



ORIGINAL ARTICLE

Use of fetal fibronectin testing in women transferred for threatened preterm labour in remote far north Queensland

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Conflict of interest: The authors report no conflict of interests.

Received: 14 May 2018;
Accepted: 15 July 2018

Background: Threatened preterm labour is a common reason for medical transfer from remote communities; however, many transferred women do not deliver preterm. A tool for prediction of preterm birth such as fetal fibronectin may reduce transfers and related social and economic costs.

Aim: To review the use of fetal fibronectin testing in women transferred for threatened preterm labour from Cape York to Cairns Hospital between 2011 and 2015 and determine the role testing could play in reducing transfers and associated costs.

Materials/methods: Records from the Royal Flying Doctor Service and Cairns Hospital were accessed. Women transferred solely for threatened preterm labour were included in the study. Fetal fibronectin testing, hospital admission, outpatient stays and birth outcome data were collated and analysed. Costs were assigned using the National Hospital Cost Data Collection, round 19.

Results: Forty-seven women were included in the study; however, only 20 underwent fetal fibronectin testing. Transfer of 30 women who had either a negative test or were not tested but delivered at term resulted in 41 inpatient nights and 443 excess outpatient nights, costing an estimated AU\$57 408. Aeromedical transfers were estimated to cost a further \$151 500.

Conclusion: Adherence to clinical guidelines and greater availability and use of fetal fibronectin testing in Cape York have the potential to reduce aeromedical transfers for threatened preterm labour. Substantial inpatient and excess outpatient stays could be avoided with associated reduction in health system and social costs. Strategies to improve adherence to guidelines and increase access to testing are required.

KEYWORDS

air ambulance, cost savings, fibronectins, obstetric labour, premature, rural health services

BACKGROUND

Preterm birth remains a major challenge in reproductive health care. In 2015, 8.7% of deliveries in Australia occurred prior to

37 weeks completed gestation.¹ Prematurity contributed to 74% of special or neonatal intensive care admissions and 84% of perinatal deaths.¹ Perinatal outcomes are improved when preterm delivery occurs in a facility with higher levels of care and inpatient volumes and levels.^{2–4} Consequently, obstetric transfers to

higher-level facilities for preterm labour or threatened preterm labour (TPL) is one of the most common transfer reasons.⁵⁻⁷

Preterm labour is difficult to diagnose and women transferred for TPL, particularly without ruptured membranes, have a high likelihood of discharge home undelivered.^{5,6} Fetal fibronectin (fFN) is an established test for the prediction of preterm birth in symptomatic women. It has a 99.5% negative predictive value for preterm birth within 7 days and 99.2% in the next 14 days.^{8,9} A 2013 systematic review concluded that the use of fFN testing could potentially reduce healthcare resource usage by identifying women not requiring intervention and that current evidence suggests the use of fFN does not increase adverse outcomes.¹⁰

The Cape York region in far north Queensland is a remote area of 110 000 square km with a population of 15 000 people and 51% identifying as Aboriginal and/or Torres Strait Islander.¹¹ It has 10 primary healthcare (PHC) facilities, one integrated health service (IHS) and one multipurpose health services (MPHS), one of which reopened a birthing service for low-risk pregnancies in 2014. Aboriginal health workers and registered nurses, some of whom may have additional midwifery qualifications, staff the PHCs with visiting medical officers and midwives for part of the week. The IHS and MPHS have medical officers available 24/7. Women from Cape York routinely transfer to Cairns at 36 weeks gestation for pending delivery with funded travel and accommodation. Cairns is also the closest destination for birthing preterm for women dwelling in Cape York communities. It is located 330 km by road from the nearest IHS/MPHS, and as far as 900 km from some PHCs. Cairns Hospital offers a neonatal facility for babies at 29 completed weeks of gestation.

The Queensland state-wide guidelines for preterm labour endorse the use of fFN for clinical decision-making. Hospital admission is not indicated for women with a negative test unless there are additional medical complications.¹² This test is available in the MPHS and IHS, but not PHCs in Cape York. Our study investigates the use of this test and its impact on clinical decision-making and transfers from Cape York to Cairns Hospital.

AIM

The study aimed to review the use of fFN testing in women transferred for TPL from Cape York to Cairns Hospital between 2011 and 2015 and determine the role testing could play in reducing transfers and associated costs.

MATERIALS AND METHODS

All transfers from Cape York communities allocated with an International Statistical Classification of Disease and Related Health Problems code (ICD-10)¹³ for obstetric transfer between 2011 and 2015 were selected from the Royal Flying Doctor Service (RFDS) database. Review of medical notes identified and

confirmed which women presented with an ICD-10 diagnostic code where clinical guidelines recommend a fFN test result could be used in determining the need for transfer. Cases where transfer would have been indicated on grounds other than TPL were excluded (Fig. 1).

The RFDS records, transfer documentation from the community of origin and medical records from Cairns Hospital were reviewed. Collected data included demographics, presenting symptoms, obstetric history (parity, previous preterm birth), fFN test result (if performed), use of steroids, tocolytics and antibiotics, gestational age at birth, and the number of inpatient and outpatient nights. Excess outpatient nights were calculated as those the woman spent in Cairns at less than 36 weeks gestation. To estimate the costs associated with potentially avoidable hospital transfers, we utilised the national estimated cost for DRG O66B for the 2014–2015 financial year¹⁴ (Antenatal and Other Obstetric Admission, Minor Complexity) for excess admitted hospital stays, and the Queensland Patient Travel Subsidy Scheme¹⁵ accommodation subsidy amount for excess outpatient nights.

The Far North Queensland Human Research Ethics Committee approval for the study was granted (HREC/16/QCH/33-1039LR).

RESULTS

Between 2011 and 2015, the RFDS transported 339 obstetric cases from Cape York communities to Cairns Hospital, accounting for 7% of all transfers. Forty-seven women were eligible for inclusion in the study. The majority of women identified as Aboriginal and/

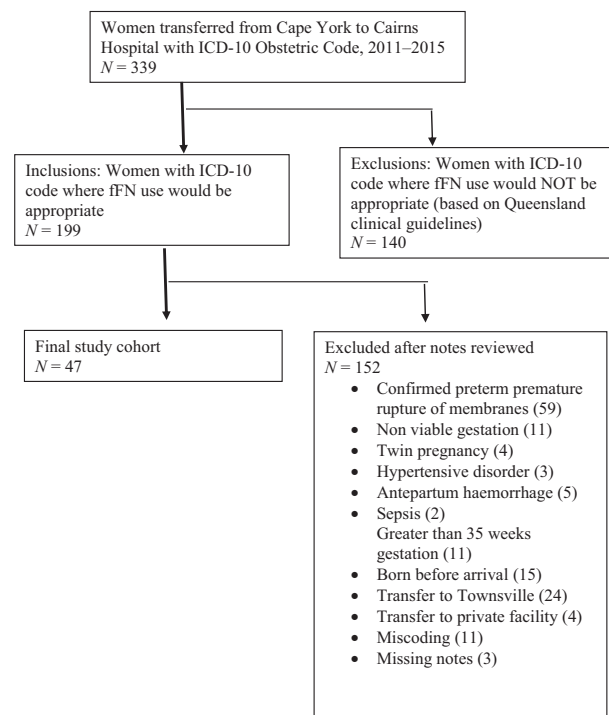


FIGURE 1 Study cohort selection methods.

or Torres Strait Islander (79%). Forty per cent of women were nulliparous and 47% aged between 20 and 29 years. Ten (21%) had a history of previous preterm birth. The MPHS and IHS accounted for 25 transfers with the remaining 22 women transferred from three PHCs (Table 1).

Most women (77%) presented with contractions. Thirty-six percent of women did not have a speculum examination and only eight women (17%) had a fFN test, of which five had a negative result. All eight women tested had presented to either the MPHS or IHS. Almost every woman (98%) was administered nifedipine, the vast majority (89%) had steroids commenced, and 38% received antibiotics.

On arrival at Cairns Hospital, 29 women (62%) had a speculum examination and a further 12 had a fFN test of which eight were negative. Several reasons were given as to why fFN testing was not done, including the women symptomatically being well with the test no longer being indicated and a vaginal examination having been performed. However, 13 (37%) records offered no explanation as to why fFN testing was not done, or documented whether the test was considered. Overall 20 (42%)

women had a fFN test performed either in the community or in hospital. Of the seven positive results, only one woman went on to premature delivery.

None of the 13 women with a negative fFN result delivered prematurely or within 2 weeks of the test (Table 2). All were discharged from hospital within 1–5 days. Seven of these women travelled home to their community; however, six remained in Cairns until delivery. The transfer of women with a negative fFN result led to an excess of 221 outpatient nights (17 per woman) in Cairns, at an estimated cost of \$13 260. There were also 19 inpatient nights (1.5 per woman) in this group, at an estimated cost of \$14 677.

Twenty-seven women who were transferred for TPL did not have a fFN test either in the community health facility or Cairns Hospital. Early cervical change was noted in three women with delivery ensuing, while a further three women also prematurely delivered. Outcomes are unknown for four women who transferred interstate or to private care; however, the remaining 17 women did not deliver preterm (Table 2). These 17 transfers accounted for a further 217 excess outpatient nights, and 15 inpatient nights. This was at a cost of \$16 451 for inpatient nights and \$13 020 for outpatient nights.

Only three women (6%) delivered during the initial admission following transfer, with a further four women transferring interstate or to private care with an unknown outcome. Thirty women transferred from their community for TPL did not return home until after delivery. For these women, there were several reasons for remaining in Cairns: proximity to 36 weeks gestation, medical indications, social requests and preterm delivery, but for 12 women (40%), no reason for failure to return to their community was documented.

TABLE 1 Demographics of women transferred from Cape York communities for threatened preterm labour, 2011–2015 (*n* = 47)

	<i>n</i>	%
Age group (years)		
<20	8	17.0
20–29	22	46.8
30–39	13	27.7
40+	4	8.5
Healthcare facility†		
A	12	25.5
B	5	10.6
C	5	10.6
D	11	23.4
E	14	29.8
Indigenous		
Yes	37	78.7
No	8	17.0
Not stated	2	4.3
Parity		
0	19	40.4
1–2	15	31.9
3–4	10	21.3
5+	3	6.4
Gestation (weeks)		
27 to <32	22	46.8
32 to <35	25	53.2
Previous preterm delivery		
Yes	10	21.3
No	37	78.7

†De-identified healthcare facility names

DISCUSSION

This study has found that fFN tests were not utilised according to guidelines in Cape York community health facilities or at Cairns Hospital during the study period. Women presenting with TPL were not consistently tested, and a negative result did not necessarily alter the management. For the women in our cohort who had a negative fFN test, the negative predictive value was certainly true, with no preterm births in this group. This is in line

TABLE 2 Delivery outcomes for women transferred from Cape York communities for threatened preterm labour, by fFN test result, 2011–2015

	Delivery			
	All	Term	Preterm	Unknown
fFN positive	7	6	1	0
fFN negative	13	13	0	0
Not tested	27	17	6	4
Total	47	36	7	4

fFN, fetal fibronectin

with findings from previous studies.^{8,9} The delivery rate for our cohort of women during the initial admission following transfer was 6%; however, previous Australian studies have shown delivery rates following transfer for TPL ranging between 15% and 38%.^{5,16,17}

An estimated cost of \$57 408 was attributed to excess inpatient and outpatient nights associated with transfers that potentially could have been avoided. Numerous factors influence the cost of each aeromedical retrieval. A conservative estimate of average costs saved for an RFDS retrieval avoided in Cape York is \$5050. An estimated saving of \$151 500 could have been made during the study period if unnecessary transfers were avoided. This figure does not take into account the cost of medications and other procedures that may not have been required.

The social and emotional cost borne by Aboriginal and Torres Strait Islander women through transfer from their home community to a regional centre to give birth has been well documented.^{1,18–20} These studies describe the fear and loneliness induced by being away from family and community and the concern for the welfare of children left behind. Our study found that women who could have safely returned to their community remained in Cairns for extended periods prior to giving birth. This finding warrants further investigation to explore whether women are choosing to stay in Cairns or if there are structural barriers that prevent returning home.

Several studies have shown that effective use and interpretation of fFN results can lead to cost savings due to unnecessary maternal admissions, shorter length of stay and reduced use of tocolytic agents with no negative impact on outcomes.^{21–24} However, simply introducing fFN testing does not necessarily translate into a change in clinical management and associated cost savings. In our retrospective study cohort of transferred women with a negative fFN result at the community level, all were commenced on a tocolytic agent and steroids prior to transfer. This seeming reluctance of clinicians to avoid interventions in women at low risk of preterm delivery has also been found in previous studies.^{22–25} More recent studies where the introduction of fFN testing has been accompanied by staff education^{26,27} and a standardised evaluation protocol²⁸ have shown improved results.

There are several limitations to this study. The overall number of fFN tests conducted at the community level is unknown as this study included only transferred women. There may have been women with a negative fFN result managed at the community level. Secondly, the potential cost savings are likely to be an underestimate as costs of unnecessary treatments were not calculated and the aeromedical retrieval costs are an average for the region. Finally, documentation was not complete with the outcomes for four women remaining unknown.

This study found inconsistent application of the current clinical guidelines for fFN testing in women from Cape York communities transferred to Cairns Hospital for TPL. Further investigation is required to gain a greater understanding of the barriers to testing, the influence

results have on clinical decision-making and why, when medically able, women did not return home. A reduction in the social and emotional costs to women and their families and cost savings to the health system through the appropriate use of clinical guidelines and increased availability of testing in Cape York communities is feasible.

REFERENCES

1. Australian Institute of Health and Welfare. *Australia's mothers and babies 2015—in brief*. Perinatal statistics series no. 33. Cat no. PER 91. Canberra: AIHW, 2017.
2. Chien LY, Whyte R, Aziz K *et al*. Improved outcome of preterm infants when delivered in tertiary care centers. *Obstet Gynecol* 2001; **98**(2): 247–252.
3. Cifuentes J, Bronstein J, Phibbs CS *et al*. Mortality in low birth weight infants according to level of neonatal care at hospital of birth. *Pediatrics* 2002; **109**: 745–751.
4. Phibbs CS, Baker LC, Caughey AB *et al*. Level and volume of neonatal intensive care and mortality in very-low-birth-weight infants. *N Engl J Med* 2007; **356**: 2165–2175.
5. Jony L, Baskett TF. Emergency air transport of obstetric patients. *J Obstet Gynaecol Can* 2007; **29**: 406–408.
6. Goh A, Browning Carmo K, Morris J *et al*. Outcomes of high-risk obstetric transfers in New South Wales and the Australian Capital Territory: the High-Risk Obstetric Transfer Study. *Aust N Z J Obstet Gynaecol* 2015; **55**(5): 434–439.
7. Hutchinson FH, Davies MW. Time-to-delivery after maternal transfer to a tertiary perinatal centre. *Biomed Res Int* 2014; **2014**: 325919.
8. Abbott DS, Radford SK, Seed PT *et al*. Evaluation of a quantitative fetal fibronectin test for spontaneous preterm birth in symptomatic women. *Am J Obstet Gynecol* 2013; **208**: 122.e1–6.
9. Peaceman AM, Andrews WW, Thorp JM *et al*. Fetal fibronectin as a predictor of preterm birth in patients with symptoms: a multicenter trial. *Am J Obstet Gynecol* 1997; **177**: 13–18.
10. Deshpande SN, van Asselt AD, Tomini F *et al*. Rapid fetal fibronectin testing to predict preterm birth in women with symptoms of premature labour: a systematic review and cost analysis. *Health Technol Assess* 2013; **17**(40): 1–138.
11. Australian Bureau of Statistics, 2016, Data by Region, viewed 21 March 2018, <http://stat.abs.gov.au/itt/r.jsp?databyregion&ref=CTA2#/>
12. Queensland Health. Preterm labour and birth. Queensland health website. https://www.health.qld.gov.au/_data/assets/pdf_file/0019/140149/g-ptl.pdf Updated November 2016. Accessed March 21, 2018.
13. Australian Consortium for Classification Development. *The International Statistical Classification of Diseases and Related Health Problems*, Tenth Revision, Australian Modification (ICD-10-AM/ACHI/ACS), 10th edn. Darlinghurst, NSW: Independent Hospital Pricing Authority, 2017.
14. Independent Hospital Pricing Authority (IHPA). *National Hospital Cost Data Collection, Public Hospitals Cost Report, Round 19 (Financial year 2014–15)*. Sydney: IHPA, 2017.
15. Queensland Health. *Patient Travel Subsidy Scheme (PTSS) guideline (part A)*. Brisbane: Queensland Government, 2016. Available online: https://www.health.qld.gov.au/_data/assets/pdf_file/0021/441453/ptss-guideline-pta.pdf. Last accessed 5/7/18
16. Badgery-Parker T, Ford JB, Jenkins MG *et al*. Patterns and outcomes of preterm hospital admissions during pregnancy in NSW, 2001–2008. *Med J Austr* 2012; **196**: 261–265.
17. Roberts CL, Henderson-Smart D, Ellwood DA. Antenatal transfer of rural women to perinatal centres. High Risk Obstetric and

- Perinatal Advisory Working Group. *Aust N Z J Obstet Gynaecol* 2000; **40**: 377–384.
18. Dietsch E, Martin T, Shackleton P *et al.* Australian Aboriginal kinship: a means to enhance maternal well-being. *Women Birth* 2011; **24**: 58–64.
 19. Parker S, McKinnon L, Kruske S. 'Choice, culture and confidence': key findings from the 2012 having a baby in Queensland Aboriginal and Torres Strait Islander survey. *BMC Health Serv Res* 2014; **14**: 196.
 20. Barclay L, Kornelsen J, Longman J *et al.* Reconceptualising risk: perceptions of risk in rural and remote maternity service planning. *Midwifery* 2016; **38**: 63–70.
 21. Dutta D, Norman JE. Pilot study into the efficacy of foetal fibronectin testing in minimising hospital admissions in women presenting with symptoms of preterm labour: a randomised controlled trial of obstetric and neonatal outcomes. *Arch Gynecol Obstet* 2011; **284**: 559–565.
 22. Lowe MP, Zimmerman B, Hansen W. Prospective randomized controlled trial of fetal fibronectin on preterm labor management in a tertiary care center. *Am J Obstet Gynecol* 2004; **190**: 358–362.
 23. Joffe GM, Jacques D, Bemis-Heys R *et al.* Impact of the fetal fibronectin assay on admissions for preterm labor. *Am J Obstet Gynecol* 1999; **180**(3 Pt 1): 581–586.
 24. Giles W, Bisits A, Knox M *et al.* The effect of fetal fibronectin testing on admissions to a tertiary maternal-fetal medicine unit and cost savings. *Am J Obstet Gynecol* 2000; **182**(2): 439–442.
 25. Grobman WA, Welshman EE, Calhoun EA. Does fetal fibronectin use in the diagnosis of preterm labor affect physician behavior and health care costs? A randomized trial. *Am J Obstet Gynecol* 2003; **191**(1): 235–240.
 26. Bolt LA, Chandiramani M, De Greeff A *et al.* Does fetal fibronectin testing change patient management in women at risk of preterm labour? *Eur J Obstet Gynecol Reprod Biol* 2009; **146**: 180–183.
 27. Fell DB, Sprague AE, Grimshaw JM *et al.* Evaluation of the impact of fetal fibronectin test implementation on hospital admissions for preterm labour in Ontario: a multiple baseline time-series design. *BJOG* 2014; **121**: 438–446.
 28. Rose CH, McWeeney DT, Brost BC *et al.* Cost-effective standardization of preterm labor evaluation. *Am J Obstet Gynecol* 2010; **203**: 250.e1–5.