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Future perspectives for wastewater-based epidemiology: Testing urban water for community-wide public health assessment

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Over the last decade, wastewater-based epidemiology (WBE) has grown as a solid methodology to monitor and back-estimate illicit drug use in a population. The potential of using WBE to assess other population indicators of lifestyle-related health risks has been discussed in the literature. Very promising results have been obtained, which support the potential of this approach to obtain valuable information about hidden or hardly measurable phenomena. Yet, the information from wastewater that can be gathered is not limited to illicit drugs. If seen as a pooled sample of human excretion (mainly urine and faeces), wastewater potentially bears valuable information relevant to the population's lifestyle and health. Numerous urinary biomarkers have been reported in the literature as potential indicators for diagnosis and prognosis of diseases. If present and stable in wastewater, these biomarkers could potentially be used to obtain valuable information about the health status of large populations.
With regard to the potential of this approach, we need to i) identify biomarkers specific to various diseases, such as diabetes, cancer, stress, etc, which could potentially be analysed in wastewater; ii) develop reliable and robust analytical methods; iii) monitor the occurrence of the selected biomarkers at different time points and sampling locations and iv) evaluate the findings in perspective of relevant epidemiological data, providing an innovative strategy to monitor and assess public health directly at population level.
Only a limited amount of research has been done in this area, with the most notable findings related to the investigation of the cumulative oxidative stress biomarker 8-iso-prostaglandin F2α by LC-MS/MS and measurement of DNA by amperometric sensors. Yet, there are numerous other promising biomarkers which could provide useful information about the health status of the population, such as tobacco specific nitrosamines or markers of alcohol-induced liver disease to name just a few.
Using this approach, disease prevalence could thus be noninvasively monitored over longer periods of time and at different spatial resolutions (local and (inter)national), potentially allowing to setup early-warning systems. Moreover, it could be used to evaluate public health policies and prevention campaigns.