Development and External Validation of a Logistic Regression Derived Algorithm to Estimate a Twelve-Month Open Defecation-Free Status

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1 TARGET AUDIENCE

This paper aimed at all development actors working in, for and with rural communities. It is particularly beneficial to rural households, community-led total sanitation (CLTS) volunteers, toilet masons, traditional leaders, rural water sanitation & hygiene (WASH) practitioners, local and national government officers and national & international non-governmental organisations (NGOs).

2 BACKGROUND

In Zambia, a chiefdom is declared open-defecation free (ODF)when all its households in all villages have an "adequate" toilet. An adequate toilet is one that satisfies the following requirements: 1) contains a smooth cleanable floor, 2) has a superstructure that provides privacy, 3) includes a handwashing station with soap and, 4) has a lid or vent valve to prevent flies. A household toilet that includes all four requirements is considered "adequate". If not every village in the chiefdom contains adequate toilets, the chiefdom is denoted with an open defecation (OD) status. Maintaining the ODF status in chiefdoms post verification and certification, however, has become increasingly challenging.
To maintain the ODF status, a chiefdom must adopt appropriate interventions that focus on the four adequacy parameters. However, in the absence of cost-effective systematic approaches, the process of identifying the villages in a chiefdom at most risk of not maintaining adequate toilets—reverting back to an OD status—can be costly to both chiefdoms and the Government of Zambia.

3 PURPOSE

After attaining ODF status, utilising non-systematic follow-up interventions in villages can be costly and unsustainable. This paper aims to develop a simple systematic tool to identify villages at high risk of losing ODF status. Equipped with this information, decision-makers can more wisely prioritise and allocate scarce human, financial, logistical and other associated resources for ODF sustainability interventions.

4 METHOD

The study developed a systematic approach to predict when and how an ODF chiefdom in Zambia will revert back to open defecation. The study followed household data collected from 67 villages in the North Zambian Chungu chiefdom, for a period of 12 months. The study used a WASH reporting tool with real time data entered at village-level by community volunteers. The study saw limitations in data capture and reporting, with some of the consulting data set reported as missing. It was assumed that data missingness was a random phenomenon. However, a small fraction of villages had missing data associated to specific variables. Only villages with complete data sets were analysed; a complete case analysis approach was used.

To test whether or not the systematic approach developed could be transferred between chiefdoms, 200 computer-generated samples of fictional chiefdoms (test cases) were created using the Chungu chiefdom data set. This testing of the test cases was conducted using the Harrell method that allowed for improvement of the developed approach.

The improved systematic approach was further tested for its power to predict the transition of a chiefdom from ODF to OD status, using data from a different the Chabula chiefdom of the Northern province.

5 RESULTS

The systematic approach developed showed that a chiefdom can revert from an ODF status back to an OD status with time and with increases in the village population. Furthermore, a chiefdom is more likely to revert to an OD status if there is a higher number of toilets built as a result of community-led total sanitation (CLTS) projects compared to those built prior to any CLTS intervention.

For a model to be acceptable, it must be able to correctly predict the loss of ODF status based on measurable parameters. In addition, it must also correctly distinguish between a successfully maintained ODF status and an ODF reversion to an OD status. The model developed successfully accomplished both criteria.

6 IMPLICATIONS FOR TARGET AUDIENCE

The systematic approach developed in this study uses parameters that are easily accessible to the chiefdom and the Zambian Government, using the community led total sanitation (CLTS) reporting protocol utilised in Zambia. However, cultural, social cohesion, geographical and socio-economic factors were only sparingly considered in this study. Furthermore, the scientific approach applied in the model development phase excluded factors that were not significantly related to ODF status loss. These factors, however, may be of importance to decision-makers and as a consequence may limit the overall outputs of the model. As a consequence of these and other limitations, the results of the study should be applied with caution. In addition, if the results are to be applied in other contexts outside Zambia, uniformity in the definition of the ODF status must be assessed.