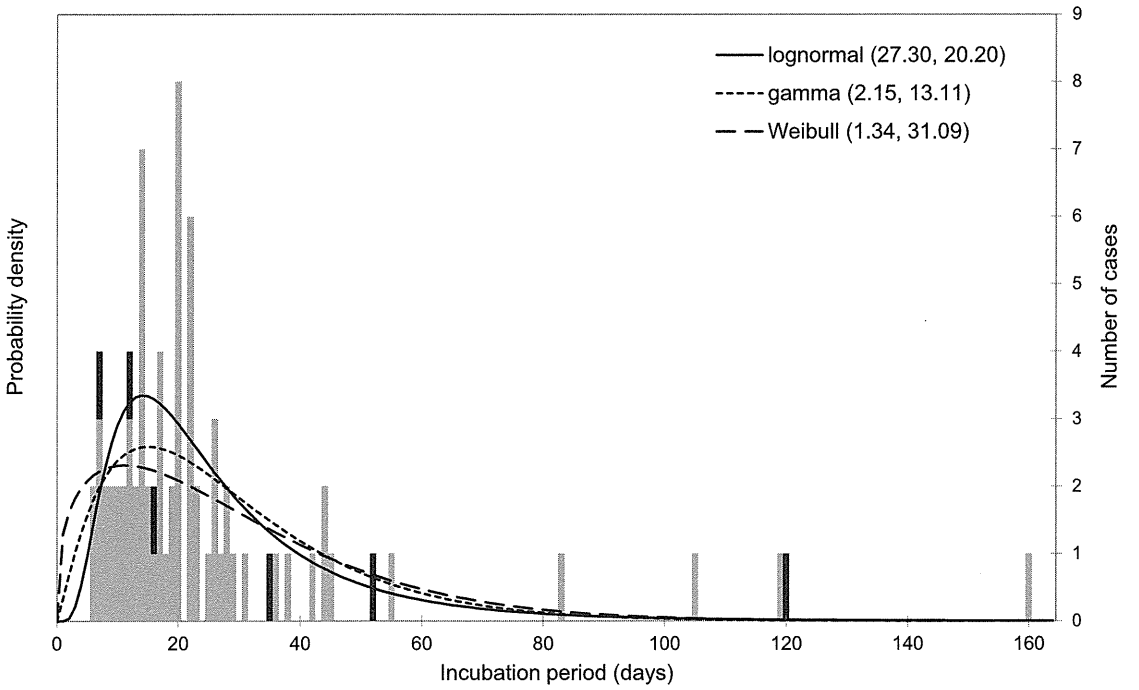

Fig. 1. Probability distribution of incubation period for rabies estimated using data of rabies cases during the 1948–1954 epidemic in Tokyo. Lognormal (solid line), gamma (dotted line) and Weibull (dashed line) distributions were used to model the incubation period. Black stacked bars (cats) and grey stacked bars (dogs) indicate the number of rabies cases with known incubation periods.

doses (log $MICLD_{50}$/ml dog virus) resulted in incubation periods of 9–69 days. Another experimental study by Soulebot et al. (1981) using cats inoculated with 4.43–4.95 doses (log LD_{50}/ml virus) resulted in incubation periods of 10 to 38 days. In these cases the animals would have been infected with a viral dose that may be much higher than the dose that would be transmitted in a natural infection, at an inoculation site relatively closer to the brain. Therefore, it is likely that the disease would manifest more quickly than it would in naturally occurring cases.

In the natural infection study in the UK (Advisory Group of Quarantine, 1998), of 30 naturally infected animals observed, 17 animals had an incubation period between 13 and 25 days, nine animals had an incubation period of 31 days, and four animals had 47, 56, 90 and 168 days respectively. Jones et al. (2005) and Goddard et al. (2010), used a probability distribution lognormal (38.12, 45.59) and lognormal (35.0, 36.8) respectively, in the risk assessment of rabies entry into the UK through importation of dogs and cats. These distributions were derived from both natural and experimental rabies.

The incubation period estimated in our study appears to be longer than that estimated by Hampson et al. (2009). They, based on observations of rabid animals in Tanzania, estimated the incubation period of rabies to be 22.3 (95% CI: 20.0–25.0) days.

The historical literature indicates that the incubation period for rabies is not only influenced by dose but by virus strain, host species, site of inoculation/bite and the immunological status of the exposed animal or person (Garg, 2014). No information was available on these factors, although one can easily guess that dogs and cats in those years were in poor nutritional condition and consequently were in poor immunological state. As a result, the rabies cases used in our study might have had incubation periods shorter than those cases with average nutritional condition and immunological status.

In estimating the probability distribution of incubation periods in our study, we only used data from animals for which information on the initial date of exposure was available. This might have resulted in a selection of animals biased toward shorter incubation periods, because the longer the incubation period was, the more difficulty the owner would have in remembering the initial date of exposure, thus, the animals with longer incubation periods would have been excluded from our data set, and consequently the probability distribution of incubation period might have been underestimated. Despite the possible existence of selection bias, the incubation period of rabies that we estimated will provide useful information in risk assessment and management of naturally occurring rabies in dogs and cats. In particular, the incubation period distribution that we estimated can be used for scenario analysis in conducting risk assessment of rabies through importation of dogs and cats into Japan.

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