EtD 42c. Should frequent breastmilk expression vs. less frequent breastmilk expression be used for mothers of preterm infants?

POPULATION:	Mothers of preterm infants
INTERVENTION:	Frequent breastmilk expression
COMPARISON:	Less frequent breastmilk expression
MAIN OUTCOMES:	**Critical outcomes** Breastmilk supply/volume Fully breastfed or breastmilk feeding at hospital discharge Necrotising enterocolitis Mortality Neurodevelopmental impairment Sepsis: proven or suspected Time to full enteral feeds **Important but not critical** Adverse effects Faltering growth/body composition Duration of initial hospital stay Bronchopulmonary dysplasia Retinopathy of prematurity Anaemia of prematurity Cost: cost of intervention, cost of neonatal care and life-long cost **Less important for decision making** Time to full sucking feeds
SETTING:	Neonatal care
PERSPECTIVE:	Clinical recommendation-patient perspective
BACKGROUND:	Breastmilk is the optimal source of nutrition for preterm infants, providing essential nutrients, immune protection and developmental benefits. However, many mothers of preterm infants face challenges in establishing and maintaining milk supply, particularly when direct breastfeeding is not immediately possible. Effective breastmilk expression strategies are critical for ensuring sufficient milk production and supporting breastfeeding or breastmilk feeding at discharge. Early initiation of breastmilk expression, within one to six hours of birth, is believed to stimulate milk production by mimicking the natural hormonal responses that occur with direct breastfeeding. Delayed initiation of breastmilk expression may result in lower milk volumes and reduced breastfeeding or breastmilk feeding rates at discharge. The frequency of breastmilk expression may also be a key factor in maintaining lactation because this follows the natural feeding patterns of newborns and may help prevent low milk supply. The volume of breastmilk produced in the first 1 to 2 weeks may be a predictor of breastfeeding success. Insufficient expression frequency and volume may contribute to decreased milk production and early cessation of breastmilk feeding. The volume of breastmilk available for enteral feeding in the first two weeks after birth is an important determinant of how quickly parenteral nutrition can stop which reduces the risk of sepsis and whether the infant receives infant

	formula which increases the risk of necrotising enterocolitis. Additionally, double pumping (using an electric breast pump to express milk from both breasts simultaneously) may be more effective than single or sequential pumping. Understanding the evidence and whether it supports these practices and beliefs is essential to optimising milk production, minimising feeding related morbidity and mortality, and supporting breastfeeding success for mothers of preterm infants.
CONFLICT OF INTERESTS:	None

Assessment

Desirable Effects

How substantial are the desirable anticipated effects?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
○ Trivial ● Small ○ Moderate ○ Large ○ Varies ○ Don't know	**Breastmilk expression within 6 hours of birth** [1-4] **Breastmilk supply/volume**: Cohort: Expressing within 6 hours of birth was associated with higher milk yield on day 4 (88.3 g, 95% CI 7.1 to 169.4) and day 14 (155.7 g, 95% CI 12.2 to 299.3) but not on day 21 (73.6 g, 95% CI −91.4 to 238.7). There was an interaction between expressing frequency and time to first expression (p<0.005), with increased expressing frequency being associated with higher yield only in those who expressed within 6 hours. Cohort study: Women who expressed milk within 6 hours of delivery produced more milk than women who started expressing after 6 hours. The increased lactation was attributable to women who commenced expressing within one hour of delivery [Critical]. **Fully breastfed or breastmilk feeding at hospital discharge**: Retrospective case histories: Initiation of breastfeeding in the first 6 hours of life was associated with a relatively high probability of exclusive breastfeeding at hospital discharge (OR 2.38; 95% CI 1.19–4.75). **Double pumping** [5-9] **Breastmilk supply/volume**: RCT: Milk yield higher with double pump vs. sequential expression [Critical]. **Frequent expression of breastmilk (≥ 8 times in 24 hours) after preterm birth** [10] **Breastmilk supply/volume**: Cohort: Expressing frequency was positively associated with 24-hour milk yield. Expressing 8 or more times per day was associated with higher adjusted milk yield than expressing <6 times (on day four, 146.8g, 95% CI 47.4 to 246.1), but not in comparison to expressing 6–7 times (on day four, 82.1g, 95% CI −25.9 to 190.1) **Desirable effects for Māori** No additional evidence available	**Breastmilk expression within 6 hours of birth** Levene 2024 [1] Infants 23+0 to 31+6 weeks postmenstrual age Prikhodko 2022 [2] Infants gestational age of 34–36 weeks Parker 2020 [3] ≤1500 g and ≤32 weeks' gestation Parker 2015 [4] ≤1500 g and ≤32 weeks' gestation **Double pumping** Jones 2001 [7] Overall mean infant birthweight was 1535 g (1610 g in the sequential group, and 1460 g in the simultaneous group); mean gestational age was 29.97 weeks (sequential 29.9, simultaneous 30.2). Hill 1996; Hill 1999 [5,6] <1500 gm and <32 weeks' gestation Köroğlu 2017 [8] Gestational ages of the infants varied between 25 to 38 weeks (31.9±3.8) and their birthweights were within 760 and 3200 g (1554.8±663.6). Fewtrell 2016 [9] Cohort analysis within a RCT. Babies <34 weeks admitted to neonatal intensive care. **Frequent expression of breastmilk (≥ 8 times in 24 hours) after preterm birth**

		Levene 2024 [10] Infants were between 23+0- and 31+6-weeks' gestation. Some additional studies were identified that reported on frequency of expression but did not report on 8 or more sessions. Cohort study [11]. Preterm infants with gestational age 32 weeks or birthweight 1,500 g. Milk outputs on days 7, 14, and 42 of mothers with a pumping frequency of ≥ 6 times/d were greater than mothers with a pumping frequency of 6 times/day. On postpartum day 42, this difference was statistically significant (t=−2.828, p= 0.009). Cohort study [12]. Babies <34 weeks' gestation. High intensity pumping (HIPG) resulted in significantly greater mean daily milk volume over the 14-day study compared with low intensity pumping (LIPG). Compared to mothers in the LIPG, HIPG mothers pumped more frequently per day (5 ± 2 times vs. 2 ± 2 times, p < 0.001), The 14-day cumulative mean pumped MOM volumes for the HIPG and LIPG were 4769 ± 3154 mL and 2582 ± 1492 mL, respectively (p= 0.02). Cohort study [1] There was an interaction between expressing frequency and time to first expression (p<0.005), with increased expressing frequency being associated with higher yield only in those who expressed within 6 hours. Infants were 23+0- and 31+6-weeks' gestation. Australian cohort study [13]. Infants with median gestational age 29 weeks (24 to 32 weeks range). Comparing three expressions a day to four, five and six expressions/day there was no significant increase between three and four expressions or three and five expressions, but an increase between three and six expressions (228 g (95% CI: 43 to 414), p=0.006). Comparing four expressions a day to five and six, there

		were increases for both (five: 170 g (95% CI: 42 to 298), p=0.002, six: 223 g (95% CI: 77 to 370), p<0.001). The daily milk production was not different between frequency of expressions of five, six, seven, eight and nine times. Mother should express 5+ times/day with a maximum interval of 7 hours. USA cohort study [14] of infants admitted to Neonatal Intensive Care Unit mean birthweight 1909 ± 902 g. Pumping frequencies stabilised by postnatal day 5, with mothers who achieved coming to volume (CTV; ≥ 500 mL/day for at least one 24-hour period during the first 14 days) pumping an average of 5 times per day, and those who did not achieve CTV pumping approximately 3 times per day on postnatal day 5. Of women who were pumping at least 5/day × Day 5, 66.7% achieved CTV compared with 29.4% of those who did not CTV.

Outcomes	№ of participants (studies) Follow-up	Certainty of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects* (95% CI)	
				Risk with breastmilk expression (double, delayed, less frequent)	Risk difference with breastmilk expression (sequential, early, frequent)
Breastmilk supply/volume: RCT: Sequential vs. double pump assessed with: Weight (g)	36 (1 RCT)	⨁◯◯◯ Very low[a,b,c]	-	Milk yield is higher with double pump vs. sequential expression (88 g; 95%CI 79 - 97 vs. 51 g; 95%CI 46-56; *P*< 0.01).	
Breastmilk supply/volume: RCT: Sequential vs. double pump assessed with: Weight (g)	48 (2 RCTs)	⨁⨁◯◯ Low[a,d]	-	Pilot study n=9 Mean daily milk yield in the sequential single group ranged from a low of 158.4 gm on day 3 to a high of 505.8 g on day 20. The mean daily milk yield in the double pump group ranged from a low of 41.4 g on day 3 to a high of 741 g on day 41. The overall mean milk yield for the 40 days in the sequential single and double pump groups was 395.2 (SD 270.9) and 445.3 (SD 188.9) g, respectively. RCT n=39 Milk weight change was higher for double pump than sequential groups between weeks 2 and 5 (P=0.049).	
Breastmilk supply/volume: RCT: 60 (early), 61–180	180	⨁⨁◯◯	-	For mothers who initiated early mother's own milk production over time was	

(intermediate) or 181–360 (late) minutes following delivery assessed with: Milk volume	(1 RCT)	Low[b,e]		significantly lower through the 42 days (p=0.045) compared to the late group but did not differ between the intermediate and late groups when controlling for covariates (mode of delivery and prior lactation experience). While the late expression group produced more others own milk during the first three days, there were no differences for days 4 to 7 or weekly for six weeks.	
Breastmilk supply/volume: Cohort: (early <6 hours vs. later >6 hours from birth) assessed with: Milk yield (g)	120 (1 non-randomised study)	⨁◯◯◯ Very low[b,e,f]	-	One cohort study (UK) reported 51.7% expressed within 6 hours of birth (62/120) and 48.3% expressed more than 6 hours after birth (58/120). Expressing within 6 hours of birth was associated with higher milk yield on day 4 (88.3 g, 95% CI 7.1 to 169.4) and day 14 (155.7 g, 95% CI 12.2 to 299.3) but not on day 21 (73.6 g, 95% CI −91.4 to 238.7). There was an interaction between expressing frequency and time to first expression (p<0.005), with increased expressing frequency being associated with higher yield only in those who expressed within 6 hours. Expressing within 2 hours of birth was not associated with further milk yield increase.	
Breastmilk supply/volume: Cohort: Frequent vs. less frequent expression	132 (1 non-randomised study)	⨁◯◯◯ Very low[b,f]	-	Expressing frequency was positively associated with 24-hour milk yield, with an adjusted 30.5g increase per expressing session on day four (95% CI 15.7 to 45.3) and 94.4g on day 21 (95% CI 62.7 to 126.2). Expressing 8 or more times per day was associated with higher adjusted milk yield than expressing <6 times (on day four, 146.8g, 95% CI 47.4 to 246.1), but not in comparison to expressing 6–7 times (on day four, 82.1g, 95% CI −25.9 to 190.1).	
Fully breastfed or breastmilk feeding at hospital discharge: Retrospective case histories: early <6 hours vs. later >6 hours from birth	84 (1 non-randomised study)	⨁◯◯◯ Very low[b,c,g]	-	Initiation of breastfeeding in the first 6 hours of life was associated with a relatively high probability of exclusive breastfeeding at hospital discharge (OR 2.38; 95% CI 1.19–4.75).	
Necrotising enterocolitis - not measured	-	-	-	-	-
Mortality - not measured	-	-	-	-	-
Neurodevelopmental impairment - not measured	-	-	-	-	-
Sepsis: proven or suspected - not measured	-	-	-	-	-
Time to full enteral feeds - not measured	-	-	-	-	-
Adverse effects - not measured	-	-	-	-	-
Faltering growth/body composition - not measured	-	-	-	-	-
Duration of initial hospital stay - not measured	-	-	-	-	-
Bronchopulmonary dysplasia - not measured	-	-	-	-	-
Retinopathy of prematurity - not measured	-	-	-	-	-
Anaemia of prematurity - not measured	-	-	-	-	-
Cost: cost of intervention, cost of neonatal care and life-long cost - not measured	-	-	-	-	-
Time to full sucking feeds - not measured	-	-	-	-	-

a. Downgraded one level for concerns for risk of bias
b. Downgraded one level for indirectness as evidence is only reported in a single study
c. Downgraded one level for indirectness as not generalisable as no very preterm infants were included
d. Downgraded one level for imprecision due to low sample numbers
e. Downgraded one level for indirectness as study was in very preterm infants only
f. Downgraded two levels for imprecision due to extremely wide confidence intervals
g. Downgraded two levels for concerns with risk of bias

Undesirable Effects

How substantial are the undesirable anticipated effects?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
● Trivial ○ Small ○ Moderate ○ Large ○ Varies ○ Don't know	**Breastmilk expression within 6 hours of birth** [1-3] **Breastmilk supply/volume**: RCT: For mothers who initiated early mother's own milk production over time was significantly lower through the 42 days (p=0.045). While the late expression group produced more others own milk during the first three days, there were no differences for days 4 to 7 or weekly for six weeks. **Undesirable effects for Māori** No additional evidence available	

Certainty of evidence

What is the overall certainty of the evidence of effects?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
● Very low ○ Low ○ Moderate ○ High ○ No included studies	Low to very low certainty of evidence overall. **Certainty of evidence for Māori** No additional evidence available	

Outcomes	Importance	Certainty of the evidence (GRADE)
Breastmilk supply/volume: RCT: Sequential vs. double pump assessed with: Weight (g)	CRITICAL	⨁◯◯◯ Very low
Breastmilk supply/volume: RCT: Sequential vs. double pump assessed with: Weight (g)	CRITICAL	⨁⨁◯◯

		Low
Breastmilk supply/volume: RCT: 60 (early), 61–180 (intermediate) or 181–360 (late) minutes following delivery assessed with: Milk volume	CRITICAL	⨁⨁◯◯ Low
Breastmilk supply/volume: Cohort: (early <6 hours vs. later >6 hours from birth) assessed with: Milk yield (g)	CRITICAL	⨁◯◯◯ Very low
Breastmilk supply/volume: Cohort: Frequent vs. less frequent expression	CRITICAL	⨁◯◯◯ Very low
Fully breastfed or breastmilk feeding at hospital discharge: Retrospective case histories: early <6 hours vs. later >6 hours from birth	CRITICAL	⨁◯◯◯ Very low
Necrotising enterocolitis - not measured	CRITICAL	-
Mortality - not measured	CRITICAL	-
Neurodevelopmental impairment - not measured	CRITICAL	-
Sepsis: proven or suspected - not measured	CRITICAL	-
Time to full enteral feeds - not measured	CRITICAL	-
Adverse effects - not measured	IMPORTANT	-
Faltering growth/body composition - not measured	IMPORTANT	-
Duration of initial hospital stay - not measured	IMPORTANT	-
Bronchopulmonary dysplasia - not measured	IMPORTANT	-
Retinopathy of prematurity - not measured	IMPORTANT	-
Anaemia of prematurity - not measured	IMPORTANT	-
Cost: cost of intervention, cost of neonatal care and life-long cost - not measured	IMPORTANT	-
Time to full sucking feeds - not measured	NOT IMPORTANT	-

Values

Is there important uncertainty about or variability in how much people value the main outcomes?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
○ Important uncertainty or variability ● Possibly important uncertainty or variability ○ Probably no important uncertainty or variability ○ No important uncertainty or variability	Possibly important uncertainty or variability	

Balance of effects

Does the balance between desirable and undesirable effects favour the intervention or the comparison?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
○ Favours the comparison ○ Probably favours the comparison ○ Does not favour either the intervention or the comparison ● Probably favours the intervention ○ Favours the intervention ○ Varies ○ Don't know	**Frequent expression of breastmilk (≥ 8 times in 24 hours) after preterm birth - very low certainty evidence** Increased milk yield **Balance of effects for Māori** No additional evidence	

Resources required

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
○ Large costs ○ Moderate costs ● Negligible costs and savings ○ Moderate savings ○ Large savings ○ Varies ○ Don't know	Access to breast pumps Prenatal educational resources Access to breastfeeding support specialist and staff **Resourcing for Māori** No additional evidence available	

Certainty of evidence of required resources

What is the certainty of the evidence of resource requirements (costs)?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
○ Very low ○ Low ● Moderate ○ High ○ No included studies	A formal assessment of the certainty of evidence of the cost was not undertaken. **Certainty of evidence of required costs for Māori** No additional evidence available.	

Cost effectiveness

Does the cost-effectiveness of the intervention favour the intervention or the comparison?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
○ Favours the comparison ○ Probably favours the comparison ○ Does not favour either the intervention or the comparison ○ Probably favours the intervention ○ Favours the intervention ○ Varies ● No included studies	No studies reported on the cost effectiveness of breastmilk expression for mothers of preterm infants. **Cost effectiveness for Māori** No additional evidence available	

Equity

What would be the impact on health equity?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
○ Reduced ○ Probably reduced ○ Probably no impact ● Probably increased ○ Increased ○ Varies ○ Don't know	**Equity for Māori** Māori mothers of preterm pēpi Māori face systemic barriers that affect their ability to establish and maintain breastfeeding. Early and frequent breastmilk expression is vital to improving milk supply and long-term breastfeeding success, yet pēpi Māori are less likely to be exclusively breastfed at discharge. Delayed or infrequent expression may worsen these outcomes and reinforce existing inequities. Given the impact of colonisation on health systems and whānau support, structured support for early and consistent expression can empower wāhine Māori. Prioritising these practices in neonatal care may enhance breastfeeding rates and promote culturally responsive care for whānau Māori with preterm pēpi. **Equity for Pacific families** Pacific mothers may face barriers to early and frequent milk expression due to limited support, inconsistent staff engagement or lack of culturally aligned guidance. Although Pacific infants had high rates of transition to mother's own milk only, 22% still received alternative nutrition by day three, suggesting gaps in consistent breastfeeding support. Delayed or less frequent breastmilk expression may contribute to reduced supply and interrupted feeding progress. Equity requires respectful education and proactive lactation support that affirms Pacific values and promotes confidence in maintaining milk supply from birth. **Equity for underrepresented groups** Mothers from migrant, rural or low-income backgrounds may experience delays in accessing pumps, lactation advice or culturally appropriate care. These barriers can reduce early expression and long-term supply. Equity demands timely resources, interpreter services and individualised support to ensure all mothers can establish and maintain breastmilk feeding. Promoting early and frequent expression can improve outcomes by creating more equitable opportunities for breastfeeding success. Ensuring access to equipment, culturally appropriate education and staff support across	

	all neonatal settings is essential to closing the gap in feeding disparities.	

Acceptability

Is the intervention acceptable to key interest-holders?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
○ No ○ Probably no ● Probably yes ○ Yes ○ Varies ○ Don't know	While early, frequent breastmilk expression is clinically recommended to support milk supply for preterm infants, acceptability will vary across mothers and families depending on a range of personal, cultural and systemic factors. **Emotional readiness**: Parents of preterm infants are often under intense emotional stress. Some may feel overwhelmed by the expectation to express milk frequently and early, especially in the first hours after birth. **Physical discomfort or health**: Breastmilk expression—especially with a pump—can be physically uncomfortable. Some mothers recovering from a complicated birth or surgery may not feel able to express immediately. **Time and capacity**: Sequential and frequent expression is time intensive. Mothers caring for other children, managing work or without consistent support may struggle to commit to a strict schedule. **Acceptability for Māori** No additional evidence available	

Feasibility

Is the intervention feasible to implement?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
○ No ○ Probably no ● Probably yes ○ Yes ○ Varies ○ Don't know	Frequent expression is feasible if adequate equipment, education and support is available. **Feasibility for Māori** No additional evidence available.	Huang *et al* [15] reported on an implementation project to promote early, frequent and effective breastmilk expression. Breastmilk expression within 6 hours of birth of preterm infants (<37 weeks) increased from 23% to 87%. Compliance of expression for 8–12 times daily in the first 48 hours after delivery also experienced dramatic improvement from 0 to 50%. The volume of breastmilk expression in the first 24 hours increased from 2.1 +/- 5.5 to 7.7 +/-17.2 mL on average. In the following 24 h, the volume improved from 7.1 +/-13.0 to 43.8 +/-80.9 mL.

Summary of judgements

	JUDGEMENT						
DESIRABLE EFFECTS	Trivial	**Small**	Moderate	Large		Varies	Don't know
UNDESIRABLE EFFECTS	**Trivial**	Small	Moderate	Large		Varies	Don't know
CERTAINTY OF EVIDENCE	**Very low**	Low	Moderate	High			No included studies
VALUES	Important uncertainty or variability	**Possibly important uncertainty or variability**	Probably no important uncertainty or variability	No important uncertainty or variability			
BALANCE OF EFFECTS	Favours the comparison	Probably favours the comparison	Does not favour either the intervention or the comparison	**Probably favours the intervention**	Favours the intervention	Varies	Don't know
RESOURCES REQUIRED	Large costs	Moderate costs	**Negligible costs and savings**	Moderate savings	Large savings	Varies	Don't know
CERTAINTY OF EVIDENCE OF REQUIRED RESOURCES	Very low	Low	**Moderate**	High			No included studies
COST EFFECTIVENESS	Favours the comparison	Probably favours the comparison	Does not favour either the intervention or the comparison	Probably favours the intervention	Favours the intervention	Varies	**No included studies**
EQUITY	Reduced	Probably reduced	Probably no impact	**Probably increased**	Increased	Varies	Don't know
ACCEPTABILITY	No	Probably no	**Probably yes**	Yes		Varies	Don't know
FEASIBILITY	No	Probably no	**Probably yes**	Yes		Varies	Don't know

Type of recommendation

Strong recommendation against the intervention	Conditional recommendation against the intervention	Conditional recommendation for either the intervention or the comparison	**Conditional recommendation for the intervention**	Strong recommendation for the intervention
○	○	○	●	○

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