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Measurement uncertainty estimation based on multiple regression analysis (MRA) and Monte Carlo (MC) simulations – Application to agar diffusion method

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ABSTRACT

The agar diffusion method is well known in the scientific literature, but it presents as a disadvantage the high variability. Despite of this, as far as we know, the main sources of uncertainty associated with inhibition zone sizes have not been studied previously. The aim of this work was to evaluate the main sources of uncertainty related to the formation of inhibition zone size. Using four cephalosporins antibiotics (cefazolin, cefuroxime, ceftriaxone and cefepime), multiple regression analyses (MRA) were performed by varying the components of the MHA culture medium, proportion of the inoculum and preincubation time for different antibiotic concentrations. It was possible to obtain a mathematical model for each cephalosporins. In addition, Monte Carlo simulations estimated that the proportion of the inoculum was the source that most contributed to the final uncertainty (67.8%-80.4%). Therefore, it is important to have a strict control of this parameter, in order to allow the uncertainty to assume low values, and with this guarantee the quality, safety and efficacy of antibiotics.

A Keywords: Measurement uncertainty, multiple regression analysis (MRA), Monte Carlo simulations, agar diffusion method.

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