

Rapid Communication

Serial intervals and incubation periods of the monkeypox virus clades

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Submitted 3 September 2022; Revised 8 September 2022; Accepted 10 September 2022

Monkeypox is a viral zoonotic disease considered as the most important orthopoxvirus infection after the eradication of smallpox.¹ Monkeypox cases have been reported in multiple non-endemic countries since May 2022,¹ raising global public health concerns. Agreement was made on 12 August 2022 that the new variant names, Clade I and Clade II, would refer to the former Congo Basin (Central African) clade and the former West African clade, respectively.² Clade II consists of Clade IIa and Clade IIb, with the latter mainly denoting the predominant variant in the 2022 monkeypox outbreak.² Serial interval (SI) and incubation period (IP) are two essential epidemiological parameters, referring to the time between symptom onset in the primary and secondary case and the time from exposure to symptom onset, respectively.³ Timely and reliable estimates of these metrics are vital for public health intervention development.

We identified 58 studies by searching PubMed, medRxiv and bioRxiv for articles that were published or pre-print by 26 August 2022, and included 1 additional study (Figure S1, Supplementary Methods). There were 41 studies removed through the initial screening, leaving 18 studies for full-text evaluation. Ten studies were eventually included in this review, reporting 3 SI estimates (Table S1) and 10 IP estimates (Table S2), where Clade IIb was most studied. Estimates of SI and IP were mainly collected from Congo, the USA, Italy, the Netherlands, England, Portugal and Spain (Figure 1).

The SI had a median value of 9.67 (interquartile range, IQR: 9.28, 10.05) days for Clade I in Congo and 9.78 (IQR: 8.9,

10.67) days for Clade IIb in England, Portugal and Spain. The IP had a median estimate of 9.50 (IQR: 8.00, 12.25) days for Clade I in Congo, and a median estimate of 16.76 (IQR: 11.39, 23.91) days for Clade IIa in the USA. The IP of Clade IIb was considered to be shorter than the ancestral clades, with a pooled estimate of 8.26 days (95% CI: 7.55, 8.97) (Figure S2). Although the included studies had different definitions of IP, we did not differentiate between them when calculating pooled estimates due to the low heterogeneity ($I^2 = 5.7\%$).

With more than 50 000 laboratory-confirmed and probable cases reported as of 1 September 2022,⁴ estimating SI and IP is necessary to interpret transmission trends and optimize contact tracing and isolation measures.⁵ However, estimates of SI and IP may vary over regions due to various factors (e.g. age-specific immunity induced by previous smallpox vaccination, and sexual transmission rate in MSM populations) not included in this review. In addition, this review may be biased, given that our study contains government briefing and preprint that have not been certified by peer review. Another limitation of this review is that only a few studies were included and finite data information on serial interval and previous variants were provided.

In conclusion, estimates of serial interval and incubation period have been reported for three clades of monkeypox virus. The potential need to adjust for control measures, such as entry restrictions and the length of a quarantine, should be adjusted following the changes in the two epidemiological metrics throughout an epidemic.

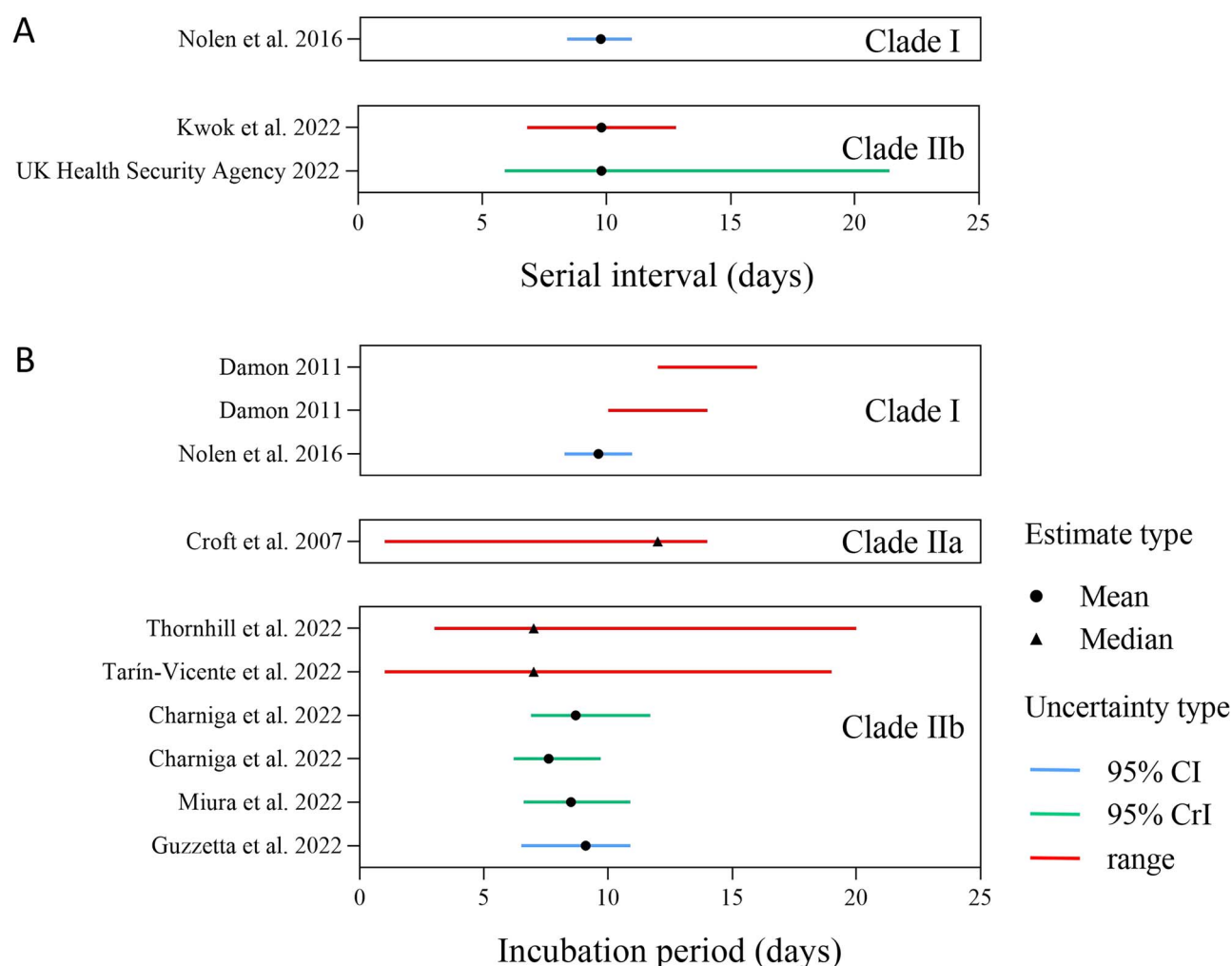


Figure 1. Estimation of serial intervals and incubation periods of monkeypox virus clades. (A) Estimation of serial intervals of monkeypox virus clades, including Clade I and Clade IIb, reported in 3 studies. (B) Estimation of incubation periods of monkeypox virus clades, including Clade I, Clade IIa and Clade IIb, reported in 8 studies. Points and triangles indicated the mean and median estimates, respectively. Horizontal segments represented 95% CI (in blue), 95% CrI (in green) and range (in red).

Supplementary data

Supplementary data are available at *JTM* online.

Data availability

All data are collected from open source with detailed descriptions in the Methods section.

Author contributions

S.W., F.Z., Z.Y. and Z.D. conceived the study, designed statistical and modelling methods, conducted analyses, interpreted results and wrote and revised the manuscript; M.X., Z.W., C.G. and R.G. interpreted results and revised the manuscript.

Funding

This work was supported by the Key Program for International Science and Technology Cooperation Projects of China (No. 2022YFE0112300), National Natural Science Foundation of China (No. 61976181), the Fundamental Research Funds for the

Central Universities (Nos. D5000210738, D5000211001), Technological Innovation Team of Shaanxi Province (No. 2020TD-013), Natural Science Basic Research Plan in Shaanxi Province of China (No. 2022JM-325). The funders of the study had no role in study design, data collection, data analysis, data interpretation, or writing of the report. All codes to perform the analyses and generate the figures in this study are available from the corresponding author upon reasonable request.

Competing interests

Not applicable.

Code availability

Code used for data analysis is freely available upon request.

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