system are recognized not to provide an accurate estimate of foodborne disease incidence. With the exception of a few pathogens, the data deal only with outbreaks (two or more cases of illness linked to a common source); are based on voluntary reporting by State health departments; and are dependent almost entirely on passive surveillance (that is, cases and outbreaks voluntarily reported to local health authorities).

A somewhat better picture of disease incidence can be obtained through national laboratory-based reporting systems. The model for this is the CDC system for reporting of salmonellosis. Again, however, data are in most instances passively collected, and are dependent on physicians submitting cultures; if a patient does not see a doctor, or the doctor does not collect a stool culture, the case does not enter the reporting system. Further, of the major foodborne pathogens, laboratory-based surveillance is available only for *Salmonella*. Recognizing these deficiencies, a number of groups have attempted to estimate actual rates of disease occurrence, drawing both from CDC databases (with their inherent limitations, discussed above) and extrapolating from population-based studies in specific geographic areas. ''Best estimates'' of the incidence of specific diseases, and the percentage of these diseases thought to be foodborne, are provided in Table 1, below (together with the source of these estimates). These estimates are in basic agreement with compilations put together by expert committees of the National Academy of Sciences and, most recently, by the Council for Agricultural Science and Technology.

Taken together, these data suggest that foodborne pathogens account for up to 7 million cases of foodborne illness each year, and up to 7,000 deaths. Of these, nearly 5 million cases of illness and more than 4,000 deaths may be associated annually with meat and poultry products contaminated with pathogenic microorganisms. Even these estimates may be low; at least one investigator has suggested that total cases of foodborne illness may reach 33 million cases a year, with up to 9,000 deaths.

TABLE 1.—SOURCES OF DATA FOR SELECTED FOODBORNE PATHOGENS, 1993

Pathogen	Total cases (#)	Total deaths (#)	Source(s) for case and death estimates	Percent foodborne (%)	Source
Bacteria:					
Campylobacter jejuni or coli	2,500,000	200–730	Tauxe	55–70	Tauxe et al.
Clostridium perfringens	10,000	100	Bennett et al	100	Bennett et al.
Escherichia coli O157:H7	10,000–20,000	200–500	AGA Conference	80	AGA Conf./CDC comm.
Listeria monocytogenes	1,795–1,860	445–510	Roberts and Pinner	85–95	Schuchat.
Salmonella	800,000–4,000,000	800–4,000	Helmick et al./Bennett et al	87–96	Bennett et al./Tauxe & Blake.
Staphylococcus aureus	8,900,000	7,120	Bennett et al	17	Bennett et al.
Parasite:					
Toxoplasma gondii	4,111	82	Roberts et al	50	Roberts et al.

Sources:

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TABLE 2.—MEDICAL COSTS AND PRODUCTIVITY LOSSES ESTIMATED FOR SELECTED HUMAN PATHOGENS, 1993

Pathogen	Foodborne illness		Foodborne* costs (bil $)	Percent from meat/poultry (%)	Meat/poultry related		Total costs* meat/poultry (bil $)
	Cases (#)	Deaths (#)			Cases (#)	Deaths (#)	
Bacteria:							
Campylobacter jejuni or coli	1,375,000–1,750,000	110–511	0.6–1.0	75	1,031,250–1,312,500	83–383	0.5–0.8
Clostridium perfringens**	10,000	100	0.1	50	5,000	50	0.1
Escherichia coli 0157:H7	8,000–16,000	160–400	0.2–0.6	75	6,000–12,000	120–300	0.2–0.5
Listeria monocytogenes	1,526–1,767	378–485	0.2–0.3	50	763–884	189–243	0.1–0.2
Salmonella	696,000–3,840,000	696–3,840	0.6–3.5	50–75	348,000–2,880,000	348–2,610	0.3–2.6
Staphylococcus aureus**	*1,513,000*	1,210	1.2	50	*756,500*	605	0.6
Subtotal	3,603,526–7,130,767	2,654–6,546	2.9–6.7	N/A	2,147,513–4,966,884	1,395–4,191	1.8–4.8