Evaluation of Medicine and Health (EVALMEDHELSE) 2023-2024

Self-assessment for research groups

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Institution (name and short name): Stavanger University Hospital, SUH
Administrative unit (name and short name): Stavanger University Hospital, SUH
Research group (name and short name): Safer Births (Safer Births)
Date: 31.01.2024
Contact person: Siren Rettedal
Contact details (email): siren.irene.rettedal@sus.no

Content

1. Organisation and strategy

1.1 Research group´s organisation

Describe the establishment and the development of the research group, including its leadership (e.g. centralised or distributed etc.), researcher roles (e.g. technical staff, PhD, post docs, junior positions, senior positions or other researcher positions), the group's role in researcher training, mobility and how research is organised (e.g. core funding organisation versus project-based organisation etc.).

Safer Births related studies started in 2009 with pilot testing of the Helping Babies Breathe (HBB) simulation-based education program in Tanzania, followed by Helping Mothers Survive (HMS) research at Haydom Lutheran Hospital (HLH) in rural Tanzania (figure 1). The first Safer Births project started at HLH in 2013, with **Hege Ersdal** and **Estomih Mduma** in the lead. As shown in figure 1 and 2 the project has later evolved to include a wide range of countries, institutions, and researchers, with increasing number of interventions, innovations, impact and funding partners. The project is substantially reliant on external funding (276 MNOK in the evaluaton period and 212 MNOK from 2018 - 22, table 2), with technical, administrative, and basic research infrastructure support from the Stavanger University Hospital (SUH). Safer Births is now one of the largest and most comprehensive maternal and newborn research projects gaining recognition and producing impact globally. The academic and innovative achievements of Safer Births have received extensive international recognition by international organisations such as the WHO, International Liaison Committee On Resuscitation (ILCOR), European Resuscitation Council (ERC), Society for Simulation in Healthcare (SSH), Society for Simulation in Europe (SESAM), American Academy of Paediatrics (AAP), USAID, UNICEF, NORAD, and clinical and academic personnel on a global scale.

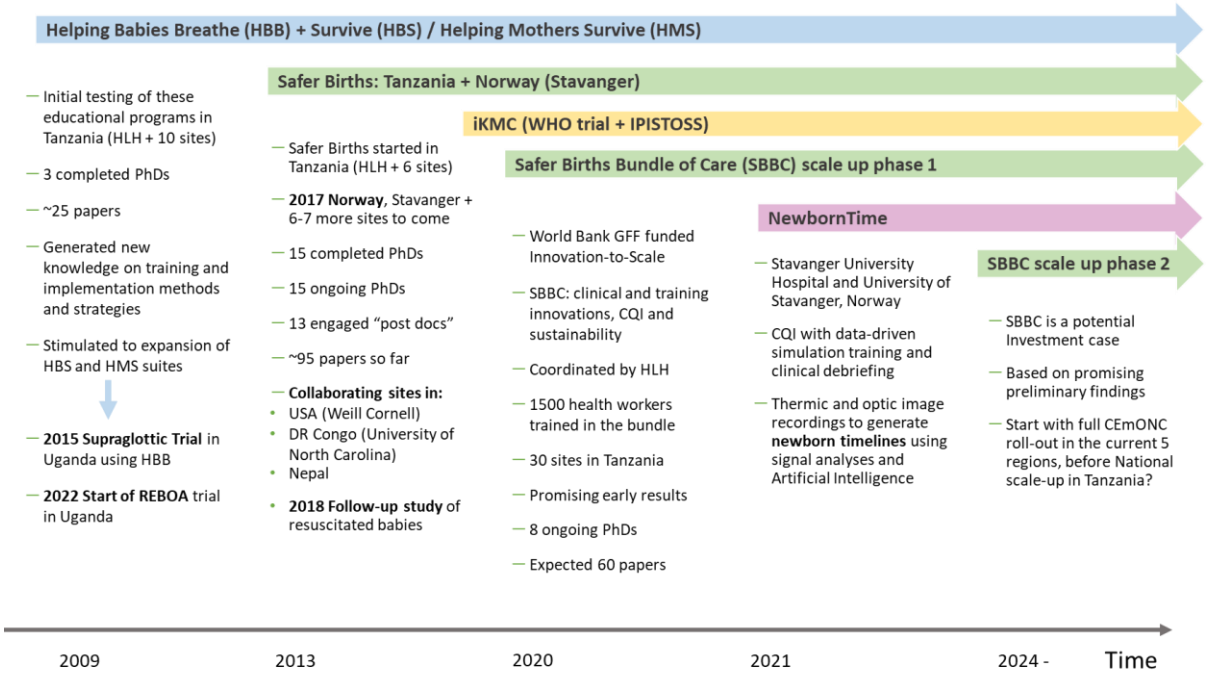

Figure 1: Historical overview of the development of the Safer Births project.

Safer Births research addresses stillbirths, maternal and neonatal mortality. In 2017-2020 the landmark immediate Kangaroo Mother Care (iKMC) randomised controlled trial was conducted in limited-resource settings, with Safer Births colleagues **Robert Moshiro** and **Siren Rettedal** in key positions.

Figure 2: Overview of projects and partners in the Safer Births project globally

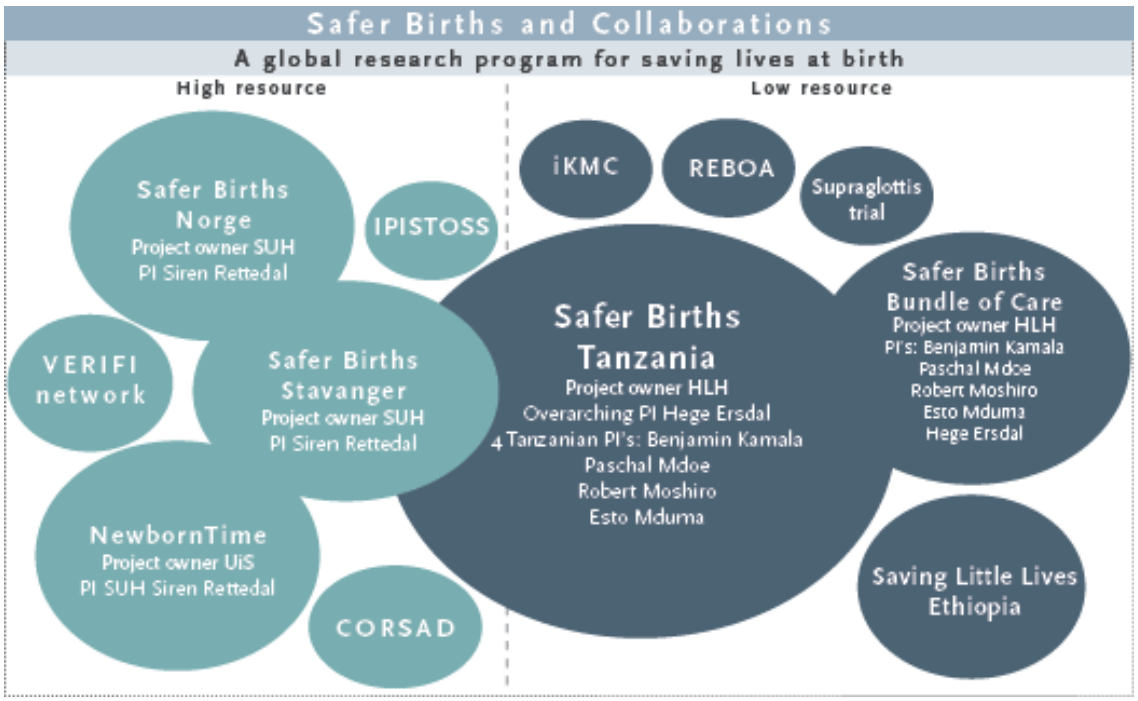

Figure 2. ***CORSAD**=**C**omparison **O**f **R**espiratory **S**upport **A**fter **D**elivery; **IPISTOSS** = **I**mmediate **P**arent **I**nfant **S**kin-**TO**-**S**kin **s**tudy; **iKMC** = **I**mmediate **K**angaroo **M**other **C**are; **VERIFI** = **V**ideo **E**valuation for **R**esuscitation of **I**n**F**ants **I**nternational; **SLL** = **S**aving **L**ittle **L**ives Ethiopia; **HLH** = **H**aydom **L**utherian **H**ospital and **SUH** = **S**tavanger **U**niversity **H**ospital, REBOA = **R**esuscitative **E**ndovascular **B**alloon **O**cclusion of the **A**orta*

Safer Births has engaged 13 post docs and enabled 18 PhD's in the evaluation period (2012 – 2022) with an additional 23 in the pipeline, of which almost 50% are local PhDs for global capacity building and sustainability. Together with its partners, Safer Births has developed highly successful training methods, interventions and patents, and extensively been involved in mobility and research dissemination including conferences, guidelines sessions, training sessions, national and international policy processes and advocacy activities. The Safer Births program is led by two full-time professors **Hege Ersdal** and **Siren Rettedal** based at SUH in collaboration with local PIs (figure 2).

Table 1. List of number of personnel by categories in 2022
Instructions: *Please provide number of your personnel by categories. For institutions in the higher education sector, please use the categories used in DBH, https://dbh.hkdir.no/datainnhold/kodeverk/stillingskoder.*

	Position by category	No. of researcher per category	Share of women per category (%)	No. of temporary positions
No. of Personnel by position	Senior physicians	20 (including PhD candidates)	9 (37%)	
	Physicians	1	1 (100%)	
	Psychologists	1	1 (100%)	
	Researchers and postdocs	1	0 (0%)	
	PhD-students	23	13 (57%)	
	Research support/ Administrative research staff/PhD supervisors	170 research support and full-time employees (mostly in SBBC) + 40 PhD supervisors from different universities/continents	Unknown PhD supervisors 15 female (43%)	150 of 170 temporary positions in SBBC
	Among these research group members, the researchers in the group holds these academic positions:			
	Professors	21 supervisors	10 (48%)	
	Ass. professors	5 supervisors	2 (40%)	

Full list of researchers in research group website Safer Births (safer-births.com)

1.2 Research group´s strategy

a) Describe the research group's main goals, objectives and strategies to obtain these (e.g. funding, plans for recruitment, internationalization etc.) within the period 2012-2022.

The main goal of the Safer Births program is to reduce stillbirths, maternal and neonatal mortality and morbidity. The program explores epidemiological and clinical challenges, but also issues vital to capacity building and implementation following the principles of the Utstein Formula for Survival (Soreide et.al. 2013). The project success is measured on the uptake of findings to transform practice, from donorship to ownership, in all the collaborating institutions and governmental partners. The project relies on effective Public Private Partnerships and a wide network of global alliances to achieve its goal. The initial Safer Births projects aimed to develop research equipment to investigate pathophysiological changes during labour/birth/newborn period in more detail, e.g. fetal heart rate during labour, fetal-newborn normal and abnormal cardio-respiratory transition, newborn responses during resuscitation, and newborn responses to resuscitation (table 7). Equally important is the objective to test effective training and implementations strategies. Based on the findings from the Safer Births research the Safer Births Bundle of Care (SBBC) aims to scale-up nationally in Tanzania and globally. Current Safer Births research continues to develop and scale up automatic data capture in different hospitals across low- and high resource settings to learn from every resuscitation event. The aim is to further improve safe labour

management, develop user-friendly tools to help guide newborn resuscitation, and implement data-guided learning and training methods.
The strengths of the research program can be summarized as follows:

- Strong scientific rigour with a wide inclusion of inter- and transdisciplinary research groups and competence.
- Strong links to policy makers, governmental authorities, international scientific and policy drivers and Public Private Partnerships.
- Science and projects implemented in both low and high resource contexts with emphasis on all components necessary to successfully implement new knowledge.
- Demonstration of substantial impact on maternal and neonatal mortality, triggering motivation and collaboration.

b) Please describe the benchmark of the research group. The benchmark for the research group should be written by the administrative unit in collaboration with the research group. The benchmark can be a reference to an academic level of performance (national or international) or to the group's contributions to other institutional or sectoral purposes. Example: A benchmark for a research group is related to the research groups' aim which again is included in the strategy for the administrative unit. A guidance for the administrative unit to set a benchmark for the research group(s) can e.g. be: What do the administrative unit expect from the research group(s)?

The Safer Births main benchmarks are closely related to both the main objectives and the strategic principles of the project. On a strategic level, within its field of research, the benchmarks include:

- Secured transition from research projects to effective implementation at project sites (from donorship to ownership).
- Established internationally leading consortium in the field of maternal and neonatal health- establishing a Center of Excellence.
- Established global alliances towards the achievement of our main goals.
- Established effective Public, Private Partnerships.
- Established and proven user-friendly innovations and technologies.
- Established new knowledge within the field of simulation and implementation theory.
- Produced policy relevant findings to improve capacity building and policy implementation guidelines for improved sustainability of health services delivery.
- Contributed to successfully achieving the UN Sustainable Development Goals, in particular goals number 3 (Good health and well-being), 4 (Quality education), 5 (Gender equality) and 10 (Reduced inequalities).

At a more specific level a few of the major project benchmarks are:
Based on the results from the Safer Births research at HLH, the goal of the SBBC scale up to 30 hospitals in Tanzania were to achieve:

- 10% reduction in maternal deaths
- 25% reduction in fresh stillbirths
- 50% reduction in early neonatal deaths (within 24 hours)
- Established effective research infrastructure and data management.

At an institutional level the project contributes substantially to important benchmarks at SUH:

- increase the number of publications by 50% from 200 to >300 per year (Safer Births has contributed with >130 publications in the period 2012-22)
- Maintain publishing quality with >25% in level 2 journals (Safer Births network has achieved 25% of publications in level 2 journals) and more than 50% including international co-authorship (Safer Births 73% international co-authorship publications)

- Increase the number of PhDs from approximately 15 per year to stable over 25 (table 1) Safer Births has contributed with 18 PhD in the past 10 years, with 23 ongoing.
- The external research funding from national and international sources is larger than the research funding from the Western Norway Regional Health Authority. Contribution to research-based innovations is substantial with at least five patents and commercial agreements annually (table 7).
- To be a nationally leading and international spearhead in simulation research (section 2.1 and 2.2) in collaboration with SAFER and InterRegSim.
- That overall internal and external funding for research increases (section 1.4 and figure 1)

c) Describe the research group`s contribution to education (master´s degree and/or PhD).
A total of 18 PhD's and 2 post-doctoral have successfully been completed through the project, and 23 PhD's in the pipeline. The project faculty contributes to master programs at HLH, the Midwives and Biomedical Analysis master's program at the UiS, as well as to the education of nurse/medical students and specialist candidates (medical doctors) in anesthesia, obstetrics and pediatrics. Other educational commitments include teaching students at the National Resuscitation Council newborn resuscitation courses and WHO endorsed HBB/ENC courses globally. Research group members conduct extended simulation training nationally and internationally with SimBegin and Advanced training programs.

d) Describe the support the host institution provides to the research group (i.e., research infrastructure, access to databases, administrative support etc.).
The administrative unit supports the research groups at the hospital with research administration related to external and special funding and project management related to international projects and EU-financing. The SUH has taken regional and national responsibility for simulation uptake in health service delivery (InterRegSim) as a result of the Safer Births program, among others. SUH gives external and internal approval and provide help with contracts/agreements for the research projects. The section for biostatistics supports the project with statistics and data management, and the biobanking unit supports biobanking. SUH also supports the group in data collection with substantial help from the analytic department, and the ICT department has been helpful in creating automated data extractions from electronic medical journals systems.

1.3 Relevance to the institutions

Describe the role of the research group within the administrative unit. Consider the research group's contribution towards the institutional strategies and objectives and relate the research group`s benchmark to these.

The research group is administratively organized under the Clinic for Emergency Care and the Obstetric and Child Health Department, while research coordination is supervised through the research department of the SUH. The project is linked to the overall Global Health strategy of the hospital. Administrative routines guiding health and safety of the SUH staff engaged in international collaboration has been developed through internal routines at the hospital. Safer Births contributes to capacity building, particularly through its strong expertise and development of simulation theory and practice, for the improvement of research, educational and research competence and implementation. Furthermore, the group successfully integrates its research into several departments and sections of the SUH and across disciplines, contributing to cross sectional collaboration and knowledge transfer. This enables high scientific competence and up-to-date relevance to clinical practice. Finally, the group contributes to securing additional funding to support infrastructure and functions for research and

increased international research collaboration. See Impact case attachment. The main benchmarks used to assess progress towards these aims are specified in section 1.2b.

1.4 Research group´s resources

Describe the funding portfolio of the research group for the last five years (2018-2022).

The project has an overall budget (including in-kind contributions) of approximately 212 MNOK with around 200 researchers/research staff and engineers. It is a multidisciplinary teamwork involving neonatology, obstetrics, nursing, psychology/ pedagogics, mathematics, statistics, physics, human factors and engineering, amongst others. It is also a multi-country and multi-site project involving institutions in Tanzania, Ethiopia, Uganda, India, Nigeria, Malawi, Ghana, Nepal, Congo, Sweden, USA and Norway. Each of the institutions contribute with basic resources including research infrastructure and management, recruitment processes, mobility, training, advocacy, and networking. Funding agencies have engaged in the project as it evolved as described in section 1.1, figure 1. Evolvement of the Safer Births portfolio would not have been possible without the comprehensive support from many donors (table 2). Safer Births is to our knowledge the largest research consortium on newborn resuscitation in the world today.

Table 2. Describe the sources of R&D funding for the research group in the period 2018-2022.

	2018 (NOK)	2019 (NOK)	2020 (NOK)	2021 (NOK)	2022 (NOK)
Basic funding (SUH)	1.300.000	1.350.000	1.400.000	2.900.000	3.000.000
Funding from industry and other private sector sources		17.525.000	4.435.000	5.210.000	8.108.000
Commissioned research for public sector				1.480.000	1.050.000
Research Council of Norway				12.000.000	
Grant funding from other national sources		2.754.000	2.823.000		
International funding e.g NIH, NSF, EU framework programmes			50.000.000		85.000.000

1.5 Research group´s infrastructures

Research infrastructures are facilities that provide resources and services for the research communities to conduct research and foster innovation in their fields. These include major equipment or sets of instruments, knowledge-related facilities such as collections, archives or scientific data infrastructures, computing systems communication networks. Include both internal and external infrastructures

a) Describe which national infrastructures the research group manages or co-manages.

The research group has a role in managing and co-managing several national and international research infrastructures. One of the main groups is the **Safer Births Stavanger - Norway**, co-created and managed together with Laerdal Medical and Laerdal Global Health. The main aim of this group is to develop, maintain and make accessible training expertise and knowledge as well as data on maternal and neonatal health, training, and implementation. The Safer Births research group is also co-responsible for the development of a large research infrastructure aimed at facilitating the roll-out of **Safer Births Bundle of Care** policies and interventions to a multihospital (150 hospitals in 2024) implementation project in Tanzania, in collaboration with SAFER simulation center, Stavanger. This

infrastructure is based in, and primarily managed by the HLH in Tanzania. Finally, the research group co-manages the biobank facilities in connection with the **IPISTOSS** project (described in 1.1).

b) Describe the most important research infrastructures used by the research group.
In addition to the infrastructures mentioned in 1.5a the research group also utilizes research infrastructure connected to the Norwegian Surveillance for Antibiotic Resistance, and the infrastructure related to the Signal Analysis Group (AI and innovation data and infrastructure) at University of Stavanger.

1.6 Research group´s cooperations

Table 3. *Reflect on the current interactions of the research group with other disciplines, non-academic stakeholders and the potential importance of these for the research (e.g. informing research questions, access to competence, data and infrastructure, broadening the perspectives, short/long-term relations).*

Interdisciplinary (within and beyond the group)	Interdisciplinary collaboration across medical fields and professions is crucial to capitalize on competence. Reducing maternal and neonatal deaths relies on a wide range of different expertise across low –, middle – and high-resource settings. We cooperate with clinical networks to gain systematic access to data and to inform research questions and to create impact on guidelines development. These international networks include ILCOR, VERIFI network and to be established Global Neonatal Resuscitation Alliance (GNRA).
Collaboration with other research sectors e.g. higher education, research institutes, health trusts and industry.	A strength in the Safer Births collaborative network is the partnership between industrial partners, academia, and health service delivery. This enables the program to establish new evidence, develop innovative products and implement new knowledge and methods, including training methods. These collaborations ensure an effective link between all factors necessary for sustainable implementation (Ref. Utstein Formula for Survival). The collaborations can be categorized as follows: 1. Industrial partners (Laerdal Medical, Laerdal Global Health, SAFER Foundation, BitYoga, Monivent) 2. Academia (University of Stavanger Faculty of Science and Technology and Faculty of Health Sciences, Karolinska Institute, University of Oslo, University of Weill Cornell Medicine New York, Addis Ababa University Ethiopia, Children's Hospital of Philadelphia, Melbourne University Australia, University of North Carolina). 3. Health service delivery (Stavanger University Hospital, InterRegSim, Haydom Lutheran Hospital, The Southern and Eastern Regional Health Trust in Norway, Tanzanian and additional 140 hospitals in Tanzania, and 290 Ethiopian NICUs).

Transdisciplinary (including non-academic stakeholders) *Transdisciplinary research involves the integration of knowledge from different science disciplines and (non-academic) stakeholder communities with the aim to help address complex societal challenges.*	Collaboration with non-academic stakeholders is essential to secure funding, gain advocacy support to achieve ownership and buy-in for scale-up and sustained changes at different levels. The most important collaborations include The World Health Organization, World Bank Global Financial Facility, local and central governments in Norway, Tanzania and Ethiopia, Laerdal Foundation, UNICEF country office in Tanzania, Innovation Norway (Vision 2020), GLOBVAC, Norwegian Research Council, Norwegian Agency for Development (NORAD), Skattefunn, Saving lives at birth, USAID, Norwegian Ministry of Education, Midwives Association (TAMA), Paediatric association of Tanzania (PAT), American Academy of Pediatrics (AAP).

2. Research quality

2.1 Research group's scientific quality

Describe the research profile of the research group and the activities that contribute to the research group´s scientific quality. Consider how the research group's work contributes to the wider research within the research group's field nationally and internationally.

SBBC is building upon the Safer Births research and development collaboration with 14 years (2009 – 2022) of research in Tanzania and Norway, and over 130 papers in peer-reviewed international journals (figure 3) of which 33 are in level 2 journals (25%), with a deliberate open-source policy. SBBC consists of proven innovative clinical and training tools, combined with new strategies for the establishment of Continuous Quality Improvement (CQI) efforts and sustainability of improved care. It is co-developed with health care workers in Tanzania to improve quality of labour and newborn care. Key components of the CQI efforts are regular on-the-job Low-Dose High-Frequency training, utilizing local data and feedback loops to visualize gaps in clinical care and guide ongoing training needs. Adequate training of local champions who can facilitate CQI and simulation training is considered essential for these processes to happen, and to stimulate a gradual and sustainable culture change. In 2019, SBBC won a World Bank Global Financing Facility innovation-to-scale award to test implementation of the package in 30 healthcare facilities in five regions in mainland Tanzania. The roll-out is led by HLH in close collaboration with the Ministry of Health and UNICEF in Tanzania. Increased maternal and newborn survival worldwide should be possible with a combination of HBB, HMS and available Safer Births innovations for clinical practice and training, supported by new published knowledge and updated international guidelines as a basis for local, national, and regional health services implementation.

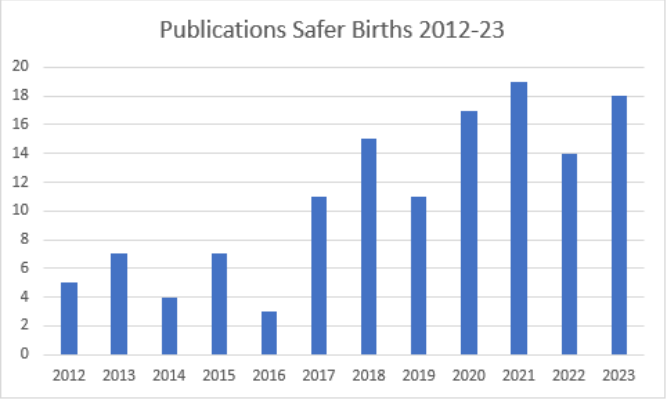

Figure 3. Publications Safer Births annually from 2012 – 2023.

Please add a link to the group`s website: Safer Births (safer-births.com)

Table 4. List of projects

Project 1: ***Safer Births Bundle of Care (SBBC) in Tanzania*** *Project period 2020 – Phase 2 ongoing*	**Project owner(s)** (project leaders organisation)	Haydom Lutheran Hospital, Tanzania **Hege Ersdal**, Stavanger University Hospital, is global principal investigator
	Total budget and share allocated research group	Appr. 135 MNOK, 100% allocated to the research group. In addition, 8 PhD's were funded by the LF, totalling 17.5 MNOK.
	Objectives and outcomes (planned or actual) **and link to website**	**Objectives:** Safer Births Bundle of Care combine the implementation of novel state-of-the-art monitoring technology by Laerdal Global Health and simulation-based in-situ newborn and maternal resuscitation training, to better equip and increase competence of health workers for improved labour, newborn and outcomes. We aim to gain new knowledge to close knowledge gaps stated by ILCOR, and influence international resuscitation guideline revisions, training and implementation strategies. **Outcome:** The aim was to reduce neonatal mortality by 50%, fresh stillbirths by 25% and maternal mortality by 10% in 30 hospitals in Tanzania. 300,000 births have been observed. Promising preliminary findings have resulted in national scaling of SBBC from 30 to 150 hospitals. **Link to website:** Safer Birth Bundle of Care Scale-up to 30 Hospitals on Vimeo.com Safer Births Scale-Up (Safer Births Bundle of Care) – Safer Births
Project 2: ***Safer Births Tanzania*** *Project period 2012 – ongoing*	**Project owner(s)**	Haydom Lutheran Hospital, Tanzania **Hege Ersdal**, Stavanger University Hospital, is global principal investigator and project manager
	Total budget and share allocated research group	LF centre support 14.000.000, 20.000.000 GLOBVAC funding (NRC). 100% allocated to the research group. In addition, the project received funding for 13 PhD's from LF (8), Ministry of Education (4) and Western Norway Regional Health Trust (1), and 1 Post Doc (LF), totalling 42 MNOK.
	Objectives and outcomes (planned or actual) **and link to website**	**Objectives:** Safer Births Tanzania aims to address identified knowledge gaps to reduce morbidity and mortality in the first 72 hours of life, when humans are the most vulnerable with the greatest potential for benefit in quality-adjusted life years. **Outcome:** Multiple new innovations have been developed, >70.000 births have been observed and analysed, >90 publications most in high-ranking journals, 2 more lives saved by each midwife, every year. **Link to website:** Safer Births Project – Safer Births
Project 3:	**Project owner(s)**	University of Stavanger Prof. Engan Local PI Stavanger University Hospital **Siren Rettedal**

NewbornTime *Project period 2021–2025*	**Total budget and share allocated research group**	Norwegian Research Council 11.955.000, Western Norway Regional Health Authority innovation funding 1.180.000, Idella 1.200.000, Helse Campus UiS 300.000. Additional 2.300.000 in in-kind from consortium partners, 100% allocated to the research group.
	Objectives and outcomes (planned or actual) **and link to website**	**Objectives:** Newborn Timelines will be developed based on artificial intelligence (AI) analysis of thermal video capturing the exact time of birth, and optic video capturing activities during newborn resuscitations. Newborn Timelines can be used for clinical debriefings and evaluation of compliance with guidelines, as well as give generate new knowledge. Secondary objectives include technological advancements in AI for activity recognition, digital consent collection, and automated data collection. **Outcome:** Data collection and project ongoing. The technical development of AI models is promising and ongoing. **Link to website:** NewbornTime – Improved newborn care based on video and artificial intelligence | University of Stavanger (uis.no)
Project 4: ***Immediate Kangaroo Mother Care (iKMC)*** *Project period 2017–21*	**Project owner(s)** (project leaders organisation)	Coordinated by the WHO in collaboration with Karolinska Institute. **Siren Rettedal** co-PI. Rettedal was responsible for ensuring that all five study sites deliver the "WHO Minimal Package of Care for Small Babies", the implementation of iKMC and monitoring of the trial.
	Total budget/share allocated research group	Planning grant to Karolinska team appr. 4.3 MNOK from Laerdal Foundation. Appr. 60 MNOK to the WHO research group grant from Gates Foundation to conduct the trial.
	Objectives and outcomes (planned or actual) **and link to website**	**Objectives:** Reduce mortality among premature infants 1-1,8 kg by 25% by implementing iKMC compared to standard care in incubator in five hospitals in Ghana, Malawi, India, Tanzania and Nigeria. **Outcome:** The trial showed more than 25% reduction in neonatal mortality at 28 days in favour of immediate KMC, and the trial was stopped early on recommendation of the data safety monitoring board. WHO published new guidelines following the trial. **Link to website:** Kangaroo mother care started immediately after birth critical for saving lives, new research shows (who.int)
Project 5: ***Immediate Parent-Infant***	**Project owner(s)**	Karolinska Institute Sweden Local PI at Stavanger University Hospital **Siren Rettedal**
	Total budget and share allocated research group	Appr. 6.68 MNOK from Laerdal Foundation, 100% allocated to the research group.

Skin-TO-Skin Study (IPISTOSS) *Project period 2016 –23*	**Objectives and outcomes** (planned or actual) **and link to website**	**Objectives:** To investigate whether Immediate Parent-Infant Skin-TO-Skin after birth leads to an improved physiological stabilization, altered epigenetic profile and improved long-term psychomotor outcome after birth in premature infants with gestational age 28 to 33 weeks. (IPISTOSS (clinicaltrials.gov)) **Outcome:** Results so far have shown that Skin-to-Skin care provided by a parent during the first 6 hours after birth improved cardiorespiratory stability, temperature control, and significantly enhanced child interactive behaviours and positive affect at 4 months. Acta Paediatri. 2022 DOI: 10.1111/apa.16371; Acta Paediatri. 2023 DOI: 10.1111/apa.16590 JAMA Netw Open. 2023 DOI: 10.1001/jamanetworkopen.2023.44469
Project 6: ***Safer Births Norway*** *Project period 2022-2025*	**Project owner(s)**	Stavanger University Hospital. PI **Siren Rettedal.**
	Total budget and share allocated research group	4.38 MNOK in total, 100% allocated to the research group; 3 MNOK from Laerdal Foundation, 330.000 NOK from Norwegian Medical Association, 1.050.000 NOK from Western Norway Regional Health Authority innovation funding.
	Objectives and outcomes (planned or actual) **and link to website**	**Objectives:** To establish a multicentre Safer Births Norway network for research in newborn resuscitation and learn from every resuscitation event using facilitated data-guided debriefing. **Outcome:** Data collection will start Q1-2 2024. **Link:** Safer Births, Stavanger University Hospital – Safer Births
Project 7: ***Saving Little Lives (SLL) Ethiopia*** *Project period 2021–2024*	**Project owner(s)**	Ethiopian Government and SLL research consortium. Stavanger University Hospital - **Siren Rettedal** and **Hege Ersdal** main/co- supervisors for 4 PhD candidates.
	Total budget and share allocated research group	4.75 MNOK from Laerdal Foundation for 4 PhD candidates. 50 MNOK from the World Bank Global Financing Funding, 100% allocated to the Ethiopian research group.
	Objectives and outcomes (planned or actual) **and link to website**	**Objectives:** The Saving Little Lives project in Ethiopia is a government led initiative to implement evidence-based minimum care packages for hospitalized preterm and LBW newborns, the highest contributors to neonatal mortality. It is outcome and impact-oriented project funded by the World Bank Global Financing Facility aiming to reduce neonatal mortality by 35% at from the rate of 33 per 1000 live births in 2019, by reaching 80% of preterm and LBW neonates at 290 hospitals in three years 2021- Q2 2024

		Outcome: Survival at 28 days among LBW neonates is the main outcome. Results not yet available. **Link to website:** Launching Saving Little Lives (laerdalglobalhealth.com)
Project 8: Supraglottic Trial Project period 2017– 21	**Project owner(s)**	University of Bergen and Makerere University Uganda.
	Total budget/share allocated research group	None allocated to the Norwegian research group
	Objectives and outcomes (planned or actual) **and link to website**	**Objectives:** Multi-centre randomized clinical trial to evaluate the efficacy of i-gel® supraglottic airway (LMA) used in neonatal resuscitation in reducing early neonatal death and morbidity compared to standard of care with face-mask ventilation in low-income countries. **Outcome:** In neonates with asphyxia, LMA was safe in the hands of midwives but was not superior to face-mask ventilation with respect to early neonatal death and moderate-to-severe hypoxic–ischemic encephalopathy. **Link to website:** NeoSupra Trial | CISMAC (uib.no)
Project 9: ***Comparison Of Respiratory Support After Delivery (CORSAD)*** *Project period 2016– 2020*	**Project owner(s)**	Karolinska Institute, Sweden. Local PI at Stavanger University Hospital **Siren Rettedal**.
	Total budget and share allocated research group	No funding to the Norwegian study site.
	Objectives and outcomes (planned or actual) **and link to website**	**Objectives:** A randomized controlled trial of delivery room intubation rates comparing a new system and T-Piece resuscitation system for initial stabilization of infants born before gestational age 28 weeks. **Outcome:** Using the new respiratory support system reduced delivery room intubation in extremely preterm infants. Stabilizing preterm infants with a system that has low imposed work of breathing and binasal prongs as interface is safe and feasible. **Link to website:** CORSAD (clinicaltrials.gov)
Project 10: ***Safer Births Stavanger***	**Project owner(s)**	Stavanger University Hospital. **Siren Rettedal** PI, **Hege Ersdal** Co-PI.
	Total budget/share allocated research group	5.25 MNOK, 100% allocated to the research group. In addition, 2 PhD's were supported through the Western Norway Regional Health Trust and 2 50% PhD's from LF, totalling 9 MNOK.

Project period 2017–2023	**Objectives and outcomes** (planned or actual) **and link to website**	**Objectives:** To gain knowledge that can help reduce the unacceptably high burden of neonatal morbidity and mortality caused by birth asphyxia and prematurity globally. **Outcome:** Gained new knowledge on resuscitation of near-term and term newborns by collecting objective resuscitation data; heart rate signals immediately after birth and throughout resuscitation, ventilation data and video recordings. Defined optimal low-dose high-frequency newborn resuscitation training. Demonstrated impact of immediate Kangaroo Mother Care (iKMC) to reduce mortality in low- and middle resource settings and reduce morbidity in high-resource settings. **Link to website:** Safer Births, Stavanger University Hospital – Safer Births

Table 5. Research group's contribution to publications

Instructions: *Please select 5-15 publications from the last 5 years (2018-2022) with emphasis on recent publications where group members have a significant role.* ***If the publication is not openly available, it should be submitted as a pdf file attached to the self-assessment.*** *We invite you to refer to the Contributor Roles Taxonomy in your description: https://credit.niso.org/. Cf. Table 1. List of personnel by categories: Research groups up to 15 group members: 5 publications. Research groups up to 30 group members: 10 publications. Research groups above 30 group members: 15 publications.*

Publication 1: *Project: Supraglottic trial* *Title:* A Randomized Trial of Laryngeal Mask Airway in Neonatal Resuscitation *Journal*: N Engl J Med (Level 2) *Year:* 2020 *DOI:* 10.1056/NEJMoa2005333. *URL:* *https://pubmed.ncbi.nlm.nih.gov/33252870/*	**Authors**	Nicolas J Pejovic, Susanna Myrnerts Höök, Josaphat Byamugisha, Tobias Alfvén, Clare Lubulwa, Francesco Cavallin, Jolly Nankunda, **Hege Ersdal**, Mats Blennow, Daniele Trevisanuto, Thorkild Tylleskär
	Short description	Open-label, superiority trial in Uganda, where neonates who required positive-pressure ventilation at birth where randomly assigned to be treated with an LMA or with face-mask ventilation. The primary outcome was a composite of death within 7 days or admission to the neonatal intensive care unit (NICU) with moderate-to-severe hypoxic-ischemic encephalopathy at day 1 to 5 during hospitalization. **Findings:** LMA was safe but was not superior to face-mask ventilation with respect to early neonatal death and moderate-to-severe hypoxic-ischemic encephalopathy.
	Research group's contribution	Hege Ersdal contributed with conceptualization, methodology, validation, writing review and editing.

Publication 2: *Project:* Immediate KMC trial *Title:* Immediate Kangaroo Title: Mother Care and Survival of Low-Birth-Weight Infants *Journal:* N Engl J Med (Level 2) *Year:* 2021 May *DOI:* 10.1056/NEJMoa2026486 *URL:* *https://www.nejm.org/doi/full/10.1056/NEJMoa2026486*	**Authors**	WHO Immediate KMC Study Group **Siren Rettedal, Robert Moshiro, Matilda Ngarina**
	Short description	Multicentre randomized controlled trial including infants with birth weight between 1.0 and 1.799 kg, comparing immediate KMC (i.e. baby placed skin-to-skin within 2 hours of birth even if considered unstable) with standard care (i.e. baby transferred to NICU/incubator and starting KMC when the baby was considered stable). **Findings:** 28 days mortality was reduced by 25% among those who received immediate KMC.
	Research group's contribution	**Co-principal investigator** responsible for conceptualization, investigation, methodology, supervision, validation, writing –review and editing.
Publication 3: *Project: CORSAD* *Title:* Comparison Of Respiratory Support After Delivery in infants born before 28 weeks gestational age – The CORSAD Randomized Clinical Trial *Journal:* JAMA Pediatr (Level 2) *Year:* 2021 *DOI:* 10.1001/jamapediatrics.2021.1497 *URL:* *https://pubmed.ncbi.nlm.nih.gov/34125148/*	**Authors**	Snorri Donaldsson, Thomas Drevhammar, Yinghua Li, Marco Bartocci, **Siren Irene Rettedal**, Fredrik Lundberg, Per Odelberg-Johnson, Tomasz Szczapa, Thordur Thordarson, Ingrida Pilypiene, Thordur Thorkelsson, Lars Soderstrom, Vladimiras Chijenas, Baldvin Jonsson for the CORSAD Investigators (including **Hanne Pike**)
	Short description	Randomized controlled trial to determine whether using a new respiratory support system with low imposed work of breathing and short binasal prongs decreases delivery room intubations or death compared with a standard T-piece system with a face mask. **Findings:** The new respiratory support system reduced delivery room intubation in extremely preterm infants by 47%.
	Research group's contribution	Siren Rettedal site-PI at SUH. Responsbile for data curation, investigation, supervision, validation, writing – review and editing.
	Authors	

Publication 4: *Project: Safer Births Tanzania* *Title:* Newborn resuscitation simulation-based skill-training and changes in clinical performance and perinatal outcomes: clinical observational study of 10 481 births. *Journal*: Advances in Simulation (Level 1) *Year*: 2022 *DOI:* *URL:* https://doi.org/10.1186/s41077-022-00234-z		**May Sissel Vadla, Robert Moshiro, Paschal Mdoe, Joar Eilevstjønn, Jan Terje Kvaløy, Barikiel Hhando Hhoki, Hege Ersdal**
	Short description	A 3-year prospective before/after clinical observational study including 10,481 births. **Findings:** Median time from birth to first ventilation decreased between baseline and phase 2, from 118 (85-165) to 101 (72-150) s, and time pauses during ventilation decreased from 28 to 16%. The proportion of high-risk deliveries increased during the study period, while perinatal mortality remained unchanged. This study was selected as an award-winning presentation at IMSH - the world leading medical simulation congress.
	Research group's contribution	Conceptualization, data curation, formal analysis, funding acquisition, investigation, methodology, project administration, resources, software, supervision, validation, visualization, writing – original draft, writing – review and editing.
Publication 5: *Project: Safer Births Tanzania* *Title:* Expired Carbon Dioxide during Newborn Resuscitation as Predictor of Outcome. *Journal:* Resuscitation (Level 2) *Year:* 2021 *URL:* *https://doi.org/10.1016/j.resuscitation.2021.05.018*	**Authors**	**Holte K, Ersdal H, Klingenberg C, Eilevstjønn J, Stigum H, Jatosh S, Kidanto H, Størdal K.**
	Short description	Observational study exploring and comparing expired CO2 and heart rate during newborn resuscitation with bag-mask ventilation of 434 newborns, as predictors of 24-hour outcome. **Findings:** Both expired CO2 and heart rate were independently significant predictors of 24-h outcome. CO2 increased before heart rate and may serve as an earlier predictor of survival. Survival at 24-hour was reduced by 17% per minute before CO2 reached ≥2% and 44% per minute before HR reached ≥100 bpm.
	Research group's contribution	Conceptualization, data curation, formal analysis, funding acquisition, investigation, methodology, project administration, resources, software, supervision, validation, visualization, writing – original draft, writing – review and editing.
Publication 6: *Project: Safer Births Tanzania*	**Authors**	**Perlman JM, Velaphi S, Massawe A, Clarke R, Merali H, Ersdal H.**
	Short description	Since 2010, the HBB and Helping Babies Survive training programs have been taught to >850 000 providers in 80 countries. Initial HBB training is associated with a significant improvement in knowledge and skills. However, at refresher

Title: Achieving Country-wide Scale for Helping Babies Breathe and Helping Babies Survive. *Journal:* Pediatrics (Level 2) *Year:* 2020 *DOI:* 10.1542/peds.2020-016915K		training, there is a knowledge-skill gap evident, with a falloff in skills. HBB has been associated with a significant reduction in early NM (<24 hours) and fresh stillbirth rates. To evaluate the large-scale impact of the growth of skilled birth attendants, we analysed neonatal mortality rates in sub-Saharan Africa (n = 11) and Nepal (as areas of growing HBB implementation). All have revealed a consistent reduction in mortality rates at 28 days between 2009 and 2018; a mean reduction of 5.34%.
	Research group's contribution	Conceptualization, data curation, formal analysis, funding acquisition, investigation, methodology, project administration, resources, software, supervision, validation, visualization, writing – original draft, writing – review and editing.
Publication 7: *Project:* Safer Births Tanzania *Title:* Positive End-Expiratory Pressure in Newborn Resuscitation Around Term: A Randomized Controlled Trial. *Journal:* Pediatrics (Level 2) *Year:* 2020 *DOI:* 10.1542/peds.2020-0494 *URL:* https://publications.aap.org/pediatrics/article/146/4/e20200494/79652/Positive-End-Expiratory-Pressure-in-Newborn?autologincheck=redirected	*Authors*	**Holte K, Ersdal HL, Eilevstjønn J, Gomo Ø, Klingenberg C, Thallinger M, Linde JE, Stigum H, Yeconia A, Kidanto H, Størdal K.**
	Short description	A randomized controlled trial testing resuscitation with self-inflating bag with integrated PEEP valve versus no-PEEP in 417 (near)term newborns. **Findings:** There was no difference in heart rate response, and 24-hour mortality was 9% in both groups. The PEEP group received lower tidal volumes. Our findings do not support routine use of PEEP during resuscitation of newborns around term. These findings were thought-provoking, knowing that many term newborns in high-resource settings are resuscitated with PEEP.
	Research group's contribution	Conceptualization, data curation, formal analysis, funding acquisition, investigation, methodology, project administration, resources, software, supervision, validation, visualization, writing – original draft, writing – review and editing.
Publication 8:	**Authors**	**Ersdal HL, Eilevstjonn J, Perlman J, Gomo Ø, Moshiro R, Mdoe P, Kidanto H, Hooper S, Linde JE.**

Project: Safer Births Tanzania *Title:* Establishment of functional residual capacity at birth; observational study of 821 neonatal resuscitations *Journal:* Resuscitation (Level 2) *Year:* 2020 *DOI:* *10.1016/j.resuscitation.2020.05.033* *URL:* *https://doi.org/10.1016/j.resuscitation.2020.05.033*	**Short description**	Observational study including 821 newborns of median (p25, p75) birthweight 3180 (2844, 3500) grams and gestation 38 (37, 40) weeks receiving PPV with ≥20 ventilations and complete datasets. **Findings:** The combination of increasing expired volumes, ECO2, and heart rate with decreasing inflation/expired volume ratios and constant PIP, suggests establishment of FRC during the first 20 PPVs in near-term/term neonates using a self-inflating bag-mask without PEEP, the most common device worldwide for ventilating non-breathing neonates.
	Research group's contribution	Conceptualization, data curation, formal analysis, funding acquisition, investigation, methodology, project administration, resources, software, supervision, validation, visualization, writing – original draft, writing – review and editing.
Publication 9: *Project: Safer Births Tanzania* *Title:* Distribution of heart rate and responses to resuscitation related to outcome among 1237 apnoeic term newborns at birth. *Journal:* Resuscitation (Level 2) *Year:* 2020 *DOI:* 10.1016/j.resuscitation.2020.04.037 *URL:* https://pubmed.ncbi.nlm.nih.gov/32422238/	**Authors**	**Eilevstjønn J, Linde JE, Blacy L, Kidanto H, Ersdal HL.**
	Short description	Observational study including 1237 term/near-term newborns with median (25th, 75th percentiles) gestation 38 (37, 40) weeks and birth weight 3140 (2750, 3500) grams who received bag-mask ventilation at birth. **Findings:** The first HR, measured median 102 (73, 144) s after birth following drying/stimulation, was distributed into two peaks with centres around 60 and 165 bpm, 51% were ≥100 bpm. After ventilation, the HR distribution shifted to a single peak, with median 161 bpm. The HR increase occurred over median 9.2 (6.2, 13) s, was 60 (43, 77) bpm, and 86% followed a ventilation sequence of 23 (16, 34) s duration. 72% of the newborns with first HR < 60 bpm survived following ventilations only.
	Research group's contribution	Conceptualization, data curation, formal analysis, funding acquisition, investigation, methodology, project administration, resources, software, supervision, validation, visualization, writing – original draft, writing – review and editing.

Publication 10: *Project: Safer Births Tanzania* *Title:* Fetal heart rate monitoring in a low-resource setting; continuous Doppler versus intermittent fetoscope – A randomized controlled study *Journal:* Int J Gynecol Obstet (Level 1) *Year:* 2018 *DOI:* 10.1002/ijgo.12648 URL:https://pubmed.ncbi.nlm.nih.gov/30120775/	**Authors**	**Mdoe P, Ersdal H, Mduma E, Moshiro R, Dalen I, Perlman J, Kidanto H.**
	Short description	A randomized controlled trial including 2652 women; 1340 received continuous fetal heart rate (FHR) monitoring and 1312 received intermittent monitoring. **Findings:** Continuous FHR monitoring detected abnormal FHR in 108 (8.1%) participants versus 40 (3.0%) participants in the intermittent monitoring group (risk ratio [RR] 2.64, 95% confidence interval [CI] 1.8-3.7; P<0.001). The increased detection rate in the continuous versus intermittent monitoring group was associated with an increase in rate of subsequent intrauterine resuscitations (89 [6.6%] vs 42 [3.2%]; RR 2.07, 95% CI 1.4-2.9; P<0.001). In total, 92 (3.5%) infants had adverse perinatal outcomes, with no significant differences between groups.
	Research group's contribution	Conceptualization, data curation, formal analysis, funding acquisition, investigation, methodology, project administration, resources, software, supervision, validation, visualization, writing – original draft, writing – review and editing.
Publication 11: *Project:* Safer Births Tanzania *Title:* Predictors of 24-hour outcome in newborns needing positive pressure ventilation at birth in a low-resource setting *Journal:* Resuscitation (Level 2) *Year:* 2018 *DOI:* 10.1016/j.resuscitation.2018.05.026	Authors	**Linde J, Perlman J, Øymar K, Schultz J, Eilevstjønn J, Thallinger M, Kusulla S, Kidanto H, Ersdal H.**
	Short description	An observational study including 757 newborns of gestational age 38 ± 2 weeks and birthweight 3131 ± 594 g receiving ventilation at birth; 706 survived and 51 died. **Findings:** An initial rapid increase in HR to >100 beats/min in response to treatment reduced the risk of dying by 75% (RR = 0.25; CI: 0.14, 0.44, p < 0.001).
	Research group's contribution	Conceptualization, data curation, formal analysis, funding acquisition, investigation, methodology, project administration, resources, software, supervision, validation, visualization, writing – original draft, writing – review and editing.
Publication 12: *Project: IPISTOSS*	**Authors**	Agnes Linnér, **Karoline Lode-Kolz**, Stina Klemming, Nils Bergman, Siri, Lilliesköld, **Hanne Markhus Pike**, Bjørn Westrup, **Siren Rettedal***, Wibke Jonas* (*shared last authorship)

Title: Immediate skin-to-skin contact may have beneficial effects on the cardiorespiratory stabilisation in very preterm infants *Journal:* Acta Paediatrica (Level 1) *Year:* 2022 *DOI:* 10.1111/apa.16371	**Short description**	A multi-centre (Norway and Sweden) clinical RCT from 2018-2021, including preterm babies between 28-33 gestational weeks. Infants were randomised to either immediate skin-to-skin contact for the first six postnatal hours (n=46) or standard incubator care (n=45), investigating cardiorespiratory stability/transition. **Findings:** The skin-to-skin group had an adjusted mean stability score of 0.52 points higher (p<0.001) on a scale from zero to six. Thus, immediate skin-to-skin contact for very premature newborns seems beneficial also in high-resource NICU settings.
	Research group's contribution	Conceptualization, data curation, funding acquisition, investigation, methodology, project administration, resources, software, supervision, validation, writing – original draft, writing – review and editing.
Publication 13: *Project: Safer Births Stavanger* *Title:* Changes in heart rate from 5 s to 5 min after birth in vaginally delivered term newborns with delayed cord clamping *Journal:* Arch Dis Child Fetal Neonatal Ed. (Level 2) *Year:* 2021 DOI: 10.1136/archdischild-2020-320179	**Authors**	**Peder Bjorland, Knut Øymar, Joar Eilevstjønn, Hege Langli Ersdal, Peter Davis, Siren Rettedal**
	Short description	Observational study describing changes in newborn heart rate from 5 seconds to 5 minutes with centiles in 898 vaginally delivered term newborns with delayed cord clamping at SUH. **Findings:** New nomograms were developed. The median heart rate increases rapidly after birth and peaks at around 1 minute after birth.
	Research group's contribution	Conceptualization, data curation, formal analysis, funding acquisition, investigation, methodology, project administration, resources, software, supervision, validation, visualization, writing – original draft, writing – review and editing.
Publication 14: *Project: Safer Births Stavanger* *Title:* A Randomised Controlled Study of Low-Dose High-Frequency In-Situ Simulation	**Authors**	**Joanna Haynes, Siren Rettedal, Jeffrey Perlman, Hege Ersdal**
	Short description	220 healthcare workers at SUH were randomized into two groups: 1) in-situ simulation training twice a month or 2) train as often as you wish for 9 months. **Findings:** Subgroup analysis comparing no (0) training (n=32) to at least monthly (9) training (n=43) identified a clear benefit to regular training. Simulated ventilation competence improved significantly for all participants

Training to Improve Newborn Resuscitation *Journal:* Children (Level 1) *Year:* 2021 *URL:*https://doi.org/10.3390/children8121115		over the course of the study, and inexperienced workers performed as good as experienced workers at the end.
	Research group's contribution	Conceptualization, data curation, formal analysis, funding acquisition, investigation, methodology, project administration, resources, software, supervision, validation, visualization, writing – original draft, writing – review and editing.
Publication 15: *Project: Safer Births Stavanger* *Title:* Tidal volumes and pressures delivered by the NeoPuff T-piece during resuscitation of term newborns *Journal:* Resuscitation (Level 2) *Year:* 2021 *DOI:* 10.1016/j.resuscitation.2021.12.006	**Authors**	**Peder Aleksander Bjorland, Hege Langli Ersdal, Joanna Haynes, Anastasia Ushakova, Knut Øymar, Siren Irene Rettedal**
	Short description	Flow-based T-piece resuscitators with a set inflation pressure (30 cm H2O) are commonly used during newborn resuscitation in high-resource settings, and this study reports the actual delivered pressures and tidal volumes. From June 2019-March 2021, 129 term asphyxiated newborns were included. **Findings:** There is a substantial variation in tidal volumes despite a relatively stable inflating pressure, and the delivered tidal volumes are at the lower recommended range.
	Research group's contribution	Conceptualization, data curation, formal analysis, funding acquisition, investigation, methodology, project administration, resources, software, supervision, validation, visualization, writing – original draft, writing – review and editing.

A full list of publications is found in the research group's website Safer Births (safer-births.com)

Table 6. Please add a list with the research group´s monographs/scientific books.
Please delete lines which are not used.

Not applicable

2.2 Research group´s societal contribution

Describe the societal impact of the research group's research. Consider contribution to education, economic, societal and cultural development in Norway and internationally.

Worldwide, there are over three million stillbirths and around three million new-born children die every year, most of them in low-resource settings. About three million of these deaths are due to lack of oxygen during childbirth. It is clear that the strong desire to make births safer for children and mothers in low-resource settings has contributed with knowledge on capacity development and simulation that will impact how medical personnel are trained in the future. The project has demonstrated a substantial impact on maternal and neonatal mortality and morbidity and therefore also on the household economy these women come from. In addition to improving every individual's health, the results of the project therefore has a larger effect on the empowerment of women and financial sustainability of households in the society. Program results have influenced international guidelines for the resuscitation of newborns and contributed to the development of better equipment for training and treatment that can be scaled up globally.

For the SBBC implementation to 30 hospitals in Tanzania, the estimated cost is 78 USD per life year gained. Scaling up to over 100 hospitals in five regions, that cost could come down to 32 USD and further down to 19 USD with national scale-up. If results in the best regions so far could be reproduced on a national scale, the cost could be as low as 6 USD per life saved. Compared with 100 USD considered by WHO to be the threshold of cost-effective interventions, the program has demonstrated both an initial, and potentially improved use of scarce resources.

In summary the Safer Births program targets the UN SDG's 1 (No Poverty), 3 (Good Health and Well-being), 5 (Gender Equality), 9 (Industry, Innovation and Infrastructure) and 10 (Reduced Inequalities). To meet the UN SDG 3 targets for maternal and neonatal mortality, countries need to make reductions at a significantly faster pace. Evidence-based solutions which have been tested at scale are key. We therefore believe SBBC will play a significant role on a global scale in the years to come. If scaled-up globally and implemented well, the SBBC program has the potential to save 250,000 lives worldwide, annually.

Table 7. ***The research group's societal contribution, including user-oriented publications, products (including patents, software or process innovations***
Instructions: *Please select 5–10 of your most important user-oriented publications or other products from the last 5–10 years with emphasis on recent publications/products. For each item, please use the following formatting.*

No.	Name of publication/product	Date of publication/product	Link to the document
1	Moyo Fetal Heart Rate Monitor, Laerdal Global Health	CE-marked and on the market since 2015	1. Moyo Fetal Heart Rate Meter (laerdalglobalhealth.com) 2. I Was Relieved to Know That My Baby Was Safe": Women's Attitudes and Perceptions on Using a New Electronic Fetal Heart Rate Monitor during Labor in Tanzania (ncbi.nlm.nih.gov)
2	Newborn Resuscitation Monitor, Laerdal Medical	CE marked and on the market since 2013.	3. Newborn Resuscitation Monitor (saferbirths.com)
3	Upright & Upright with PEEP Bag Mask, Laerdal Global Health	Upright has been CE-marked and on the market since 2014, while Upright with PEEP has been CE-marked and on the market since 2016.	4. Upright Bag Mask (laerdalglobalhealth.com) 5. Born not breathing: A randomised trial comparing two self-inflating bag-masks during newborn resuscitation in Tanzania (pubmed.gov)
4	Algorithms for automatic object detection on the videos	Work in progress.	6. NewbornTime – Improved newborn care based on video and artificial intelligence (uis.no)
5	NeoBeat Newborn Heart Rate Meter, Laerdal Global Health	NeoBeat has been CE-marked and on the market since 2018.	7. NeoBeat Newborn Heart Rate Meter (laerdalglobalhealth.com) 8. Comparison of Heart Rate Feedback from Dry-Electrode ECG, 3-Lead ECG, and Pulse Oximetry during Newborn Resuscitation (mdpi.com)
6	NeoNatalie Live, Laerdal Global Health	NeoNatalie Live was piloted since 2016, and officially launched in 2022.	9. NeoNatalie Live Newborn Ventilation Trainer (laerdalglobalhealth.com) 10. A Randomised Controlled Study of Low-Dose High-Frequency In-Situ Simulation Training to Improve Newborn Resuscitation (journals.lww.com)
7	Spedbarnsboken (Neonatal handbook) Siren Rettedal scientific editor)	Yearly updates 2007-2024	11. Spedbarnsboken 2023-24 (gobokhandelen.no)

Additional information about the innovations developed through Safer Births.

3. Challenges and opportunities

Information about the strengths and weaknesses of the research group is obtained through the questions above. In this chapter, please reflect on what might be the challenges and opportunities for developing and strengthening the research and the position of the research group.

Challenges to developing and strengthening research and position of the research group:

- A major challenge is the legal and technical structure and management of data at institutional level. Lack of up to date and efficient information management (IT) infrastructure reduces efficient data management and data sharing among researchers, for instance between SUH, UiS and HLH. There is also a suboptimal data management structure enabling efficient communication with, and inclusion of patients and study subjects. This is exacerbated by the complicated, and sometimes lack of and outdated legal frameworks governing data management and data sharing, in turn slowing down and creating unnecessary barriers when ethical issues are handled and approved (e.g. through REK, SIK or HOD application procedures).
- In addition, there is asymmetry between the size of the project, being one of the largest maternal and neonatal projects globally, and the size of the research administration and support from the collaborating partners, in particular the SUH. Increased administrative and research support would enable researchers to spend more time on data gathering, analysis, publication, policy integration and dissemination.
- Finally, it is difficult to recruit and involve clinical staff into the different components of the project. It is vital that clinical staff responsible for the day-to-day treatment and management of patients are available and involved in data gathering, analysis and dissemination activities. Staff are however not always available due to other pressing activities within the departments. They are also often reluctant to be involved due to uncertainties surrounding safety, security of information, governmental audit processes, legal and trade union expectations and requirements.
- All of these challenges are shared with other research groups, and would benefit from stronger political, bureaucratic and hospital leadership strategies and policies.

Opportunities towards development and strengthening research and position of the research group:

- New institutional and governmental collaboration increases populations size (N), range of contexts, verification of previous results and potential generalization of results and impact globally.
- Initial findings on implementation and educational strategies, in particular simulation methodology, contribute to the possibility of improving and expanding research on effective knowledge translation to secure sustainability and impact on a larger and wider scale. An example is the scaling up from a 30-hospital project to include all Comprehensive Emergency Obstetric Care hospitals in Tanzania, as well as the interest to adopt these strategies from several states in Nigeria.