

# Development and external validation of a logistic regression derived algorithm to estimate a 12-month open defecation free slippage risk

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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 leadership, rural water sanitation & hygiene (WASH) practitioners, local and national government officers and national & international nongovernmental organizations (NGOs).

## 2 BACKGROUND

A chiefdom sustaining an open defecation free (ODF) status after verification and certification has increasingly become challenging. In Zambia, a chiefdom is declared as ODF when all its households in all villages have a toilet which has a (1) smooth cleanable floor (2) superstructure which provides privacy (3) handwashing station with soap and (4) lid or vent valve to prevent flies. A household toilet with all the four parameters is considered adequate.

To maintain the ODF status of a Chiefdom, appropriate interventions focusing on the four toilet adequate parameters are necessary. However, in the absence of cost-effective systematic approaches, the process of identifying villages in a chiefdom with households at high risk of losing any of the four adequacy parameters and reverting back to open defecation (OD) can be very costly to both chiefdoms and the government.

## 3 PURPOSE

After attaining ODF status, follow-up interventions which are not systematic can be costly and unsustainable. This paper aims to develop a simple systematic tool to identify villages at high risk of ODF slippage. 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 OD. To develop this systematic approach, the study followed-up on household data from 67 villages in the Chungu chiefdom for a period of 12 months. Chungu chiefdom is one of the ODF Chiefdoms in Northern Zambia. The study used a WASH reporting tool which has real time data entered at village level by community volunteers. However, there

are limitations regarding data capturing and reporting and consequently, the consulted data set had some data missing. It was assumed that data was missing completely at random. Only villages with complete data were analysed. However, a small fraction of villages had missing data associated to variables, which was similarly removed. A complete case analysis approach was used.

To test whether or not the systematic approach developed could be transferred from one chiefdom to another in Zambia, 200 computer generated samples of fictional chiefdoms were created using the Chungu Chiefdom data set. This enabled testing and improving the approach developed in 200 chiefdom-like samples using a highly recommended prediction testing procedure, the Harrell method. The improved systematic approach was further tested for its power to predict the transition of a chiefdom from ODF to OD using data from an entirely different chiefdom; Chungu chiefdom of the Northern province.

## **5 RESULTS**

The systematic approach developed showed that a Chiefdom can easily revert to OD with time (increasing number of months passing after ODF) and with increases in the village population. Furthermore, a chiefdom is more likely to revert to OD if there is a higher number of toilets built as a result of CLTS compared to those built prior to any CLTS intervention. In addition, results showed reductions in the likelihood of a chiefdom reverting to OD associated with the presence of a handwashing with soap facility.

For a model to be acceptable, it must be able to correctly predict ODF slippage using its prediction variables. In addition, it must also distinguish correctly between ODF and OD slippage. The model developed exhibited the two standards satisfyingly.

## **6 IMPLICATIONS FOR TARGET AUDIENCE**

The simple systematic approach developed uses parameters that are easily accessible to the chiefdom and the government using the community led total sanitation (CLTS) reporting protocol in Zambia. However, culture, social cohesion, geography and socio-economic factors were sparingly considered in the study. Furthermore, the exclusion criteria for the scientific approach applied, removed from the model development, factors that were not significantly related to ODF slippage. These factors however, might be of importance to decision-makers. 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 setups other than Zambia, uniformity in ODF definitions must be assessed.