the aim of reviewing the causes of death in the first three months of age in patients with a respiratory cause to clarify if pertussis may go undetected;
- Laboratory diagnosis of pertussis should be encouraged with special emphasis to children in the first months of age.

Incompleteness of information for surveillance purpose may require a long time to be fixed. Changes in the structure of surveillance systems are always difficult. An alternative could be considering the integration of information through existing sentinel surveillance for the integration of information not routinely collected by the local system. More in general alternative sources of information should be explored for validating and interpreting correctly the data:

- The integration and validation of surveillance data by comparison with existing sentinel surveillance system should be promoted;
- Other data useful for integration and validation of surveillance systems should be considered, such as those from hospital registries and mortality records.

One of the objectives of this surveillance program was to collect information on vaccination coverage, including an inventory of the systems used by different countries to measure the vaccination uptake. This information would be crucial for correctly identifying susceptible in the population. This objective was not met and vaccination coverage available from WHO was used instead:

an effort should be made to collect information on vaccination coverage in different birth cohorts together with the methods used for this measure.

Understanding the impact of different vaccination strategies (i.e. different vaccines and different schedules) is the final goal of this surveillance activity. Different patterns of age specific incidence have been observed in different countries. One critical issue is understanding the epidemiology of the disease in adolescents and young adults:

a more detailed analysis of data should be made to explore the relationship between vaccination schedules and age specific incidence.

Another potential objective of this program was promoting the cooperation between epidemiologist and microbiologists and integrating epidemiologic surveillance of pertussis with collection and examination of strains isolated from cases. This objective was not met:

a collaboration between epidemiologists and microbiologist should be further encouraged for surveillance of pertussis.

Surveillance methods are diverse also in countries which did not participate in the EUVAC-NET project, including accession countries:

The methods used for surveillance of pertussis in EUVAC-NET should be diffused to other European countries, including accession countries.

The EUVAC-NET project represented a common reference for participating countries to sustain and standardise surveillance of pertussis:

Further activities properly funded should be warranted for standardisation of surveillance of pertussis, for studying its epidemiology, and implementing appropriate prevention programs.