Improving Care For Mothers And Babies
In The Russian Federation

Collaborative on prevention of hypothermia among newborns

Report on the demonstration and spread collaboratives.

**a. The evidence base**

Neonatal hypothermia, defined as a body temperature below 36.5 °C, is a pervasive problem worldwide and an important contributor to the risk of neonatal mortality. In hospitals in five countries, the odds of death among babies with hypothermia were found to be 2-5 times greater than those without. (Mullany 2011, Kumar 2009). That is why the World Health Organization (WHO) has defined the “warm chain” as one of the key elements of essential newborn care; its ten steps are listed in box 1. (WHO 1994, 1997) The problem affects not only developing countries, in which 26%-85% of newborns have found to be affected by neonatal hypothermia (Mullany 2011).

In developed countries, hypothermia continues to be a concern and a focus of quality improvement efforts, particularly for preterm infants and following primary neonatal resuscitation (Mance 2008, Lee et al 2008). In an audit at 56 Canadian hospitals, 24% of full-term infants and 62% of early preterm infants were found to be hypothermic following resuscitation efforts. (Mitchell et al 2002) The California Perinatal Quality Care Collaborative (Miller et al, 2011) assessed the incidence of hypothermia among 8782 very low birthweight infants (<1500 grams) born in 127 hospitals in the American state of California in 2006-7. Only 43% of babies had a normal temperature on admission to the neonatal intensive care unit. 0.8% were hyperthermic; 30.5% were mildly hypothermic (36.0 °C-36.4 °C); 25.6% were moderately hypothermic (32.0 °C-35.9 °C) and 0.1% (9 infants) were severely hypothermic (<32.0°C).

The major patient-related factor influencing the risk of developing hypothermia is body weight of the newborn. The risk of hypothermia is significantly greater for preterm babies; these babies are affected even in the

---

**Box 1. The Ten Steps of the “Warm Chain”**

1. Warm delivery room
2. Immediate drying
3. Skin-to-skin contact
4. Breast-feeding
5. Bathing and weighing postponed
6. Appropriate clothing/bedding
7. Mother and baby together
8. Warm transportation
9. Warm resuscitation
10. Training and awareness raising

most sophisticated perinatal centers. The effect has been most thoroughly measured in
developing countries in recent years; in Nepal, Mullany found that the risk increased 7.4% for
every 100 gram decrease in weight between 3000 and 2500 grams, 13.5% for every 100 gram
decrease in weight between 2500 and 2000 grams, and 31.3% for every 100 gram decrease in
weight below 2000 grams. The major factor related to the care setting is ambient room
temperature. Mullany found that the risk of developing hypothermia <36.0 °C increased by 41% for
each 5 °C decrease in ambient temperature.

In order to prevent hypothermia and its impact on mortality in low-resource settings, and to
reduce use of high-cost incubators and high-demand skilled personnel, the method of
Kangaroo mother care has been developed. Kangaroo mother care includes immediate and
continuous skin-to-skin contact between a mother and newborn and frequent and exclusive
breastfeeding, combined with early discharge from the hospital. A recent Cochrane review
(Conde-Agudelo et al, 2011) found on the basis of 14 reviewed clinical trials that this
intervention, when applied immediately, decreased the risk of hypothermia at discharge or 40-
41 weeks gestation equivalent from 32% to 7.6% and decreased the risk of mortality by 40%.
In surviving infants, the risk of severe infections, other severe illness and lower respiratory tract
disease a follow-up were all significantly decreased.

b. Initial assessment.
The Russian Federation has one of the most severe climates in the world. During the winter of
2009-10, one of the coldest for the past 100 years, outdoor temperatures routinely reached -33°C. Faced with such a frigid climate, doctors at maternity hospitals struggled to maintain
the national standard delivery room temperature of 24°C. At that time, the Russian
government, placing a priority on reducing its already low rates of infant mortality (8.1 per 1000
live births in 2009) to western European levels, had made billions of rubles available for facility
and equipment modernization, subject to facility and regional requests. When, in mid-2009, 22
hospitals in three central Russian regions were asked to select topics for an improvement
project on maternal and child health (MCH) care, 16 of them selected to focus attention on
prevention of neonatal hypothermia. Baseline data from January-March 2009 showed that
participating hospitals’ delivery room temperatures were below the WHO-recommended 25°C in
0-100% of recorded measurements (median 17.7%) and that rates of neonatal hypothermia
after transfer to the maternity ward ranged from 0-37% of newborns (median 3.6%).

c. The change package
The changes described in the package developed under “Improving Care for Mothers and
Babies” adapt the warm chain to the Russian setting. The final written change package
contained three major objectives, divided into 17 recommended types of changes, as follows:

**Objective 1. Ensure the Warm Chain in the Facility** in order to control delivery room,
operating room, maternity ward and neonatal intensive care unit (NICU) temperatures at 25-
28°C.

- Procurement and installation of thermometers in all rooms
• Install heating systems
• Ensure backup oil heaters
• Supply each delivery room with the needed equipment, (including heated examination and resuscitation tables, and a place for heating blankets and newborn clothing)
• Introduce journals for recording room temperature
• Determine an algorithm to follow for temperatures outside the required range
• Train staff on the new procedures

Objective 2. Ensure the Warm Chain for the Newborn
• Assure availability of warm baby clothes for the newborn (to replace tight swaddling)
• Introduce systems for monitoring the temperature of the newborn (every half hour in the delivery room, immediately before and immediately after transfer to the ward, and twice daily thereafter)
• Introduce techniques for reheating the baby in cases of hypothermia: under a heat lamp and transport in a special heated bag.
• Determine a standard algorithm for essential newborn care in normal births of a healthy, full-term baby: quickly dry the baby under a heat lamp, dress it in a hat and socks, place it on the mother’s belly, cover with a warm blanket, assist the mother in guiding the baby to the breast for his first feeding. Maintain this skin-to-skin contact for at least two hours. Conduct an initial medical evaluation of the baby while the baby is lying on the mother’s belly. The baby should room-in with the mother.
• Determine standard algorithms to use in complicated cases (primary neonatal resuscitation, caesarian section, low birth weight, etc.), including use of plastic bags or sheets to maintain the temperature of babies born before 28 weeks gestation, heat lamps during resuscitation procedures, and pre-heating transport incubators.
• Train staff on the new procedures

Objective 3. Assure prevention of hypothermia during transport.
• Procure necessary supplies and equipment
• Introduce standard algorithms for intra-hospital transport (if possible, while maintaining contact with the mother, or in an incubator in complicated situations)
• Introduce standard algorithms for inter-hospital transport, in a transport incubator, including emergency measures for heating the vehicle if necessary.
• Train staff on the new procedures.

d. Participants.
In Phase I (the demonstration collaborative), 16 hospitals pursued this objective, including all participating hospitals in Yaroslavl Region, as shown in Table 1. In Phase II (the spread collaborative), 29 facilities from all 6 regions participated in this collaborative. Although the Tver Region workplan called for a sole focus on neonatal resuscitation and regionalization of care, Rzhev hospital requested to join the hypothermia collaborative and two other hospitals
implemented some of the recommended procedures as a necessary precursor to care and resuscitation for low birthweight babies, which are especially vulnerable to hypothermia.

Table 1. Facilities pursuing the improvement goal of prevention of hypothermia and respiratory ailments among newborns during phase 1 of the project.

<table>
<thead>
<tr>
<th>Region</th>
<th>Number of facilities</th>
<th>List of Facilities</th>
<th>Improvement Team Leadership</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kostroma Region</td>
<td>4</td>
<td>Sharya Central District Hospital</td>
<td>NP Vyalitsina, TG Kochulina</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Nerekhta Central District Hospital</td>
<td>E.P. Kukas, E.B. Lebedeva</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Kostroma City Maternity Hospital No. 1</td>
<td>EA Novozhilova, NP Mamontova</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Kostroma Region Hospital</td>
<td>T.N. Sokolova, E.E. Pakhteeva</td>
</tr>
<tr>
<td>Tambov Region</td>
<td>5</td>
<td>Tambov Region Hospital</td>
<td>A.Y. Prokopov</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tambov Region Children’s Hospital</td>
<td>E.N. Murzina</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tambov City Hospital No. 3</td>
<td>S.I. Vedischev</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Uvarovo Central District Hospital</td>
<td>S.V. Koltsova</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Michurinsk City Hospital No. 2</td>
<td>S.A. Kurilikova</td>
</tr>
<tr>
<td>Yaroslavl Region</td>
<td>7</td>
<td>Yaroslavl Region Maternity Hospital</td>
<td>A.L. Karpova</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Yaroslavl City Clinical Hospital No. 2</td>
<td>N.N. Galaganova</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pereslavl-Zalessky City Hospital</td>
<td>O.A. Zotova, N.S. Verkhovskaya</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Rybinsk Perinatal Center</td>
<td>A.A. Prostynkina</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Rostov Central District Hospital</td>
<td>N.S. Osipova</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tutaev Central District Hospital</td>
<td>E.V. Gorodova</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Uglich Central District Hospital</td>
<td>E.V. Lisina, M.N. Belova</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>16</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2. Participants in the collaborative on prevention of hypothermia among newborns during phase 2 of the project.

<table>
<thead>
<tr>
<th>Region</th>
<th>Number of facilities</th>
<th>List of Facilities</th>
<th>Improvement Team Leadership</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kostroma Region</td>
<td>5</td>
<td>Sharya Central District Hospital</td>
<td>NP Vyalitsina, TG Kochulina</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Nerekhta Central District Hospital</td>
<td>I.K. Petrova, E.B. Lebedeva</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Kostroma City Maternity Hospital No. 1</td>
<td>EA Novozhilova, NP Mamontova</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Kostroma Region Hospital</td>
<td>T.N. Sokolova, E.E. Pakhteeva</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Manturovo City Hospital</td>
<td>V.N. Speransky</td>
</tr>
<tr>
<td>Tambov Region</td>
<td>4</td>
<td>Tambov Region Children’s Hospital</td>
<td>E.N. Murzina</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Uvarovo Central District Hospital</td>
<td>S.V. Koltsova</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tambov City Hospital No. 3</td>
<td>S.I. Vedischev</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Michurinsk City Hospital No. 2</td>
<td>S.A. Kurilikova</td>
</tr>
<tr>
<td>Yaroslavl Region</td>
<td>4</td>
<td>Tutaev Central District Hospital</td>
<td>E.V. Gorodova</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Rostov Central District Hospital</td>
<td>N.S. Osipova</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Uglich Central District Hospital</td>
<td>E.V. Lisina, M.N. Belova</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pereslavl-Zalessky City Hospital</td>
<td>O.A. Zotova, N.S. Verkhovskaya</td>
</tr>
<tr>
<td>Ivanovo Region</td>
<td>4</td>
<td>Ivanovo City Maternity Hospital No. 1</td>
<td>O.V. Lobanova, I.A. Olevson</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ivanovo City Maternity Hospital No. 4</td>
<td>A.A. Karneev, O.V. Burova</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Teykovo Central District Hospital</td>
<td>A.Y. Plivovar, N.A. Baranova</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Shuya Central District Hospital</td>
<td>S.Y. Chastushkin, I.N. Galkina</td>
</tr>
<tr>
<td>Tula Region</td>
<td>7</td>
<td>Kircheevskaya Central District Hospital</td>
<td>Z.G. Konovalova</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Schekinskaya Central District Hospital</td>
<td>A.V. Popitchenko, LG Kuleshova</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tula Region Perinatal Center</td>
<td>N.S. Vlasova</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Novomoskovsk Maternity Hospital</td>
<td>V.A. Nefedova, IA Merkulova</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tula City Maternity Hospital No. 1</td>
<td>E.S. Makarova, E.M. Gusova</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tula Region Children’s Hospital</td>
<td>L.I. Kotik, L.A. Churyukina</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Aleksin Maternity Hospital</td>
<td>S.V. Gavrilov</td>
</tr>
<tr>
<td>Tver Region</td>
<td>1</td>
<td>Rzhev Central District Hospital</td>
<td>S.V. Sukhanova</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>25</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
e. Project inputs

In phase 1, training in hypothermia prevention was provided in learning sessions, as well as in hands-on site visits from clinical experts in neonatology. Draft versions of the written change package were prepared and distributed in Sept. 2009 (based on recommendations developed for a neonatal transport QI project during the 1998-2002 USAID Quality Assurance Project) and May 2011. During the course of phase 1, participants found an animated training film on the warm chain, produced by another USAID partner, on the internet, and produced and shared their own video training materials. Numerous relevant Russian language documents and team presentations were shared as attachments to the change package, on paper, CD and the web portal. A neonatologist and pediatric nurse from Kostroma City Hospital No. 1 were prepared as trainers on hypothermia prevention. In phase 2, clinical trainings were held in Ivanovo and Tula Regions for 39 participants from 14 hospitals; a nurse and neonatologist from Kostroma were developed as master-trainers. Training on special hypothermia prevention for pre-term babies was provided as part of training on management and prevention of preterm birth in Kostroma and Tver Regions in February 2011.

Table 3. Clinical experts on hypothermia prevention.

<table>
<thead>
<tr>
<th>Expert</th>
<th>Qualifications/background</th>
<th>Role in project and related policy development activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elena N. Bailbarina, DMS, professor</td>
<td>Deputy Director for Science, Kulakov Center, Chief Neonatologist of Russia, member of the MOHSD coordinating committee for improving care to mothers and infants, Chair of MOHSD Ethical Committee. Participated in QAP.</td>
<td>Project oversight on behalf of MOHSD. Coordination of video conferences on neonatology. Chair of learning sessions sections on neonatology. Reviewed and co-authored written change package on hypothermia prevention. Assessed quality care in Kostroma Region for MOHSD coordinating committee. Co-author of MOHSD methodological letter of July 2011 which included hypothermia prevention.</td>
</tr>
<tr>
<td>Olga Chernobrovkina MD</td>
<td>Anesthesiologist-resuscitation specialist. Director of quality improvement, URC/Russia. Led QI project on respiratory distress syndrome (RDS) prevention, treatment and transportation of newborns under QAP, Tver Region. Former deputy chief doctor, Tver Region Hospital.</td>
<td>Co-organized learning sessions and trainings on QI methods in MCH. Participated in LS sections on neonatology. Co-author of written change package on hypothermia prevention.</td>
</tr>
<tr>
<td>Expert</td>
<td>Qualifications/ background</td>
<td>Role in project and related policy development activities</td>
</tr>
<tr>
<td>------------------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Andrei Ilchenko MD</td>
<td>Anesthesiologist-resuscitation specialist. Former quality improvement expert, URC. Former chief doctor, Tver City Children’s Hospital No. 1. Participated in QAP project on RDS prevention, treatment and transportation of newborns in Tver Region.</td>
<td>Phase 1 expert on neonatology for Kostroma Region. Conducted supportive visits to facilities, participated in LS, conducted audits. Co-author of written change package on hypothermia prevention.</td>
</tr>
<tr>
<td>Boris Kapitonov MD</td>
<td>Chief anesthesiologist-resuscitation specialist of Tver Region, head of intensive care unit, Tver Region Children’s Hospital. Participated in QAP project on RDS prevention, treatment and transportation of newborns in Tver Region.</td>
<td>Phase 1 expert on neonatology for Tambov Region. Conducted supportive visits to facilities, participated in LS, conducted audits. Co-author of written change package on hypothermia prevention.</td>
</tr>
<tr>
<td>Andrei Ryabtsev MD</td>
<td>Neonatologist, Tver City. Participated in QAP project on RDS prevention, treatment and transportation of newborns in Tver Region.</td>
<td>Expert on neonatology for Yaroslavl Region for part of phase 1. Conducted supportive visits to facilities, participated in LS, conducted audits.</td>
</tr>
<tr>
<td>Tatyana Dmitrieva MD</td>
<td>Chief neonatologist, Tver Region. Participated in QAP project on RDS prevention, treatment and transportation of newborns in Tver Region.</td>
<td>Supplemental expert on neonatology for Yaroslavl Region in phase 1. Conducted support visits to facilities, conducted audits.</td>
</tr>
<tr>
<td>Olga Federyakina CMS</td>
<td>Tver State Medical Academy, docent of 2nd pediatrics department</td>
<td>Contributed to written change package on hypothermia prevention; conducted training in Tver on prevention of hypothermia after preterm birth.</td>
</tr>
<tr>
<td>Natalya Shilova MD CMS</td>
<td>Neonatologist. Junior scientific researcher, Ivanovo Institute.</td>
<td>Conducted training in Kostroma on prevention of hypothermia after preterm birth. Received training in QI in phase 1.</td>
</tr>
</tbody>
</table>

**Table 4. Clinical trainings on prevention of hypothermia.**

<table>
<thead>
<tr>
<th>Date</th>
<th>Location</th>
<th>Length</th>
<th>Trainers</th>
<th>Regions/facilities</th>
<th>Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mar 18, 2011</td>
<td>Ivanovo</td>
<td>5.5 hrs</td>
<td>B. Kapitonov, Tver Obl. Z.Izhaeva, IHCOI N. Mamontova &amp; G. Ipatova, Kostroma Maternity Hosp No.1</td>
<td>Ivanovo Region Shuy Hospital City Maternity Hospital No. 4 City Maternity Hospital No. 1 Teykovo Hospital Ivanovo State Medical Academy*</td>
<td>20</td>
</tr>
<tr>
<td>Apr 15, 2011</td>
<td>Tula</td>
<td>5.5 hrs</td>
<td>B. Kapitonov, Tver Obl. A. Novozhilov, IHCOI N. Mamontova &amp; G. Ipatova, Kostroma Maternity Hosp No.1</td>
<td>Tula Region Schekinskaya Hospital Novosmovsk Maternity Hospital Tula City Maternity Hospital No. 1 Kireevskaya Hospital Region Perinatal Center Bogorodskaya Hospital* Donskaya City Children’s Hospital #1* Uzlovaya Hospital* Novosmovsk City Children’s Hospital*</td>
<td>19</td>
</tr>
</tbody>
</table>
The warm chain—hypothermia prevention

Temperature control in delivery rooms

*Not an improvement collaborative participant

f. Testing of Changes

In nearly all participating hospitals, chief doctors issued executive orders requiring maintenance and recording of temperature control in the delivery rooms and wards that included adoption of a control algorithm, shown in the form of a flow chart. The algorithm was posted on the wall in the delivery room. For many facilities, such as Ivanovo City Maternity Hospital No. 1, implementing the “warm chain” change package involved substantial capital investments on insulating windows and radiant, ceiling-mounted heaters, as well as installation of supplemental electric systems and renovation of aging, drafty facilities. Several improvement team leaders credited the project with convincing chief doctors to meet their long-standing request for installation of insulating plastic-frame windows. In Michurinsk City Hospital No. 2, Tambov Region, during the frigid winter of 2009-10, administrative offices went unheated to conserve funds while the rooms and corridors of the maternity department were maintained at a uniform 25°C. In multi-profile hospitals, the improvement team sometimes had problems instituting control measures in shared operating rooms; these were solved by involving chief doctors in their resolution and adding surgery department leaders to the improvement team. Delivery room temperatures were monitored twice daily and temperature control journals were universally maintained at nurses stations in maternity department corridors. In Phase 2, facilities began to maintain these journals in graphic form as control charts. Initial and continuing staff education were provided; Nerekhta Hospital, Kostroma Region, trains its staff quarterly on hypothermia prevention. The accuracy of contact thermometers, placed on the
baby’s forehead, was tested against electronic thermometers and rejected as inaccurate, although they have been found acceptable in some studies (Dyuran et al, 2009).

A variety of solutions were tested to warming blankets and clothes prior to delivery; Kostroma Region Hospital found this could safely be done on the resuscitation table; there was considerable testing of how far in advance the delivery room needed to be warmed; the result of those experiments, documented in the change package, is 40 minutes to two hours; use of the resuscitation table heat lamp as a supplemental heat source was recommended. Similar experimentation and measuring of results resulted in adoption of the evidence-based recommendations on use of heat lamps and plastic bags in primary neonatal resuscitation, and transport through chilly corridors to the maternity ward on the belly of the mother, lying on a wheeled stretcher.

How to reconcile the need for baby caps and booties in the delivery room, and to eliminate tight swaddling in the maternity wards, with the requirements of the previous hygiene regulations (since updated) was the topic of extensive experimentation and discussion at learning sessions. Some Region hygiene inspectorates (Rospotrebnadzor) notably that in Kostroma Region, required use of only disposable clothing in the delivery room, and facilities found and shared sources of disposable caps and baby booties. Others, such Rostov Hospital, Yaroslavl Region, allowed parents to bring in their own baby clothing, which could then be sterilized.

Extensive debate also surrounded the topic of skin-to-skin contact with the mother following delivery, especially since many facilities were participating in the collaborative on both hypothermia prevention and breastfeeding. Breastfeeding experts, including those with the Baby-Friendly Hospital Initiative, generally recommend that the baby be placed at the breast for just one hour after birth, in order to assure early breastfeeding. Facilities in Tambov Region tested whether one hour was adequate for prevention of hypothermia, and found that newborn body temperature declined if the baby was removed from the mother for medical procedures between one and two hours after birth. Teams debated whether umbilical cord clamping could safely be delayed until the baby was placed on the mother’s belly, but some teams succeeded in introducing this practice. During phase 2 some teams, such as Shuya Hospital, Ivanovo Region, took the opportunity to incorporate other elements of essential newborn care newly endorsed by a new federal infection control regulation [6], such as tetracycline eye ointment to prevent gonococcal conjunctivitis.

There were a number of barriers identified to a full two hours of skin-to-skin contact. At Kostroma Region Hospital, some older Russian obstetricians still held to the practice of placing ice on the mother’s belly after delivery; they were convinced to abandon this non-recommended practice. Other hospitals cited inadequate nursing staff to observe the mother and child in the delivery room; in response some hospitals moved corridor nursing stations to a vantage point where they could better see the delivery room. Pediatricians needed to be convinced to come to the delivery rooms to examine babies rather than the nursery; Sharya Hospital, Kostroma Region, accomplished this by instituting a pediatric duty roster in the maternity department.
Shared delivery rooms with two or three delivery tables (a common situation in older Russian hospitals) were also cited as a barrier; however Ivanovo City Hospital No. 4 successfully maintained two or three mothers and babies at a time in the delivery room. Sharya and Michurinsk Hospitals, among others, renovated their maternity departments to create smaller individual delivery rooms (a recommended but not required practice in Russia) using hypothermia prevention as justification. Nelidovo Hospital, Tver Region, incorporated individual delivery rooms and a reduced transport distance to the NICU in the design of its new maternity department.

In order to tell mothers what to expect, many facilities participating in the hypothermia and breastfeeding collaborative also introduced prenatal parenting education programs, and included hypothermia prevention as part of the curriculum. Tours of the maternity department and delivery room were included in the curriculum at Morshansk Hospital, Tambov Region. Some facilities provided psychological counseling for mothers, in order to reduce rates of refusal of early breastfeeding. Recommended scripts were also developed for counseling mothers on skin-to-skin contact in the delivery room.

Prevention of hypothermia was also introduced into pre-service nursing curriculum at Kostroma Medical College, with use of the change package as a text. Tula Region Children’s Clinical Hospital adapted the change package to hypothermia correction and prevention for ill and preterm newborns transferred there by district (rayon) maternity facilities. They focused on measurement of temperature at admission, and attention to clinical signs of possible hypothermia on the ward, and provided training and poster reminders to both mothers and nurses.

**g. Work products**

The change package for improving “Prevention of Hypothermia among Newborns” was approved by the Kulakov Center and published in November, 2011.

**h. Evaluation methods**

We used two indicators to assess facilities’ performance in carrying out the processes recommended in the change package and two indicators to assess the clinical results on hypothermia reduction. These indicators were tracked on a monthly basis. We also assessed the overall impact of project activities on early neonatal mortality, which is discussed in Chapter 9. As recommended by the change package, facilities also assessed their performance on changes they tested by using “micro-indicators;” these are not reported here.

The first process indicator was the percent of all delivery room temperature measurements that were less than the standard of 25°C. Facilities were asked to record the temperature in each delivery room twice daily (generally at 8 AM and 8 PM) for inclusion in this indicator, and to report the number of total measurements (which would vary by the number of delivery rooms) and the number of measurements below 25°C. Delivery rooms closed for cleaning and ventilation were to be excluded, as were supplemental measurements made to monitor the
effect of corrective actions. Some facilities chose to monitor delivery room temperature three times daily. We report this as a median of facilities reporting data at any point in time.

The second process indicator assessed was the percent of all newborns with skin-to-skin contact with the mother for at least two hours after birth. Facilities were to report the number of babies born alive as the denominator, and the number of babies with 2 hours contact as the numerator. (In the change package, the denominator excludes newborns for whom primary neonatal resuscitation was provided; we have not done so here, as many babies apparently were rapidly placed in skin-to-skin contact with the mother immediately following resuscitation). This process indicator was used for both the breastfeeding and hypothermia collaborative, and here we report results from all reporting hospitals in both collaboratives. In order to display the range of performance across hospitals, we have graphed the median, 25th and 75th percentile of hospital performance on this indicator.

The first outcome indicator was the percent of newborns with hypothermia, defined as a body temperature of less than 36.5°C, measured immediately prior to transfer of the baby from the delivery room. Hospitals were expected to report the number of babies with hypothermia at this time point, and the number of live births was used as the denominator. We again graph the range of hospital performance on a percentile basis.

The second outcome indicator was percent of newborns with hypothermia measured immediately upon arrival at the ward following transportation., and is similarly reported and assessed.

i. Results

Adoption of recommended practices. From January-March 2009, before the project start, the median monthly percent of temperature measurements below the recommended minimum of 25°C among the seven hospitals that were able to report baseline data was 17.7%. Improved measurement following the start of the project, in August-September 2009, resulted in a sharp increase in the number of problems identified. After that, hospitals improved control of delivery room temperatures. During January-March 2010, the median monthly percent of measurements below 25°C among 20 reporting hospitals was 3.2%; during January-March 2011, the corresponding median among 10 reporting hospitals was 0%, a major shift.

Figure 1 shows the range of hospital performance on mother-to-child skin-to-skin contact for 2 hours after birth, among 33 hospitals participating in either the breastfeeding, or hypothermia collaborative, or both. Although some participating hospitals claimed they could support mother and baby in the delivery room for only 60-90 minutes after birth, Figure 3 shows that the typical hospital complied with the recommendation for 2 hours of contact in 70 percent of cases, and that by September 2011, even the lowest 25th percentile of hospitals had started to prolong contact to a full 2 hours.

Hypothermia Outcomes. At the end of phase 1, we made a formal statistical comparison of the effect of the change package on hypothermia upon arrival at the postpartum ward. during the
winter months of January-March 2009 and 2010. Among the 10 hospitals for which comparative
data were available at that point, results were not entirely consistent, however the combined
relative risk of hypothermia during 2010 was only 20% of the level in 2009, despite the fact
that the winter of 2010 was among the coldest in the past century. The difference was highly
statistically significant (95% CI [0.16, 0.25], p<0.0001, combined by Mantel-Haenszel method).

A look at the range of performance among facilities clarifies the reason for inconsistency in the
results. Figures 2 and 3 show that the highest-performing 25% of facilities participated in the
collaborative despite the fact that they had experienced (or at least, reported) a zero incidence
of hypothermia, before during and after the project. The median group of facilities experienced
hypothermia only during the winter months, among about 2% of newborns, and their rates of
hypothermia diminished from the winters of 2009 to 2010, and again from 2010 to 2011. The
group of facilities at the 75th percentile had severe problems with hypothermia, not limited to
the winter months. For instance, Kostroma City Hospital No. 1 reported that over one-third of
newborns experienced hypothermia upon arrival at the ward, during the winter of 2009. Their
problems also decreased over time and were under nearly complete control by the end of the
project.

While it would have been ideal to assess hypothermia separately in pre-term and full-term
newborns, there appears to be no correlation between hospitals with high rates of hypothermia
and those such as tertiary level perinatal centers – with high rates of preterm birth.
Figure 1. Hypothermia collaborative. Mother-to-child skin-to-skin contact.
Figure 2. Prevention of hypothermia collaborative. Hypothermia in the delivery room. Percent of newborns with $T<36.5\,^\circ\text{C}$. Each hospital reported data for only a portion of the period shown. Median, 75th, 25th percentiles among hospitals displayed. Hypothermia shows a seasonal pattern; winter comparison periods (Jan-March) are shaded. (Caption applies also to Fig. 5).

Figure 3. Prevention of hypothermia collaborative. Hypothermia after transfer to ward.
j. Discussion
The results of both phase 1 and phase 2 demonstrate the effectiveness of the Russian-adapted change package in implementing these evidence-based practices on hypothermia prevention. Since we began this collaboration, several key Russian regulatory and policy changes have been made, with leading input from our partners at the Kulakov Center, that facilitate and endorse implementation of the “warm chain.”

In May, 2010, the Russian equivalent of the CDC (Rospotrebnadzor) issued a 173-page sanitary-epidemiologic regulation, which modernized infection control in maternity hospitals, and either explicitly endorsed or removed many barriers to evidence-based essential newborn care practices and family-centered care, including rooming-in with newborns, and use of ordinary infant clothing. Rooming in is strongly recommended. It requires individual delivery rooms in facilities with rooming-in, and if a facility has individual delivery rooms, requires the mother to be observed in the delivery room for two hours after birth. After being quickly dried with a warm towel, they are to be put on the mother’s belly for skin-to-skin contact and first breastfeeding, covered with a warm blankets, and not washed further. Irina Riumina DMS of the Kulakov Center was a co-author of this regulation.

In July 2011, the Ministry of Health and Social Development (MOHSD) issued a “methodological letter,” reviewed by our partner Elena Bailbarina, MD, that explicitly endorsed the warm chain and most elements of our hypothermia prevention change package, as enabled by the sanitary-epidemiologic regulation:

- The recommended temperature of the delivery room is to be set at 25°C (raised from the 24°C provided in prior regulations), and monitored twice daily in a journal.

- Babies are to be dried quickly with a pre-warmed blanket dressed in a hat and covered with a blanket, and quickly placed on the mother’s belly for skin-to-skin contact lasting from 40 minutes to 2 hours. The baby is to be brought to the breast and both baby and mother are to be covered with the same blanket.

- The temperature of the baby is to be measured twice hourly (4 times) in the delivery room and before and immediately after transfer, and twice daily thereafter, using an electronic thermometer.

- Rooming-in is strongly recommended; the newborn should not be unnecessarily transported to another building, and clinical procedures should be performed in the mother and baby’s room on the ward. The baby should be swaddled only loosely, leaving the arms free.

- Kangaroo mother care is recommended for low birth weight and preterm babies.

- Administrators are required to train personnel on prevention of hypothermia.
A December 2011 Methodological letter from the Kulakov Center on care of extremely low birthweight babies (endorsement of which is expected from MOHSD) called prevention of hypothermia “one of the key elements of care for critically ill and early preterm infants.” Delivery rooms should be warmed to 26-28°C in anticipation of a preterm birth, and preterm infants’ temperature should be continuously monitored in the delivery room and upon arrival in the NICU. Detailed recommendations are provided on use of plastic bags or sheets to protect the bodies of newborns of less than 28 weeks gestation during resuscitation. Dr. Baibarina and our Kulakov partner Dmitry Degtyarev DMS oversaw preparation of these recommendations.

During the project final conference, Oleg Filippov DMS, deputy director of the MOHSD MCH department, proposed adapting the project change package on hypothermia prevention, into a more detailed MOHSD methodologic letter.

**k. References**

5) Mullany LC Neonatal Hypothermia in Low-Resource Settings, Semin Perinatol 2011 34:426-433
10) On confirming the order of providing neonatal medical care, MOHSD Executive Order 409N, June 1, 2010.
12) Sanitary-Epidemiologic Requirements for Medical Organizations, Rospotrebnadzor regulation number 2.1.3.2630, May 18, 2010.