

## Early warning of bio-terrorist attacks:

*An innovative approach to surveillance using telephone calls to a health advice service.*



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# Outline of presentation



Background to HPA and NHS Direct

Why use NHS Direct data for surveillance?

What data do we get from NHS Direct?

How are these data analysed?

How do we feedback to local health protection teams?

Examples of results so far

Future work and conclusions



The Health Protection Agency is a new national organisation for England and Wales, established on 1 April 2003.

It is dedicated to protecting people's health and reducing the impact of infectious diseases, chemical hazards, poisons and radiation hazards.

There are 9 regional and 42 Local Health Protection Teams within the HPA.

# Background to NHS Direct



NHS Direct is a telephone help line.

Open 24 hours a day, 365 days a year.

Aims to provide the public with health advice and information.

First introduced in 1998, providing a service in 3 pilot areas.

Now provides a service to the whole of England and Wales.

*NHS Direct Sites - 2001*



# Background to NHS Direct



Staffed by nurses who use the NHS Clinical Assessment System (NHSCAS) to guide the advice they give in response to callers' symptoms

The NHS CAS contains over 200 algorithms consisting of a series of questions relating to the symptoms of the person about whom the call is made

Each call results in a 'disposition' or outcome (e.g 999 call out, A&E, doctor referral or self-care)

NHS Direct nurses 'triage' rather diagnose callers

# Call volumes



NHS Direct currently answers 6.5 million calls per year

NHS Direct calls: 130 per 1000 pop/year

Primary care doctors: 3,800 per 1000 pop/year

Call rate are highest when doctor surgeries are closed

*weekends, bank-holiday, early evening (7-9PM)*

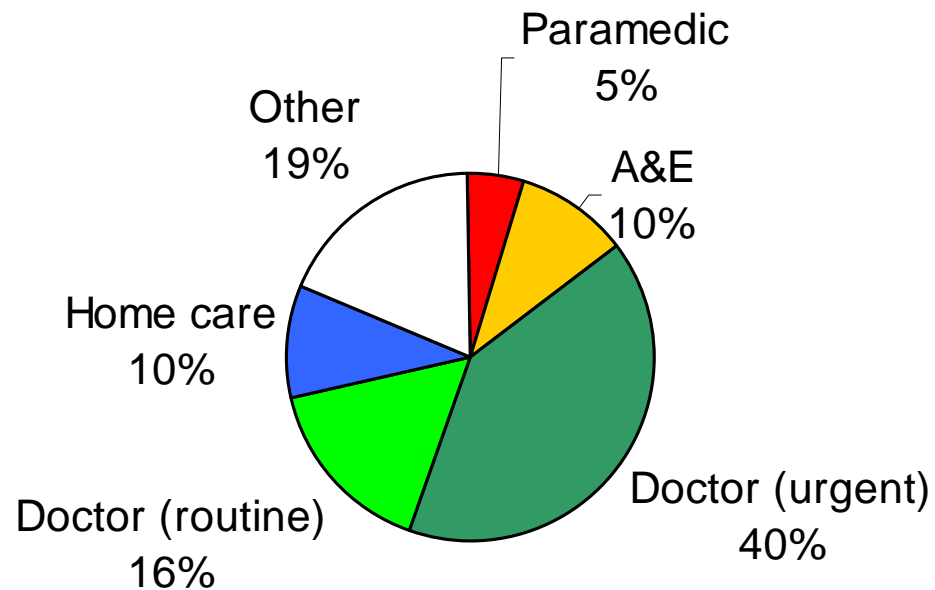
Outcome & Age proportions

# Age and outcome of NHS Direct calls

## Direct calls



**Outcome of NHS Direct calls (%)**



# Why use NHS Direct data for surveillance?



**Covers all of England and Wales**

**Data can be collected and analysed daily**

**Public contact NHS Direct for advice regarding symptoms**

**Previous experience in influenza- like illness surveillance**

**Piloting work on surveillance of gastrointestinal disease.**

to combat terror threat from Bin Laden

# NHS plans to spot anthrax outbreak

By **Lucy Johnston**

THE Government hopes to use NHS Direct to help detect the use of biological warfare.

It believes the 24-hour patient helpline could pick up outbreaks of killer diseases such as anthrax or smallpox.

Top scientists have been commissioned to work out how the service could be transformed into an early detection system.

The idea comes amid fears of germ warfare from Osama Bin Laden's Al Qaeda network

UK researchers began working on the NHS Direct project in the wake of the terrorist attacks on September 11.

They now believe that because NHS Direct covers the whole country and collects data every day, the system



**THREAT: Fears of germ warfare by Bin Laden**

could easily pick up sudden rises in deadly symptoms and alert authorities to the deliberate release of biological agents.

Dr Maureen Baker, medical advisor to the research project, told a world conference on family medicine: "This project is a direct result of the September 11 attacks and the very considerable panic from

the deliberate release of anthrax spores in the US. We believe NHS Direct data could help us provide an early warning system."

She explained that the computer software used by NHS Direct would need to be adapted so that the service could pick up sudden blips in the number of callers with severe symptoms.

Dr Baker, who is secretary of the Royal College of GPs, said early indications were encouraging.

"They showed that already NHS Direct data had successfully picked up flu outbreaks and so it was likely the system could be used to pick up more deadly diseases.

"September 11 was the catalyst for this. It would be extremely foolish not to be alert and vigilant about such attacks."

# Why use NHS Direct data for surveillance?



**A covert deliberate release might cause illness with an extended, mild prodromal phase**

**Some people will self care**

**If access professional advice, likely to contact NHS Direct or primary care in first instance**

**May be opportunity to identify an increase in illness before the increase could be identified by secondary care services**

# Why use NHS Direct data for surveillance?



**Aim is to use call data to NHS Direct to identify any increase in illness in an area within England and Wales caused by the deliberate release of biological or chemical agents**

**Also aims to detect community outbreaks of more common infectious diseases**

**Partnership between NHS Direct and Health Protection Agency**

# What data do we get from NHS Direct?



Call data on 10 'key' symptoms are transferred each week day from the 23 call centres (covering all of England & Wales) to the Health Protection Agency at West Midlands

*Cold/flu*

*Cough*

*Fever*

*Difficulty breathing*

*Vomiting*

*Diarrhoea*

*Double vision*

*Eye problems*

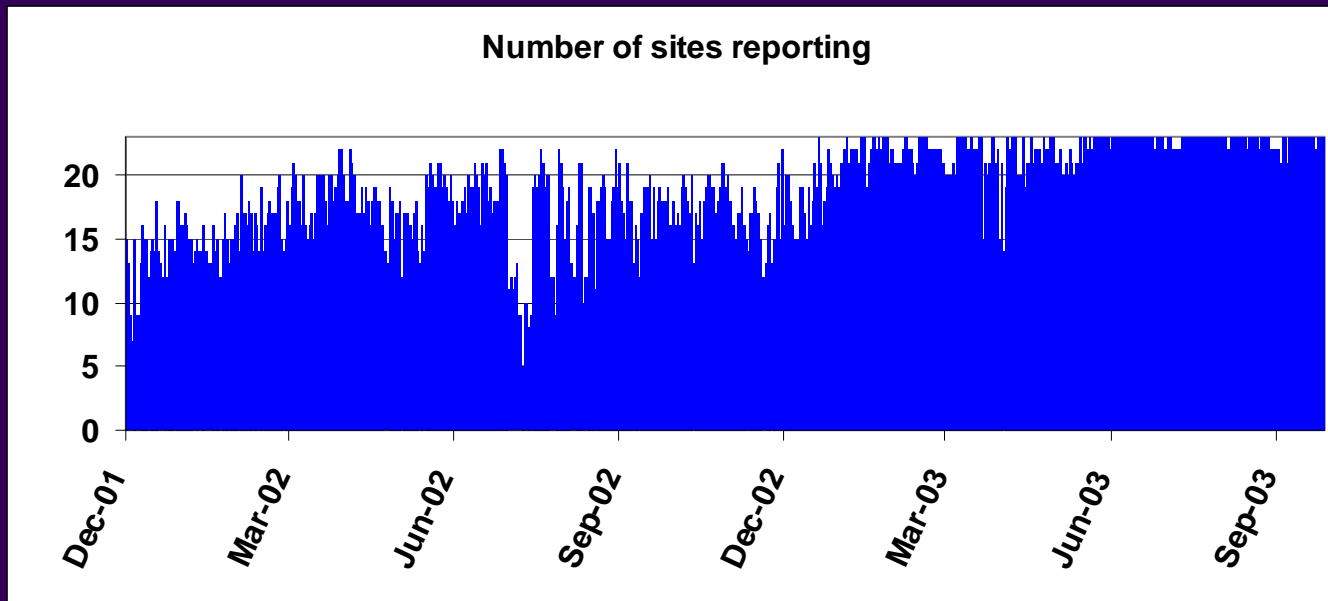
*Lumps*

*Rash*

Call data are broken down by site, symptom, age-group and call outcome

Further details of individual calls including postcodes (the geographical origin of the call) can be requested if needed

# Data collection



Consistent data reporting has been achieved through:

1. *Using routine NHS Direct data for the basic surveillance*
2. *Causing minimal disruption to the work patterns of the data providers*
3. *Ensuring continual feedback to all staff within the surveillance network*

# Data analysis

## Level 1 - Exceedances



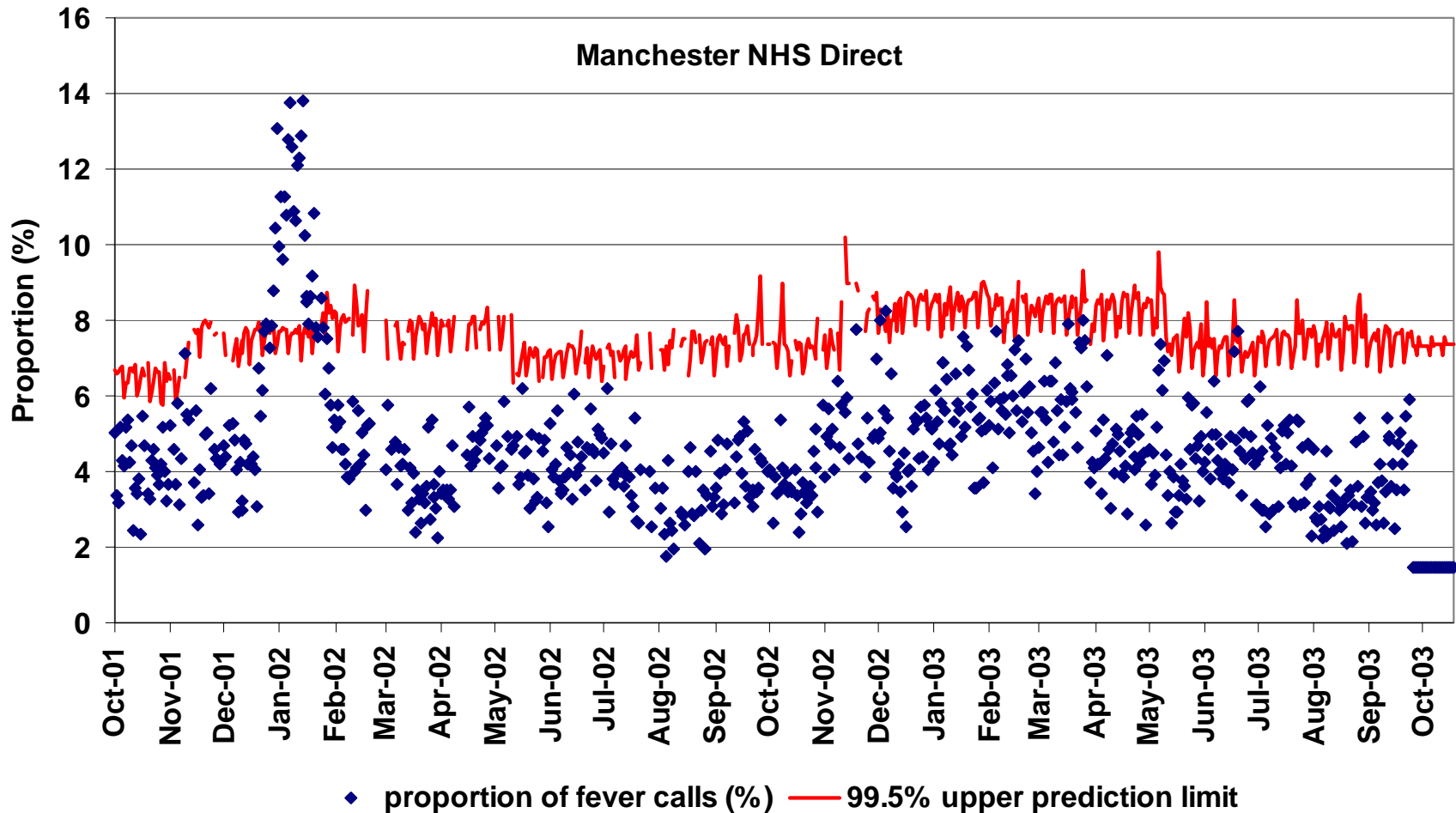
**Upper confidence limits (99.5% level) of symptomatic calls, as a proportion of daily total calls, are constructed for each of the 10 symptoms at each site**

**Significant statistical excesses ('exceedances') in calls for any of these symptoms are automatically highlighted and assessed by a multi-disciplinary team**

# Analysis - control charts



Control charts constructed for 5 algorithms for 8 sites (major urban



# Analysis of exceedances

## Stage 1



### A variety of factors are taken into consideration:

- *The proportion of call outcomes recommending emergency care*
- *The age distribution of the calls*
- *Seasonal baselines*
- *Levels of activity at neighbouring NHS Direct sites*
- *Previous exceedances at the site*
- *Current community levels of disease.*

# How do we investigate an exceedance?

## Stage 2 - Scientist investigation



If no reasonable explanation for the 'exceedance', additional call details are requested and typically arrive within a couple of hours

A geographical information system (GIS) may then be used to map the calls and check whether the rise in symptomatic calls is geographically clustered

# How do we feedback to local health protection teams?

## Stage 3 - Alert



If concerned about an 'exceedance' the surveillance team pass call information to local health protection teams and HPA Divisions (termed 'alerts')

The NHS Direct Medical Adviser can contact callers to obtain further information on the reported symptoms (e.g. spectrum and severity of illness)

Where appropriate, electronic bulletins to a wider range of public health professionals are issued

*Weekly bulletins, summarising NHS Direct call activity are routinely distributed.*

# Exceedances ('signals')

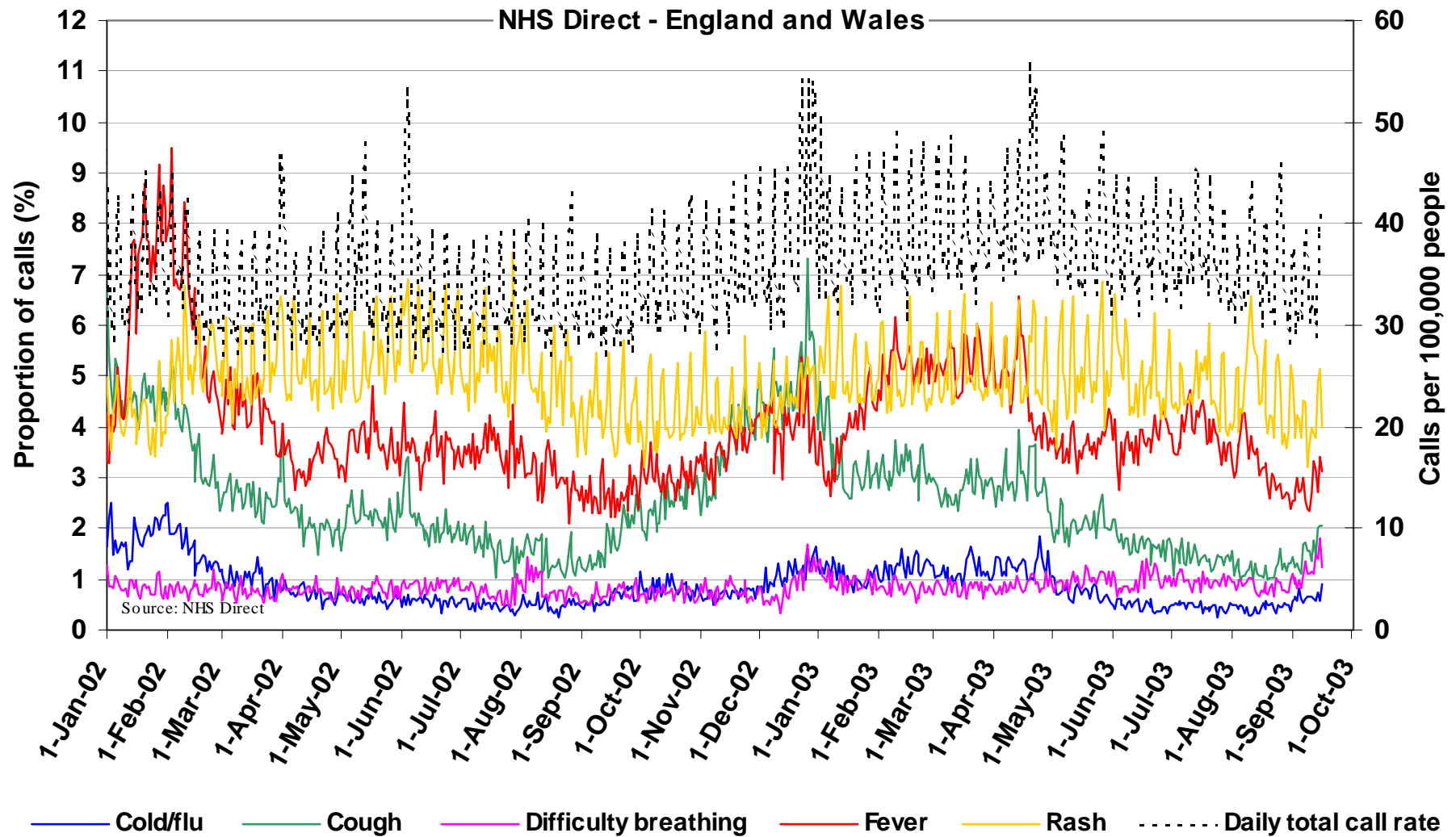
## December 2001 - February 2003



NHS Direct Site	Cold/flu	Cough	Diarrhoea	Difficulty breathing	Double Vision	Fever	Lumps	Rash	Vomiting	TOTAL
Anglia	6	4	7	8	13	10	8	4	7	69
Avon	3	11	9	10	5	11	6	3	10	73
Beds & Herts	6	18	8	13	9	12	7	3	5	96
East Midlands	22	27	5	9	9	25	5	4	9	127
Essex	4	21	6	5	7	12	8	1	13	86
Hamps	9	20	5	5	9	11	11	6	5	90
Kent, Surrey, Sussex	11	19	2	2	4	11	5	2	7	67
Manchester	9	10	3	4	3	33	8	3	15	95
North And Central London	6	7	7	3	7	6	7	2	7	62
North East	14	23	12	3	8	10	4	5	22	114
North East London	9	8	3	7	10	15	6	4	10	82
North West Coast	4	8	4	4	5	10	4	5	2	51
South East London	9	9	3	6	12	32	14	5	2	99
South West London	11	15	6	6	9	16	5	4	7	94
South Yorks & South Humber	9	11	10	4	15	13	7	3	12	91
Staffordshire	9	15	7	2	7	19	4	2	10	85
Tees, E & N Yorks	4	13	6	5	7	10	2	2	7	65
Thames Valley	10	2	2	7	9	10	3	1	5	55
Wales	5	6	0	2	7	5	5	2	5	42
West Country	0	1	17	4	4	13	4	1	9	56
West London	2	5	2	6	4	16	10	3	5	58
West Midlands	9	8	9	8	5	8	6	7	5	69
West Yorks	14	18	4	0	12	20	3	3	3	85
<b>TOTAL</b>	<b>185</b>	<b>279</b>	<b>137</b>	<b>123</b>	<b>180</b>	<b>328</b>	<b>142</b>	<b>75</b>	<b>182</b>	<b>1811</b>

**Stage 1 - 1811 Exceedances: Stage 2 - 126 'Scientist investigation' (7%)**  
**Stage 3 - 16 Alerts (1%)**

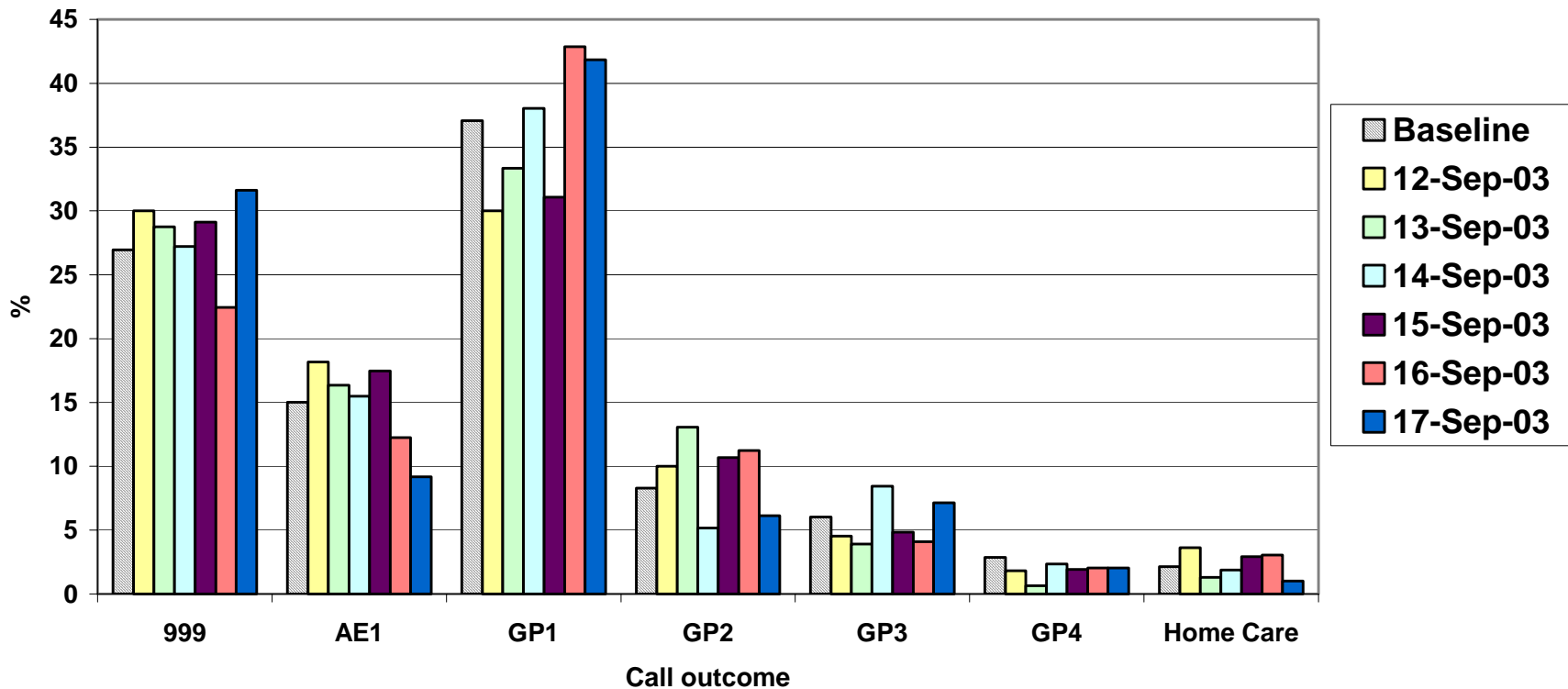
# Examples of results so far



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## Rise in difficulty breathing calls

### - September 2003

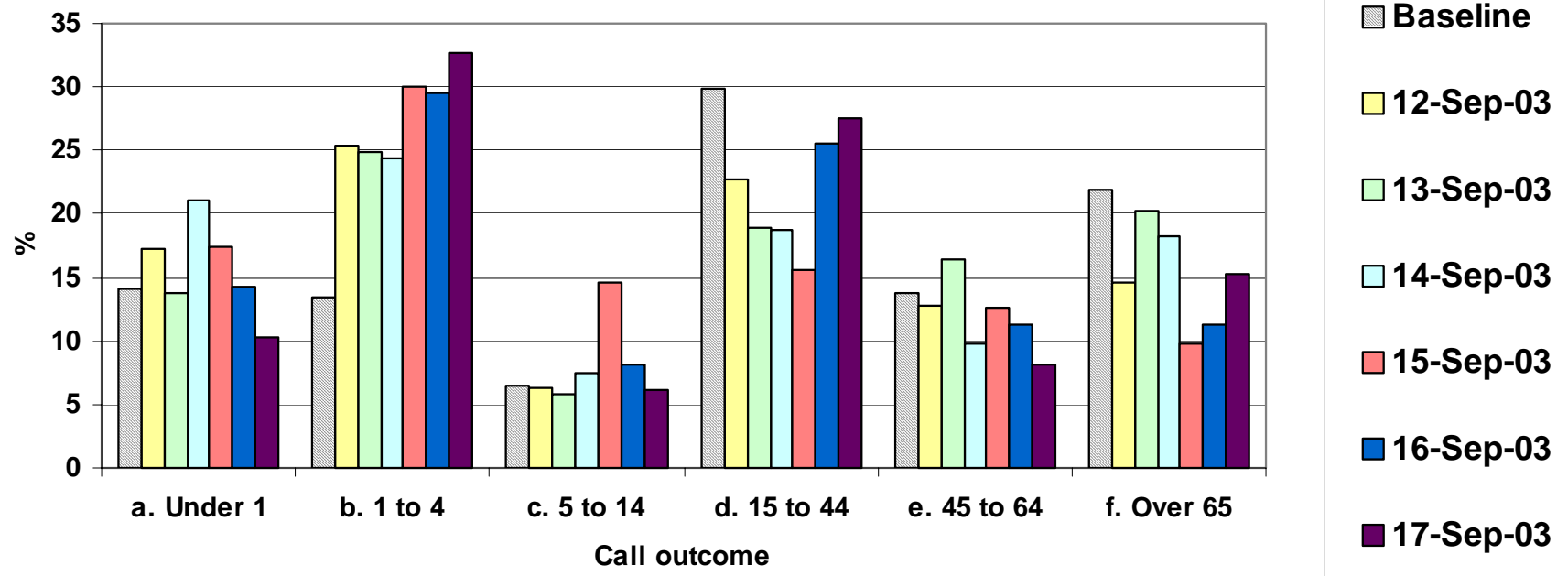


Dispositions unchanged compared with baseline

# Examples of results so far - Rise in difficulty breathing calls - September 2003



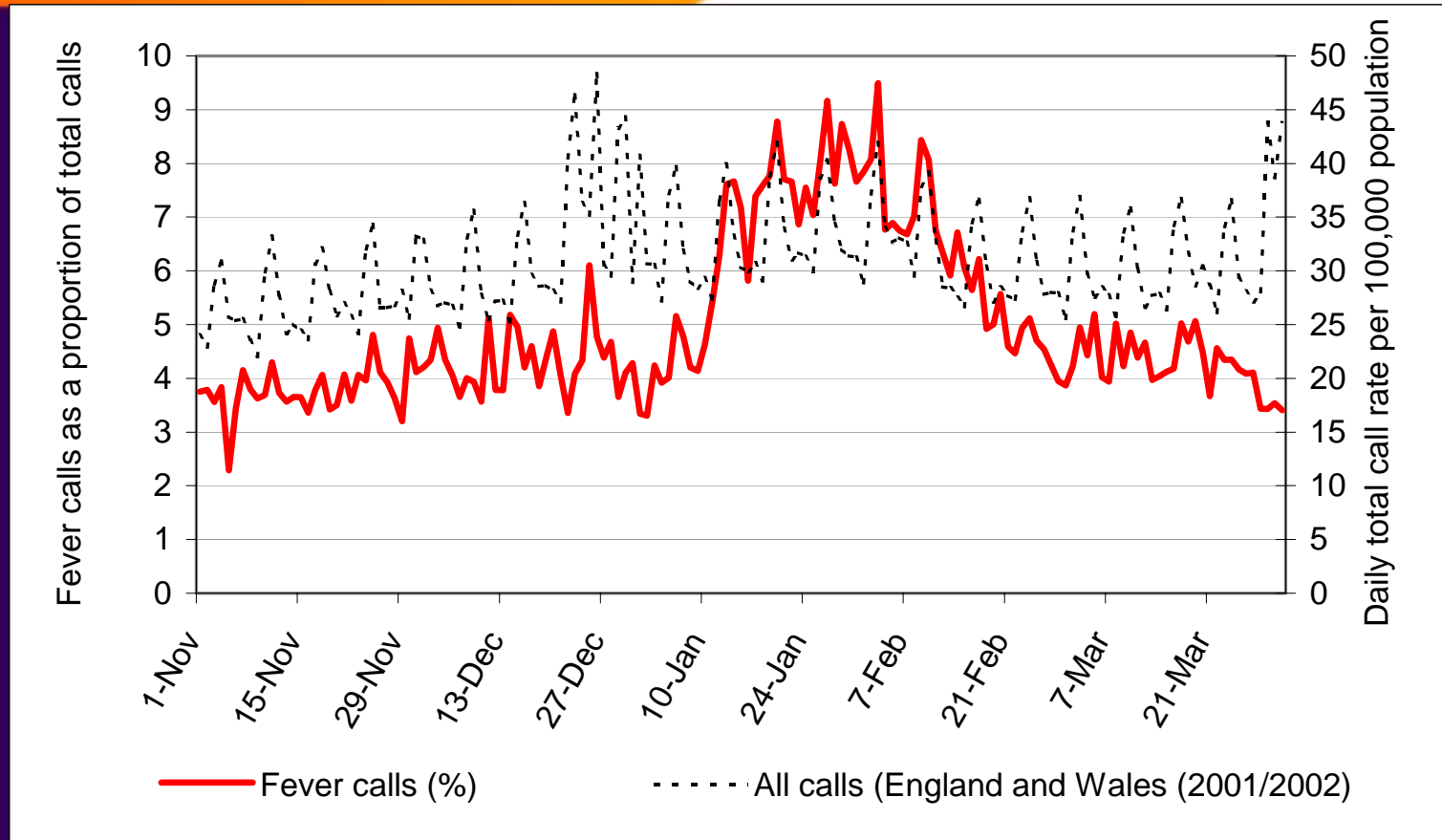
Daily Comparison of Age Distribution of Difficulty Breathing Calls



Rise in proportion of calls in 1-4 year age group

# Examples of results so far

## National rise in Fever calls



Sudden increase in 'fever' calls 10th January 2002.

National increase.

Tenth of all calls.

Fifth of all calls about children.

## INTERNATIONAL

# London police seize ricin, arrest 6



AP Photo

**POISON LINK:** Two police officers stand guard outside a house in London's Wood Green neighborhood Tuesday. The officers refused to comment on why they were standing guard at this particular property.

LONDON (AP) — Police said Tuesday they found traces of ricin — a deadly poison twice as potent as cobra venom — in a north London apartment and arrested six men of North African origin in connection with the virulent toxin that has been linked to al-Qaida terrorists and Iraq.

London police said material seized at a flat in the Wood Green neighborhood on Sunday had tested positive Tuesday for traces of the toxin, tiny amounts of which can kill an adult. There is no antidote.

Prime Minister Tony Blair, speaking to a meeting of British ambassadors, said the find highlights the threat posed by weapons of mass destruction.

"As the arrests...show, this danger is present and real, and with us now, and its potential is huge," he said.

Ricin (pronounced RICE-in) is derived from the castor

bean plant, which is grown around the world. The poison is relatively easy to produce, and Andy Oppenheimer, a chemical and biological weapons expert at Jane's Terrorism and Security Monitor, said its presence in London did not necessarily indicate a connection to any outside group or country.

Anti-terrorist police said they arrested the six men of north African origin under the Terrorism Act during raids in east and north London and seized "a quantity of material and items of equipment" at the Wood Green apartment.

Police did not identify the men and refused to specify what country or countries they were from, saying only that they were in their late teens, 20s and 30s. They were not immediately charged with a crime.

A woman arrested in the raids was released, authorities said.

Police said the arrests were prompted by "receipt of intelligence" but gave no other details.

"We have previously said that London — and indeed the rest of the U.K. — continues to face a range of terrorist threats from a number of different groups," police anti-terrorist branch chief David Veness and Deputy Chief Medical Officer Dr. Pat Troop said in a statement.

Blair's spokesman said he knew of no specific intelligence about how the suspects may have planned to use the ricin.

The Department of Health said doctors around Britain had been informed of the find and warned to look for symptoms of ricin exposure, including fever, stomach pains, diarrhea and vomiting.

Ricin causes diarrhea so severe that victims can die of shock from massive fluid and electrolyte loss.

Oppenheimer, the

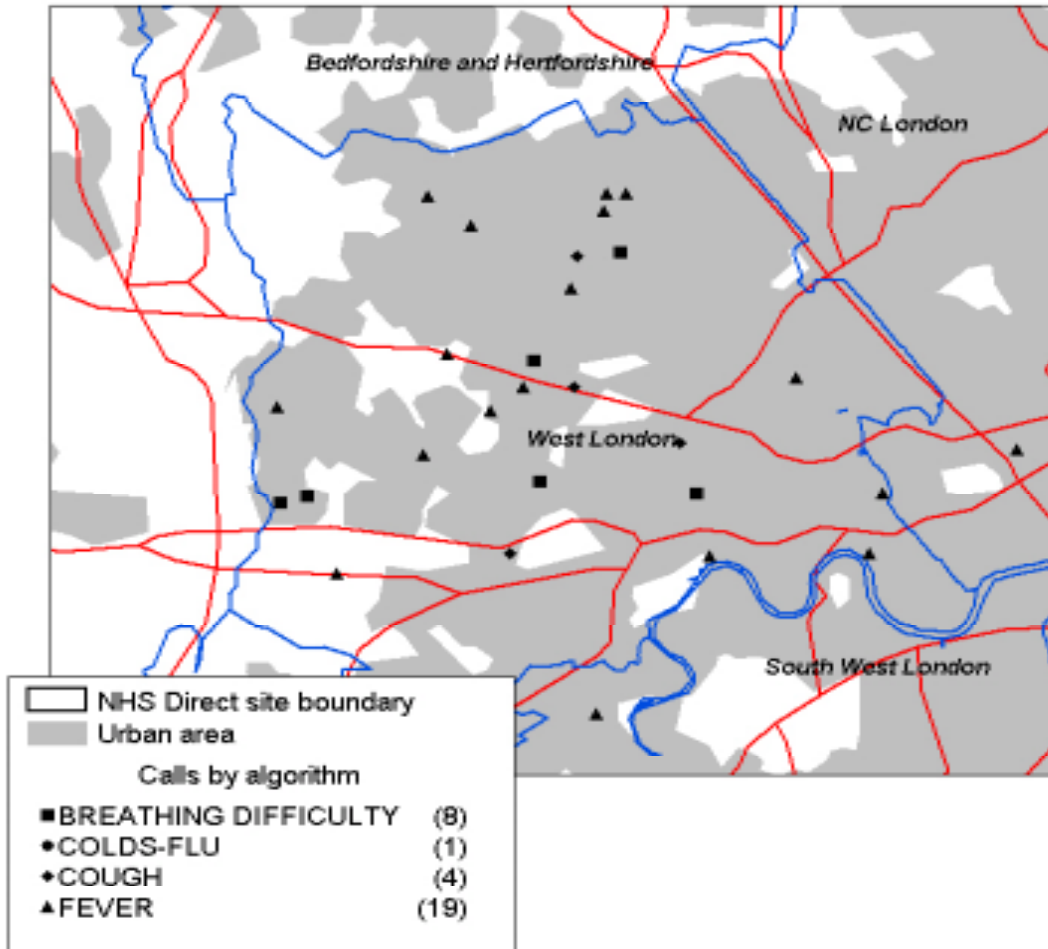
weapons expert, said injecting ricin was an effective way of targeting individuals as was the case of Bulgarian defector Georgi Markov, killed in London in 1978. Police said ricin was in a pinhead-sized pellet injected into Markov's thigh, but couldn't confirm the widely reported theory that he was jabbed by a rigged umbrella.

Oppenheimer said terrorists could kill large numbers of people with ricin if they put it into aerosol, a job he described as tricky but not impossible. A crowded, enclosed environment like the London subway would probably be the most appealing target, he added.

"It's just one of these horror scenarios which people are very frightened of at the moment," he said. "You only need milligrams to kill somebody."

## North Korea says 'sanctions mean a war'

Calls to West London NHS Direct - 7th of January 2003  
Difficulty Breathing, Cold/flu, Cough and Fever



## Real time Health Protection

### Ricin scare in London

What would be the first symptoms if there were a Ricin attack?

Data were updated every 2 hours

Mapping NHS Direct calls may provide the first clues that a deliberate release has occurred at a particular point source

or

provide re-assurance that a deliberate release is unlikely to have occurred.

# The future



Over the next 3 years there will be a 3 fold expansion of NHS Direct call handling capacity

Increased call volumes from a potentially wider section of the general population may improve the:

*representativeness of the call data*

*potential for early identification of disease outbreaks.*

# Conclusions and further work



Only national daily surveillance system in UK

Only national surveillance system using a health helpline in the world?

When action is taken, local or national agencies are normally informed within 24-48 hours of the NHS Direct calls being made

Still establishing baseline data and refining the statistical methodology

Microbiological investigation of the cause of increases in calls (e.g fever) is not currently possible. Aim to conduct pilot study.

# Conclusions and further work



To date, no deliberate release of either chemical or biological agents has been detected

*Will this system provide early warning?*