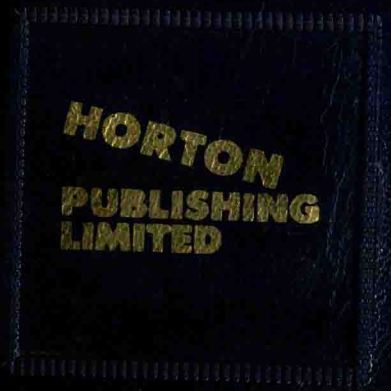
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FOOD-BORNE DISEASE - THE HIDDEN HAZARD

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Currently there is widespread concern about food safety. Diseases caused by pathogenic bacteria which are present in food represent one of the most serious issues. This paper is an attempt to draw together many of the different aspects of bacterial food-borne disease, with the emphasis on policy.

In preparing this paper, I have been heavily dependent on a great many people who have provided information, and perhaps more importantly, insight. Several of them have also taken time and trouble to read and comment on earlier drafts. This final version incorporates numerous ideas which have been suggested to me. I am most grateful to everyone who has helped, especially colleagues in the School of Biomedical Sciences here in Bradford. Nevertheless, there may be errors and omissions that remain, for which I accept full responsibility.

CONTENTS

SUMMARY

The number of officially recorded cases of food-poisoning is only the tip of the iceberg and represents a very small proportion of the total. Even so, in England 22,000 cases were reported in 1986 - a 50% increase on the figure for 1982. A serious oubreak can cause many deaths - in 1984, the incident at Stanley Royd resulted in the death of 19 elderly patients.

The economic costs are enormous. Where an outbreak is linked to a specific food product, the consequences for the manufacturers because of loss of sales can be disastrous. In the United States government sources indicate that illness associated with microbiological contamination of foods probably represents a loss of $164 BILLION a year in direct costs.

For the vast majority of cases, we know the causes and we know the precautions that have to be taken. These include:

* Storing food at the correct temperatures - either in a refrigerator or at a temperature about 63°C. In particular there are certain high risk foods which should not be stored at room temperature because this will facilitate the growth of pathogenic bateria

* Cook high risk food thoroughly. Foods such as poultry which are highly likely to be contaminated with pathogenic bateria in the raw state, should be properly thawed - otherwise the bacteria will survive cooking

* Avoid cross-contamination. For example, by preventing contact between raw and cooked meat

There are many companies and organisations which enforce very high standards of hygiene control thereby keeping the incidence of bacterial food-poisoning to a minimum. These include most of the major food retailers, many food manufacturing companies as well as catering and hotel chains. By contrast, there are also plenty of examples of poor practice - in some hospitals and other large institutions plus many small companies, especially those involved in catering.

The worst excesses, when detected by environmental health officers, lead to prosecution. However, on average, food premises receive less than one visit per annum from an environmental health officer. Hence bad practice can go undetected for long periods. Furthermore, there are serious deficiencies in the law which limit the degree of control that can be exerted by the environmental health officers.

The fundamental problem is that people generally do not take the issue seriously enough even though food-borne disease is a genuine food safety hazard. If more people were concerned then the necessary pressure would be generated for appropriate action to be taken by government and by the other authorities involved.

INTRODUCTION

Food-borne disease caused by bacteria and viruses is a very serious problem. Contaminated food and water play an important role in the development of the estimated 1,000 million cases of acute diarrhoea which occur annually in children under the age of five in the countries of Africa, Asia (except China) and Latin America. About five million of these cases are fatal [1].

This paper will be confined to cases of 'food-poisoning' in the UK which are produced following the consumption of foodstuffs which have been contaminated with specific bacterial pathogens, or with toxins produced by some of these pathogens. In 1986, the number of recorded cases of bacterial food poisoning notified to the Office of Population, Censuses and Surveys for England was over 22,000; this is about 50% more than the value reported for 1982 [2]. However, the recorded cases only represent the tip of the iceberg. The vast majority of cases of food-poisoning are not reported. Investigations in the United States designed to establish the true incidence indicate that only about 1 in 25 cases would be reported [3].

For most people, a bout of food-poisoning only lasts a few days, but the experience can be extremely unpleasant; in some cases, the effects can be much more serious. The very young and the elderly are especially vulnerable. In 1984, there were 48 deaths in England and Wales in people with bacterial food poisoning [4]. This included 19 elderly patients in the outbreak at Stanley Royd Hosptal in Wakefield [5]. In Sweden, over 30 years ago, a single outbreak caused 8,845 reported cases with at least 90 deaths.

TABLE 1 EXAMPLES OF THE ECONOMIC COST OF OUTBREAKS OF FOOD-BORNE DISEASE

Examples of the economic cost of outbreaks of food-borne disease

Year	Illness	Food	Cost £ (current prices)
1964	Typhoid	Canned corned beef	25 million
1974	Salmonellosis	Cold roast pork	350,000
1978	Botulism	Canned salmon	2 million
1979	Staphylococcal food poisoning	Canned corned beef	1 million

Source : R.J. Gilbert [14]

These were distributed over three provinces and one city. Secondary outbreaks occurred throughout the country [6]. Recently, the authorities in Switzerland banned the production of the gourmet cheese, Vacherin Mont d'Or because there were indications that it had been responsible for about 60 deaths due to listeriosis [7]. A link was established between some cases of food-poisoning and a branded salami snack stick. As a result, there was a nationwide recall of the product in February 1988 [8]. At the beginning of March 1988, almost 40 cases of paratyphoid were identified following the celebration of Indian Independence Day in Birmingham. This was attended by visitors from all over the country. Subsequently, health workers in Bradford and other cities with Asian populations were alerted to the possibility of a serious outbreak in the city [9].

The economic costs are enormous. In the United States it has been estimated that the total number of cases of food-borne diarrhoeal disease varied between 24 and 81+ million. The lower value represents an estimated economic loss of $5 billion, due to the costs of medical care and lost productivity in 1985. If the higher figure is used then the loss would be $17 billion [10]. Another estimate in 1986 using community based studies indicated that there were 99 million acute cases of vomiting and/or diarrhoea in the U.S. giving a calculated economic loss of $23 billion [11]. At a seminar held in London recently Dr Sanford Miller who at the time was Director of the Center for Food Safety and Applied Nutrition in the U.S. Food and Drug Administration, stated that illness associated with microbiological contamination of foods probably represents a loss of $164 billion a year in the U.S. in direct costs [12].

The total costs of some specific outbreaks in the U.K. have been compiled by R.J. Gilbert [14] (Table 1). For example, an outbreak of botulism in Birmingham in 1978, is estimated to have cost the

TABLE 2 CONSUMER VIEWS ON HEALTH HAZARDS

ISSUE OF MOST CONCERN	%
Smoking	40
Environmental pollution	28
Ingredients in food we eat	15
Amount of alcohol drunk	6
Obesity	4
Lack of exercise	4
None	4

200 adults were asked to rank the above six items in order of their own concern.

Source : Ministry of Agriculture, Fisheries and Food [16]

firm involved £2 million. The total economic cost of a similar outbreak in Belgium was assessed at about $150 million (Canadian) [13]. In 1985, the sale of a baby food company was being negotiated at a price rumoured to be over £40 million when there was an outbreak of salmonellosis linked to baby milk produced at one of its plants. As a result, negotiations were broken off. Because of the high cost involved in recalling products from world-wide markets, the company's capital declined to a dangerous level and so it was put into voluntary liquidation. Subsequently, the liquidators sold the company at the much lower price of £18 million [15]. We also have to recognise that there are significant costs incurred by the National Health Service in the treatment of people suffering from food-borne infections.

Despite the serious implications of bacterial food-borne disease, there seems to be little public concern at present. A recent survey conducted on behalf of the Ministry of Agriculture, Fisheries and Food, did not even include food-borne disease as one of the six topics of concern about health that were put to respondents. By contrast, it is clear that many people are worried about the safety of food ingredients (Table 2). In the same survey, over 50% of the sample agreed with the statement that artificial additives are harmful [16].

Various attempts have been made to determine the risks associated with different food safety hazards. Almost invariably, food-borne disease heads any list. Thus, according to an assessment at a symposium about ten years ago, the hazards associated with microbial contamination of food exceeded those linked to additives by a factor of about 100,000 [17] (Table 3). These calculations were based on a combination of severity and frequency of possible adverse effects.

TABLE 3 RISK ASSOCIATED WITH DIFFERENT FOOD SAFETY ASPECTS

FOOD SAFETY ASPECT	RELATIVE RISK
Microbial Contamination	100,000
Nutritional Imbalance	100,000
Environmental Pollution	100
Pesticide Residues	1
Food Additives	1

Source : A.S. Truswell, N.G. Asp, W.P.T. James and B MacMahon [17]

One of the major difficulties in attempting to devise a sound policy on food safety is that the public perception of the risk associated with food additives is high, yet in reality the risk is low. By contrast, food-borne disease constitutes an extremely serious safety issue, yet public concern is very low.

The object of this paper is to provide a brief background to the subject of bacterial food-borne disease, and to discuss some of the implications for consumers, food industry and government.

TABLE 4 BACTERIA RESPONSIBLE FOR CASES OF FOOD POISONING

(England and Wales)

CAUSAL AGENT	% OUTBREAKS
Salmonella typhimurium	40
Other *Salmonella* spp.	46
Clostridium perfringens	11
Staphylococcus aureus	1
Bacillus cereus + other species	1

Source : Communicable Disease Surveillance Centre [4]

THE BACTERIAL AGENTS OF FOOD POISONING

Bacteria are minute organisms which are present throughout the environment. Under suitable conditions they can multiply very rapidly. Some food may act as an ideal medium because of the presence of a range of nutrients which meet the requirements of the bacteria. Most bacteria do not normally cause any problem - some are positively beneficial and are used in the production of cheese, yogurt and in brewing. However, certain groups of bacteria cause food to deteriorate, thereby rendering it patently unacceptable for human consumption. There are other groups which do not have any obvious effect on the food, but can be pathogenic to humans or, indeed, to many different animal species. When present in large numbers, they may produce damaging toxins either in the food before it is eaten, or in the alimentary tract after ingestion. Some bacteria such as those causing typhoid or listeriosis act by overcoming the body's defences and invading the tissue. There are at least 11 groups of bacteria which are known to cause food poisoning quite regularly [18]. These are:

Salmonella various species

Staphylococcus aureus

Clostridium perfringens

Clostridium botulinum

Bacillus cereus (plus other Bacillus spp.)

Eschericia coli

Campylobacter jejuni

Yersinia enterocolitica

Vibrio parahaemolyticus

Aeromonas hydrophila

Streptococcus various species

In this paper I will present a brief description of six different types in order to illustrate some of the characteristic properties of the bacteria involved in food-borne disease. The ones selected are Salmonella spp., Staphylococcus aureus, Clostridium perfringens and Bacillus cereus because these four have been shown to be responsible for most of the reported cases.

In 1984, 15,312 cases of bacterial food poisoning and salmonella infection were reported by laboratories. Of these, 40% of cases were due to Salmonella typhimurium and 46% were due to other salmonellas [4] (Table 4). Information is also given about campylobacter because of its growing importance during the last ten years, so that in 1985 it was responsible for about 24,000 reports of gastrointestinal infections - almost twice as many as for salmonella - although evidence of food-borne spread was found in relatively few (Public Health Laboratory Service Communicable Disease Surveillance Centre - unpublished). Finally, I have included Listeria monocytogenes because recent evidence from a small number of outbreaks has shown that the fatality rate is very high [19].