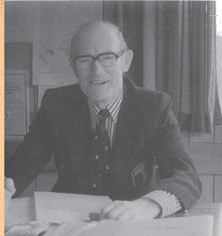


Laboratory-Acquired Infections: A Brief History



N.R. Grist studied laboratory-acquired infections between 1979 and 1989.

Laboratory-acquired infections are as old as laboratories themselves. As soon as the culture of microorganisms was introduced, so too was their transfer to laboratory workers.

Early recorded cases

The first recorded laboratory-acquired infection (LAI) was a case of typhoid fever in 1885 and 1915, including six deaths. Routes of transmission were aerosols, sharps injuries, splashes onto mucous membranes, ingestion and mouth pipetting.

- 1887: Brucellosis (from syringe)
- 1893: Tetanus (from syringe)
- 1894: Cholera (from pipette)
- 1897: Brucellosis (from syringe)
- 1898: Diphtheria (from pipette); Glanders (from syringe)
- 1904: Sporotrichosis (from syringe)

- The first surveys of LAIs (Kischaub 1915) found 50 cases of typhoid between 1885 and 1915, including six deaths. Routes of transmission were aerosols, sharps injuries, splashes onto mucous membranes, ingestion and mouth pipetting.
- American surveys in 1915, 1929 and 1939 found infections with pythiosis and Q fever, primarily in microbiologists, following the grinding and centrifuging of yolk sac cultures.

Relative risks of infection between laboratory workers and the general population.

Organism/disease	Risk/100,000 microbiologists	Risk/100,000 general population
Brucellosis	64.1	0.08
<i>E. coli</i> O157	8.3	0.96
Meningococcal sepsis/meningitis	25.3	0.62
Salmonellosis	1.5	17.9
Shigellosis	6.6	6.6

Global interest in LAIs

- Widespread interest in the issue of LAIs began in the 1950s.
- Studies by Pike (1965), Sulkin (1969) and Grist (1979-1989) revealed the most common LAIs in the UK to be tuberculosis (25.3%), hepatitis (20.0%), shigellosis (27.4%), salmonellosis (11.6%), brucellosis (2.1%) and typhoid (3.2%).

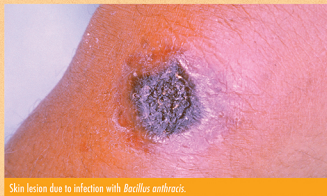
Laboratory-acquired infection and death rate in the USA and Europe, 1951-1978.

Study/report	Infections (n)	Associated deaths (n)
Sulkin and Pike, 1951	1275	39
Sulkin, 1961	1073	68
Pike <i>et al.</i> 1965	641	13
Pike, 1976	3921	164
Pike, 1978	158	4

- The UK study by Harrington and Shannon (1976) found 21 cases of TB, 28 hepatitis, 45 shigellosis and one brucellosis.
- Grist's annual studies of UK LAIs between 1979 and 1989 showed 47 cases of TB, 36 hepatitis, 35 shigellosis, 17 salmonellosis, four *Campylobacter* spp., two brucellosis, and one case of *E. coli* O157.
- Pike's studies also listed accident types and their numbers
- Up to 1997, approximately 120 different organisms have given rise to more than 3500 LAIs, resulting in 160 deaths.

Accident types and the number of LAIs.

Accident type	Infections (n)	Total (%)
Splashes and aerosols	188	26.7
Needlestick	177	25.2
Other sharps injuries	112	15.9
Animal bite/scratch	95	13.5
Mouth pipetting	92	13.1
Other/unknown	39	5.5



Skin lesion due to infection with *Bacillus anthracis*.



Most of the early laboratory-acquired infections were from syringes

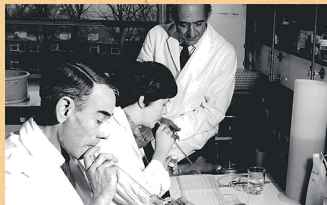
Outbreaks that precipitated debate and subsequent legislation

Hepatitis outbreak

- In Edinburgh renal dialysis unit, 40 cases: 26 patients, 12 staff, two home contacts. Eleven of them died.
- In a London unit: 69 cases including 32 staff.
- The index case in Edinburgh thought to be incubating the infection while undergoing dialysis:
 - Inadequate disinfection of dialysis machine led to spread of the virus to subsequent patients.
 - Likely transmission to staff probably resulted from handling the contaminated machine, needlestick injuries and contamination of mucous membranes by aerosols.

Smallpox outbreak

- In 1973 a science technician who worked with equipment used for smallpox research became ill with what was subsequently diagnosed as the disease:
 - Prior to diagnosis he contracted the disease.
 - The technician and her visitors died but the mother survived.
- In 1978 a medical photographer in Birmingham also contracted the infection
 - Although research into the virus was being carried out nearby, it was not possible to determine the route of transmission.



Mouth pipetting, especially of liquid bacterial cultures, blood and serum, was the cause of approximately 13% of LAIs in a study undertaken by Pike.

Acquisition of a laboratory infection

The published literature records five major routes for the acquisition of a laboratory-acquired infection.

Generation of aerosols

Aerosol generation was the most common route described. Surveys show that they may have caused between 35% and 65% of cases.

Reitman and Wendum in 1956 recovered 118 viable particles of *Serratia indica* per cubic foot of room air sampled over 10 minutes when a tube containing 50 ml of broth culture was broken during the operation of a centrifuge.

Aerosol dispersion from centrifuges was a major danger.

Accidental inoculation

Needlestick injuries were the most commonly described LAI in the surveys, and accounted for up to 25% of infections.

Mouth pipetting

Mouth pipetting, especially of liquid bacterial cultures, blood and serum, was the cause of approximately 13% of LAIs in the study by Pike. Mouth pipetting of bacterial cultures was particularly dangerous.

Splashes and spillages

Splashes to the eyes and face generally occurred as the worker was aspirating the needle while the syringe was still under pressure. Pike's study in 1976 included 177 cases (a quarter of the total number) due to needle and syringe accidents.

Spillages of cultures, noticed and unnoticed, onto the bench surface may occur and then via hands and fingers. Hand-to-mouth and hand-to-eye transfer occurred in a further 25% of cases in Pike's 1976 study.

Eating, drinking and smoking

Once accepted as normal in the laboratory but now forbidden as these habits were implicated in a number of LAIs.

Historical examples include cases occurred where food submitted for laboratory examination was wrongly labelled as safe and subsequently eaten by staff. Similar cases have occurred with milk samples.

One case of laboratory acquired anthrax occurred in a scientist who smoked while working with cultures of the organism.