

[University of Stavanger, IMF] [case number 1]

Institution: University of Stavanger
Administrative unit: Department of Mathematics and Physics (TN-IMF)
Title of case study: Safer Births
Period when the underpinning research was undertaken: 2009-2024
Period when staff involved in the underpinning research were employed by the submitting institution: 2009-2024
Period when the impact occurred: 2013-2024

1. Summary of the impact (indicative maximum 100 words)

Safer Births (<https://saferbirths.com/>) is claimed to be the largest project on saving perinatal lives worldwide. A main outcome of the project is reduced newborn and maternal mortality during birth in low-resource settings. It is estimated that the project has led to two extra lives saved per midwife per year over the project period in hospitals in Tanzania.

In addition, the project has led to increased knowledge on fetal heart rate, transition of newborns at birth and newborn resuscitation that will improve international guidelines. Furthermore, during the project life-saving medical devices and training programs for low-resource setting have been developed.

2. Underpinning research (indicative maximum 500 words)

Safer Births is a large collaborative interdisciplinary research and development project. Some key partners in the project are Haydom and Muhimbili hospitals in Tanzania, Laerdal Global Health, Safer, Stavanger University Hospital, University of Stavanger and Laerdal Medical. Up to 2019 the project involved around 100 persons, including researchers, research staff and engineers, from 12 international institutions. More than 10 PhD students graduated from the original project up to 2019, and more than another 10 from follow up projects afterwards. See more details here: https://saferbirths.com/wp-content/uploads/sites/2/2023/01/Safer-Births-Report-Update-v3_7mb.pdf.pdf

The project has been research based all the way, scientific documentation via peer reviewed research has been a cornerstone in the project. Around 100 research papers have been published related to the project.

The project has led to development of medical devices suited for use during births in low resource settings, and programs and devices for training midwives and other health care workers. Collecting detailed data and their analysis has been a key part throughout the project to improve and to document the effect of the devices and training programs. For instance, detailed high quality data has been gathered on every birth (around 4-5000 per year) at Haydom hospital over the entire project period (and beyond).

Three members of the statistics group at the department have been involved to analyse the collected data by using and developing suitable statistical methods, at different stages of the project, and thus, have been a crucial part in the project. We have for instance been involved in calculating the estimated number of lives saved in the project, identifying factors of importance for survival, documenting improved practice and gaining novel understanding of development of newborn heartrate.. Some of our master students have also been working on analysing data from the project

3. References to the research (indicative maximum of six references)

1. Mduma E, Ersdal H, Svensen E, Kidanto H, **Auestad B**, Perlman J. Frequent brief on-site simulation training and reduction in 24-h neonatal mortality--an educational intervention study. *Resuscitation*. 93, 1-7, 2015. doi: 10.1016/j.resuscitation.2015.04.019.
Documenting improved practice and improved survival due to frequent training in an early phase of the Safer Birth project.
2. Mduma E, **Kvaløy JT**, Søreide E, Svensen E, Mdoe PF, Perlman J, **Johnson CA**, Hussein K, Ersdal HL, Frequent refresher training on newborn resuscitation and potential impact on perinatal outcome over time in a rural Tanzanian hospital: An observational study. *BMJ Open*, 9, 1-10, 2019. doi: 10.1136/bmjopen-2019-030572
Using statistical process control methods to document that a resuscitation training program leads to improved perinatal survival, with an estimated 250 lives saved over a six-year period in one single hospital. Initial analyses done in the master thesis by Caroline Johnson, master student at IMF.
3. Linde JE, **Schulz J**, Perlman JM, Øymar K, Francis F, Eilevstjønn J, Ersdal HL. Normal Newborn Heart Rate in the First Five Minutes of Life Assessed by Dry-Electrode Electrocardiography. *Neonatology*. 110, 231-7. 2016. doi: 10.1159/000445930.
Estimation of break points for heart rate changes of healthy newborns in the first minutes of lives using a newborn resuscitation monitor invented as part of the Safer Birth project.
4. Moshiro RD, Perlman JM, Mdoe PF, Hussein K, **Kvaløy JT**, Ersdal HL, Potential causes of early death among admitted newborns in a rural Tanzanian hospital. *PLOS ONE*, 14, 2019. doi: 10.1371/journal.pone.0222935.
Analysing causes of newborn mortality, for improving future training and treatment.
5. Linde JE, **Schulz J**, Perlman JM, Øymar K, Blacy L, Kidanto H, Ersdal HL. The relation between given volume and heart rate during newborn resuscitation. *Resuscitation*. 117, 80-86. 2017. doi: 10.1016/j.resuscitation.2017.06.007.
Studying the relationship between tidal volume during initial positive pressure ventilation and heart rate response in resuscitation of newborns, using a generalized additive model.
6. **Schulz J**, **Kvaløy JT**, Engan K, Eftestøl T, Jatosh S, Hussein K, Ersdal H, State transition modeling of complex monitored health data. *Journal of Applied Statistics*. 47, 1915-1935, 2020. doi: 10.1080/02664763.2019.1698523
Methodological paper on how to analyse complex monitored data, illustrated with data on newborn resuscitation from the Safer Birth project.
7. Ersdal HL, Mdoe PF, Mduma E, Moshiro RD, Guga G, **Kvaløy JT**, Bundala F, Marwa B, Kamala B. "Safer Births Bundle of Care" Implementation and Perinatal Impact at 30 Hospitals in Tanzania—Halfway Evaluation. *Children*, 10, 2023. doi: 10.3390/children10020255.
Reporting promising results for newborn and maternal mortality in a follow up project implemented at 30 new hospitals, where a bundle of training programs and devices develop during the Safer Births project is used.

4. Details of the impact (indicative maximum 750 words)

It is estimated that at the four hospitals in Tanzania where the Safer Birth project was first implemented around 2 extra lives were saved per midwife per year during 2013-2019. At Haydom hospital (where good baseline data existed) it is estimated that 250 newborns were saved during six years.

This was achieved by a combination of introducing training programs and medical devices suitable for the low-resource setting. More specifically the devices are a digital fetal heart rate monitor to monitor the baby during birth, a heart rate meter to measure the heart rate of newborn babies and an upright bag mask for ventilation of babies not breathing (see more details e.g. here: [e](https://laerdalglobalhealth.com/partnerships-and-programs/safer-births-research-project/) or <https://laerdalglobalhealth.com/partnerships-and-programs/safer-births-research-project/>). In addition, training programs and training devices for training midwives have been developed and continuously improved (see more details e.g. here: https://saferbirths.com/wp-content/uploads/sites/2/2023/01/Safer-Births-Report-Update-v3_7mb.pdf). Although developed for the low resource setting, some of these devices have also turned out to be useful for use in developing countries, e.g. the heart rate meter is now used for research projects at Norwegian hospitals.

Furthermore, the research done as part of the project has led to increased knowledge on fetal heart rate, transition of newborns at birth and newborn resuscitation. Insight from this research will contribute to improve international guidelines.

The research output is documented in the around 100 published research papers, more than 10 completed PhD theses and more than 10 ongoing PhD projects in continuations of the project. Very important here is that a majority of these PhD students are Tanzanians, and the project has thus led to important capacity building also on the research side in Tanzania. Some of the first Tanzanians graduating with PhDs from the project are now leading persons in the Safer Births Bundle of care project described below, and other related projects.

A continuation of the Safer Birth project, called the Safer Births Bundle of care started in 2021. In this project the key elements developed during the Safer Birth project is implemented at 30 hospitals in rural parts of Tanzania (see more detail here: <https://laerdalglobalhealth.com/cdn-498d65/globalassets/lgh/partnerships--programs/safer-births/sbbc-mini-report-2023.pdf>). This project is funded by winning a call from the Global Financing Facility (GFF). Among 320 proposals the Safer Births Bundle of Care was rated to have the highest impact potential of all. Even further financing from GFF to scale the project up to over one hundred hospitals was received last year, and the scale up is being rolled out in the start of 2024. The statistics group are part also of this project, with an allocated part of the budget.

There is also an offspring from the original Safer Births project in form of a Safer Births project for high resource settings, led from Stavanger University hospital and with many collaborating partners: <https://www.helse-stavanger.no/fag-og-forskning/forskning-i-helse-stavanger/forskningsgrupper/safer-births>

5. Sources to corroborate the impact (indicative maximum of ten references)

The project has received a lot of attention in media, at conferences among politicians and health officials at all levels in Tanzania, Norway and other countries. Some of these stories are documented here: <https://saferbirths.com/news/>

See also:

<https://saferbirths.com/testimonials/>
<https://saferbirths.com/save-stories/>