Nina Tjomsland

Saving more lives – together

The vision for 2020

Dear Reader,

This book is a celebration. It is a story of warm bodies; it attempts to tell about thousands of people who are working together to save more lives.

“In our society, every fourth death is untimely,” said the CPR pioneer, Peter Safar. Åsmund S. Lærdal made it his company’s mission to help prevent untimely deaths. The scale and scope of this mission expanded dramatically after Millennium Development Goals 4 and 5 had drawn attention to the much worse figures for low-resource countries due to birth-related fatalities.

The book written at Laerdal’s 50th anniversary, “From Stavanger With Care”, told the story of the transition from the little clog – the company’s first logo – that brought joy to millions of children with its loads of books and toys to Laerdal Medical’s ground-breaking hi-tech systems and its range of simple and low-cost training programs for life saving. When the second book, “Saving more lives – together”, appeared in 2005, the company was increasingly involving itself in all three areas of the Utstein Formula for Survival: medical science, educational efficiency, and local implementation. The Chain of Survival illustrated the importance of each link, from the bystander to the professional health carers, emphasizing the need for networks and collaboration.

A major theme of this book is the ever-growing importance of collaboration and partnerships for the greatly expanded vision. As Laerdal celebrates its 75th anniversary, so many people and organizations are working together to reduce untimely deaths that my limited capacities and insight make it impossible to do justice to such a rich and multifaceted story. However, I am deeply grateful for the opportunity to be a tiny cog in this ever-growing system. My heartfelt thanks go to the numerous people who have generously and patiently given me their time, and in particular to Ken Morallee who has helped structure and quality assure the many observations. Moreover, Laerdal’s Art Director Bernt Erik Rossavik, who is responsible for the lay-out and a great number of the photographs, brings life and immediacy to this celebration.

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3rd of October 2014, a happy birthday at Haydom hospital in Tanzania

Regina's baby did not breathe when it was born, but Monica Tippe, one of Haydom's most experienced midwives, immediately started resuscitation, helping the baby survive. When the baby was brought to the Neonatal Unit, Mama Regina started bleeding heavily because the placenta was not complete when it emerged. Midwife Monica manually removed the remains and stopped the hemorrhage.

Opposite page: Thanks to a well-trained and well-equipped midwife, Regina and her baby were able to survive – and thrive.

Setting the boldest of goals

Helping save 500,000 more lives. Every year. By 2020. This is the audacious goal that the Laerdal companies established after a thorough internal process in 2013. Nothing less.

The Laerdal goal will be achieved by combining three contributing areas. Two of these refer primarily to high-resource countries: helping 50,000 more cardiac arrest and accident patients survive, and 50,000 extra lives saved through improved patient safety. Every year.

The third area, which has by far the largest potential in terms of the numbers of lives that can be saved, addresses birth-related mortality and the survival of children under five in low-resource countries. The goal here is to help save 400,000 more babies and mothers. Every year.

The key word in the 2020 goal is "helping". True to the company culture that goes all the way back to the founder Åsmund S. Lærdal, no-one would claim that the companies are saving lives. Well trained and equipped lay people, first responders, ambulance personnel and healthcare workers do. Laerdal's role is to help train and equip the rescuers. The way that this happens, and evolves, is what this book is about.

Fulfilling the goal requires wide and manifold collaboration, involving interaction between authorities, professional associations, official agencies and NGOs, via commercial and not-for-profit companies to foundations, research agencies, and end users. Moreover, for sustainability – lasting effect and continued progress – local ownership of programs for training

Halvard lives, thanks to his father

The 2-year old Halvard had fallen into the brook and been swept through a 200 metre long conduit under the field. Halvard's father Jan had just attended a 10-day lifesaving course in the Civil Defence. Cradling the lifeless boy, he ran back to the farm house, shouted for his wife, Rønnaug, to call for help, started CPR and kept it up until the Air Ambulance arrived.

When Halvard woke up in the hospital in Stavanger the next day, the doctors could tell the parents that the toddler would be all right – thanks to his father's training and action.

Ever since that day Halvard has been an inspiration for Laerdal employees. The companies' conference room in Stavanger bears his name.

Opposite page: Halvard, now a young and sturdy farmer, shows where his father found him. Lifeless.

and therapy is essential. This is a chain reaction: successfully implemented programs for helping save lives empower the users, provide income for the professional associations, and help them expand their capabilities.

It took 25 years from 1990 to halve the global death rate for children up to five years of age, from 9% to 4.6%.
Now, a new vision is to accelerate progress and halve this rate again in 15 years. This vision is expressed in the follow-up to the UN Millennium Development Goals (MDGs), set in 2000: the Sustainable Development Goals for 2016 - 2030.

Moving from bare statistics to lives that would have had a chance if only simple, low-cost, and essential care had been available, the current figures translate into close to one million newborns that officially die because they do not breathe on their own at birth, plus another million who are wrongly believed to be not breathing. Every year. Added to the two million lost babies are the over 280,000 mothers who die after giving birth. About 90,000 bleed to death, and eight out of every 10 could have been saved by simple action.

The eye-opening moment

Having invested his personal efforts and those of Laerdal Medical in helping save lives from cardiac arrest, accidents, and fatal medical errors, for nigh on 30 years, Tore Lærdal recognized the huge potential for reducing birth-related mortality during a 2008 visit to a hospital in Tanzania. During his brief stay, two babies were "stillborn".

Typically, about one out of every six newborns needs help to start breathing, and in most cases stimulating the baby's back will suffice. But seconds count. Those who need ventilation, need it fast in order to live, and live without the risk of brain damage. Trained birth attendants will recognize the needs instantly and act promptly and assuredly. Affordable and simple training programs for both mother and baby care are available, and ongoing research contributes to continuous improvements in implementation. All the programs result from collaboration, from the combining of skills, resources, contacts, and information. Progress spreads as these programs increasingly empower helpers by enabling them to acquire skills and build up confidence – even in outlying districts and without high degrees of literacy.

Effective rescue chain saved a long-distance runner

Having finished the marathon track of a triathlon event in Seoul, South Korea, Mr. Ha (53), suddenly collapsed. The emergency team from Hallym University Hospital arrived within 3 minutes. After 1 minute of CPR and a single AED shock, his heart resumed beating. He was still unconscious, but high quality hospital care had him fully recovered after a few hours.

A professional runner for many years, Mr. Ha had attended several CPR courses, and is able to appreciate fully the importance of an effective Chain of Survival. Having resumed running, he is now an enthusiastic CPR supporter on every marathon and all IronMan games.

Opposite page: Mr Ha, on track - now an enthusiastic and active supporter of CPR.

Strengthening the Chain

However, tools and programs have no effect unless they are fully understood, absorbed, and brought into use. Ever since physicians and engineers in Baltimore developed modern resuscitation, CPR, in the 1950s, numerous individuals, companies, associations and agencies around the world have worked to improve the rate of survival after a heart stops beating. The concept of the Chain of Survival, which was to become established in the late 1980s, links the bystander, the emergency dispatcher, the crews of ambulances and rescue helicopters, and the hospital. Just one weak link will drastically reduce the patient's outlook. The newest and simplest training program for bystander CPR, CPR Anytime using MiniAnne, was initiated by the American Heart Association and developed in close collaboration with Laerdal. Its efficiency has been proven by research, and it is highly affordable. Yet, in spite of concerted efforts to strengthen rescue chains and spread training, the rate of survival is still disappointingly low in most places around the world.

Currently, it is estimated that more than 1 million people die of sudden cardiac arrest each year in high-resource countries, with an average survival rate of less than 10%. There is therefore an ongoing need to improve the implementation of a strong Chain of Survival. This includes every link: training bystanders of every age from school children to retirees, and spreading the idea that the person doing CPR is never alone but can remain in contact with and be guided by an experienced dispatcher; and helping professional rescuers and hospital staff improve their skills. Aiming at collaboration that will raise the survival rate by another 5% by 2020 means helping to save 50,000 more lives each year.

Improving outcomes in emergency care

Emergency care represents a parallel challenge to the Chain of Survival. Medical errors are estimated to cause many hundreds of thousands deaths per year in higher-resource countries. Here, the helping save lives goal entails improving patient safety by promoting better and wider use of simulation education and related activities. Simulation programs have wide application, helping all types of healthcare professionals, from medical and nursing students via military medics and rescue crews to nurses and physicians, to train in teams. Such training hones skills and interaction while also providing the opportunity to make and correct errors and learning to discuss them as a routine.

Alive, thanks to suction and CPR

Rikta's baby did not breathe when she was born. But the baby arrived under a lucky star and with a Penguin suction device to hand: just one week earlier, the birth attendant Sakhina Begum had trained in the HBB program.

When stimulating the baby had no effect, Sakhina immediately performed suction and resuscitation, using equipment she had been given during training.

Within one minute, baby Taiyaba cried out, announcing that she was going to live.

Opposite page: Sakhina Begum helped Rikta's baby, Taiyaba, survive.

Improvements here can contribute to helping save a further 50,000 lives each year. Maximal implementation will require collaboration between professional associations, hospitals, educational institutions, and companies able to develop efficient training programs and equipment.

Empowering birth helpers

In 2000, the United Nations set a number of Millennium Development Goals. Goal 4 was for early childhood mortality to be reduced by two thirds and Goal 5 for maternal mortality to be reduced by three quarters from 1990 to 2015. By the late 2000s it was clear that the progress on MDGs 4 and 5 was unsatis factory; extra efforts were needed if the Goals were to be achieved. In 2008-2009, the American Academy of Pediatrics (AAP) developed the Helping Babies Breathe (HBB) program with support from Laerdal, and initiated implementation studies in several countries. In Tanzania, a study was conducted under the auspices of the Ministry of Health and Social Welfare, encompassing 80,000 deliveries in eight hospitals where the nurses and midwives had been trained in the HBB program. This study showed that newborn deaths during the first 24 hours had been almost halved.

By early 2015, the HBB program was being implemented in 75 countries, and an estimated 300,000 birth attendants had been trained. Also by then, constant communication around user needs and possibilities for further improvement, supported by research, had resulted in a range of programs addressing not only the need for help to start breathing, but also the two other main needs in the newborn period: preventing infection and complications among those born too early. And very important, integration of the neonatal programs with those directed at the mother - from the stemming of hemorrhage to family planning, and to programs for reducing premature birth - with the growing understanding that saving mothers also saves babies.

Currently, premature and underweight babies account for at least half of all deaths during and soon after birth. Many mothers need training and support to feed their babies adequately. Working closely with different collaborators, Laerdal has developed programs and equipment to train carers, including a simulator for inserting a device for birth control into the womb, plus wraps for so-called kangaroo mother care, KMC, and simulators to train mothers how to breastfeed their babies, including milk expression by hand.

Josh and his father Tommy.

The youngest team ever to save a life?

In TS Tiger Sea Cadets, the UK's oldest nationwide nautical youth organization, youngsters learn to handle boats plus "extra skills to give you a head start in life". Just six months after joining the Junior Section, 11-year old Josh Williams in Leicester had acquired the "extra life skills" to save his father's life, collaborating with the dispatcher, Collette Storr, when 56-year old Tommy Elverston collapsed.

Josh immediately called 999 and carefully followed Collette's instructions from the beginning: "I need you to place the heel of the hand on the breastbone in the centre of his chest", performing compressions until paramedics arrived after four minutes. After using a defibrillator and a state-of-the-art chest compressor they told Josh that his dad's heart was beating again. His response brought a tear to paramedic Rachael Cavill's eye: "Thank you, I am not ready to lose my dad yet."

The combined age of the team before the paramedics arrived was 29 years: Collette Storr was 18 at the time, and had completed her dispatcher training just two weeks before.

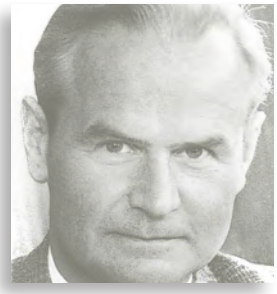
Opposite page: Collette Storr. Communicating with the distressed 11-year old, she managed to stay calm and competent: "I wanted to do whatever I could. All the emotions had to wait until the end of the call."

Stimulating interaction

"Intimacy multiplied by action is the key: being close to product users, meeting their challenges with what we have, and listening closely to how we can help meet their needs", says Tore Lærdal. "We are also entrepreneurs, and we can help our partners achieve their goals even better."

This all reflects and honors the guiding principles of the company's founder.

"If we can create value to the society at large, and do our job well, satisfactory economic results will follow – and allow us to build a stronger company with time"



Åsmund S. Lærdal

Laerdal employees around the world feel that their work has special meaning: they are all contributing to the mission of helping save lives. Åsmund created this rare company culture, basing it on his ability to understand both the patient's and the caregiver's needs. He was convinced that lasting success in business can only be achieved on the basis of an ability to listen, endless curiosity, practical problem solving, respect for the customer, and a passion for continuous improvement. Plus hard work – the endless hard work that such commitment demands.

His values run through the entire Laerdal 75 years' history, shaping the striving and achievements of every Laerdal employee.


EMERGENCY MEDICAL DISPATCHER
EMERGENCY MEDICAL DISPATCHER

Having sent Cleng Peerson to the US as a scout, the first organised group of Norwegian emigrants - mostly Quakers - left Stavanger on July 5th, 1825 on the one-master "Restauration".

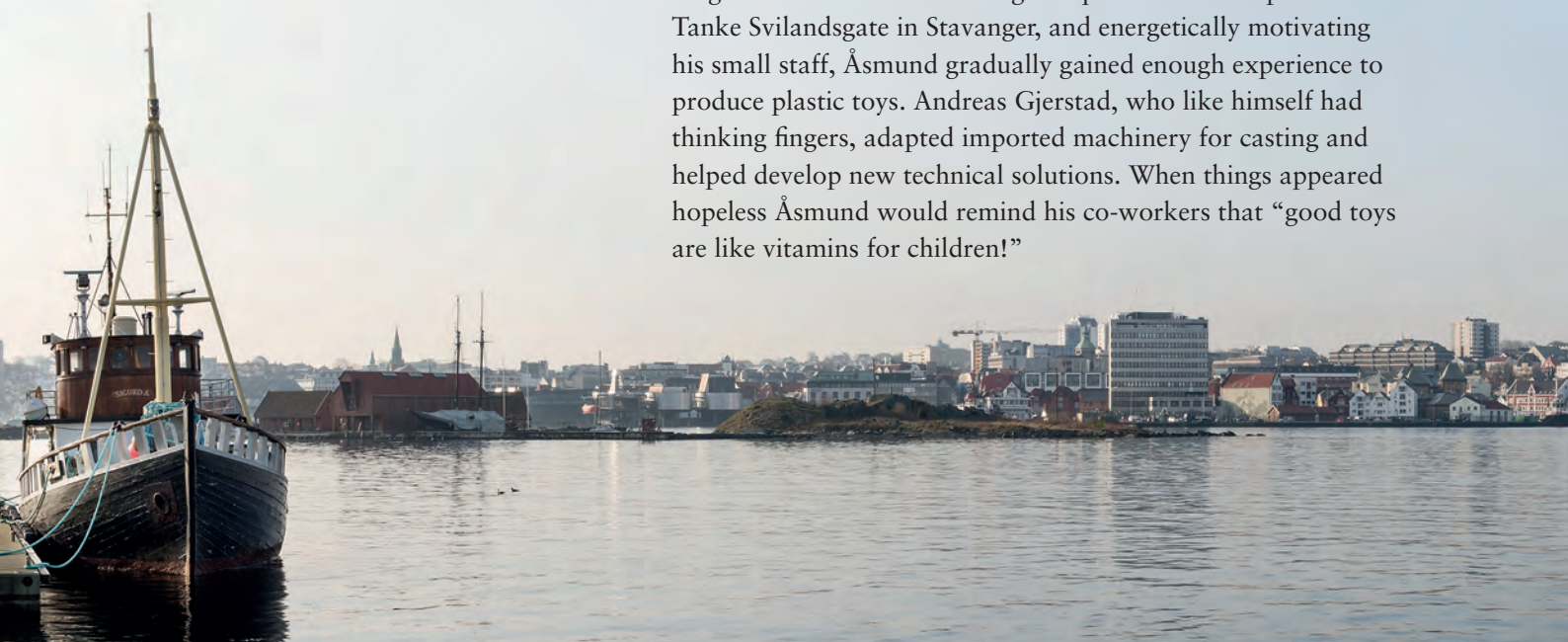
They were 52 in all, and the voyage took 100 days. Between 600,000 and 800,000 countrymen were to follow over the next 100 years.

Many years after that first crossing, Cleng Peerson led the first Norwegians to an area near Gatesville in Texas.

The way we came

When Åsmund S. Lærdal set up his company in 1940, he was convinced that only high quality products would make it sustainable. He was undaunted by the following five years of war and desperate lack of supplies. Wanting to offer beautiful books to Norwegian children he commissioned recognized artists to work for him. Motivating and enabling were other basic premises: his affordable "Barnas Ønskebøker" – children's wishes books – were treasures of puzzles and other tasks, aiming to stimulate creativity and involvement. Several times, he travelled illegally into the fjords to forest communities, under cover of the night, to buy the wood he needed for making attractive and hard-wearing toys.

Åsmund was an adventurer. As a teenager he had made bicycle trips on his own to Spain and through Russia to Greece. Soon after the war he flew to the US to look for new inspiration, and returned with the ingredients for soft plastics – albeit without the manufacturing know-how because industrial users wanted to protect their knowledge. He experimented with softeners, dyes, and temperatures in the oven at home, until his wife, Margit – who was pregnant with their youngest child, Tore – could no longer stand the smell. Moving the quest to his new premises in Tanke Svilandsgate in Stavanger, and energetically motivating his small staff, Åsmund gradually gained enough experience to produce plastic toys. Andreas Gjerstad, who like himself had thinking fingers, adapted imported machinery for casting and helped develop new technical solutions. When things appeared hopeless Åsmund would remind his co-workers that "good toys are like vitamins for children!"



By nature, he was an utterly demanding taskmaster, capable of expecting – and getting – the impossible made possible. From his closest collaborators – and from himself.

Never ever looking back, he developed life-like, beautiful and cuddly Anne dolls, and the indestructible Tomte cars. In 1960, Norwegian post-war restrictions on car sales were lifted. Boys dreamt of their families owning a car, and Åsmund's model maker, Bjarne Strøm, fed their dreams by ensuring that every detail on each model car was correct. At this time, Norwegians were building subsidized basic houses and, if possible, treating themselves to newly fashionable teak furniture. Bedrooms were tiny, but the new cars enabled children to play in the precious sitting room: "furniture friendly" cars would never make a scratch. The dolls came to dominate the European market, and the cars were sold all around the world – even in Hong Kong.

By 1964, Åsmund employed 100 people and his toys were sold in 65 countries. He was proud of providing steady employment, especially for women, in a part of Stavanger where a great many people had had to survive on seasonal work during brief herring and sardine fishing periods. Later, when the oil industry moved in on a big scale and wages and salaries shot up, he was always conscious of the importance of not being caught by excessive labor cost: his industry had to stay competitive. This legacy lives. Based in one of the world's most expensive countries, Laerdal maintains its position as a world leader in its field.

115 years after the "Restauration", another wooden vessel set sail from Stavanger for foreign coasts. The wooden shoe was Laerdal's first logo.

Since 1949, the Laerdal headquarters have been located here, overlooking the Stavanger harbour.

Karin B. Kvisgaard's collection of Laerdal toys forms a large part of the permanent exhibition in the The Norwegian Children´s Museum. With Solveig Otlo, she also wrote the book "Det var engang en tresko" about all the books and toys that Åsmund S. Lærdal produced.

A fairy tale in a children's museum

To mark the centenary of Åsmund S. Lærdal's birth, in 2013, his three children donated a special permanent exhibition to The Norwegian Children´s Museum in Stavanger: "Once upon a time there was a clog…The toys from Åsmund S. Lærdal."

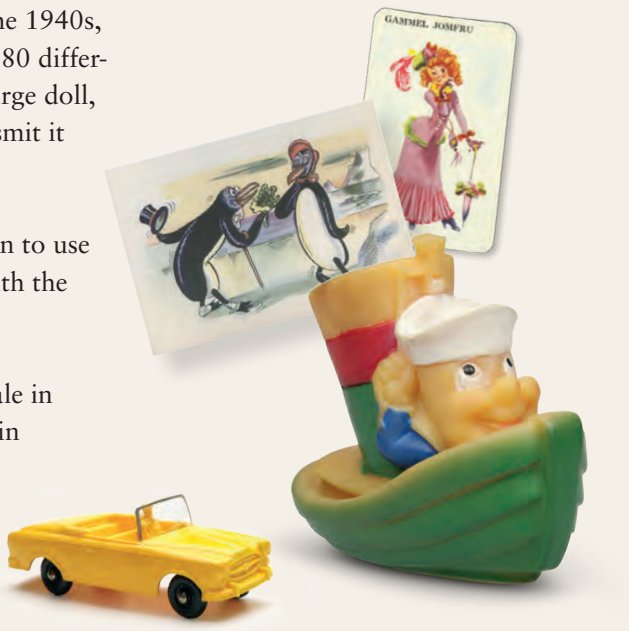
After the books, and the wooden toys from 1943 onwards, came the toys made of soft plastics. The Anne dolls were beloved by children all over Europe, and the production of Tomte model cars reached 100 million, exported to 110 countries.

Along with rich collections of books and toys, texts explain the founder's goal of creating enjoyment for children and set the

story in the context of the times - all the way back to the 1940s, when toys were rare and precious. A collection of over 80 different Anne dolls leads the children to a screen, inside a large doll, where they can make their own digital design and transmit it to friends.

The final display shows how Åsmund S. Lærdal went on to use his expertise in soft plastics to move into life-saving, with the Resusci Anne manikin.

The entire story presented in this exhibition is a fairy tale in itself, designed to follow up the founder's achievement in creating joy for children.



Stamps celebrate toy history

At first, the Norwegian national mail service, Posten, planned to use Laerdal Tomte cars as the motif for one of their two stamps to be issued in June 2015: toys that practically every Norwegian father and grandfather would recognize immediately. However, plans were adjusted when the project team saw the book that Laerdal produced for the opening of the permanent toy exhibition that was the company's gift to The Norwegian Children´s Museum, marking the centenary of the founder Åsmund S. Lærdal's birth in 1913.

With illustrations of all the toys that the company made through more than 35 years, this book testifies to the creativity as well as the sense of quality and aesthetics that are embodied in this great diversity. Plus the scope: not only was Laerdal Europe's dominating doll maker, but the Tomte cars gave pleasure to children all around the world.

PostEurop, the umbrella organization for all the national postal services in Europe, encourages its members to issue a set of new European stamps every year. For 2015, the Norwegian theme was to be historical toys. No other toy maker could match Laerdal's place in Norwegian toy history. The project team decided to use Laerdal motifs for both stamps: three Anne dolls for the NOK 14 issue, and a red fire engine in front of a blue Studebaker pick up for the NOK 17 one.

The issue date was June 5th – just two days before Laerdal celebrated its 75th anniversary. "We live to deliver" is the motto of Posten. In this case, the mail service echoes Åsmund S. Lærdal's drive to deliver joy to children. At least half of all Norwegians – both men and women - are likely to experience fond memories when seeing these two stamps.

With Åsmund's ever-awake eyes for detail, this Anne doll has been equipped with rollers and Lux soap, encouraging the proud owner to take extra good care of Anne's real hair.

Imitation wounds – for real

Åsmund S. Lærdal's approach to imitation wounds contributed in important ways to affirm the company culture. Finding that no-one was able to describe accurately the different types of wounds – for example a burn, a knife slash, a snake bite, a wound from exposure to radiation – he persuaded physicians in the A & E Department of the University Hospital in Oslo to let him install a camera for them to provide the necessary details. Collaborating with an experienced surgeon, he then created accurate models of relevant wounds.

The wounds could be cast in the same machine as the Tomte model cars. But finding a way to fasten the wounds on the "casualty's" skin, without hurting when subsequently removed, entailed testing more than 200 different types of glue. This detailed and thorough process resulted in Practoplast kits with 33 different wound imitations, 20 capsules of blood, glue, alcohol for removal, and color pens. These training kits were adopted on several continents, figuring in manuals such as the one produced by the German Red Cross, and are still in production.

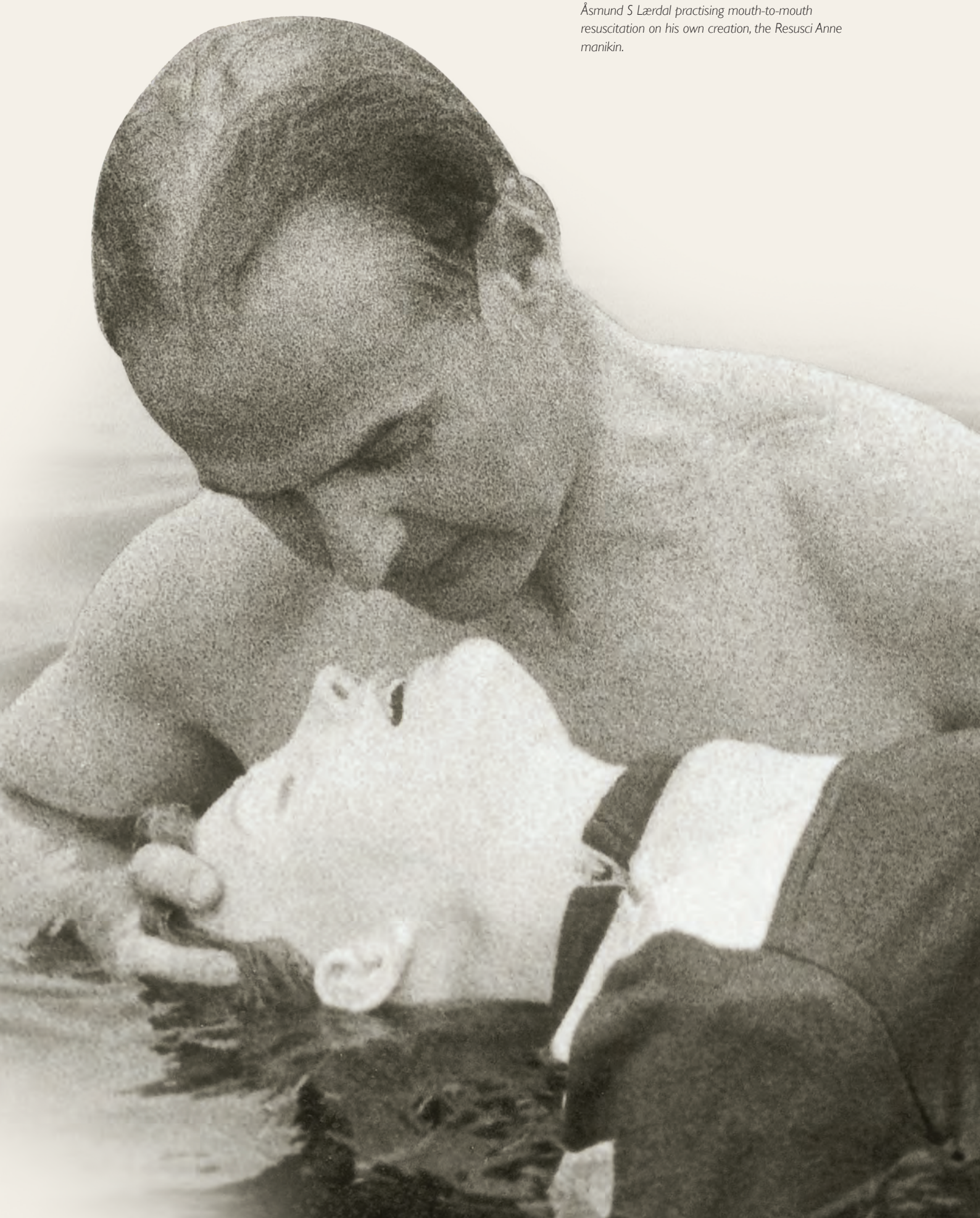
Two-year old Tore, alive thanks to his father's resourcefulness. Åsmund S. Lærdal found his son floating lifeless in the water, and quickly did what was necessary to open his airways and make him breathe.

Moving into life-saving

When the Norwegian Civil Defense asked Åsmund to use his plastics expertise to develop imitation wounds for training, his network expanded into the medical profession. The medical director of the Swedish Red Cross told him about a group of physicians and engineers in Baltimore who had developed a new and much better method for resuscitation, involving mouth-to-mouth breathing. Åsmund was instantly receptive – only a few years earlier, he had saved the life of his own two-year old son Tore by grabbing his inert body out of the water, slapping and shaking the toddler to clear his airways and stimulating him to breathe.

The big question was how people could learn the new mouth-to-mouth technique. Pondering the matter and after testing a face mask alternative for use on volunteers, Åsmund soon became convinced that a life-size manikin would be the best. He appealed to Stavanger's only anesthetist at the time, Bjørn Lind, for help, and the two worked closely together for a year to make every detail anatomically correct. Quality was an absolute, but at the same time the price had to be affordable: "It is much more meaningful to make 10,000 manikins at 1,000 kroner each, than 1,000 at 10,000 kroner." He was adamant: "when people choose to exchange their money for a Laerdal product, the exchange must benefit both."

The name was to be Resusci Anne – 'Anne' drawing a line back to the play dolls and the expertise needed to produce them. When people questioned the little-known word 'resusci', he never budged – and here, it is possible to draw a line 50 years forward, to objections that 'Natalie' is not a generally known term related to birth, nativity; the likelihood is that it will become almost generic, exactly the way that 'Resusci' has, and probably even more so. Which is quite a tall order: at the golden anniversary of modern lifesaving in 2010, AHA estimated that 3-400 million people around the world had been trained in CPR, most of them on Resusci Anne. CPR was recognized as one of the most important public health initiatives in the last two generations, and is estimated to have saved at least 2 million lives.



Åsmund S Lærdal practising mouth-to-mouth resuscitation on his own creation, the Resusci Anne manikin.

Working and playing together: Bjørn Lind and Peter Safar.

Instant connection with US pioneers

When Åsmund brought his prototype Resusci Anne to the US in 1960 and met the resuscitation pioneers, Peter Safar and Archer S. Gordon, the chemistry was instant, and Peter and Åsmund became close friends and collaborators. Safar's first suggestion was a chest ring for including compression training, and Lærdal complied – as always, intent on listening to user needs and ideas.

The burning question was implementation, how to inspire as many people as possible to learn at first the mouth-to-mouth technique, and eventually, some years later, full CPR, push-and-blow?

Having become a strong advocate, Bjørn Lind played a key role when manikins were used for the first large-scale training of school children. The outcome was scientifically recorded, analyzed and published in the *Journal of the American Medical Association*, *JAMA*. Norway had shown the way: every school-child can learn how to save a life.

New concept: the trained bystander

When the Norwegian Association of Anesthesiology organized the first international symposium on emergency resuscitation in Stavanger a year later, Åsmund S. Lærdal was both initiator and sponsor. The conclusion was simple and clear: first-aid workers of all categories, schoolchildren and the general public should be taught mouth-to-mouth resuscitation, and the training should be compulsory for all schoolchildren. At this stage, compressions were still considered too risky for lay people to administer, being reserved for medical personnel, nurses and certified lifesavers.

But in effect, the concept of the trained bystander had been born – the lay person who happens to be on the scene and is able to help when someone appears to be lifeless. In his quiet, almost self-effacing but determinedly efficient way Åsmund was a persistent key mover. He supported the production and printing in 12 languages of Peter Safar's CPR manual, and enabled Norwegian anesthetists to organize a new international symposium in 1967, which recommended that all health personnel should be trained in the full CPR method. Six years later, the American Heart Association (AHA) decided to recommend that also lay people should train in chest compression; any chest injuries would be outweighed by the chance of preventing lasting brain damage or death.

Denis and Lesley Chopin, performing in "The Legend of l'Inconnue".

Opposite page: Faye Hansson dancing the Girl from the River Seine.

A death mask became the face of life

In the 1950s, a person who did not breathe was considered dead. One big question was the face of the manikin: how could it appear dead, and yet not too scary to breathe into? Åsmund always immersed himself in a problem, thinking and discussing with his nearest collaborators and thinking again. In this case, he found the answer in a face mask in the home of his parents-in-law. Around 1900, a mask maker in Paris had been so struck by the serene expression of a beautiful young woman who was found drowned in the River Seine that he made a mould for the mask that became a best-seller, the enigmatic "L'Inconnue".

Åsmund asked the Danish sculptor who had shaped the face of the Anne dolls to create a face based on this mask for Resusci Anne. In this way, "L'Inconnue" has played her part in helping save at least 2 million lives around the world, and continues to convince learners that they are able and willing to act when a life is at stake.

When Denis and Lesley Chopin and the Mulberry Hawk group in the UK created "The Legend of l'Inconnue. An adventure in art and music" in 2012, they dedicated the stage production and the book that Lesley Chopin wrote with Joy Beresford Frye to the memory of Åsmund S. Lærdal.

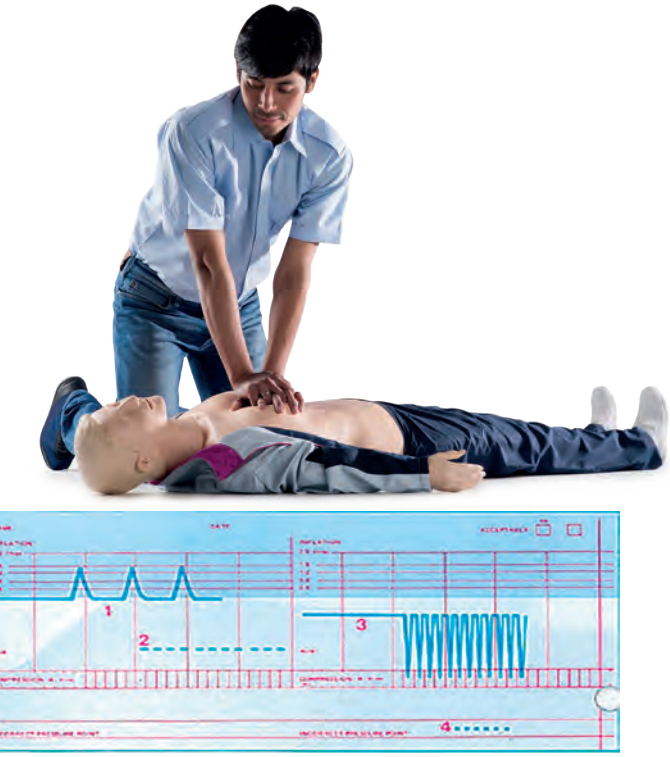
"Without Laerdal products, CPR would never have been implemented so rapidly and widely as was the case, in particular among lay people who are the vital first link in the life support chain"

Peter Safar

The key word in Safar's statement is "implemented". Tore Lærdal is firm about the fact that it is well trained and equipped lay people, birth attendants and other health care workers who do save lives.

Never satisfied with the status quo

Åsmund was always seeking to improve things. He kept listening to users and discussing needs for innovation with his gradually increasing network of specialists and users: what is required, what is possible, how simple and low-cost could the solutions be? Gradually, Resusci Anne gained a family, and became more sophisticated. One particularly significant development was Recording Resusci Anne that was launched in 1971 along with a flip-over training system. In recent years, both the theme of "training to perfection" and the flip-over systems have been given new and prolonged lives through the QCPR and Helping Babies Breathe concepts, respectively.



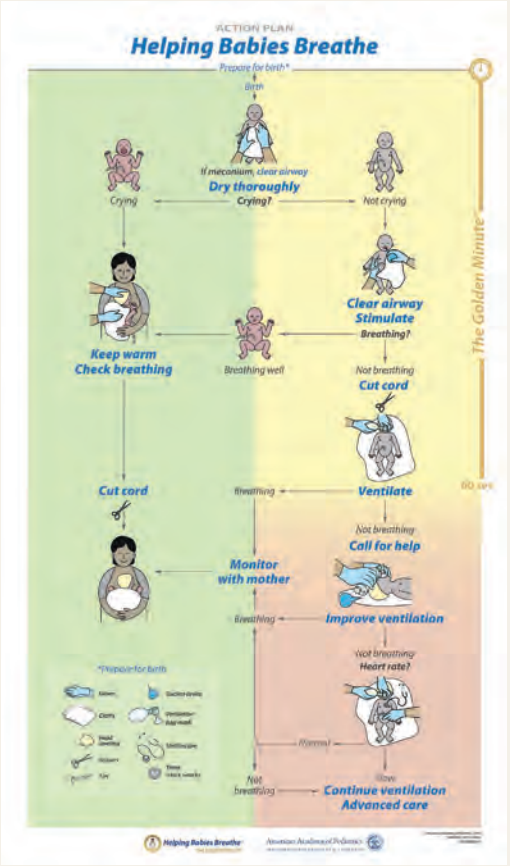
The Recording Resusci Anne provides feedback, printing out an accurate recording of ventilation and compression quality.

As various urgent needs became clear to him, Åsmund also responded with products ranging from a child intubation model to a pocket mask.

In the midst of all this creativity, US customs duties and copiers inspired Åsmund to establish the Laerdal Medical Corporation in Armonk, NY, in 1967; the first step in creating a multi-national company. In line with this, the Norwegian vowel 'æ' in the company name was replaced by the more easily internationally grasped 'ae'. The family, however, retained the Norwegian spelling of the name.

Within a few years, a new, simple and low-cost product was on its way. Research had shown that every fifth traffic death could have been prevented if help had arrived in the next car. Laerdal's car cushion first aid kit included a self-learning

Anne Jorunn Svalastog Johnsen and Harald Eikeland working to simplify the visual expression of the training programs.



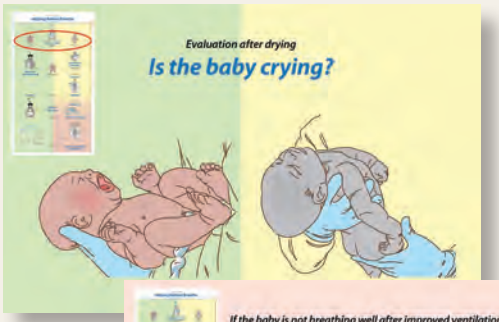
Complex algorithms are given a simple-to-grasp visual expression.

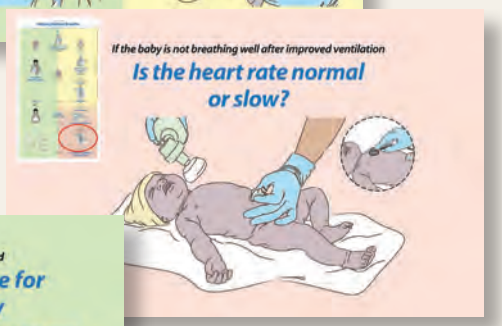
Visual expression is a key element

The anatomical modelling and facial expression of training manikins make them appealing and natural to relate to. In addition, the flip-over systems developed for Laerdal's resuscitation training programs have helped refine company expertise in producing clear and simple instructions. Key collaborators were Peter Safar, who took great interest in the psychology of learning, the Swedish physician Stig Holmberg, and the company's educational specialist, Harald Eikeland, together with the illustrator, Kurt Arnøy. Always striving to reduce information to only the absolute essential, they kept simplifying drawings and the use of words. As a tool for simplification, the learner information on the front side of the flip-overs was supplemented with teaching points for trainers on the reverse side. This two-way program helped trainers concentrate on key points and stimulate learners to grasp and retain better.

"Can you copy Arnøy's style?" asked Harald Eikeland when Anne Jorunn Svalastog Johnsen joined Laerdal as an illustrator in 1993. She passed the test: looking at her work, the seasoned illustrator declared himself unable to see the difference. He had been central in developing the visual expression that has become a key element in life-saving programs. The style is never fancy, but rather traditional and classic, and always anatomically correct. However, the realism must avoid being scary and off-putting. "Harald was extremely precise and demanding. Following his lead, we work things over and over and over again, and keep asking: is it possible to improve this further?" says Anne Jorunn.

Now, global health poses an extra challenge: to make posters which are multicultural icons and can be understood all over the world, even in areas with low literacy rates. The Laerdal illustrators often receive requests from doctors and nurses who are used to writing extensively without having to simplify and cut down to the essence. This entails a need to analyze, and to keep honing. Some of the results, the flip-overs, are also adapted to the different cultures in close collaboration with partners such as Jhpiego and AAP.





Laerdal's car cushion first aid kit

Laerdal's car cushion first aid kit, which was introduced in the 1970s, included a Norwegian "quarter" - 25 øre - coin for use in the nearest public telephone box. Now, the ubiquitous mobile phone not only makes for instant contact with the dispatcher who will then remain connected and provide running feedback; it also potentially enables the life saver to use the phone's capacity for transmitting a video of proceedings.

Moreover, by the rescuer's just pressing a button on the phone, the dispatcher can use the positioning system to plot in the exact location for the ambulance or rescue helicopter.

booklet with easy-to-grasp instructions. Marketing it as widely as possible and promoting its use became the responsibility of the 22-year old Tore, who had just graduated from the Norwegian Business School in Bergen and had wanted to work abroad – but was persuaded that he could make a difference at home.

He did. Over the next six years more than half a million motorist first aid kits were sold in Norway, which at the time had four million inhabitants. And about one million cars.

1978 was the year when toy production was discontinued. From then on, Laerdal was exclusively medical, as expressed in the stylized Good Samaritan logo. The mission was clear: helping save lives. That year, Åsmund S. Lærdal was the first non-physician to receive AHA's international award; in addition, he became the first honorary member of the British Association for Immediate Care (BASICS). His company provided steady employment for 300 people and had an annual turnover of about 100 million NOK.

A dream of helping people to help themselves

Even before starting his own company, Åsmund S. Lærdal had told his wife-to-be, Margit, of his dream to make so much money that he could afford to give away half. For decades he had provided direct financial support to the mission of saving lives, mostly behind the scenes. In 1980, he finalized his plans for the Laerdal Foundation for Acute Medicine and provided it with a starting capital of 10 million NOK.

Also, he began playing with the thought of handing over the company and devoting his energies to help low-resource countries. Notably, enabling people to help themselves. As he expressed it: not equipping them with tractors, but with better spades – here again, an attitude which points forward to the drive, achievements and vision of the subsequent Laerdal Global Health.

Safeguarding the company's independence

However, Åsmund became seriously ill, and died in November 1981 – before the fund's first award ceremony. His son Tore, who was not yet 30, but with the mission firmly in his blood, had to shoulder the full responsibility for running the company.

Tore and his brother Åge, a pediatrician, and his sister Astrid, a lawyer, owned the company jointly until 2004, when they moved

to ensure its continuing independence. A division of assets left Tore and his closest family as the sole owners of Laerdal Medical and now also Laerdal Global Health, and Hanne, Jon and Ingrid of the third generation have all chosen to work in the companies.

Innovation and implementation continued intensively after Åsmund's death. In 1982, the Laerdal Foundation helped initiate and support an international conference for CPR trainers in London, where AHA presented their growingly popular basic and advanced life support programs. This example from the US stimulated health authorities, schools, rescue organizations and Laerdal to collaborate on two projects for mass CPR training in the Stavanger region during the 1980s. Under the motto "Action Rogaland 1983: You can save lives", the first one demonstrated that an intensive two-hour course sufficed to train trainers, and that the 5,000 volunteer learners over just two weekends pointed to great potential.

These experiences formed the foundation for Stig Holmberg from Gothenburg to develop a Swedish CPR training model, primarily aimed at all healthcare personnel. Laerdal contributed with a training program and sponsored thousands of large posters for hospitals and health institutions. Here again, complex algorithms were given a simple-to-grasp expression, making it easy to learn. These posters proved so popular that special editions were added, for children and infants. Since the early 1990s, poster versions for both basic and advanced life support have been printed in many languages for the European Resuscitation Council, for displaying in thousands of hospital emergency rooms and training sites. In addition, pocket-size versions have been supplied for use as personal reminders.

Moving into hi-tech

American experiences also inspired Laerdal's understanding of the need for "heart starters", and the company's consequent move into hi-tech. For the first time, Laerdal decided to collaborate with another commercial company, First Medic in Seattle, to develop a "thinking" defibrillator. The first generation, Heartstart 2000, represented a potential major strengthening of the Chain of Survival. Its capacity to log vital medical data, including the patient's ECG, simplified proceedings to the extent that reservations dwindled against having out-of-hospital emergency crews use it. Although Laerdal was the third company to enter this field, the Heartstart 2000 rapidly became market leader, gaining an estimated worldwide market share of 70% by 1992.

The Good Samaritan

The story is ancient, of the traveler who selflessly saves the life of a total stranger. When Åsmund S. Lærdal in 1960 made it his mission to advance the cause of life saving, he chose the image of the Good Samaritan as the company logo. His father-in-law, Alexander Brekke, who was the town's leading surgeon, had used the motif for his Ex Libris. When Åsmund S. Lærdal asked his illustrator to use this image as the basis for the logo, the result was characterized by the clear, simple, and anatomically precise lines that remain part of the key to the Laerdal visual training programs.

Thirty years later, Tore Lærdal asked his associates around the world whether they still felt the symbol to be real and true. The response was overwhelmingly positive: the Good Samaritan image is inextricably tied to the company values and culture.

So the logo was modernized, and the three key words "helping save lives" were added to complete the expression of both the practical and the idealistic sides of the founder's spirit.

Laerdal
helping save lives

Previously, the crucial shocking to re-start a heart had only been possible in hospital settings. Now, the goal became to start CPR within four minutes after the heart stopped beating, out-of-hospital, and defibrillate within eight minutes.

During the 1980s, Laerdal Medical's internationalization progressed rapidly. Whereas the number of employees in Stavanger remained around 350-400, sales companies in eight countries and a production company in Portland, US, had increased the total to about 600.

The company's financial base was more than quadrupled with this expansion and the introduction of other new products in addition to Heartstart 2000, including the 1987 launch of Heartsim 2000, an improved heart rhythm simulator, and Skillmeter Resusci Anne which recorded the precise efficiency of the CPR effort and gave real time feedback on performance.

A flexible and vital alliance

International alliances also contribute to multicultural adaptation. A prime example is Laerdal's long-standing alliance with the AHA. Laerdal's purchase of Actronics, a company leasing an AHA-owned patent, opened for a vital alliance. Founded around 1980, Actronics was early in exploring the use of computers for training. Progressing from the initial magnetic tapes to laser discs for learning systems, the company needed venture capital, and AHA suggested Laerdal involvement. As Laerdal distributed AHA books and learning systems in the US, and other countries such as Japan, joint work progressed on e-learning.

Japan is a good example of Laerdal involvement through collaboration with AHA. By 2005, the Japanese Resuscitation Council had more than 40 AHA training sites for both BLS and ACLS, each with several instructors. That same year, the Laerdal sales organization in Japan was followed by one in Hong Kong, to cover the Greater China area where nurses and doctors were comparatively well trained, but bystander training required a major shift in attitudes.

Recognizing errors – and learning from them

Arguably, Laerdal's first venture into simulation training for lifesaving was Resusci Anne. However, in late 2000 the company

introduced its first simulator in the true hi-tech range, SimMan – whose electronic innards enable him to develop great varieties of symptoms and life-threatening states, to react according to the action, and provide vital feedback. The story runs all the way back to 1994, when the young Pittsburgh anesthetist-cum-engineer, John Schaefer, and his colleague, René Gonzalez, tinkered in order to equip an extremely costly simulator – which was reserved for research only – with crucial airway functions. Medical Plastics Laboratory (MPL) in Texas acquired exclusive rights to use their subsequent patent in its manikins, at a time when MPL and Laerdal were discussing a possible joint venture to update Resusci Anne. Laerdal engineers saw the potential in combining MPL's airway torso trainer with their own new HeartSim 4000 rhythm simulator. Laerdal acquired MPL around 2000, and testing was scheduled at five sites in Europe and five in the US throughout that year.

The project was transferred to Stavanger and feedback from the testing fed into an expansion and refining of SimMan's capabilities. The result, costing a fraction of previous simulators and eminently suited for training as well as research, was an instant hit; US involvement in Afghanistan and Iraq jump-started large sales to the military, and simulation centres were set up on several continents. By end 2005, 3,000 SimMan were in use worldwide.

According to Doris Østergaard, head of the Danish Institute for Medical Simulation, training programs with simulators have a vital second role, by making it natural and positive to discuss errors in constructive ways – thereby creating great potential for changes in healthcare cultures, and helping reduce the number of fatal errors.

SimMan and his numerous offspring are key elements in SAFER, the multi-disciplinary centre that was founded in conjunction with Stavanger University Hospital and University of Stavanger in a part of the Laerdal building complex in 2005.

The contrast: super-low-tech Mini Anne

At the same time as SimMan was rapidly revolutionizing the team training of professionals, AHA challenged Laerdal to develop a dramatically simplified video-based CPR program for lay people that could be delivered in 30 minutes - compared with 2 to 4 hours for traditional courses. 30 years after pioneers prepared the ground for mass training, the number of

Hi-tech simulation training in teams -

bystanders ready and willing to act immediately was still far too low in many communities. The program had to include complete and efficient hands-on training, and yet the materials should cost less than $30.

After testing out ten different versions developed by Harald Eikeland and Jens Petter Janke and discussing them with AHA counterparts, Laerdal presented the final MiniAnne prototype program in mid-2003 and agreed to sponsor extensive evaluations. The Laerdal Suzhou plant started mass production in 2005; AHA launched the kit in New York soon after, under the title CPR Anytime, and the insurance foundation Trygfonden collaborated with the Danish Resuscitation Council and Red Cross to offer a MiniAnne to every 13-year old in Denmark. Training the young, who will live the longest, is of course vital. But the possible spin-off includes training the potential life-savers that will be faced with the majority of heart arrests, in their homes: the elderly. When each pupil trains during a school lesson, brings the kit home and challenges family and friends to learn, implementation can spread quickly.

The five-year gestation of Laerdal Global Health

In 2006, important new contacts drew Laerdal's attention to the area which now accounts for the largest share of the company's Helping Save Lives goal for 2020: maternal, newborn and child health.

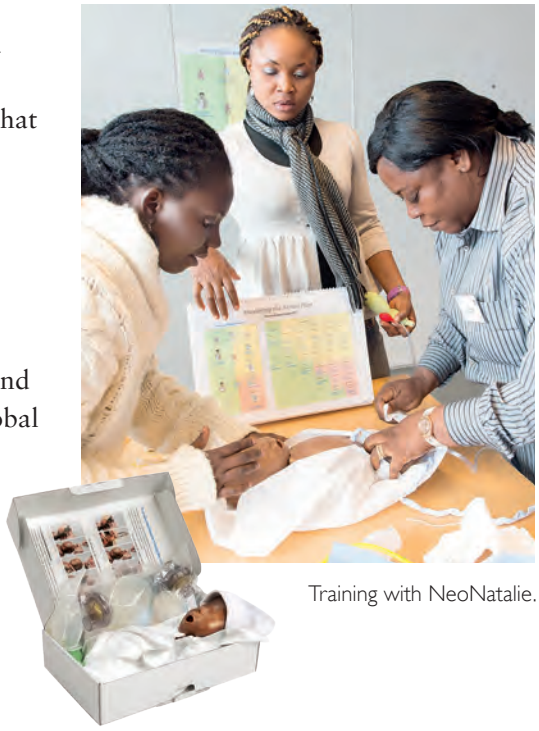
The American Academy of Pediatrics (AAP) also believed that the crux of simulation is neither the simulator nor the technology, but an educational methodology: teaching geared to enabling. AAP and Laerdal partnered to help advance educational science and resources needed for training in neonatal resuscitation.

AAP had been early adopters of simulation-based training, and had collaborated with AHA to create a course suitable for the US. Many cultures had wanted translations, and the Newborn Resuscitation Program was being used in 120 countries. It was, however, too complex and resource-demanding to be widely applied in low-resource countries, as the increased attention through the Millennium Development Goal 4 made clear the need for a new approach.

The call for radically simpler and affordable training appealed to Tore: Laerdal was already collaborating with AHA and AAP, and the MiniAnne and MiniBaby programs demonstrated its

- and the revolutionary MiniAnne for self-learning.

capability. In close collaboration with AAP, a Laerdal team developed what was to become the NeoNatalie simulator, and helped the AAP task force develop the first draft action plan. Helping Babies Breathe (HBB) was on its way – the program that teaches birth attendants to clear a non-breathing baby's airways, to stimulate it and if necessary use bag-mask ventilation. These basic skills can help 99% of the otherwise doomed babies to live.



Training with NeoNatalie.

In late 2009, Lily Kak, the USAID lead person for newborn health, contacted Laerdal. Having seen the strong interest in and potential for the HBB project, she proposed establishing a Global Development Alliance to support its implementation. Enthusiasm was catching: within three months, Save the Children, AAP, The National Institute of Child Health and Human Development, USAID, and Laerdal had joined forces as founding partners of this alliance.

The collaboration with AAP opened doors and helped LGH establish new contacts. When giving a presentation at the US Embassy in Tanzania, Tore met a representative of the Baltimore based Johns Hopkins University affiliate, Jhpiego. The potential of working together was clear immediately: Jhpiego had more than 35 years' leadership experience in strengthening health systems in low-resource settings, and had built up a wide network of contacts through involvement in 60 countries. However, its printed manuals had not made any use of pictures or color.

"We often forget that non-literates can be intelligent and capable"

Harshad Sangvi

"There is no need to marginalize poor people. The Laerdal materials are so visually attractive, simple and clear that even non-literates can see, understand, and learn" says Harshad Sangvi of Jhpiego.

Close contact with alliance partners, professionals in the field, researchers, and end users, keeps adding functions to training programs, inspiring new alliances for both development and implementation. The basic requirements hold: simple, afforda-

Ingrid Lærdal and Ferdousi Begum in Bangladesh.

A motivating eye-opener

Ingrid Lærdal experienced a deeply motivating eye-opener when she travelled with her father to India in early 2009, listening to discussions about NeoNatalie at a pediatricians' conference and glimpsing the rich and diverse culture; the enormous differences between five-star hospitals and those caring for the underprivileged made a lasting impression. She immediately put all her energies into her first task, as LGH's general manager. Now, she heads LM operations in the Nordic countries.

ble and truly efficient training programs and equipment to help mothers and babies survive and thrive - all based on Åsmund S. Lærdal's core values.

Together with its partners, Laerdal has great experience in implementing and bringing about practical changes. "Normally, a published article may lie ignored for five years before someone notices, and even then it may take five more years before someone makes use of the material", says Hege Ersdal. "Without collaboration, the programs would have lacked the excellence they now have, and taken much more time to develop."

"The entire Survive & Thrive alliance is waiting eagerly for elucidating research"

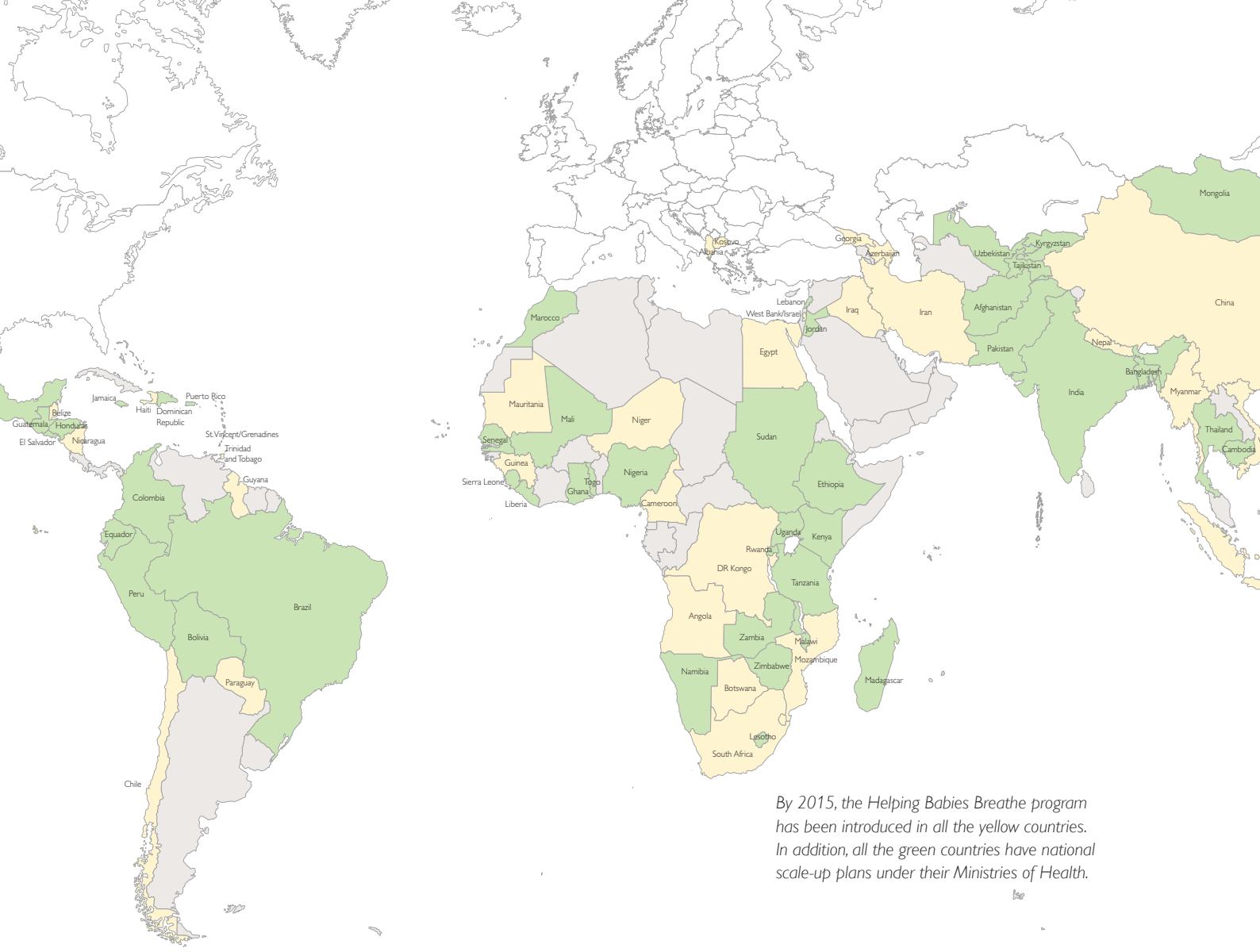
Hege Ersdal

Laerdal Global Health

As different possible alliances were evaluated, one complication stimulated a major Laerdal move. Because powerful potential partners harbored strong reservations about working with commercial companies, Tore Lærdal established the not-for-profit Laerdal Global Health (LGH) in 2011. He then turned virtually all of his own attention to this new venture, becoming the managing director of an entrepreneurial team, assisted by his daughter, Ingrid.

The LGH vision is helping save 400,000 more lives a year, by 2020. This goal is symbolized by the LGH logo, a companion to the Laerdal Medical Good Samaritan. The contours in the new logo are mother and baby, Mira and Shifa – the first official saving-of-a-life by the HBB project in Bangladesh.

According to Harshad Sangvi, LGH has contributed greatly to helping the global health community build trust in public private partnerships.



By 2015, the Helping Babies Breathe program has been introduced in all the yellow countries. In addition, all the green countries have national scale-up plans under their Ministries of Health.

Another involved physician who sees a cultural change is Hege Ersdal, whose current world-renowned research on newborn resuscitation was triggered by her PhD study starting in 2008, on the evaluation of the HBB program in Tanzania:
"My profession generally disapproved of collaboration with a commercial company. I was warned that close collaboration might well harm my research career, but I saw that the joining of experience and competencies would enable us to bring about rapid improvements. Instead of each of us sitting on our own little hill, we had to work together. I am truly privileged to do research in collaboration with Laerdal, because the resources are made available so quickly, and research findings can be implemented much faster."

The Upright Resuscitator helps overcome the problem of mask leakage and is easier to clean between uses than conventional newborn resuscitators.

Mobilizing lifesavers in the community

Dramatically different thinking

After more than 60 years, bystander action – the first and crucial link in the Chain of Survival – is making rapid, major progress thanks to research, innovation, and wide collaboration between academia, commercial companies, professional organizations, educators, communities, and individual drivers who ensure that new programs are adopted. Faster and wider. The energy is palpable: locations such as Denmark, the Nowon district of Seoul, and Singapore are sending survival curves steeply upwards, approaching the well-known leading communities of Seattle and Stavanger.

The first step was developing a greatly simplified and truly affordable training program for life saving. Next came studies leading, quickly, to a new approach which makes for far better retention of skills, building the confidence required for acting when seconds count. At the same time, the spreading of mobile phones all over the globe opened for shedding the idea that the bystander providing CPR is all on his or her own - through the phone, the dispatcher remains in contact throughout, supporting and providing feedback. Such innovations encourage community programs where volunteer trainees learn the skills required to save someone they know, and keep their knowledge active by frequent refresher sessions.

Opposite page: Mobile interaction between the rescuer and the dispatcher.

Tore Lærdal and Clive Patrickson with AHA colleagues, John Meiners, Executive Vice President of Emergency Cardiac Care and Global Strategy, and Meighan Girghus, Chief Mission Officer.

"Laerdal acts as a catalyst"

The AHA partnership with Laerdal goes back many years, but was formalized in 2005. According to John Meiners, "this is a partnership that brings together the science and educational leadership of the American Heart Association, with the technology and know how of Laerdal".

The AHA has full time advocates that are focusing on ensuring CPR is a part of the graduation requirements for high school, and reaching the community with campaigns to improve cardio-vascular care. It was the collaboration in the development of MiniAnne which resulted in the CPR Anytime kit, for teaching these life-saving skills in just 22 minutes. "We have found that Laerdal helps the AHA to think differently, acting as a catalyst to challenge the way things have happened historically," says John Meiners.

"The entire field is in continuous progress" says Tore Lærdal. "We know that much is lost during teaching, and that memory loss sets in soon after a training session. Identifying the needs, and building on research, we work with our partners to keep improving the methodology: better training, and then working to counter memory loss and maintain competence over time, leads to stronger motivation."

2002 was an important year for what has developed into a revolution: much better and more efficient training of large numbers of potential bystanders, of all ages from schoolchildren and up. Although training programs had been widely available throughout almost four decades, and several hundred million people had attended courses to learn the method, survival rates differed greatly. Not only from country to country, but also between neighbouring regions. King County, Seattle, where Leonard Cobb, Mickey Eisenberg, and colleagues had established a strong Rescue Chain, led the field, and among others, Stavanger was rapidly catching up. But in many cities people who suffered sudden cardiac arrest out-of-hospital were up to 20 times less likely to survive than patients in the best functioning areas.

Eisenberg later drew up 10 steps that any community can take to improve its system, and thereby increase the potential for survival. "Community" is a key word, in the sense of caring for your family and your neighbour. With 70 to 80% of out-of-hospital cardiac arrests occurring at home rather than in public places, the vast majority of rescuers are trying to save the life of someone they know. The mission was becoming clearer and emotionally appealing: be prepared to save the life of a loved one.

The task is complicated in multiple ways, including a psychological gap between practising on a manikin and actually working to save a life. Research showed that in many cultures the majority of people who had attended courses lacked the confidence to start CPR, and limited their action to making an emergency call.

Motivating all ages, including seniors, to learn

In this picture, age is an important factor. Since elderly people are most at risk, the typical bystander in the home is at least 50 years old; an age group that had been rather sparsely represented in previous training campaigns. The AHA concluded that "we will never reach our goals of training 20 million citizens in CPR annually without dramatically different thinking on how the message is delivered." Seeking to appeal to all age groups, the AHA envisioned a revolutionary simplified video-based course.

The main challenge was to create a personal trainer, enabling a course that could have 10-15 minutes individual practice time and make it possible for each trainee to take the kit home and train family members and friends.

It was at a strategy meeting in Florida in 2002 that the AHA asked if Laerdal Medical could develop a training program that met all these requirements. The company's Director of Strategic Education Projects, Harald Eikeland, had 30 years' experience in CPR education, and had always stressed the need to apply optimal learning methods. A low-cost program appealed strongly, because it could be used to refresh skills and help break down psychological barriers. Together with Jens Petter Ianke and Ottar Kvindesland, and in dialogue with the AHA, he helped develop and test ten different versions of a manikin.

The final prototype was presented to the AHA in the middle of 2003. The company agreed to sponsor extensive evaluations of the program, complete with a self-learning video, in Portland, Dallas, and Stoneybrook, New York. This project was co-ordinated by Clive Patrickson and Jerry Potts, Director of the AHA Emergency and Cardiac Care programs. The conclusions were clear. The short "CPR Anytime" program was at least as effective as traditional training. MiniAnne was ready for her debut.

The company's new factory in Suzhou, China started mass production in early 2005. Ten years later, the kit is available in over 30 versions and 20 different languages, and a total of more than 4 million kits have been sold.

AHA's 2011 advisory statement on Dispatcher-Assisted CPR pointed to vital new findings about educational efficiency, also regarding the potential bystander. Analysis showed that science had been concentrating on the last two links of the Chain of Survival: little had been known about the first two, bystander and dispatcher and the connection between them. New research studied how dispatchers can advise people even better and know more about the quality of what happens in the homes. These findings are feeding straight into the development of better training programs for both bystander and dispatcher.

Danish schoolchildren leading the way into the home

Although training of schoolchildren in CPR had begun in Norway in the early 1960s, widespread implementation in other countries had been inhibited by the time needed for training and the cost of materials. The CPR Anytime concept now removed

Jens Petter Ianke, Ottar Kvindesland and Harald Eikeland discuss a MiniAnne prototype.

Paring down to the vital functions

"Our single starting point was the structure of the course, and we tested numerous ideas" recalls Jens Petter Ianke. "Low-cost devices must be pared down to the vital functions, and yet be appealing to the learner and intuitive to understand."

The team had to find precisely those simple mechanisms that are essential. They started with a sturdy envelope, drawing nipples on it and blowing air into it through a thin tube. They added a face mask, tested the principle of an inflatable bathing ring but were unable to prevent leaking, and concluded by switching to the doughnut principle, and fine-tuning it. The resulting manikin had to be small enough to fit into a book-sized kit when deflated, together with video and instruction book. This was an absolute requirement, because the kit had to be easy to send in the mail and place on a bookshelf.

The Danish achievement stimulated initiatives in other countries and, by 2013, the city of Münster in Germany had won a place in the Guinness Book of Records by having 11,800 school children train lifesaving simultaneously.

The German Minister of Health, Daniel Bahr, joined the 11,800 record makers.

these barriers but, equally importantly, MiniAnne paved the way for entering the home and training the over 50s. The pioneers were to be Danish 13-year olds. Collaborating with the Danish Resuscitation Council, the Red Cross, and the schools, the Tryg Foundation funded a campaign offering a free kit to every 13-year old in the country. The proof of ability was clear from the first class in Copenhagen: after the children had watched a brief case history, the video instructed them how to proceed. Many were surprised at the pressure required for the confirming click. Some grasped the moves immediately; others needed a little time for the body to find the correct position with straight arms and using body weight to apply force. Soon the entire class were able to do it, determinedly and in step with the beat from the video. After the session, they were quiet and thoughtful – but the body language was expressive: "I'm empowered, I can really do it!"

They were indeed empowered – also to spread the mission. Each child brought the kit home, with the idea of encouraging as many friends as possible, and at least three family members, to spend half an hour using the program and mastering the technique. Drawing supportive media attention, this pilot project led to systematic training in schools over a longer period. Its effectiveness was confirmed by significantly improving survival rates: over a few years, they have risen from 3% to more than 10%. According to Freddy Lippert at the Emergency Medical Services in Copenhagen, the project helps build public awareness of the benefits of bystander CPR, and inspires the making of CPR courses mandatory for obtaining a driver's license.

In Norway, progress is temporarily slower after the Norwegian Air Ambulance had to discontinue its successful schools funding program in 2010. In only three years, this program had resulted in 15% of the Norwegian population being trained.
However, intensive efforts are planned to rectify the situation and bring the country back into a leading position.

"The Danish school CPR program has probably more than any other factor contributed to the tripling of survival from pre-hospital cardiac arrest over the past ten years"

Freddy Lippert

Training a nation of lifesavers

In the UK, Laerdal is collaborating with the British Heart Foundation (BHF) in its "A Nation of Lifesavers" campaign to implement community CPR programs across the country. This partnership is currently formalised through a five-year contract: "It is a privilege to work with the BHF and be part of their program, using our experience from Scandinavia and the US," says Jon Lærdal, Managing Director of Laerdal Medical Ltd.

The BHF is the leading independent funder of cardiovascular research in the UK, in the order of £100 million a year. Also, the organization has been instrumental in funding early defibrillation programs and CPR community campaigns for many years.

However, by the early 2010s still only one in five of patients suffering cardiac arrest outside hospital in the UK received bystander CPR, and only about eight out of every 100 survived. A new approach was needed to enable the acceleration of CPR programs. This came with the BHF's "Call. Push. Rescue" program focusing on chest compressions for adult cardiac arrest and ventilations where needed, and the development by Laerdal of a special version of MiniAnne tailored to the program's needs. This program is now a key element in BHF's new strategy for mass training in communities, schools, and corporations. The statistics point to the potential: each year, 175,000 patients are admitted to hospital because of heart attack. The current goal for the Nation of Lifesavers initiative is to save 5,000 extra lives a year out of the 30,000 cardiac arrests that occur outside hospitals. Andy Lockey represents the Resuscitation Council (UK) in a joint approach with the BHF - lobbying for mandatory

As a parallel to Denmark, UK children are spending a school lesson training with the CPR kit and then taking it home, encouraging family and friends to learn the technique. This program was launched in York, England, in September 2014, when in one day, more than 11,000 14-year olds learned how to save a life.

Helping kick off the Nation of Lifesavers program in Fulford School, York: (left to right) Dan Morland, Emma Wright, David Whiting, Jon Lærdal, Taig Genet. Behind: Philippa Walters and Steve Overton.

13-year old Hanne Haug, in Våland School, Stavanger, training to become a lifesaver.

inclusion of emergency life support skills in the school curriculum. But this notwithstanding, the BHF is offering free of charge CPR kits to all secondary schools in the UK. Just six months after the launch, acceptance of the program was greatly beyond expectations. Each set of 10 kits can be used for training in class, after which the students take turns to bring them home for a fortnight, encouraging family and friends to train; in this way, the school can stage regular refresher training sessions for all ages from 14 and up with the re-usable sets.

Among other initiatives, the BHF supplies in-house training programs to companies and organizations, sparing them the cost of sending people away for courses. An example is the Barclay's Bank project to train 10,000 employees in 10 days – and keep them trained through refresher sessions.

Another element in the project is the 745 BHF retail shops around the country. To a large extent, these shops are run by motivated volunteers who will not only offer the CPR kits for sale, but also for borrowing. Moreover, Laerdal is advertising the BHF-branded kits for sale on its web site.

"We have different strengths, and different networks. In Laerdal, we have exclusive tools. We have consistently strived to fulfil our mission of helping save lives, over a long time. This is best achieved through alliances with partners sharing our mission, where we can help our partners achieve more," says Jon Lærdal.

Involving the community

In the US, the AHA has emphasized the importance of community involvement ever since the Emergency Cardiac Care Update conference in late 2004, which they organized in collaboration with the American Red Cross and the Citizen CPR Foundation. The AHA kit bears the key words "Family and Friends" and "CPR Anytime": a clear appeal to the community aspect, to the overwhelming likelihood of the patient being someone the potential rescuer not only knows, but is close to.

Concerted efforts are bringing about significant change in many parts of the Western world. In the US, almost 20 states had made CPR training mandatory for graduating from high school by 2015, and persistent lobbying promotes further adoption of the rule. Networks are growing exponentially, also globally. Ben Bobrow has acted as trailblazer in his home state of Arizona and is working to promote dispatcher training and collaboration as

widely as possible all over the US. He also serves as an advisor to EMS systems in a variety of countries in Asia.

You are never alone

Previous manikin studies of elderly people's performance had shown disheartening results, with low CPR quality and poor skill retention. However, a research program at the SAFER centre in Stavanger, published in 2010 and involving Tonje Birkenes and Helge Myklebust from Laerdal, found that lay persons aged 50-75 are capable of performing 10 minutes of CPR with satisfactory quality when training is supported by verbal coaching and visual feedback. Reassuringly, no participants developed a faster pulse while practising CPR than when walking rapidly. Not only did they handle the task satisfactorily during the training session, but with the presence of the training kit in their homes they were able to retain their skills well enough to perform adequately 5-7 months later.

This study and subsequent studies from the same team have indicated a great potential for improving CPR training programs aimed at this important age group and thereby help increase survival.

One greatly encouraging factor is the insight that with the help of the ubiquitous mobile phone - it is estimated that there are now more than 7 billion mobile phones in use in the world, an average of one for every man, woman and child - the bystander no longer has to be alone. Although provision of CPR instructions by the dispatcher is not new - it has been endorsed in CPR guidelines and implemented by leading EMS systems for more than 20 years - widespread use has been lacking. Use of a landline is problematic for a single rescuer unless the lifeless body is conveniently close to the phone. The mobile phone changes that. But equally importantly, new research points to the great benefits to be achieved from integrating interaction with the dispatcher into the lay rescuer CPR course through role play. This prepares the learner for working with the dispatcher if called upon to perform resuscitation in the future. Such interaction addresses the issue of poor skill retention with the dispatcher refreshing in real time what the rescuer learned on his or her CPR course.
In addition to the integration of role play into the training, yet another potential link between bystander and dispatcher is being launched this year: the layperson's version of the new CPRcard for health carers. Placed under the helper's hands on the patient's chest, the card will give accurate feedback on compression depth and rate.

Improving rescuer and dispatcher interaction

A key element of new CPR courses is the role playing of the link between rescuer and dispatcher. Training kits come with mock mobile phones and trainees work in pairs, one playing the dispatcher reading from script and the other the rescuer.

They then switch roles. This prepares the rescuer for optimal interaction with dispatchers in a real life emergency.

10-year old Subin inspires Korea

Having trained CPR at the local fire station just four hours earlier, 10-year old Subin was on her way to the market with her mum when they heard people shouting. A 50-year old man had collapsed, but the adults around him had no idea what to do. Subin did – and after one minute of compressions, the man started coughing, holding her hand and talking to her. He was still conscious when the ambulance arrived, and recovered fully.

This happened in early April 2015 and was immediately picked up by the media, helping raise both public and government awareness. Subin was honored with citations from the Fire Department and the government. The ministry considered making CPR training mandatory all the way from primary school to high school. Describing "the Subin effect", Tae Hoon Park, Managing Director Laerdal Korea, stresses the importance of Laerdal's involvement in promoting and implementing community CPR programs.

The lifesaver school

One big question was how to attract the over-50s to enrol for CPR training which they hitherto had avoided. In this case as well, the key was to have a very short initial course of just one hour to learn the basics, and follow up with short annual refreshers over the next four years, adding something new such as infant resuscitation. Coupled with "learning how to save a life in collaboration with the dispatcher" this would suffice to maintain confidence and readiness to intervene in an emergency, when the verbal help comes from the dispatcher centre. With collaboration between Laerdal, SAFER and Oslo University Hospital, Livredderskolen, the lifesaver school, was born.

The resulting course program functioned so well that the Norwegian Heart and Lung Association LHL, Landsforeningen for Hjerte- og Lungesyke, bought it for offering to their about 40,000 members – most of them over 50. Denmark was also among the early adopters of this program, initially in Djursland and Grenaa. Moreover, the vital insight that refresher training is crucial had been gaining ground, and the concept became much more viable with the presence of the MiniAnne kit in the home.

Livredderskolen has helped clarify how lay people gain confidence when the bridge to the dispatcher is incorporated into the training – and how important it is to study the two-way flow across the bridge, map problems and include solutions in training programs. Also for the dispatchers.

A study at SAFER, where rescuers found a Resusci Anne lying lifeless on the floor and the dispatcher sitting in another room could follow the proceedings on a screen and provide feedback - "open the jacket, find the nipple line, start compressions, please press faster and deeper" – revealed a potentially lethal pattern: whenever the dispatcher spoke, the rescuer would stop to listen. The lesson is clear. Every dispatcher must learn to say, and stress, that "whatever I say, please do not stop!" This is the more important because the majority of bystanders are elderly and may tend to concentrate totally and be single-taskers.

The Swedish Resuscitation Academy was quick to adopt the program and across the Atlantic, at a conference in Orlando, contact was made with Ben Bobrow, who works to promote better utilization of dispatchers all over the US. Livredderskolen courses were introduced in Arizona in 2014. Another key contact, Marcus Ong who is chairman of PAROS – an organization working in 26 locations in 10 South-East Asian countries

Singapore: preparedness in a tightly packed community

Creating and developing a strong Chain of Survival in Singapore demands innovative use of existing systems. More than 5 million people, packed into 712 square kilometres, means that on average an ambulance will arrive after 10 minutes – too late if bystanders have failed to act – and need 46 minutes to carry the patient to the hospital. Moreover, lifts in its high-rise towers typically have no place for a stretcher or a gurney.

Innovative measures that are lifting this bustling city to be among the leaders in survival include the multidisciplinary organization DARE – dispatcher assisted community responsiveness – that aims to have a trained and confident bystander in every household, well-equipped paramedics using motorcycles to move quickly through traffic, and special smart phone emergency apps that will alert trained community responders to rush in with the nearest public AED. Also, the CPRcard for lay people is being tested in Singapore. Key leaders have realized that precisely the density of the population provides great opportunities. Because three generations often live together, most cases will entail the possibility of saving someone really close.

Much of the inspiration came from Seattle. Marcus Ong Eng Hock, who heads PAROS – Pan Asian Resuscitation Outcomes Study, established in 2010 – is a driving force in Asian lifesaving. He strongly advocates more and better bystander CPR, while helping build up one of the world's largest cardiac arrest registers with more than 30,000 cases a year. This enables the precise tracking of effectiveness and deficiencies of each EMS system, and the use of training and Quality Improvement processes to improve outcome.

The network is growing quickly, and by hundreds of million people. South Korea, Thailand, the Philippines, and Japan are all part of the PAROS network, and plans are being prepared for assisting China, Indonesia, Pakistan, and Qatar in adopting the dispatcher-assisted CPR intervention package.

"The key to success is determined and enthusiastic local leadership," says Marcus Ong. The initiative must come from each locality, when a community realizes that it has a problem and needs collaboration to solve it. Moreover, fast-progressing Singapore and Seoul are cultures where people have a strong will to improve and are ready to contribute to the community.

Marcus Ong with motorbike ambulance paramedic.

Olivia: "Henry is my friend!"

totalling 100 million inhabitants – is equally keen on ensuring that lifesavers have good support when they call the emergency number. Myklebust and Birkenes were invited to present their findings in Singapore, Seoul, and Tokyo; when asked to develop a course for Seoul, they had Livredderskolen translated into Korean for the planned training of 160,000 people. Along with Copenhagen, Seoul may be the city in the world that currently leads this field of integrating bystander CPR training and dispatcher assistance.

"Leadership is vital", says Helge Myklebust. "Enthusiastic and skilled campaigners are capable of setting off chain reactions – people's impression that a program really functions becomes a motivation in itself." As he sees it, lifesaving has developed in periods of about 15 years. During the first one, up to 1974, bystanders trained only in mouth-to-mouth resuscitation. Then followed a period with the focus on "pump-and-blow" until the late '80s when early defibrillation became the focus and CPR receded somewhat into the background, because many believed that electric shocking alone would save the patient. However, it rarely does. It certainly stops fibrillation but in most cases CPR is then needed for the heart to start pumping again. Also it has no effect on hearts that are not fibrillating but have stopped beating for other causes. The latter are now in the majority. Fortunately, by the mid-2000s the need for CPR, and in particular CPR of high quality, as part of a system for improving survival was being recognized again.

However, the fast application of an automated external defibrillator (AED) does of course remain vital when the patient's heart is fibrillating, and modern technology opens for much more efficient use of the rapidly spreading availability of public access AEDs. AED application is included in many training programs, and the practice is easily adopted because the machine tells the operator precisely what to do, step by step. In Copenhagen, dispatchers now have maps positioning precisely the location of each of more than 6,000 AEDs, and one click on the relevant symbol suffices to alert a helper to bring it to the patient as fast as possible.

Henry, for the pre-schoolers

Not only are there continuously improving programs for all ages from 13-14 and up, but pre-schoolers can train to master simple lifesaving steps. Collaboration between Rogaland Red Cross and Laerdal led to the development of a first aid awareness program for the little ones. The aim is clear: helping them train techniques

that they can easily master, and sowing the seeds for life-long community care. Basically, the question is what responsibilities a young child should shoulder. Serious problems will at all times be a matter for professionals, but in kindergarten and pre-school there will always be minor injuries. The children can easily master the skill of asking what happened, giving comfort, fetching an adult, recognizing the type of injury; and, if necessary, calling the emergency number – children learn very early how to use a phone.

The Henry kit comprising soft toy, flip charts and DVD was developed in dialogue with kindergartens, puppet specialists and drama teachers. The kit is named after Henri Dunant, the Swiss who founded Red Cross in 1863.

The Norwegian branch is one of its oldest, dating from 1865. All Rogaland kindergartens were provided with the Henry kit in 2010, and it is now being rolled out nationwide by the Norwegian Red Cross as part of its 150 year jubilee celebrations.

André, Noah, and Olivia with Henry - able and willing to comfort him.

Ingunn Haug demonstrating Henry.

Henry is a mascot who likes to play

When Laerdal interns were asked to take on the assignment for the Red Cross, they decided to replace the traditional manikin with a vulnerable, loveable "companion" who comes with flip-overs that inspire the children to make stories, and with songs. Supervised by Laerdal's Ingunn Haug and Cathrine T. Tellnes from the Rogaland Red Cross, the team developed a collection of pictures that set off the children's imagination: what happened to break a piece off this snow-slide? Did that bike crash?

Each picture has flip-overs illustrating the choices of what to do - when a child has scrubbed a knee, squashed a finger, has a nosebleed, chokes on something, or appears unconscious. Henry is not a pedagogue but a mascot who likes to play. He can be shy, but he is curious and vulnerable, and can be used either as a talking and moving puppet, or just for illustration.

Left to right: Cole Edmonson, CNO; Alex Klacman, RQI Program Coordinator; Cathleen Shellnutt, Clinical Nurse at Texas Health Resources.

RQI impact and value

In early 2013, after four years of development, AHA and Laerdal released the resuscitation quality improvement program (RQI) to 2,000 healthcare providers at Texas Health Presbyterian Hospital Dallas. Reviewing the first year of implementation, Chief Nursing Officer Cole Edmonson confirmed 99 percent compliance with quarterly required training activities, and shared early results that indicate a significant improvement in patient outcomes. At the same time, the implementation saved the facility almost $500,000 in CPR related training and education expenses.

Opposite page: Tom Oyugi at Texas Health Resources. The RQI Station is made for individual in situ training, with instant feedback on the screen.

Revolution in healthcare quality

Learning, retaining, and doing better

The revolutionary changes in training and procedures for lay rescuers – chiefly the practice of telephone assisted CPR training complete with feedback, with the rescuer no longer being alone because of running contact with the dispatcher – are matched by innovative developments in the training and procedures of professional carers. Two key elements are named RQI, resuscitation quality improvement, which was introduced in 2014, and QCPR, quality CPR.

RQI is based around the Low Dose, High Frequency (LDHF) principle, which focuses on short sessions repeated every 2-3 months rather than the traditional longer course every two years. As John Meiners, Executive Vice President of Emergency Cardiac Care and Global Strategies at the American Heart Association, says: "This major innovation now has wide application in hi-tech programs for professional carers."

"Low Dose High Frequency learning is a major innovation, driving change in healthcare"

John Meiners


Resusci Anne
American Heart Association.
RQI
RESUSCITATION QUALITY IMPROVEMENT

QCPR aids

The CPRcard is a personal device, to be carried around at all times, giving CPR performance to the rescuer.

The CPRmeter is a high-intensity and re-usable system for professional health workers.

Opposite page: Learning with HeartCode. (Malin Solberg and Helga Tjelta Mørk).

Also, wide collaboration on studies of both lay and professional performance has resulted in a clear understanding that measuring, assessing, and providing feedback are crucial prerequisites for improvement. The importance of sufficiently deep and uninterrupted chest compressions has been particularly emphasized. Optimal procedures, with collaboration between bystander and dispatcher, during the first few minutes after a cardiac arrest quadruples the patient's chances of surviving; the best care during the following hour, when professionals have taken over, can triple the chances for survival.

New standards – and goals – for resuscitation quality

"In Laerdal, we see the opportunity of helping save more lives by developing products for training and therapy that have added functions: to record and assess performance, help maintain knowledge and skills, store data for the course leader, and serve for analysis" explains Tor Bryne, Resuscitation Business Director. "We must measure everything – time, depth, ventilation, continuity – to assess what was done right and see what can be improved." To this purpose Laerdal has helped develop an RQI Station, a manikin connected to a PC where the user sees the feedback on the screen and is able to compare with earlier sessions. Participants are notified by e-mail when the quarterly expiration of the skills certificate approaches, and provided with AHA updates to science and guideline changes.

The RQI program comprises a succession of pieces of cognitive learning, acquired through individual study in order to build a more complete understanding. The actual skills testing takes only 10 minutes, after which the carer can go straight back to work. For employers the station helps cut costs because competence can be maintained and improved without sending people out of the house for a half-day course. Moreover, upcoming technology in the form of the CPRcard for professionals will record real CPR performance, and show whether the practitioner has done sufficiently well to make a scheduled high frequency session superfluous: "This is my proof, I took part in a resuscitation attempt in the ward this morning and here is the record of my performance."

Learning with e-simulation

The cognitive part of the RQI program is called "e-simulation" rather than the previous term "e-learning". The Laerdal team in Copenhagen builds the learning software for both HeartCode and RQI. Compared to just reading an e-book, these learning


HeartCode SLS
00:05
AED

A standard of care for preemies

AAP and Laerdal have collaborated on incorporating simulation in the AAP Neonatal Resuscitation Program, with SimNewB and NRP scenarios. However, although the program explained how healthcare providers may treat a premature baby, no manikin or simulator provided a method of practising.

According to the US Center for Disease Control, one in nine babies was born prematurely (37 weeks or less) in 2012 in the States. Consequently, AAP saw the need for a standard program for learning how to treat preemies, and a standard for care. Clearly, this entailed an urgent need for a good simulator, and the idea was born for SimPreemie: a manikin simulating a 26-week baby, only 30 centimeters long. A truly collaborative development, this will be the smallest human simulator ever developed. Released in 2015, SimPreemie will support the material and program for the 2015 Guidelines, and be a crucial part of helping save more lives.

Opposite page: Training at SAFER, how to care for a vulnerable preemie. (Christel Valand Pedersen).

systems are a significant advance through their good use of e-simulation: trainees answer questions, make choices and are scored before an automated debriefing assesses their decision-making ability. The HeartCode system is a self-learning means of completing biennial certifications, which are often required to allow healthcare providers to practice. RQI breaks these two-yearly activities into smaller ongoing learning activities. "We need data to show users that moving to quarterly doses is a paradigm shift" says Rosie Patterson, VP Business Development Americas, reporting on the commitment and excitement of the new specialist RQI team that is now focusing on customer success.

"We have chopped up the HeartCode e-simulation program into much more efficient learning units, and our ambition is that no-one should learn resuscitation without QCPR feedback. We want to enable all our products to provide this feedback" says Tor Bryne.

Exclusive HeartCode and RQI agreements are in place with AHA through 2015, and the shared goal is to have 1 million subscribers for RQI by 2019 in the US alone. In addition, Laerdal has a strong collaboration with HealthStream - a US company specializing in healthcare learning management – to help reach the almost 6,000 US acute care hospitals with this technology. Moreover, the network is spreading quickly, especially in China. By 2014, a memorandum of understanding had been signed between China Heart Federation (CHF), China County Hospital Confederation (CCHC), AHA, and Laerdal. Another forward looking agreement was signed between Laerdal, AHA, and the American Association of Physicians of Indian Origin (AAPI) to collaborate on advancing shared goals – including better handling of emergency cardiovascular diseases and stroke, in India and the US.

SAFER: "a new wind is blowing"

SAFER, Stavanger Acute medicine Foundation for Education and Research, is a young institution. Founded in 2005 as a collaboration between the Stavanger University Hospital, the University of Stavanger, and Laerdal, and located in the Laerdal complex, it is already making headway – also internationally. "A new wind is blowing," says Elsa Søyland, the Managing Director. Increasingly, and with great drive, SAFER is bringing forward the fields of acute medicine and patient safety, stimulating and working with practical research, and strengthening local and international networks. In particular, it confirms and expands its role in an international network for patient simulation, constantly helping improve the Circles of Learning and Research.

Learning means behavioral change, both individually and on an organizational level. The centre includes an apartment where trainees can experience traumatic situations in a realistic setting; this apartment can be used for a variety of disciplines, from the handling of psychiatric patients to the ethical questions of possibly switching off life support and handing a case back to nature.

First and foremost, the goal is to improve patient safety and strengthen competence among employees of the founding partners. Today over 250 facilitators are active in running more than 50 educational programs at the center. The training activities have grown every year since the start, with over 10,000 participant days being logged in 2014.

New field: technology in home nursing

Stavanger University Hospital and the University of Stavanger run their own courses, and SAFER experiences from collaboration on these sessions may contribute to developing programs for community nurses, for example. The Lyse energy company is collaborating with the University and local authorities on a pilot project using video and mobile phones in home nursing, where resources have to be stretched. All the vital elements are in place for rapid progress and cost control.

SAFER's own research activities keep gaining scope and momentum. By 2015, the first five PhD degrees have been completed here, with more underway. All the doctorands had been recipients of the Bjørn Lind PhD fellowship that is offered annually by the Laerdal Foundation.

All healthcare personnel in the North Sea industries are drilled in acute care procedures at SAFER.

Expanding horizons

SAFER is also moving forward into new fields, including the healthcare training that has become obligatory for offshore personnel. Moreover, in this field telemedicine is expanding, enabling a doctor on duty onshore to treat remote patients. "Altogether, technology is the future," says Elsa. "Sending physicians and nurses to courses at SAFER is comparatively costly, but we can deliver virtual courses on offshore installations, telemedically, including simulation and role play."

SimMan and his numerous offspring are key elements in the drives to strengthen both the science and its practical implementation in the form of a stronger Chain of Survival. Also, the centre can instantly draw on models, supporters, and intellectual exchange at a top international level – while increasingly contributing with its findings and new developments.

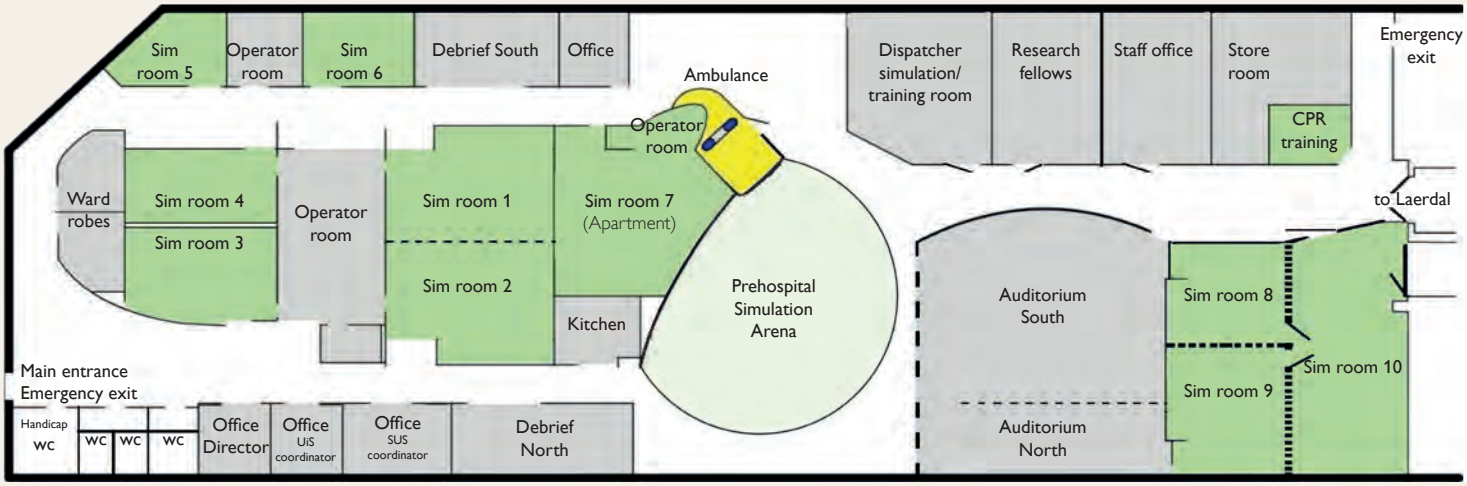
In the control room: Elsa Søyland directing the simulation scenario.

A top international network

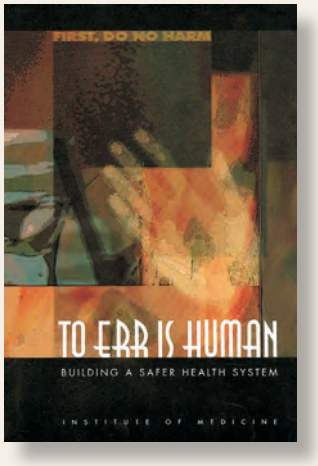
SAFER's network network includes major simulation centres such as DIMS in Copenhagen, Tübingen in Germany, and St Barts in London.

"We are learning also from research in Tanzania, through ground-breaking methods where disciplines such as psychology, anthropology, and sociology are included, as well as from measured outcome. One example is Hege Ersdal's research on training methodology, which helps us improve simulation programs," explains Elsa.

All ambulance personnel in Greater Stavanger train four days every year at SAFER.



With 900 m² floor space, SAFER covers the needs for all links in the Chain of Survival.



Why simulation?

The case for patient simulation training was thoroughly documented in this landmark report from the Institute of Medicine in the US in 1999. The report estimated that 50,000 – 100,000 lives were lost every year due to medical errors during hospital stays only in the US. It stated that the health care industry is decades behind other high risk industries (e.g. aviation, military, oil drilling) in applying simulation training for improved safety, and presented the following arguments for patient simulation training:

- Most effective learning method
- Realistic preparation for rare, difficult cases
- Errors allowed
- No harm to patients
- Repetition possible

In a recent publication, WHO estimates that as many as one in 10 patients are being harmed while receiving hospital care.

Opposite page: Interdisciplinary in situ simulation training in the A&E ward of Stavanger University Hospital.

When good teamwork is paramount

Laerdal hi-tech training simulators and programs were originally created to serve mainly acute healthcarers. In these professions good teamwork is crucial, and efficient practice is paramount - not least because, typically, physicians have trained to be independent and work on their own. However, as the networks of centres for simulation training and services are growing quickly, users in numerous new areas are discovering how much can be gained by training in teams.

Alliances and programs are being developed worldwide, driven by many inter-related factors. Among them are ever increasing pressures to improve patient safety while shortening clinical trainees' learning curves, technological developments, including industry initiatives, and cross-industry influences from sectors such as aviation, where simulation-based training and development have long been part of operational training. More recently, a parallel expansion has occurred in the range of modern training technologies available to clinicians and educators, including virtual reality and web-based learning alongside the more traditional apprenticeship-style learning that has taken place in healthcare and caring professions for centuries.

Learning methodologies keep evolving as studies map effects of changes and adaptations. As Nick Sevdalis at London's Imperial College expresses it, simulation and learning are now inter-disciplinary fields. Questions abound: to what extent and how efficiently have new training methods affected outcomes? If attendees' knowledge, skills, or attitudes improved, how long did the improvement last, and exactly when did it start to decay? And, crucially: did trainees actually transfer training skills into clinical practice? Numerous studies are combining to validate simulation as a method, but there is still a need for policy analysis, including the incorporation of simulation and other technology-enhanced training methods into hospitals and healthcare systems, and medical and nursing schools.

"Simulation and learning are now inter-disciplinary fields"

Nick Sevdalis

The 21st century stethoscope

New technology keeps improving diagnostics and therapy. One example is the growing use of ultrasound imaging, using high-frequency sound waves to see complications. With this "modern stethoscope" comes the challenge to speed up its application by developing high quality learning solutions. SonoSim Inc, a leader in ultrasound learning technology, now combines its competency with Laerdal simulator programs.

The wide body of evidence on the advantages of simulation-based training includes a meta-analysis of over 500 published papers which appeared in the journal *Resuscitation* in the autumn of 2014 and concluded that "simulation-based training for resuscitation is highly effective. Design features such as booster practice, team and group dynamics can equally distract and integrate, and feedback improves effectiveness."

SimMan: more affordable for wider use

At the end of the 20th century, the few and very expensive advanced simulators that had been made were used mostly for research. Laerdal decided to aim for 90% of the functionality at 10% of the cost, and its SimMan was thoroughly tested and ready for launching in late 2000 – eminently suited for training as well as research. A SimBaby followed soon after. Today, more than 40,000 Laerdal hi-tech simulators are in use around the world, in a range which includes SimMan3G, SimMan3G Trauma, SimMan Essential, ALS Simulator, SimMom, SimJunior, SimBaby, and SimNewB.

Pioneering pediatricians

The American Academy of Pediatrics (AAP), an organization of 60,000 pediatricians, was among the early adopters of simulation-based training. Early 2007, the Neonatal Resuscitation Program (NRP) Steering Committee decided to transition future education program initiatives to simulation-based training, and a year later Laerdal was invited to join the NRP Global Implementation. This collaboration led to the Helping Babies Breathe (HBB) program. Also, Laerdal's holistic approach to helping save lives by attention to all links in the Chain of Survival stimulated the joint development of the new SimNewB neonatal patient simulator. SimNewB meets specific training requirements of neonatal emergency care and resuscitation courses for hospital staff. Gradually, this was followed by projects including Pediatric Life Support Scenarios, Pediatric Education for pre-hospital personnel program scenarios, plus several self-directed programs including the Simply NRP.

"Sim-based training has brought a new dimension to medical education in the last decade"

Doris Østergaard

Birgit Lie holding the newborn, training with SimMom.

Room to make errors - and learn how to correct them

SimMom evolved from Laerdal's ALS Simulator together with the PROMPT birthing simulator from the UK company Limbs & Things to provide users with anatomical accuracy and authentic simulation experiences for a wide range of midwifery and obstetric skills. Modules include cervix, amniotic bag, post-partum hemorrhage, uterine inversions, and a special kit for babies born with congenital abnormalities and birthing traumas.

Collaboration drives continuous progress: physicians at the Healthcare Simulation Center of the Medical University of South Carolina have created an automatic delivery module for Laerdal's SimMom, for training obstetrics and gynecology students as well as midwives, nurses, and emergency medical personnel at reduced cost.

This module allows training to be completed quicker and with fewer instructors than with the original SimMom system. Scenarios and assessments can be standardized to a large extent, and be adapted through software to simulate a range of situations from a typical delivery to complex and dangerous situations.

The SimMan 3G Trauma patient simulator was developed for the specific needs of military and emergency medical teams. The operating system is easy to use, and can switch between running standardized pre-programmed scenarios and operating on-the-fly to capturing those unique learning moments that help improve both individual and team performance. Testing has confirmed its robustness and the durability of the program. A rugged Patient Monitor and Instructor Tablet push the boundaries of field-based scenario training further than ever before.

NLN

National League
for **Nursing**

Accelerating to Practice

In the US, about 20% of newly graduated nurses entering acute care drop out within one year, reportedly because of high levels of stress connected to lack of confidence. Patient care suffers, and hospitals have to carry the cost of almost $80,000 of fully orientating a replacement nurse in each case. Research shows that a well-organized orientation program can both speed up the learning process and help the nurses gain confidence.

This has led NLN to collaborate with Wolters Kluwer Health and Laerdal on building a break-through program, "Accelerating to Practice". Opinion leaders from hospitals and colleges help define the competencies that healthcare employers want nurses to possess. Blending e-learning and simulation, the program will provide a more standardized learning experience for delivering patient care, faster and with more confidence, confirms Beverly Malone, CEO of NLN.

Revolution in nurse education

A paper published in 2007 showed that 90% of nursing academy deans believed that nurses were able to practise satisfactorily straight out of school – but 90% of nursing administrators in hospitals disagreed. Also, because hospitals are very focused on cost, it is extremely difficult to find placement for trainee nurses.

The National League for Nursing (NLN) is the preferred organization for nurse faculty and leaders in nursing education in the US. Around 2005, both hospitals and NLN started looking at the methodology of simulation, which was rapidly becoming more affordable. With support from Laerdal, the NLN produced a publication on the use of simulation in nursing; this is now in its 3rd edition and being used in 2,200 nursing schools, and has led to NLN and Laerdal collaborating on a range of projects. The Accelerating to Practice Program consists of six modules based on competency categories including communication, clinical knowledge, clinical reasoning, management of responsibilities, professionalism, and technical skills.

Patient simulation is a vital element in helping nurses become more competent and therefore perform better after graduation.

"The impact goal is better patient care, but the program will also significantly reduce cost for the employer"

Beverly Malone

"We are the perfect Trojan horse"

Whereas simulation-based training is comparatively new in nurse and inter-disciplinary training in the US, some institutions have experience in team training for the healthcare community. The vision for the next five years is a healthcare system where nobody practises on patients until they are really competent to do so. Also, learning has to be continuous because of the enormously rapid progress and change in medical knowledge and practice. According to Paul Phrampus of the Wiser Institute for Simulation, Education and Research in Pittsburgh – where SimMan is a main protagonist - in the 1950s it still took 50 years to double medical knowledge; in 2015, it takes 73 days. "The culture of medicine is defensive. Simulation provides the opportunity to unmask preconceptions and deal with them. We are the perfect Trojan horse, hiding educators and assessers inside the belly. It is dangerous when I don't know what I don't know about myself, and we do not experience the hot seat in life often enough. Physicians must be aware of the risk of failing – and yet be confident enough to do the job. Simulation increases both knowledge and experience – and students are not the ultimate beneficiaries: the patients are. People always come before numbers."

"We do not experience the hot seat in life often enough"

Paul Phrampus

"The individual experiences that lie behind statistics and benchmarks and action plans must never be forgotten." Paul Phrampus finds a Winston Churchill quote highly relevant: "Never let a good crisis go to waste. Let it drive change".

Professional training and cultures differ from country to country. In Norway, all but one of the 28 nursing schools, two of the medical schools, and two nurse academies are using interdisciplinary team training. Whereas medical students tend to have a clear understanding of their future role, nurse students are often more

SimPreemie

vague on this point, according to Ingunn Aase at the University of Stavanger. This adds to the importance of training together, to collaborate on joint tasks and gain insight both in their own roles and in those of other professions. In the areas of clinical skills, team work, and patient-centred perspective, communication is paramount. Yet another advantage of inter-disciplinary team training with simulation is the transparency of the action followed by the debriefing sessions: finding it impossible when troubled to withdraw and avoid taking responsibility, student nurses will use and repeat the programs to build confidence.

Accelerating development of UK hospital simulation centres

In the UK, most simulation centres for healthcare are in hospitals. "We have been instrumental in helping establish them, and probably almost 80% of the centres are equipped by Laerdal. Total service is our goal. We help develop and implement training programs, and progress has been dramatic," says Jon Lærdal.

The UK Laerdal team can also participate in looking at the work flow from when the alarm goes off – how long does it take for people to be in place, and is the set-up good enough? "Ideally, we become partners in making simulation centres work and help them demonstrate to the community that systems are becoming safer by preventing so many injuries caused by human error," says Jon. He points out that Laerdal's collaborators are now also seeing that they can benefit from experiences and research in low-resource countries.

The UK National Health Service is the third largest employer in the world, and the not-for-profit Association for Simulated Practice in Healthcare (ASPiH) has grown to over 500 members during its first five years.

ASPiH is instrumental in advancing simulation, also by encouraging research on training and testing both technical and non-technical skills, and on issues ranging from the reduction of learning time to methods of assessment and selecting the best candidate for a position. Generally, it is important to facilitate – not to instruct, but to draw out thoughts, share incidents and near misses, and on the whole to turn safety management from being reactive and corrective to becoming proactive and anticipating possible risks. Failures can tentatively be shrugged off as "I would not have done that if this had been real." Cases of that type will help emphasize that debriefing is also about making the rest of the group into debriefers, learning from reflection upon errors.

SimPad

The SimPad is a tablet device for capturing activities undertaken by the learner.

Opposite page: Team training with SimPad. (Helga Tjelta Mørk, Thomas Søndenaa, and Mona Ajmi).

Lower hanging fruits for change

The Resuscitation Academy recommends 10 steps for saving more victims of pre-hospital cardiac arrest. The first four steps are what they refer to as the low-hanging fruits:

1. Establish a cardiac arrest registry
2. Implement dispatcher assisted CPR
3. Implement high perfomance CPR
4. Implement rapid dispatch

Opposite page:
High performance EMS CPR in action. (Petter Danielsen and Anne Jorunn Svalastog).

Learning to overcome impediments to change

'Given the unpredictable and catastrophic nature of sudden cardiac arrest, not to mention the brief therapeutic window of opportunity, it is remarkable that any one can be resuscitated' writes Mickey Eisenberg in his book "Resuscitate!" Devoting his life to the remarkable, with the firm conviction that it takes a system to save a life, he was one of the initiators, in 2009, and guiding lights of The Resuscitation Academy. This is offered twice a year in Seattle, tuition-free, to EMS directors from all over the world – and increasingly inspires similar efforts to improve other systems. From the firmest of standings: for decades, Seattle has been the world's most favorable place to suffer cardiac arrest.

Having experimented with length, the initiators settled on two-day sessions with no more than 40 participants. One of the mantras is "if you've seen one EMS system, you've seen one EMS system": every community has a different constellation of culture, leadership, resources, and opportunity, and it would be wrong to assume that a good idea will always be embraced and implemented. No system will transform itself overnight. Impediments to change, whether they stem from habit, inertia, malaise, or lack of resources, can overwhelm the best of intentions – as Norwegian dramatist Henrik Ibsen's Peer Gynt ponders: "think it, wish it, even want to, yes – but actually do it?"

The Academy empowers professionals to do it, and to do it better. And better. The courses embody Mickey Eisenberg's own tenet: you must measure to improve, and measure to improve – an ongoing process, because once you measure, you will reveal things that need improving.

A related view is stated in an AHA Consensus on Science paper from 2013: "Without CPR measurement and subsequent understanding of CPR performance, improvement and optimized performance cannot occur. Providing CPR without monitoring performance can be likened with flying an airplane without an altimeter."


STAVANGER UN
UKEH
ULANS

Helping save lives at birth

Coming together for outstanding results

"Delivering a world where every pregnancy is wanted, every childbirth is safe and every young person's potential fulfilled" – the motto of United Nations Population Fund (UNFPA) may sound like a remote dream. But as understanding of the problems grows and networks and alliances are creating and implementing crucial programs for maternal and child survival and health, progress is not only spreading. It is accelerating. Rapidly.

"The beginning point and the forward point is the patient," observes Bill Keenan, Executive Director of the International Pediatric Association (IPA). "We are privileged to be able to think about this. And maybe make a contribution."

He elaborates: "Partnerships of governments, professionals, and industry are coming together in powerful ways for outstanding results." Geeta Lal, UNFPA coordinator for midwifery care and advisor strategic partnerships, confirms Keenan's observation: "There is a huge global push on innovation and collaborating opportunities."

"There is a gathering force, and we are moving forward with fierce intent"

Bill Keenan

Opposite page: Rashmi Aradhya in Pune, India, acting as a delivering mother with MamaNatalie.


MamaNatalie

Susan Niermeyer and Nalini Singhal caring for a baby. They were co-editors of the Helping Babies Breathe program with Bill Keenan and George Little.

Hege Ersdal and Jeff Perlman training birth attendants at Haydom in bag-mask ventilation.

In this drive Laerdal sees its role as a catalyst. By contributing more than half a century's experience in helping develop and implement constantly evolving programs for training and therapy, they are helping the collaborators do better. According to Frances Ganges, CEO of the International Confederation of Midwives (ICM) "we combine experience to overcome obstacles. Laerdal's design expertise helps us optimize outcome. There is no possible way we could have done this without Laerdal."

Laerdal's involvement in maternal and child health was sparked off in 2006, when the company partnered with the American Academy of Pediatrics (AAP) to help advance educational science and resources available for teaching and learning neonatal resuscitation.

The babykin arrives

Mads Gilbert, Norwegian anesthetist with extensive experience from training rural health workers in the Global South in CPR and trauma care and a founder member of the Trauma Care Foundation, had alerted Tore Lærdal to the need for much simpler solutions in low-resource countries. Consequently, when the pediatrician Jeffrey Perlman invited Tore to join him for a field trip to Tanzania, August 2008, the Laerdal team had already made some rough sketches for the simulator that came to be called NeoNatalie and for a suction device. In Tanzania, the response was clear: this was a very interesting direction. Development progressed rapidly and intensively. "This was not a matter of selling advanced equipment, but on the contrary to put to use the knowledge, experience, and resources that we had built up. Using our experience with simulators, we focused on role play and interaction with the trainees," recalls Tore. "Quite early the AAP task force thought of using the colours of the traffic light to illustrate: green for OK, yellow for alert, and red for danger, instant action. There were several elements in the Helping Babies Breathe success: simple action to make the baby breathe, the need for the simulator to be realistic, simple, and low cost, and that the program would enable the trainees to become trainers."

"Low-resource countries represent over 80% of untimely deaths but have less than 10% of the global human and capital resources to fight this problem"

Mads Gilbert

Dogged work – and serendipity

One clear theme running through the Åsmund S. Lærdal story is the mix of dogged effort - going into every detail, to develop the best possible products and systems, as simple and low-cost as possible – and what we might call serendipity, often as an off-shoot of creativity.

More than 40 years after his death, this mix is still part of the culture. A prime example is the "instantly-turned-into-an-icon" Penguin suction device.

Until work intensified on the Helping Babies Breathe program, suction devices had been disposable: in high-resource countries it is too expensive to dismantle a device for cleaning and putting it together again, fully sterilized. In low-resource settings, these devices would be used repeatedly, turning into microbial greenhouses. All the potential birth helpers in outlying regions needed a truly affordable and hard-wearing suction device that was simple to clean - to be boiled between each use, again and again and again.

The team in Stavanger tried out numerous possibilities: different methods of sterilization, different materials and welding methods. Since boiling is comparatively cheap and not dependent on electricity, the material should not deteriorate during 10 minutes of boiling. Succeeding models clarified that an oval shape fitted better into the hand for squeezing than the original round one. At first, the narrow tract for inserting pointed straight up from the oval part.

New tests and trials showed that putting this tract at an angle made it easier to extract obstructive matter.

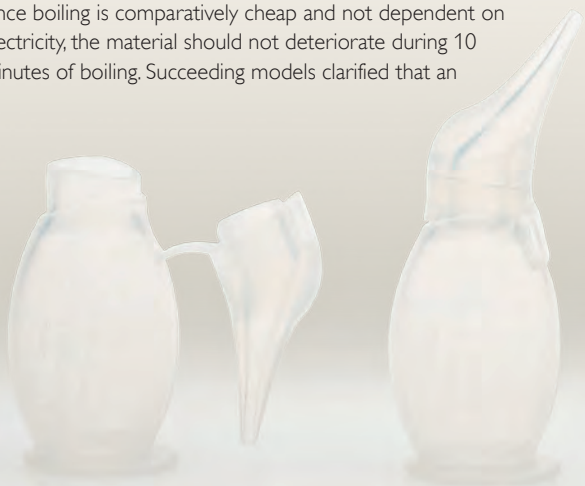
Serendipity was about to break through: the gadget was beginning to look like a penguin.

One early assumption was that the device would lie flat when not in use. But now, the emerging penguin look inspired the team to cast it with a round base, enabling it to stand. The next problems were creating a loop to keep "body" and "head" joined when opened for cleaning, and to make a simple cast. Solving this, the team found that the "body" would topple when the "head" was off and hanging down one side. Solution: expand the base forward to make stabilizing "feet".

The result lives up to the "Bauhaus" style dictum: form follows function. Every feature has a function. The one exception was the two tiny eyes that the team added for fun. But in use it turned out that in hot and humid regions the head can be slippery to hold – and then, the eyes serve to enable a better grip.

Serendipity? The Penguin makes people smile, wherever it goes. In its loveability, it also does away with all fears about transmitting dangerous germs.

"The Laerdal team is a key driver. We'll whine about a problem, such as suction, and they will come to the next meeting with a solution which is much more imaginative than just a mechanical piece," says Bill Keenan.



The award-winning Penguin suction shown open for cleaning and closed for use.

What it took to change behaviour

"Beginning in 2009, we tested the HBB program in eight sites in Tanzania, four months before and 18 months after a one-day HBB course. The first results showed dramatic differences in implementation: survival rates improved in four sites, but remained unchanged in the other four," recalls Hege Ersdal, who was doing research for her PhD program. When learners did well in the classroom during a one-day HBB course but failed to bring their skills into the labour ward, the researchers asked what it would take to change behaviour. The answers were clear and direct: "We want to train often, perhaps once a week, next to the delivery room. And we need to know that we are supported by both hospital management and local authorities."

In other words, here too the lessons learned with CPR training in high-resource countries about the efficiency of Low Dose, High Frequency (LDHF) training, with the simplest and clearest programs possible, were confirmed, and at the same time the importance of local ownership was emphasized.

As Hege says, "within months of introducing LDHF methods, with weekly 5-minutes training in HBB, we saw dramatic progress: the midwives' attitudes changed to the extent that they themselves observed and commented on it. The participating hospitals in Tanzania showed the way, almost halving newborn deaths, and the conclusions of the project were published in *Pediatrics* in 2013. With these advances, the UN selected the HBB program as one of 10 breakthroughs in the Millennium Development Goal 4 efforts."

By focusing on the essential features only and designing NeoNatalie from the start for low-cost manufacturing at the plant in China, Laerdal was able to make the simulator available for less than $60 on a not-for-profit basis. The modest price meant that large numbers could be distributed, and the simulators could be left in labour wards after the course for regular Low Dose, High Frequency refresher training of airway clearance and bag-mask ventilation skills. The Helping Babies Breathe (HBB) program, as it was now called, was on its way. By early 2015, 65,000 NeoNatalies were in use, more than 95% of them in low-resource countries.

Collecting the evidence

When HBB was launched on a greater scale in 2010, the ambitious goal of training millions of birth helpers was within reach. However, as with all programs that Laerdal is involved in the basic requirement was that its implementation must be evidence-based. Extensive and systematic testing was needed to document its value. Knowing that local ownership is the prerequisite for efficiency and sustainability, the AAP announced a funding scheme for testing in countries where the health authorities were receptive, and chose Tanzania, India, and Kenya. Laerdal assisted with some of the tests, including internal fund raising. The HBB program quickly demonstrated its potential – after initial testing combined with research in Tanzania yielded crucial knowledge about methodology.

Implementation of HBB in Tanzania fed into ground-breaking research right from the outset. Key collaborators for phase I of the HBB project were Ministry of Health representative Georgina Msemo and Jeffrey Perlman from the Weill Cornell Medical College in New York. They were soon joined by August Massawe from Muhimbili hospital, Hege Ersdal from SAFER, and Prisca Ringa from Bugando hospital. In phase II Estomih Mduma from Haydom, Hussain Kidanto from Muhimbili and additional researchers from the Safer Births research program,

Members of the strong Haydom research team (left to right): Robert Moshiro, Estomih Mduma, Hege Ersdal, Hussein Kidanto, and Paschal Mdoe.

Haydom research has global importance

"My 2030 vision for the Haydom hospital is that we are a large, multi-disciplinary research institute, and that birth-related baby mortality in our country is down from 11 per 1,000 in 2015 to about five," says Esto Mduma, clinical officer – and according to Hege Ersdal, a prime mover behind building the Safer Births project. Esto has built up the unique research system at Haydom, recruiting, inspiring and training a great number of people to take responsibility.

Esto combines leading the unique gathering of data, and implementation of research findings, with working on his own PhD. In 2015, the data already gathered are so rich that six PhD candidates are at work- and there is room for many more. Because Tanzania lacks experts in this field, collaboration with research institutions is crucial. Haydom partners include the Weill-Cornell Medical College in New York, the University of Virginia, and SAFER.

"Tanzania is a poor country, and the infrastructure very limited. This makes it paramount to spread information, attract young people and motivate them to participate," says Esto. "We try to share the results of research, through local leaders and meetings with the local population."

Low-cost devices must function faultlessly

"Developing low-cost MiniAnne and MiniBaby had trained us in working out simple mechanisms that are easy to use and to maintain, pared down to the vital functions – and yet, appealing to the learner," explains Jens Petter Ianke. "One example is using pipes that can be bent as valves. Low cost devices must function faultlessly, without ever needing service."

Collaborating closely with Tore Lærdal and Harald Eikeland on the NeoNatalie-to-be, he often worked through late hours to come up with models for next day's discussions. "The simple idea of filling the plastic doll with lukewarm water instead of air made the baby much more realistic in both weight and feel, but required us to change both material and welding method to overcome the messiness of water." Squeeze bulbs helped produce simulated birth cries, breathing, and palpable umbilical pulse.

The Helping Babies Breathe program comprises the babykin itself, an action plan wall poster, a clinical reminder wall poster, 26 flipcharts, plus a learner workbook for each trainee. It teaches birth attendants to clear the baby's airways, to stimulate it, and if required to use bag-mask ventilation - basic skills that can help 99% of the otherwise doomed babies to breathe. The simplicity and clarity of the program makes it possible to reach much higher numbers of health workers, not least in remote rural areas.

SAFER, Stavanger University Hospital (SUS) and the University of Stavanger (UiS) also came in.

Introducing the numerous publications to come, Hege Ersdal and colleagues showed in a 2012 paper on early initiation of basic resuscitation that mortality increased by 16% for every 30 seconds delay in ventilation, and in "Causes of 24-hour death?" that 60% of 24-hour mortality was due to birth asphyxia.

"The patient data gathered in Haydom represent an unparalleled source for research"

Jeffrey Perlman

Spreading out

Under the guidance of Lily Kak at USAID, the strong and vibrant HBB Global Development Alliance (GDA) – comprising USAID, the National Institute of Child Health and Human Development (NIHCD), Save the Children, AAP, and Laerdal - was formed in late 2010 in order to promote wide implementation. "Better impact is mostly a matter of better implementation of what is already known. And that is best achieved through collaboration, by bringing together different capacities, experiences and networks," says Tore Lærdal. As was demonstrated also in Tanzania, local ownership of programs is essential and, by 2015, over 50 of the 75 countries where the HBB program had been introduced already had national plans coordinated by governments.

In Bangladesh and Ethiopia, the HBB programs made impressive progress after only two years of a massive scale-up effort that revealed additional challenges. The conclusion is clear: HBB implementation requires continued nurturing well past the initial scale-up, including inclusion in the national plan and budget - but if done well, can have a substantial impact on newborn mortality.

"The HBB GDA has demonstrated that public-private partnership, driven by a shared goal and vision, can be a highly effective strategy for health development"

Lily Kak

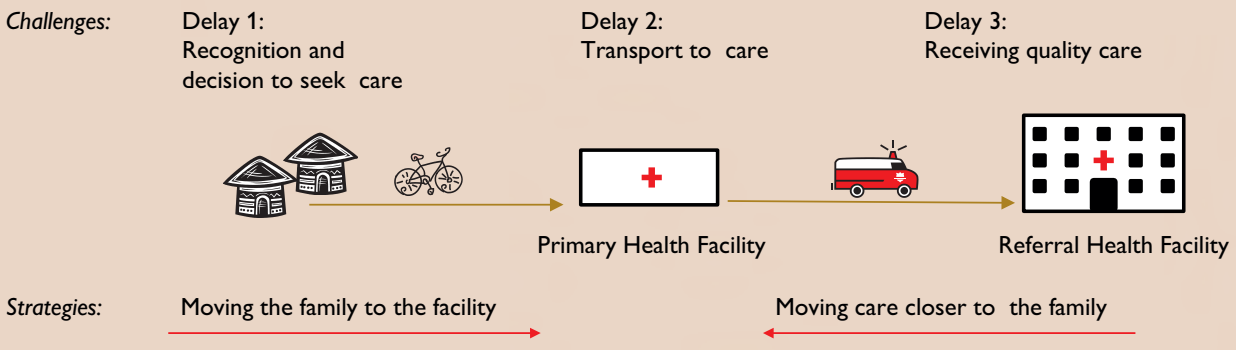
The roughest journey

Eight men have been carrying the woman for several days. Her agony is such that full unconsciousness would be a blessing. The baby inside her is dead. The men are bringing her to the hospital in the hope of saving her life.

Transport to care can be a dire problem for the majority of women who live in rural areas. Perhaps the pregnant woman had wanted to go to the nearest primary health station to give birth there, when contractions started suddenly and the baby appeared to be stuck.

Clearly, bad or non-existent roads, great distances and worn-down and exhausted ambulances - if any - make it important to train birth helpers also in small and remote communities. The problem of bridging distance is two-sided: moving the family to the medical care facility, and moving care closer to the family.

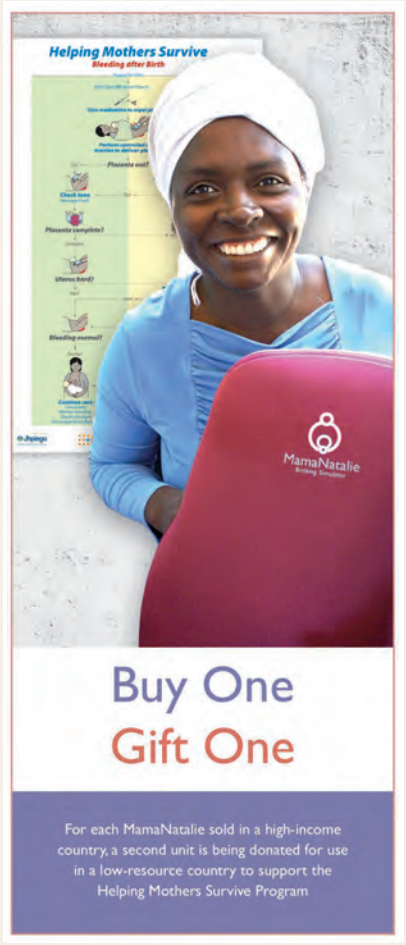
The diversity and crucial importance of transport is illustrated in India, where 18,000 modern ambulances have been bought over the past few years. Whereas only a tiny fraction of ambulance capacity in many countries in the West is used for pregnant women, every fourth person carried in these ambulances is a woman about to give birth.



MamaNatalie
Buy One Gift One

MamaNatalie was originally designed to meet the needs in low-resource countries. However, her unique features have made her a very popular simulator also in high-resource settings – and this adoption opened for the introduction of Buy One Gift One: for every MamaNatalie sold in a high-resource country, a second unit is donated for use in a low-resource country's Helping Mothers Survive program. In fact, tests at the Johns Hopkins University simulation centre showed MamaNatalie to out-perform their $20,000 birth mother simulator on all the relevant parameters for training in stopping bleeding after birth.

By mid-2015, a pool of more than 2,500 units had been gifted to ICM, FIGO, UNFPA, AAP, and Jhpiego.



Helping save mothers

The collaboration with AAP opened doors and helped Laerdal establish new contacts. One of these, the Baltimore based NGO Jhpiego, now creates sim-based learning programs that reflect the interconnection between mother and baby health. Saving mothers also saves babies, even more so because very often one person has to take care of both, stresses Jphiego Senior Advisor, Cherrie Evans. Creating a specific package, addressing maternal health and reaching the same providers as HBB, was a golden opportunity. Existing birth simulators were technical and complicated, and priced between $3,500 and $30,000. In 2009, the *International Journal of Gynecology and Obstetrics* made an Evidence-for-Action call for "significantly lower cost, durable, easy-to-disassemble-and-sanitize high-fidelity mannequins with culturally appropriate features." This sounded like a tall order. But when Laerdal challenged two interns to come up with a concept for a low-cost and efficient birth simulator, intensive team work enabled Laerdal to bring a prototype low-cost, and startlingly simple, MamaNatalie to a world congress in Cape Town.

Strapped on the front of the instructor, MamaNatalie ensures immediate, live contact, doing away with all considerations of appearance and intimidating cultural differences. As NeoNatalie makes her way down the birth canal the instructor can produce all the most common and potentially deadly complications by very simple means – including bleeding of up to 1.5 litres. This concept was so well received that work on improving the long series of prototypes proceeded almost round-the-clock in Stavanger.

"The Helping Mothers Survive program is already in use in over 50 low-resource countries"

Cherrie Evans

As with NeoNatalie and HBB, the integration of MamaNatalie into a program for education and implementation was essential. Laerdal collaborated with Jhpiego and the AAP in developing the Helping Mothers Survive (HMS) program, and is involved in studies of its impact with the International Confederation of Midwives and the International Federation of Gynecology and Obstetrics.

From womb-in-a-box to hug to MamaNatalie

Having been exposed to social problems in her native Guatemala, the designer Paulina Quiñones wanted to focus on alternative solutions that met basic needs. Ironically, her first impression of Laerdal was as a manufacturer of very advanced equipment. However, Laerdal paired her with a medical engineer, Lise Lørup, who had chosen maternal health for her internship. When challenged to work on a birth simulator, Lise did a lot of research, attending births and consulting midwives. She was reading "Kristin Lavransdatter" at the time, where the Norwegian Nobel prize winner, Sigrid Undset, describes pregnancy and birth in medieval Norway, and it struck her how, until just a century ago, conditions in the North were quite similar to today's low-resource countries.

"Understanding that simple knowledge and skills can make a huge difference was enormously motivating," she recalls. Lise and Paulina brainstormed intensively with Tor Inge Garvik and Helge Myklebust, and Lise began to visualize a kind of womb-in-a-box trainer. All along, Paulina kept drawing, to build up a concept from mind to visual to tangible. "We were talking about exactly what stops the major cause of maternal mortality, bleeding after birth. One option is uterine massage. My doodles evolved into two people embracing – and that sketch set off the teamwork to shape MamaNatalie," explains Paulina.

An "apron" is strapped onto the instructor, who manually controls fetal heart sound, body positions in the birth canal, uterine firmness, delivery of placenta and intensity of bleeding. It can be used by any qualified instructor after only a few minutes' introduction. Because it is easily portable and quickly made ready for use in any setting, MamaNatalie is particularly suitable for 'in situ' simulation training.

In 2011, MamaNatalie was ready for mass production, and the following year, the entire Helping Mothers Survive program was complete with The Natalie Collection: mama and baby simulators, suction device and bag-mask.

Mama-U

The Mama-U Postpartum Uterus Trainer has been developed for the simulation of just-after-birth insertion of Intra Uterine devices, IUDs. In addition to being designed for separate task training, this module can also fit into MamaNatalie for a complete birth simulation.

Opposite page: Family size and lack of spacing between pregnancies remain major challenges in many countries.

New alliances – and learning modules

Collaboration with Jhpiego brought Laerdal into contact with its Baltimore partner, the Center for Bioengineering, Innovation and Design (CBID) at Johns Hopkins University. The three organizations are very complementary and combined their expertise in The Day of Birth Alliance in order to accelerate innovation to save babies and mothers. Jhpiego's strongest areas are in needs assessment and implementation, CBID's in prototype development, and Laerdal's in prototype development plus industrialization – creating high-quality programs and making them available at the lowest possible cost.

In 2012, the HBB GDA partners joined with the American College of Obstetricians and Gynecologists (ACOG) and the American College of Nurse Midwives (ACNM) to form the public-private Survive and Thrive (S&T) GDA for addressing maternal, newborn, and child health challenges. Under the S&T umbrella, and drawing on the experiences of creating and rolling-out of HBB, the group went to work to create additional training modules: Essential Care for Every Baby (ECEB) and Essential Care for Small Babies (ECSB). Yet another module is under development for administrating a steroid to the mother before early preterm births in order to strengthen the lung function of the fetus. These ground-breaking modular training initiatives are referred to collectively as Helping Babies Survive (HBS).

Family planning

Close contact with users drew attention to areas that were new to LGH, including family planning. Every year, 600,000 babies and 100,000 mothers die from unwanted pregnancies. This is not only tragic for the lost babies and mothers, but also for the families left behind. Just after birth, insertion of intra uterine devices - IUDs - can play a major role in family planning. To meet this need, LGH has developed the Mama-U trainer.

Key lessons from all the HBS programs have been that simplicity and clarity open the door for change: facility based training initiatives, not just community based training, are a prerequisite for success; and how important it is to mentor and empower health workers. The four HBS modules link into a simple program, based on the latest WHO guidelines, with an Action Poster and graphical education material.

Each year, 15 million babies are born too early. The urgent need for new modules is illustrated by the fact that these preterm

Facilitating breast feeding is an important part of Kangaroo Mother Care. Here, nurse Temweke Mtenja demonstrates breast feeding to a birth mother.

LGH's Ida Neuman about to demonstrate the KMC wrap at the Asian launch of the HBS program in Bangladesh.

Opposite page: Salome Prosper, a Malawi mother with triplets. Twins and triplets are typically low weight, and benefit greatly from KMC care. The total weight of the three babies was 3.75 kgs, equal to one single robust newborn.

babies have a 20 times higher mortality risk than the full terms: in 2012, they accounted for over half of the neonatal deaths worldwide. Simple means could suffice to save most of preterm deaths. 800,000 lives. Every year.

When the Essential Care for Every Baby program was field tested in India and Kenya in mid-2013, Laerdal learnt that two training devices were needed: a breast milk expression trainer, and a preterm model that was suitable for training in feeding and in the skin-to-skin contact technique of Kangaroo Mother Care (KMC). Company developers went to work, making rapid progress on MamaBreast and PreemieNatalie for launching in 2015.

Development in India

In 2013, LGH set up a group of three Stanford India graduates in Pune, India, to gain closer contacts with millions of potential users. "Just five years ago, measures such as vaccines were in focus, and much simpler possible methods to help preemies were ignored. Now, when the advantages of Kangaroo Mother Care (KMC) have been scientifically proven, the question is why this method is not used everywhere," explains Pushkar Ingale, head of the LGH team in Pune.

KMC originated decades ago in Latin America. In regions where they had no incubators, helpers discovered that tiny babies fared much better if kept in warm skin contact. But the shawls that mothers used to keep such a child in position would have large, uncomfortable knots in the back and strain the mother's spine. Even worse, in many low-resource hospitals underweight babies would be put sardine-like into one incubator, which could then become a hotbed for infection.

The LGH team rapidly developed a wrap that would hold the baby comfortably without causing the mother back pain. User feedback led to improvements such as a firmer support for the child's head along the upper edge of the wrap. At this stage, the possibilities of actually manufacturing wraps, or simply making the pattern available for local seamstresses, had to be evaluated. "Practices are different in different cultures. We want them to use what they have," says Francis Ganges, CEO of the International Confederation of Midwives (ICM).

Approaching the global breakthrough for KMC

However, 2015 is set to be a break-through year for the KMC method, also in parts of the high-resource world. A 2013 recom-

The Concert Hall in Stavanger was packed for the concert in 2014 that launched the 10,000 Happy Birthdays program. Among the participants were: Frances Ganges (ICM), Mads Gilbert, and Jane Zgambo (Association of Midwives of Malawi).

mendation in the *Lancet* stated that up to 450,000 of the more than 1 million preterm deaths each year could be averted by near-universal adoption of this very low-cost solution. Until then, KMC had largely been perceived as a second-best poor people's alternative to incubators. New research had shown beneficial effects beyond survival, through continuous skin-to-skin contact, including with the father taking his turns with the gender-neutral design of the wrap; supportive care for mother and baby, exclusive breastfeeding, and reduced risk of infections. The call for action, by Expert Summit, set up the goal of achieving 50% global coverage of KMC among preterm newborns by the year 2020.

The LGH team spent 10 months working out the wrap design in collaboration with potential users in India, Tanzania, and Malawi. INAP, India Newborn Action Plan, was set up to introduce the method in health institutions and have it adopted for 35% of all underweight babies by 2017, 50% by 2020 and 90% by 2030.

More Happy Birthdays

In mid-2014, the S&T partners, including four national pediatric associations, announced the Helping 100,000 Babies Survive and Thrive effort, across Ethiopia, India, and Nigeria, in support of the Every Newborn Action Plan. Emphasizing that HBB is a zero/low literacy system, this project seeks to implement the Helping Babies Survive programs to educate clinical staff on newborn care, treatment, and resuscitation protocols, and can address almost 90% of the causes of newborn death. This project was launched in Washington, D.C. at USAID's forum Acting on the Call: Ending Preventable Maternal and Child Deaths.

Another goal was set with the LGH-initiated 10,000 Happy Birthdays fund raising campaign for a program which is yet another example of powerful partners combining in order to speed up progress. The drive begins in Zambia and Malawi, where the day of birth is the most dangerous one in a child's life and maternal mortality is among the highest in the world.
In Zambia, every year 6,000 children die on their first – and only – day of life. The initial goal of LGH was to raise 10 million NOK, 5 million NOK from public donations matched by 5 million NOK from Laerdal, in order to fund ICM training of 10,000 midwives, using the HBB and HMS programs, in the two countries between June 2014 and October 2016.

Abelone rapped herself into a UNICEF goodwill ambassadorship

18-year old Abelone Melesse instantly said "yes I can and yes I will" when Tore Lærdal asked her to create and perform a special song for the kick-off 10,000 Happy Birthdays fund-raising concert in Stavanger Concert Hall in June 2014. Having shown herself a talented rapper in a Norwegian TV contest, she was a great favourite that evening with her "Birth-giving mother", English text with refrain in Amharic – Abelone is born in Stavanger to Ethiopian parents. She comes from a musical family and had begun rapping even before she started to write her own texts in her early teens. The video she now made circulated widely among Ethiopians, and led to a UNICEF invitation to become their goodwill ambassador. "We can reach people, but she can reach further" says Tore Lærdal. "This is about reaching young people."

Having drawn a full house, Laerdal matched the price of 1,100 sold tickets and brought the total income from the evening to well over 1 million NOK. Among the recruited partners was a Stavanger Rotary club which rapidly inspired 50 Norwegian Rotary clubs to join – and to stake on having the campaign adopted globally at the Rotary World Congress in 2015.


KULTUR

Rapper engasjert av Unicef

10,000 Happy Birthdays

At the Helping 100,0000 Babies Survive and Thrive Stakeholder meeting in Aruba Nigeria, from left: Mairo Mandara, Country representative for the Gates Foundation in Nigeria, Nancy Lowenthal, USAID Nigeria mission office, and Lily Kak, Senior Advisor for Newborn Health with USAID in Washington DC.

Three well-trained midwives, moving with great enthusiasm into the 10,000 Happy Birthdays project: Annie Mandala, Gloria Lingalawe and Patricia Yosiya.

Crucially, the national midwifery organizations in the respective countries, MAZ and AMAMI, are among the collaborators. "The support from this fund raising campaign will give us a fantastic start in the spreading of these life-saving programs. Good experiences in Malawi and Zambia will form the basis for bringing the programs to a great number of other countries," says CEO of ICM Frances Ganges.

Two-way learning for safer births

With all the programs and modules being developed and improved for use in low-resource countries, it might be easy to overlook that in addition to two-way exchanges between high- and low-resource sites, some projects – including research - will be equally useful in both worlds. In her PhD project, Signe Egenberg is comparing the benefits in African countries and in Norway of scenario-based training to prevent, identify, and treat excessive blood loss after birth. "Each postpartum hemorrhage requires teamwork. Nurses may be scared that excessive bleeding will be seen as a sign of a mishandled birth which they will be blamed for; debriefing of every scenario is vital because it facilitates the process of learning through reflection – which is much more effective than being told," says Signe.

In particular, rural Tanzania offers a goldmine for research. Together with Tanzanian, Norwegian, and international research institutions, LGH has initiated the Safer Births research program at the Haydom and Muhimbili hospitals. In 2014, the research program involved six PhD fellows, three of whom are Tanzanian. Partial funding is provided by NORAD/Globvac and the Laerdal Foundation. Haydom has had contact with Norway for 50 years. The Haydom focus on birth related mortality is the more impressive and valuable because whereas 98% of all birth related problems occur in low-resource countries, until now 98% of all birth related research has taken place in rich countries.

"No birth is simple. The complexity is enormous. We have much more to learn from data collection: there is a huge consensus that this has to remain a priority"

Frances Ganges

A potential user, midwife Nyaki in Muhimbili, has a voice in the development process.

Helge Myklebust discussing a protoytype of the MOYO fetal heart rate monitor with Mama Kadongo at the Haydom Hospital.

MOYO: "heart" or "life" in Swahili

The Swahili term graces a Tanzania-inspired project, the Fetal Heart Monitor, MOYO. This is basically a warning device: currently, birth asphyxia not only accounts for 1.9 million stillbirths and newborn deaths each year, but also leaves 1.2 million babies with lifetime disabilities. Monitoring the Fetal Heart Rate (FHR) makes it possible to detect a fetus at risk and ensure appropriate and timely obstetric responses.

The traditional method used in low-resource settings is the Pinard fetoscope, an ear trumpet, but there is hardly any evidence concerning its reliability and efficacy. Feedback from midwives in Tanzania revealed that the Pinard is often time-consuming to use, and can be painful for the mother. Moreover, it may be difficult for the carer to distinguish between fetal and maternal heart beats. Laerdal developers aimed for an affordable and easy-to-use ultrasound monitor which could reliably detect FHR in less than 5 seconds, enabling attendants to make rapid and appropriate obstetric interventions. Comfortably positioned on the mother's stomach the MOYO will ease the workload without interrupting existing routines. The MOYO is a Saving Lives at Birth Grand Challenge project, receiving seed money for developing the monitor and an adapted simulation based training program for timely and improved obstetric care.

In partnership with the Tanzanian Ministry of Health, Tanzanian Midwifery Association, and the Association of Tanzanian Obstetricians, MOYO is being field tested in four hospitals with the hypothesis that earlier detection of fetuses at risk and timely obstetric responses can lead to a 30-40% reduction in fresh stillbirths and birth asphyxia.

Keen cap knitters

When Laerdal employees in Stavanger heard that newborns in many low-resource countries need woollen caps, not only did they start knitting, but they recruited so many friends that shops ran out of baby wool.

Mindy Christensen now coordinates an entire network of keen cap knitters. By mid-2015, the first 1,000 caps had helped to keep babies warm in Africa. And the knitting continues.

Opposite page:
A workshop meeting in Stavanger (from left) Tor Inge Garvik (LGH), Phyllis Clark (American College of Nurse Midwives), Andrea Pembe (FIGO), Cansu Akarsu (LGH), Rashmi Aradhyia (LGH), Sheena Currey (Jhpiego), and Trude Thommessen (Norwegian Association of Midwives).

In Haydom, birth data are gathered round-the-clock. 14 assistants equipped with stop watches register what they observe during and after birth, providing unique material. Hege Ersdal and colleagues realized that the research assistants could provide a great deal more vital data if they were equipped with special devices. In the autumn of 2011, Haydom management, midwives, and a Laerdal group discussed the idea: if the Norwegians made the equipment, would they use it?

The answer was a resounding "yes". An important principle was established immediately: research would be equally useful in both worlds, and there would be no resorting to short-cuts. Learning should be equal, for Tanzania and the rest of the world.

Gathering forces roll forward

The increasing momentum that Bill Keenan, AAP, describes as "the gathering force, moving forward with fierce intent" came to rich expression during a two-day gathering in Stavanger, early 2015. Representatives from global and US professional organizations, including five of the founding members of the Survive & Thrive Alliance, shared research findings from the rollout of HBB and HMS programs, discussed how to leverage lessons for further research and better implementation support, and exchanged ideas on needs and opportunities for additional training modules complete with supporting training tools.

The Forum agreed that the clinical impact of the training programs could be much enhanced by:

- More efficient transition from training to practice, in particular by use of Low Dose, High Frequency refresher training and practice.
- Capitalizing on the lessons learnt to make the case for prioritization and funding for scale up.
- Developing seamlessly integrated modules to enhance the adoption for mainstream use.
- Endorsement of the combination of HBS and HMS programs by all relevant stakeholders.
- Strong ownership of local implementation.

Through three workshops, participants provided feedback for Laerdal developers and insights on work to improve equipment and modules for newborn ventilation and labour management for both HBS and HMS, vaginal assisted delivery, and vaginal examination. In addition to all of this, attention was drawn to the need for developing systems that help free the learner from


INDUSTRIALIZE
Aim :Find unmet needs to training in labour man
Method

2014 Richard C. Holbrooke Business Leadership Award

At a USAID high level forum in Washington, D.C, and in the presence of health ministers from over 20 low-resource countries, Laerdal Global Health was announced as the 2014 winner of the Richard C. Holbrooke Business Leadership Award for Outstanding Contribution to Global Health. This is the most prestigious honour bestowed by GBCHealth, a global coalition of companies and other organizations. Presenting the award, GBCHealth President, Nancy Wildfeir-Field, declared that Laerdal has "demonstrated singularly effective and passionate leadership, with a laser-focus on helping mothers and newborns in low-resource settings survive and thrive."

Index design award

Acknowledging excellence in development and mass production, the 2013 Denmark-based bi-annual international design award, Index, went to Laerdal Global Health for its Natalie Collection. 1,000 projects had been nominated for this €100,000 award which promotes sustainable solutions to global problems. LGH was the first-ever Norwegian winner, and donated the prize money to the International Confederation of Midwives, ICM.

the fear of being blamed for possible mistakes – a key element in modern simulation training for all health care workers.

Norway's Vision 2030

Norway has launched a national initiative called Vision 2030 to encourage researchers, commercial organizations, civil society and others to produce innovative ideas that could play a part in achieving education and health Sustainable Development Goals.

Laerdal Global Health expects to play a significant role in this initiative, but it cannot do so without a successful Laerdal Medical. The two Laerdal companies complement each other in many ways. Laerdal Medical brings financial stability; the investments made to establish and support LGH would not have been possible without the good results achieved in LM over many years. Remarkably, its not-for-profit status enables LGH to venture into, and contribute to, important user needs that may not have any commercial potential - but are important for the mission of helping save lives, and for the joint learning of the two Laerdal companies.

"The catalytic role of HBS spreads change. This is a passionate crowd, and that is what makes it happen"

Nalini Singhal

Mira with Shifa: The first official save after HBB training in Bangladesh. This photo in a stylistic version forms the logo of LGH.

Norwegian Prime Minister, Erna Solberg, attending a demonstration of NeoNatalie at Nkhoma Nurse School in Malawi, in 2014.

Opposite page: Fund-raising for the 10,000 Happy Birthdays project; the upper left team is Laerdal Copenhagen, the middle right one is the staff at ICM headquarters, and the lower one is Laerdal Korea.

Working together globally

Generous involvement

The interaction between the two companies, Laerdal Medical and the not-for-profit Laerdal Global Health, is even richer and more far-reaching than might be expected. On the one hand, LM contributes more than 50 years' experience in developing and implementing simple and clear training and therapy systems, at the lowest possible cost. On the other, LGH inspires and reinforces the entrepreneurial spirit and agility in the 75-year old mother company, in addition to its importance for the feeling, among employees in widely different cultures, of truly contributing to the Laerdal mission.

This interaction is recognized by Norway's Prime Minister, Erna Solberg, who visited Laerdal in Stavanger in 2015. As co-chair of the UN Millennium Development Goals Advocacy Committee she is directly involved in the drive to reduce birth-related mortality in low-resource countries.

Laerdal Medical employees all around the world feel similarly enthusiastic and involved. Appreciation of the vision of helping save 500,000 more lives each year by 2020 pours out in warm-hearted generosity. First out were US sales staff: when they were shown a prototype NeoNatalie and told about her potential the room immediately started throbbing. Dave Johnson, President of Laerdal Americas recalls: "People who had won awards for sales went to ATM machines in the hotel to take out cash. It was frantic; I literally had my hands full of money, and for me it was the most incredible moment of seeing passion for the mission in our team". Subsequently, the "Buy One Gift One" scheme for MamaNatalie echoed that evening's management decision to have the company match gifts.


I helped save a life today.
What did you do?
#10KHappyBday
I helped save a life today.
What did you do?
$ 7,000

Clive swimming in penguin suit

The company-wide enthusiasm for the new vision brought fund-raising to new heights when the 10,000 Happy Birthdays project was announced.

Clive Patrickson, who has worked on three different continents for Laerdal, wondered what he could do to help motivate people. When asked whether he would be willing to swim in the fish pond in the winter garden in the Stavanger premises, he responded that in view of the law of Archimedes, about water displacement, there would be little water left. Considering that the target was "a stretch", he offered - half jokingly - to swim in the North Sea in December if the target for the first week was met.

His professed scepticism was proven wrong, and he did atone - by donning a penguin suit to swim in water just barely above freezing.

These initial manifestations of generous involvement keep being renewed, as witnessed by the reactions in Suzhou, and other units, to the 10,000 Happy Birthdays project.

The blending of cultures

Clearly, direct contributions of this type help boost the feeling of values, mission, and vision. This is crucial. The blending of cultures in the global organization is a balancing act with constant tension between three factors: the Laerdal culture, the Norwegian heritage, and the local culture. In other words, the need to understand others is paired with the need to be true to oneself.

The cultural differences across Laerdal are enormous, and learning is a continuous process, both within the Laerdal "family" and in the collaboration with a growing network of partners. Failure to appreciate particularities can cause serious problems, such as the time when re-branding included "the white line" - packaging all medical products in white – which in Japan is the colour of death.

The internationalization process has required two-way adaptation. The Laerdal values that form the firm basis for the entire enterprise are Norwegian values. Whereas the company strives to make every unit feel a part of "the Laerdal family", the work-family balance is different in Norway. Paid maternity and paternity leaves are generous, and a top manager may well declare that a meeting has to end because it is his or her turn to fetch a child from kindergarten or soccer training. Moreover, the Norwegian style is firmly based on achieving consensus rather than having the boss decide, and on the egalitarian principle of not linking wages and salaries to performance. But clearly, as manufacturing units were added in the US, China, and Mexico, and the number of sales companies grew to 24 and "the Laerdal family" to well over 1,400, globalization meant learning more about each culture, step by step. At the same time, Norway was rapidly moving away from its traditional monoculture, as the offshore industry brought in large numbers of expatriates and immigration from several continents kept increasing.

But gradually, Norwegian culture permeates local cultures, and vice versa. Being very self-sufficient, going for quality in everything while never showing off or stooping to conspicuous consumption, and finding listening more important than telling, have been traditional Norwegian characteristics. As Clive Patrickson explains: "our managers are not surrounded by

"Way beyond expectations – and yet natural"

Over the years, initiatives to strengthen Suzhou employees' understanding of the helping save lives mission and their pride in producing high quality products have included sponsoring poor students' return to school, participating in various fund-raising projects, and, not least, undergoing CPR training so they could experience what it was all about. They now also offer basic life support training to companies and the public at large.

"Against this background it was not surprising that our people here in Suzhou immediately took the 10,000 Happy Birthdays project to heart, particularly as all the LGH products are made here," explains Michael Yang, General Manager Laerdal Suzhou. "We set up a special project team and organized brainstorming sessions that resulted in a variety of initiatives such as a project launch ceremony, an interactive program on the international midwife day, May 5th 2014, for staff and kindergarten children, traditional Chinese dragon boat racing with 23 teams totalling more than 600 participants; and selling t-shirts with the 10,000 Happy Birthdays logo." These events yielded RMB 108,910. Union donations plus individual initiatives added an additional RMB 45,360 – helping lift the total to a level equivalent to close to $30,000, earning warm applause throughout the global Laerdal company.

Michael Yang expresses his pride: "The results are even more impressive than expected – and yet, this is natural in our company culture. People are diligent and truly caring. And this kind of contribution strengthens the feeling of belonging to the Laerdal family: a feeling that requires careful nurturing because of the dramatic diversity in local cultures and the geographical distances that have to be overcome."

Another impressive contribution to the fund raising, of $7,000, came from the relatively small Laerdal company in Korea.

At the Monterrey plant: involved in making products that are truly amazing.

Every contribution is vital

When producing only components and not the completed product, it may require special consideration for all the employees to feel a meaningful part of the "family" and the mission. "It is especially important to stage CPR practice sessions for both employees and the local community, to let people experience hands-on how the programs - to which Monterrey contributes - are used to help save lives" explains Daniel Ruiz, Plant Manager in Monterrey.

"One day in 2014, we invited our employees and their families to learn about, and actually use, Laerdal products. Our connection with Gatesville was reinforced by the presence of Ray Dixon, their technical product manager. In addition to on-site CPR training, Monterrey employees created simulation scenarios for training professionals in both first response and hospital treatment."

After these sessions, Laerdal invited members of the public who were passing by the show-room to come in and have a go. "Some people were amused, others were totally surprised and impressed by how nurses, paramedics and hospital staff can be trained," says Daniel.

At the end of the day, participants shared their discoveries: "I had no idea that a member of my family, or my neighbour, is involved in making these products that are so truly amazing!"

assistants, but tend to handle all the practicalities themselves – by itself very different from the situation in some of our partner organizations. Also, the organizational structure is much flatter, with a degree of egalitarianism that differs from what you would normally find in many other cultures. Staying with Laerdal is a life style choice: there are no steep career ladders with many steps – but people who stay beyond the first five years tend to embody the fact that the values and the mission underpin everything we do. And stay for a very long time."

Encouraged to learn – and branch out

The flatter organizational structure does not preclude individual development and branching-out. "On the contrary," says Brit Broberg, who left the oil business to join Laerdal in 1992 and now provides administrative support to the management team.

On arrival, she found the cultural differences working in a family company huge, not least in the way people interacted: Laerdal staffers were much less preoccupied with set procedures and rigidly defined roles. "I learned a great deal from the Laerdal culture, from the genuine motivation to help save lives and to think holistically of the cause and what will benefit the company – rather than me and myself. I am part of the large puzzle, and I know that I am doing a job that is important for the whole." Another example of learning to fill different jobs is Tom Guthormsen who over 25 years has served, among other tasks, as head of sales in Australia and in Benelux, and is now Director of Product Development.

Listening to the voices of the employees

Starting in 2007, annual employee perspective surveys have mapped work satisfaction and attitudes to values and the sense of mission. Questionnaires specify areas such as customer and solution focus, competence development, and how well managers are perceived to perform – including when it comes to handling conflicts. A large majority of employees respond to the surveys, and accurate analysis of the data pin-points where improvement is possible. Commendably, over 90% of respondents feel both that their work helps to achieve the companies' strategic goals and that they understand the key elements in the Laerdal Code of Conduct. And almost as many are confident of succeeding in helping save 500,000 more lives by 2020.

Cultural differences are reflected also here, not least in degrees of engagement. Generally, the job itself is by far the most important

Gatesville employees and all their collaborators made very good use of learning systems that they help manufacture: Ramon Sosa, head of Manufacturing Americas, had good reason to feel proud of everyone after "Stormy Weather".

Making it come alive

"Controlled chaos" sounds like a contradiction in terms. But that is precisely what struck the Laerdal Gatesville plant on the morning of May 1st, 2012: a tornado had apparently demolished the manufacturing building, 12 employees were reported killed, 59 appeared seriously injured, and four were missing. All of a sudden, hundreds of people were in the hot seat. The disaster rang true: in recent years, tornadoes, hurricanes, floods and other natural catastrophes have ravaged and paralyzed regions of the US. This was a scenario for learning to collaborate on dealing with devastation and mass casualties. Laerdal employees teamed up with emergency personnel from 29 surrounding counties. And the mass of 40-50 vehicles, dominated by ambulances, fire brigade engines and other rescue units, added to the immediacy of "Operation Stormy Weather".

Injuries pointed back to Åsmund S. Lærdal's first venture into health care supplies, the imitation wounds that led to his contacts with the CPR pioneers. Now, Laerdal manikin artists "fabricated" wounds, lacerations and broken bones with other employees playing the parts of the casualties. Arriving on the scene, the first responders had to assess the situation quickly, and first of all remove survivors from around and inside the collapsed buildings and rush them to safe areas for emergency treatment.

A Mobile Medical Unit was erected to house 30 casualties for triage, treatment, and preparation for evacuation to cities throughout Central Texas. Inside this crammed unit, the participants were under intense pressure to identify and stabilize patients in crisis and perform casualty movements using litters and gurneys.

The entire scenario was very realistic and helped empower the participants. "This is unlike anything I've ever experienced" and "I can't believe I'm able to participate in an operation this massive, I'm so glad to help" were typical reactions when peace and well-being had been restored and the proceedings were evaluated.

Vividly, Debra Sloane recalls the day: "The goal of Stormy Weather was to enhance working relationships and collaboration between the agencies and organizations involved. Although it was a mock exercise, it was a very real test of our ability to respond to an actual disaster." And, as such, clearly an additional contribution to commitment and team spirit in Gatesville. As Arne Dyngeland, VP Supply Chain and Manufacturing, expresses it, one main strategic focus area is to link Laerdal employees all around the world to the vision, to make it come alive.

ChuraSim for beautiful elegance

In Japan, the simplicity and efficiency of simulation training in health care is now celebrated with the term 'ChuraSim' – 'chura' meaning 'beautiful elegance' in the dialect of Okinawa.

In order to achieve maximum impact with simulation training for health carers, Laerdal Medical Japan (LMJ) has collaborated with university hospitals in Japan and the US to develop innovative simulation training courses and curricula, tailored to the Japanese language, clinical protocols, and standards.

Japanese collaborators include hospital simulation centres in Okinawa, Tokyo, Jikei, and Akita, plus the Okayama Community Healthcare Human Resource Development Center and Tokyo Medical University Faculty of Medicine, School of Nursing. The ChuraSim range of programs includes FunSim-J, Fundamentals Simulation for Japan, and iSim-J, Improving Simulation Instructional Methods for Japan.

LMJ is committed to continuing its collaboration with these healthcare institutions on a longer term, aiming to help improve clinical outcomes.

arena for learning. "We learn by doing. In Laerdal, at least 70% of learning occurs through challenging assignments and on-the-job experiences. About 20% is developed through relationships, networks, and feedback, and only about 10% is delivered via formal training processes," says Arne Seglem Larsen, Corporate Director for Human Resources and IT.

Doing the right thing

However, work conditions as well as management attitudes also influence employee satisfaction. "Co-location inspires people to do the right thing", says Arne Dyngeland, Vice President for Supply Chain & Manufacturing. "Each team is effective in the value chain. For even better contact, Gatesville has now gathered all employees and functions in one building, a major re-shaping of the plant." He emphasizes the value of open offices for tying teams together, and of locating the entire value chain together so that, for example, people in production can go directly to the engineers with questions such as "does this screw need to be in such an awkward place?"

In all departments - R&D, Manufacturing, and Sales - doing the right thing includes continuous attention to sustainability. The Laerdal companies are members of the UN-initiated Global Compact and consistently strive to adhere to its principles: supporting and respecting the internationally proclaimed human rights and help prevent abuses; respecting the freedom of association and the effective recognition of the right to collective bargaining; upholding the elimination of all forms of forced or compulsory labour, including child labour and discrimination in respect of employment and occupation; supporting a precautionary approach to environmental challenges, undertaking initiatives to promote greater environmental responsibility, and encouraging the development and diffusion of environmentally friendly technologies; and working against corruption in all its forms, including extortion and bribery.

Clearly, these principles are a given for Laerdal, with their intrinsic connection to the Laerdal values.

Revitalizing the entire company

These are years of dramatic change for Laerdal. The practice of responding to user needs with individual life saving training and therapy products has rapidly developed into offering solutions in the form of complete training programs. Increasingly, the company's role is now expanding into providing comprehensive

services. Laerdal is moving from “here is a piece of equipment” to “this is how our solution works, and we’ll be there with you as long as it takes for you to succeed in achieving your goals.”

Two parameters are coming to dominate: demonstrating, through collaboration with partners, that Laerdal really can help save more lives, and helping the users convince their bosses that they are actually able to cut costs. The company’s greatest opportunity is to understand what the needs are and to help people succeed. There is a sense of exploration which is revitalizing the entire company.

Stavanger ambulance crew putting the Laerdal Suction Unit and Silicone Resuscitator to good use.

Helping improve value

Just 10 years ago, value for money was a non-topic in professional health care. Now, it is different. As Paul Phrampus of the Wiser Institute points out, four points dominate his work for safety in hospitals that employ a total of 26,000 nurses: money, reduced risk, compliance with regulations, and patient safety. Dynamic health care focuses on improving quality and return on investment and in this respect, education has greater potential than devices alone.

“Before, we supplied learning programs but were not involved in the clinical side. When health institutions have used our programs for years, and their managements ask whether the training really is effective, objective data are necessary,” explains Alf-Christian Dybdahl, Business Director, Emergency Care. “Now we can help them understand that what we do has real value, that we can offer solutions that help them perform better and commit fewer errors, and that they can document their improvement to their bosses. We have effective ways to record how much people actually did train and how much they improved. And if there is a gap in skills being used we can offer solutions.”

Laerdal has a large knowledge base and network, and now users are asking the company to expand its role as consultants: if results are not satisfactory, Laerdal can analyse their problems and perhaps refer them to hospitals in other parts of the world, which have succeeded in improving implementation. Since this involvement in best practice is a new area for Laerdal Medical, the company is linking in with new partners who have longer experience, such as Wiser, the Medical University of South Carolina, and SAFER. “We are not inventing a methodology, but helping choose what works best,” says Alf-Christian. “Our job is not finished until the user’s goal has been reached.”

Laerdal senior management, including: (from the left) Tore Lærdal, Martin Hetland, Arne Dyngeland, Alf-Christian Dybdahl, Tom Guthormsen, Brit Broberg, Arne Seglem Larsen, Egil Mathisen, Clive Patrickson and Tor Bryne.

Dave Johnson demonstrates SimNewB.

Opposite page: Design review in Stavanger of CPRmeter version 2: (from the left) Jonas Rørbech Marstrand, Hilde Tertnæs, Siren Ertzeid, Mathias Molden, Jo Fredrik Ranhoff, and John Sigve Risanger.

Helping improve value

Changing behaviour is always a big challenge. LM has to instill the principle of helping improve value among all employees. The years 2010-11 dramatized this through quality problems with the hi-tech SimMan 3G. By now, Dave Johnson leans back relaxedly as he tells the story. "Upholding the Laerdal brand is paramount. We did the right thing and upgraded all the simulators. But at the time there were over 3,000 SimMan 3Gs in the US. Instead of our usual pattern of placing 100 pieces of equipment every month, our sales people were dealing with an unusual situation, and had to go back to numerous angry customers a number of times. We introduced technical help desks, implementing a third party service organization and learning to run an adaptable work force. This trouble-shooting helped us upgrade the entire process and schedule more efficiently, and our field service organization changed completely. Because today's user is more complex, we have to become a more comprehensive organization. We have made great strides, and 3G provided an important lesson."

Dave Johnson's responsibility for the widely different markets in the Americas illustrates some of the diversity of his team's task. The US market is large and mature, with a well-established organization and loyal customers. Canada is similar, but the health care system is more socialized; one challenge in both countries is to help the users benefit as much as possible from their investments. Latin-America is a new market, very much a matter of building confidence and working together. "We are constantly working on re-evaluating our role and defining what competencies we need to move from the old way of selling to the new way of partnering: we have to go in and help change behaviours," says Dave.

Balancing cost and quality

The extreme variation in requirements, from products that need to be so low-cost that every cent counts to the market-leading hi-tech simulators, entails careful value analysis and aggressive cost control all the way from sourcing. According to Arne Dyngeland, there is significant change in the optimization of competence and profit.

The right balance between cost and quality has to be sustainable. Laerdal has a long tradition of doing everything in-house, but to ensure greater flexibility and to cover a multitude of technical competencies, strategic sourcing is becoming more important. One example is the Moyo device for registering fetal heartbeat.


CPRmeter II Exploded View
Laerdal

The Laerdal Board:
(from the left) Egil Mathisen, Mette Stavland, Anne Lise Eikefjord, Marit Reutz, Petter Andreas Steen, Clive Patrickson, Hanne Lærdal, Tore Lærdal, Oddvar Hetland, Svein Aaser, and Ken Morallee.

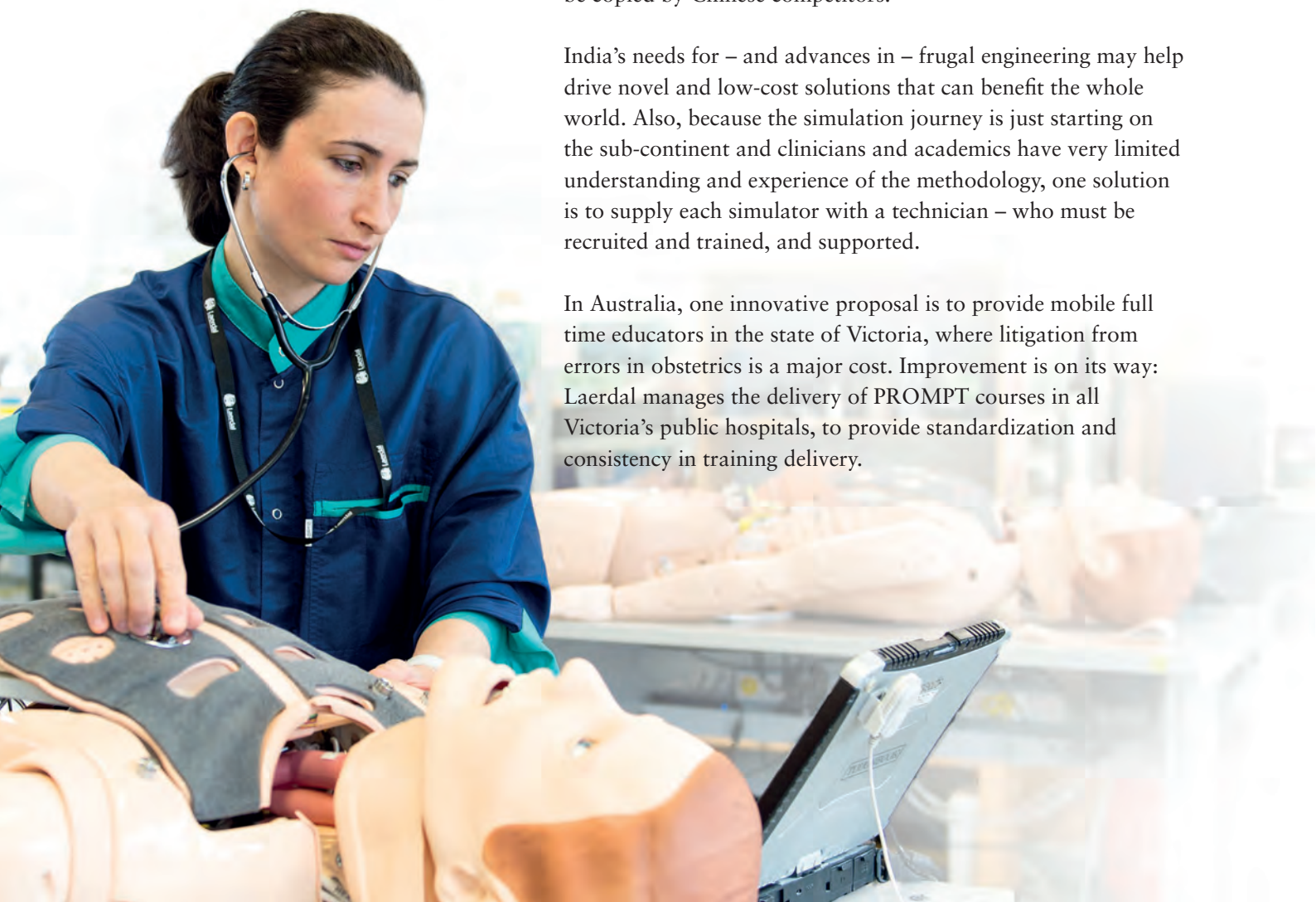
Having analysed a multitude of sourcing possibilities, the company broadened its supply base by using an external, competent partner that has the capacity to undertake other projects. "Selecting new partners takes time and resources, but we are on target for both quality and cost," explains Arne.

A multicultural corporation

The complexity of the company's task is symbolized by a summary of Laerdal in Asia Pacific: "Staff 190, Languages – too many." Phil White's team covers a region with more than half the world's population. Whereas Singapore and Hong Kong topped the global ranking of efficient health care in 2014, with more than twice the efficiency of the US at less than a quarter of the cost, other regions lag way behind. Many areas lack skilled health care professionals even as life spans are lengthening, and there can be drastic gaps between health care in urban and rural areas.

The Chinese government has introduced the Healthy China 2020 program, aimed at providing universal health care and treatment for all. Among the challenges for Laerdal is to bring together Chinese and US centres of excellence, and to provide solutions for areas that are new to the company – and cannot be copied by Chinese competitors.

Vania Alexieva is helping save lives, by testing SimMan in Stavanger.



India's needs for – and advances in – frugal engineering may help drive novel and low-cost solutions that can benefit the whole world. Also, because the simulation journey is just starting on the sub-continent and clinicians and academics have very limited understanding and experience of the methodology, one solution is to supply each simulator with a technician – who must be recruited and trained, and supported.

In Australia, one innovative proposal is to provide mobile full time educators in the state of Victoria, where litigation from errors in obstetrics is a major cost. Improvement is on its way: Laerdal manages the delivery of PROMPT courses in all Victoria's public hospitals, to provide standardization and consistency in training delivery.

Collaborating on developing tailored products

In Copenhagen, about 40 developers are divided in specialized teams, each working on tasks such as instructorless learning for emergency care and resuscitation, product configurations, and on systems related to CPR training and certification. In addition, consultants assist with special tasks such as changes in connection with new international guidelines, and the production of 3D animation.

"Close collaboration with partners, including AHA, HealthStream, and Wolters Kluwer Health, leads to solutions that none of the organizations could have developed on their own," says Hans Gundersen, Director Software. "In order to achieve the potential impact we strive for, the instructorless products must be tailored to defined learning objectives and curricula that our partners have specified."

Working proactively was the major challenge of QCPR and RQI: anticipating the users' most important needs, and helping increase survival rates by combining existing and new technology in new ways to replace two-yearly training and certification with instructorless Low Dose, High Frequency programs. Already now, users are documenting improved survival rates combined with major reductions of training costs.

From left: Dan Hua Zhu, Ling Mei Meng, and Ji Shu Ni are helping save lives, by assembling NeoNatalies in Suzhou.

Utstein Abbey

A link with the Middle Ages: from the 1200s, Utstein was the regional health care centre. Monks who had studied at Europe's first school of medicine in Salerno, Italy, spread through the international networks of monasteries to cultivate medicinal plants and treat the sick.

Today, only Utstein remains of Norway's 25 medieval monasteries – but once again, it is part of an international health care network, through the concept of Utstein-style guidelines.

Building Consensus

A mission-oriented foundation

The Laerdal Foundation was established in 1980 with a mission of helping save lives by providing financial support for practically oriented research and development. Many investors began their research careers with the assistance of Foundation grants and many centres of excellence have benefited from sustained Foundation funding. According to Mickey Eisenberg, Director of The Center for Evaluation of Emergency Medical Services (CEEMS) in Seattle, USA, the Laerdal Foundation has provided "the glue, the programmatic security and bedrock for its activities through decades, contributing to major progress in many areas of resuscitation therapy and training and helping spread and scale up some of the programs that have resulted from CEEMS work." Other research centres of excellence that have benefited from Laerdal Foundation support include the CPR group at the Ullevål University Hospital in Oslo, headed for many years by Petter Andreas Steen; the Uppsala Research Laboratory Research Group and the Gothenburg Outcome Research Group in Sweden, DIMS in Copenhagen, Sarver in Tucson, and Rescue in Toronto. Other key institutions in this network are SAFER in Stavanger and PAROS in Asia.

Utstein guidelines: blazing trails that others could follow

Åsmund S. Lærdal was a practical, hands-on man. When he established the Foundation in 1980, his idea was to support practical research to improve life-saving and acute care. This came to include a new level when the Laerdal Foundation celebrated its first decade by inviting leading specialists in resuscitation medicine to a workshop at the Utstein Abbey.

The seed was planted for the Utstein guidelines.

By 2015 more than 20 Utstein meetings had been held. The recommendations from these meetings are listed in the Bibliography on pages 118 - 122.

Another Utstein meeting in June 2015 – Utstein implementation – will focus on Mickey Eisenberg's "low-hanging fruits" and current and future "gold standards". Plus, not least, the full potential of the Chain of Survival and individual links.

Five of the more than 20 published papers on Utstein recommendations.

Finding answers. For life.

Consensus on Science

The 1990 meeting at Utstein was the first important collaboration between AHA and other global resuscitation councils, including the newly formed European Resuscitation Council. Further international conferences led to the establishment of ILCOR, the International Committee on Resuscitation – representatives of multinational organizations who meet to evaluate the latest research. The grandfather principle applies: "bring forward what we have no basis for throwing out." The consensus process yields a revised, common knowledge base once every five years.

The Chain of Survival was revised in accordance with the recommendations of the consensus meeting in 2005, to include the pre- and post-incident links. Now, as work progresses to ensure that the bystander is never alone with a patient, but is part of a team through constant telephone contact with the dispatcher, time may approach for a new revision.

2015 brings the latest ILCOR Consensus on Science. The regional guideline updates which follow on from the Consensus are of major importance.

Setting a style

One highly visible effect of the Laerdal Foundation's activities is a process that is now internationally established: Utstein style reporting. For the 10th anniversary of the Foundation in 1990, 35 leading specialists in resuscitation medicine were invited to a workshop at Utstein Abbey, Norway's only preserved medieval monastery which is located on the island of Klosterøy a few kilometres north of Stavanger. Discussion centred on what areas the Foundation should prioritise. When Tore Lærdal arranged for the group to join him in his favourite hike to the Pulpit Rock, the spectacular rock plateau 600 metres above Lysefjord, the need for uniform guidelines for reporting outcomes of cardiac arrest had a good airing – planting the seed for what became the Utstein guidelines for uniform reporting of data from out-of-hospital cardiac arrest. Over time, these guidelines were followed by similar processes for many other medical specialities, giving birth to the concept of Utstein-style reporting.

By mid-2015, the Laerdal Foundation had supported more than 20 Utstein expert conferences related to recommendations for reporting research findings.

The Resuscitation Giants honored by the American Heart Association at the Consensus on Science Meeting in preparing the 2015 ILCOR Guidelines update.

First row from left: Leo Bossaert, Carl Kern, Joe Ornato, Leon Chameides, Mary Fran Hazinski, Roger White, Guy Knickerbocker, Myron Weisfeldt, William Keenan. Second row: William Montgomery, David Zideman, Vinay Nadkarni, Tom Aufderheide, Jerry Nolan, Petter Andreas Steen, Robert A. Berg, and Lance Becker. Other Giants, not in the picture: Mickey Eisenberg, Douglas Chamberlain, Richard Cummins, Richard Kerber, Leonard A. Cobb, Gordon A. Ewy, Steven Carvett, James Elam, Archer Gordon, James Jude, Peter Safar, Paul Zoll, Frank Pantridge, Joseph Redding, Max Harry Weil, Keith Twaites, Peter Baskett *(several of the last mentioned Giants are no longer alive)*.

The Giants Award was also bestowed on the Laerdal Foundation in 2000.

Stavanger has become a well-known meeting place, hosting nine international conferences within resuscitation and simulation during the last 15 years.

A beacon for all

Mickey Eisenberg has been, and remains, an untiring pioneer in lifesaving of world-wide importance. Under his leadership King County, Seattle has been a beacon for everyone with survival rates for witnessed cases with a shockable rhythm – the Utstein benchmark - exceeding 50%.

The research conducted with his colleagues in the Center for Evaluation of Emergency Medical Services has been crucial for identifying what works best and has been the basis for many updates of international guidelines. The basic principles are set out in his book "Resuscitate! How Your Community Can Improve Survival from Sudden Cardiac Arrest" and are being spread to communities across the world through "Resuscitation Academies".

Mickey strongly believes the success is down to collaboration, expressing his appreciation to professionals who helped make Seattle a world leader: "the hundreds of emergency dispatchers, the thousands of EMTs, and the hundreds of paramedics." In his book, he draws up the prerequisites for developing a culture of excellence: strong medical and administrative leadership, high-quality training and continuing education, continuous quality improvement, and high expectations.

According to the British resuscitation pioneer, Douglas Chamberlain, the Utstein meetings have made a huge impact on the development of the science of resuscitation, a multi-disciplinary field which until then had lacked definitions, objectives, and even realistic concepts: "The Utstein conferences changed all that. Excellence became much easier to distinguish from dressed-up mediocrity and could more readily blaze trails which others could follow."

"The Utstein conferences have given a language and a method of assessing results and making international comparisons within resuscitation"

Douglas Chamberlain

Widening the scope

Tore Lærdal and his siblings, Astrid and Åge, signed over the Laerdal company headquarters in Tanke Svilandsgate to the Foundation in 2004. The resulting rental income enabled the Foundation to more than double annual grants. This increase helped facilitate major changes in the Foundation's perspective, moving to bring research on clinical work into a larger framework and contributing to better implementation of research findings for society as a whole.

At the same time, its original Western focus has been widened to encompass countries with very high birth-related and early childhood mortality, and support research related to achieving MDGs 4 and 5. Initially, most of these research projects were located in Tanzania, Ethiopia, India, and Bangladesh.

By mid-2015, the fund's capital amounted to NOK 450 million (US$ 70 million), allowing annual grants of NOK 30-40 million.

Widening the focus

"The Helping Babies Breathe program illustrates this widening of focus," says Board Chairman, Geir Sverre Braut. "To help bring about major improvements for society at large we need a good and evidence-based medical platform. Our involvement in the macro scale must also relate to the micro level: we must focus on

the individual in order to protect it in vulnerable situations. Therefore, the Laerdal Foundation supports the testing of implementation research findings in different cultures and climates. For the period 2010-2017, $25 million has been earmarked for projects relating to low-resource countries, in particular innovative approaches to more efficient education and implementation: collaborative initiatives such as the HBB and Survive & Thrive Global Development alliances."

"It is important that locally conducted research can reach other cultures as well"

Geir Sverre Braut

The Laerdal Foundation board emphasizes the importance of anchoring each research project in the local community, ensuring that implementation does not collapse when a project has been concluded.

The Foundation board at one of its excursions to Tanzania, here ready to depart from Haydom. From left Esto Edomi (host), Astrid Lærdal Frøseth, Geir Sverre Braut, Åge Lærdal, Emmanuel Mighay (host), Lars Wiklund, Petter Andreas Steen, Doris Østergaard and Tore Lærdal.

A Norwegian force

Petter Andreas Steen, who moved from a chair in anesthetics at the University of Oslo to the new Laerdal Foundation chair in acute medicine – Europe's first – in 1992, has not only researched and published extensively, but has been a key driver behind remarkable growth in academic Norwegian acute medicine. He has functioned as main supervisor for about 15 PhD candidates and assisted another 15 – of which four were at the Mayo Clinic. In total, about 40 PhDs in acute medicine have been completed in this small country, and another 30 were under way in 2015.

For more than 20 years, he has been a member of the Laerdal Medical Board. In addition to being an important contributor in the wide collaboration to strengthen the Chain of Survival, through serving on other boards including the Laerdal Foundation and the Air Ambulance, Petter Andreas has made his mark internationally, also serving as chairman of the European Resuscitation Council and as a board member of the World Federation of Societies of Anesthesiologists and ILCOR. AHA declared him a Giant of Resuscitation in 2005, and ERC followed up by making him an honorary member a year later.

500,00

Delivering the Vision

Mutual trust and opened doors

Helping save 500,000 extra lives each year by 2020 might sound overly ambitious. However, like the Millennium Development Goals, on analysis this fully documented and underpinned Laerdal vision appears "easy to understand, ambitious – and achievable."

Coming from such a small country, the company has had to expand beyond national borders and is free to be curious and possibly less bound by received ways of doing things. This stimulates openness to different needs in diverse cultures combined with a continuous requirement to adapt. Increasingly, Laerdal is perceived as a partner, invited in to help solve people's problems rather than simply offering a set of products. Doors are open. Building that kind of trust and reputation takes a long time.

Combining the competencies of the numerous cultures both inside the company and in its increasing network of alliances and partners, on a basis of mutual trust, supports the vision.

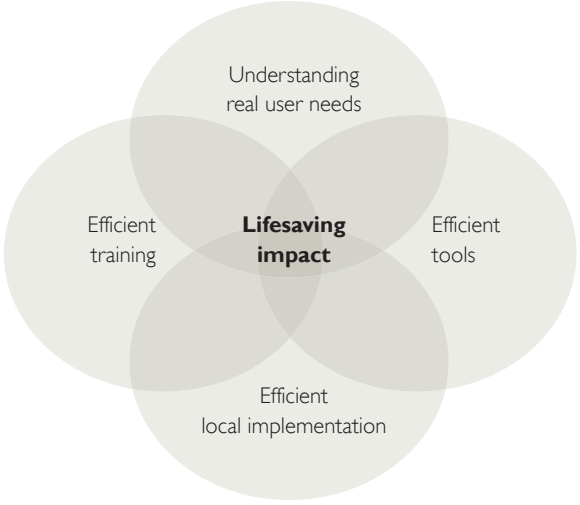
Moreover, Laerdal has a crucial strength: its caring and committed people, who have the firm guidance of the Laerdal values – an ability to listen, endless curiosity, practical problem solving, respect for the customer, hard work, and a passion for improvement.

0 lives

These values are underpinned by the Laerdal guiding stars:

- **Implement what has been shown to work**
- **Collaborate to help save more lives**
- **Simplify products and programs**
- **Drive therapy through education**
- **Embrace customer responsiveness**
- **Deliver quality in all we do**

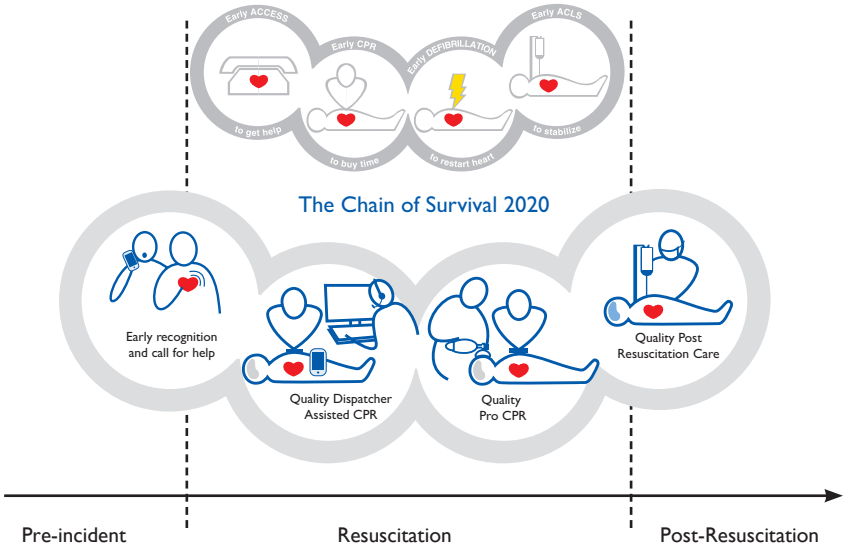
and by Laerdal's mantra that innovation is about lifesaving impact, which is best facilitated by integrating the following four factors:



50,000 saves from cardiac arrests

For more than 25 years, the Chain of Survival has been a potent metaphor for the key actions necessary to improve survival from cardiac arrest. At first addressing only the issues during the resuscitation attempt, it was subsequently extended to emphasize the importance of early recognition and post-resuscitation care.

Whilst early defibrillation, the third link in the Chain, is critically important for those patients whose hearts are fibrillating, these now represent less than 25% of all cardiac arrest patients in many communities.



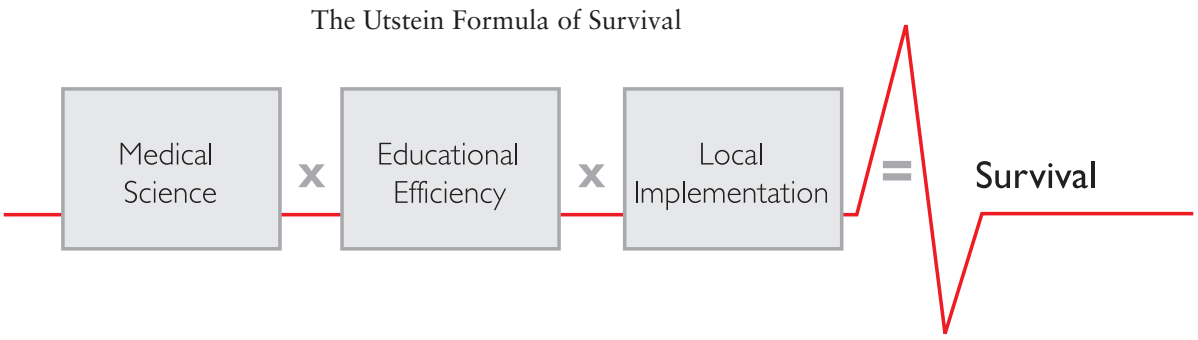
To maximise the chances of survival of all patients, there is an increasing realization that the quality of care throughout the rescue chain is critical. A new corporate strategic direction reflects what Ben Bobrow of Arizona calls the "Anchor Link" – merging the first two links of the traditional Chain to optimise interaction between the caller and the dispatcher and improve both the recognition of a need for CPR and its quality.

Together, the Utstein Formula for Survival and The Chain of Survival have become valuable metaphors for increased understanding of the factors that impact the chances of survival.

Multiply for survival

The Formula of Survival arose out of the ILCOR Advisory Statement on Education in Resuscitation in 2003 where three interactive factors - guideline quality (medical science), efficient education of caregivers, and implementation of a well-functioning chain of survival at a local level - form multiplicands in determining survival from resuscitation.

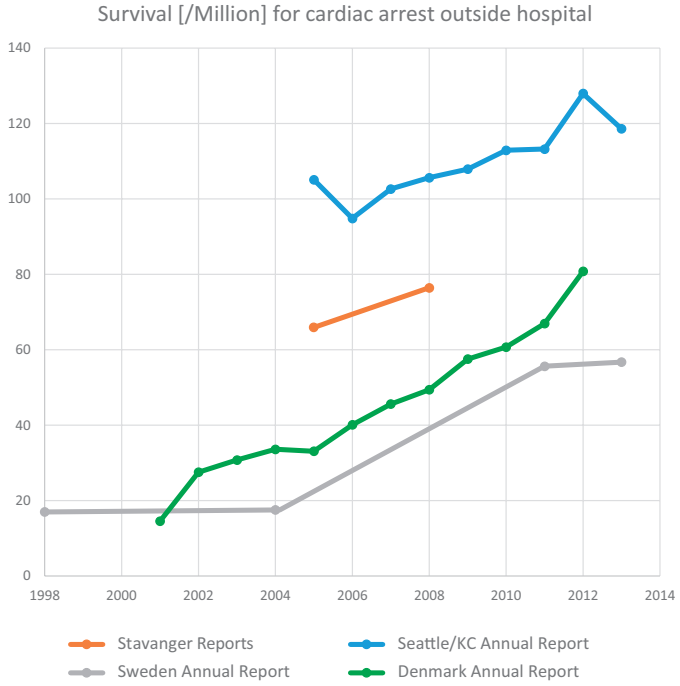
An Utstein symposium in 2006 concluded that the local implementation multiplicand was probably the easiest to improve and the one likely to have the most immediate improvement in survival. It is increasingly apparent that this metaphor is as applicable in Emergency Care and Global Health as in Resuscitation.



The Rising Northern Stars

Published data suggest such quality interaction in the Anchor Link could increase survival fourfold. Whilst King County Seattle has led the way, many are now following with initiatives such as those described earlier. As a result, Scandinavia and other regions around the world are fast approaching the gold standard of the American North West.

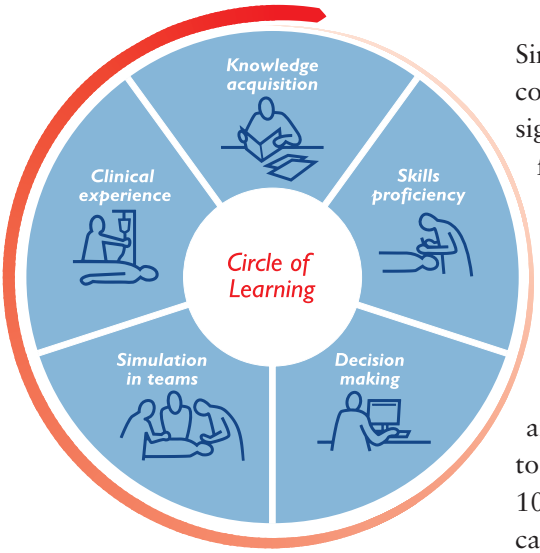
The Danish Cardiac Arrest Registry and the Swedish Cardiac Arrest Registry comprise all cardiac arrests, including trauma. The Seattle/King County register excludes trauma. From Stavanger, only cardiac etiology is reported, which excludes 1/3 of the total cardiac arrest data. All reports include EMS witnessed arrests.



50,000 saves by improved emergency care

As patient safety is turning into a major concern at a time of economic constraints in health care, and medical science is equally accessible to all, the two last elements in the Utstein Formula for Survival – educational efficiency and local implementation – demonstrably account for the dramatic differences in patient outcomes.

However, newly developed learning programs enable health care institutions to improve the quality of care and at the same time reduce costs. As symbolized in the Circle of Learning, effective education involves knowledge, technical skills, decision-making, teamwork – and effective reinforcement through the frequent combining of e-simulation with hands-on practice. Continuous improvement results from methodology that blends all the elements in ways that can be adapted to meet the particular needs of each health care provider. Laerdal offers product solutions for all of these steps.



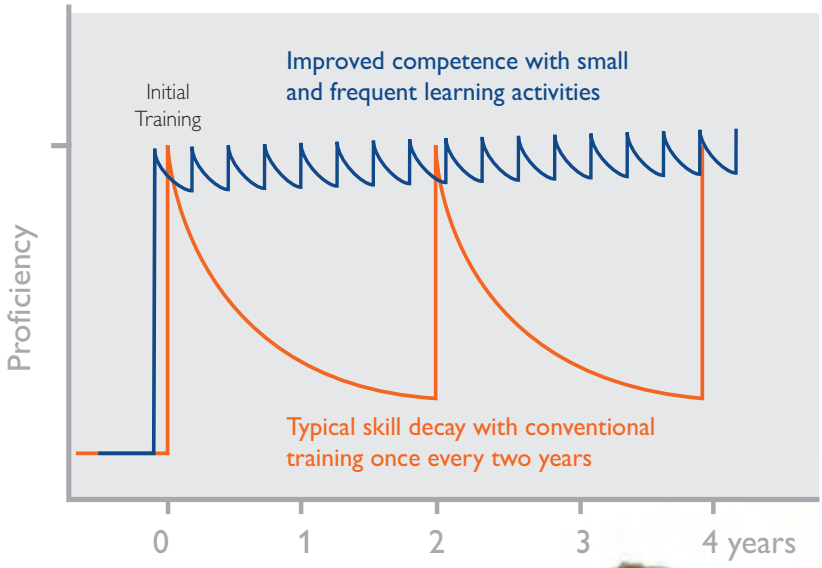
Circle of Learning

Since the early 2000s, it has been proven that simulation combined with effective debriefing can improve teamwork significantly. However, unless simulation is part of a program for continuous development, it may just add cost without improving patient outcomes.

The traditional approach to learning in health care has been annual or biennial high intensity sessions. However, research has shown clearly that skills and knowledge decay quickly: Oermann and colleagues have demonstrated that knowledge and skills may need refreshing every three months. This has led to the idea of Low Dose, High Frequency (LDHF) learning: 10-20 minutes of efficient learning activities performed quarterly can not only maintain skills, but actually improve performance and enhance confidence significantly over time. Moreover, the LDHF method encourages cultures of continuous learning in the work environment, with skills such as resuscitation and teamwork learnt through effective simulation – "in situ" learning.

Low Dose, High Frequency refresher training

Crucially, the LDHF method has the major advantage of more value for less money. Instead of incurring the cost of sending carers away from the work place for courses, LDHF learning occurs as a part of normal, daily activities with the added advantage of being fully in context. As a result, greatly improved patient care can be combined with good return on investment.



Cansu Akarsu demonstrating the QCPR station.

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asociación internacional de pediatría

International Confederation of Midwives
Strengthening Midwifery Globally

FIGO

unicef

UNFPA

Norad

BILL & MELINDA GATES foundation

400,000 saves in global health

Within a few years, a series of powerful new alliances have been formed for helping mothers and children survive through further development of programs and testing their implementation.

AAP sparked off Laerdal's involvement as a catalyst in this gathering force in 2008 by asking for help in advancing educational science and resources for implementing neonatal resuscitation. This resulted in the HBB Global Development Alliance with AAP, USAID, NIH, Save the Children, and Laerdal.

When Jhpiego and AAP wanted Laerdal to collaborate on developing a learning program for controlling post-partum hemorrhage, widening networks were engaged in the implementing of increasingly comprehensive programs, from HMS to the public-private Survive & Thrive GDA for addressing maternal, newborn, and child health challenges. The networks keep growing, involving ever more national associations of pediatricians, obstetricians, midwives and nurses.

In this field as well, the crucial importance of Low Dose, High Frequency training manifested itself clearly during the pilot projects, through the birth helpers' own comments. The extremely low-cost programs make it possible to leave the training packages on site, enabling the carers to maintain and confirm their skills.

Rehema Ramadhani Gumbo giving her newborn a good start in the KMC wrap, at the Muhimbili hospital in Dar es Salaam, Tanzania.

Sustainable Development Goals

The success of the Millenium Development Goals (MDGs 4 and 5) on health has been due to their being easy to understand, ambitious and achievable, as Børge Brende and Bent Høie of the Norwegian ministries of Foreign Affairs and Health and Care Services pointed out in a commentary in *Lancet* in January 2015. The goals "have brought quantifiable targets and measurement of results to centre stage for politicians worldwide." They are now coming to an end and will be replaced by a Sustainable Development Goal for Health for the period 2016 to 2030. This goal is still being negotiated by the world community along with 16 other SDGs, but it is now generally accepted that most deaths before the age of 70 are avoidable. Norheim and colleagues have shown in a *Lancet* study published in late 2014 that avoiding 40% of these premature deaths by 2030 is achievable, including halving under-50 mortality, halving traffic deaths, and avoiding 2/3rd of child and maternal deaths and 1/3rd of premature deaths from non-communicable diseases.

A long-term commitment

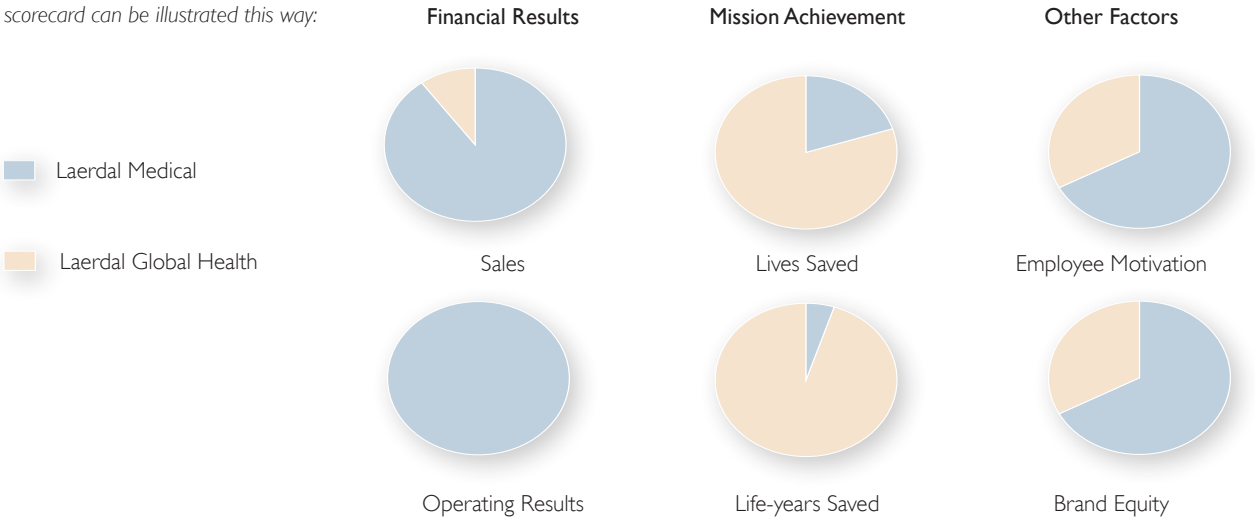
"Our two companies, Laerdal Medical and Laerdal Global Health, complement each other in many ways," says Tore Lærdal. "Laerdal Medical brings financial sustainability. The investments made to establish and support Laerdal Global Health are only possible thanks to the good results achieved in Laerdal Medical over many years."

The same is true for the donations made to the Laerdal Foundation over four decades.

"While Laerdal Global Health is expected to contribute only marginally to the revenue, and in accordance with its not-for-profit commitment not contribute to the net income of operations, it is expected to account for around 80% of the lives saved and also to positively influence both employee motivation and the brand value of Laerdal Medical."

Laerdal's performance measurement, a so-called balanced scorecard that encompasses important elements beyond the economic numbers, is illustrated as follows in the company's sustainability report.

The estimated contributions from our two companies to Laerdal's balanced scorecard can be illustrated this way:



Three generations meet in The Norwegian Children´s Museum: to the left, a depiction of the founder, Åsmund S. Lærdal, experimenting in his kitchen in the 1950s. To the right, in the greatly upscaled Tomte Mercedes, Hanne Kristin Lærdal, Tore Lærdal, Jon Åsmund Lærdal, and Ingrid Lærdal.

Since its the inception 75 years ago, Laerdal has had the full commitment of the first two generations of shareholders to the long term development of the company. This has enabled it to focus on ensuring that it stayed true to its mission and vision.The third generation in the family is now actively involved in the company at senior levels.

Three books are handed to all Laerdal employees on their first day of work at the company: The Laerdal Values, The Sustainability Report, and this book you have just finished reading.

Embracing the values, and in view of what has already been achieved, each of the elements of the 500,000 more lives a year are well within reach: 50,000 more lives saved by improved Chains of Survival, 50,000 fewer fatal medical errors, and 400,000 fewer deaths of mothers and children under five.

Every year.

Publications that have guided our strategy

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This book is also available on Laerdal.com where this bibliography will be kept updated.

ABBREVIATIONS

AAP	American Academy of Pediatrics
ACLS	advanced cardiovascular life support
ACNM	American College of Nurse Midwives
ACOG	American College of Obstetrics and Gynecologists
A & E	Accident and Emergency Department
AED	Automated External Defibrillator
AHA	American Heart Association
ASPiH	Association for Simulated Practice in Healthcare
ATP	Accelerating to Practice program
BASICS	British Association for Immediate Care
BHF	British Heart Foundation
BLS	Basic Life Support
CBID	Center for Bioengineering, Innovation and Design
CCHC	China County Hospital Confederation
CEEMS	Center for Evaluation of Emergency Medical Services
CHF	China Heart Federation
CMMB	Center for Global Health and Economic Development
CPR	Cardio-Pulmonary Resuscitation
DARE	Dispatcher Assisted Community Responsiveness
DIMS	Danish Institute for Medical Simulation
ECEB	Essential Care for Every Baby
ECSB	Essential Care for Small Babiess
EMS	Emergency Medical Services
ERC	European Resuscitation Council
FIGO	International Federation of Gynecology and Obstetrics
GDA	Global Development Alliance
HBB	Helping Babies Breathe
HMS	Helping Mothers Survive
ICM	International Confederation of Midwives
ILCOR	International Liaison Committee on Resuscitation
IUD	Intra Uterine Device
IPA	International Pediatric Association
KMC	Kangaroo Mother Care
LDHF	Low Dose, High Frequency
LGH	Laerdal Global Health
LHL	Norwegian Heart and Lung Association
LM	Laerdal Medical
MDG	Millennium Development Goal
MPL	Medical Plastics Laboratory
NGO	Non-Governmental Organization
NIH	National Institutes of Health
NLN	National League for Nursing
NOK	Norwegian krone
NRP	Neonatal Resuscitation Program
PAROS	Pan Asian Resuscitation Outcomes Study
QCPR	Quality Cardio-Pulmonary Resuscitation
R & D	Research and Development
RMB	renmimbi
RQI	Resusci Quality Program
S & T	Survive and Thrive
SAFER	Stavanger Acute medicine Foundation for Education and Research
SDG	Sustainable Development Goal
SUS	Stavanger University Hospital
UiS	University of Stavanger
UNFPA	United Nations Population Fund
UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development
WHO	World Health Organization