CDC is updating webpages with the term "mpox" to reduce stigma and other issues associated with prior terminology. This change is aligned with the recent World Health Organization decision.

Technical Report 4 Supplementary Analysis: Multi-National Monkeypox Outbreak, United States, 2022

Updated November 18, 2022

Data as of November 14, 2022 (unless otherwise noted)

This technical report supplementary analysis is for scientific audiences. Additional information, including materials for the public, are available on the monkeypox site.

This addition to Technical Report 4, originally published on October 27, 2022, is intended to provide updated national reproduction number estimates and to report newly created sub-national reproduction number estimates.

Outbreak Reproduction Number Estimates

Based on CDC analyses using data as of November 14, 2022, the overall incidence of new cases of monkeypox in the United States is declining. We have high confidence in this assessment.

We estimate the national time-varying reproduction number (R_t), which is the average number of secondary cases infected by a single primary case in a large population, has been below one since late July (Figure 10-1). Analyses were conducted using the EpiNow2 package, which adjusts for truncated data and reporting delays, using three parameter distributions: generation interval, incubation period, and delay from symptom onset to report date.[1]

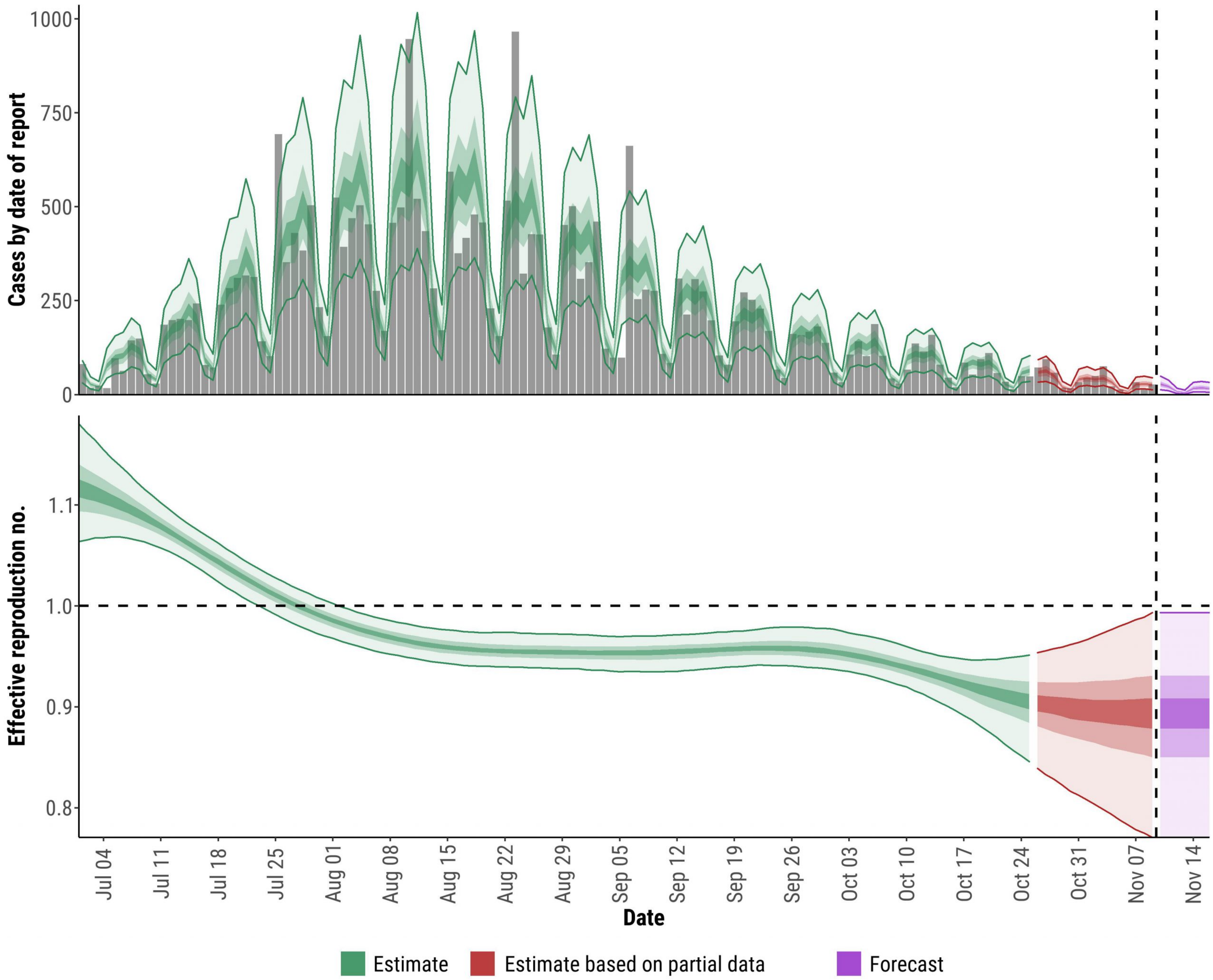

Figure 10-1[2]. The top panel shows estimates of cases by date of report with actual cases shown by gray bars. The bottom panel shows estimates of the effective reproduction number by date. In both panels, shaded regions reflect 90%, 50%, and 20% credible intervals in order from lightest to darkest. Green shows estimates, red shows estimates based on partial data, and purple shows forecasts[3].

The declining incidence of new cases is likely due to a combination of many factors, including vaccination, behavior change, and possibly increases in infection-acquired immunity among a segment of affected sexual networks. As we noted in Technical Report 3, the timing of this initial slowing in late July suggests the initial decline is unlikely to be due to vaccination alone, though vaccine is likely to have had a greater impact over time. In the most recent weeks since early August, based on partial data and the forecasted time period, the 90% credible interval[4] of our effective reproduction number estimates remain below 1.0.

An online survey of gay, bisexual, and other MSM conducted in early August found half of respondents reported that they had changed their behavior and reduced sexual partners and encounters due to the monkeypox outbreak (Impact of Monkeypox Outbreak on Select Behaviors). Continued effective health communication and protective behavior messaging, coupled with strong and equitable vaccination uptake, are helping to sustain declines in cases. If these efforts are not sustained, there is a possibility that the declining trends could be reversed, and the incidence of new cases could increase again.

Vaccination remains an important tool as the outbreak evolves and vaccination coverage, especially of second doses, increases. As of November 12, 2022, 692,298 first doses and 396,410 second doses of JYNNEOS vaccines have been administered (Monkeypox Vaccine Administration in the U.S.). An analysis posted on September 28, 2022, estimated a 14-fold higher monkeypox incidence in unvaccinated individuals compared to those who received one dose of JYNNEOS vaccine at least 14 days earlier (Vaccine Considerations). Studies to further evaluate vaccine effectiveness are underway.

Sub-national Time-varying Reproduction Number Estimates

We estimated R_t for six jurisdictions with the highest incidence of monkeypox cases: California (CA), Florida (FL), Georgia (GA), Illinois (IL), New York City (NYC), and Texas (TX) [Figures 10-2 – 10-7]. These estimates had greater uncertainty than the national estimate, and their point estimates were variable, but all are higher (closer to 1) than the national estimate. Variation and greater uncertainty would be expected in these jurisdictional estimates due to smaller sample size. In addition, reports from some jurisdictions have sometimes come in large batches, which adds to uncertainty and may violate the assumptions of the model underlying EpiNow2.

The 90% credible interval of the forecasted R_t for all six of the selected jurisdictions include 1.0, which could reflect smaller sample size and/or true changes in rates of transmission, as noted for the national estimates, and could potentially reflect recent changes in the reporting process that are not fully captured by the model.

Further declines in incidence are expected in four of the jurisdictions (CA, FL, NYC, TX), with the upper end of the 50% credible interval for R_t being below 1.0. Of these jurisdictions, TX has had greater uncertainty and fluctuations in Rt over the estimation period, compared to the other reported jurisdictions. Two jurisdictions (GA, IL) have more uncertain recent trajectories with the 50% credible interval for R_t in GA containing 1.0 and the 20% interval in IL containing 1.0. While these differences may simply reflect variation due to smaller sample size, the possibility of a value of R_t near 1.0 points to the importance of continuing effective health communication regarding harm reduction and encouraging strong and equitable vaccine uptake.

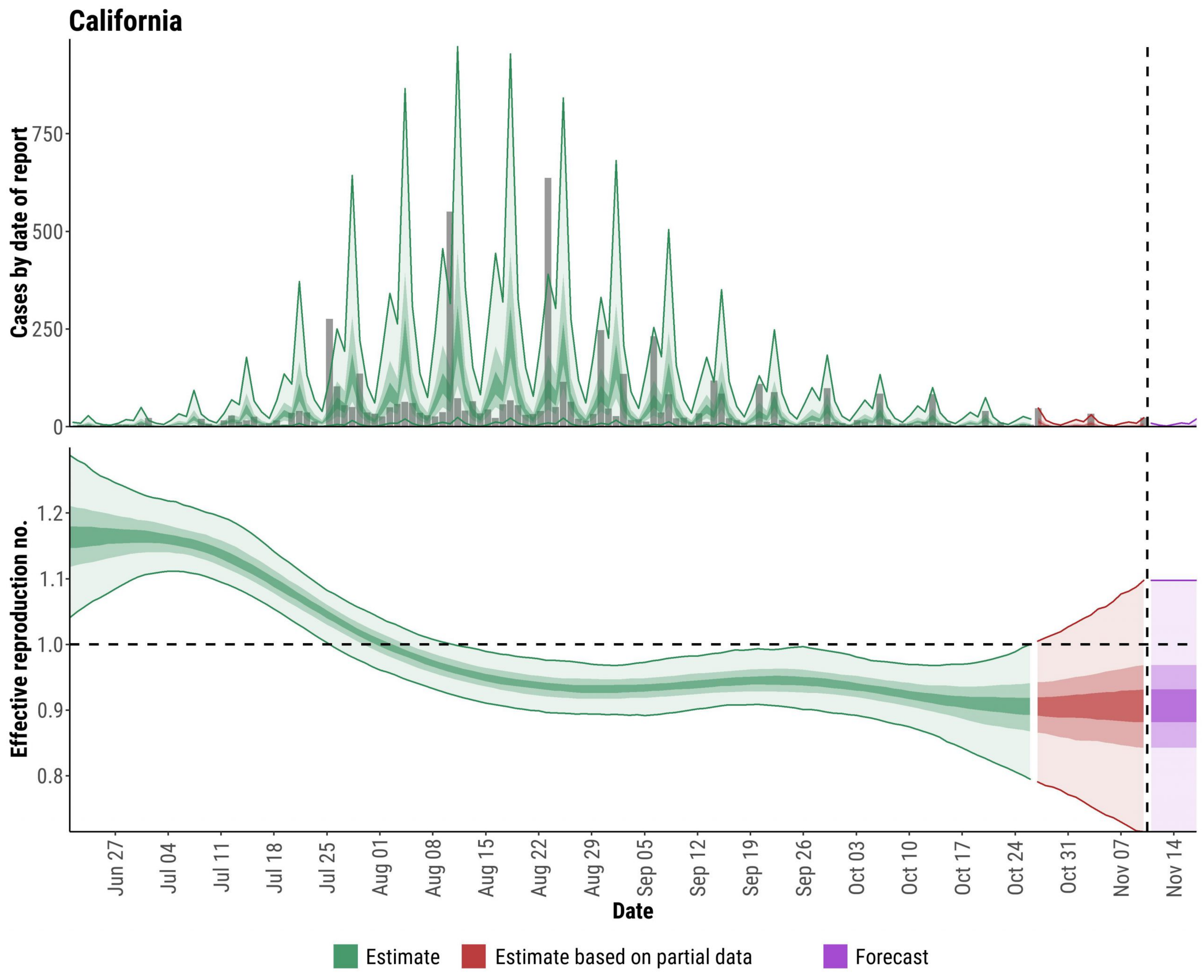

Figure 10-2. The top panel shows estimates of cases by date of report with actual cases shown by gray bars for the state of California. The bottom panel shows estimates of the effective reproduction number by date. In both panels, shaded regions reflect 90%, 50%, and 20% credible intervals in order from lightest to darkest. Green shows estimates, red shows estimates based on partial data, and purple shows forecasts[3].

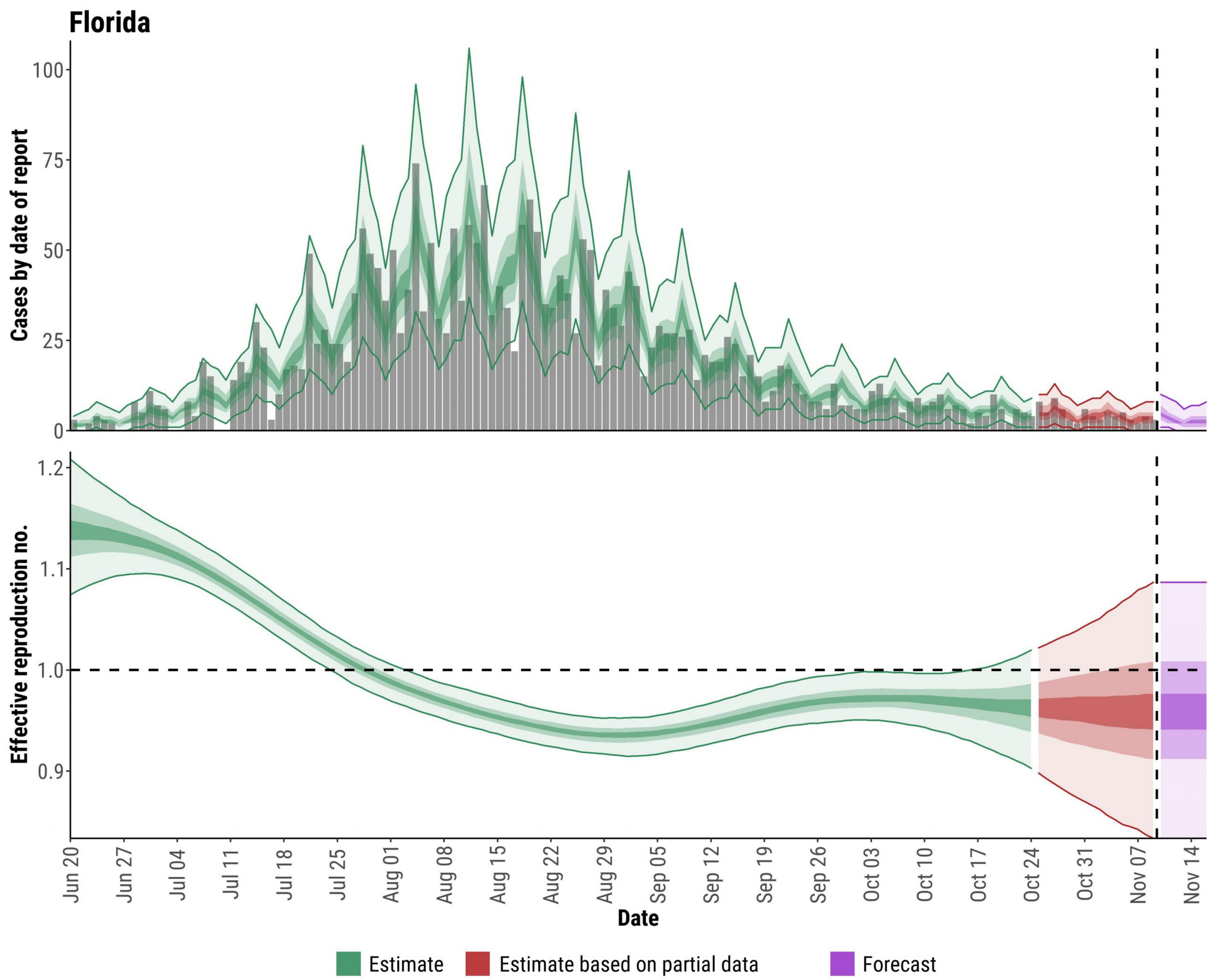

Figure 10-3. The top panel shows estimates of cases by date of report with actual cases shown by gray bars for the state of Florida. The bottom panel shows estimates of the effective reproduction number by date. In both panels, shaded regions reflect 90%, 50%, and 20% credible intervals in order from lightest to darkest. Green shows estimates, red shows estimates based on partial data, and purple shows forecasts[3].

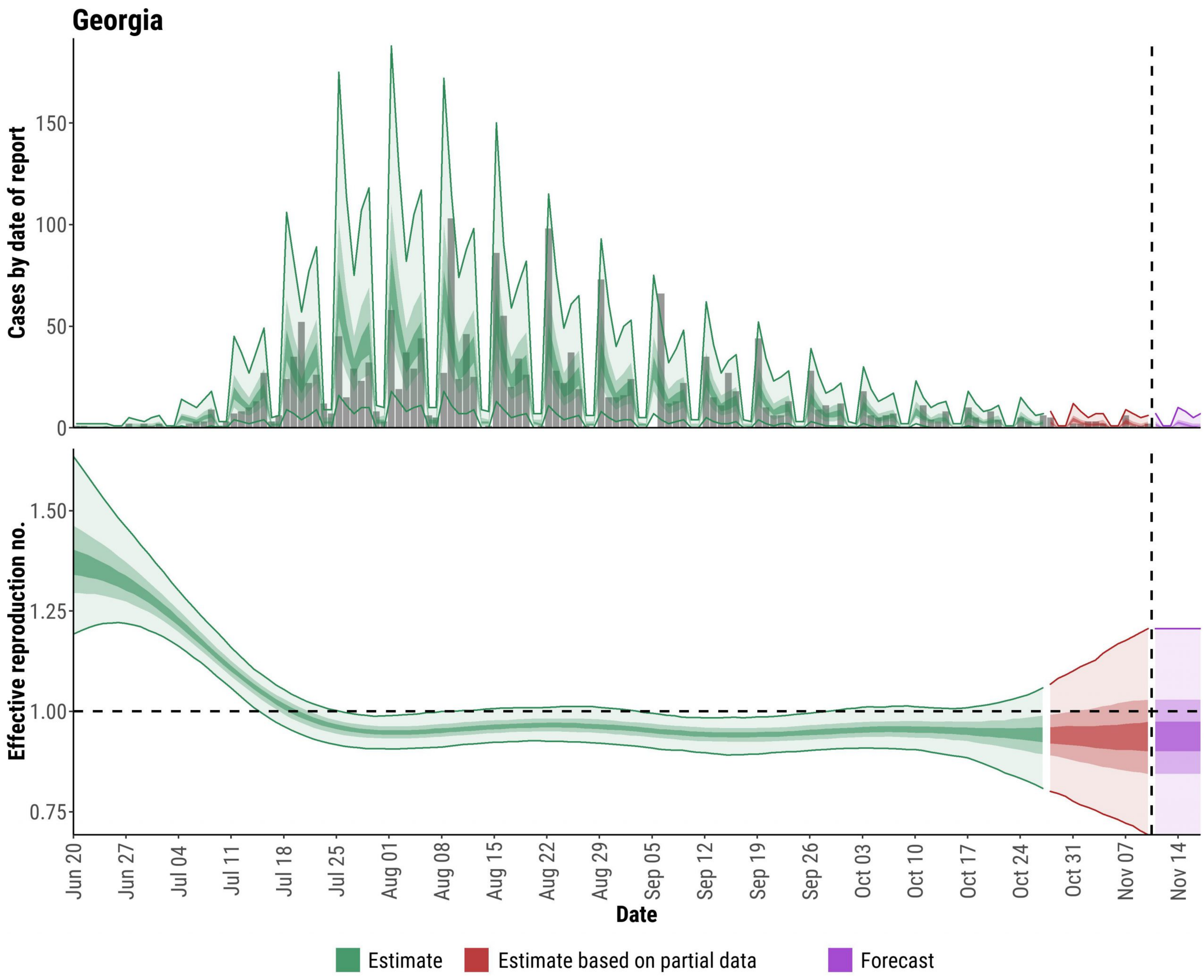

Figure 10-4. The top panel shows estimates of cases by date of report with actual cases shown by gray bars for the state of Georgia. The bottom panel shows estimates of the effective reproduction number by date. In both panels, shaded regions reflect 90%, 50%, and 20% credible intervals in order from lightest to darkest. Green shows estimates, red shows estimates based on partial data, and purple shows forecasts[3].

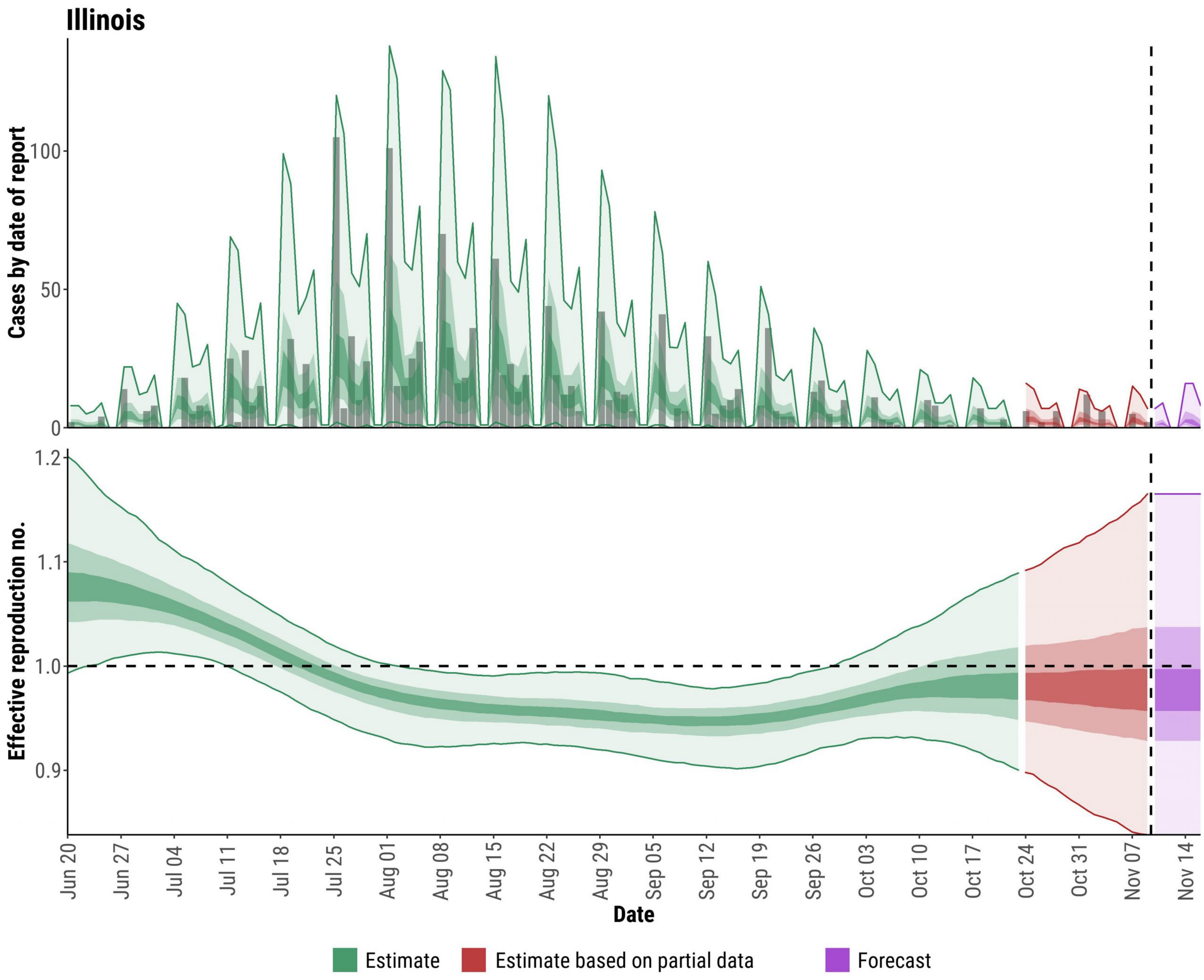

Figure 10-5. The top panel shows estimates of cases by date of report with actual cases shown by gray bars for the state of Illinois. The bottom panel shows estimates of the effective reproduction number by date. In both panels, shaded regions reflect 90%, 50%, and 20% credible intervals in order from lightest to darkest. Green shows estimates, red shows estimates based on partial data, and purple shows forecasts[3].

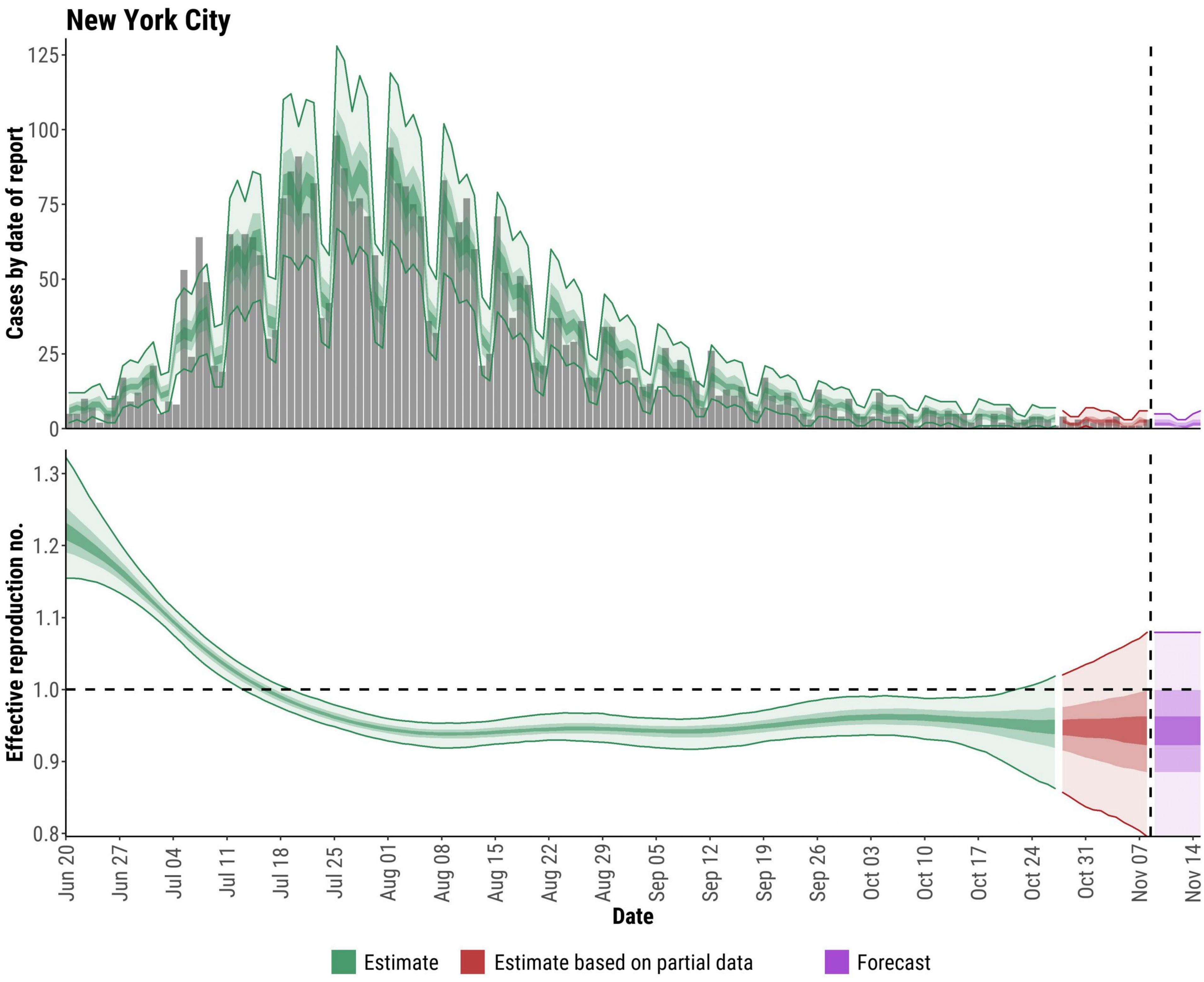

Figure 10-6. The top panel shows estimates of cases by date of report with actual cases shown by gray bars for New York City. The bottom panel shows estimates of the effective reproduction number by date. In both panels, shaded regions reflect 90%, 50%, and 20% credible intervals in order from lightest to darkest. Green shows estimates, red shows estimates based on partial data, and purple shows forecasts[3].

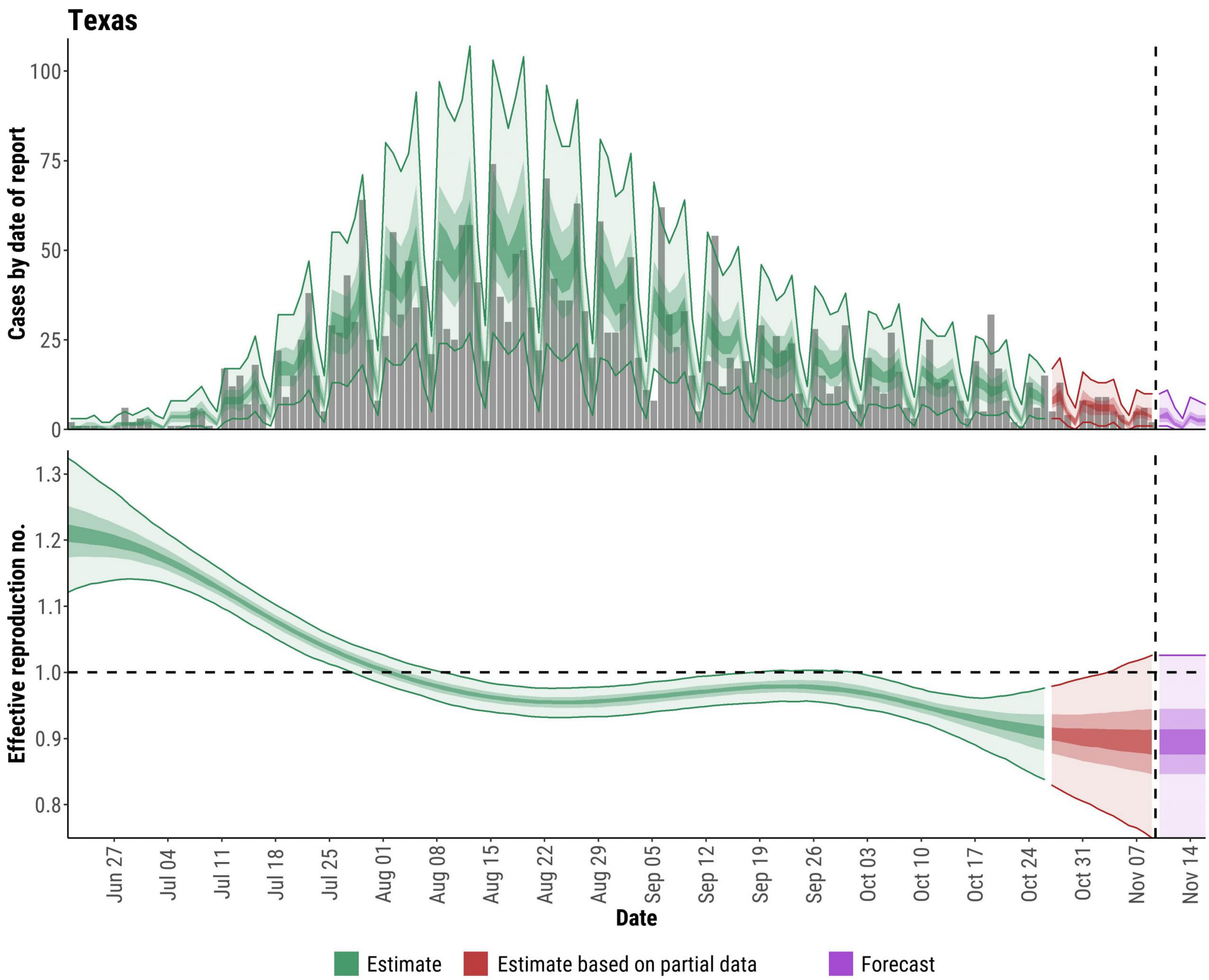

Figure 10-7. The top panel shows estimates of cases by date of report with actual cases shown by gray bars for the state of Texas. The bottom panel shows estimates of the effective reproduction number by date. In both panels, shaded regions reflect 90%, 50%, and 20% credible intervals in order from lightest to darkest. Green shows estimates, red shows estimates based on partial data, and purple shows forecasts[3].

Footnotes

1. The generation interval and incubation period are internal estimates updated from Charniga K, Masters NB, Slayton RB, Gosdin L, Minhaj FS, Philpott D, et al. Estimating the incubation period of monkeypox virus during the 2022 multi-national outbreak. medRxiv . 2022
2. Figure 10-1 is an update to Figure 10 in Technical Report 4, with updated data as of November 14, 2022.
3. Report date is determined by a hierarchy across the different data streams where priority is given to diagnosis date, orthopoxvirus test date, orthopoxvirus test confirmation date, case investigation start date, orthopoxvirus sample collection date, date of call to CDC call center, report date (to public health department, county, or state), date CDC announced case, and the date the case was entered into DCIPHER, in that order. Note that this date is distinct from the dates used elsewhere in this report. We have updated the approach for modeling the reporting process from Technical Report 3 to better estimate delays in case reporting.
4. Credible interval refers to the interval that contains a particular parameter value with the given probability.

Last Reviewed: November 18, 2022