An Economic Analysis of Salmonella Detection in Fresh Produce, Poultry, and Eggs Using Whole Genome Sequencing Technology in Canada

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Foodborne illnesses cause a significant socio-economic burden worldwide. Nontyphoidal Salmonella is one of the major foodborne disease agents in Canada. To date, there is hardly any research on the cost and benefits of Whole Genome Sequencing (WGS) compared to the traditional technology (PFGE) for the detection of Salmonella from specific food products and the macroeconomic impact of the improved technology in outbreak detection. The current study is an attempt to make a contribution in this direction. The study estimates the annual costs of Salmonella from fresh produce, poultry and eggs in Canada and the economic benefits from the introduction of WGS in the detection of Salmonella clusters and outbreaks. The results from the cost-benefit analysis (microeconomic analysis) are then used to measure the impact on macroeconomic variables like industrial output, gross domestic product (GDP) and employment. Cost-of-illness and Health Adjusted Quality Life Years are used to estimate the monetary and non-monetary costs of Salmonella respectively. Probability models are used to account for uncertainty in the cost-of-illness estimates. The input-output framework is used to measure the macroeconomic impact. The macroeconomic impact is based on Canadian Supply-Use tables have been . To account for uncertainty of the net benefits from WGS three scenarios have been estimated based on the reduction in total illnesses and reduction in reported and unreported cases. Further, to estimate the macroeconomic impact of changes in the economy due to the introduction of advanced WGS. Four scenarios are exercised using the input output framework: i) productivity improvement, ii) decrease in direct healthcare cost, iii) decrease in federal cost and iv) total net benefits from WGS. The estimated number of Salmonellosis cases are 47,082 annually, which represents a cost of $287.78 million from the traditional method- PFGE. The non-monetary estimates from PFGE are 529.20 years (Disability Adjusted Life Years) and 289.90 years (Quality Adjusted Life Years), annually. The total net benefits from the introduction of WGS ranges from $64.98-$90.25 million for total cases of illnesses (in 2013 CAD) and $5.21 million for reported cases of illnesses. These net benefits are then used to measure the macroeconomic impacts of WGS. Positive net benefits from WGS, for total cases of illnesses, lead to increased industrial output (ranging from $1.16-$26.73 million), GDP ($126.46-$390.32 thousand) and employment generation (58-132). Overall, WGS will help in reducing the economic burden from Salmonella. In this regard, the study has offered some potential policies implications. The monetary savings from the reduction in direct health care cost and laboratory costs due to WGS can be invested in further research and development. A proper intervention of federal and provincial government is required, however. Finally, a holistic approach is essential for food safety which will improve the benefits from WGS in outbreak containment.