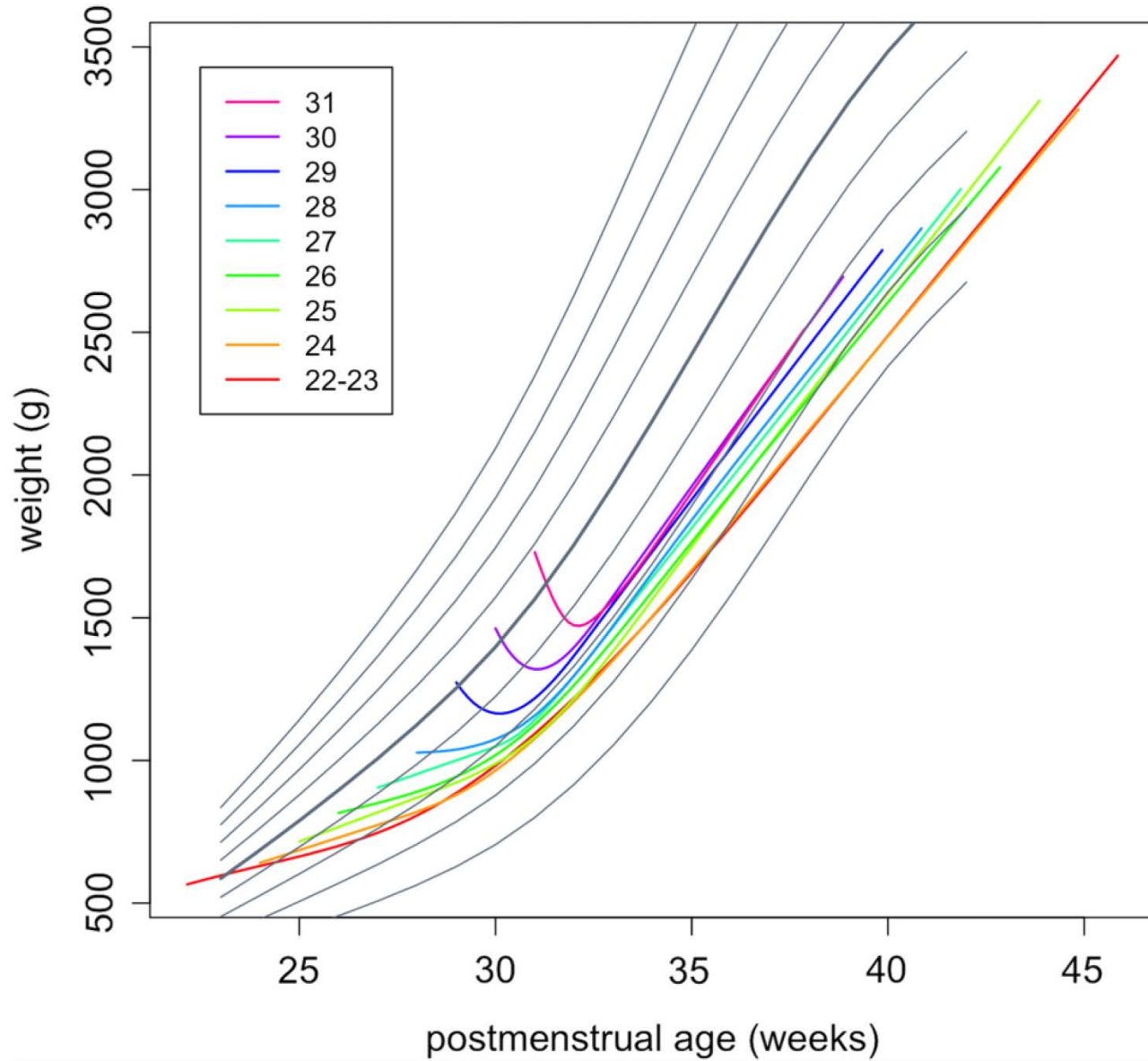


The Value of a Systematic Approach to Nutritional Care in the Neonatal Unit

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Background

- Infants born extremely preterm represent 1% of all births
- They are a growing population
 - EPICure 1 (1995) 40% survival vs EPICure 2 (2006) 52% survival
- Despite improved survival, **growth remains poor**



Background

- Infants born extremely preterm represent 1% of all births
- They are a growing population
 - EPICure 1 (1995) 40% survival vs EPICure 2 (2006) 52% survival
- Despite improved survival, **growth remains poor**
- Growth poor both **quantitatively** and **qualitatively**
 - Preterm infants have reduced lean mass and increased body fat at term equivalent age compared to infants born at term (MJ Johnson et al, *Pediatrics* 2012) Important implications for adult life

Background

- Infants born extremely preterm represent 1% of all births
- They are a growing population
 - EPICure 1 (1995) 40% survival vs EPICure 2 (2006) 52% survival
- Despite improved survival, **growth remains poor**
- Growth poor both **quantitatively** and **qualitatively** (Johnson et al, *Pediatrics* 2012)
- High rates of neurodisability in these infants
 - No difference in neurodisability between EPICure 1 and 2 (40% vs 34% with severe or moderate disability)
- Poor growth associated with poor neurodevelopmental outcomes (R Ehrenkranz et al. *Pediatrics* 2006)
- Some evidence that enhanced nutrition improves developmental outcomes (SHT Chan and MJ Johnson et al, *Acta Paed*, 2016)

Nutrition and Preterm Infants

- Nutrition clearly an important factor in growth
- Likely to play important part in both quantity and quality of growth
- Multiple interacting factors:
 - Achieving adequate growth (and defining adequate growth)
 - Achieving adequate intakes
 - Concurrent illnesses and infections
 - Premature metabolism
 - Missing vital in-utero growth window
- Improving nutritional status of preterm infants will have an impact on both growth and outcomes (likely positive)
- What can be done?

Evidence for neonatal nutritional interventions

Levels of evidence (Oxford CEBM)

Level	Definition
1	Systematic review of randomized trials or n-of-1 trials
2	Randomized trial or observational study with dramatic effect
3	Non-randomized controlled cohort/follow-up study
4	Case-series, case-control studies, or historically controlled studies
5	Mechanism-based reasoning

Evidence for neonatal nutritional interventions

- Level 1
 - Use of trophic feeds
 - Use of breast milk
 - Use of fortifier and preterm formula
 - *Probiotics*
- Level 2
 - Use of supplements/iron/vitamins
 - Feeding increments (SR with insuff numbers, large RCT pending)
 - Early commencement of PN (RCTs plus SR of RCTs and Obs studies)
- Level 3
 - Neonatal pharmacy/dietetic support
 - Nutrient intake targets (Tsang 2005, Koletzko 2014). Evidence they improve growth if followed)
- Level 4
 - Dealing with gastric aspirates
- Level 5
 - Use of donor milk

Translational Research

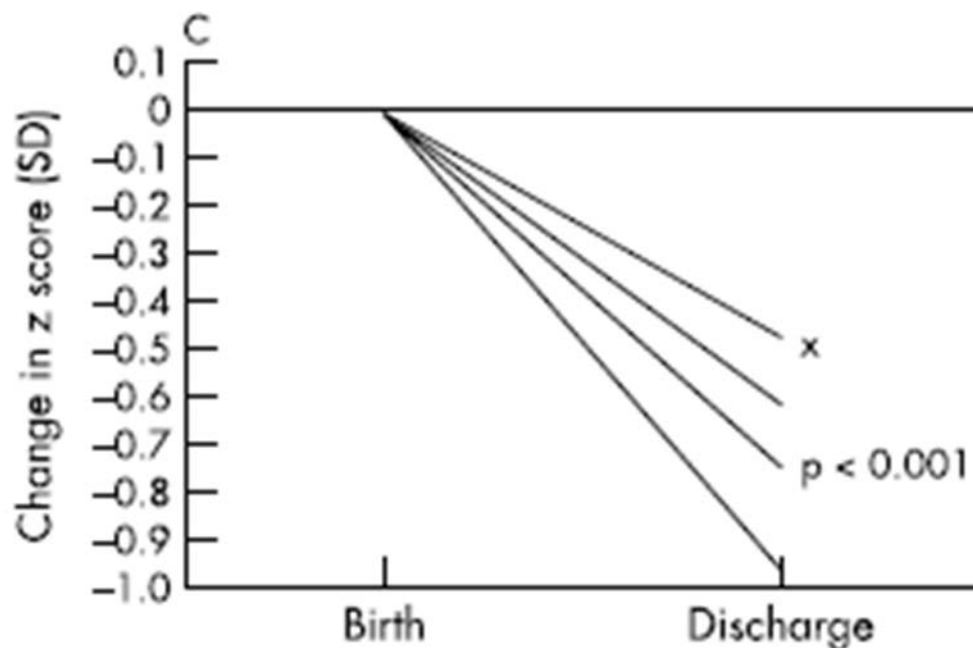
- Many evidence-based practices fail to become part of routine care due to a failure of translation from research into practice.
- Gap between research evidence and practice is often wide
- There are 2 stages of translation of research evidence into practice
 - T1- the transfer of new understandings gained in the laboratory into the development of new methods for diagnosis, therapy, and prevention and their first testing in humans
 - T2: the translation of results from clinical studies into everyday clinical practice and health decision making
 - ***Implementation Science***

Implementation Science

- “The study of “methods to promote the systematic uptake of research findings and other evidence-based practices into routine practice, and, hence, to improve the quality and effectiveness of health services”
 - Includes the study of influences on healthcare professional and organisational behaviour
 - Seeks to understand the translation of knowledge into practice and close the ‘research-practice’ gap.

Putting it all together

- Growing body of evidence for best practice in neonatal nutrition
- Practice is often variable both within and between different units (R Cooke et al, 2004, ADC)



it

care

'Better Practices' for
practice (Kuzma

Figure 1 Comparison of infants discharged from level III units.

Guidelines

- Guidelines also shown to help standardise care
- A systematic review by Patole and De Klerk (2005, ADC FN) showed that a feeding protocol reduced the risk of NEC.

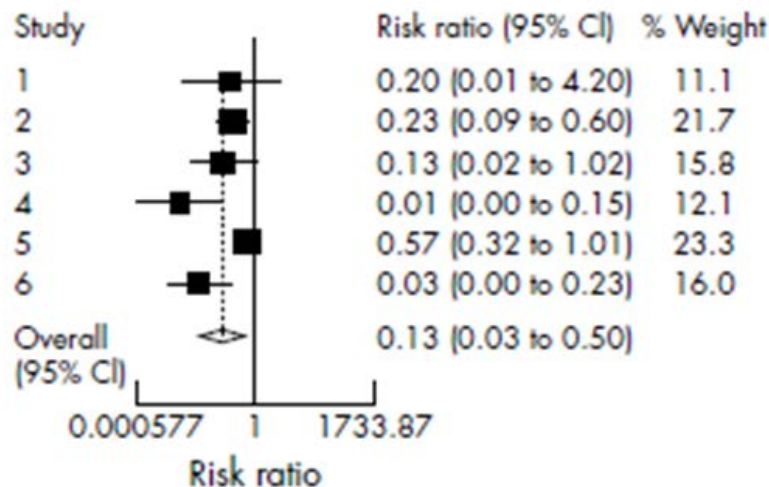


Figure 1 Meta-analysis of the six studies that used a random effects model: 1, Premji *et al*¹⁵; 2, Kamitsuka *et al*¹⁶; 3, Brown *et al*¹⁷; 4, Spritzer *et al*¹⁸; 5, Kuzma-O'Reilly *et al*¹⁹; 6, Patole *et al*.^{10 11} CI, Confidence interval.

Standardising Preterm Infant Nutrition

- SPIN aimed to investigate the effect of introducing a standardised approach to nutritional care (based on current evidence and consensus best practice) in improving
 - Nutrient Intake (especially energy and protein)
 - Growth
 - Neurodevelopmental outcomes at 2 years
- In preterm infants born at <30 weeks or weighing <1501g

Sounds straightforward but.....



Complex
patients

Complex
health-care
environment



Practice change interventions

- Well established guidelines alone are inadequate to change practice
- Several strategies/interventions exist to aid guideline implementation/practice change, as defined by the Cochrane Effective Practice and Organisation of Care (EPOC) Group
 - Professional
 - Financial
 - Organisational
 - Regulatory
- Given nature of problem and available resources, we focussed on professional interventions

EPOC Professional Interventions

Distribution of educational materials
Educational meetings
Local consensus processes
Educational outreach visits
Local opinion leaders
Patient mediated interventions
Audit and feedback
Reminders
Marketing
Mass media

Normalization Process Theory (NPT)

- Given the challenge of practice change, we used NPT as a framework to help guide the development and implementation of an intervention to improve nutritional care
- NPT is a novel sociological framework which focusses on how people work to make a new practice become embedded in routine care, offers a way better understand this process
- 4 main concepts
 - Coherence- do people understand why they need to do what they are being asked to do?
 - Cognitive Participation- are they prepared and willing to do it
 - Collective action-are they able to do it, and actually doing it?
 - Reflexive monitoring- can they see the benefits of it in their work?

Changing Practice

- Review of literature (MJ Johnson and CR May 2015, *BMJ Open*)

Open Access

Research

BMJ Open Promoting professional behaviour change in healthcare: what interventions work, and why? A theory-led overview of systematic reviews

Mark J Johnson,^{1,2} Carl R May^{2,3}

To cite: Johnson MJ, May CR. Promoting professional behaviour change in healthcare: what interventions work, and why? A theory-led overview of systematic reviews. *BMJ Open* 2015;**5**:e008592. doi:10.1136/bmjopen-2015-008592

► Prepublication history

ABSTRACT

Objectives: Translating research evidence into routine clinical practice is notoriously difficult. Behavioural interventions are often used to change practice, although their success is variable and the characteristics of more successful interventions are unclear. We aimed to establish the characteristics of successful behaviour change interventions in healthcare.

Design: We carried out a systematic overview of systematic reviews on the effectiveness of behaviour

Strengths and limitations of this study

- This overview of systematic reviews of professional behaviour change interventions investigates heterogeneous, non-standardised and complex interventions and provides indicative rather than definitive conclusions about effectiveness.
- This overview of systematic reviews identifies the types and combinations of interventions more likely to successfully initiate and sustain professional behaviour change in the context of com-

EPOC Professional interventions vs NPT

← Spread of NPT Constructs within Intervention →

	NPT Constructs	← Spread of NPT Constructs within Intervention →													Total		
		Coherence			Cognitive Participation				Collective Action				Reflexive Monitoring				
		Individual Specification	Communal Specification	Internalization	Initiation	Legitimation	Enrolment	Activation	Interactional Workability	Relational Integration	Contextual Integration	Skill Set Workability	Systematization	Individual Appraisal		Communal Appraisal	
← Increasing Intervention Effectiveness	EPOC Professional Intervention																
	Patient mediated interventions																3
	Audit and feedback																6
	Educational outreach visits																5
	Reminders																6
	Educational meetings																3
	Distribution of educational materials																3
	Marketing																3
	Local consensus processes																1
	Mass media																2
	Local opinion leaders																1
	Total	0	4	2	2	3	3	0	3	3	3	2	3	2	3		

Changing Practice

- Review of literature (MJ Johnson and CR May 2015, *BMJ Open*)
 - Some interventions more effective than others
 - Audit and Feedback, Education (outreach visits, meetings), Reminders
 - Identification of barriers to implementation of strategies important
 - Use of multiple strategies better than single approaches
- ‘Complex Intervention’ needed to gain best effect
 - MRC: “An intervention with several interacting components”
 - Guidance suggests
 - Need for theoretical unchange (used NPT)
 - A “process evaluation” Toolkit and audit)
 - Tailoring and adaption implementation



Developing the Intervention

- Complex intervention
 - Guidelines (***educational materials***)
 - Nutrition Team and Weekly Ward Round (***educational outreach***)
 - Nutrition Screening Tool (***reminders***)
(MJ Johnson et al, Acta paediatrica 2014)
 - Nurse ‘Champions for Nutrition’ (***educational outreach***)
(JA Westbury et al, Journal of Neonatal Nursing 2013)
 - Nurse and doctor education (***educational meetings***)

HIGH RISK PRETERM INFANT

PARENTERAL NUTRITION

ENTERAL NUTRITION

DAY 1

Start 'Preterm' Stock PN at 60-90ml/kg/day ideally within 6 hrs

Give colostrum as mouth care or trophic feeds

DAY 2

Start Trophic Feeds at 1ml/kg 2-4 hourly (if no MBM can use DBM)

DAY 3

Consider Changing to 'Preterm +Sodium' Stock PN if able to give sodium

Increase milk by 10-20ml/kg/day

DAY 4+

Begin to decrease PN flow rate as feeds increase

Continue increasing feeds at 10-20ml/kg/day

Total Fluids = 180ml/kg/day

Halve flow rate of lipid, continue decreasing PN in line with feeds

Continue increasing feeds at 10-20ml/kg/day

Total Milk Feeds = 90ml/kg/day

Stop lipid, continue decreasing PN in line with feeds

Consider adding ¼ strength fortifier, and increasing by ¼'s every 48 hours

Total Milk Feeds = 135ml/kg/day

Stop PN once target feed volume achieved

Once fully fed: If on MBM add ¼ strength fortifier, and increase by ¼'s every 48 hours. If on DBM, start introducing LBW formula at ¼ of feed volume and increasing proportion by ¼'s every 48 hours.

Total Milk Feeds = 150-180ml/kg/day

Neonatal Nutritional Screening Tool

Affix Patient Label Here

To be completed on admission and weekly (every Monday)

Gestation at birth:

Birth Weight:

1. Assess Growth

Current Weight:		Current Centile:		Birth Centile:	
Current OFC:		Current Centile:		Birth Centile:	
Current Length:		Current Centile:		Birth Centile:	

2. Determine Risk Category

	Any one of:	Tick
HIGH RISK	<ul style="list-style-type: none"> Preterm <28 weeks at birth Extremely Low Birth Weight < 1000g Infant establishing feeds after episode of NEC or GI perforation Infants with severe congenital GI malformation e.g. gastroschisis 	
MODERATE RISK	<ul style="list-style-type: none"> Preterm 28-31⁶ weeks, otherwise well IUGR (weight < 9th centile) and AREDFV <35 weeks Very Low Birth Weight 1000 - 1500g Illness or congenital anomaly which may compromise feeding 	
LOW RISK	<ul style="list-style-type: none"> Preterm 32-36⁶ weeks, otherwise well IUGR (weight < 9th centile) and AREDFV >35 weeks Well Term Infant ≥37 weeks 	

3. Determine the need for nutrition team review

The nutrition team should review any infant meeting the following criteria:

	Tick
High Risk Infants according to criteria above	
Not regained birth weight by 2 weeks of age	
>15% weight loss at any time	
Weight gain <10g/kg/day from 2 weeks of age onwards	
NEC or GI surgery at any time	

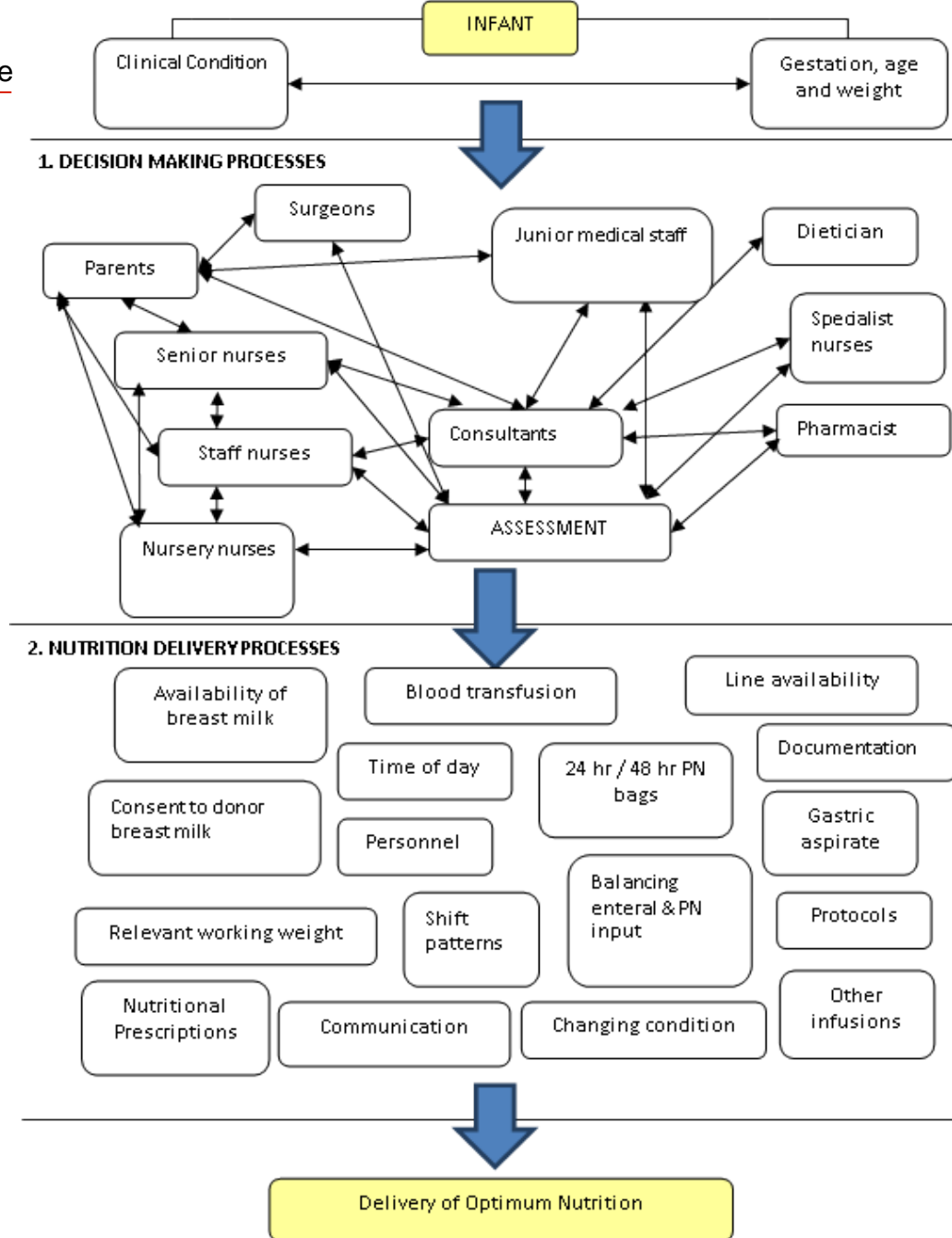
Name of person completing assessment: _____ Signature: _____

If completing admission assessment, please file in the baby's nursing folder, next to the nutrition flow charts

If completing a weekly assessment, please place this form in the nutrition screening box

Developing the Intervention

- Complex intervention
 - Guidelines (*educational materials*)
 - Nutrition Team and Weekly Ward Round (*educational outreach*)
 - Nutrition Screening Tool (*reminders*)
(MJ Johnson et al, Acta paediatrica 2014)
 - Nurse ‘Champions for Nutrition’ (*educational outreach*)
(JA Westbury et al, Journal of Neonatal Nursing 2013)
 - Nurse and doctor education (*educational meetings*)
- Identification of barriers/tailoring
 - Process mapping
 - Focus groups
 - Questionnaire



Focus Groups – Barriers and Facilitators

- Barriers identified
 - Time to carry out the work of the guideline
 - Availability of information and training
 - Shift of responsibilities towards nurses, with more shared decisions (may be facilitative)
 - Content represented a significant change in practice
- Solutions identified
 - Ensuring guideline widely distributed and easy to access
 - Training and teaching for staff regarding nutrition
 - Producing laminated versions of the flow charts (incorporated into the guideline) for each infants nursing folder
 - Publicising the new practices on the unit's audio visual system

Process and Outcome Evaluation

- Outcomes:
 - Measured daily nutrient intake and growth continuously during study
 - Linear modelling was used to compare differences between intervention groups, and to study relationship between NPT scores and outcomes
- Processes:
 - Ongoing bimonthly audit and feedback of compliance
 - Used NPT to both
 - Develop and plan the intervention
 - Measure and guide the process using the NPT Toolkit bimonthly (16 point questionnaire, with 4 questions relating to each of the 4 constructs of NPT, each scored out of 10)
 - Qualitative interviews based on NPT Framework carried out after the intervention period

Using NPT

- NPT allows the implementation process to be planned, assessed/measured and therefore guided
 - Identification of areas for improvement
 - Facilitates an iterative/dynamic implementation
- Using NPT to measure normalisation- the NPT Toolkit
 - A 16 question questionnaire, with 4 questions relating to each of the 4 constructs of NPT (www.normalizationprocess.org)
 - Gives radar plots indicating the extent to which users feel the intervention is being 'normalised'

Toolkit results

Report generated on 11/09/2013 13:56:47

Results

The Radar Plots show the strength that you have assigned to each variable. Use them as heuristic tools to think through an implementation or integration process. Positive responses extend further out from the centre than negative ones. Look for areas where the responses are closer to the centre. These may tell you that participants cannot make sense, or have not signed up to the innovation. Perhaps they cannot enact it in a way that works for them, or cannot assess its effects and their value. If the responses are positive, the opposite may be true.



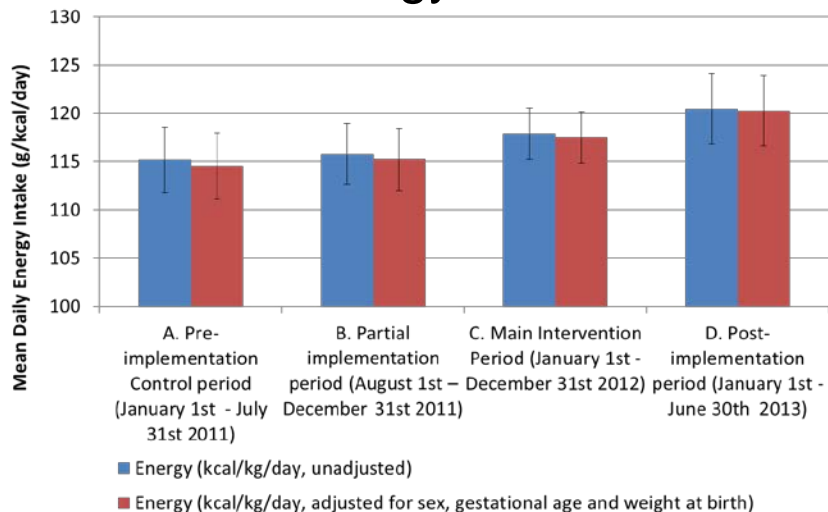
Study groups

- Nutrient intakes and growth compared across 4 periods
- Period A - pre-implementation control period (Jan-Jul 2011)
- Period B - partial implementation (Aug-Dec 2011)
 - Preterm formula milk fortifier formulations revised
 - Stock PN revised August 2011 (concentrated to 130ml/kg/day)
 - Multidisciplinary nutrition team and ward round
 - Focus groups, Tailoring of intervention, education
- Period C - full implementation period (Jan-Dec 2012)
 - Comprehensive nutritional guidelines
 - Weekly nutrition screening tool
 - Nurse ‘Champions for Nutrition’
- Period D – post-implementation period (Jan-Jul 2013)

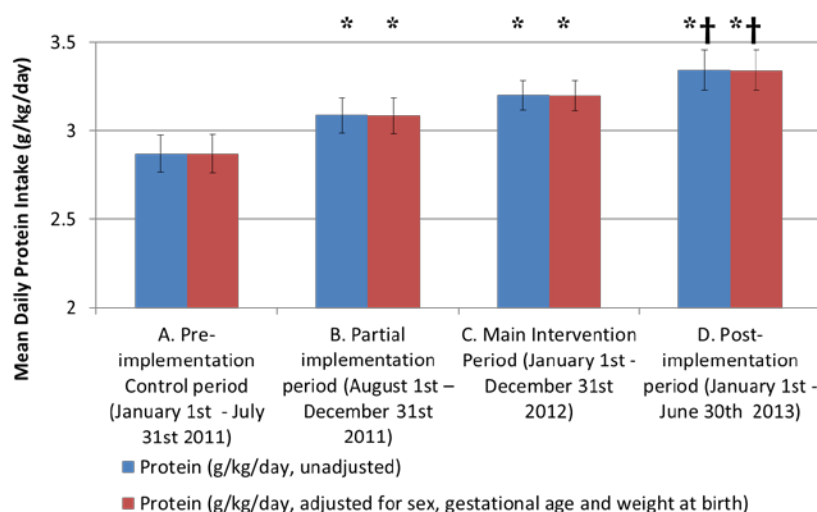
Results - Infant Characteristics

Period	n	Male (%)	Mean Birth weight (SD)	Mean Gestational Age (SD)
A. Pre-implementation Control period (Jan 2011 - Jul 2011)	52	23 (44.2)	1.084 (0.270)	29.2 (2.6)
B. Partial implementation period (Aug – Dec 2011)	36	18 (50)	1.029 (0.311)	29.2 (2.9)
C. Main Intervention Period (Jan - Dec 2012)	75	37 (49.3)	0.998 (0.269)	28.65 (3.0)
D. Post-implementation period (Jan - Jun 2013)	35	22 (62.9)	0.924 (0.261)	28.1 (2.8)
p value for difference between groups (ANOVA)		0.392*	0.066	0.290

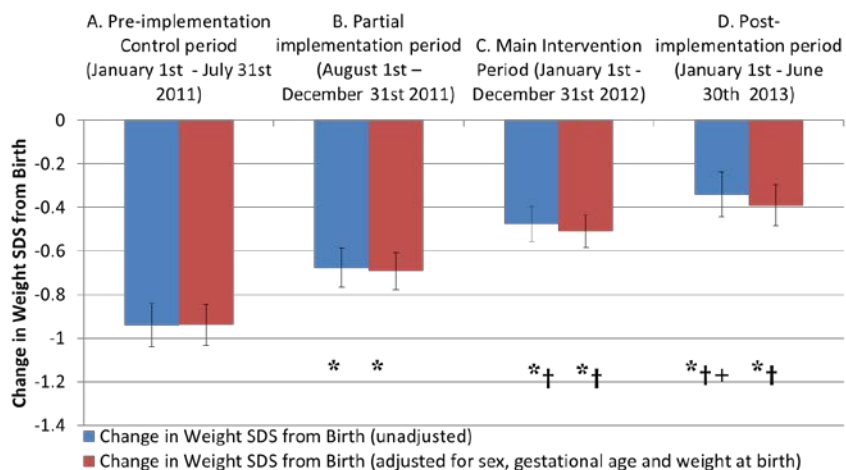
Results – Energy Intake



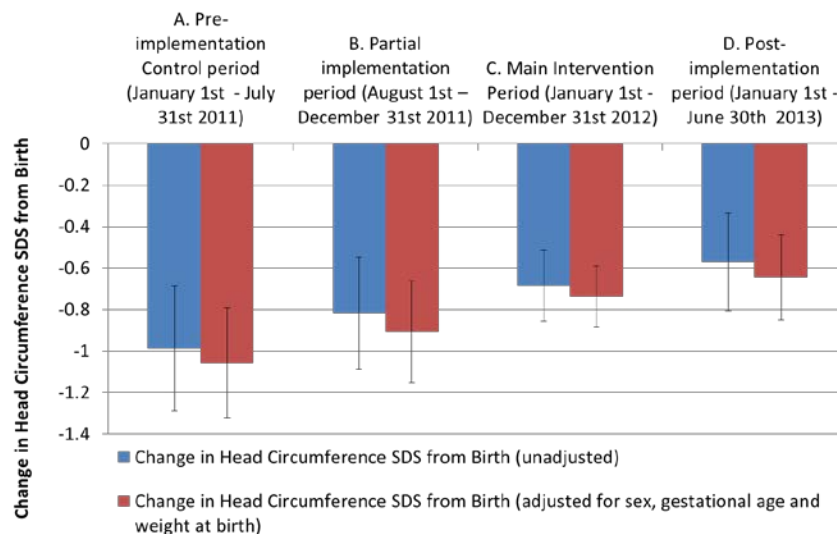
Results – Protein Intake



Results – Weight Gain



Results – Head Circumference



*p<0.05 for difference vs group A, †p<0.05 for difference vs group B, +p<0.05 for difference vs group C.

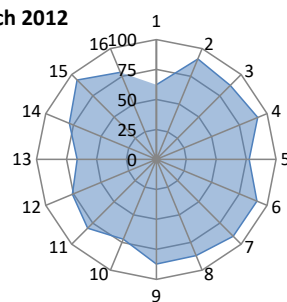
Results

- During the intervention period, NPT scores used to identify areas where implementation was lacking, allowing these to be addressed in a dynamic way during the study

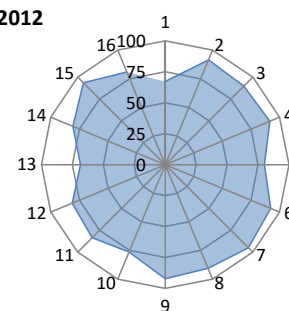
NPT Toolkit Measures

‘Reflexive
monitoring’
intervention
(feedback of
preliminary
results) here
(August 2012)

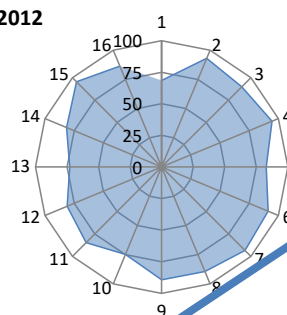
1. March 2012



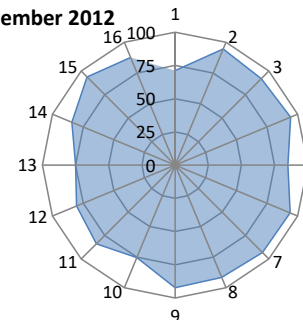
2. May 2012



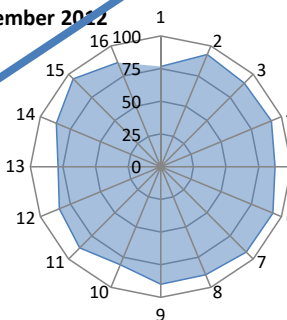
3. July 2012



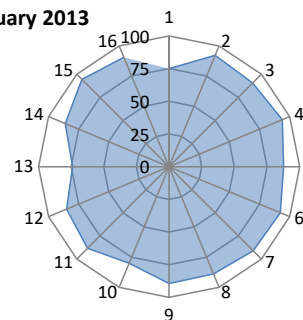
3. September 2012



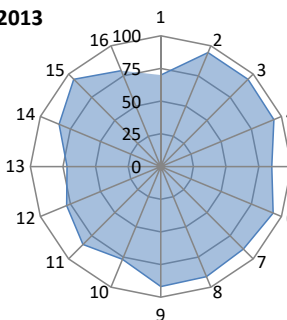
5. November 2012



6. January 2013



7. July 2013



Key:

Items 1-4=Coherence

Items 5-8 = Cognitive Participation

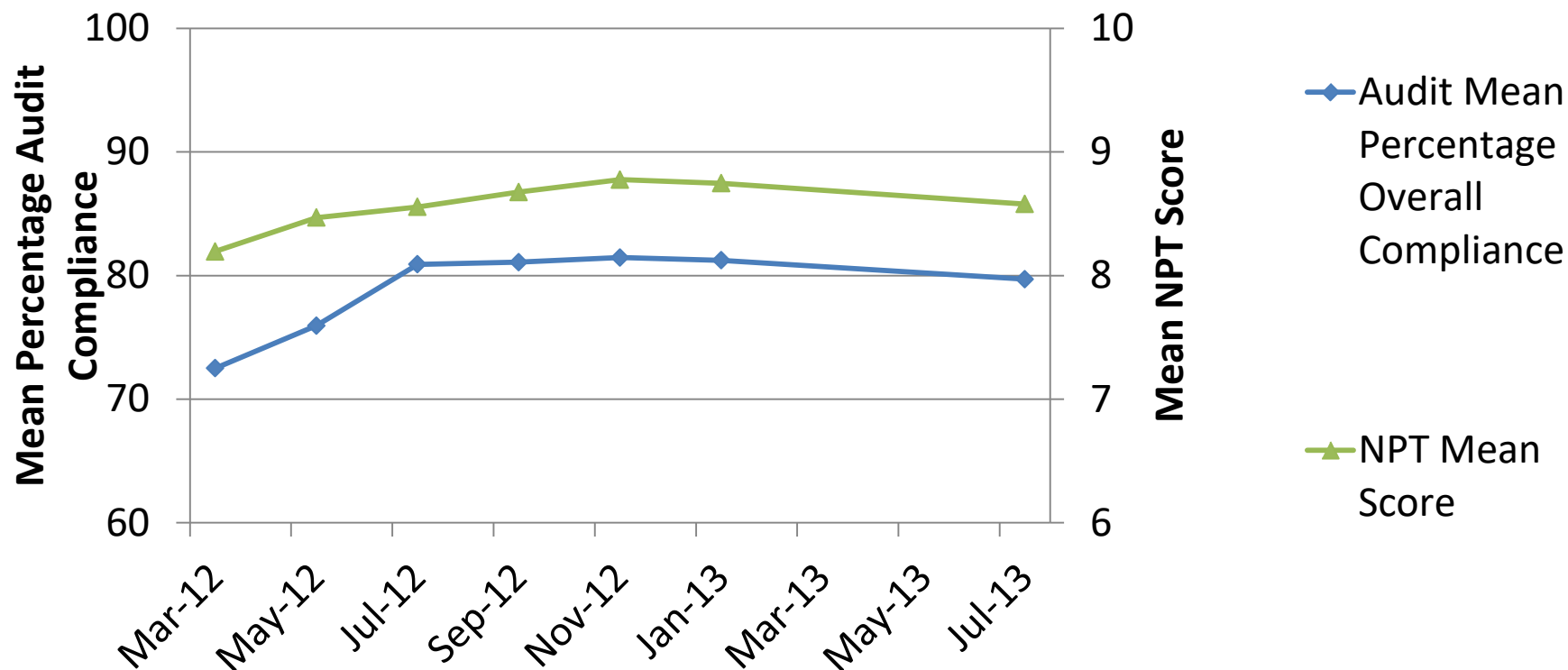
Items 9-12 = Collective Action

Items 13-16 = Reflexive Monitoring

Results

- During the intervention period, NPT scores used to identify areas where implementation was lacking, allowing these to be addressed in a dynamic way during the study
- **Guideline compliance improved at the same time**
 - Consistently high (>75%) peaking at 85%
 - There was a significant linear relationship between guideline compliance and time ($r=0.86$ $p=0.028$)
- **NPT scores also improved over time**
 - There was a significant linear relationship between NPT scores and time ($r=0.15$ and $p=0.023$)
- **Audit compliance was closely related to NPT scores**
 - After adjusting for time, there was a significant linear association between the mean audit score and the mean NPT score ($p=0.048$)

NPT vs Audit



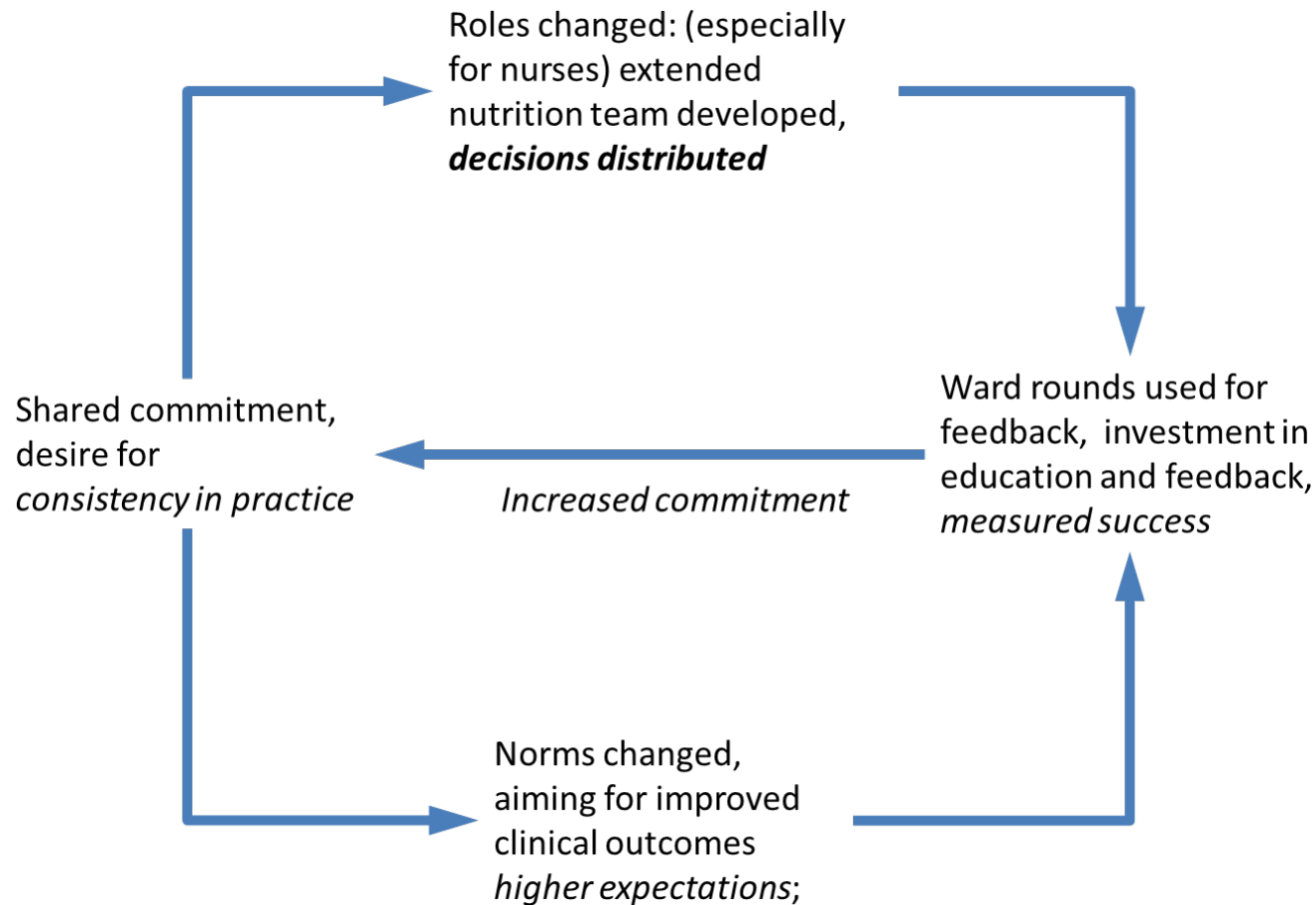
Linear regression model adjusting for the effect of time, Mean NPT scores predict Mean Audit Compliance

- NPT β 0.38 $p < 0.05$,
- Time β 0.5 $p < 0.001$
- r for whole model 0.7, r^2 0.5, $p < 0.0001$

Interviews

- 22 members of staff interviewed (2 consultants, 3 ANNPS, 4 senior sisters, 8 sisters, 3 staff nurses and 2 nursery nurses).
- What was the intervention and why was it successful?
 - **Guidelines** and the **nutrition team** highlighted as key elements of the intervention.
 - Continued reinforcement of the practices and support in making them work by the **nutrition team** and **nurse champions** was repeatedly identified as a major factor in success
 - Increased awareness, **education** and a gradual introduction with **provision of feedback** also important.
- The experiences of the staff regarding the implementation process can be used to develop a theoretical model of how the intervention drove the change process

A simple model for the implementation of the complex intervention used in this study



Summary 1

- There is growing evidence for:
 - A need to address growth and nutrition in the neonatal period
 - Improvements in outcomes associated with growth and nutrition
 - Certain interventions and best practices in neonatal nutrition
- There are benefits to optimising and standardising care
 - Benefits from standardisation itself
 - Application of current evidence or consensus best practice
- Using complex/multifaceted approach to practice change can promote a sustained change in practice
 - Important as effects of malnutrition not immediately apparent
 - Need to be clear about what evidence is available
 - Also provides a framework to test new interventions

Summary 2

- NPT appears to offer an effective way of implementing and monitoring the introduction of new practices.
- Measures of practice change using NPT can be related to real measures of clinical practice
 - This is important, as social theory does not always do this!
 - While audits measure compliance, they do not tell you *why* staff are not complying. NPT may offer a way to do this
- Reflexive monitoring vital in successful implementation
- Distribution of decisions seems an effective change strategy
- Implementation science and associated theories offer promise for understanding practice and translating evidence into practice in many areas or care

Future work

- Nutritional intervention may be translatable to other units
- Use of NPT and implementation science approach in other areas
 - Infection prevention
 - Standardisation of practices across networks
- Understanding why some things fail to be translated into routine care
- Development of generic tools to aid implementation

Acknowledgements

- Dr Alison Leaf, Consultant Academic Neonatologist
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- Prof Howard Clark, Professor of Child Health
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 - Southampton NIHR Biomedical Research Centre
- Co.Efficient Consultancy

Thanks for listening

- Email
 - m.johnson@soton.ac.uk
- NPT website
 - www.normalizationprocess.org