

The challenges of performing large-scale multi-city wastewater-based epidemiology studies

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Wastewater-based epidemiology (WBE) has matured to a stage where large-scale temporal and spatial multi-city studies are being performed in Europe and Australia resulting in the collection and analysis of wastewater samples from numerous states and countries. For example, SCORE has since 2011 conducted annual week-long monitoring studies, with the number of participating cities growing from 19 in 2011 to more than 70 in 2016. Australia has commenced in 2016 the National Wastewater Drug Monitoring Programme, including 50 sites across all states and territories capturing approximately 58% of the population (14 million people). The quality of analyses is assessed through the SCORE interlaboratory study, however this is just one aspect of the WBE workflow. Being able to readily collect and analyze wastewater samples is key to bringing wastewater testing as near as possible to routine work. This requires a good relationship with wastewater treatment plants (WWTPs). Local jurisdictions or private companies often run WWTPs, and as such, certain approvals or confidentiality agreements may need to be in place before sampling can occur. An understanding of, and sensitivity to, the concerns of local authorities and WWTP owners is often necessary with solutions such as the de-identification of data sometime necessary. A good working relationship with WWTP personnel is also necessary for the collection of high quality samples and the associated data regarding the sample collection environment (such as flow data and catchment maps for obtaining population estimates). In some cases, lab personnel set up the sampling equipment and then train WWTP staff to operate it. Alternatively training and access is provided so that lab personnel may collect samples. In certain cases WWTP staff may not be willing to conduct random stratified sampling, for example, which is more difficult to plan for than collecting samples over consecutive days.

Another aspect that cannot be overlooked when conducting large-scale wastewater sampling is appropriate handling of both samples and data. Successfully shipping the samples to a lab for analysis often depends on courier companies. To ensure that samples arrive on time and in an acceptable state (ideally frozen), it is worth choosing a reputable, trustworthy courier. Furthermore, the volume of sample required, which depends on the difficulty of detecting a particular biomarker, can vary from several microliters to one liter, and as such, appropriate freezer space must be available at the analytical labs. Finally, to be able to re-analyze samples for future purposes, careful archiving of instrument data and aliquots of the original samples or sample extracts may be necessary. If archiving is not possible at a particular lab, collaboration with other labs may be required. For this reason, data management should be centralized between collaborators, with staff adequately trained in uploading quality data in a consistent format, and with dedicated staff to check data for inconsistencies.

The media has been extremely interested in the findings of wastewater analyses as well as certain proposed applications of the approach (e.g. work places and prisons). This has sometimes been to the benefit, and at

others to the detriment, of the development of WBE and an acceptance of its potential. In some respects, WBE may also be a victim of its own success in certain quarters, with journalists, politicians and policy makers keen to apply, (mis)interpret and use the data in ways that go beyond that perceived as beneficial and possibly leading to some of the stigmatisation concerns that we have been careful to avoid and originally identified in the ethical guideline developed by Pritchard and colleagues (<http://score-cost.eu/ethical-guidelines-for-wbe/>). The purpose of this presentation is to share the combined experience of running large wastewater-based monitoring studies and the foreseen and unforeseen operational challenges faced.

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