



Smarter Analytics Live 2013

Turning information and insight into actionable business outcomes.

Ground-breaking Clinical Research with Predictive Analytics

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August 2013

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A graphic element consisting of several vertical bars of varying heights in shades of orange and black, resembling a bar chart or data visualization.

Clinical Intelligence

*A scientific program of data acquisition and reporting,
for the improvement of healthcare*

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Background: Metro Spinal Clinic



- Specialist medical facility established in 1988
- Musculoskeletal disorders involving;
 - Spine, muscles/joints, headaches, neck pain to low back pain and disc pain to more complex conditions
- Employs approx 30 staff, including 3 founding partners and 6 other physicians.



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Treatment of pain is a complex challenge



Requires

- accurate diagnosis
- precise understanding of location and intensity

No objective external way to measure pain;

- the patient must be carefully questioned



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Building accurate measurements into clinical processes

Quantification is important

- Difficult to measure the success of treatments
- Many clinical decisions based on anecdotal evidence
- Amass a body of data that would be hugely valuable in assessing the effectiveness of different treatment methods.



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Initial Data Collection Choices

Mail

- cheapest, wide coverage, standardised, low response rate

Telephone

- medium cost, wide coverage, medium response rate, standardisation depends on interviewer

Face to face

- most expensive, coverage depends on personal contact, highest response rate



Paper Questionnaires

Difficulties

- Struggles with the volume of paper
- Imprecise and difficult to interpret
- High postage costs >\$10/Qx
- Data entry costs, subject to human error
- Incomplete forms
- Follow up rate of 60-80%

Needed to find a better solution



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Interventional Techniques: developing an Australian evidence-based approach to the management of chronic spinal pain.
Pre Consult Questionnaire

Q9) How long has your injury or condition been causing you pain?
 3-6 months 6-12 months 1-2 years 3-5 years 6-10 years More than 10 years

Q10) Approximately how many days in the last 3 months have you been limited in your activities due to pain?
 0-2 3-6 7-15 16-24 25-90

Q11) In the last 6 months, approximately how many days have you experienced pain?
 0-30 31-60 90-120 121-160 161-180

Q12) On a scale of 0-10 how would you rate your pain levels over the past week?

*Remember: 0 is no pain and 10 is the worst pain imaginable

	0	1	2	3	4	5	6	7	8	9	10
Pain right now?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Least severe pain over the past week	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Average pain for the past week	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Most severe pain over the past week	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Acceptable pain level following treatment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Q13) Where is your number 1 (main) area of pain? (please select one option below)

Head Neck Shoulder Upper Back Middle of Back Lower Back
 Upper Limb Lower Limb Abdomen Groin Buttock Pelvis
 Other (Please Specify): _____

Q14) Do you have pain elsewhere? (Please select as many options as required)

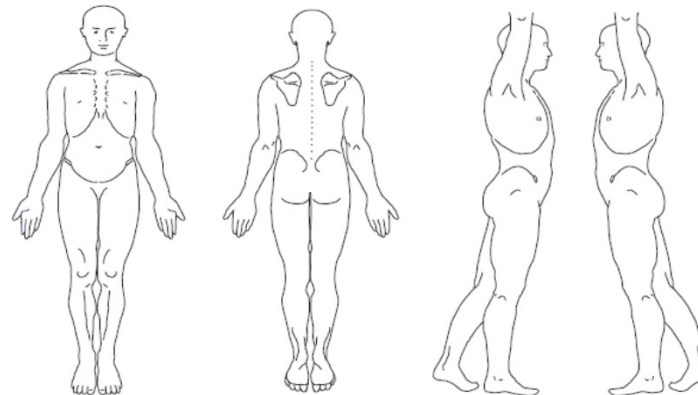
Head Neck Shoulder Upper Back Middle of Back Lower Back
 Upper Limb Lower Limb Abdomen Groin Buttock Pelvis
 Other (Please Specify): _____

Q15) Please indicate the number of days that you will be unable to do your usual work (Please select as many as required)

Middle of Back Lower Back
 Buttock Pelvis

Patient's Name: _____

Date: _____



_____ (Please describe below) No

_____ (If Yes, please describe below) No

_____ (Frequency or condition? *Note: Please do not include
 6-7 times 8 or more

_____ (Condition?
last month in the space provided
 Osteopath: _____
 Psychologist: _____



Electronic vs. Paper Data Collection

Why use electronic instead of paper?

- Standardised,
- Structured instrument,
- Focus on closed ended questions,
- Administered in a standard way
- Ability to filter questions
- Randomise order of responses
- Mandatory questions





Brief to SPSS

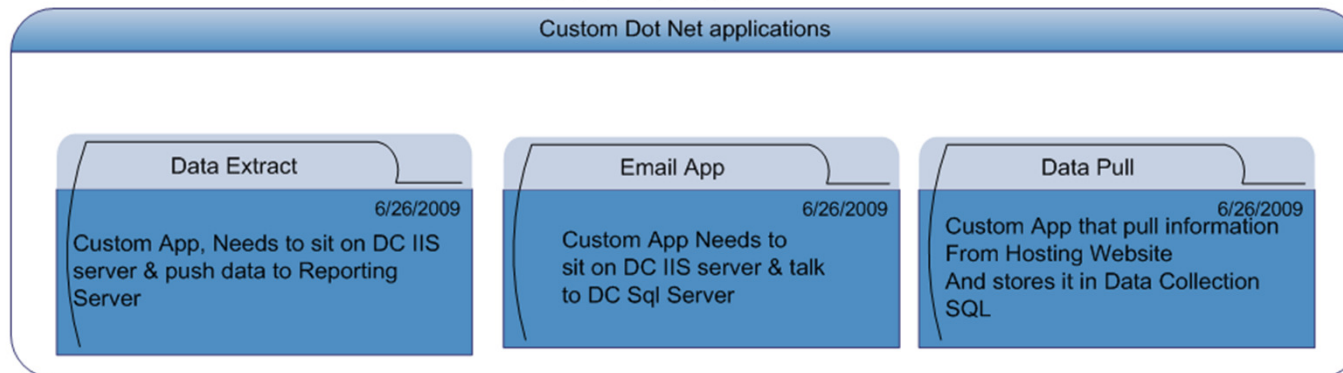
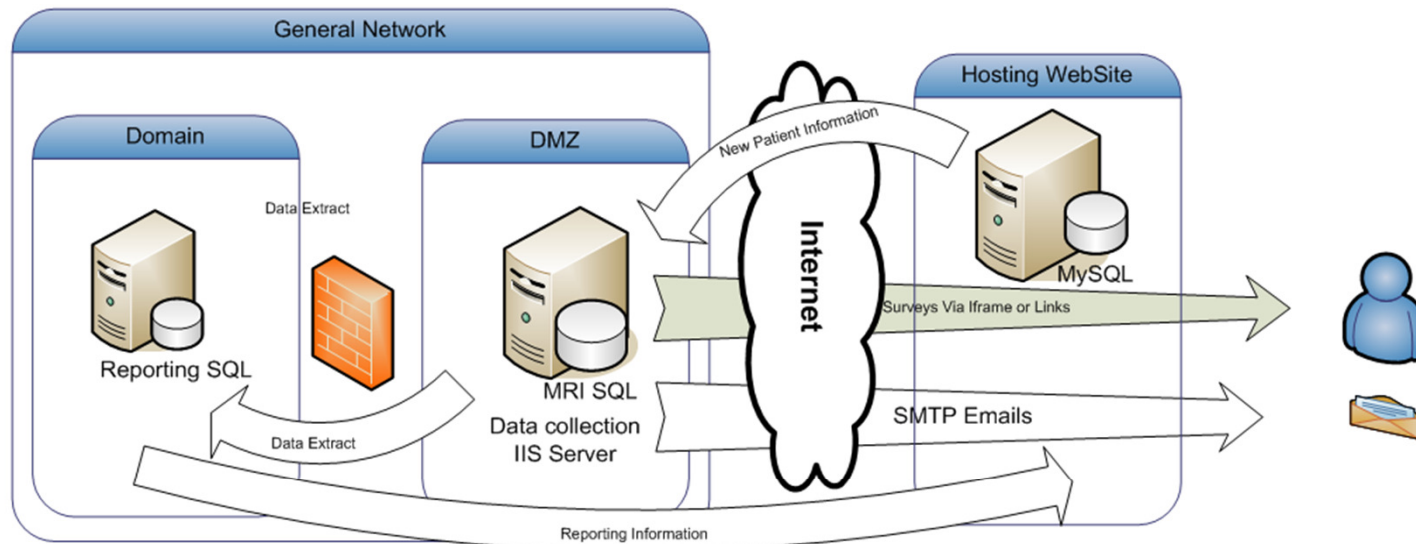
- Allow client to determine surveys for patient using a .Net front end
- Allow clients online access report screens and printed reports for patients
- Calculate scores for patients in real time
- Patients to automatically receive personalised email links to on-line surveys
- Allow building of customised reports



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Proposed Data Acquisition and Reporting System



Proposed Solution – IBM SPSS Data Collection



SPINAL INTERVENTIONAL PAIN MANAGEMENT

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lowbackpain.com.au

18) Where is your number 1 (main) pain?

- Head
- Neck
- Shoulder
- Upper back
- Middle of back
- Lower back
- Upper limbs
- Lower limbs
- Groin
- Buttocks
- Pelvis
- Other (please describe):

Previous

Next

Stop



SPINAL INTERVENTIONAL PAIN MANAGEMENT

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The total score was ...

15

Previous

Next

Stop

31%

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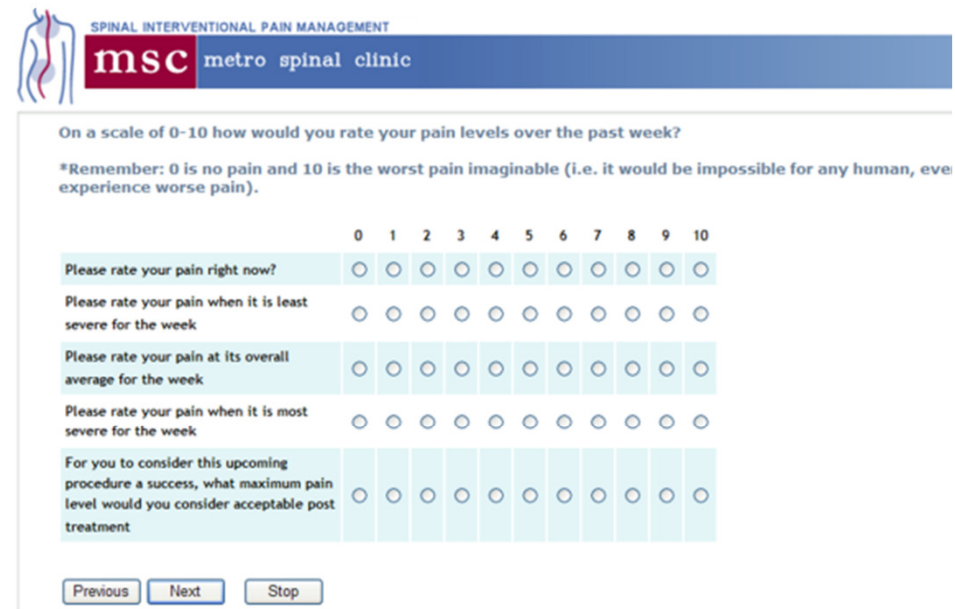
Clinical Intelligence



- IBM SPSS Data Collection Interviewer Web
- IBM SPSS Statistics

Intuitive online patient data system

- To increase efficiency
- Increase rates of patient compliance
- Easy access, analysis and reporting



SPINAL INTERVENTIONAL PAIN MANAGEMENT

msc metro spinal clinic

On a scale of 0-10 how would you rate your pain levels over the past week?


*Remember: 0 is no pain and 10 is the worst pain imaginable (i.e. it would be impossible for any human, even experience worse pain).

	0	1	2	3	4	5	6	7	8	9	10
Please rate your pain right now?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Please rate your pain when it is least severe for the week	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Please rate your pain at its overall average for the week	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Please rate your pain when it is most severe for the week	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
For you to consider this upcoming procedure a success, what maximum pain level would you consider acceptable post treatment	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Previous Next Stop

22%

Please don't hesitate to contact the clinic on 03 9595 6111 if you have any questions.

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Data Collection: Body Image



- Select defined areas of pain
- Individually rate the severity of the pain
- Qualitative analysis of pain condition over time

1 Please use your mouse cursor to roll over the body regions, then click to select the area of pain.

2 Once you have selected the area of pain, please select a number on the 10 point pain scale. Continue selecting other areas of pain that you may have.

3 Once you have selected the area of pain, you have the opportunity to further select different areas.

4 You are able to select a highlighted region and un-select it with a mouse click.

FRONT BACK

right left left right

Please rate your average pain

No pain 0 1 2 3 4 5 6 7 8 9 10 Worst imaginable pain

UNDO CLEAR FINISH

Region	Pain
L Psis	7
L Medial Thigh	10

Data Collection: Body Image



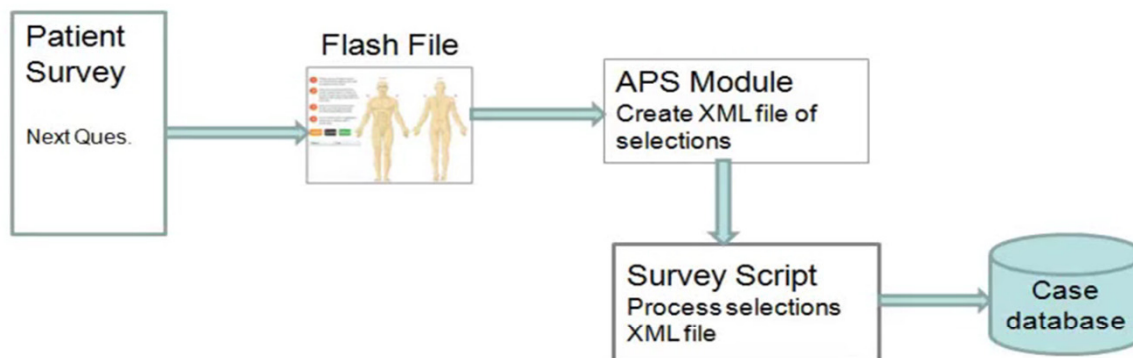
*Patient Survey -
Data Acquisition -
Evidence Based Medicine*

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Data Collection: Body Image

IBM

Body Image App...



Created by Bob Yandow, Clinical Intelligence Pty. Ltd. and Doug Porton, IBM/SPSS

Data Capture ... Storage ... Analysis ... Education... Effectiveness... Quality of Life Improvement...

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Data Export and Storage



- Questionnaire variables weighted and exportable - .SAV and .XLS
- Storage –SQL database, offsite server

ODI_Sitting Apply | Undo

Question Text Please select the one answer that most closely describes your situation.
Sitting:

Variable Label ODI Sitting

Category Label	Export Value	Set as Missing	Factor
I can sit in any chair for as long as I like	99	<input type="checkbox"/>	0
I can only sit in my favourite chair as long as I like	1	<input type="checkbox"/>	1
Pain prevents me sitting more than one hour	2	<input type="checkbox"/>	2
Pain prevents me sitting more than 30 minutes	3	<input type="checkbox"/>	3
Pain prevents me sitting more than 10 minutes	4	<input type="checkbox"/>	4
Pain prevents me from sitting at all	5	<input type="checkbox"/>	5

Previous | Next

IBM SPSS and Clinical Intelligence



Collaboration Benefits

- Reduced survey administration time by 75%
- Eliminated majority of printing and posting expenses
- Cost per survey has reduced by 89%

Clinical Intelligence Benefits

- Qx can be completed in-clinic on a touch pad, or on a home PC
- Improved follow up rates – 85-100%



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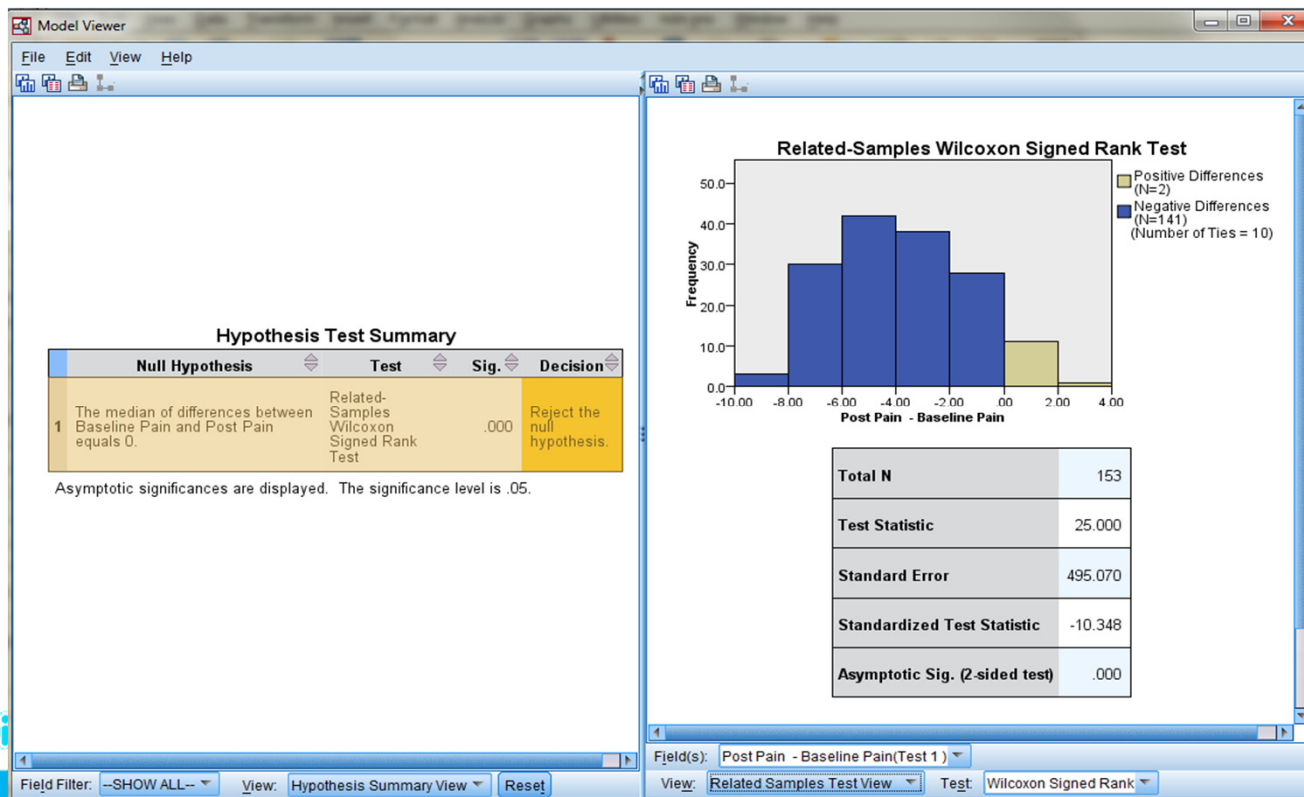
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Types of analysis done with SPSS Statistics

- Non-parametric means testing

- Statistical change in clinically meaningful variables – Pre & Post Pain



twi

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Types of analysis done with SPSS Statistics

- Bivariate Correlations

- Correlation between improved pain relief and;
 - Increased capacity for paid employment, decrease in analgesic use and patient satisfaction
- Non smokers are more likely to achieve greater pain relief



Correlations

[DataSet1] P:\Clinical Intelligence\Deidentified PNFS patient data for IBM Modeler.sav

		Correlations				
		PainRelief	Changes to capacity for paid employment	Changes to analgesic use	Patient satisfaction	Smoker
PainRelief	Pearson Correlation	1	.385*	.418**	.565**	-.272*
	Sig. (2-tailed)		.011	.000	.000	.016
	N	153	43	83	81	78
Changes to capacity for paid employment	Pearson Correlation	.385*	1	.542**	.376*	.252
	Sig. (2-tailed)	.011		.001	.024	.245
	N	43	43	33	36	23
Changes to analgesic use	Pearson Correlation	.418**	.542**	1	.539**	.089
	Sig. (2-tailed)	.000	.001		.000	.594
	N	83	33	83	58	38
Patient satisfaction	Pearson Correlation	.565**	.376*	.539**	1	.092
	Sig. (2-tailed)	.000	.024	.000		.562
	N	81	36	58	81	42
Smoker	Pearson Correlation	-.272*	.252	.089	.092	1
	Sig. (2-tailed)	.016	.245	.594	.562	
	N	78	23	38	42	78

*. Correlation is significant at the 0.05 level (2-tailed).
 **. Correlation is significant at the 0.01 level (2-tailed).



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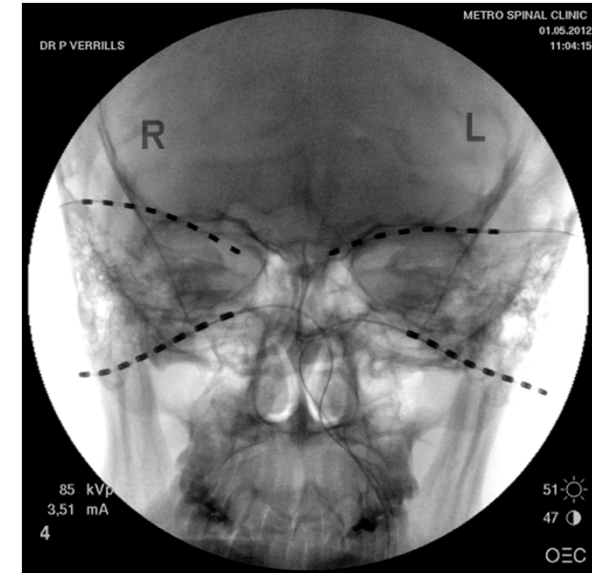


Better Decision Making

- Reducing lead migration rates

- Treatment: Occipital nerve stimulation for intractable headache disorders
- Complication: Lead Migration
- Cause: Predictive analytics and regression models identify possible related factors.
- Result: improvements to clinical practice;
 - Most complications occurred within the first year
 - length of implant time was not found to be a factor
 - Introduced new suturing techniques and the use of anchors to maintain lead placement
 - Of the 172 patients implanted over the past 4 years, steadily reduced lead migration rates;

2008	2009	2010	2011
4 cases	2 cases	1 case	1 case



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Harnessing the power of IBM SPSS & Clinical Intelligence

- Recently published results of a major clinical study
- Results of 100 consecutive cases where we'd used these implants



Peripheral Nerve Field Stimulation for Chronic Pain: 100 Cases and Review of the Literature

Paul Verrills, MD, David Vivian, MD, Bruce Mitchell, MD, and Adele Barnard, PhD

Metro Spinal Clinic, Caulfield South VIC, Australia
Reprint requests to: Adele Barnard, PhD, Metro Spinal Clinic, Level 1 544 Hawthorn Road, Caulfield South VIC Australia 3162. Tel: +61 3 9595 6111; Fax: +61 3 9595 6110; E-mail: abarnard@metrospinal.com.au.

PNFS has the potential to fundamentally change the way we think about pain management.

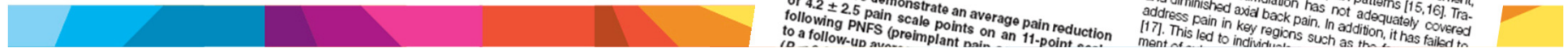
Key Words. Peripheral Nerve Field Stimulation; Chronic Pain; Neuromodulation; Subcutaneous Lead Stimulation; Craniofacial Pain; Low Back Pain

Abstract
Objective. To evaluate the clinical outcomes of 100 consecutive patients receiving peripheral nerve field stimulation (PNFS) for the treatment of chronic intractable.
Design. Prospective, observational study.
Setting. A private interventional pain specialty referral practice.
Patients. One hundred consecutive private practice patients receiving PNFS for the treatment of chronic craniofacial, thorax, lumbosacral, abdominal, pelvic, and groin pain conditions.
Outcome Measures. Pain (11-point numerical rating scale), complications, changes to analgesic use and employment status, disability (Oswestry or Neck Disability Indexes), depression (Zung Depression Index), and patient satisfaction.

Introduction
Neuromodulation generally involves the selective application of a programmable pulse waveform through a series of electrodes within a lead to stimulate afferent nerve fibers and, subsequently, reduce the perception of pain [1]. This treatment is most indicated in cases of severe localized pain, intractable to analgesics, and other conventional therapies. The use of electrical stimulation for the treatment of pain dates back to the late 1800s when Julius Althaus applied alternating current electrotherapy to peripheral nerves for pain relief [1]. However, it was not until the publications by Metzack and Wal [2] and Shealy and colleagues [3] did neuromodulation in the form of spinal cord stimulation (SCS) become a noted alternative to traditional pain management.

Results. We demonstrate an average pain reduction of 4.2 ± 2.5 pain scale points on an 11-point scale following PNFS (preimplant pain scale) to a follow-up average of 1.7 ± 1.5 pain scale points. Historically, SCS has primarily been used for widespread leg, buttock, and to some extent back pain, particularly following failed back surgery [4-14]. In some cases, SCS becomes ineffective over time with some contributing factors postulated to stem from original lead placement, lead migration, and changes in pain patterns [15,16]. Traditionally, SCS stimulation has not adequately covered and diminished axial back pain. In addition, it has failed to address pain in key regions such as the face, neck, and groin [17]. This led to individuals such as the patient

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Participant Management System



- Appointment/treatment tracking
- Programed to seamlessly send out follow up questionnaires, based on appointments
- Significantly reducing admin overheads

The screenshot displays the 'Update Patient' interface of the Clinical Intelligence system. The top navigation bar includes 'Home', 'Patient', 'Treatment', 'Admin', and 'Report'. The user is logged in as 'Admin' with a 'Log Out' option. The main form is divided into two sections: 'Update Patient' and 'Appointments'.

Update Patient Form:

- Medicare*: 686865478
- Patient ID*: 54354
- Salutation*: Dr
- First Name*
- Middle Name
- Last Name*
- Gender*: Female
- Date of Birth*: 18/07/1981
- Email: abarnard@metrosinai.com.au
- Phone*
- Address*
- Suburb*: CBD
- Post Code*: 3000
- Country*: Australia
- State*: Victoria
- Note

Appointments Section:

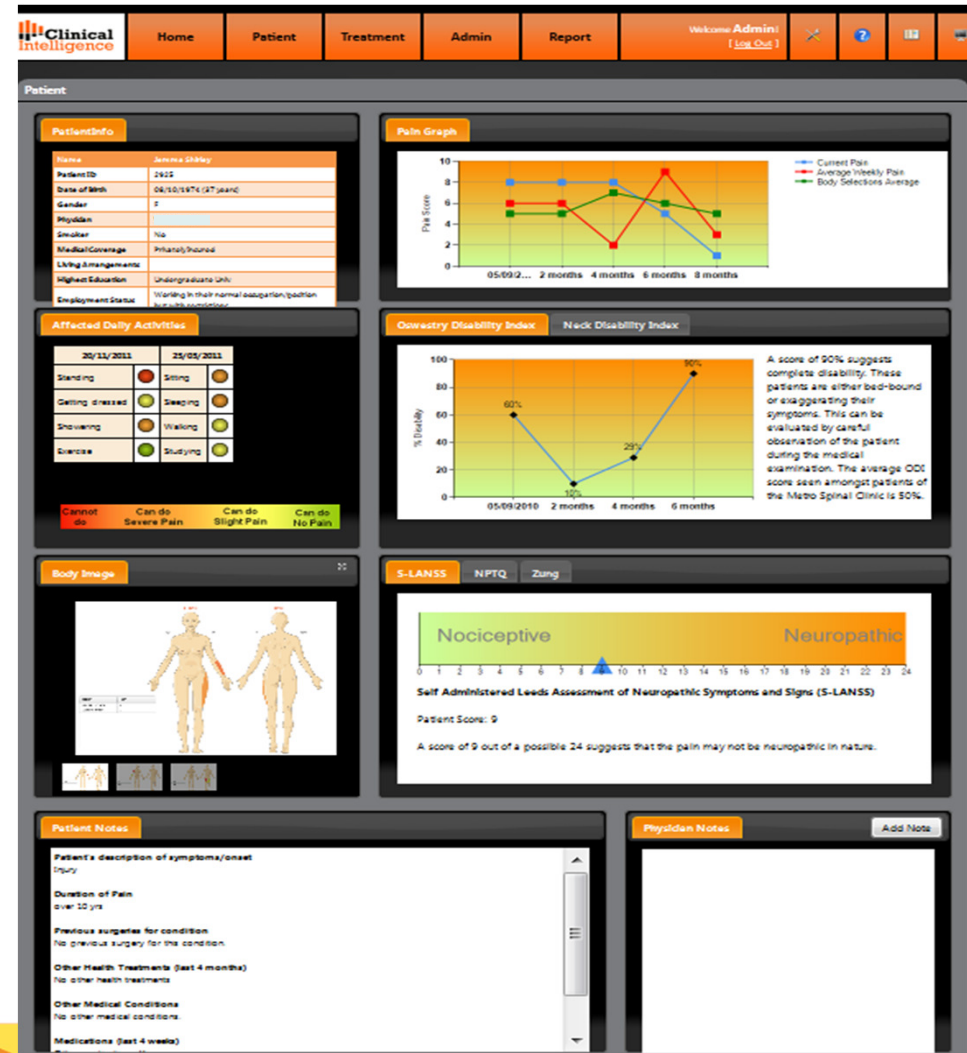
- Select:** Thu, 23 Sep 2010; **Tue, 16 Nov 2010** (selected); Fri, 26 Nov 2010; Sat, 27 Nov 2010
- Details - Inserting:**
 - Appointment Date/Time*
 - Appointment Category*: Treatment, Procedure, Consultation
 - Appointment Type*: Sacro-iliac joint injection/DIL
 - Site*: Caulfield South
 - Physician*: Dr.

* = Required Entry

Buttons: Update Patient, Clear, << Back

Dashboard Interface – Patient View

- Respondent management
- Real-time access to individual outcome data over time
- Clinical interpretations



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Dashboard Interface – Treatment Cohort

- Real-time access to cohort data
- Data mining filters without the need to access complicated stat programs



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What's Next.....

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Data mining – clusters with similar results?



File Generate View Preview

Model Summary Annotations

Clusters

Cluster	cluster-1	cluster-4	cluster-3	
Label				
Description				
Size	37.3% (57)	19.6% (30)	17.0% (26)	
Inputs	PainRelief 70.53	PainRelief 13.38	PainRelief 62.12	PainRelief
	Changes to analgesic use	Changes to analgesic use	Changes to analgesic use	Changes to analgesic use
	Patient satisfaction 2.47	Patient satisfaction 0.94	Patient satisfaction 3.35	Patient satisfaction
	Changes to capacity for paid employment	Changes to capacity for paid employment	Changes to capacity for paid employment	Changes to capacity for paid employment

Cluster Comparison

cluster-1 cluster-4 cluster-3 cluster-5 cluster-2

PainRelief

Changes to analgesic use

Patient satisfaction

Changes to capacity for paid employment

Display

Predict outcomes

- Can we predict who may respond better to certain treatments



The screenshot displays the IBM SPSS Modeler interface. The main workspace shows a workflow starting with a data source 'Deidentified PNFS pa...' containing '54 Fields'. This data flows through a 'Type' node, then a 'Filter' node, and finally to a 'PainRelief' node. A 'Medication decrease' node is also visible in the workflow. A 'HighImprovement' dialog box is open, showing a table with columns 'Use?', 'Graph', and 'Model'. The 'C&R Tree 1' dialog box is also open, showing a decision tree structure for 'HighImprovement' with a split point on 'NPTQ_Score Improvement=0.139' at the root node. The tree branches into two nodes based on the condition ' ≤ 23.500 ' and ' > 23.500 '. Each node contains a table of category counts and percentages.

Node 0		
Category	%	n
0	59.615	62
1	40.385	42
Total	100.000	104

Split: NPTQ_Score Improvement=0.139

Node 1		
Category	%	n
0	70.000	7
1	30.000	3
Total	9.615	10

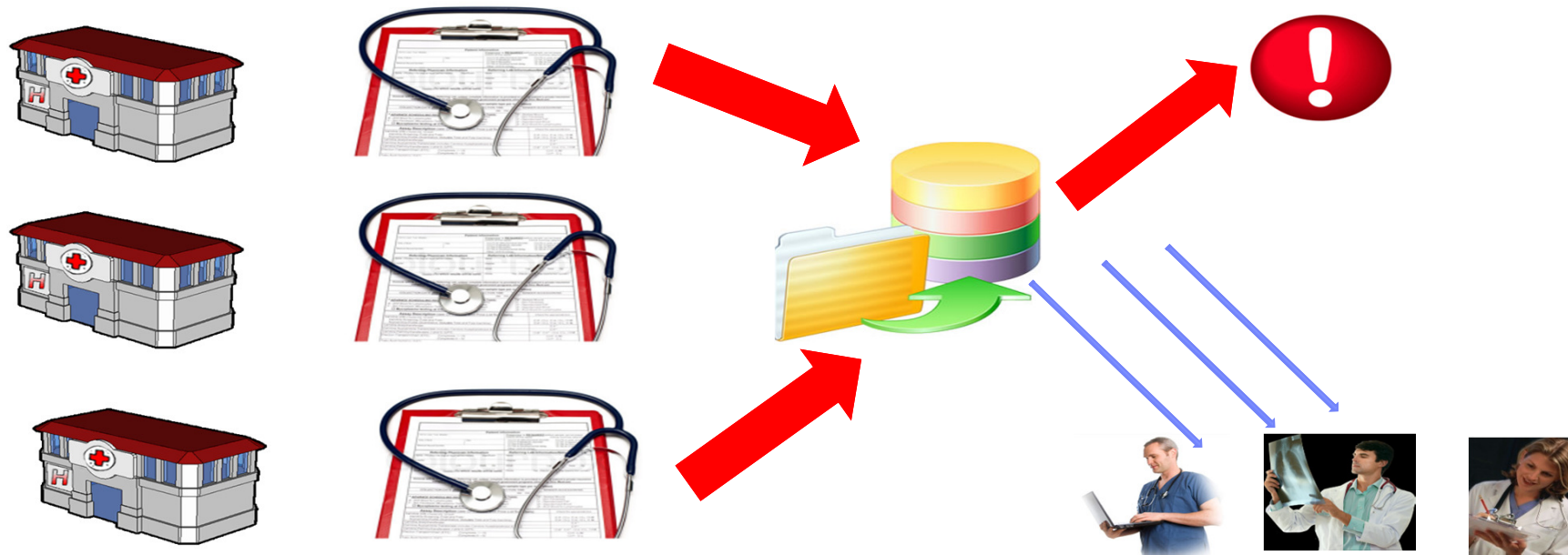
Condition: ≤ 23.500

Node 2		
Category	%	n
0	58.511	55
1	41.489	39
Total	90.385	94

Condition: > 23.500

Improvement: 0.233

Collaborative analytics and deployment



Predict psychological counselling treatment pathways

Chronic pain is debilitating condition, often confounded by certain psychological states.

1. Using a combination of psychometric questionnaires and predictive analytics
2. Red-flag patients who may benefit from psychological counselling prior to seeking treatment
 - High depression and/or state anxiety
 - Unrealistic treatment expectations
3. Identify at-need patients earlier in the treatment continuum
4. Shown to improve patient outcomes following treatments



Improving patient treatment



- Clinical Intelligence provides ways to automate and integrate analytical processes into your clinical decision making.
 - Make more informed decisions
 - Improve patient outcomes through evidence based medicine
 - Deploy statistically valid clinical models based on questionnaire scores
 - Enable standardisation amongst physicians
 - Generate your own best practice clinical models based on your unique patient and treatment pool.
 - Treatment pathways triggered by preceding outcome data and results
 - Confidence in results



Benefits of IBM Analytics and Clinical Intelligence



- Our Clinical Intelligence systems provide an efficient tool for longitudinal and vertical health measurement.
- IBM analytics has made the process intelligent.

It's a smarter way of doing medicine.



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Smarter Analytics Live 2013



Let's Get Technical!

We will be showcasing our solutions through scheduled demos at our dedicated "Demo Zone". The demos are held throughout the breaks at the following times:

Time	Demonstration
Morning Tea	
10:55am - 11:10am	Australian Open - Big Data and Analytics
Lunch	
12:40pm - 12:55pm	Faster, Smarter Data Exploration and Visualisation
1:00pm - 1:15pm	Social Media Analytics
1:15pm - 1:30pm	Trusted Information for Analytics
Afternoon Tea	
3:00pm - 3:15pm	Intelligent Investigation Manager





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IBM Table Talk!

Got questions?

Ask an IBM expert here today.

Continue the conversation with the IBM team

For more information on the solutions covered during this session, visit the IBM Table Talk zone in the pre-function area. Our subject matter experts are on-hand to answer your questions throughout the day.





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Become part of the dialogue.

Join us on: [#SALive2013](#) [@ibmbaanz](#)

Tweet your questions for the panel discussion this afternoon.

