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Appendix

This appendix was part of the submitted manuscript and has been peer reviewed.
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Appendix to: Lai FY, O'Brien J, Thai PK, et al. Trends in methamphetamine residues in wastewater in metropolitan and regional cites in south-east Queensland, 2009–2015. *Med J Aust* 2016; 204: 151-152. doi: 10.5694/mja15.01054.

Technical appendix

Methods

Wastewater sampling

Wastewater sampling was performed at the major wastewater treatment plants (WWTP) of each of the two locations in South East Queensland, Australia. The sampling campaigns were conducted over seven years with a total of 498 and 712 samples collected and analysed for the urban and regional area, respectively. In the urban area we collected daily composite samples as follows: Nov 2009 (12 days), Nov–Dec 2010 (21 days), Jan–Dec 2011 (160 days), Jan–Dec 2012 (188 days), Jan–Dec 2013 (61 days), Jan–Dec 2014 (49 days) and Mar 2015 (7 days). In the regional area we collected daily composite samples as follows: Aug–Dec 2010 (34 days), Jan–Dec 2011 (84 days), Jan–Dec 2012 (243 days), Jan–Dec 2013 (273 days), Jan–Dec 2014 (51 days) and Jan–May 2015 (27 days).

Daily composite samples were collected using best practice sampling techniques.[1] The sampling system was installed at the inlet of a WWTP. For the urban catchment, a continuous flow proportional sampling mode was used to collect the samples between November 2009 and October 2012. After November 2012 sampling was scaled down to once a week on Tuesday or Wednesday due to limited access to the treatment plant. In this period, daily composite samples were taken using a time-proportional sampling technique with a sampling frequency of 100 ml/15 min. For the regional area, volume-proportional sampling mode was used to collect a sub-sample at 100 m^3 intervals. At both sites, sample collection (over 24 hours) was conducted under refrigeration. To keep the target chemicals stable in wastewater, samples were acidified to pH 2 onsite and frozen until analysis. Data on daily wastewater volumes were recorded by the WWTP operators. We obtained catchment map boundaries from the WWTP operators and gave them to Australian Bureau of Statistics personnel to calculate the population for each catchment.

Analytical measurement

The analytical method applied in this study has been validated and previously published.[2, 3] Briefly, filtered wastewater samples (1 mL) were spiked with mass-labelled internal standards and then analysed without an extraction process. All samples were analysed together with calibration standards by high-performance liquid chromatography (Shimadzu Nexera UHPLC system) coupled to a triple quadrupole tandem mass spectrometer (AB SCIEX QTRAP®5500). Residues of the parent drug methamphetamine were measured.

Back calculation of illicit drug consumption

We applied the back-calculation method for estimating illicit drug consumption (mg/day/1000 people) previously reported in the literature.[4] This used the following formula:

$$\frac{Drug\ residue\ concentration\ \left(\frac{ng}{L}\right) \times Waterwater\ flow\ rate\ \left(\frac{L}{day}\right) \times Correction\ factor}{Estimated\ number\ of\ people\ in\ a\ given\ area}$$

Briefly, the drug residue concentration (ng/L) measured was multiplied by the total daily wastewater volume (L/day) to produce an estimated amount (mg/day) of the drug residue. This estimate was then corrected using the excretion factor and normalised to the catchment area population to estimate the consumption level (usually in mg/day/1000 people). A correction factor, that relates to average excretion rate of a given drug residue and the molecular mass ratio of a parent drug to its metabolite, was calculated based on published values. A correction factor of 2.6 was used to back estimate methamphetamine consumption from methamphetamine residues. This correction factor has been applied in our previous studies (e.g.[2, 3, 5]). The estimated number of people in the catchment area was based on the latest census data.

References

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