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Kangaroo Mother Care and Traditional Care

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Abstract

Prematurity and low birth weight are leading causes of infant death. Throughout recent years care methods for this population have evolved from incubator care to Kangaroo Mother Care (KMC). The purpose of this systematic review was to answer the following PICO question: in the case of preterm and low birth weight (LBW) infants, how does the technique of Kangaroo Mother Care (KMC) compare to traditional incubator use, regarding long and short-term outcomes of preterm and LBW infant recovery. Methods of this study included the selection of twenty peer-reviewed articles that studied the effect of incubators and KMC on premature and LBW infants. Articles published between the years of 1983 to 2017 were selected from databases including Google Scholar, PubMed, and CINAHL. Studies were synthesized in a table of evidence (See appendix A for synthesized table of evidence). Sample sizes ranged from nine to 4,165 premature and low birth weight infants. Study designs selected included systematic reviews and various experimental designs. For this systematic review, the PICO question that will be analyzed will be the following: in the case of preterm and low birth weight infants, how does the technique of Kangaroo Care compare to traditional isolette use, regarding long and short-term outcomes of preterm and low birth weight infant recovery? It was found that overall, KMC was most effective in caring for LBW and premature infants. Therefore, the recommendation is to expand research on neonatal care techniques with more comprehensive studies while encouraging a low-cost method for those without modern technology, and to utilize KMC whenever possible to provide for the best outcomes in this population.

Key-words: kangaroo mother care, preterm infants, traditional incubator care, and preterm

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care.

Introduction

This systematic review set out to answer the following PICO question: in the case of preterm and low birth weight (LBW) infants, how does the technique of Kangaroo Mother Care (KMC) compare to traditional incubator use, regarding long and short-term outcomes of preterm and LBW infant recovery (See appendix A for synthesized table of evidence). Prematurity accounts for 10% of all births annually, which may lead to various complications, including death (Menezes, Garcia, Melo, & Cipolotti, 2014). In fact, an estimated four million infants that die each year die within the first four weeks of life as a result of neonatal complications (Boundy et al., 2015). Low cost methods of care for premature and LBW complications are essential considering 99% of all infant deaths occur in low or medium income countries where neonatal intensive care units (NICU's) are not developed or readily available (Boundy et al., 2015). Neonatal complications that premature and LBW babies are at higher risk for may include hypothermia, respiratory distress, and infection (Boundy et al., 2015). One of the most common complications for preterm and LBW infants is hypothermia, which untreated can lead to cold shock and eventual death (Elwis & Ramu, 2014). Some long-term ramifications of prematurity or low birth weight may include chronic respiratory difficulties, such as asthma or allergies, decreased growth, and increased risk of diabetes (Charpak et al., 2016). In severe cases, it may lead to mental retardation, cognitive deficits, attention problems, and decreased academic performance (Charpak et al., 2016).

One traditional method for caring for premature and LBW infants is placing the infant in an incubator, with use being recorded as far back as the 1880's (Baker, 2000). Incubators are

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used to promote thermoregulation for premature newborns since this population is unable to maintain body heat on their own (Baker, 2000). An incubator, also known as an isolette, is a clear, box-like structure where temperature, humidity, and oxygen can be controlled. Often, the incubator is closed to keep the warm atmosphere inside intact (Meissels, Jones & Steiffel, 1983). While in the incubator, infants have very little contact with the outside world. Infants in the incubators are not held, based upon the belief system that this is best for their fragile immune systems, as well as their underdeveloped bodies (Meissels et al., 1983). Incubators are still in use today in developed countries where NICU's have the resources to maintain them. Incubators are useful when infants are too premature and fragile to risk prolonged handling and exposure to outside infectious agents and stimulation (Hartz, Bradshaw & Brandon, 2015). They are also beneficial when mothers, fathers or family members cannot provide care for their infant in situations such as maternal death or other complications; incubators are an alternative care method when KMC is not achievable.

More recently, researchers have begun looking at the possible benefits of not placing neonates in incubators; but instead placing the infants on their mothers' skin as early as possible after birth, known as Kangaroo Mother Care (KMC) (Bera et al., 2014; Boundy et al., 2015; Dandekar & Shafee, 2013; Menezes, Garcia, Melo & Cipolotti, 2014). Studies analyzed characterize KMC technique as the placement of the neonate directly onto the caregivers skin for the duration of as much care as possible, an alternative natural and lower cost method of care than traditional incubator use. Studies included in this review indicated that average KMC usage lasted for several hour sessions throughout the day. This method originated in 1978 in Botoga, Columbia by Dr. Edgar Rey Sanabria as a possible replacement to traditional incubator care (Boundy et al., 2015; Menezes et al., 2014). The KMC is meant to promote stabilization of newborn vital signs and provide preventative measures against other complications through natural and holistic means. Since many mothers worldwide do not have access to traditional

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western care in NICU's, the theory of KMC was created to provide a simple, effective, alternative to traditional care that is available to all socioeconomic classes. It is recommended that the mother should continue to practice KMC throughout the postpartum period to continue to promote more successful breastfeeding, weight gain, stress relief, and increased bonding (Bera et al., 2014; Boundy et al., 2015; Pour & Raghibi, 2016; Tessier et al., 1998).

This systematic review will analyze and synthesize existing research regarding outcomes for infants born prematurely and identified with LBW comparing traditional incubator use with KMC. The purpose of this review is to address the gap in knowledge regarding best infant care policy in order to contribute to the improvement of care for at risk infant populations. Outcomes such as thermoregulation, mortality, transfer of flora, neonatal sepsis, respiratory status, bonding, long term cognitive effects, pain control, weight gain, and ability to adapt to environmental changes will be addressed.

Methods

Twenty research articles were selected for review, retrieved from medical journals, found within the databases of Google Scholar, PubMed, and CINAHL. Keywords and term searches included: *kangaroo mother care*, *preterm infants*, *traditional incubator care*, and *preterm care*. Studies that did not use KMC care from the point of birth, were excluded. Other exclusionary factors included studies on full term infants, normal weight infants, studies that utilized other methods of infant care besides KMC or incubator care, or studies that did not use solely incubator or KMC care, such as a combination of the two in which case the results would not be pertinent to the study were all excluded. Selection bias was eliminated because articles chosen meet the inclusion criteria pertaining to the research question and were not considered based on the outcome alone. Articles were determined relevant, and thus included, based on relevance having to do with incubator care or Kangaroo Mother Care in that they showed either benefits or negatives of the two different methodologies of care when used for preterm or low birth weight

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infants. Articles published more than five years ago were included in this review since studies on traditional care were predominantly performed greater than two decades ago due to changing trends in neonate care.

Results

Twenty peer reviewed articles were analyzed for this systematic review that compared the effects of kangaroo mother care and traditional incubator care on the populations of LBW and premature infants. Studies were located in the countries of India, the United States, Columbia, Sweden, Canada, Iran, and Brazil. Study designs included a variety of experiments and systematic reviews. Themes emerged showing beneficial usage of KMC in preterm and low birth weight infants in decreased mortality rates, improved thermoregulation, decreased infantile stress levels, improved infant-mother bonding, improved respiratory status/oxygenation and ventilation, improved immune response, increased non pharmacological pain control, and environmental adaptation abilities. However, incubator care was beneficial in the isolation of a fragile infant in acute or unstable condition such as infants on ventilators or in severe distress.

Overall Effects on Mortality

In seventeen of the 20 studies reviewed, it was found that when Kangaroo Mother Care (KMC) was used for preterm and LBW infants there was a decrease in overall infant mortality up to 30% when compared to traditional incubator care (Baley, 2015; Bera et al., 2014; Boundy et al., 2015; Charpak, Ruiz-Palaez, Figueroa de C, Charpak, Y., 1997; Charpak et al., 2016; Dandekar & Shafee, 2013; Elias & Ramu, 2014; Johnston et al., 2003; Karlsson, 1996; Lai & Bearer, 2008; Ludington-Hoe, Morgan & Abouelfettoh, 2008; Menezes, Garcia, Melo & Cipolotti, 2014; Morelius, Ortenstrand, Theodorsson & Frostell, 2015; Parmar, Kumar, Kaur, Basu & Narula, 2009; Pour & Raghobi, 2016; Sloan et al., 2008; Tessier et al., 1998). It was found that premature and LBW infants have an increased risk of death due to their

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condition. With use of traditional incubator care, it was found that premature and low-birth weight infants have approximately 30% chance of death compared to term and normal weight infants (Boundy et al., 2015). Also, premature and low-birth weight infants that reside in open air cribs have a higher chance of mortality than those in incubators and those using KMC (Karlsson, 1996). When using KMC compared to traditional incubator care it was found that overall mortality caused by LBW and premature infant status decreased by approximately 30% (Bera et al., 2014; Boundy et al., 2015; Charpak et al., 2016; Dandekar & Shafee, 2013; Sloan et al., 2008). Charpak et al. (1997) also found that of all infants studied that used KMC, 30% less died from low birth weight or prematurity complications compared to those using traditional care. Long term results which included infants up to one year of age, found that 41% less infants died from complications such as infection or hypothermia when using KMC compared to traditional care (Charpak et al., 1997).

A randomized control cluster experiment, with a sample of 4,165 LBW babies was conducted to compare traditional incubator care with KMC. Results indicated that KMC decreased infant mortality overall (Boundy et al., 2015). In two studies, researchers found that morbidity of premature and LBW infants decreased by approximately one-third when KMC was used when compared to incubator use (Boundy et al., 2015; Sloan et al., 2008). However, Sloan et al. (2008) found that KMC did not change the rate of mortality between newborns and infants. In this study by Sloan et al. (2008), LBW newborns were followed from 30 to 45 days after birth and then monitored quarterly to record infant status. Sloan et al. (2008) monitored the technique of care administered to the LBW babies, focusing on when KMC was performed, and found that if KMC was implemented for a longer duration of hours per day consistently for more days, the more effective the treatment was (Sloan et al., 2008). A limitation to this study included the self-report provided by family members regarding infant status. The researchers were concerned that families in rural parts of India, where the study was conducted, were not reporting infant demise.

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This would cause inaccuracy within the values because survival values would be inflated. This study had the first level of evidence because of its large sample size of 4,164 and its design of randomized cluster control trial.

The meta-analytic review conducted by Boundy et al. (2015) included 124 studies and took place in Columbia, the birthplace of KMC. The Boundy study was a meta-analytic review, therefore categorizing it as first level of evidence. This article included studies that were randomized trials and observational studies; studies that lacked a control group were not included. From these 124 studies it was revealed that KMC is an effective protection against common neonatal complications and that it does not pose a risk to the infant (Boundy et al., 2015). In addition, it was found that KMC is a low-cost method of care for premature and LBW infants that may also have positive effects for term infants as well (Boundy et al., 2015).

Thermoregulation and Energy Conservation

Thermoregulation is important for newborns, and even more important for those who are premature and LBW. Infants who are premature lose heat even faster than term babies because they have less fat to insulate their bodies. Depending on gestational age at the time of birth, infants may lack brown fat which is vital for infant's ability to maintain temperature stability (Elias & Ramu, 2014). Infants that do not have the ability to thermoregulate are at very high risk for hypothermia which may lead to cold shock and death for these populations (Bera et al., 2014; Karlsson, 1996). Researchers have found that KMC is an effective way for mothers to decrease their infants' risk of hypothermia by transferring their body heat to the infant (Bera et al., 2014; Boundy et al., 2015; Chapak et al., 1997; Dandekar & Shafe, 2013; Elwis & Ramu, 2014; Karlsson H., 1996; Parmar et al., 2009). In an observational study, consisting of 135 LBW infants, performed in a NICU in Chandigarh, India by Parmar et al. (2009), it was found that during KMC no infants developed cold stress and that their temperatures increased from approximately 36.75 degrees Celsius to 37.23. The study was of an observational experimental

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design therefore it is categorized as level one evidence. This study was limited by a smaller sample size.

Karlsson (1996) found that premature infants lose heat through radiation while performing KMC if their skin was exposed to air. Therefore, Karlsson (1996) stressed the importance of keeping the infants covered during KMC. The skin that came in contact with the mother, as well as skin that was covered with an insulator towel reported very little heat loss while the skin exposed to the air showed a mean temperature change of 9.5-10 degrees Celsius on the surface of the skin over seventy minutes (Karlsson, 1996). This study was performed in a NICU in Sweden with a sample size of nine LBW infants. This study's level of evidence was a two because it was an experiment, but this study was limited by its small sample size of nine infants.

Chapak et al., (1997) identified that incubators, while they provided the infant with a stable temperature environment, did not help the infant to adapt and stabilize their own temperature. Infants that were in an incubator had a 78% higher chance of becoming hypothermic and experiencing metabolic cold stress along with a 21% greater chance of becoming hyperthermic at a temperature over 40 degrees Celsius and being at risk for fatal heat stroke than infants being treated with KMC (Chapak et al., 1997).

Pain Management

Researchers have shown that KMC is an effective non-pharmacological intervention for pain among preterm and LBW infants (Boundy et al., 2015; Johnston, 2003). It is important for infants, especially preterm and LBW infants, to have effective pain management with little pharmacological intervention. Because of their small size and underdeveloped body systems and organs, pain medications can have detrimental effects, since the medications may not be metabolized and cleared by the body effectively (Johnston, 2003). Johnston (2003) studied the pain demonstrated by a neonate receiving a heel stick while in an incubator comparative to the

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pain of an infant being held in a Kangaroo hold also receiving a heel stick. He measured the pain in three ways: (a) facial expression, (b) maximum heart rate, and (c) changes in oxygen saturation. In conclusion, Johnson found that infants treated with KMC exhibited less physiologic signs of stress, demonstrating that pain can be reduced by KMC. A limitation of the study was the use of a heel stick for monitoring pain level. It is unclear if pain elicited in another manner would have the same results when comparing incubator care with KMC (Johnston, 2003). Since infants cannot communicate their pain scale, researchers are somewhat limited in determining the analgesic effect of KMC. However, physiological values of pain response may be assessed. For example, the 74 infants included in this study showed lower and more stable vital signs compared to those who were treated in incubators (Johnston, 2003). Overall, KMC infants had better pain management than the control group using traditional incubators (Johnston, 2003).

Immune System/Sepsis

A common belief is that in order to prevent infection the individual at risk must be isolated and away from infectious agents (Hartz, Bradshaw & Brandon, 2015). Despite this, six of the 20 studies selected for this review investigated the effect of allowing the mother's natural flora to transfer onto the newborn infant. Interestingly, researchers in all six studies demonstrated that KMC decreased the chance of infection and sepsis for premature and LBW infants compared to traditional incubator care (Baley, 2015; Boundy et al., 2015; Dandekar & Shafee, 2013; Hartz, Bradshaw & Brandon, 2015; Ludington-Hoe, Morgan & Abouelfetoh, 2008; Parmar et al., 2009). A study consisting of 117 premature and LBW infants performed by Baley (2015) examined the effect of KMC on the infants' immune systems. The health of these infants after half of them were exposed to the natural flora of their mothers through KMC, and infants who were kept in an incubator away from natural flora and surrounding bacteria were compared to see if there was any benefit. It was noted that infants benefited from being exposed

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to the natural flora of their mothers as opposed to the disinfectant resistant hospital bacteria found in an incubator. It was found that since the infants were exposed to this low dose of their mother's bacteria, they were able to build up their immune system, and demonstrated less episodes of sepsis, pneumonia, and necrotizing colitis, which are often found in infants that have been using incubators and could be fatal (Baley, 2015). A limitation to this study is that the sample contained only healthy premature infants; excluding premature infants with respiratory distress or those that were intubated (Baley, 2015).

A systematic review, conducted by Hartz, Bradshaw and Brandon (2015) at Duke University School of Nursing, analyzed the effect of KMC on infant bacterial flora, defined as the infants' community of bacterial flora. The review consisted of 39 evidence-based practice articles. This review identified that infants born via cesarean section lacked the flora that would normally be transferred from the mother during vaginal birth, and it could take the infants born via cesarean section up to six months to colonize the normal bacteria (Hartz, Bradshaw & Brandon, 2015). Though it was found traditional care using an incubator is beneficial in that it controls the atmosphere and humidity within its confines, this saturated heat also contributes to colonization of bacteria like *Staphylococci*, *Streptococcus*, *Neisseria*, and *Enterobacteriaceae* which may put the infant at increased risk for infection (Hartz, Bradshaw & Brandon, 2015). However, it should be noted that it was also found that similar bacteria such as *Enterobacteriaceae*, *Enterococcaceae*, and *Staphylococcaceae* with low levels of *Bifidobacteria* and *Lactobacilli* was transferred to the infants using KMC, which could also put the infants at risk (Hartz, Bradshaw & Brandon, 2015). This review indicated that both techniques of care showed the possibility of transferring harmful bacteria to neonates.

Infant-Mother Bonding

Five out of 20 articles reviewed in this study state that KMC has an effect on infant-mother bonding (Bera et al., 2014; Ludington-Hoe, Morgan & Abouelfetoh, 2008; Morelius,

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Ortenstrand & Theodorsson, 2015; Pour & Raghibi, 2016; Tessier et al., 1998). Four out of five studies indicated that increasing skin to skin time between mother and infant promotes better emotional attachment (Bera et al., 2014; Ludington-Hoe, Morgan & Abouelfetoh, 2008; Morelius, Ortenstrand & Theodorsson, 2015; Pour & Raghibi, 2016). The research has suggested that KMC decreases the stress of the mother and allows her to focus on infant attachment and bonding (Pour & Raghibi, 2016; Tessier et al., 1998). Overall, the use of KMC indicated a better promotion of the family unit compared to infants receiving incubator care (Pour & Raghibi, 2016). Additionally, it was found that, the mothers using KMC felt more in control of the infant care and situation when they were actively involved (Morelius, Ortenstrand & Theodorsson, 2015; Pour & Raghibi, 2016; Tessier et al., 1998).

According to Tessier et al. (1998), both the mother and infant benefitted from utilizing the KMC technique. This randomized control trial of 488 infants studied the effect of KMC on mother-infant bonding. Upon assessment evidence was not found to support that KMC increases mother-infant bonding and attachment. However, it was determined that the mothers and infants that used KMC did act differently compared with the control group using traditional care where the infant was placed in an incubator and had limited physical contact with the mother (Tessier et al., 1998). Researchers concluded that the mothers in the KMC group benefitted from this technique due to positive findings in follow-up evaluations conducted after the infants went home.

Evaluation indicated that the mothers in the KMC group identified a greater level of competence in caring for their infant when compared to the control group (Tessier et al., 1998). This experiment displayed the first level of evidence due to its randomized control trial status and its large sample size of 488 infants. However, Tessier et al. was limited by lack of long-term

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follow-up determining how bonding and attachment behavior evolved.

Newborn Stress

Research demonstrates that infants using KMC were less likely to become reactive and stressed when experiencing stimulation like noise, movement, and the switching of caretakers (Bera et al., 2014; Pour & Raghibi, 2016; Tessier et al., 1998). While participating in KMC the infant experiences constant maternal heartbeat, temperature, and tactile stimulation which indicates a possible calming effect on the infants (Bera et al., 2014). A quasi-experiment performed by Pour and Raghibi (2016), determined that KMC was likely to decrease stress on the infant's body, evidenced by lower instances of vomiting and crying. Additionally, the authors concluded that infant resilience was increased by using KMC (Pour & Raghibi, 2016). This experiment displayed the second level of evidence since it was primarily observational in nature and had a smaller sample size of 30 infants. Limitations of this study included a small sample and a decrease in follow-up data after the infant was discharged from the hospital.

Another study by Morelius et al. (2014), looked at infant cortisol levels. Salivary cortisol, a chemical that in increased amounts indicates stress within an individual, was found to be lower in the infants that were experiencing KMC compared to infants in incubators (Morelius et al., 2014). These findings suggest that infants treated with KMC experience less stress than those who are treated in incubators. Conversely, infants that were kept in incubators had stable salivary cortisol levels, which indicated low levels of stress. The results of this study demonstrate that incubators have an ability to maintain a stable environment represented by low amounts of the stress hormone, over time there was no decrease in cortisol in the control group of babies in incubators signifying stable levels of stress among this group (Morelius et al., 2014). A limitation of this study was the small sample size of 42 newborns.

Ludington-Hoe and colleagues (2008) studied oxygen saturation of 78 premature infants;

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infants experiencing less stress have higher oxygen saturations. Infants were divided randomly, placed in either the control incubator care group or the experimental KMC group. The results of their study showed an increase of oxygen saturation by 2-3% when treated with KMC. The infants in the KMC group also showed less arousal from sleep and less intermittent sleep patterns, as well as fewer events of apnea and desaturations compared with the incubator control group (Ludington-Hoe et al., 2008). This suggests that infants slept deeper and longer when using KMC compared to the infants left in the incubator.

Breastfeeding and Weight Gain

Six of the 20 articles analyzed in this review discussed the effect of KMC on breastfeeding and weight gain for premature and LBW infants. In these studies, researchers demonstrated that infants using KMC increased success in breastfeeding and encouraged faster weight gain compared with infants using traditional incubator care, (Baley, 2015; Bera et al., 2014; Elias & Ramu, 2014; Menezes, Garcia, Melo, & Cipolotti, 2014; Sloan et al., 2008; Tessier et al., 1998). Kangaroo Mother Care generally facilitates breastfeeding due to the positioning of the infant. Since the infant is placed on the mother's abdomen, often inside a small pouch or strap, the infant is positioned closer to the breasts for unlimited breastfeeding (Bera et al., 2014; Tessier et al., 1998). Researchers also demonstrate that infants that are utilizing KMC are more likely to achieve a faster latch and feed successfully than traditional incubator care infants (Elias & Ramu, 2014; Sloan et al., 2008).

An experimental study by Elias and Ramu (2014), took place in Tamilnadu, India, investigated weight gain among a sample size of 80 infants utilizing either KMC or incubator care. A comparison of infants demonstrated that those who were treated with KMC reached the goal weight of 2.7 kilograms faster than those treated with traditional care incubator. Mothers in the KMC group breastfed their infants more often and longer; 12 times per day versus nine times in the traditional incubator care group (Elias & Ramu, 2014). Not only did those using KMC

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have a higher success rate of breastfeeding but they were more likely to choose to breastfeed overall than conventional care mothers whose babies were placed in incubators; 97.5% of KMC mothers chose to breastfeed compared with 85% in the traditional care incubator group (Elias & Ramu, 2014). This study revealed more weight gain among the infants in the KMC group compared with those in the traditional method group at the time of hospital discharge (Elias & Ramu, 2014). In this study, researchers the second level of evidence because of its experimental structure and was limited by its smaller sample size of 80 infants compared to other studies with larger sample sizes.

Long Term Cognitive Effects

Charpak et al. (2016), states that long term effects of prematurity could include life-long cognitive difficulties among premature and LBW infants. These complications may include difficulty with social interaction, neurologic and behavioral impairment, poor intellectual performance and attention span difficulties. Charpak et al. (1997) studied cognitive effects of 716 infants in Colombia. This was a longitudinal study that revisited participants at 20 years of age to determine long term effects of KMC versus traditional incubator care. In 2016, Charpak and his colleagues tested the intelligence quotient's (IQ's) of the original infants used in the study and compared the adults who had utilized KMC as infants and those that had utilized traditional incubator care. The researchers found that there were no significant differences in IQ between KMC and conventional care groups at 20 years of age (Charpak et al., 2016). However, at six months of age the infants that had experienced KMC were found to score higher on a neurologic examination testing brain function of typical infants of this age (Charpak et al., 2016). Within primary schooling evaluation, children from the KMC group were found to be less likely to miss school, but children who experienced traditional care in incubators scored better on language evaluations, and males that experienced KMC specifically had lower scores in mathematics (Charpak et al., 2016). At 20 years old the study revealed that KMC adults were

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less likely to be aggressive, hyperactive, or antisocial than the adults in the control group (Charpak et al., 2016). The researchers attribute these minute differences to the possibility that KMC motivated mothers and families were more attuned to their child's needs, resulting in a more caring and nurturing environment (Charpak et al., 2016). Due to its case control nature and large sample size this study is classified as first level evidence. Limitations of this study include the longitudinal nature without control of extraneous variables as well as attrition to participants over time. Also, only 494 participants were found and identified, and only 264 of the original 716 participants were used in the follow up comparison (Charpak et al., 2016).

Stability and Safety of Environments

Three of the 20 articles reviewed discussed the overall environment of premature and LBW infants. The researchers showed that conventional incubator care provided stable environments, including stable temperature, lighting, low levels of stimuli, and low levels of stress on the body from movement and from immune system introduction to unfamiliar bacteria (Baker, 2000; Lai, Bearer, 2008; Meisels, Jones, Stiefel, 1983). Jeffrey Baker (2000), in a historical review, discussed the crucial nature of long-term incubator use worldwide, as they date back to 1880. Baker (2000) discussed the invention of the incubator, provide a stable environment to protect infants. Incubators also provided a way for infants to receive oxygen via the oxygen chamber created by Julius Hess, and to maintain stable body temperature via the heated bed (Baker, 2000). Due to these modifications of the incubator over time, the medical community has seen a drastic decline in premature infant deaths compared to before incubator use (Baker, 2000).

A systematic review conducted by Meisels et al. (1983) evaluated the benefits of low levels of stress on premature and LBW infants (Meisels et al., 1983). By exposing the preterm infant to as little stress as possible, the body was able to spend time healing and strengthening itself (Meisels et al., 1983). Incubator care, according to Meisels et al. (1983), was the ideal

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option for infants who have respiratory depression, are attached to a ventilator, with the inability to breathe on their own, since the incubator provides a stable environment. This systematic review was based on 658 infants in 16 different studies and takes place in Michigan. A limitation of the study by Meisels et al. (1983) is having too many infant variables including birth weight, socioeconomic status, race, and medical complications, these variables limit the ability to determine if the results are truly related to incubator care.

Lai and Bearer (2008) found similar results to Meisels et al. (1983) in that incubator care is beneficial for infants in various ways, stating that incubators have improved over time reducing the amount of stress placed upon premature babies. Similar to Meisels et al. (1983), Lai and Bearer (2008) found that lamps, used for conditions such as jaundice as well as for general thermoregulation, cause retinopathy in infants (Lai & Bearer, 2008). As a result of medical discoveries over time, filters over the light and goggles for infants were developed which led to fewer cases of retinopathy in the premature infant (Lai & Bearer, 2008).

However, several components of incubators may not be beneficial for infant outcomes. Lai and Bearer (2008) performed a systematic review of incubators and their harmful effects on neonates. They found that the constant light in incubators can lead to disrupted circadian rhythms, causing increased stress on the infant (Lai & Bearer, 2008). In addition, Lai and Bearer (2008) discussed the correlation of the electromagnetic fields of the incubators and cancer. The International Agency for Research on Cancer has labeled electromagnetic fields as a potential carcinogenic factor. Incubators sometimes use electromagnetic fields within the lamps and heating systems technology. Several studies reported by Lai and Bearer (2008) looked into incubators contributing to childhood leukemia, but were inconclusive. Another harmful effect of NICU incubators is the disinfectants used to clean them. These disinfectants have been found to be toxic for human skin and yet often are used on the surfaces of these incubators (Lai & Bearer, 2008). This study had a second level of evidence and was limited in the fact that it lacked long

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term research on the effect to these neonates.

Recommendations

Based on information collected throughout this systematic review, improvements on methods of care for LBW and preterm infants need to be made due to the portion of births worldwide that fall into this category of infants and the deaths that still occur today as a result of the condition. Most deaths that occur in this population occur in low income countries, therefore a low-cost method of care for these infants should be developed (Boundy et al., 2015). An easy-to-use method of care for those who do not have access to modern neonatal equipment is imperative.

The use of KMC for LBW infants has provided a way to care for when a traditional NICU is not an option; however, as a newer technique its success is under scrutiny. Literature shows that studies have occurred analyzing the effect of either individual method. Researchers have addressed outcomes in risk for infection, respiratory concerns, thermoregulation etc. but not all utilized a control group for comparison. One of the largest priorities includes future studies using control groups with alternative methods of care in order to have more direct comparison of perspective techniques. In addition, in order to claim effectiveness of one method compared to another, researchers must include more longitudinal studies to show long-term effects and overall health of those included in the study well into adulthood. However, those caring for LBW infants should consider a combination of the two care methods if possible. By synthesizing the two techniques, infants would receive the benefits of physical contact with the mother and the stable environment provided by the incubator. In addition, current practice could improve by having care professionals recommend KMC when possible. By keeping the skin of the caregiver providing the direct contact as clean as possible and keeping the infant and caregiver in a safe and stable environment risks associated with KMC could be reduced. If the infant is not stable or strong enough to experience KMC precautions can be taken with incubator

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safety, such as monitoring for risk of heat stroke or cold shock, and making sure the device has been cleaned properly. Family members should also be encouraged to touch their infants while in the incubator to allow for some skin to skin contact. Another present practice that some hospitals utilize are volunteers as infant cuddlers. This does not provide skin to skin contact; however, it provides the infants with extended interaction and the sense of connection that busy nurses cannot always provide.

Future studies could further utilize opportunities to study more variables presented in this population of infants to determine progress. For preterm and LBW infants weight gain is often an important factor to recovery and rehabilitation. Researchers could elaborate on the success of weight gain progression comparing the methods of KMC and traditional care. Since weight measurements are easily acquired and noninvasive tests could be performed quickly and efficiently. Another recommendation for further research would be to select groups of infants to observe that are all the same age. A limitation that current research experiences is that it is the ages at which KMC is performed is not uniform. In addition, to expand on utilizing LBW and preterm infants would be to start KMC at different ages to analyze the effects of KMC on a neonate compared to an infant a few months old.

The literature also indicates common limitations of size, location, and reliability within studies (Bera et al., 2014; Boundy et al., 2015; Dandekar & Shafee, 2013; Menezes, Garcia, Melo & Cipolotti, 2014). Many cases of LBW infants occur in rural low-income countries, therefore studies within this population experience limitations due to a decreased ability to track its subjects in the field. Accountability of subjects is necessary in order to identify variables affecting outcomes. Consistently and accurately observing subjects is imperative to gather information that is beyond question. Sample size also presents as a limitation among research in this area, to accurately represent effects of LBW care future researchers should increase sample size by providing incentive. Another barrier for LBW and preterm infant care research is that

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location of studies is not distributed equally around the world, future findings should include more studies inclusive geographically, culturally, and economically.

Conclusion

This analysis of evidence has explored research findings related to the care of LBW and preterm infants utilizing techniques of traditional incubator care compared to KMC. Studies have examined complications such as thermoregulation, mortality, transfer of flora, neonatal sepsis, respiratory status, bonding, long term cognitive effects, pain control, weight gain, and ability to adapt to environmental changes among the population of LBW and preterm infants. The research has shown positive and negative characteristics among both techniques. KMC shows better long-term results with improvement of thermoregulation, stress, bonding, respiratory status, pain control, and adaptation abilities. However, incubator care was beneficial in the isolation of a fragile infant in acute condition. Further research is required to determine whether or not one method should be used exclusively in place of the other or if the methods

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should be recommended integrated inclusively for the best results of infant health.

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Appendix A**Systematic Review Table of Evidence****Appendix A****Systematic Review Table of Evidence**

APA formatted reference	Purpose statement. Research question	Clinical Practice Setting, Sampling methods, Sample size	Design. Level of Evidence	Findings, Conclusion	Practice & Research Implications	Limitations of Findings
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<p>Baker J. P. (2000). The Incubator and the Medical Discovery of the Premature Infant. <i>Journal of Perinatology</i> 2000; 5:321-328.</p>	<p>Purpose: history of the premature infant and how insulators have affected infant recovery. Research : How has the insulator affected infant outcome in the case of premature babies?</p>	<p>Setting: North Carolina Sample: random Size: 100</p>	<p>Design: Systematic Review Level of Evidence: 1</p>	<p>Over time and with improvement from scientists, insulators have led to significantly better neonatal outcomes.</p>	<p>EBP can be seen in the changes of the isolettes over time.</p>	<p>Historical review and not new information</p>
<p>Baley, J. (September 2015). Skin-to-Skin Care for Term and Neonatal Interventions : Problem, Purpose, and Prospect. <i>Pret erm Infants in the Neonatal ICU. American Academy for Pediatrics. DOI 10.1542/peds.2015-2335.</i></p>	<p>Purpose: to discuss the outcomes of preterm and term infants who receive KMC. Research: How does Skin-to-skin contact affect preterm vs term infants?</p>	<p>Setting: NICU Sample: random size: 117</p>	<p>Design: systematic review Level: 1</p>	<p>There are both benefits and risks for both preterm and term infants involved in KM. Benefits include increased success breastfeeding, nonpharmacological pain management, reduced stress, and lower cortisol levels. Risks include exposure to staph A.</p>	<p>Skin- to-skin contact benefits outweigh risks and should be implemented in both full term and premature infants</p>	<p>Does not include results of intubated premature infants, only healthy infants</p>
<p>Bera, A., Ghosh, J., Singh, A., Hazra, A., Som, T., & Munian, D. (2014). Effect of Kangaroo mother care on vital physiological parameters of the low birth weight newborn. <i>Indian Journal of Community Medicine</i>, 39(4), 245. doi:10.4103/0970-0218.143030</p>	<p>Purpose Statement: To determine the effectiveness of Kangaroo Mother Care on physiological vitals Research Question: Does the use of KMC help stabilize vital signs after birth?</p>	<p>Setting: India Sampling Method: convenience Sampling Size: 265</p>	<p>Design: Quasi-Experimental Level of Evidence: 1</p>	<p>Vitals during and after KMC showed slight increase, transfer of body heat was obvious. No infant went into respiratory distress during KMC, and most infants fell asleep</p>	<p>Premature infants should be put skin to skin with their mother straight after birth as a way to effectively keep them warm, instead of under a warmer</p>	<p>The study was observational and some mothers were not able to execute KMC correctly and they were eliminated from the study. Cannot determine if constant supervision of mothers to make sure they are doing it correctly is attainable</p>

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<p>Boundy, E. O., Dastjerdi, R., Spiegelman, D., Fawzi, W. W., Missmer, S. A., Lieberman, E., ... Chan, G. J. (2015). Kangaroo Mother Care and Neonatal Outcomes: A Meta-analysis. <i>Pediatrics</i>, 137(1), e20152238. doi:10.1542/peds.2015-2238</p>	<p>Purpose Statement: To determine the effectiveness of Kangaroo Mother Care on preterm infant mortality</p> <p>Research Question: In the cases of low birth weight and preterm babies, does the use of Kangaroo care decrease infant mortality</p>	<p>Setting: Columbia</p> <p>Sampling Method: Convenience</p> <p>Sampling to that hospital</p> <p>Sampling Size: 124</p>	<p>Design: Meta Analytic and Systematic Review</p> <p>Level of Evidence:1</p>	<p>Kangaroo care decreased mortality in low birth weight and preterm babies by approximately a third</p>	<p>Kangaroo care should be increased in the neonatal situation</p>	<p>Lack of information on Kangaroo care limited the ability to analyze dose response from mothers</p>
<p>Charpak, N., Ruiz-Palaez, J., Figueroa de C, Z., Charpak, Y. (October 4, 1997). Kangaroo Mother versus Traditional Care for Newborn Infants <2000 grams: A Randomized, Controlled Trial. <i>PEDIATRICS Vol. 100 No. 4</i> 1997;100:682-688.</p>	<p>Purpose: To compare KMC and traditional isolette care</p> <p>Research: Does KMC lead to better neonatal outcomes than traditional incubator care</p>	<p>Setting: Columbia</p> <p>Sample: random</p> <p>Size: 1084</p>	<p>Design: Meta-Analysis</p> <p>Level of Evidence: 2</p>	<p>KMC infants were released from the hospital earlier and had less nosocomial infections than infants in the control group (incubators)</p>	<p>KMC should be implemented in addition to incubator care to provide the best chance for preterm survival.</p>	<p>Infants are only followed up to one year so we do not know long term effects of KMC versus traditional care</p>
<p>Charpak, N., Tessier, R., Ruiz, J. G., Hernandez, J. T., Uriza, F., Villegas, J., ... Maldonado, D. (2016). Twenty-year Follow-up of Kangaroo Mother Care Versus Traditional Care. <i>Pediatrics</i>, 139(1), e20162063. doi:10.1542/peds.2016-2063</p>	<p>Purpose Statement: To determine the effectiveness of Kangaroo Mother Care on preterm infant mortality</p> <p>Research question: What is the effect of kangaroo care vs. NICU care in preterm or LBW babies throughout their lives?</p>	<p>Setting: Colombia</p> <p>Sampling method: Convenience</p> <p>Sample</p> <p>Sample size: 716</p>	<p>Design: Case Control Study</p> <p>Level of Evidence: 1</p>	<p>Kangaroo care had effects on brain development and relationship skills</p>	<p>Kangaroo care should be suggested over infants staying in isolettes and the NICU ward</p>	<p>Not every infant was able to come back to participate in further testing, some died and some were not reached</p>

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Dandekar, R. H., & Shafee, M. (2013). Kangaroo Mother Care Technology as a Boon to Tertiary Care Hospital in Western Maharashtra. <i>International Journal of Biomedical and Advance Research</i> , 4(10), 731. doi:10.7439/ijbar.v4i10.502	<p>Purpose Statement: To find the effect of kangaroo care on low birth weight baby growth</p> <p>Research Question: What is the effect of kangaroo care on low birth weight growth versus traditional isolette?</p>	<p>Setting: Maharashtra, India</p> <p>Sampling Method: Convenience to that hospital</p> <p>Sampling Size: 120</p>	<p>Design: Retrospective Cohort Study</p> <p>Level of Evidence: 1</p>	<p>Kangaroo care accelerates the growth of low birth weight babies. Kangaroo care is a good preventative method against sepsis, hypothermia, and apnea for mothers in low resource countries</p>	<p>Kangaroo care should be taught to mothers with limited resources as preventative care</p>	<p>There were not follow ups past one month after the study, not allowing for infant evaluation</p>
Elias, E., & Ramu, B. (2014). Randomized Controlled Study on Kangaroo Mother Care in the Management of Low Birth Weight Babies. <i>International Journal of Science and Research</i> , 3(10), 847-849.	<p>Purpose Statement: To determine the effect of Kangaroo Care on infant morbidity and mortality over conventional care</p> <p>Research Question: Does the use of Kangaroo care on low birth weight babies improve outcome versus traditional care?</p>	<p>Setting: Tamilnadu, India</p> <p>Sampling Method: convenience</p> <p>Sampling Size: 80</p>	<p>Design: Experiment</p> <p>Level of Evidence: 2</p>	<p>Kangaroo care is an effective way to care for low birth weight babies, especially in countries where NICU's are not as developed, almost 80% more babies maintained body heat using KMC vs. CMC, it also promotes easier breastfeeding resulting in faster weight gain</p>	<p>KMC should be taught as a promotion to breast-feed and to infants that are at risk for hypothermia</p>	<p>Small sample size</p>
Hartz, L. E., Bradshaw, W., & Brandon, D. H. (2015, October). Potential NICU Environmental Influences on the Neonate's Microbiome: A Systematic Review. <i>Advanced Neonatal Care</i> 2015 October: 15(5):324-335. DOI 10.1097	<p>Purpose Statement: The purpose of this article is to discuss the bacteria that neonates come in contact with in the NICU.</p> <p>Research question: Is there a way to control the microbiome of a newborn in the NICU</p>	<p>Setting: North Carolina</p> <p>Sampling method: random</p> <p>Sample size: 39 EBP articles</p>	<p>Design: Systematic review</p> <p>Level of Evidence: 1</p>	<p>Skin to skin contact with the mothers has been shown to improve neonatal outcome, despite isolate attempts to control the microbiome.</p>	<p>Human milk and skin to skin contact have a positive effect on neonatal microbiomes and overall health</p>	<p>More research needs to be done on what is a "normal" neonate microbiome</p>
Johnston, C. C., Stevens,	<p>Purpose: to see if skin to skin</p>	<p>Setting: Canada</p>	<p>Design: Experimental</p>	<p>Skin to skin did decrease infant's</p>	<p>Based on the evidence,</p>	<p>Pain is subjective so</p>

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<p>B., Pinelli, J., & E. A. (2003, November). Kangaroo Care Is Effective in Diminishing Pain Response in Preterm Neonates. <i>Archives Pediatric Adolescent Medicine</i> 2003; 157(11): 1084-108. DOI 10.1001/archpedi.157.11.1084.</p>	<p>contact and kangaroo care can effectively diminish pain in neonates</p> <p>Research: Does skin-to-skin contact decrease infant pain levels?</p>	<p>Sample: babies born between 32 and 37 weeks.</p> <p>Size: 72 infants</p>	<p>Level: 2</p>	<p>pain in terms of crying and screaming levels.</p>	<p>infants should be held during testing procedures to reduce pain levels</p>	<p>it is hard to see if the treatment is truly effective. Also different infants have different pain tolerances</p>
<p>Karlsson, H. (1996). Skin to Skin Care: Heat Balance. <i>Archives of Diseases in Childhood</i> 1996; 75s:F130-F132</p>	<p>Purpose: to see if KMC can help in maintaining body temperature homeostasis in newborns. Research: Does skin to skin contact affect infants ability to maintain body temperature homeostasis?</p>	<p>Setting: Sweden NICU</p> <p>Sample: Convenience</p> <p>Size: 9</p>	<p>Design: Experimental</p> <p>Level: 2</p>	<p>The nine infants maintained body temperature during skin to skin care</p>	<p>Low birth weight and infants normal for gestational age both benefit from kangaroo care.</p>	<p>Extremely small sample size</p>
<p>Lai, T. T., Bearer, C. F. (March 2008). Iatrogenic Environmental Hazards in the Neonatal Intensive Care Unit. <i>Clinical Perinatology</i>. 2008, March: 35(1): 163-ix. doi:10.1016</p>	<p>Purpose: To discuss the environmental effects of the isolette environment on the premature infant Research Question: What are the environmental hazards of the NICU isolettes</p>	<p>Setting: Cleveland, Oh</p> <p>Sample: Random</p> <p>Size: 96 articles</p>	<p>Design: Systematic Review</p> <p>Level of Evidence: 1</p>	<p>There are many dangers to infants in incubators including but not limited to the lights used for phototherapy, the toxic chemicals used to clean the NICU beds, and radiation</p>	<p>Infants can be potentially harmed by these factors, and either improvements to isolettes need to be initiated or alternative therapy needs to be implemented.</p>	<p>Limited research done on environmental hazards of NICUs</p>
<p>Ludington-Hoe, S. M., Morgan, K., Abouelfetoh, A. (2008). A Clinical Guide for</p>	<p>Purpose Statement: to observe the psychological, physical, behavioral changes</p>	<p>Setting: Cleveland, OH</p> <p>Sample: Random</p> <p>Size: 78</p>	<p>Design: Systematic Review of Randomized Clinical Trials</p> <p>Level: 1</p>	<p>There are numerous psychological, developmental, physical, behavioral benefits to</p>	<p>KMC should be implemented in newborns over the age of 30 weeks</p>	<p>Does not include KMC results for under 30 premature infants</p>

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<p>Implementati on of Kangaroo Care With Premature Infants of 30 or More Weeks' Postmenstrua l Age. <i>Advances in Neonatal Care Vol 8.</i></p>	<p>associated with Kangaroo Mother Care in infants 30 weeks and greater gestational age.</p> <p>Research: What effects does KMC have on preterm infants?</p>			<p>Kangaroo care including improved vital signs, stronger immune systems, greater success breastfeeding, lower pain levels</p>		
<p>Meissels, S. J., Jones, S. N., & Steffel, G. S. (1983, April). Neonatal Intervention: Problem, Purpose, Prospect. <i>Aspens Systems Corp. 1983, 3(1), 1-13.</i></p>	<p>Purpose: to compare neonatal environments and care interventions</p> <p>Research: How does changing the environment and care interventions of the medical staff change neonatal outcome in premature infants?</p>	<p>Setting: Michigan</p> <p>Sample: random</p> <p>Size: 16 studies, 658 infants</p>	<p>Design: Systematic Review</p> <p>Level: 1</p>	<p>The environment of the neonate and interventions by medical staff can greatly improve the outcome for infants</p>	<p>Environment control should be implemented for newborns, as well as interventions such as skin to skin</p>	<p>This article is older, and therefore not as relevant, but does provide significant information to compare to findings now.</p>
<p>Menezes, M. A., Garcia, D. C., Melo, E. V., & Cipolotti, R. (2014). Preterm Newborns at Kangaroo Mother Care: A Cohort Follow-up from Birth to Six Months. <i>Revista Paulista de Pediatria, 32(2), 171-177.</i> doi:10.1590/0103-0582201432213113</p>	<p>Purpose Statement: To evaluate premature infants that experienced exclusively breastfeeding and KMC at birth</p> <p>Research Question: What is the effect of KMC and exclusive breastfeeding on growth at discharge and six months of life?</p> <p>Setting: Northeast Brazil</p>	<p>Setting: Northeast Brazil</p> <p>Sampling Method: systematic sampling</p> <p>Sampling Size: 137</p>	<p>Design: Cohort follow up</p> <p>Level of Evidence: 1</p>	<p>At six months of life premature infants that experienced KMC were in between 15-85% weight percentiles</p>	<p>KMC should be promoted to mothers with preterm infants in order to normalize infant weight</p>	<p>There was a lack of control group, also not every infant participated in the six month follow up exam</p>
<p>Mörelis, E. L., Örténstrand, A., Theodorsson,</p>	<p>Purpose: to discuss the effects of KMC on salivary cortisol,</p>	<p>Setting: Sweden</p> <p>Sampling method: random</p>	<p>Design: Experimental</p> <p>Level of evidence:</p>	<p>Led to lower cortisol levels in both the parent. Parents showed improved mood</p>	<p>KMC should be implemented in infants to lower stress on their body and to</p>	<p>Small sample size</p>

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<p>E., Frostell, A. (2015). A Randomized Trial of Continuous skin-to-skin Contact After Preterm Birth and the Effects on Salivary Cortisol, Parental Stress, Depression, and Breastfeeding . <i>Early Human Development</i>, (91), 1, 63-70</p>	<p>parental depression and stress and successful breastfeeding. Research Question: Does constant skin-to-skin contact of a premature infant to their parents affect their cortisol levels, parental mentality, and breastfeeding?</p>	<p>Size: 42</p>	<p>2</p>	<p>and less relationship problems</p>	<p>promote bonding</p>	
<p>Parmar, V. R., Kumar, A., Kaur, R., Parmar, S., Kaur, D., Basu, S., ... Narula, S. (2009). Experience with Kangaroo mother care in a neonatal intensive care unit (NICU) in Chandigarh, India. <i>The Indian Journal of Pediatrics</i>, 76(1), 25-28. doi:10.1007/s12098-009-0024-2</p>	<p>Purpose Statement: To find the effect of KMC on vital parameters on low birth weight babies</p> <p>Research Question: What is the effect of KMC on the vital signs of low birth weight babies compared to conventional care?</p>	<p>Setting: Chandigarh, India</p> <p>Sampling Method: Convenience</p> <p>Sampling Size: 135</p>	<p>Design: Observational</p> <p>Level of Evidence: 1</p>	<p>Oxygen improved, respirations decreased and body temperature went up, the heart rates went down 3-5 beats per minute but remained within limits</p>	<p>Not only is KMC effective in caring for LBW infants, it helps decrease resources within the unit. A consideration for low budget units</p>	<p>A relatively small sample size</p>
<p>Pour, M., & Raghibi, M. (2016). The Impact of Increasing the Frequency and Duration of Kangaroo Mother Care on Maternal Attachment and the Clinical Status of Premature Infants. <i>International Journal of Medical Research & Health</i></p>	<p>Purpose Statement: To determine the effectiveness of Kangaroo Mother Care on low birth weight infant attachment</p> <p>Research Question: What is the effect of KMC on low birth weight infants' attachment and clinical</p>	<p>Setting: Iran</p> <p>Sampling Method: convenience</p> <p>Sampling Size: 30</p>	<p>Design: Quasi-Experimental</p> <p>Level of Evidence: 2</p>	<p>There is an increase in attachment in the experimental group in which there was increased frequency and length of KMC, KMC has also decrease infant complications like crying vomiting and temperature</p>	<p>KMC is an effective and low cost way for mothers without resources to care for their babies, it should be utilized in countries where NICU units are not developed</p>	<p>Only thirty mothers and infants used, small sample. Also after mothers returned home there was a dip in follow up values</p>

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<i>Sciences</i> , 5(7), 318-322.	status versus traditional isolette care?					
Sloan, N. L., Ahmed, S., Mitra, S. N., Choudhury, N., Chowdhury, M., Rob, U., & Winikoff, B. (2008). Community-Based Kangaroo Mother Care to Prevent Neonatal and Infant Mortality: A Randomized, Controlled Cluster Trial. <i>PEDIATRICS</i> , 121(5), e1047-e1059. doi:10.1542/peds.2007-0076	Purpose Statement: To determine the effectiveness of Kangaroo Mother Care on preterm infant mortality Research Question: What is the effect of Kangaroo care in LBW and preterm baby's mortality vs. traditional isolette use?	Setting: Bangladesh Sampling method: Randomized Control Cluster Sampling Sample Size: 4165	Design: Randomized control cluster Level of Evidence: 1	Kangaroo care reduced mortality in about a third of low birth weight, preterm, and overall neonate babies participating	Kangaroo care is an effective way to reduce neonate mortality and should be used with all preterm neonates	A lot of neonates participating were not weighed at birth, not providing a starting point to measure progress of the trial
Tessier, R., Cristo, M., Velez, S., Giron, M., Ruiz-Palaez, J. G., Charpak, Y., & Charpak, N. (1998). Kangaroo Mother Care and the Bonding Hypothesis. <i>PEDIATRICS</i> , 102(2), e17-e17. doi:10.1542/peds.102.2.e17	Purpose Statement: To find the effect of Kangaroo Mother Care (KMC) on infant bonding Research Question: What is the effect of KMC on infant bonding vs. traditional care?	Setting: Canada Sampling Method: convenience Sampling Size: 488	Design: Experimental, Randomized Controlled Trial Level of Evidence: 1	KMC did not show a direct effect on infant bonding with mothers but showed an increase in infant resilience	KMC is still beneficial to the infant and should be promoted as soon as possible to mother, and continued use until after discharge	The study did not follow up on infants and cannot allow for the long term effects of KMC