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CLINICAL REVIEW:

Improving colostrum and breast milk supply

Reviewed by: **Dr Helen McIntyre** RM, RGN, MSc, DHSci, Associate Professor specialising in infant feeding, complications in midwifery and normal childbearing

Learning Objectives

After reading this module and completing the online assessment, you should:

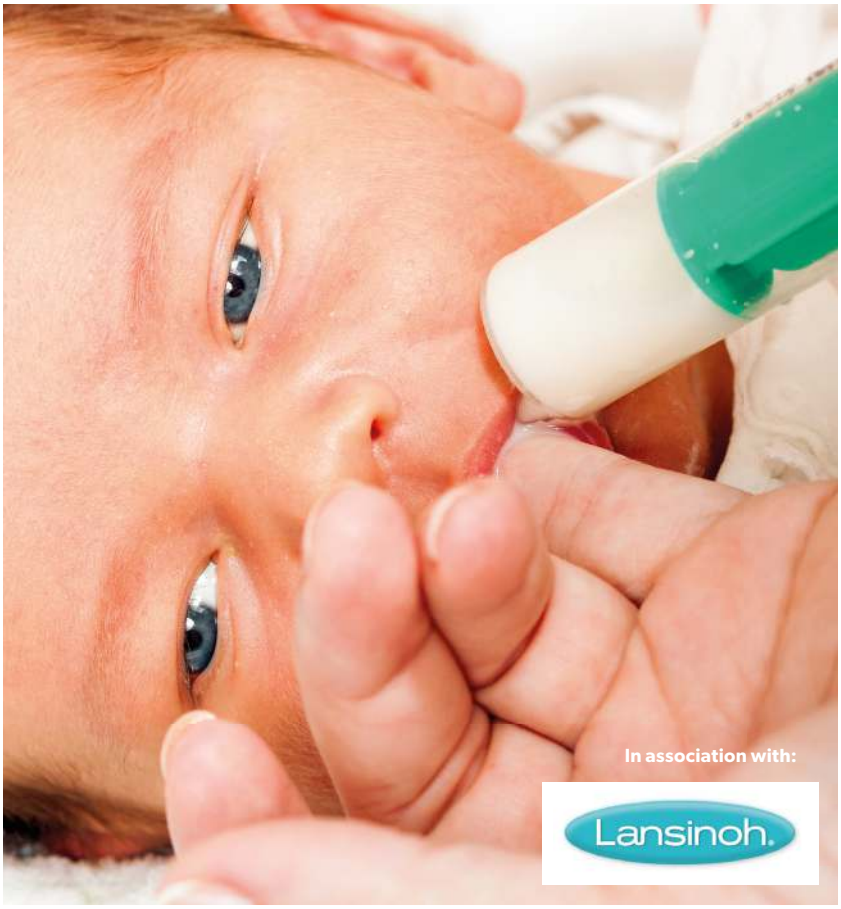
- have sufficient understanding of breast anatomy and physiology of lactation to support breast milk feeding
- know how to initiate and maintain milk supplies when babies cannot suckle
- understand the basic principles and techniques of breast massage and expressing
- know how to optimise the integrity of expressed milk and store, freeze and thaw milk safely.

? Questions

Visit our website to test your knowledge. Our questions cover:

- breast anatomy and physiology of lactation
- breast milk composition
- breast massage and expressing
- breast milk feeding and storage.

This learning module can be used towards CPD for revalidation with the Nursing and Midwifery Council (NMC).



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Improving colostrum and breast milk supply

The National Institute for Health and Care Excellence (NICE) recommends that mothers initiate breastfeeding within an hour of birth and continue exclusive breastfeeding for at least 6 months[1]. Given appropriate support, nearly all mothers and babies can benefit from the substantial health benefits provided by breastfeeding. However, not all babies can feed directly from the breast in the immediate postpartum period (see Box 1). A mother may need to initiate a supply of expressed milk and, in some cases, sustain this for weeks or months before she can rely on her baby to maintain her milk supply.

Even if a baby can feed from the breast, mothers may need support to express their milk for other reasons. For example:

- to tempt a baby to breastfeed
- to clean a baby's mouth
- to sustain a baby during a period of separation
- to maintain milk production when milk has to be discarded (e.g. due to HSV-1 breast lesions, after taking anti-epileptic medication or cytotoxic chemotherapy)
- to soften overly full breasts so that a baby can latch on, or relieve blocked ducts and mastitis.[1]

Box 1:

Situations that can prevent feeding from the breast

Prematurity: Babies born before 36 weeks may be unable to co-ordinate the necessary suck-swallow-breathe reflex.

Congenital abnormalities, e.g.:

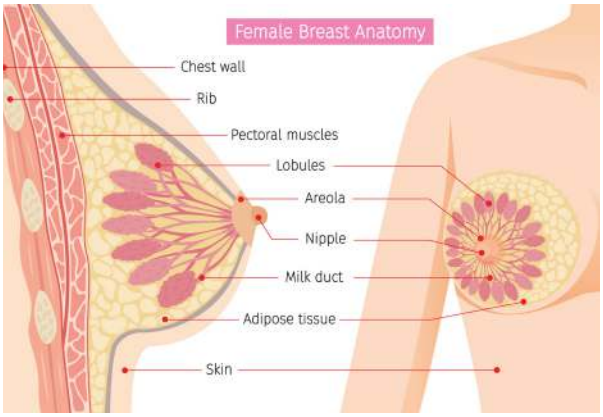
- cleft with insufficient palate for the tongue to press the breast against
- severe tongue tie (ankyloglossia) that restricts latching on
- muscular weakness due to Down Syndrome or cerebral palsy, causing difficulty with attachment and suckling.

Separation: Breastfeeding may not be possible while mother or baby receive treatment or recover from procedures or illness (e.g. sepsis).

To improve colostrum and breast milk supplies for vulnerable babies and ensure all babies receive the invaluable breast milk they need, healthcare professionals need to be able to support mothers to initiate and maintain their milk supply and teach them how to express, store and feed their breast milk safely.

Breast anatomy

Knowledge of the anatomy and physiology of the lactating breast is essential to support breast milk feeding.



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Note: The glandular tissue is closer to the nipple than depicted.

The breast is composed of glandular and fatty (adipose) tissue, supported by a framework of fibrous tissue known as Cooper's ligaments. The glandular tissue consists of several lobules, each containing clusters of alveoli (acini). Each alveolus is a tiny sac, lined with milk-synthesising cells (lactocytes) and surrounded by muscle (myoepithelial cells). This opens into a milk duct that merges with others as it travels toward the nipple. Within 8 mm of the nipple, all these branches merge to form about nine milk ducts that exit each breast.[2] The nipple contains muscle fibres and nerves, and becomes erect when stimulated. The areola contains Montgomery glands, which release sebum to soften and maintain the integrity of the skin.

Breast changes

In early pregnancy, oestrogen and progesterone levels rise. The milk ducts branch and extend, with significant growth of the lobes and multiplication of the alveoli. The breasts enlarge and become more sensitive and with increased vascularisation, veins become prominent.

At about 12-weeks gestation, the areola and nipples darken. Montgomery glands enlarge and begin to secrete an oily fluid, which lubricates the nipple and will provide an olfactory stimulus to the newborn.[3]

At around 16-weeks gestation, secretory differentiation occurs. The lactocytes/acini cells are now able to produce and secrete the unique fats, proteins and carbohydrates that make up breast milk, and colostrum begins to collect in the alveoli. Enzymes necessary for milk production are stimulated by prolactin (produced by the anterior pituitary) and by placental lactogen, but copious milk production is supressed by high progesterone levels.

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Secretory activation occurs when progesterone levels suddenly drop following expulsion of the placenta. Copious milk production then begins around 3 days later. The milk 'coming in' can create an uncomfortable fullness, but this generally resolves within a few days as milk production becomes regulated to the baby's needs.

Hormonal control of lactation

Following childbirth, the effect of circulating prolactin is no longer blocked. It binds with receptors in the walls of the lactocytes, stimulating them to produce milk. Skin-to-skin contact and suckling stimulate further prolactin release from the anterior pituitary.

Lack of suckling shuts down the prolactin receptors. As the alveoli fill with milk, the lactocytes change shape, which deactivates the receptors so that prolactin cannot bind, and milk synthesis ceases.[4] As the breast is emptied, prolactin can again bind, and milk synthesis resumes.

During the first few weeks, the more a baby suckles and stimulates the nipple, the more prolactin will be released, and the more milk will be produced. Prolactin levels peak about 30 minutes after starting to feed, triggering milk production for the next feed.[5] The highest peaks occur at night, so night feeds may be key to increasing milk supply.[5]

Suckling or stimulation of the nipple, and seeing, touching, smelling or hearing the baby, cause the release of oxytocin from the posterior pituitary gland. Oxytocin stimulates the myoepithelial cells to contract, propelling the milk from the alveoli along the milk ducts and out of the nipple. This 'milk ejection reflex' or 'let-down' can cause a tingling sensation and may occur several times during each feed. After a few days, even the anticipation of feeding may trigger the reflex. Oxytocin also acts on the uterine muscles, causing them to contract, which can be painful, but helps the uterus return to its pre-pregnancy size.

Autocrine control

A polypeptide produced by the lactocytes, known as Feedback Inhibitor of Lactation (FIL), also regulates milk production. When milk accumulates in the alveoli, FIL levels rise and milk production reduces. Conversely, when the alveoli contain less milk, FIL levels fall and milk production increases. This local feedback mechanism ensures that as milk is removed from one breast, more is produced. It also accounts for individual variation in milk production between the two breasts.

Composition of breast milk

Breast milk composition is dynamic and perfectly adapted to the baby's changing needs, both in its nutritional content (which includes fat, carbohydrates, proteins, vitamins, minerals and water) and in the non-nutritive bioactive factors that promote survival and development. Pre-term milk differs from term milk. It tends to contain more protein and fat.[6] Following birth, there is a gradual change in composition from colostrum (days 1-5), to transitional milk (days 6-14) to mature milk (day 14 onward).[6]

Sticky, golden colostrum is produced in low quantities (about 40-50 ml on day 1).[5] It is rich in protein, anti-infective factors, secretory IgA, lactoferrin, leucocytes and developmental factors such as epidermal growth factor, and has an invaluable role in priming and protecting the baby's gut, including its colonisation with 'friendly' bacteria.[6] It increases gut peristalsis, enabling the baby to pass meconium and reduces the risk of bilirubin reabsorption and consequent jaundice.[7] It contains relatively low concentrations of lactose and fat compared to later milk.[6,8]

Following a transitional period where there is rapid change in composition, as more lactose is produced and milk volume rises, at 2 weeks postpartum, composition becomes relatively stable. However, protein content gradually falls from the second to the seventh month.[8] There is also diurnal variation in fat content, which tends to peak midmorning and fall overnight.[8] Fat content also gradually increases during a feed giving a more energy-dense 'hind milk'.[6,10] For mothers exclusively breastfeeding a baby between 1 and 6 months old, the amount of mature milk produced averages 750 to 800 ml/day, but it can vary from 440 to 1220 ml/day for mothers whose babies grow within the normal range.[9]

Initiating milk supply

Immediate and uninterrupted skin-to-skin contact within the first hour promotes prolactin and oxytocin release. Wherever possible, the baby should be placed skin-to-skin immediately after birth and, without interference, the baby will instinctively follow the nine steps to self-attachment[10], and approach the breast to suckle in its own time. Healthcare professionals can help build a mother's confidence in her ability to breastfeed, and offer skilled support to enable comfortable positioning and attachment.

"Immediate and uninterrupted skin-to-skin contact within the first hour promotes prolactin and oxytocin release"

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Once the mother's milk 'comes in' (about day 3), frequent and thorough milk removal is the key to maintaining production. Thorough removal also helps capture the more energy-dense 'hind milk', which ensures the baby's satiety and energy needs are well met. Any situation that contributes to infrequent stimulation and removal of milk can diminish the supply. However, mothers should respond to their baby's feeding cues (e.g. rooting, tongue movement and putting hands to mouth) rather than adhere to any rigid guidelines on feeding frequencies, durations or amounts.[9]

If a newborn is unable to feed from the breast, the mother should be supported to begin expressing as soon as possible (ideally within 2 hours) to initiate her milk supply. It is important she knows that she will only express tiny amounts of colostrum until her milk 'comes in'. She should then be encouraged to express frequently, as often as a baby would feed, to maintain production. Frequent short sessions can be more productive than infrequent longer sessions. Milk should be expressed at least 8-10 times in 24 hours, including at least once during the night (when prolactin levels are highest), without leaving more than 5 hours between expressions.

Technique and volume of milk produced should be reviewed at least four times in the first 2 weeks and additional support offered if supplies are less than 750 ml by day 10. A logbook can be useful for recording frequency and volume of milk expressed.

All mothers should carry out as much of their baby's care and have as much skin-to-skin contact as possible to induce instinctive feeding behaviours. Non-nutritive sucking at the breast and oral stimulation may be beneficial until breastfeeding is established.[11]

If a mother is able to feed her expressed milk to her baby herself, she should be encouraged to do so, ideally using a method that won't jeopardise any future breastfeeding. She should be taught to respond to early feeding cues and how to hold her baby close in a semi-upright position with plenty of eye contact, so her baby feels secure and she can respond to cues that her baby has taken enough. Mothers will need support to continue expressing and, as soon as they are able, to begin or resume responsive breastfeeding. It is useful if the mother has already learned to recognise and respond to her baby's feeding cues.

Enabling let-down

Little milk can be obtained without activating the oxytocin reflex.[9] Healthcare professionals can advise mothers that they can enable their milk to flow by:

- being comfortable and relaxed in a warm room with enough privacy to avoid interruption
- thinking about, hearing or looking at her baby (or even at a photograph)
- skin-to-skin contact (or kangaroo care as soon as the baby is stable)
- warming her breasts (e.g. using a compress warmed in a microwave)
- gently massaging her breasts.

A Cochrane Review (2016) found that the quantity of breast milk increased following interventions involving relaxation, music, warmth and breast massage.[12]

Breast massage

Massage can stimulate the milk-ejection reflex. It may also mechanically move milk out of the alveoli along the milk ducts toward the nipple.[13] Massage can be used to help start the milk flowing, promote efficient emptying of the breast, increase production, and encourage milk to flow from a particular part of the breast to relieve common breastfeeding difficulties, such as engorgement, blocked ducts and mastitis.[1,14]

Breast massage doesn't only increase milk quantity, there is evidence it enhances composition. Foda *et al* (2004) found that breast massage significantly increased the total solids, lipids, casein and energy content of breast milk.[15] Foda and Oku (2008) also demonstrated increased whey protein concentrations following breast massage.[16] Changes induced by breast massage may benefit infant growth and development.[15]

Box 2:

Basic massage technique

1. Place your breast between your hands, with hands held horizontally, and gently move hands back and forth.
2. Repeat with hands held vertically.
3. With one hand supporting your breast, place three or four fingertips of your other hand flat on your breast and massage with small circular movements.
4. Move your fingers 2-3 cm around your breast and repeat until you have massaged your entire breast.
5. Use your fingers to caress your breast from near the base of the areola to the nipple. Milk may begin to flow.

Massage technique

There are several documented techniques, including the Oketani Lactation Management, Gua-Sha Therapy, and the Marmet Technique.[14] However, mothers should experiment to see what works best for them (see **Box 2** for a basic technique). Whatever technique is used, the mother should massage her entire breast, and it should not be painful or uncomfortable (see **Box 3**).

Box 3:

Teaching methods

When teaching a mother how to massage her breasts or express her milk, be empathetic, respect her boundaries and take care to understand her cultural norms and preferences. Use a 'hands-off' approach, for example using a breast model or teaching video, unless the mother agrees that a 'hands-on' approach would provide a better understanding and consents to your assistance.

Expressing

NICE recommends that all breastfeeding women are shown how to express their milk.[1] Hand expression is effective, particularly for small volumes of colostrum, but mothers should also be taught to use an electric pump once mature milk is noted. Hand expression can still be used alone or in conjunction with pumping if desired.

SOURCE A

Collecting colostrum

Mothers should express their colostrum by hand into a sterilised container. It can then be drawn into a syringe and fed directly to the baby via a spoon, cup, syringe, gastric tube, or supplementer, or stored for later use. However, the small amounts of viscous colostrum produced can adhere to the container, making it difficult to retrieve and feed to the baby. Trying to transfer tiny amounts from one container to another can be frustrating and the colostrum may be lost or contaminated in the process.

Closed systems for collecting and feeding colostrum are available with a hand-expression funnel, which can connect to an enteral syringe and breast pump. These systems have obvious advantages – minimal loss of the collected colostrum and less risk of contamination.

Antenatal harvesting

It is possible to express and store colostrum during pregnancy to help guarantee supplies for the newborn. When a baby is likely to need special care or have difficulty breastfeeding, a clinician may recommend expression and storage of colostrum from 36 weeks gestation. However, as there have been concerns that this might trigger an earlier onset of labour, antenatal expression is not advised if there is a history of threatened or premature labour; a multiple pregnancy; cervical incompetence or cervical suture *in situ*, and should be stopped if uterine contractions are felt. The harvested colostrum can be stored in a refrigerator if it will be needed within 48 hours (e.g. in advance of a planned Caesarean) or frozen. It should be stored in sealed containers, labelled with the mother's name and date of expression and brought into hospital in a cool bag when childbirth begins. Some clinicians encourage women with diabetes (pre-existing or gestational) to express and store their colostrum in late pregnancy as their babies are at more risk of hypoglycaemia and admission to a neonatal unit. A Cochrane Review (2014) found no high level evidence regarding the potential benefits and harms of this.[17] However, following a randomised controlled trial, Forster *et al* (2017) concluded there was no harm in advising women with diabetes at low risk of complications to express their breast milk from 36 weeks gestation, and this practice is growing.[18] However, if antenatal harvesting is advised, clear instructions must be given.[18]

Expressing by hand

Knowing how to express by hand is a useful skill, which requires no special equipment. NHS Choices provides advice for parents:[19]

- Cup your breast with one hand then, with your other hand, form a 'C'-shape by placing your forefinger and thumb about 2-3 cm from the base of your nipple.
- Squeeze gently, keeping your finger and thumb near the areola but not on it (do not squeeze the nipple itself).
- Release the pressure, then repeat, building up a rhythm. Try not to slide your fingers over your skin.
- Drops should appear, and then your milk usually starts to flow. If your milk does not flow, try moving your fingers slightly towards your nipple or further away, and try a gentle breast massage.
- When the flow slows, move your fingers round to a different section of your breast and repeat. Keep going until the milk drips very slowly or stops altogether. When the flow from one breast slows, swap to the other breast. Keep going until your milk drips very slowly or stops.

SOURCE B

Make sure the mother washes her hands and has an appropriate container ready to collect her milk before she begins. Colostrum can be collected in small (3-5 ml) containers, but once the milk 'comes in', a container with a wide mouth or funnel is more practical. Collections from one day may be combined if stored in a refrigerator between collections.

Using a breast pump

Various pumps are available, including manual pumps, electric single and electric double pumps. These consist of a breast shield (or flange) that fits over the nipple and a pump, which creates a vacuum to draw out the milk. They often screw directly onto a milk storage container. Closed systems are more hygienic. They have a barrier to stop milk reaching the pump's working parts, thus reducing the risk of microbial growth within the equipment. Pumps with a range of shield sizes should be available in hospitals, and women should be offered instruction on how to use them.[1] This should include suction settings and choosing the correct size. Mothers should use the maximum comfortable setting to maximise milk flow and volume. A two-phase pump allows the mother to use a rapid pumping rhythm to stimulate let-down, followed by a slower, deeper suction to maximise her milk flow.

Double pumping with breast massage is encouraged as it can save time and helps ensure good drainage:

- In a study involving 31 mothers of full-term babies, Prime *et al* (2012) showed that double pumping was faster and removed more milk than sequential single pumping. The expressed milk also had a higher energy content.[20]
- From a randomised controlled trial involving 36 women comparing methods of expressing milk after pre-term delivery, Jones *et al* (2001) concluded that double pumping was more effective, giving a higher milk yield than sequential single pumping, and that breast massage further improved milk production.[21]
- From a further study involving 67 mothers of pre-term babies, Morton *et al* (2009) demonstrated that more breast milk could be expressed by combining hand techniques (breast massage) with electric pumping.[22]

Healthcare professionals should encourage mothers to use breast massage before and during pumping to increase flow. Seeing the milk spraying into the pump can help guide the mother as to where to place her hands.

Storing expressed milk

During storage, any microbes acquired from the mother's skin or inadequately cleaned equipment, can multiply. In addition, nutrients are lost and degradation occurs. For some components, loss is rapid. Vitamin C, for example, is lost even whilst feeding freshly expressed milk. For many components however, significant degradation only occurs with prolonged storage and freeze-thaw cycles.[6]

To optimise the integrity of expressed milk, it should be used as soon as possible. However, sometimes it is necessary to store milk for later use and NICE recommends teaching all breastfeeding women how to store and freeze their milk.[1] Correct storage helps preserve the milk's composition and limits microbial growth. Guidance on storage varies. La Leche League[23] advises that in domestic settings, expressed milk for a healthy term baby can be stored in closed containers for up to:

- 4 hours at room temperature (16-29°C)
- 5 days in a fridge at 4°C
- 6 months in a freezer at 18°C.

However, NICE guidelines for postnatal care during the first 8 weeks advise keeping breast milk no longer than 24 hours in a refrigerator, 1 week in a freezer, or up to 3 months in a deep freeze.[24] As an added precaution, neonatal units may require mothers to express into sterilised containers and further restrict the time milk is stored. Dedicated fridges and freezers are used and temperatures are recorded daily to ensure these remain within limits.

Heating milk reduces the concentration and function of its components.[6] Frozen milk should be defrosted slowly in a refrigerator. If it is needed quickly, it can be defrosted in a jug of warm water or held under running warm water, but never in a microwave.[1] NICE recommends thawed milk is used within 24 hours and never re-frozen.[1]

Hospitals should provide storage containers and labels and ensure there is a system whereby milk is used in the order it was expressed. Not only does this give less opportunity for microbial growth, but as breast milk composition changes over the course of lactation, it will help ensure the milk given is compatible with the baby's needs.

Summary

- Breast milk composition is unique and dynamic, providing everything a baby needs for the first 6 months.
- Colostrum may be harvested from 36 weeks gestation for a baby likely to need special care or have difficulty breastfeeding.
- Hand expression is effective, particularly for small volumes of colostrum.
- Little milk can be produced without stimulating the oxytocin reflex (e.g. through skin to skin contact).
- Milk production is increased by increasing the frequency and degree of drainage of the breast.
- Breast massage and double pumping can increase the quantity of milk produced.
- If breast milk cannot be used immediately, it must be stored safely and used in the order it was expressed.

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Source A & B: Provided by funding partner.

Expressing breast milk – offering mothers solutions

The National Institute for Health and Care Excellence (NICE) recommends that all babies are fed exclusively on breast milk for the first 6 months.[1] However, in England, less than 75% of mothers start breastfeeding when their baby is born, and after 6-8 weeks only 44% continue to do so.[2] This makes breastfeeding rates in England amongst the lowest in the world.[2]

Given appropriate support and advice nearly all mothers can breastfeed. However, every mother's breastfeeding journey is different and breastfeeding is not always possible or easy. Difficulties arise when a baby is unable to latch on (e.g. due to severe tongue tie or cleft palate), when breast milk production is poor, and when a mother and baby are separated. These mothers need additional support and practical solutions to help them initiate their breast milk supply and provide their babies with sufficient quantities of breast milk for as long as they are needed.

Expressing breast milk

For babies who cannot feed directly from the breast, feeding expressed breast milk is the next best option. NICE recommends that all mothers are shown how to express their milk.[1] It's a useful skill, which can be used to

- establish a supply of breast milk prior to the birth
- maintain milk production when milk has to be discarded
- soften overly full breasts, making it easier for baby to latch on
- help relieve blocked ducts and mastitis
- provide a milk supply to sustain a baby when the mother returns to work or spends time away from her baby.

For small volumes of milk or colostrum, hand expression is effective but once mature milk 'comes in', mothers should be taught to use a breast pump, such as one of the award-winning range of manual and electric breast pumps provided by Lansinoh®. Lansinoh® breast pumps are designed to be comfortable, quiet and powerful and they are all closed systems. This means they have a physical barrier that prevents any expressed milk passing into the pump body or tubing. This helps to prevent bacteria contaminating the equipment, thus ensuring safer pumping.

Lansinoh® has a strong heritage of trust, care and commitment. Health professionals have recommended Lansinoh's award-winning product, HPA® Lanolin Nipple Cream, for more than 30 years.

When to recommend a manual pump

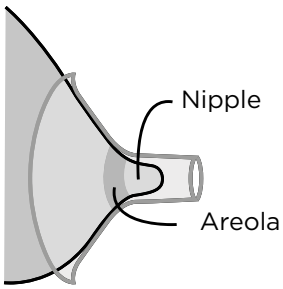
- Good for mothers who express occasionally
- Useful for reducing engorgement while apart from baby
- For discreet and convenient expressing, with no need for batteries or an electrical source

When to recommend an electric pump

- Good for mothers who express regularly, e.g. to sustain a baby in special care or multiple births
- For mothers returning to work
- For mothers wanting to involve family and friends in the feeding process
- Quicker than a manual pump
- Varying suction and pumping styles simulate a baby's natural feeding pattern, offering comfort and flexibility

Breast flange/cushion sizing

Mothers may need assistance from a knowledgeable health professional or qualified lactation consultant to find the appropriate breast shield/flange size for their chosen pump. A good fit can make pumping more comfortable and help mothers express more milk.



When the mother is pumping, ask her to check that only her nipple and a small amount of her areola are pulled into the tunnel of the breast shield/flange. If a large amount of her areola is pulled into the tunnel, it is too large and a smaller size is required. If her nipple touches or rubs against the sides of the tunnel, the shield is too small.

Expressing advice for mothers

- ✓ Expressing takes time. Mothers should not be disheartened if they don't produce much milk at first.
- ✓ Being relaxed is important. Stress inhibits oxytocin which is required for milk ejection.
- ✓ Try a warm compress and gentle breast massage. Lansinoh® TheraPearl 3-in-1 breast therapy pads can be used with any pump to encourage let-down and reduce pumping time.
- ✓ If away from baby, a picture or video of them, or something with their scent may help trigger the let-down reflex.

- ✓ Staying hydrated is important for milk production, so make sure mothers drink enough water.
- ✓ Track the date, time, duration and amount of milk collected from each breast, to establish an optimal pumping routine.
- ✓ Save time by pumping directly into Lansinoh® breast milk storage bags – these are the bags with the white and purple flowers above the line.

For further information on how to express and store breast milk, visit www.lansinoh.co.uk

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Lansinoh®

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Whether mothers need to express regularly or just occasionally, you can recommend that they choose one of Lansinoh's award-winning range of breast pumps to help them express their milk efficiently. The Lansinoh® Manual, Compact Single & Double Electric Breast Pumps are designed to be comfortable, quiet and powerful.

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