DEVELOPING A THEORETICAL MODEL OF CLINICIAN INFORMATION USAGE PROPENSITY

Dr Philip J Scott MSc PhD FBCS CITP
University of Portsmouth, UK
Contents

- Introduction
- Methods
- Results
- Discussion
- Limitations
- Conclusions
- Questions
Introduction

- **Background**
  - PhD literature review on theory in health informatics (HI)
  - Main extant theoretical areas in HI were design principles and sociotechnical and semantic models
  - Research aim was to contribute to sociotechnical theory in health informatics using a *theory-building* approach
  - Started with qualitative studies in general practice, community children’s services and acute hospital using grounded theory approach
  - Initial focus on electronic patient records; widened to all forms of patient information usage (paper, oral, etc.)
Introduction

- Qualitative results
  - Observed major differences in information usage and attitude towards electronic health records between settings and disciplines
  - Constructed hypothesis (from qualitative data and the literature) that these patterns of attitude and usage were linked to differences in clinicians’ …
    - philosophy of medicine (beliefs about clinical judgement)
    - beliefs about information quality
    - cognitive approach
    - cultural resistance (to change)
Hypothetical model of “clinician information usage propensity” (CIUP)
Methods

- Research strategy was pragmatist mixed methodology (Scott & Briggs, 2009)
- Decided to seek quantitative validation of CIUP
- Followed exemplar instrument validation studies
- Piloted draft survey with 10 clinicians
- Launched by email and administered by website to ~850 clinicians
Methods

- Twenty eight questions in total
  - Nineteen items related to CIUP, with free text box for qualifying comments
  - Four demographic questions (gender, age group, specialty, grade)
  - Five exploratory questions (free text)
- Principal components (factor) analysis using SPSS
- KMO measure of sampling adequacy
- Cronbach’s alpha to test internal consistency of factors
- Spearman’s correlation coefficient to test factors against demographics
Results

- 146 participants completed the survey
- Response rate 17% (20% for hospital doctors, 10% for GPs)
- KMO=0.69 showed the sample was adequate for principal components analysis (PCA)
- Bartlett’s test of sphericity significant ($p<0.001$) showed inter-related clusters of variables exist
Results

- Kaiser criterion for PCA (SPSS default) extracted six components, accounting for 58.6% of variance
  - Scree plot consistent with four or six factors
  - **But:** two of the six extracted factors had no obvious meaning as logical constructs

- Alternative analysis specifying four components explained 47.2% of variance

- Four factor model matched the CIUP hypothesis
Results

- Two factors had adequate reliability
  - Cultural resistance: $\alpha=0.76$
  - Beliefs about clinical judgement: $\alpha=0.65$

- Two factors had low reliability
  - Cognitive approach: $\alpha=0.55$
  - Beliefs about information quality: $\alpha=0.53$
Results

Factor 1: Cultural resistance

15.5% variance explained; reliability=0.76

<table>
<thead>
<tr>
<th>Patient notes and records would be improved by standardizing our terminology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moving from mostly paper-based to mostly computer-based patient records would improve patient care</td>
</tr>
<tr>
<td>Clinical culture is better suited to paper-based information than computer systems</td>
</tr>
<tr>
<td>Integrated electronic patient records will improve completeness and sharing of clinical information</td>
</tr>
<tr>
<td>The need to use computers interrupts the traditional pattern of clinical practice</td>
</tr>
<tr>
<td>Using computers during patient consultations would harm personal interaction</td>
</tr>
</tbody>
</table>
Results

- **Factor 2: Beliefs about clinical judgement**
  - 11.1% variance explained; reliability=0.65

<table>
<thead>
<tr>
<th>Statement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Effective clinical practice depends on experience and judgement rather than fixed protocols</td>
</tr>
<tr>
<td>Figuring out what's happening with a patient takes imaginative detective work rather than just a flowchart of pre-determined steps</td>
</tr>
<tr>
<td>Medical case knowledge relies on both objective and subjective information</td>
</tr>
<tr>
<td>Diagnosis and care plans are largely based on inference and expert interpretation</td>
</tr>
<tr>
<td>Clinical decision-making can be described by well-defined sets of rules and criteria</td>
</tr>
</tbody>
</table>
### Results

#### Factor 3: Cognitive approach

10.4% variance explained; reliability = 0.53

<table>
<thead>
<tr>
<th>Statement</th>
</tr>
</thead>
<tbody>
<tr>
<td>I have to cope with important information missing from the patient record</td>
</tr>
<tr>
<td>Free text notes convey a more useful picture than a structured pro forma</td>
</tr>
<tr>
<td>All diagnoses and care plans are justified by data found in the patient medical record</td>
</tr>
<tr>
<td>Clinical decision-making can be described by well-defined sets of rules and criteria</td>
</tr>
</tbody>
</table>
Results

- **Factor 4: Beliefs about information quality**
  - 10.2% variance explained; reliability = 0.55

<table>
<thead>
<tr>
<th>Perception</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient notes and records would be improved by standardizing our terminology</td>
<td>Information has to be put into correct medical terms before it is entered into patient records</td>
</tr>
<tr>
<td>I have to cope with important information missing from the patient record</td>
<td>There is a problem of poor handwriting and inaccurate terminology in our patient notes</td>
</tr>
<tr>
<td>Patient handovers convey irrelevant detail that obscures the key issues</td>
<td></td>
</tr>
</tbody>
</table>
Results

- Medical specialty did **not** correlate with factor scores
- Other demographic correlation (p<0.05; #p=0.055):

<table>
<thead>
<tr>
<th>Factor</th>
<th>Description</th>
<th>Gender</th>
<th>Grade</th>
<th>Age group</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Cultural resistance</td>
<td>0.21</td>
<td>0.19#</td>
<td>0.24</td>
</tr>
<tr>
<td>2</td>
<td>Beliefs about clinical judgement</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Cognitive approach</td>
<td>0.20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Beliefs about information quality</td>
<td></td>
<td>0.28</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sum of factor scores</td>
<td></td>
<td>0.20</td>
<td></td>
</tr>
</tbody>
</table>
Results

- Consensus (shown from qualitative results) that clinical judgement is a mixture of protocol and wisdom
  - But some strong contradictory views
    - Example: whether treatment decisions are mostly evidence-based or mostly empirical
  - Distinct beliefs about medicine as art or science
    - “There is no need for imagination”
    - “Objective evidence is always better than a ‘gut feeling’ ”
    - “It can be harder to communicate ‘gut feeling’ either on paper or on a computer system. It is crucial that any clinical software does have the facility for free text.”
Qualitative results showed a **strength of feeling** suggesting that beliefs about clinical judgement are an important factor underlying information usage propensity

- “Some cases can be treated well with protocols but there are often too inflexible. One size does not fit all.”
- “Protocols are great for those with little experience, but should not be fixed in tablets of stone. Insulin sliding scales are a great example of this. One size DOES NOT fit all!”
- “Guidelines and protocols stop healthcare workers thinking and things get missed.”
- “Evidence Based Medicine is fine up to a point, but not always available, and only deals in generalisations and statistics: have to engage brain.”
Discussion

- We interpret that lower CIUP scores mean:
  - Higher cultural resistance to information systems
  - Stronger anti-algorithmic view of medicine
  - Greater preference for narrative over structured documents
  - Stronger belief in poor information quality

- We propose that the aggregate CIUP score provides a measure of clinical propensity to adopt information systems
Discussion

- We anticipated significant variation between specialties but this conjecture was not supported.
- We were surprised that beliefs about clinical judgement did not correlate with any demographic variables but seem to be purely idiosyncratic.
Discussion

- Cultural resistance was the dominant factor, explaining 15% of variance and with $\alpha=0.76$
- This factor is similar to the “Behavioural intention” factor in Phansalkar, et al. (2008)
- The “beliefs about information quality” factor is comparable to the “Attitude towards information quality” factor in Phansalkar, et al. (2008)
Discussion

- Female participants scored significantly lower than males ($p<0.05$) on cultural resistance and cognitive approach.
  - We interpret this as higher cultural resistance and preference for narrative among females in our sample.

- Hospital doctors scored significantly lower than general practitioners on cultural resistance ($p<0.05$).
  - We interpret this as higher cultural resistance among hospital doctors than GPs in our sample.
Limitations

- Selection bias towards technically literate
  - Invitations to participate sent by email
  - Survey administered on website
  - Only affects scores not the constructs

- Statistical weaknesses
  - Sample size **adequate** for PCA, but at low end
  - Two factors had **poor reliability** \((\alpha < 0.6)\)
  - Four factor model explained < 50% of variance
  - Weak correlation with demographics
  - Need confirmatory factor analysis to generalise
Conclusions

- This study has shown **some support** for the hypothetical CIUP construct.
- Further work would **extend the model** and **refine the instrument** to remove redundancy and improve sensitivity.
- We suggest the CIUP construct has potential for application as a technology adoption model.
- We propose that beliefs about clinical judgement merit further attention in HI research.
Questions...?

- **Contact:** philip.scott@port.ac.uk
- **Website:** http://userweb.port.ac.uk/~scottp

(This slide set and references available on Publications page)

School of Computing
University of Portsmouth
Portsmouth PO1 3HE