Planning scenarios for the next 6 months

Imperial College COVID-19 response team

Model used: Spatially explicit individual based simulation of respiratory virus transmission in the entire GB population. The model was first previously developed for pandemic influenza planning [Ferguson et al., Nature, Nature, 2005. 437(7056): p. 209-14], including non-pharmaceutical interventions (NPIs) [Halloran et al, PNAS, 2008. 105:4639-4644]. The model has been parameterised to reproduce current knowledge of COVID-19 epidemiology, including age-dependence in severity and healthcare utilisation.

Policies examined (central assumptions)

CI - case isolation in the home. 70% of symptomatic cases withdraw to the home for 7 days, reducing non household contacts by 75%. Household contacts unchanged.

HQ - voluntary home quarantine. Following the identification of a symptomatic case in the household, all other household members withdraw to the home for 14 days. Household contacts double during quarantine, all contact outside the household are reduced by 75%. 50% of households are assumed to comply with the policy.

PC - **Closure of schools and universities**: schools assumed to completely close, 25% of universities remain open. Household contact rates for student families increased by 50% during closure. Contacts outside the household increase by 25% during closure.

SD- Social distancing of the entire population: All households reduce contacts outside the household or school/workplace by 75%. School contact rates are assumed to be unchanged. Workplace contact rates are reduced by 25%. Household contact rates are assumed to increase by 25%. This policy implies cessation of all activities outside the household (including social contact between different households) bar the essentials and attending school and work.

Timing: policies assumed to start on 17th March, other than school closure which starts 1 week later. Policy duration assumed to be 6 months.

Transmissibility of COVID-19 in the absence of interventions: R_0 values of 2.8 and 3.2 examined. R0=2.8 scenario gives best fit to growth rate in last 9 days (up to 25/3) of UK deaths and ICU beds occupied

Infection seeding: calibrated to approximately match spatial distribution of COVID-19 in GB on 24/3/2020.

Geography: results for GB shown

Compliance scenarios – three examined:
1. "Central" intervention scenario uses policy compliance/effectiveness assumptions previously assumed by Imperial.
2. "Good compliance" scenario assumes 75% (rather than 50%) of households comply with 14-day household quarantine policy, and that general social distancing reduces contacts outside the household and workplace by 90% and workplace contacts by 50% (rather than 25% for central).
3. "Poor compliance" scenario assumes school closure increases household contacts by 100% (rather than 50% for central) and social contacts outside the household by 50% rather than 25%. It also assumes general social distancing only reduces contacts outside the household and workplace by 66% (rather than 75% for central).

Figure 1: ICU beds occupied for R0=2.8 scenarios (lower panel zooms in on top panel)
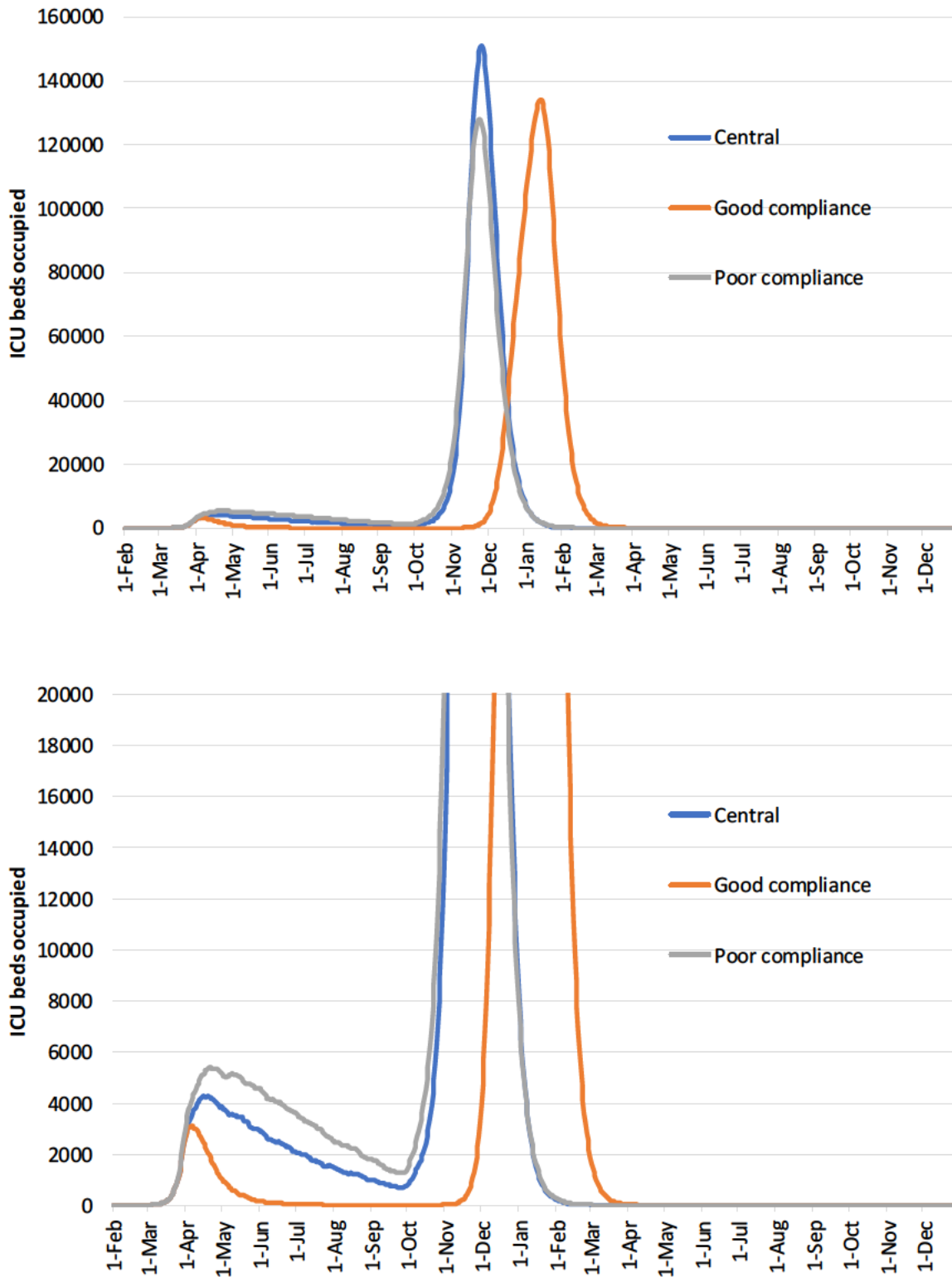
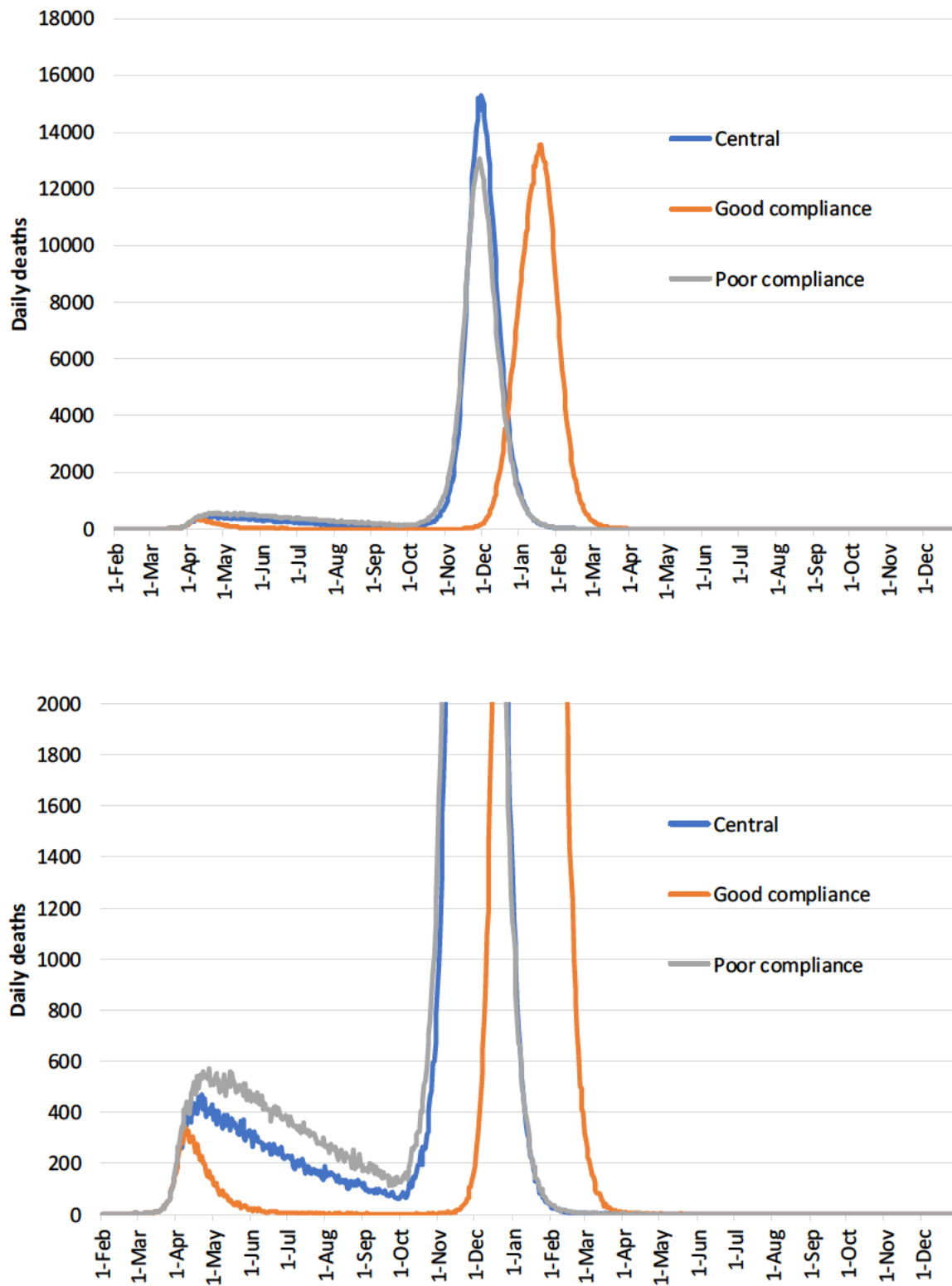**Figure 2: Daily deaths for R0=2.8 scenarios (lower panel zooms in on top panel)**

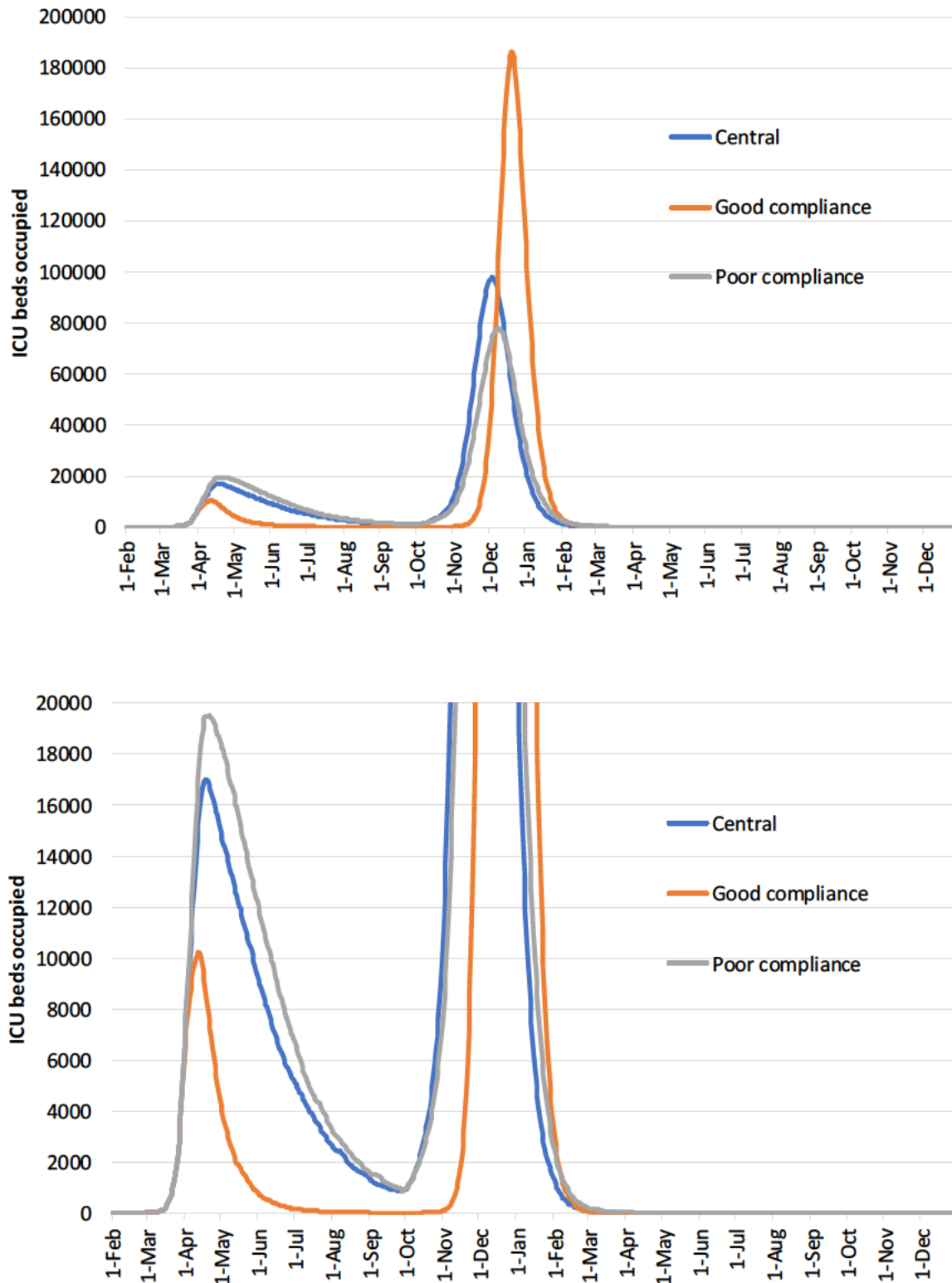**Figure 3: ICU beds occupied for R0=3.2 scenarios (lower panel zooms in on top panel)**

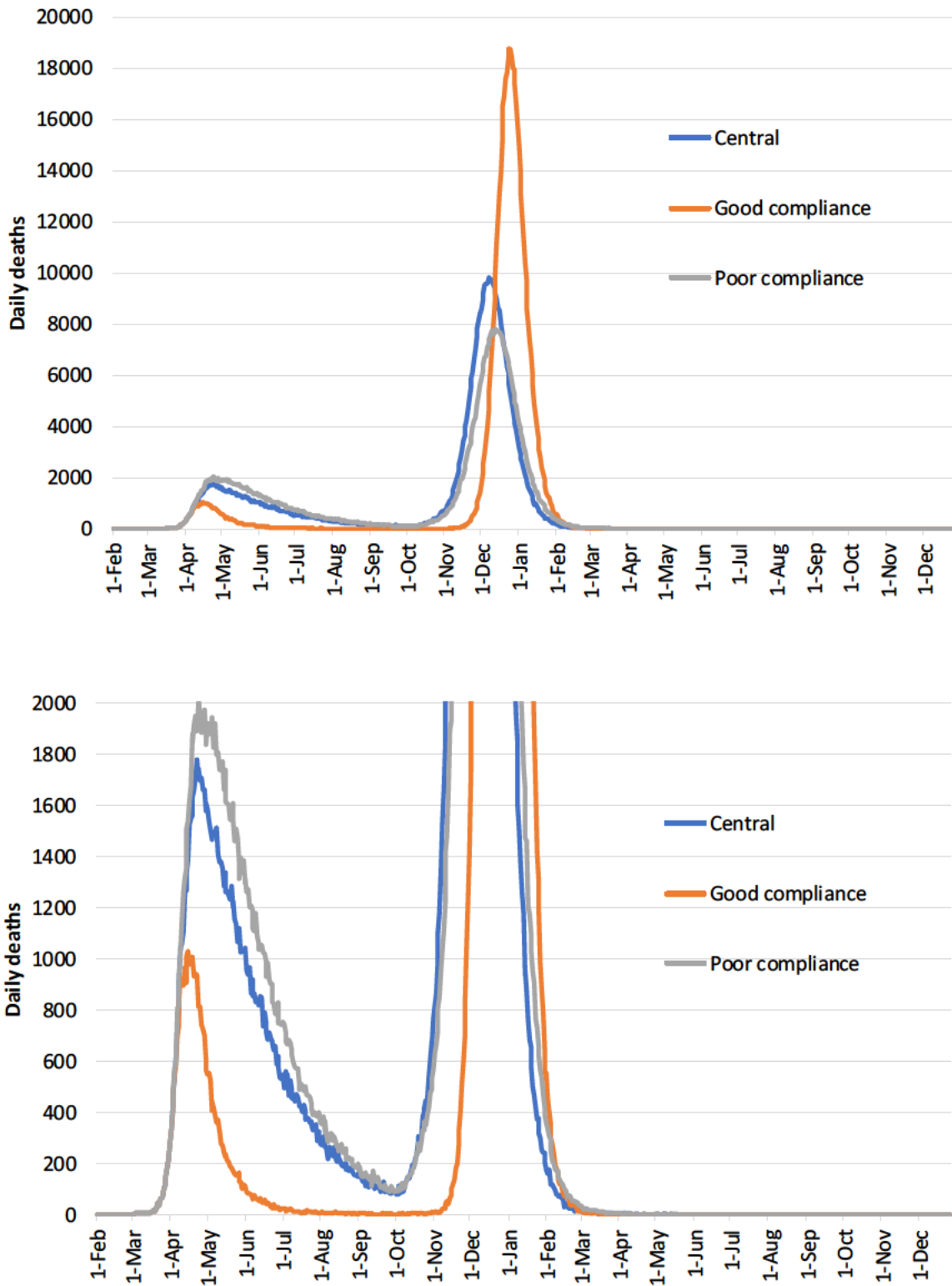**Figure 4: Daily deaths for R0=3.2 scenarios (lower panel zooms in on top panel)**

Figure 5: Cumulative proportion infected over time for R0=2.8 (top) and R0=3.2 (bottom)