

Use of TaqMan Array Card Technology in Determination of Cause of Death for Stillbirths and Under-five Deaths in Eastern Ethiopia

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Background

Child Health and Mortality Prevention Surveillance (CHAMPS) network has implemented custom multi-pathogen TaqMan Array Card (TAC) technology as a molecular testing method for detection of infectious agents contributing to stillbirths and under-five child mortality. A standardized process, known as Determination of Cause of Death (DeCoDe), was performed by a panel of experts to thoroughly analyze and review compiled data, including TAC results, to assign underlying and immediate causes for each under-five child death and stillbirth. We analyzed use of TAC technology in DeCoDe in the CHAMPS-Ethiopia site.

Methods

Four separated TACs (Respiratory, Enteric, Blood/CSF tier1, and Blood/CSF tier2) customized multi-pathogen panels consisting of multiplex real-time Polymerase Chain Reaction (PCR) assays in microfluidic system were used to test postmortem specimens (lung tissue, respiratory (nasopharyngeal/oropharyngeal) swab, rectal swab, whole blood, and CSF) collected from the deceased using a minimally invasive tissue sampling procedure.

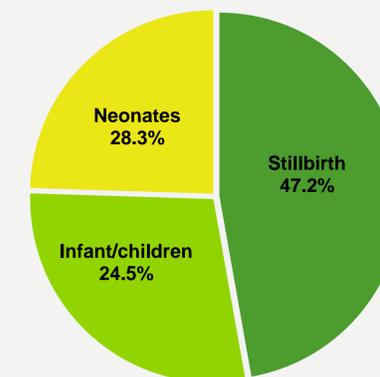
Total nucleic acids (DNA and RNA) were extracted using QIAGEN EZ1 DSP Virus Kit, according to the manufacturer's instructions, in EZ1 Advanced XL instrument. The TAC runs were performed in QuantStudio 7 Flex real-time PCR system.

Results

Overall, a total 116 pathogen targets were used to cover bacterial, virus, parasites and fungi pathogens. Of the total 59 cases recruited from 4th February 2019 to 03rd February 2020, 53 (89.8%) of cases were reviewed and assigned a final cause of death (Fig 1). Excluding stillbirths, 22 of 28 (78.6%) cases were infection-related deaths and TAC results were used to determine cause of death. A TAC results were the primary source of data considered by the DeCoDe expert panel in 12 of 13 (92.3%) of cases in children beyond the neonatal period. Similarly, causes of death in 10 of 15 (66.7 %) neonatal cases were also determined based on TAC results.

In addition, among the pathogens detected, 33 were determined as definitive cause of death consisting of bacteria (87.9%), viruses (9.1%) and parasites (3%). *K. pneumoniae*, *S. pneumoniae*, *E. coli*, and *Salmonella* species accounted for cause of death in more than two thirds (63.6%) of cases, with the remainder of bacterial detections being *N. meningitidis*, *H. influenzae*, *U. urealyticum/parvum*, *Group A Streptococcus*, *Group B Streptococcus*, *V. cholerae*, and *P.aeruginosa*.

Fig 1. Type of cases reviewed and assigned Definitive cause of death (n=53)



Conclusions

TAC was found to be valuable in determining cause of death in under-five children. We emphasize use of TAC as a multi-pathogen detection platform for disease surveillance, outbreak investigation and severe case diagnostics.

References

1. Diaz MH, Waller JL, Napoliello RA, et al. Optimization of multiple pathogen detection using the TaqMan array card: application for a population-based study of neonatal infection. PLoS One 2013; 8:e66183.
2. Diaz MH, Waller JL, Theodore MJ, et al. Development and implementation of multiplex TaqMan array cards for specimen testing in the Child Health and Mortality Prevention Surveillance (CHAMPS) network. Clin Infect Dis 2019; 69(Suppl 4):S311–21..

See more data at champshealth.org



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