Summary of Day 1

An introduction to survival analysis

Mark Stevenson

Faculty of Veterinary and Agricultural Sciences

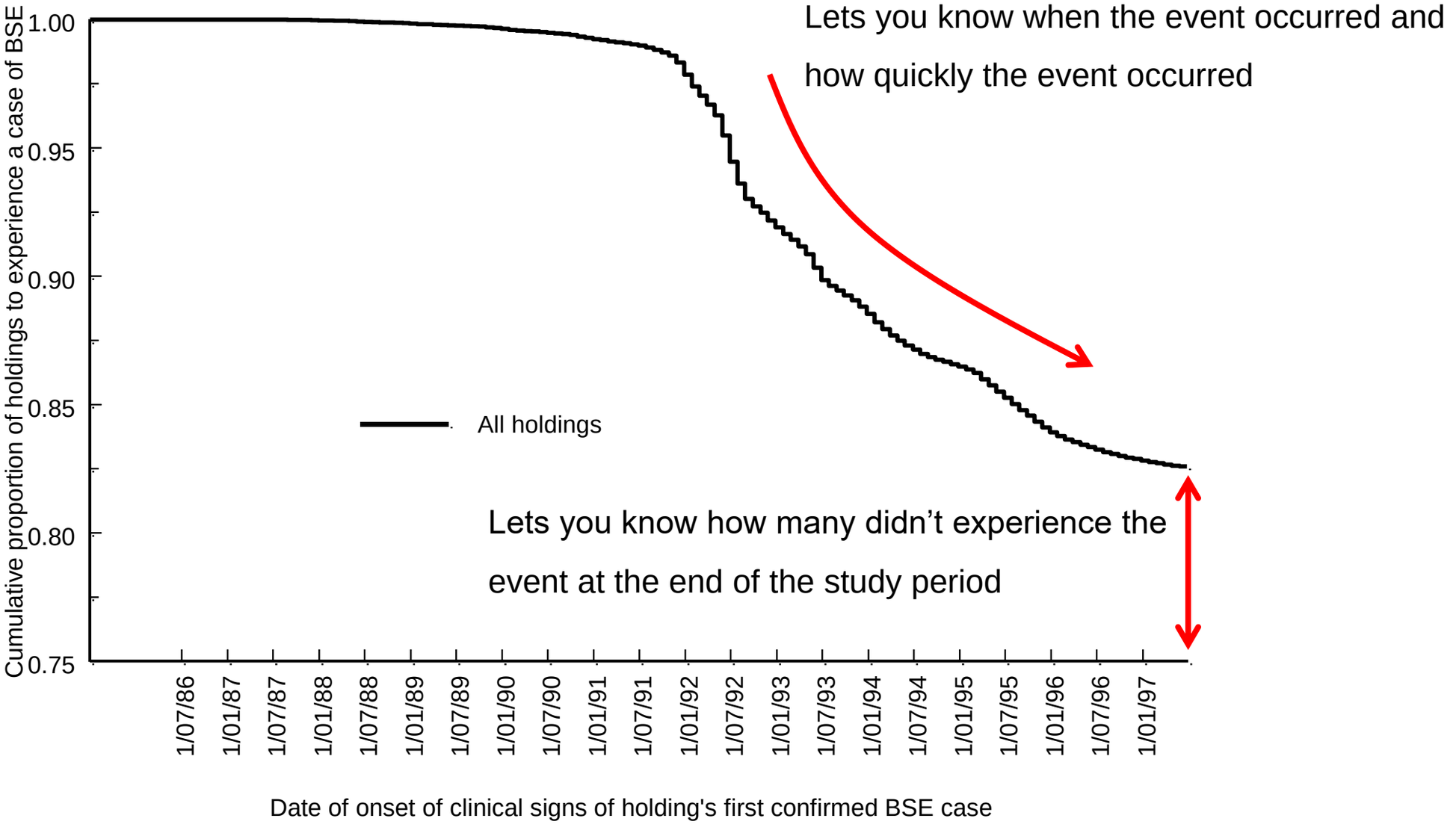
The University of Melbourne, Parkville Victoria 3010 Australia

mark.stevenson1@unimelb.edu.au

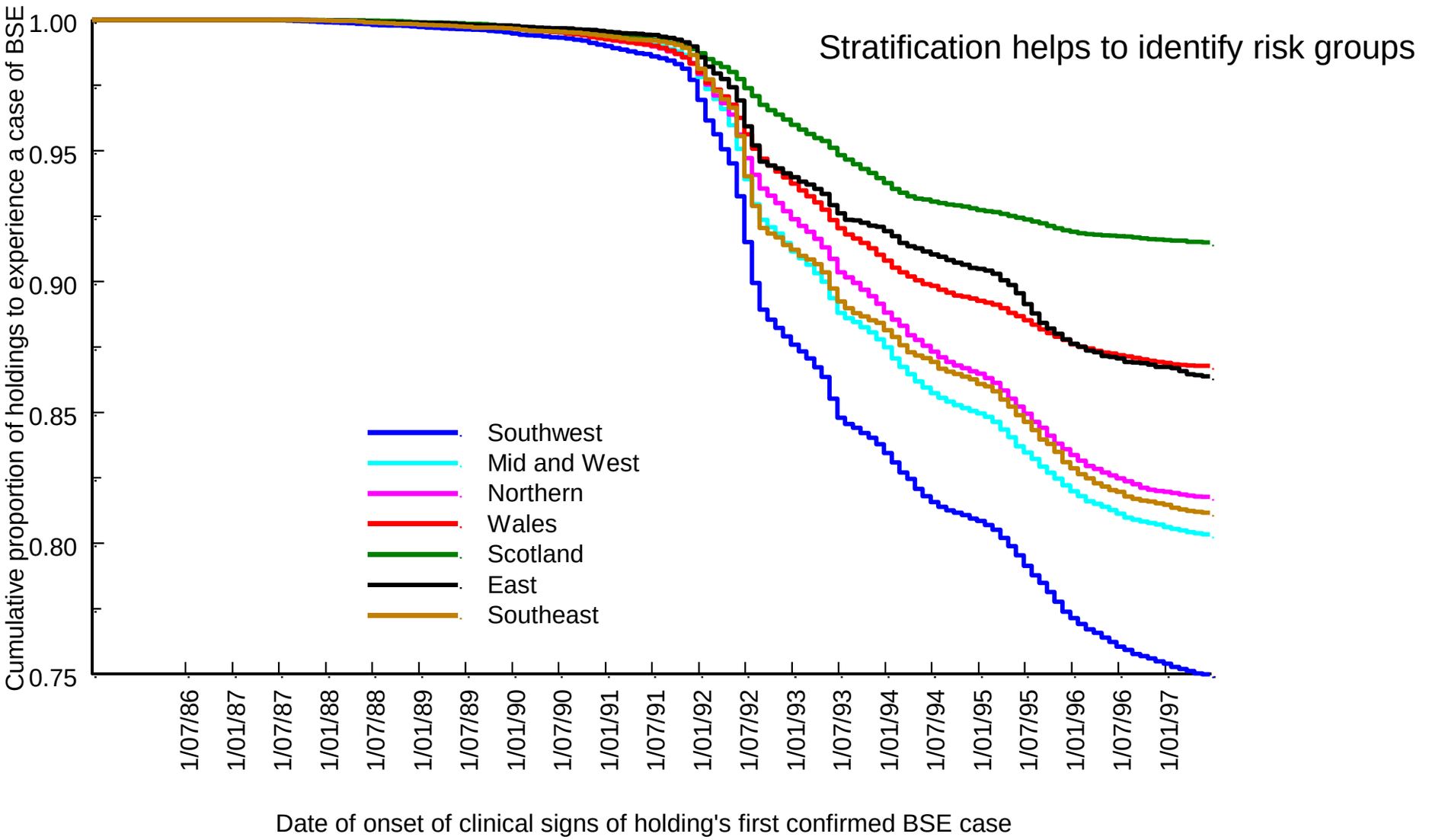
Topics covered

- Survival and hazard
- Censoring
- Instantaneous hazard

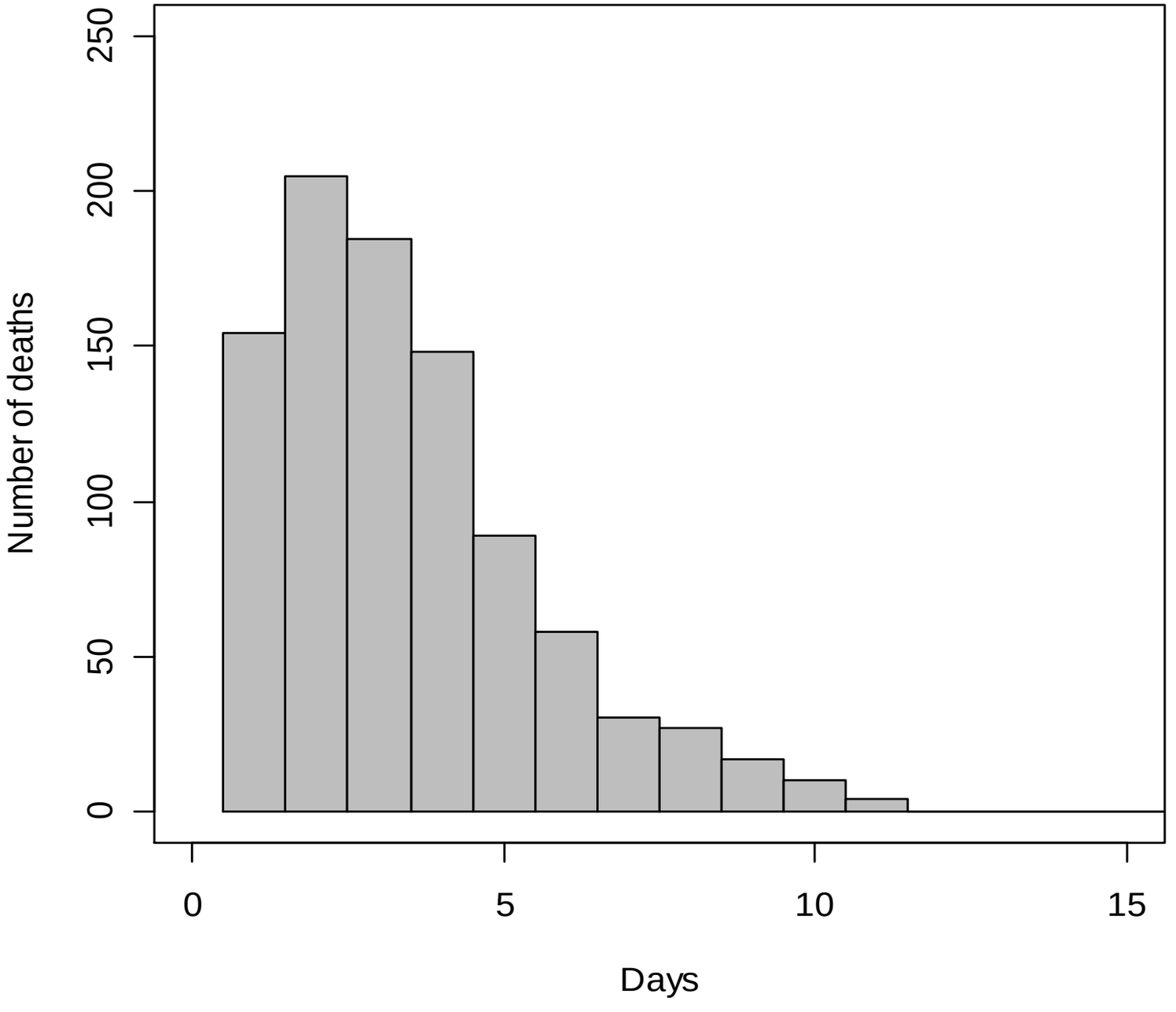
Days to index BSE case - British cattle holdings.



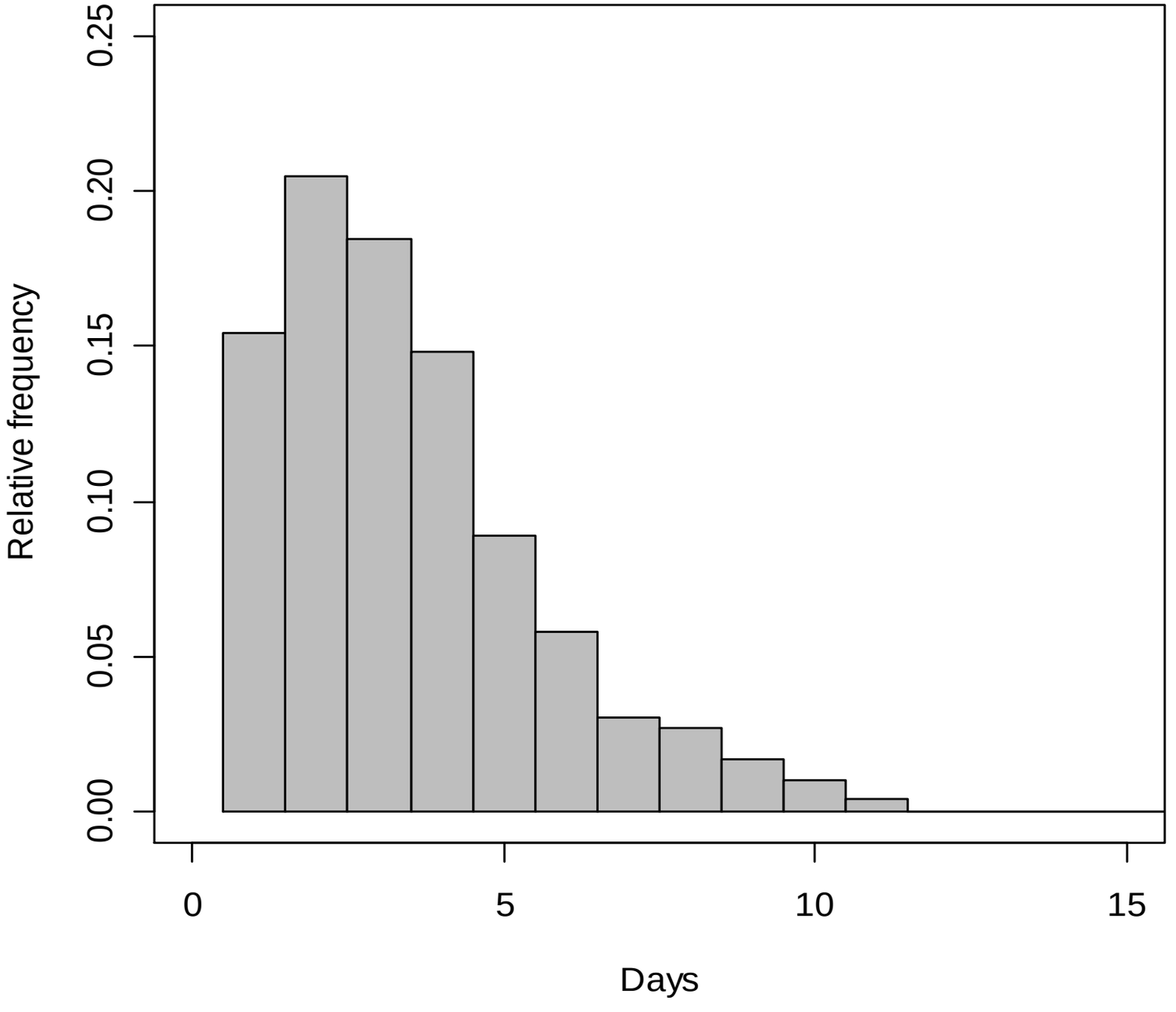
Days to index BSE case - British cattle holdings.



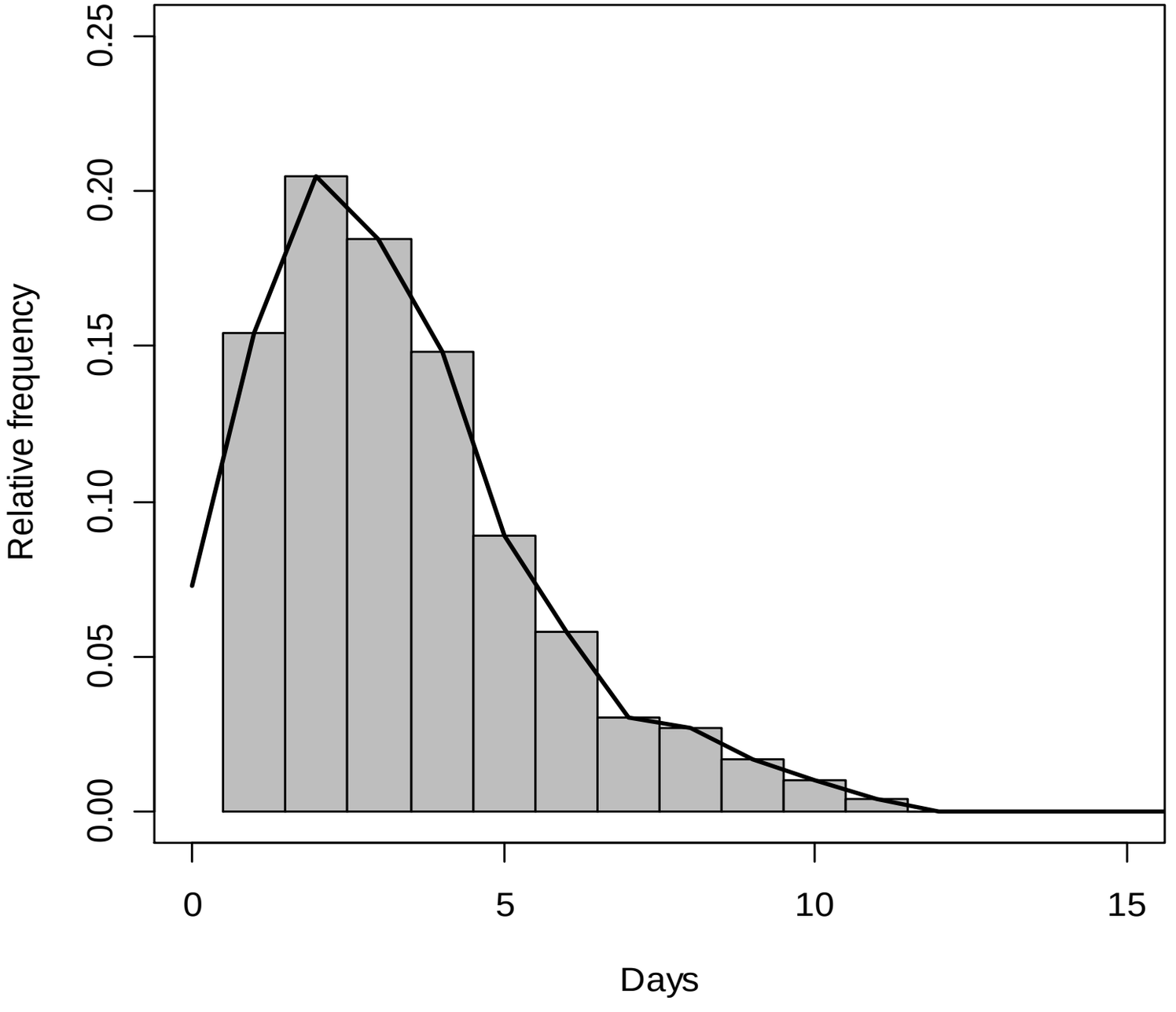
Frequency histogram showing the number of deaths as a function of time.



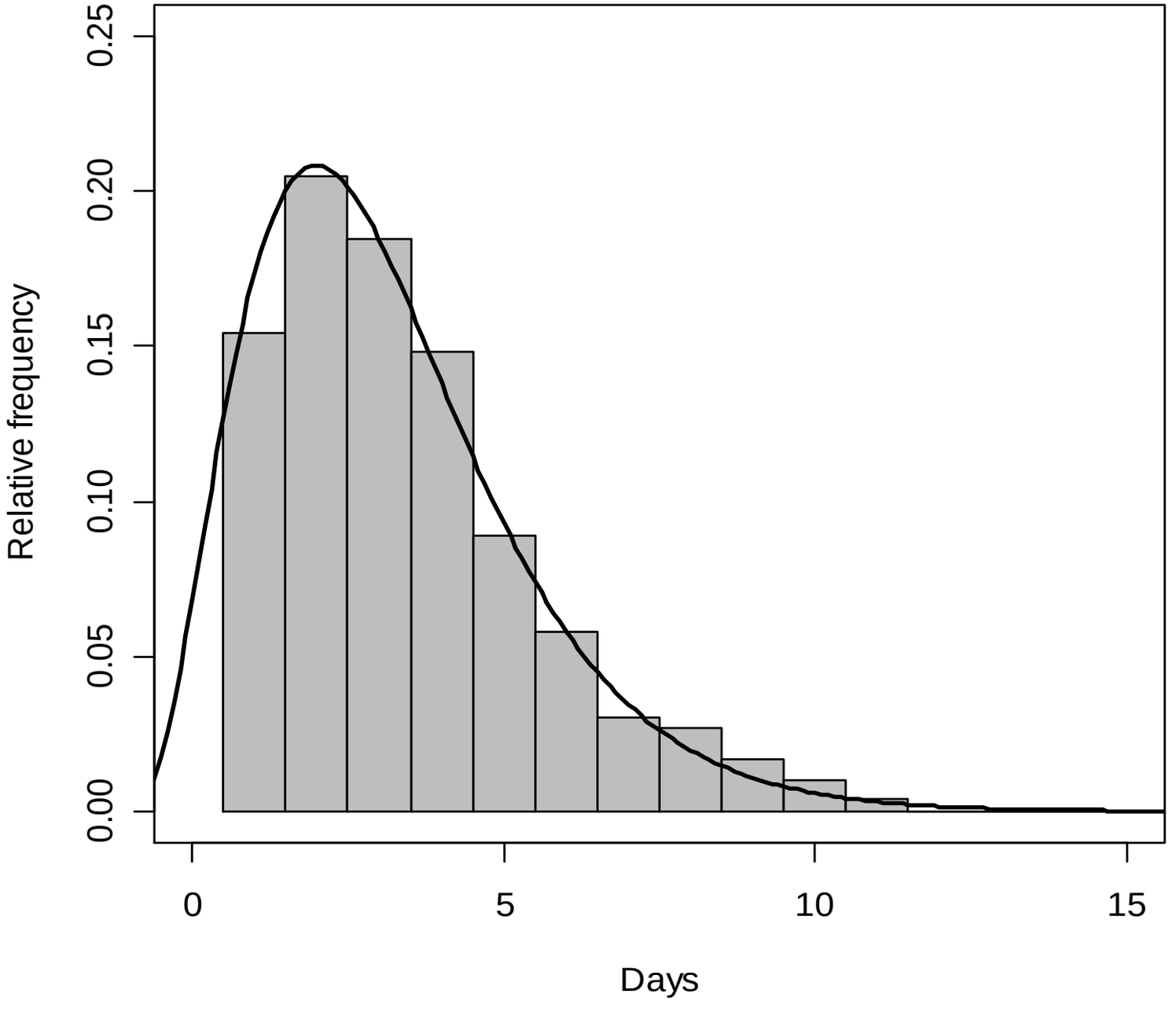
Frequency histogram showing the relative frequency of deaths as a function of time.



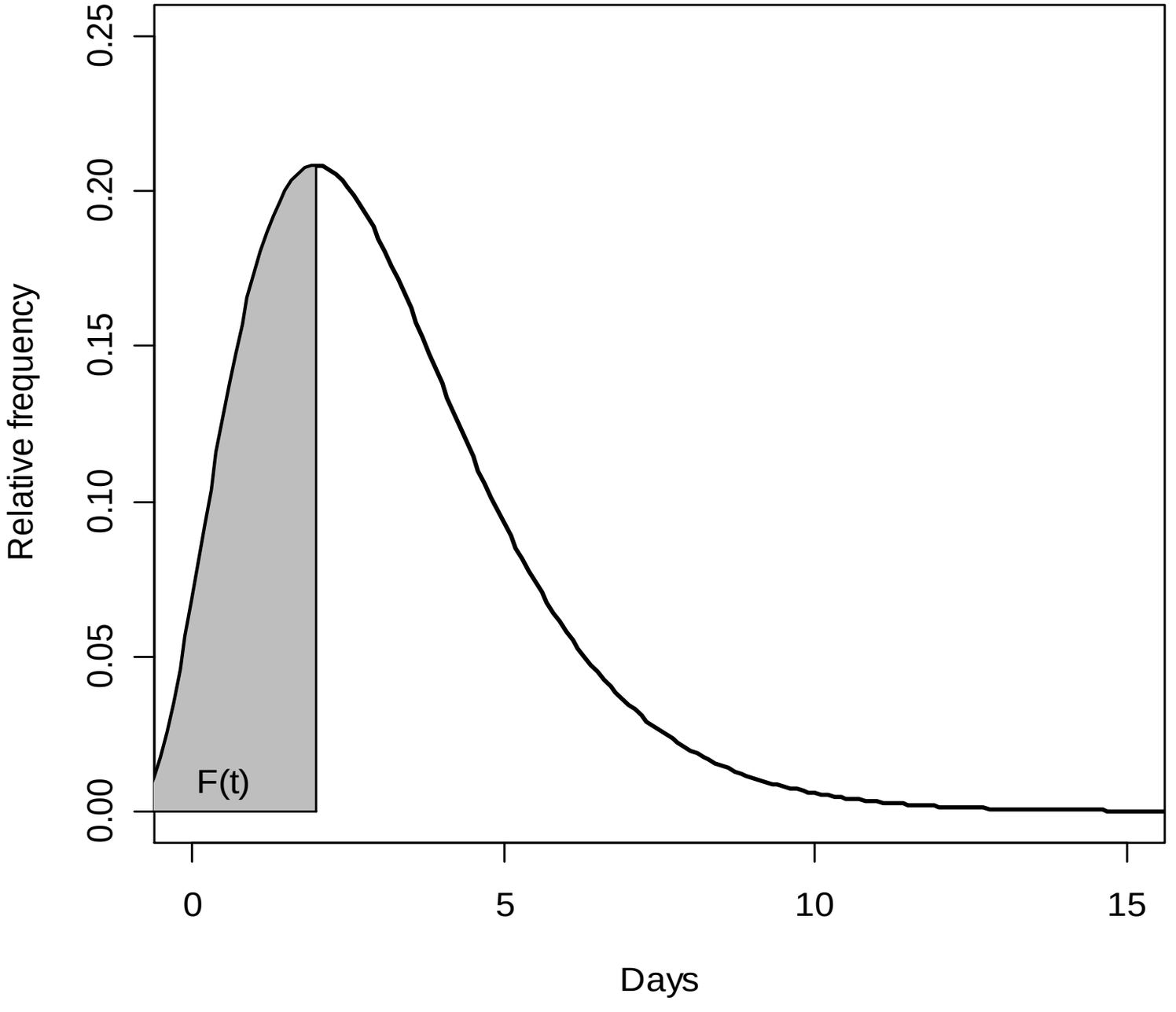
f(t) = death density function.



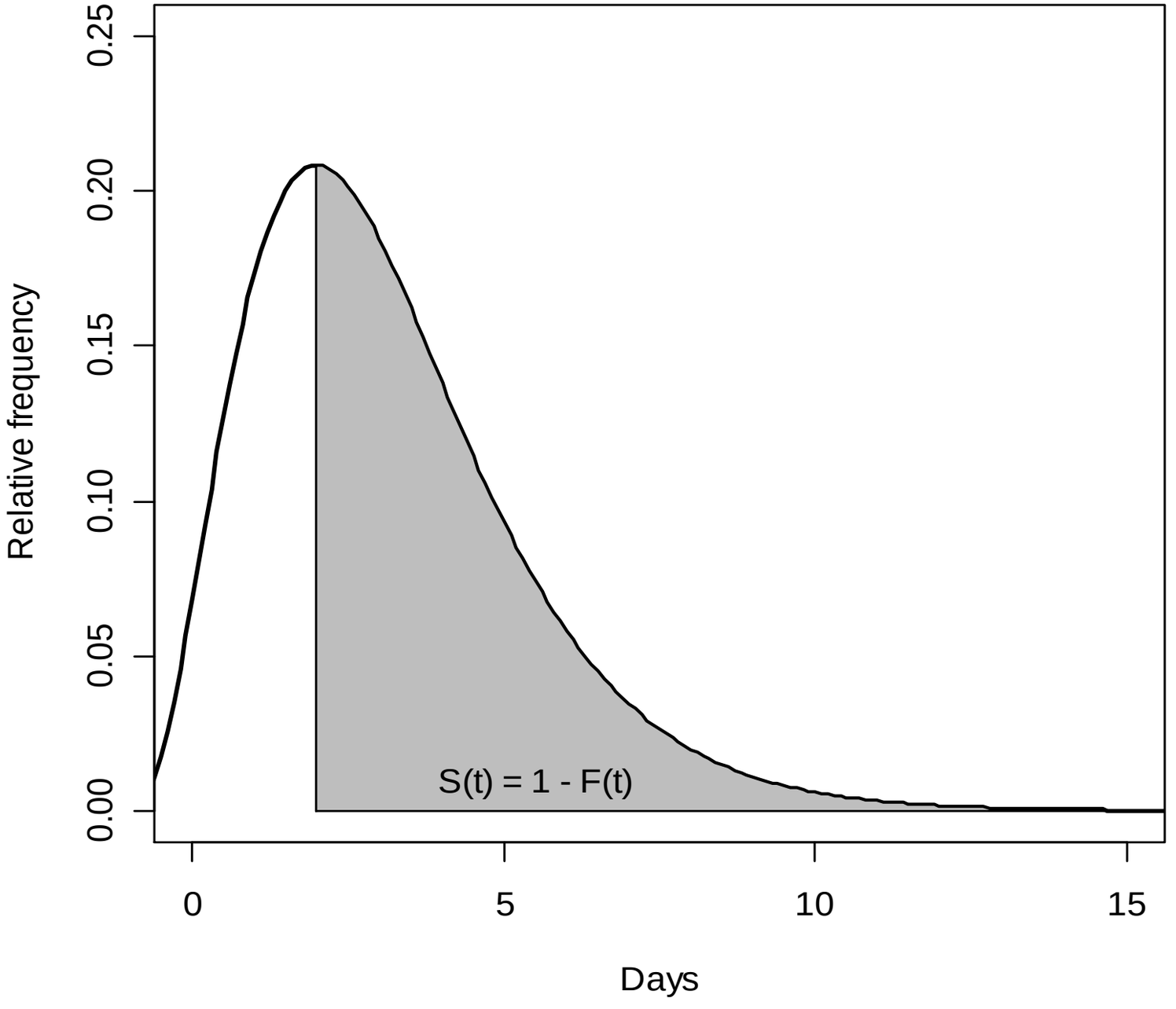
f(t) = death density function.



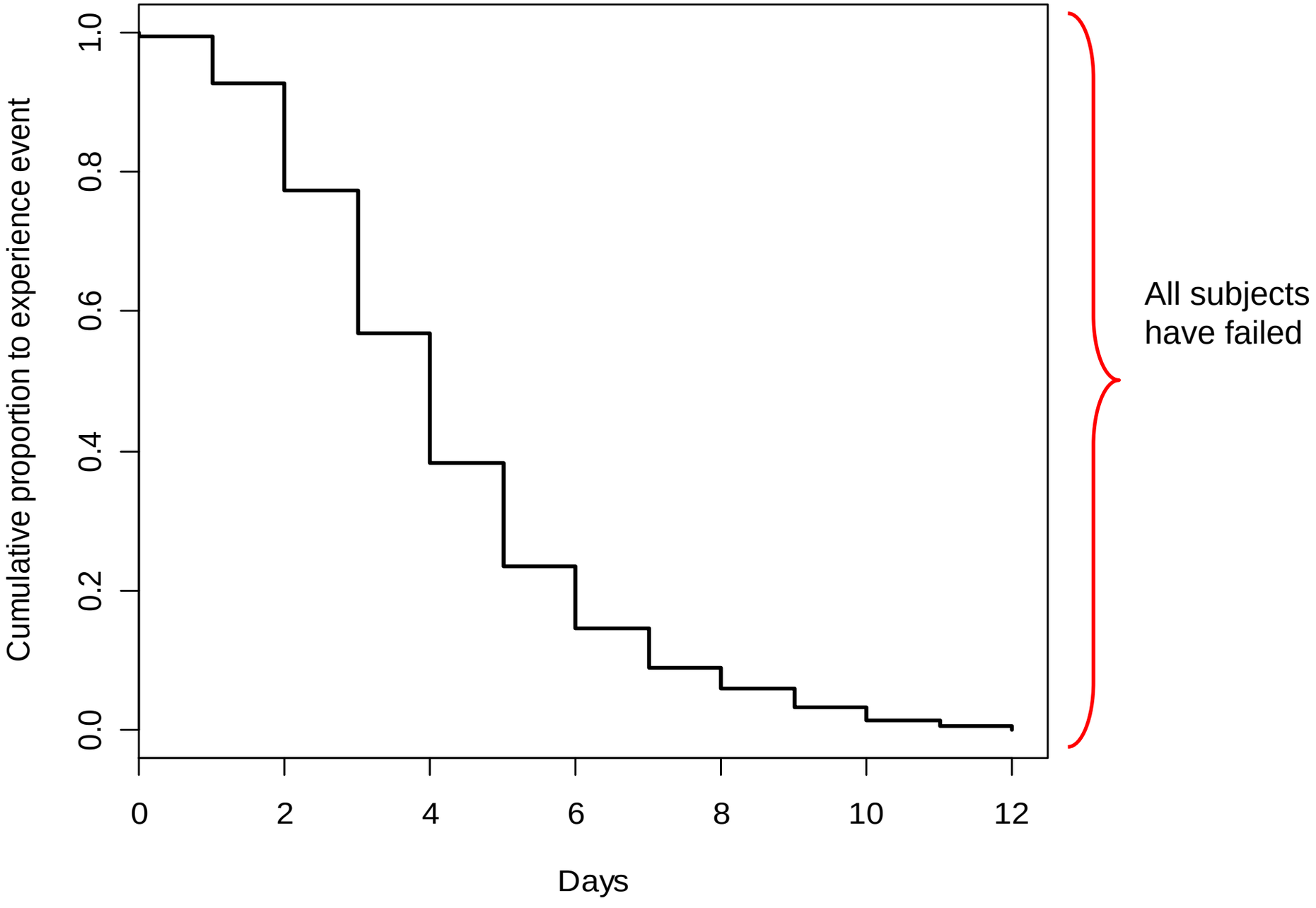
F(t) = the failure function = the proportion not surviving past time t.



$S(t)$ = survival function = the proportion of the group that survive up to time $t = 1 - F(t)$.



$S(t)$ = survival function = the proportion of the group that survive up to time $t = 1 - F(t)$.

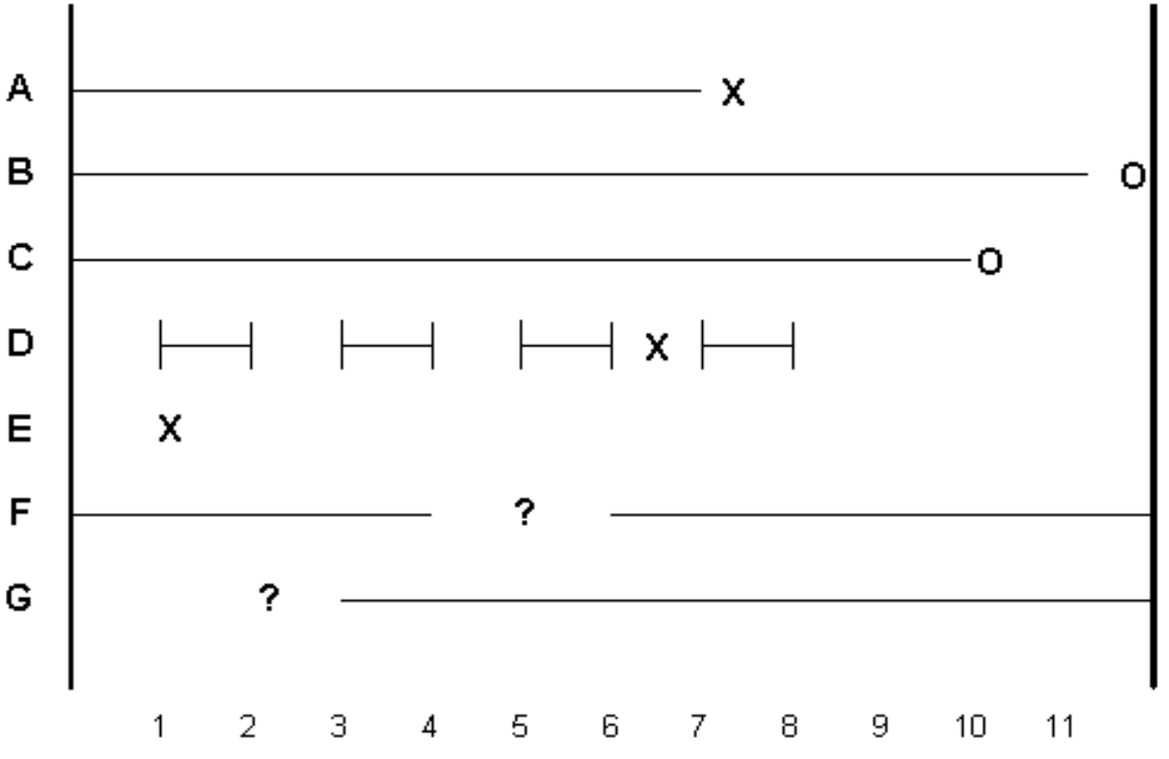


Topics covered

- Survival and hazard
- Censoring
- Instantaneous hazard

Censoring

- Censoring
  - in a follow-up study, the exact survival time is only known for those individuals that show the event of interest during the study period
  - other individuals (that were observed until the end of the study) might have shown the event of interest after the study finished
  - these individuals are said to have censored observations
  - types ≡ *right*, *left*, *interval*
  - usual to code censored observations as ‘0’ and events as ‘1’



Event of interest on day 7.

Right censored on day 12.

Right censored on day 10.

Interval censored on day 6.5.

Left censored on day 1.

Interval truncated data.

Left truncated data.

× = event of interest; **o** = censored; **?** = absent from data set

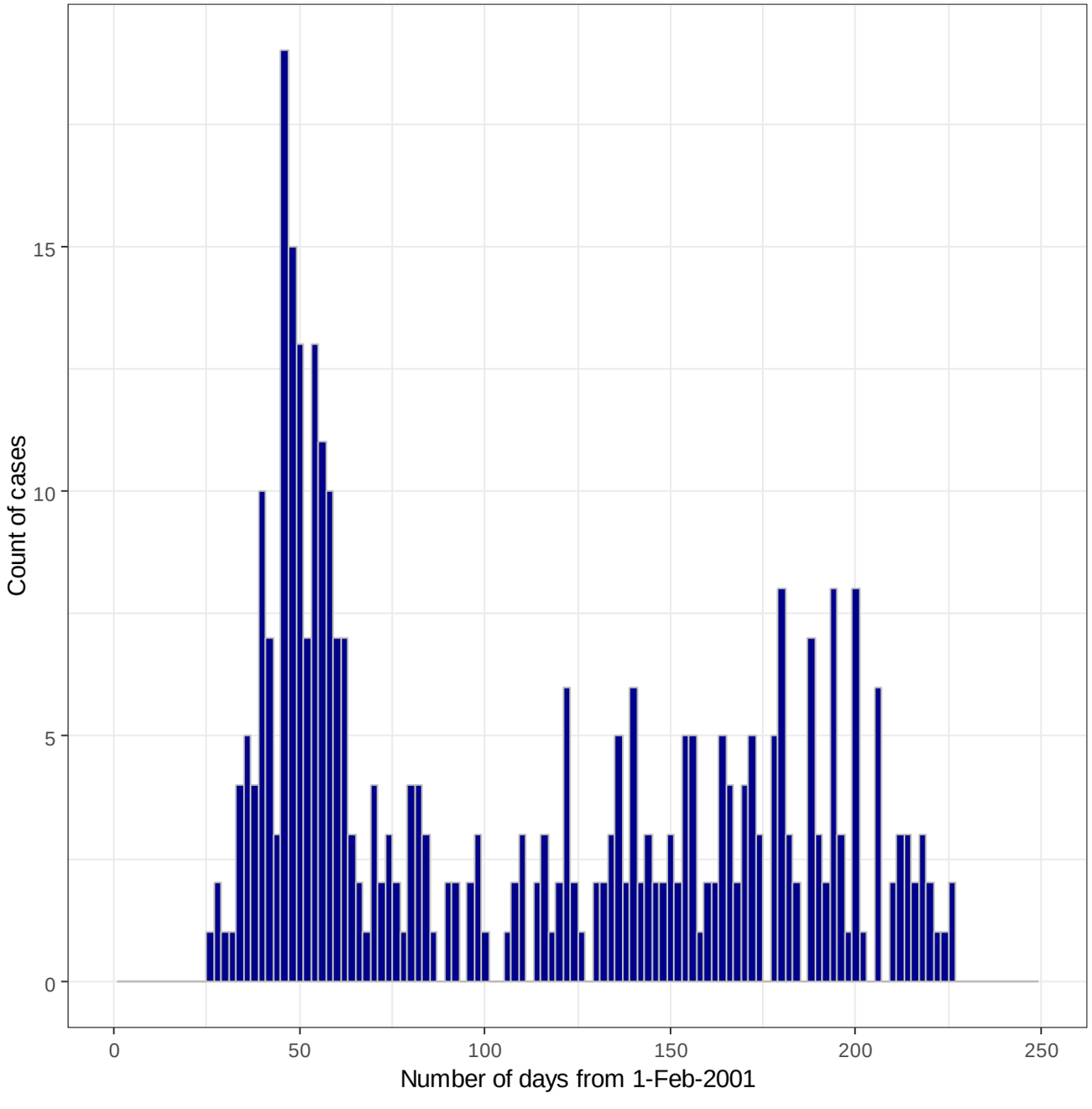
Censoring

id	days	status
001	11	1
002	12	0
003	21	1
004	10	1
005	41	0
006	2	1

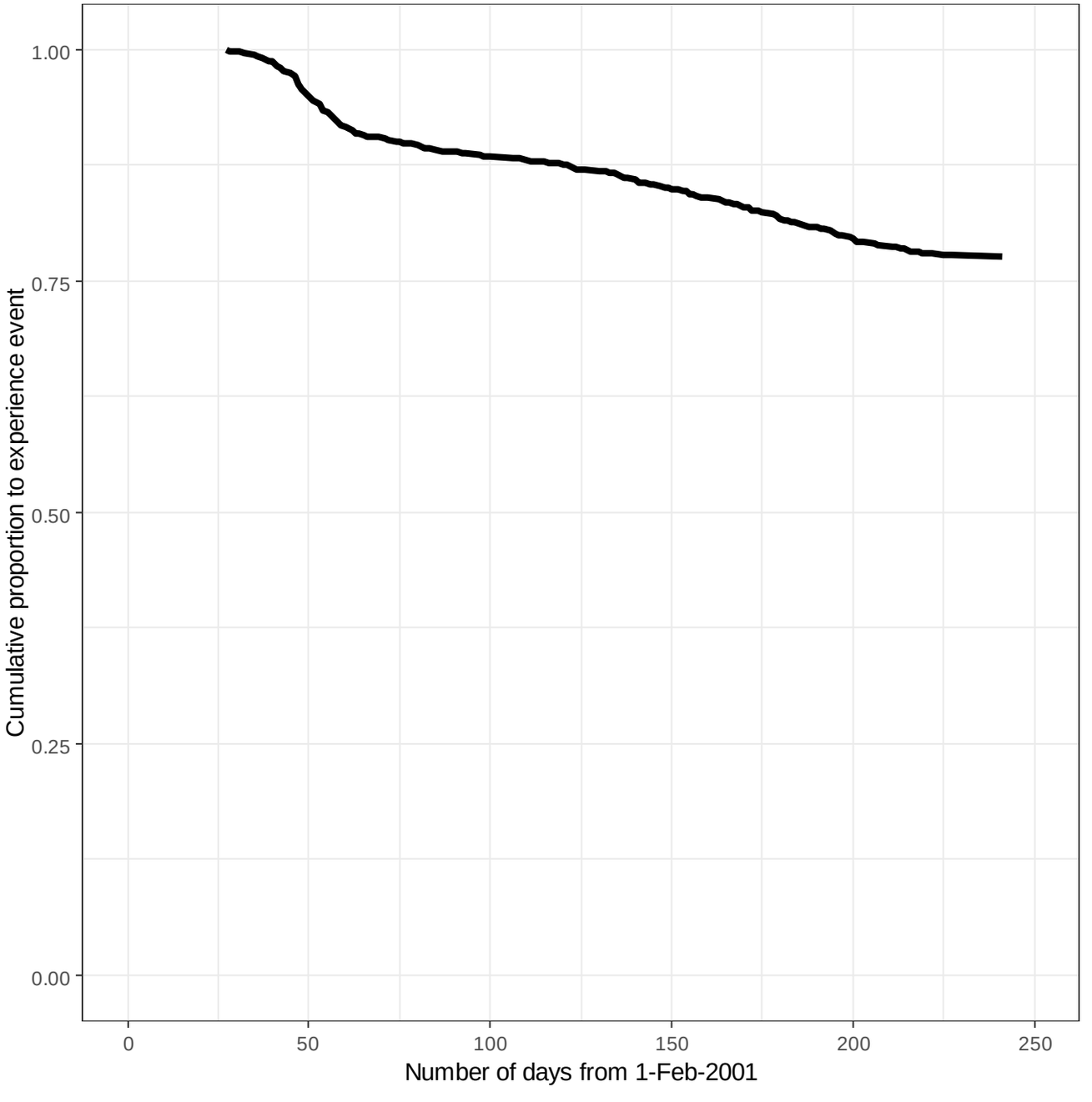
Topics covered

- Survival and hazard
- Censoring
- Instantaneous hazard

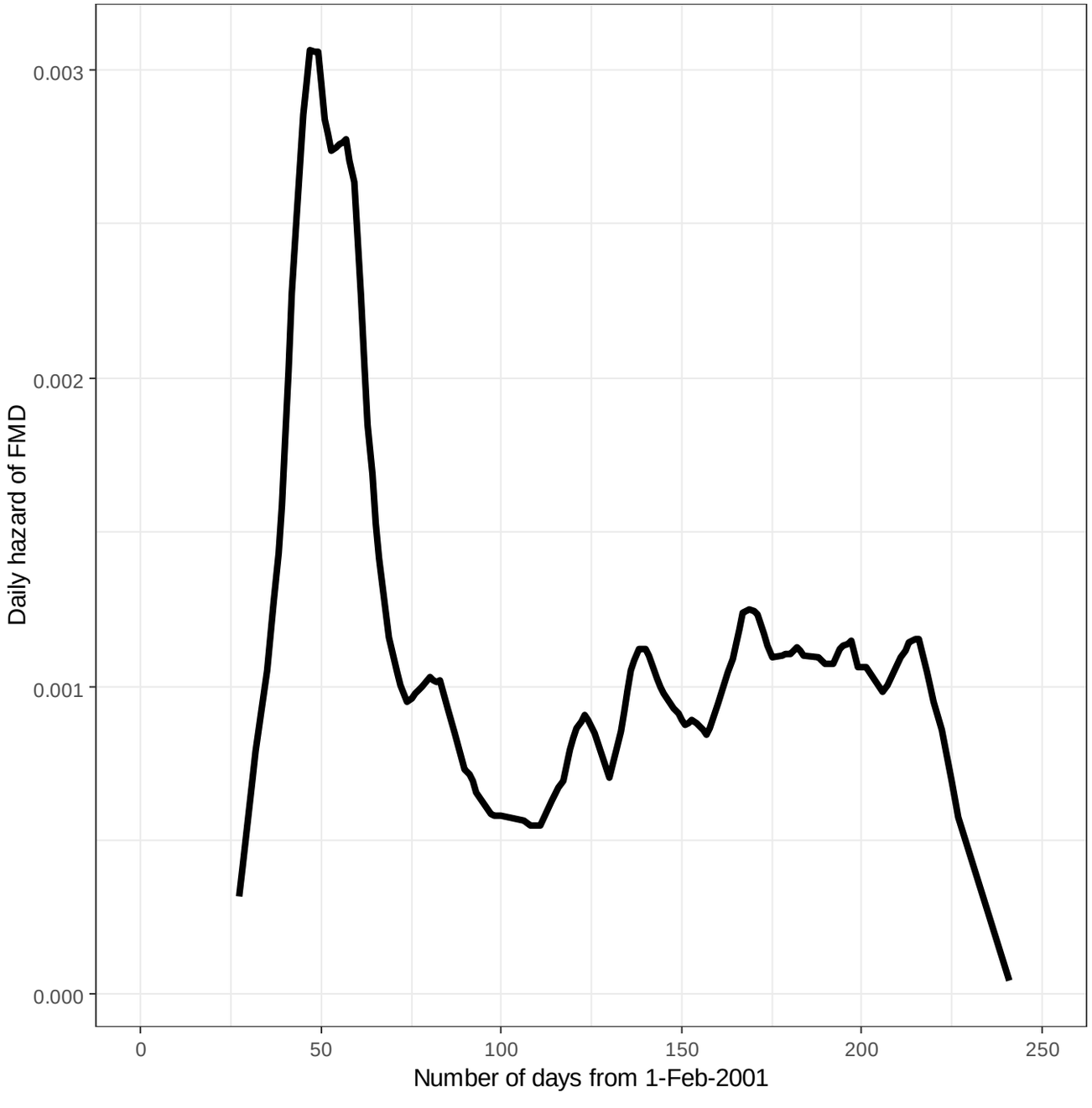
Frequency histogram of FMD date of onset of clinical signs for herds in Cumbria, 1 Feb 2001 to 30 Sep 2001.



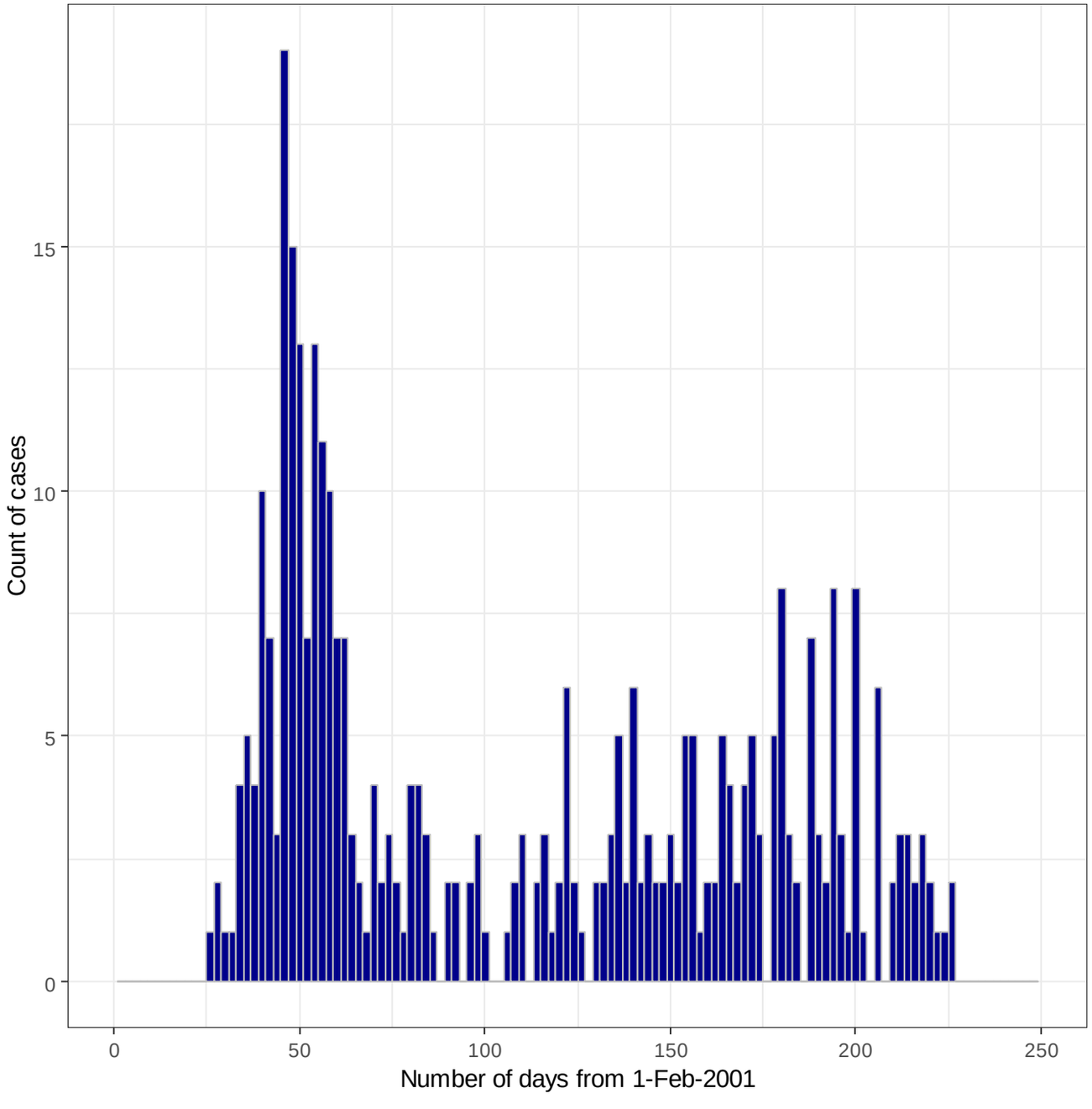
Kaplan-Meier survival curve showing the cumulative proportion of herds to show signs of FMD, Cumbria, 1 Feb 2001 to 30 Sep 2001.



Line plot showing the instantaneous hazard of FMD, Cumbria, 1 Feb 2001 to 30 Sep 2001.

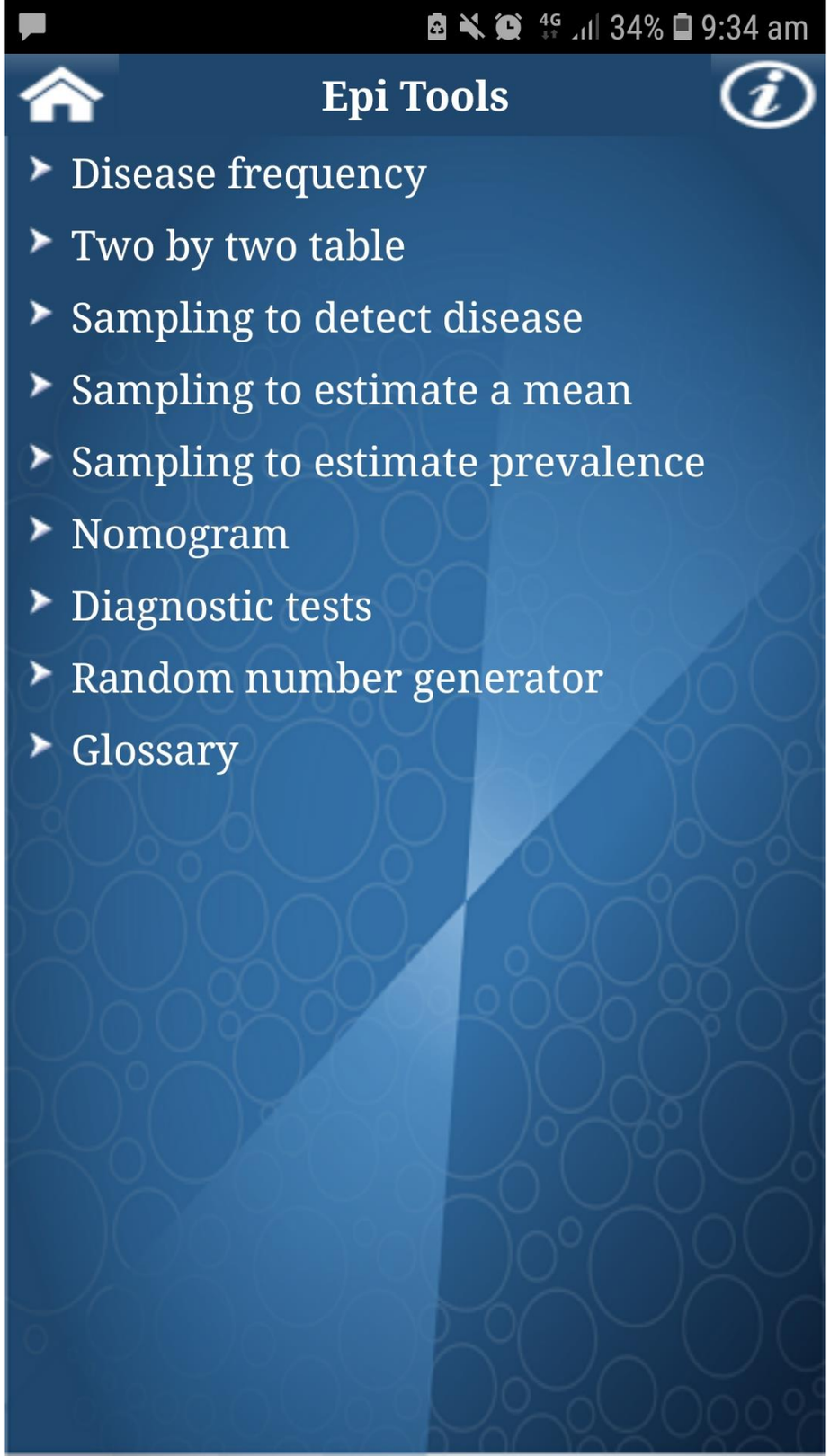


Frequency histogram of FMD date of onset of clinical signs for herds in Cumbria, 1 Feb 2001 to 30 Sep 2001.



Materials and methods

Lot	Market	Avg wgt	n	Date in	Date out	Censor
1	20	293	109	52	165	0
1	20	293	1	52	75	1
1	20	293	1	52	81	0
2	13	450	142	53	199	0
2	13	450	1	53	60	1
3	12	500	267	59	180	0


34% 9:34 am
Epi Tools
Disease frequency
Two by two table
Sampling to detect disease
Sampling to estimate a mean
Sampling to estimate prevalence
Nomogram
Diagnostic tests
Random number generator
Glossary


34% 9:34 am
Epi Glossary
A
C
D
E
I
L
M
N
O
P
R
S


34% 9:34 am
Epi Glossary
C
Case-control study
Case-crossover study
Case definition
Case reports
Case series
Closed population
Cluster sampling
Cohort study
Collider variable
Confounding
Community trial
Common point source epidemic
Common continuous source epidemic
Component cause
Controls, case-control study
Controls, historial, case-control study
Controls, hospital, case-control study

Cluster sampling

Cohort study

Collider variable

Confounding

The distortion of the true association between an exposure and an outcome of interest, because of the influence of a third factor. To be a confounder three criteria must be met: (1) the confounder must be associated with the exposure;
(2) the confounder must be a cause of the outcome; and
(3) the confounder and the exposure as causes of the outcome must be on two distinct causal pathways.

Community trial

Common point source epidemic

Common continuous source epidemic

Component cause

Controls, case-control study

Controls, historial, case-control study

Controls, hospital, case-control study

Controls, matched, case-control study

Controls, neighbourhood, case-control study

THE UNIVERSITY OF

MELBOURNE