

Conceptualisation, development and validation of a community-based Patient Complexity Instrument (PCI) for district nurses

Dr Sue Thomas PhD RN

Aneurin Bevan University Health Board and RCN Wales

Aims

The study aimed to:

- Address a gap in contemporary district nursing practice: to be able to articulate the daily, combined observations made of patients and their breadth of individual circumstances and needs
- Identify key factors relating to the complex needs of community-based patients, as perceived by district nursing experts in Wales
- Assist in “enabling nurses to assess the severity of patients' conditions, whether they are likely to deteriorate, and what their ongoing needs will be” (Welsh Government & National Health Service Wales, 2013)
- Contribute to the portfolio of acuity tools for the Chief Nursing Officer (CNO) for Wales, as directed by Welsh Government & National Health Service Wales

Objectives

The objectives for the study were to;

- Undertake a concept development for patient complexity
- Undertake a construct development of a patient complexity instrument/measure
- Develop items for a Patient Complexity Instrument
- Establish the validity and reliability of each subscale within a Patient Complexity Instrument, according to its psychometric properties

The All-Wales PCI Development Team

Aber Bro Morgannwg University Health Board (UHB)	Jayne Hopkins	Hywel Dda Health Board UHB	Emma Hawkins Annwen Jenkins Sharon Jones Ruth Keil Jill Paterson Jane Phillips Keryl Raynel Karen Thomas Yvonne Thomas	
Aneurin Bevan Health Board UHB	Patricia Hapgood David Hopkins Lynwen Law Sue Pinkstone Tanya Spriggs Lorraine Ware Jo Webber			
Betsi Cadwaladr Health Board UHB	Bethan Jones Marnel Owen Elizabeth Powell Delia Roberts	Powys Teaching Health Board	Marion Baker Jason Crawl Paul Labourne Carol Shillabeer	
Cardiff and Vale Health Board UHB	Kay Jeynes	National Leadership and Innovation Agency for Health (NLIAH) now WEDS	Charlette Middlemiss Matt Wyatt	
Cwm Taf Health Board UHB	Paul Crank Angela Hopkins Sonia Jones Julie Powell Mair Thomas Lynda Williams		National Wales Informatics Service (NWIS)	Anne Owen
			RCN Wales	Sue Thomas

Methodology

Stage	Stages of instrument development and validation <small>(DeVellis, 1991; Netemeyer, Bearden & Sharma, 2003; Streiner & Norman, 2003; Wilson, 2005)</small>	Aim	Research Approach
1	Theory and concept building	Instrument development	1. Group Concept Mapping (GCM) <small>(Kane & Trochim, 2007)</small> <i>(Qualitative and quantitative)</i>
2	Items development		
3	Scale development		
4	Psychometric Testing	Instrument validation	2. Rasch analysis <small>(Bond & Fox, 2007)</small> <i>(Quantitative)</i>

Timeline of the PCI development

5 x GCM structured conceptualisation and consensus workshops across Wales with 29 expert participants

Scale development of the PCI

Data collection using the PCI by 119 district nurses for 526 patient assessments

Amendments made to PCI in light of results from Rasch analysis

Rasch analysis of the 2nd test data

Sept 2013

Jan 2014

June 2014

Sept 2014

Oct 2014

Jan 2015

April 2015

June 2015

Sept 2015

Final PCI

Item confirmation and development of items for the Patient Complexity Instrument (PCI)

7 x Training sessions for district nurses in the use/testing of the PCI. Further face-validity testing of content.

Rasch analysis of the test data

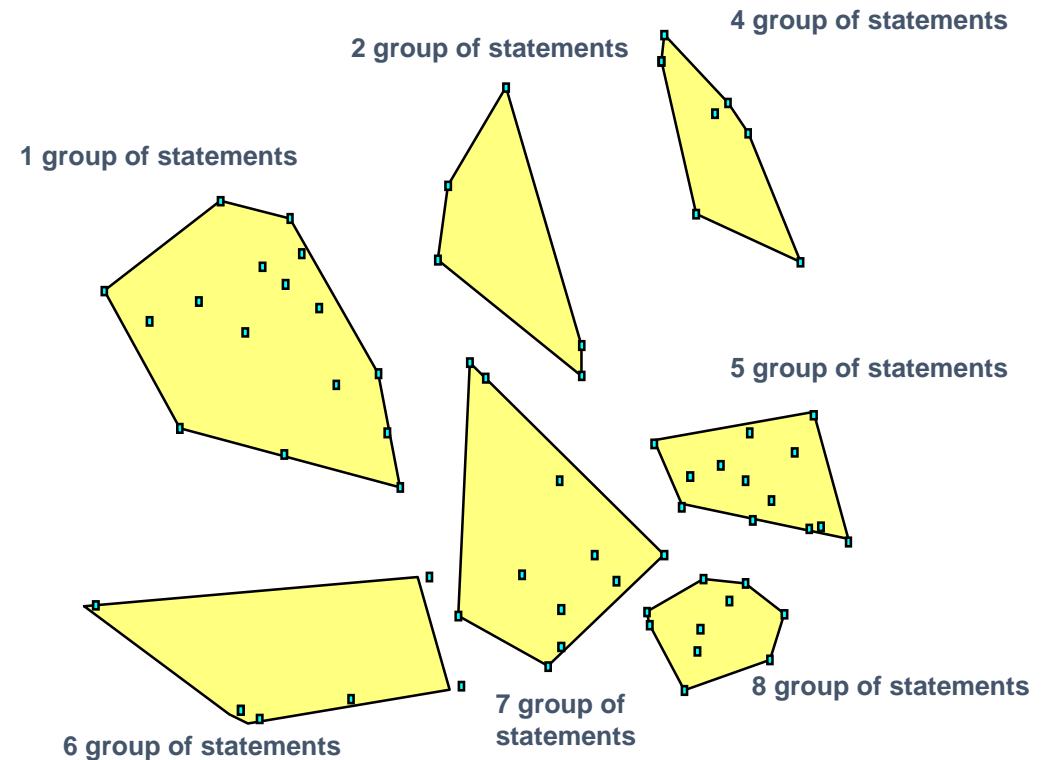
Data collection using the amended PCI by 100 district nurses for 957 patient assessments

Consensus research: Concept Mapping

- Group Concept Mapping (GCM) is a participatory methodology, which enables a diverse participant group to develop a shared conceptual framework
- Helps individuals think as a group, without losing their individuality
- Uses information from individuals to:
 - identify group shared vision
 - encourage teamwork
 - facilitate group decision making
 - represent group ideas pictorially

Group Concept Mapping (GCM) process

1. Brainstorming – ideas generation (produced as statements)
2. Statement analysis and synthesis
3. Unstructured sorting/organising of statements
4. Multidimensional scaling and cluster analysis of statements to observe results
5. Generation of interpretable maps and data displays of key ‘issues’



1. Brainstorming

- Five face-to-face workshops were held across Wales between July and October, 2013.
- Twenty nine nurses of all levels were asked “**what specific information should a district nurse record as part of an assessment of patient complexity?**” in order to identify the necessary items for inclusion in the instrument.

2. Statement analysis

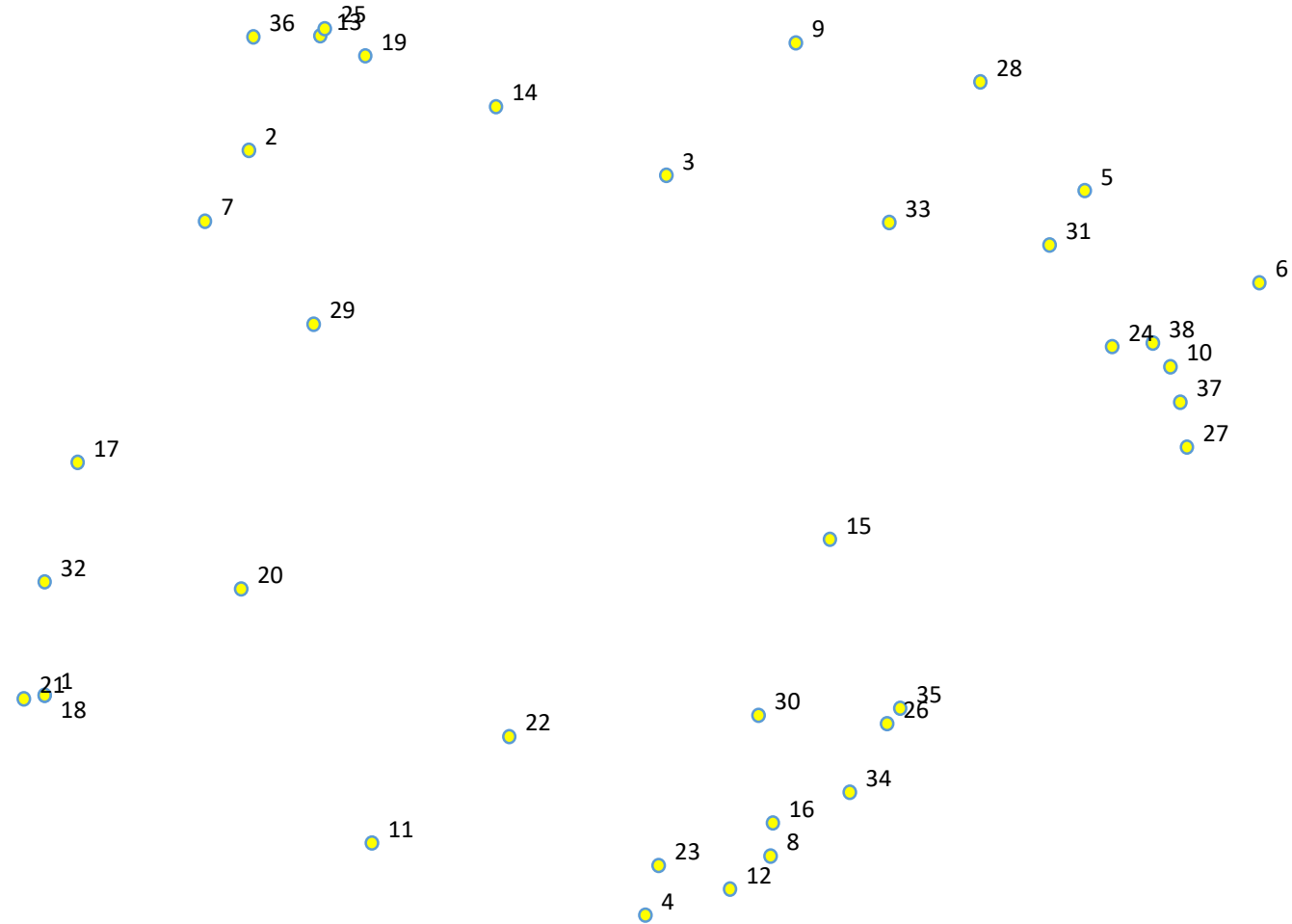
- Following group brainstorming, ten statements were generated by each individual participant, collated, then sorted into “piles that made sense to them”
- Sort-pile “data synthesis” - edited by researcher for relevance, clarity, duplication etc. (*not* removal or prioritisation). Final data set of 38 statements/items
- Sort data entered into Global Max™ software by researcher (ST attended training at Ithaca, NY)
- Global Max™ software enables quantitative and qualitative analysis and results of stakeholder participants’ aggregated data.

Quantitative Analysis of Qualitative Data

Quantitative analysis includes:

- **Similarity Matrix** from sort data - paired sorting decisions made by all participants
- **Multidimensional scaling (MDS)** of similarity matrix - plots sorting results as points on X, Y axis (distance indicates theoretical similarity or not between the sorted data items)
- A **point map** is generated – with each statement represented by a number

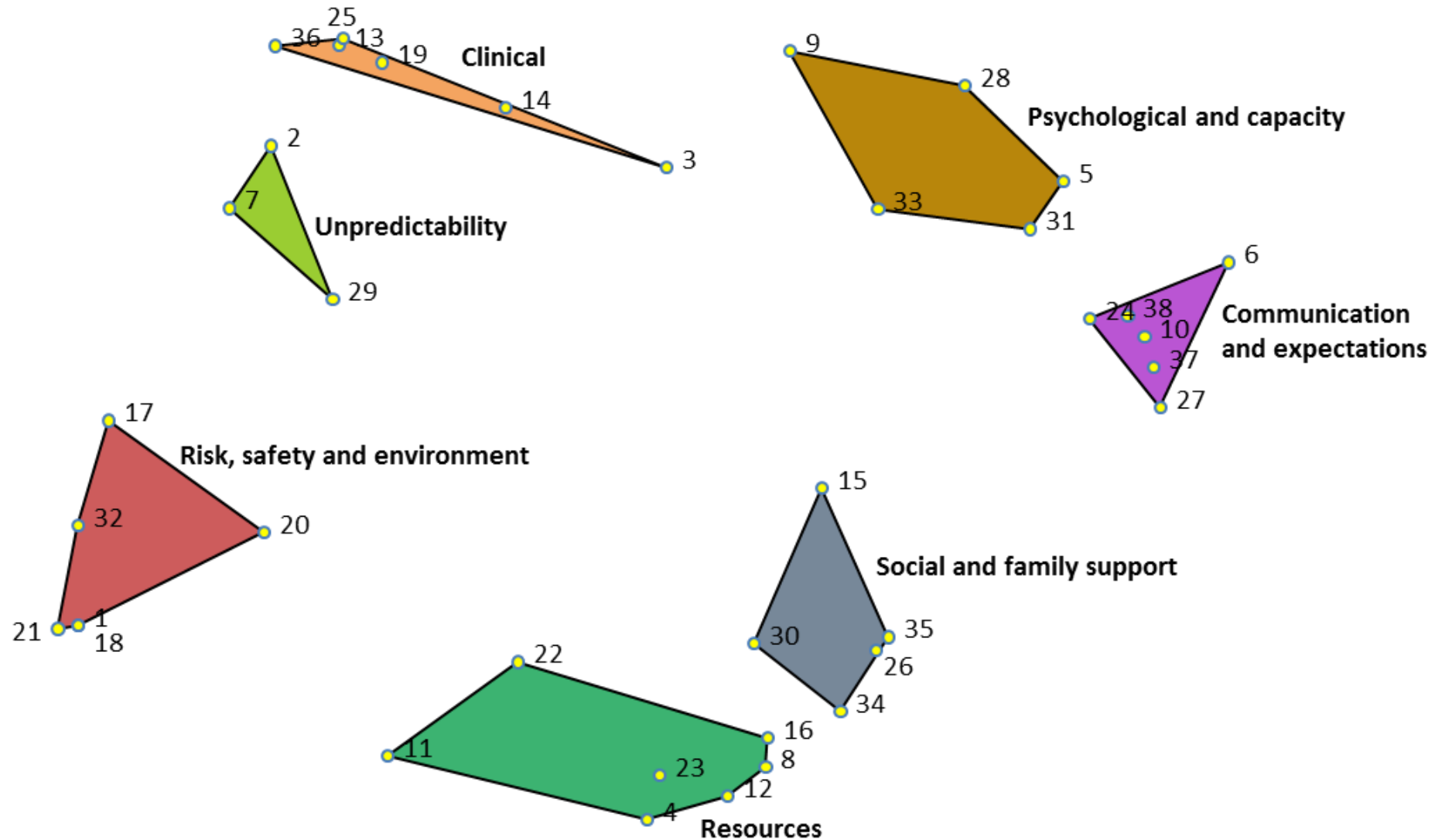
Multidimensional Scaling - Point Map



Quantitative Analysis of Qualitative Data

- **Hierarchical Cluster Analysis** - apportions the MDS points into groups (or clusters)
- Qualitative results seen as **clusters** (from sort data, not as with thematic analysis)
- Data clusters for this study revealed a range of environmental, sociological, psychological, behavioural, physical and organisational factors
- Illustrated by a **Concept Map**

Concept Map for Patient Complexity



Concept Map

- Visually reveals the concept of patient complexity
- Possible to see items that are conceptually closer together, e.g. communication/expectations and psychological/capacity (anchors)
- Also possible to see items that are conceptually further away from each other, e.g. communication/expectations and risk, safety and environment (bridges)
- Important to remember all cluster items have been agreed as being core components of a concept; but the map helps to add further information to the analysis and understanding of the enquiry

Results of phase 1

- Results concurred with other research^{1,2,3,4}, that it is inadequate to consider clinical features alone in an assessment of community-based patient complexity.
- Risks and safety, environment, patient cognition and mental capacity, resources, support networks, patient dependence, coping, and family and carer factors are considered as important as the physical support needs of the patient.
- A comparative analysis was undertaken of the results with an existing taxonomy¹⁵ to establish whether it contained the items identified through the consensus research .
- Amendments were made to the existing taxonomy to reflect gaps found during the mapping exercise. These included 1. family/carer and 2. safety aspects.
- The amended instrument became known as the Patient Complexity Instrument (PCI)¹⁶.

Linking the GCM cluster results to the items of the PCI

GCM Clusters			The Patient Complexity Instrument items (v1)	
			Items	Descriptor
1	Psychological and Capacity	→	Engagement	Identification and agreement of personalised care plan for and with this patient
2	Communication and Engagement	→		
3	Clinical	→	Clinical Need	Scale and scope of physical and psychological nursing needs
4	Social and Family Support	→	Social Contact	Support systems for this patient
		→	Family and Carers	Factors relating to key carers (usually family)
5	Resources	→	Resources	Any resources required to meet holistic needs and goals for this patient
6	Risk, Safety and Environment	→	Safety	How safely the care will be delivered for this patient in the current environment
7	Unpredictability	→		

Items/Domains of the Patient Complexity Instrument

The Community- based Patient Complexity Instrument (Thomas, 2015)	
ITEM	DESCRIPTOR
Engagement	Identification and agreement of personalised care plan for and with this patient
Clinical Need	Scale and scope of physical and psychological nursing needs
Social Contact	Support systems for this patient
Family and Carers	Factors relating to key carers (usually family)
Resources	Any resources required to meet holistic needs and goals for this patient
Safety	How safely the care will be delivered for this patient in the current environment

The Patient Complexity Instrument (v1)

Score each column	Engagement Identification and agreement of personalised care plan for and with this patient	Clinical Scale and scope of physical and psychological nursing needs	Social Contact Support systems for this patient	Family and Carer Factors relating to key carers (usually family)	Resources Any resources required to meet holistic needs and goals for this patient	Safety How safely the care will be delivered for this patient in the current environment
5	This patient lacks capacity Or does not agree to engage in a shared care plan	This patient requires constant supervision and immediate access to nurse intervention to avoid harm or sustain life	This patient is isolated & vulnerable to immediate risk or harm	The carer or family is isolated & vulnerable to immediate risk or harm Or there is no carer	Imminent crisis or failure to progress care plan, care plan in dispute Or resources not available	Patient safety is unachievable by remaining in this environment
4	This patient has fluctuating capacity Or chooses not to engage in some aspects of a care plan	This patient has changeable needs and requires nurse supervision within a comprehensive plan of care	This patient has limited family support, social connection or activities	There is carer or family strain	Urgent referral (same day) to any multi-disciplinary/sector/ agency team or member, or specialist service	Patient safety is unpredictable by remaining in this environment
3	This patient has capacity but there is some patient difficulty with engaging in a shared care plan	This patient has established on-going need and requires scheduled nursing team interventions	This patient has support, social contact or activities available within informal family or community	Carer or family coping strategies are in place, including patient's dependents	Referral for any aspect of a multi-disciplinary/sector/ agency team or member	Environmental or other factors present difficulties for patient, carer or nurse which might impact on patient safety
2	This patient has capacity and agrees to engage with a shared care plan	This patient has stable or predictable need and requires some nursing team intervention and support	This patient has regular family or social contact and support for daily activities	The carer or family has regular family or social contact and support	On-going nursing assessment, intervention & care planning	Minor factors from within the home or the external environment present easily manageable risks to patient safety
1	There is full patient-led engagement with shared care plan	This patient is self-caring and requires minimal nursing team support	This patient is fully independent Or well supported by family or community	The carer or family is fully independent and requires minimal support Or there is no need for carer support	Task-oriented, delegated nursing team care and support	There is no identifiable environmental or other apparent risk to the patient

Phase Two

- Use of the PCI leads to a score being attributed to each of the items used to measure the patient's level of complexity
- From which clinical decisions will be made, care plans developed (and staff deployed)
- It is therefore important that different scores represent clinically meaningful differences for practitioners and others relying on results generated by the instrument
- The purpose of phase 2 was to ensure that the PCI is valid and reliable in context and for its specified use

Method for phase 2

- Cwm Taf UHB was study site for phase 2
- Enabled participatory philosophy and expert input to be maintained (esp. during case study development and training sessions)
- The PCI was tested by CTUHB district nurses during regular patient assessments
- Scores from approx. 1,400 patient assessments were collected for input to Rasch analysis software (RUMM2030¹⁷)
- Rasch analysis¹⁸ was performed with the aim to produce a well-targeted instrument.

Data analysis

SUMMARY STATISTICS for Analysis Name MODEL2V1

ITEM - PERSON INTERACTION

ITEMS		PERSONS	
	Location		Fit Residual
Mean	0.000	Mean	0.304
Std Dev	0.708	Std Dev	0.943
		Skewness	-0.019
		Kurtosis	-1.785
		Correlation [location/stdResidual]	0.348

ITEM - TRAIT INTERACTION

Total - Item Chi Square	60.912
Degrees of Freedom	48
Chi Square Probability	0.099910

RELIABILITY INDICES

PerSepIdx: Model2v1	0.80984
* with extms	0.78128
* NO extms	0.78128
CronbAlpha	N/A
* with extms	N/A
* NO extms	N/A

[Cronbach alpha not applicable with missing data]

LIKELIHOOD RATIO TEST

Analysis	Likelihood	ChiSq	DegF	Prob
anaName1				
anaName2				

POWER OF ANALYSIS OF FIT

Excellent	
Good	GOOD
Reasonable	
Low	
Too Low	

< Display Control

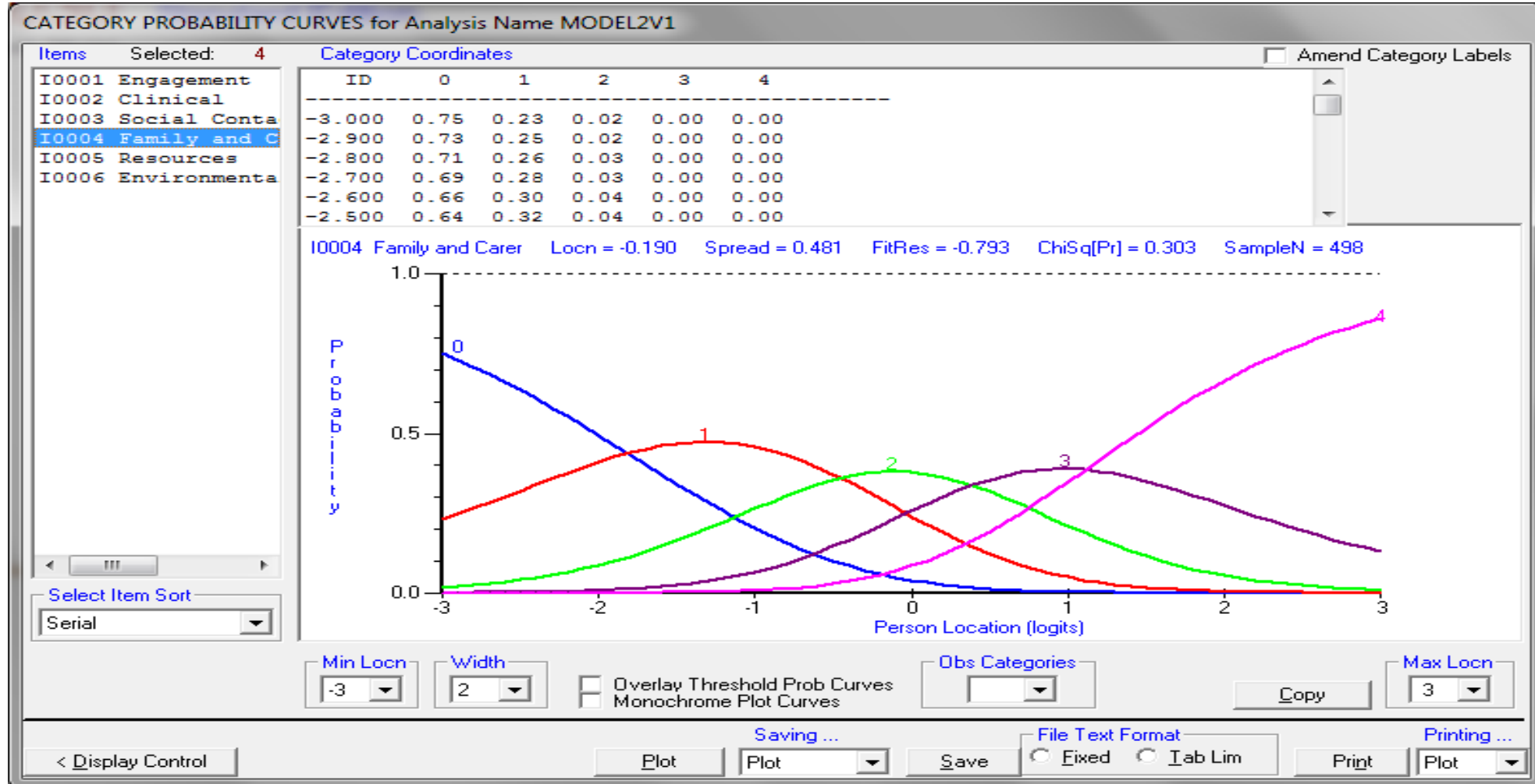
File Text Format

Fixed Tab Delimit

Save

Print

Category Probability Curves



Results for phase 2

- The instrument is constructed with appropriate items for identifying patient complexity as a 'uni-dimensional' construct.
- The instrument is reliable for use with different subgroups of district nursing patient caseloads; namely males and females of all age groups.
- The instrument's response options are discernible for differential selection by participants.
- The instrument was constructed so there is good spacing between the instrument's response options.

Update and Impact

- PCI being used in areas of Wales
- International interest and testing (UK, Scotland, Australia, Canada)
- Included in Welsh Community Care Information System (WCCIS)
- Website = www.pci.wales
- Further studies to test the contribution of the PCI within the all-Wales Nurse Staffing Programme for DN, including:
 - Does it contribute knowledge about acuity or professional judgement?
 - How does it work in practice?

PCI



Patient Complexity Instrument (PCI)

Welcome

Welcome to the Patient Complexity Instrument (PCI) website.



The Patient Complexity Instrument (PCI) is designed for **assessing the complexity of a community-based adult patient's care needs** and producing an indicative score (1-5) within each of the six Likert scales, as perceived by the assessing District Nurse (DN).

The PCI is constructed of the issues identified by DNs in Wales as important for assessing the multiple, overlapping and interlinking biopsychosocial needs (or complexity) of patients on their caseloads.

The PCI allows DNs to generate a description of a patient in the context of their home and community-based circumstances, to identify any areas of need that may require a range of care and support interventions to be planned.

- The PCI may be used for a number of different purposes e.g.
- for undertaking a holistic, biopsychosocial assessment of need with an individual patient which results in a plan of care,
 - briefing colleagues about an individual patient's situation,

A definition of community-based patient complexity from a district nursing perspective:

The interaction of factors in a patient's life, including biological, psychological, social, environmental and support systems, which requires a shift in an expectation of predictable outcomes (Thomas, 2017).

Thank you

For further information

Please contact: susan.thomas30@wales.nhs.uk

References

1. Peek, Baird & Coleman (2009) Primary Care for Patient Complexity, Not Only Disease. *Families, Systems & Health*. Vol. 27(4), 287-302
2. Kathol R, Perez R & Cohen J (2010) *The Integrated Case Management Manual; Assisting Complex Patients Regain Physical and Mental Health*. Springer Publishing Company, New York
3. Wade D (2011) Complexity, case-mix and rehabilitation: the importance of a holistic model of illness (Ed). *Clinical Rehabilitation*. Vol. 25, 387-395
4. Shippee N, Shah N, May C, Mair F & Montori V (2012) Cumulative complexity: a functional, patient-centred model of patient complexity can improve research and practice. *Journal of Clinical Epidemiology*. Vol. 65, 1041-1051
5. Grant R, Ashburner J, Hong C (2011) Physician perspective on patient complexity: not simply based on comorbidity. *Annals of Internal Medicine*. Vol. 155. 797-804
6. Rodgers B & Knafl K (2000) *Concept Development in Nursing: Foundations, Techniques and Applications* 2nd ed. W B Saunders co.
7. Finfgeld-Connett (2006) Qualitative Concept Development: Implications for Nursing Research and Knowledge. *Nursing Forum*. Vol. 41(3) 103-112
8. Walker L & Avant K (2011) *Strategies for Theory Construction in Nursing*. Prentice Hall
9. Netemeyer R, Bearden W & Sharma S (2003) *Scaling Procedures: Issues and Applications*. Sage Publications
10. Streiner D & Norman G (2003) *Health Measurement Scales: A Practical Guide to Their Development and Use* (2nd ed.). Oxford University Press
11. Wilson M (2005) *Constructing Measures: An Item Modelling Approach*. Psychology Press
12. DeVellis R (2012) *Scale Development: Theory and Applications*. Sage Publications
13. Wilson M (2005) *Constructing Measures: An Item Response Modelling Approach*. Psychology Press.
14. Kane M & Trochim W (2007) *Concept Mapping for Planning and Evaluation*. Sage Publications
15. Wyatt M (2012) *ANGEL Taxonomy: a cognitive model for assessment, decision making and planning in complex care*. Technical Briefing Document. www.complexcarewales.org.
16. Thomas S, Wallace C, Jarvis P & Davis R (2015) Using Group Concept Mapping in a mixed method study to develop a patient complexity instrument for district nurses. *Nurse Researcher*. Accepted for publication
17. RUMM2030 (2014) <http://www.rummlab.com.au/> accessed 20/10/2014
18. Bond T & Fox C (2007) *Applying the Rasch Model: Fundamental Measurement in the Human Sciences* (2nd ed.) Routledge