Validation of a probabilistic modeling approach to assess mortality in children under five in Bangladesh

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BACKGROUND

Every day in Bangladesh, children under 5 pass away without the cause being reported; this information could be used to prevent premature death. In order to assess the causes of death (COD) in children under 5 in Bangladesh verbal autopsies (VA) were conducted as part of an evaluation of the national water, sanitation, and hygiene program (SHEWA-B). The International Center for Diarrheal Disease Research, Bangladesh (ICDDR,B) conducted the Health Impact Study (HIS) to in part determine the impact SHEWA-B has made on hygiene, sanitation and water related behavior and subsequently child mortality. The VA used to obtain child mortality data are standard questionnaires given to family members of the deceased in order to obtain sign/symptoms relating to the death. Physicians must be staffed in order to extract causes of death based on the VA via their clinical expertise; however this is a time consuming and expensive process. Thus, there is a need to expedite the discernment process of causes of death in contexts where vital registration systems are lacking, allowing appropriate political, planning and programmatic decisions to be made in accordance with needs. The InterVA probabilistic model (Byass et. al) is poised to meet this need. This study evaluates the models ability to assign COD from VA elicited signs and symptoms in reference to physicians assessment.

PURPOSE

To validate the InterVA all ages, all causes model to predict COD in children under 5, and consequently standardize VA data analysis, and avoid the need for physician review thus saving money, time and other resources.

METHODS

Study participants
- SHEWA-B households with children under 5, who passed away in the proceeding 4 years
- Willing to give consent, close relative of the deceased (usually mother), present during final illness/death, able to describe illness symptoms and medical consultations prior to death

Data collection (2007-2008)
- VA instrument: identification of respondent, identification & background info, of deceased; Background of Death: open-ended history, signs and symptoms
- Physician Review (PR): 2 physicians independently review VA, ICD-10 coding of underlying & direct COD

Data analysis (2009)
- Signs and symptom from VA are input into the model, and the 3 most likely COD are output, along with associated likelihoods; based on semi-qualitative probabilistic matrix.
- Direct and underlying cause proportionality (0.5)
- Malnutrition & HIV/AIDS endemic prevalence setting “Low” for Bangladesh
- Coding, translation of signs/symptoms from VA to InterVA language, grouping of ICD-10 COD (headings/main sub-groups) [Figure 2]

Ethics
- This study was exempt from the Internal Review Board at Emory University and ICDDR,B as it is not defined as human subject research

RESULTS

Physician assigned cause specific mortality fraction (CSMF)

Physician assigned COD
- Grouped via ICD-10
- Introduction COD: Chhattogram Hill Tracts
- Sherlock COD: Chittagong Hill Tracts

Figure 1: Map of Bangladesh displaying the SHEWA-B intervention and control areas where HIS and VA data were also collected. Study area: SHEWA-B: Bangladesh, nation-wide, randomized controlled cluster sampling with oversampling of Chittagong Hill Tracts and an emphasis on hardcore poor.

Figure 2: The physician assigned cause specific mortality fractions (CSMF) of children under 5 deaths. In order to assess the causes of death (COD) in children under 5 in Bangladesh verbal autopsies (VA) were conducted as part of an evaluation of the national water, sanitation, and hygiene program (SHEWA-B). The International Center for Diarrheal Disease Research, Bangladesh (ICDDR,B) conducted the Health Impact Study (HIS) to in part determine the impact SHEWA-B has made on hygiene, sanitation and water related behavior and subsequently child mortality. The VA used to obtain child mortality data are standard questionnaires given to family members of the deceased in order to obtain sign/symptoms relating to the death. Physicians must be staffed in order to extract causes of death based on the VA via their clinical expertise; however this is a time consuming and expensive process. Thus, there is a need to expedite the discernment process of causes of death in contexts where vital registration systems are lacking, allowing appropriate political, planning and programmatic decisions to be made in accordance with needs. The InterVA probabilistic model (Byass et. al) is poised to meet this need. This study evaluates the models ability to assign COD from VA elicited signs and symptoms in reference to physicians assessment.

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