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The Difference is Research

## Introduction

- Australasia has one of the highest prevalence of amphetamine-type stimulant (ATS) use. Australia's ATS market has been dominated by methamphetamine since the 1990s.
- Given the timely availability of data on wastewater load of drugs, wastewater data may serve as a predictor of emerging trends in methamphetamine-related harms.

## Aim

To determine whether the trend in methamphetamine load in wastewater can predict trends in methamphetamine-related hospitalisations and deaths.

## Methods

**Scope:** August 2016 – March 2023 in Australia (excluding Tasmania and Northern Territory)

### Data sources

- Methamphetamine load in wastewater:** National Drug Wastewater Drug Monitoring Program
- ATS-related hospitalisations:** hospitalisations identified by the ICD-10-AM codes for ATS in the first 20 diagnoses in the National Hospital Morbidity Database (NHMD)
- ATS-induced deaths:** deaths identified by the presence of any ICD-10 codes related to drugs in the underlying cause of death and to ATS in the multiple causes of death in the Cause of Death Unit Record File (CODURF)

### Analysis approach

**Outcome:** Rate of ATS-related hospitalisations & ATS-induced deaths per 100,000 person years at 4-monthly intervals starting in April, August & December of each year

**Statistical analysis:** ARIMA modelling on number of ATS-related hospitalisations & ATS-induced deaths to March 2022 with forecasting to March 2023

Two models were fitted:

- Wastewater model** – model with wastewater load of methamphetamine as a predictor
- Base model** – model with no predictors

### Evaluation of the wastewater model against the base model using:

- corrected Akaike's information criterion (AICc) as measure of model fit with smaller AICc indicating a better fit
- predicted rate with 95% prediction interval against the observed rate in April 2022 to March 2023
- time series plots of predicted rates with 80% and 95% prediction intervals against the observed rates

## Results

- The wastewater model had a better fit to the observed data than the corresponding base model (e.g., AICc=272.3 versus 295.4 for hospitalisations in Table 1; see also Figures 1 and 2).
- The forecasting accuracy at 4-monthly intervals were similar between corresponding wastewater and base models.
- Caution is needed in the usage of the predicted rates as the observed rates were outside of the 95% prediction intervals.

## Implications

- Forecasting accuracy was similar between the wastewater and base model in the current study, meaning that wastewater data did not improve the ability of the model to predict trends in deaths and hospitalisations. However, further work should be undertaken to investigate its utility for other drugs and when major changes in trend occurs, e.g. major drug market disruptions.
- Wastewater load of methamphetamine can improve the statistical modelling of time series data on ATS-related hospitalisations and deaths. Models incorporating lags can be investigated using longer or more frequent time series data.

Figure 1: Rate of ATS-related hospitalisations in the wastewater model (top) and the base model (bottom)

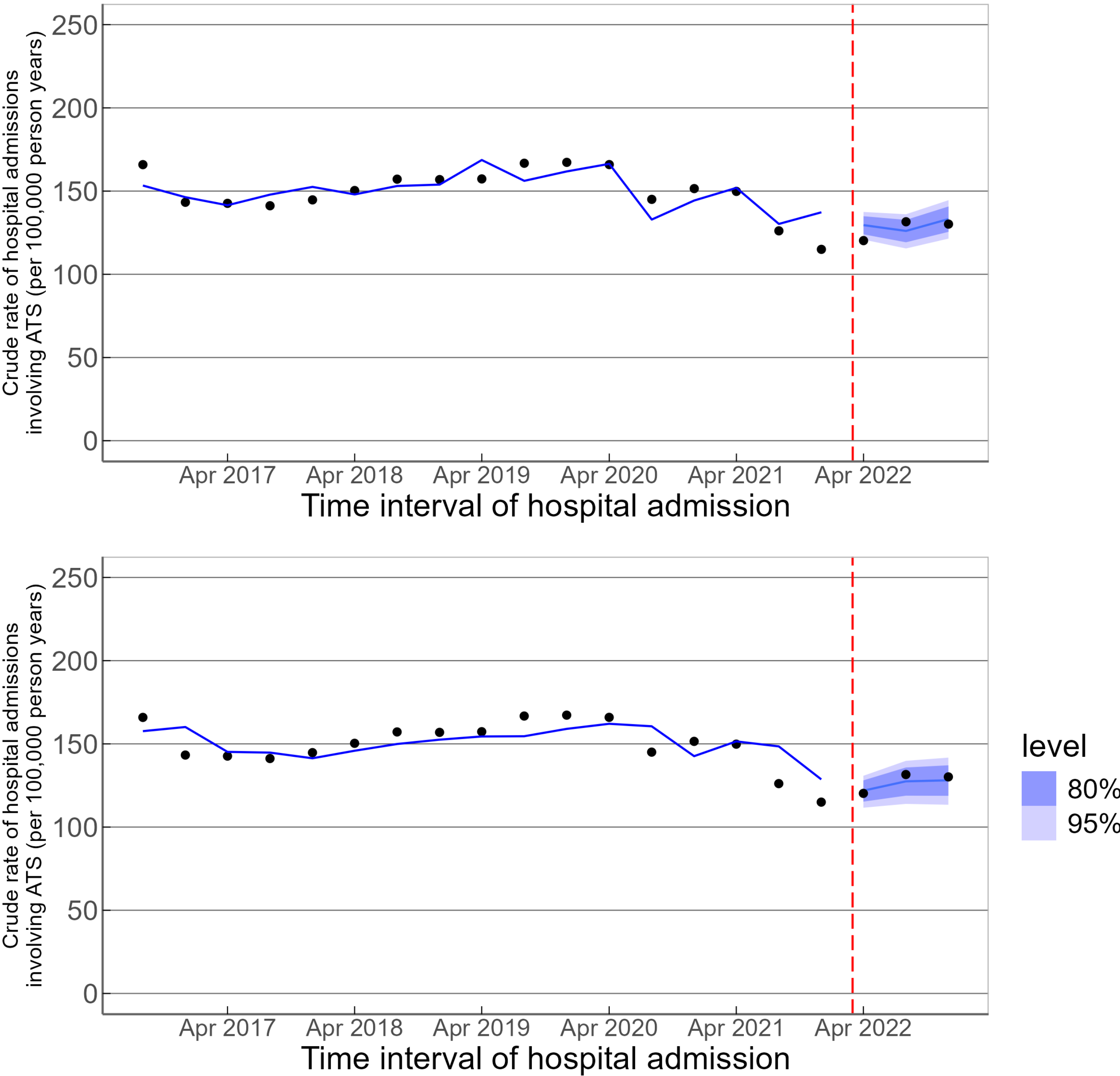
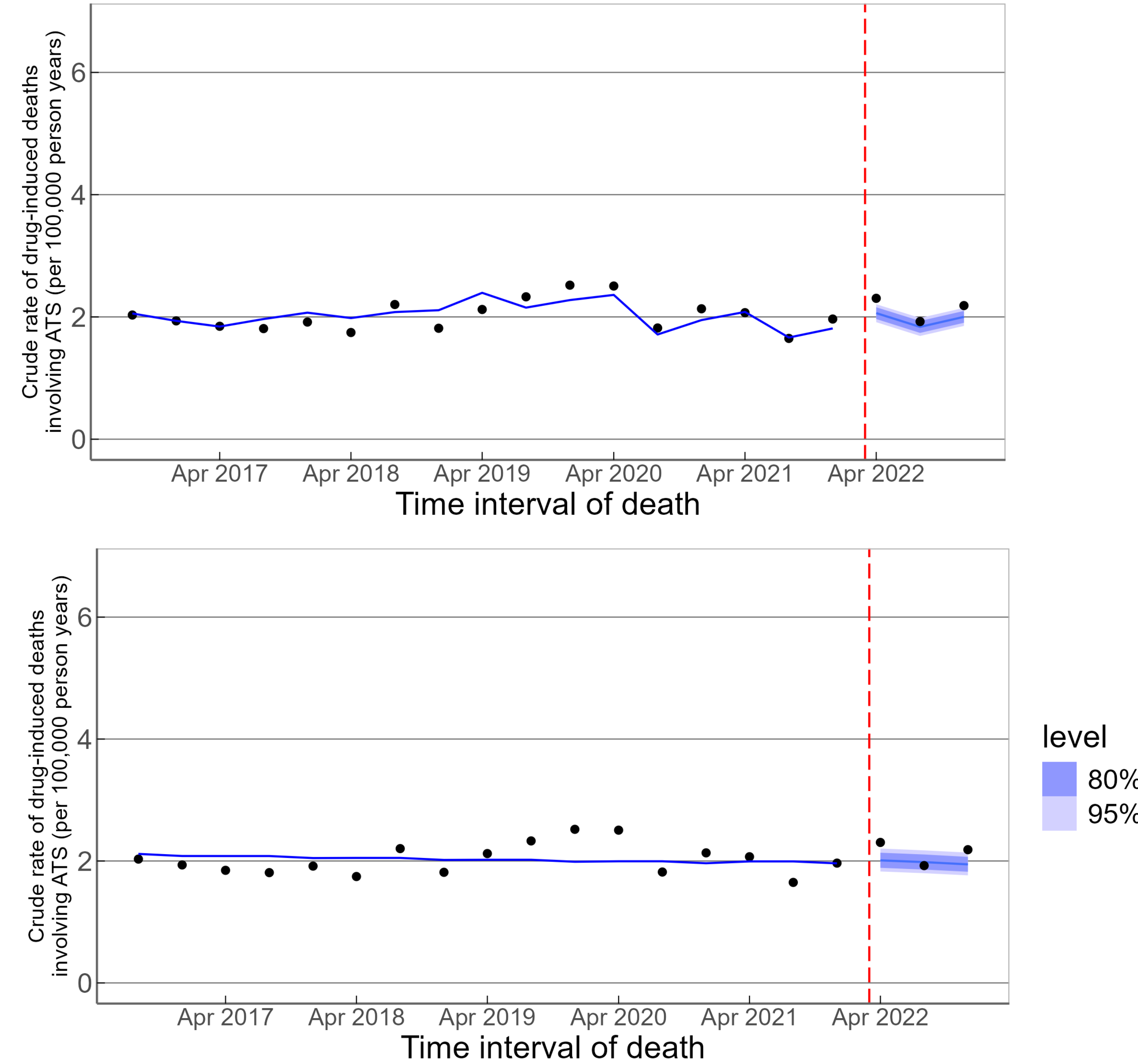


Figure 2: Rate of ATS-induced deaths in the wastewater model (top) and the base model (bottom)



Note: The black dots are the observed rates. The blue line (or dot) and shaded area show the estimated rate and its prediction intervals, respectively. The red dashed line indicate the start of where the observed data were withheld to test the prediction accuracy of the model between April 2022 and March 2023.

Table 1: Model fit, and predicted (95% prediction interval) and observed rates in April 2022 to March 2023

Model	Model fit: AICc	Rate (per 100,000 person years) in Apr 2022-Mar 2023	
		Predicted (95% PI)	Observed
ATS-related hospitalisations			
Wastewater	279.8	129.6 (121.5, 137.5)	128.4
Base	285.4	125.8 (115.0, 135.8)	
ATS-induced deaths			
Wastewater	144.7	1.9 (1.8, 2.1)	2.2
Base	157.5	2.0 (1.8, 2.1)	

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