

Private Consultations Excess Respiratory Encounters Report

Week 38 2020

Introduction

Worldwide, there have been significant challenges for accurately estimating coronavirus disease 2019 (COVID-19) cases and mortality. Assessing increases in syndromic activity through preexisting respiratory surveillance systems can provide broader insight concerning the impact of COVID-19, as well as inform public health decision-making and preparedness strategies. In this report, we use time series regression models, adjusted for influenza and respiratory syncytial virus (RSV) activity, to evaluate increases in respiratory outpatient consultations and hospital admissions relative to those expected in the absence of COVID-19. Measuring excess respiratory encounters can identify locations with heightened COVID-19 activity and vulnerable demographic groups.

Data Sources

Virologic Surveillance Data: We receive weekly counts of influenza positive samples and respiratory syncytial virus (RSV) positive samples from three syndromic respiratory illness surveillance programmes coordinated by the National Institute for Communicable Diseases (NICD): the Viral Watch Programme, the ILI Public Clinics Programme, and the Pneumonia Surveillance Programme. Viral Watch collects samples from a network of general practitioners, spread throughout eight of South Africa's nine provinces. Samples are collected from patients who present with acute respiratory illness, fever ($> 38^{\circ}\text{C}$), and cough. ILI Public Clinics systematically collects samples from patients at public hospitals and clinics in KwaZulu-Natal, Western Cape, and North-West provinces, using the same eligibility criteria as the Viral Watch programme. The Pneumonia Surveillance Programme collects samples from hospitalized patients with severe respiratory illness, at sites located in KwaZulu-Natal, Mpumalanga, North-West, Gauteng, and Western Cape provinces. Samples are tested at NICD for influenza, RSV, and, more recently, SARS-CoV-2.

Respiratory Medical Encounters Data: We receive inpatient and outpatient data on a weekly basis from a private hospital group and a network of general practitioners. Provinces with sufficient levels of reporting vary according to the type of consultation: inpatient (Eastern Cape, Free State, Gauteng, KwaZulu-Natal, Limpopo, North-West, Western Cape), outpatient-emergency department (Eastern Cape, Free State, Gauteng, KwaZulu-Natal, Limpopo, Western Cape), outpatient-general practitioner (Eastern Cape, Gauteng, KwaZulu-Natal, Northern Cape, Western Cape). Consultations were coded based on discharge diagnosis using the International Classification of Diseases and Related Health Problems, 10th revision (ICD-10). Respiratory hospital admissions and outpatient consultations are calculated as all cause respiratory-coded encounters (J00-J99), including confirmed and suspected COVID-19 encounters (U07.1, U07.2). Weekly data were aggregated by age group (<5 years, 5-19 years, 20-49 years, ≥ 50 years) and by province, with the <5 age group removed for all provincial analyses.

Methods

Adjusting for Reporting Delays: Depending on the province, the reporting delay for hospital admissions and outpatient consultations is typically 1-4 weeks. Thus, we used a Bayesian approach [1] to account for occurred-but-not-yet-reported all cause respiratory (J00-J99) and COVID-19 (U07) encounters from weekly data drawdowns. The reporting delay distribution was used to backfill age-specific and province-specific encounters, and these backfill-adjusted time series were used in subsequent time series regression models. Time series were estimated through the week of September 6, 2020 (the last week of data available).

Excess Respiratory Encounters: We conducted a counterfactual analysis, in which observed respiratory consultations were compared to the baseline number of consultations expected in the absence of COVID-19. Age groups and provinces were analyzed separately for each data source (inpatient, outpatient-emergency department, outpatient-general practitioner). We fit dynamic regression

models with ARIMA errors [2] to the weekly number of all cause respiratory consultations from the weeks of January 3, 2016 to February 23, 2020. Models were adjusted for seasonality and weekly influenza and RSV activity. The baseline number of respiratory consultations was projected for the weeks of March 1, 2020 to September 6, 2020 and compared to the observed number of all cause respiratory consultations (J00-J99), including confirmed and suspected COVID-19 (U07).

Interpretation of Data Presented

Inpatient (Figures 1-2)

In provinces with sufficient levels of reporting (Eastern Cape, Free State, Gauteng, KwaZulu-Natal, Limpopo, North-West, and Western Cape), respiratory hospital admissions in all ages combined increased throughout the lockdown period and reducing in recent weeks. Since the initiation of lockdown measures in late March, respiratory hospitalizations in young children (<5 years) have been substantially below those expected in the absence of COVID-19, likely due to diminished transmission of RSV, influenza, and other seasonal viruses. In contrast, admissions in older children (5-19 years) have gradually increased with the easing of lockdown measures, suggesting greater susceptibility to SARS-CoV-2 infection compared to younger children. Respiratory admissions for adult age groups (20-49 years, ≥ 50 years) have increased during the lockdown period and reached numbers several times higher than those observed in past influenza seasons during Alert Level 3. The risk of hospitalization for ICD coded COVID-19 increases with age, with older adults at the greatest risk for developing severe COVID-19 disease.

Outpatient - General Practitioner (Figures 3-4)

Outpatient respiratory consultations spiked in early March, consistent with “worried well” health-seeking behavior. General practitioner visits then declined sharply across South African provinces and age groups, reflecting the impact of the lockdown and potential increased usage of telemedicine. Respiratory consultations in adults (20-49 years, ≥ 50 years) and provinces with sufficient levels of reporting (Eastern Cape, Gauteng, KwaZulu-Natal, Northern Cape, Western Cape) increased during Alert Level 3 but remain below numbers projected in the absence of COVID-19.

Outpatient - Emergency department (Figures 5-6)

Outpatient emergency department consultations at private hospitals experienced a “worried well” spike in early March, though to a lesser degree than observed for general practitioner providers. Since the initiation of lockdown measures in late March, respiratory visits in children (<5 years, 5-19 years) are substantially below baseline numbers expected in the absence of COVID-19. In adults (20-49 years, ≥ 50 years), respiratory consultations increased after the transition to Alert Level 3 but have declined sharply in recent weeks. Respiratory consultations in Western Cape, Eastern Cape, Gauteng, and KwaZulu-Natal also increased during Level 3 but are beginning to decline.

References

1. McGough SF, Johansson MA, Lipsitch M, Menzies NA. 2020 Nowcasting by Bayesian Smoothing: A flexible, generalizable model for real-time epidemic tracking. *PLoS Comput. Biol.* , 663823. (doi:10.1101/663823)
2. Rob J. Hyndman, Yeasmin Khandakar. 2008 Automatic Time Series Forecasting: The forecast Package for R. *J. Stat. Softw.* **27**, 22.

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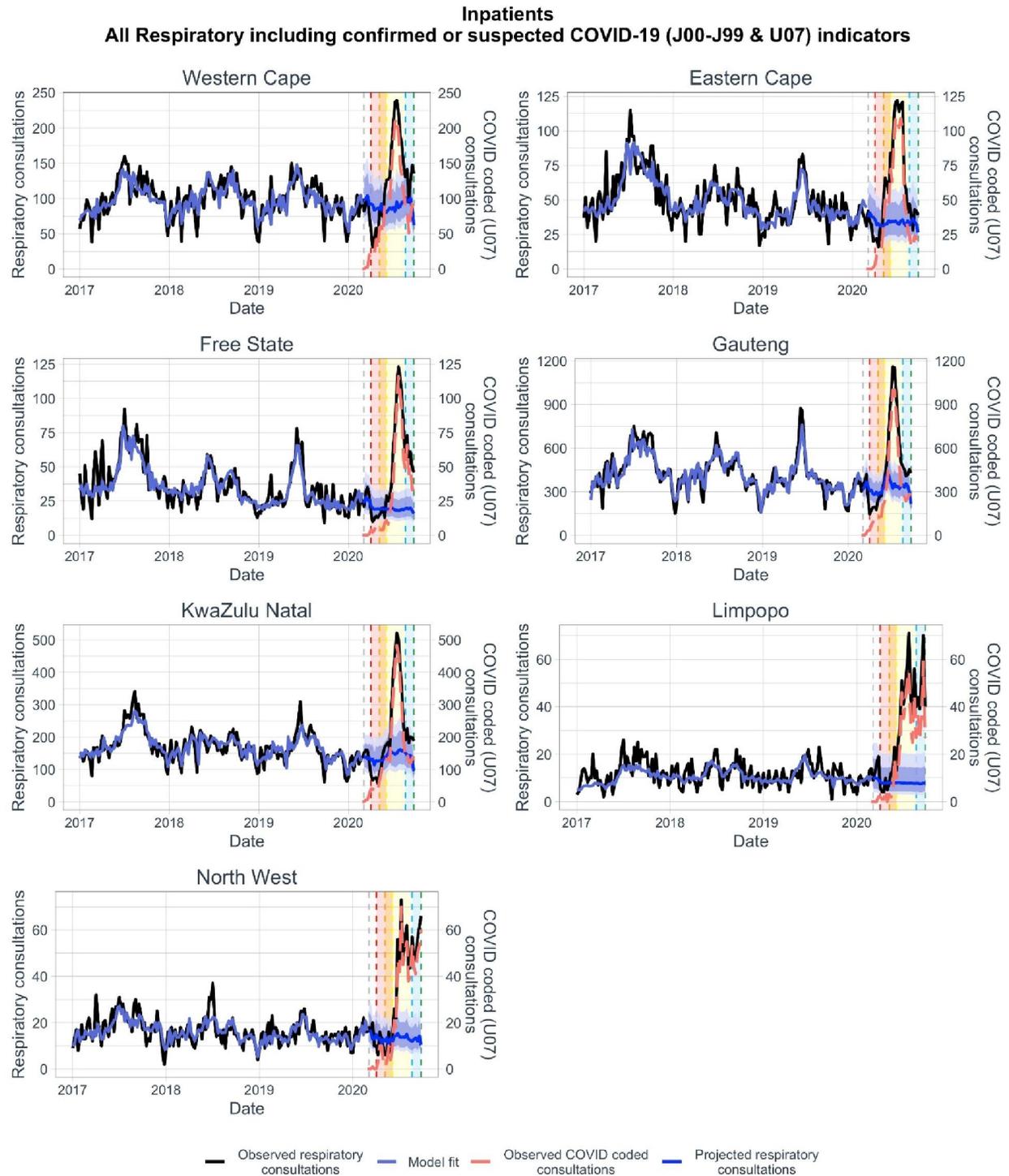


Figure 1. Weekly hospital admissions among individuals aged ≥ 5 years in seven provinces (black), relative to admissions expected in the absence of COVID-19 (blue band). The red line is the number of COVID-coded admissions (U07). The grey vertical dashed line indicates the start of the model prediction period (March 1, 2020 – September 6, 2020), and panel colors indicate lockdown alert levels (Level 5: red, Level 4: orange, Level 3: yellow, Level 2: blue). The left y-axis refers to all cause respiratory admissions (J00-J99 & U07), and the right y-axis refers to COVID-coded (U07) admissions.

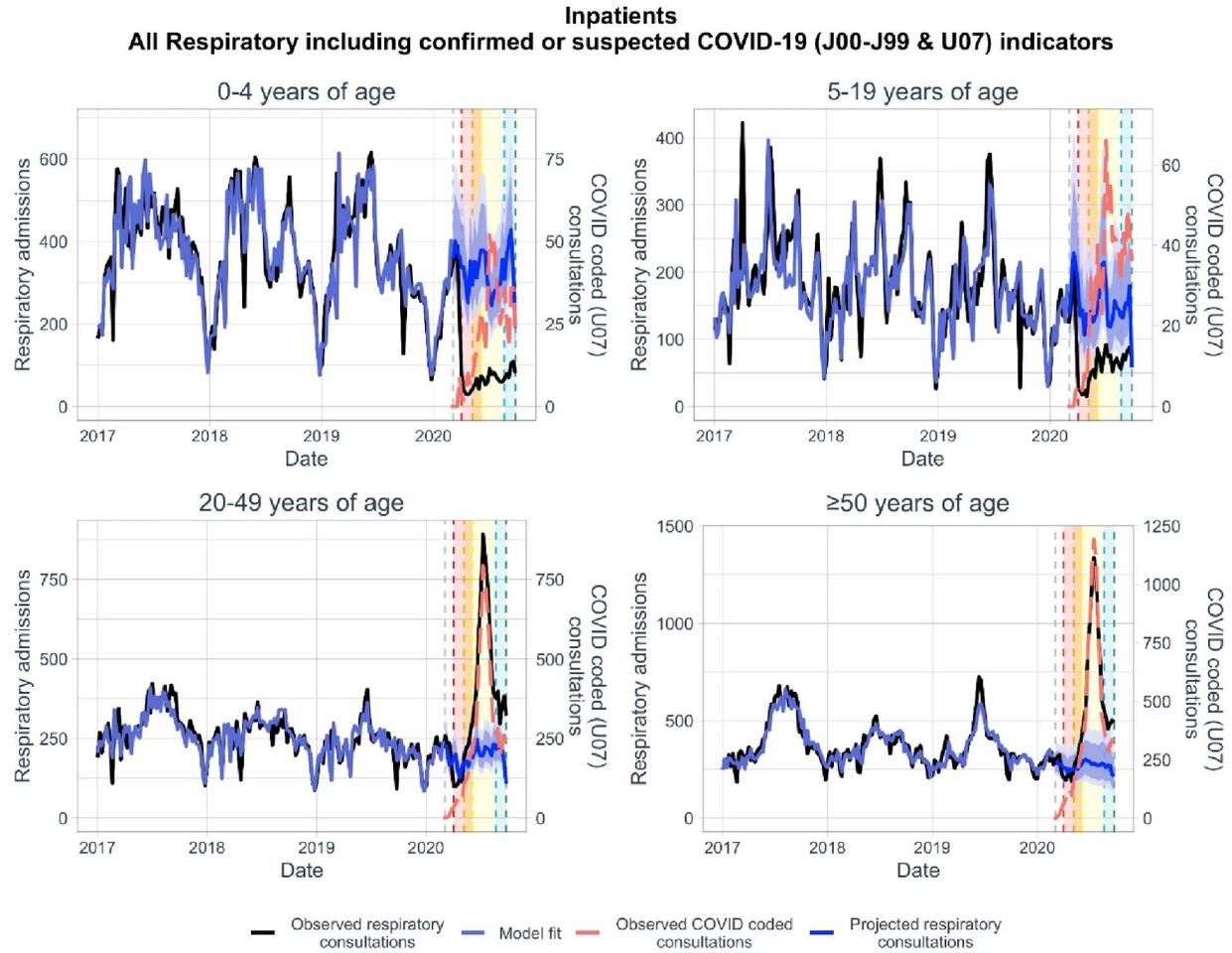


Figure 2. Weekly hospital admissions by age group (black), relative to admissions expected in the absence of COVID-19 (blue band). The red line is the number of COVID-coded admissions (U07). The grey vertical dashed line indicates the start of the model prediction period (March 1, 2020 – September 6, 2020), and panel colors indicate lockdown alert levels (Level 5: red, Level 4: orange, Level 3: yellow, Level 2: blue). The left y-axis refers to all cause respiratory admissions (J00-J99 & U07), and the right y-axis refers to COVID-coded (U07) admissions.

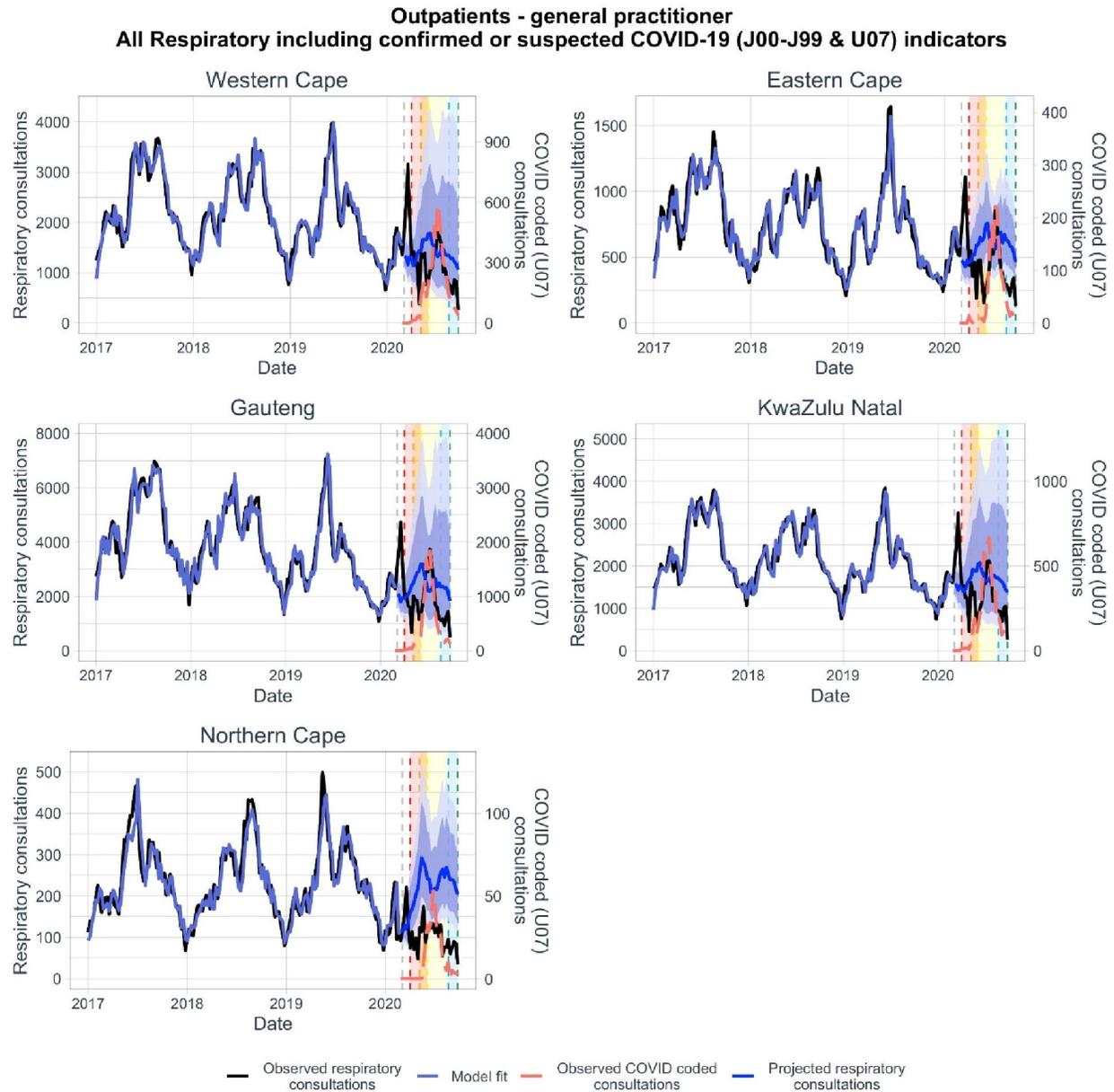


Figure 3. Weekly general practitioner consultations among individuals aged ≥ 5 years in five provinces (black), relative to consultations expected in the absence of COVID-19 (blue band). The red line is the number of COVID-coded consultations (U07). The grey vertical dashed line indicates the start of the model prediction period (March 1, 2020 – September 6, 2020), and panel colors indicate lockdown alert levels (Level 5: red, Level 4: orange, Level 3: yellow, Level 2: blue). The left y-axis refers to all cause respiratory consultations (J00-J99 & U07), and the right y-axis refers to COVID-coded (U07) consultations.

Outpatients - general practitioner
All Respiratory including confirmed or suspected COVID-19 (J00-J99 & U07) indicators

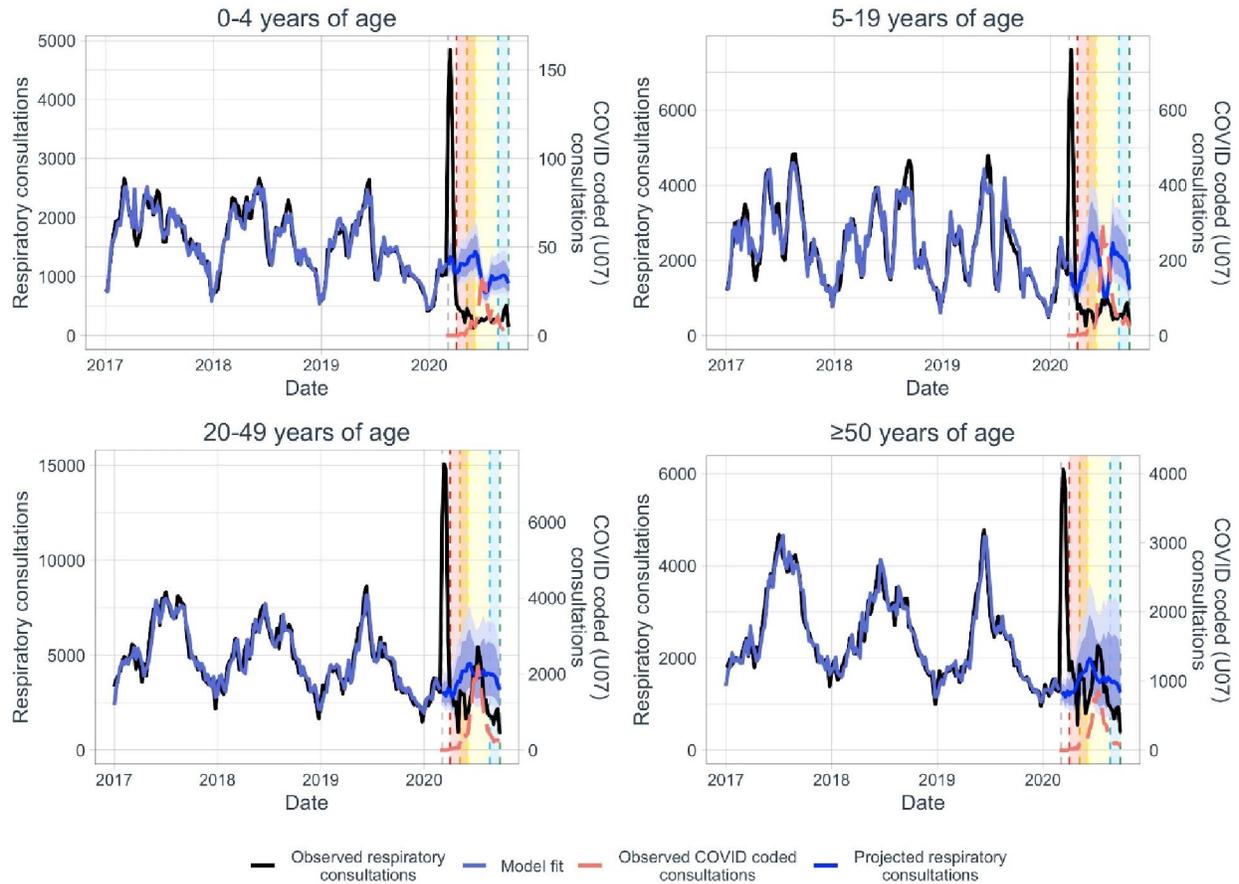


Figure 4. Weekly general practitioner consultations by age group (black), relative to consultations expected in the absence of COVID-19 (blue band). The red line is the number of COVID-coded consultations (U07). The grey vertical dashed line indicates the start of the model prediction period (March 1, 2020 – September 6, 2020), and panel colors indicate lockdown alert levels (Level 5: red, Level 4: orange, Level 3: yellow, Level 2: blue). The left y-axis refers to all cause respiratory consultations (J00-J99 & U07), and the right y-axis refers to COVID-coded (U07) consultations.

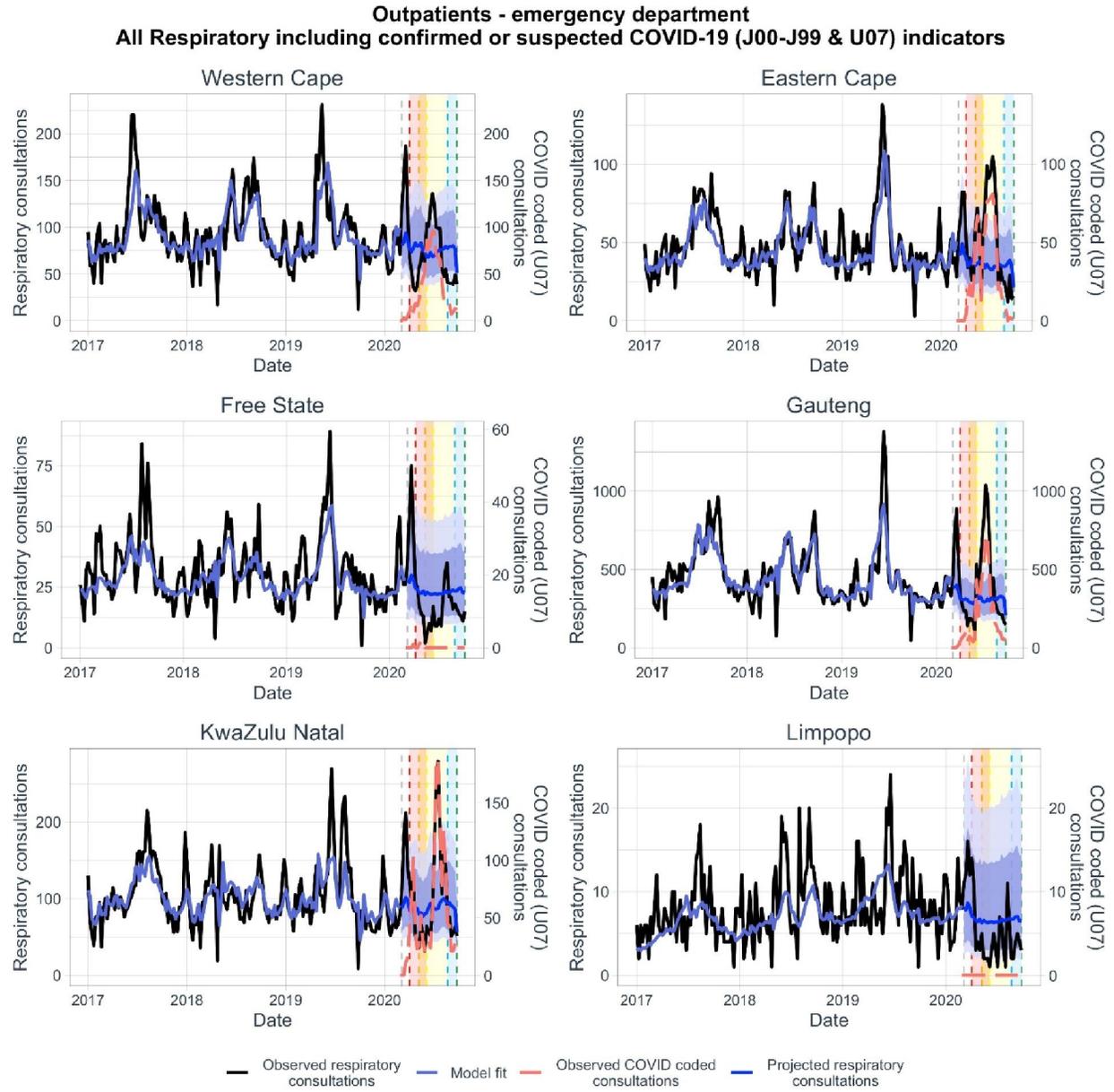


Figure 5. Weekly outpatient emergency department consultations among individuals aged ≥ 5 years in six provinces (black), relative to consultations expected in the absence of COVID-19 (blue band). The red line is the number of COVID-coded consultations (U07). The grey vertical dashed line indicates the start of the model prediction period (March 1, 2020 – September 6, 2020), and panel colors indicate lockdown alert levels (Level 5: red, Level 4: orange, Level 3: yellow, Level 2: blue). The left y-axis refers to all respiratory consultations (J00-J99 & U07), and the right y-axis refers to COVID-coded consultations alone (U07).

Outpatients - emergency department
All Respiratory including confirmed or suspected COVID-19 (J00-J99 & U07) indicators

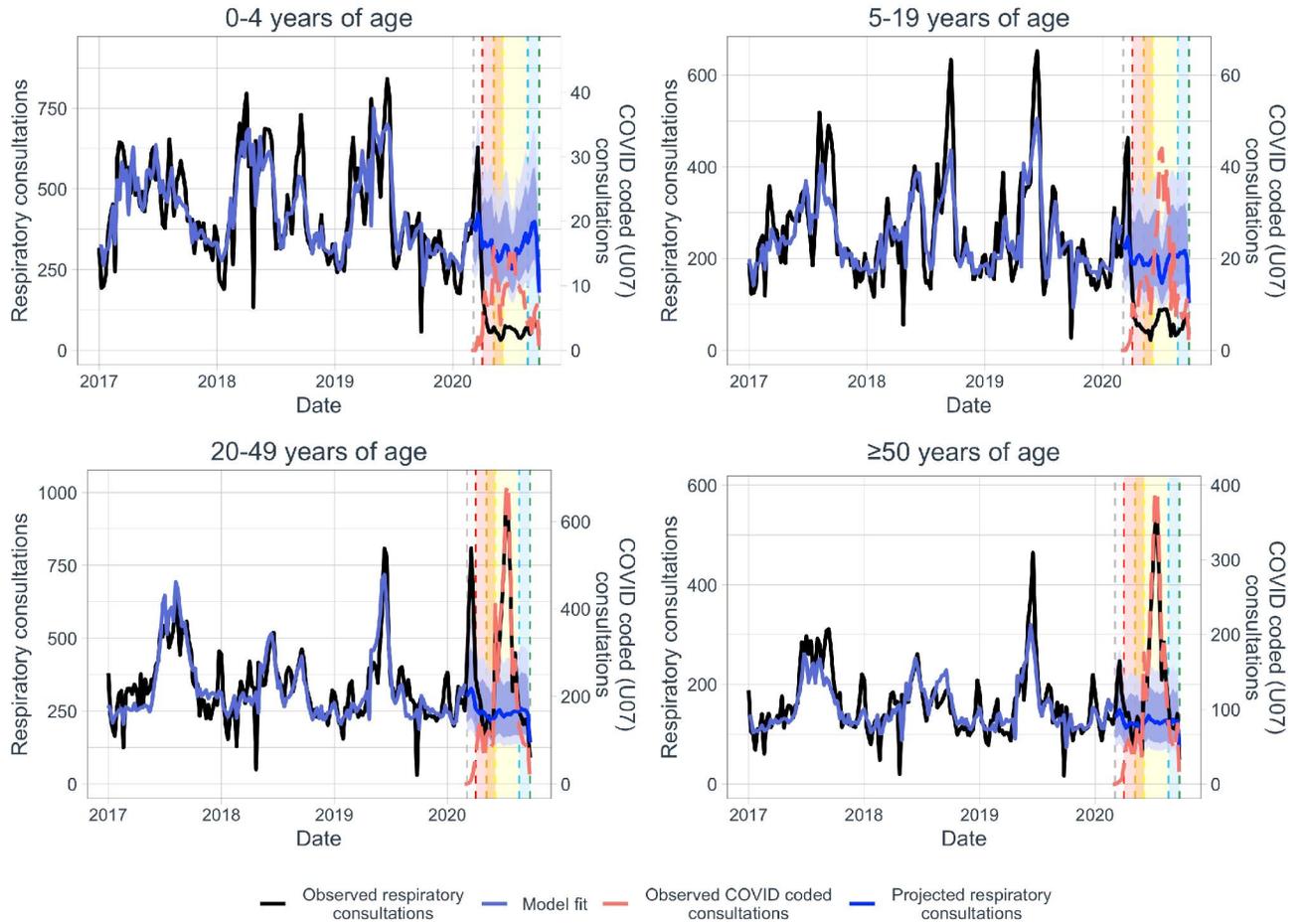


Figure 6. Weekly outpatient emergency department consultations by age group (black), relative to consultations expected in the absence of COVID-19 (blue band). The red line is the number of COVID-coded consultations (U07). The grey vertical dashed line indicates the start of the model prediction period (March 1, 2020 – September 6, 2020), and panel colors indicate lockdown alert levels (Level 5: red, Level 4: orange, Level 3: yellow, Level 2: blue). The left y-axis refers to all respiratory consultations (J00-J99 & U07), and the right y-axis refers to COVID-coded consultations alone (U07).