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Does experience in general practice influence the clinical thinking of foundation trainees?

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What is already known in this area

There is much debate as to the role and relevance of time spent in the clinical setting to the learning and development of trainees.

There is a pressing need to refocus research to develop a more detailed understanding of the impact of spending time in practice, here general practice, on the development of clinical thinking skills.[1]

What this work adds

The aim of this small-scale exploratory study was to identify whether there was a significant change in the nature of foundation trainees' thinking about a clinical case scenario after a four month attachment in general practice.

Through the innovative use of Mind Maps, data was collected and analysed to identify the areas of change and development.

Suggestions for future research

This study has demonstrated changes in clinical thinking of trainees about a case when exposed to clinical experience in the primary care setting. The work would benefit from wider testing in general practice and other specialties to explore the value of Mind Maps to learning.

[1] We use the term 'clinical thinking' consistently throughout our paper to refer to the trainees' general thinking about a case, and do so in the same way as other academics.[1-4]

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Summary

The aim of this exploratory study was to capture and identify changes in clinical thinking amongst foundation trainees after an attachment in general practice, and to develop a means of analysing the data collected to inform understanding about how clinical thinking develops and changes for the trainee and learner in the context of clinical experience. Through the innovative use of Mind Maps, we have sought to demonstrate whether there was a significant change in the themes and key features contained in maps drawn by foundation year 2 trainees before and after an attachment in general practice, and to locate the nature of the change if present. Being able to identify such change is potentially valuable as it can assist in revealing a trainee's learning needs and shape future learning.

Overview of theoretical and research perspectives from the literature

The consultation lies at the heart of the doctor-patient relationship, and through the interaction that occurs, the doctor brings bio-medical, experiential and contextual knowledge to bear on an issue or concern presented by the patient.[5] Understanding and identifying the processes that occur in the midst of this interaction have been the subject of research and theorising for some 60 years across a broad range of disciplines, with little agreement on detail, language or if a 'model' exists.[2,6] In 2005 Norman[7] conducted a review of theoretical and methodological approaches to understanding clinical reasoning, a significant element of clinical thinking. His paper presents an account of the development of this field, and in it he describes trends in approaches and theory that have informed understandings over the last three decades. These have moved through skills-based understanding of clinical thinking

through to ones concerned with knowledge, experience and memory, and extending more recently to interpretive approaches which have tended to view the interaction holistically and provide accounts accordingly, which go beyond it being about reasoning alone[1-3,8] or focus on more difficult aspects of the process, for instance communicating evidential uncertainty to patients (for example Griffiths *et al*., 2005).[9] Norman (2005: 426)[7] concludes his review by stating:

> "[O]ne thing is clear. There is no such thing as clinical reasoning; there is no one best way through a problem. The more one studies the clinical expert, the more one marvels at the complex and multidimensional components of knowledge and skill that she or he brings to bear on the problem, and the amazing adaptability she must possess to achieve the goal of effective care."

In the same way research and theory about clinical thinking have evolved and moved towards more interpretative understandings, so too has an appreciation of the cultural and political landscapes the consultation sits within: previously where doctor-centred and medical models may have dominated; now ethical and professional dimensions are recognised as important facets of the interaction[5,10] and particularly in the UK, the patient perspective has come to be overtly situated within the diagnostic and treatment process (c.f. Higgs and Jones (1995) vs. Higgs and Jones (2000) for evidence of this evolution).[6,11] Thus, as argued by Greenhalgh and Heath (2010),[12] the consultation is more than a purely clinical and diagnostic encounter. Further, researching clinical thinking is made more complex by recognising that it is not the same across specialties, with subtle variations in aims and ends across clinical contexts.[13] This is most clearly seen across the boundary of the hospital and general practice, where a consultation may be approached quite differently. Previous research[14] has reported that trainees are aware of different consultation styles between the two contexts, however the

nature of this difference is less well understood and how it impacts on thinking about cases. Added to this is the evolving nature of the consultation: whilst clinicians may learn a particular approach to consulting during their training, over time they develop their own preferred style which may draw on and merge various approaches.[5,15] Thus describing what occurs becomes a considerably more complex challenge. Higgs and Jones (2000: xiv),[6] like Norman (2005),[7] sum up the state of knowledge in this field thus: "[T]here is no one accepted theoretical or research-based model of clinical reasoning." They are led to this conclusion by recognising the uncertainty surrounding the consultation and the invisibility of processes bound up in clinical thinking. Trainees are generally only shown the outcome, and rarely do they gain insight into how and why more experienced doctors arrive at their conclusions. The significance of being able to come to sound, professional judgements is paramount for a doctor, yet the complexity of reaching these decisions is often taken for granted within a medical trainee's education.[1,3]

In designing our study, our interest was to better understand the value of clinical experience to trainees' learning, and to generate practically useful knowledge for clinical educators about learning (Pring 2000).[16] We looked for an approach to enquiry that would bring to the fore clinical thinking as a whole, rather than fragmented elements of the process, and in a form that would allow us an opportunity to interpret the whole.

Method

Design

In designing our project and considering how we might go about collecting data about clinical thinking, we were not in a position to draw on narrative-rich data collection methods to reveal the participants' clinical thinking. For reasons of time, such methods were set aside, and our approach to data collection instead looked for alternatives. Having identified a movement

towards more graphical data collection methods in this field,[5] we chose Mind Maps.

Mind Maps are widely used as study aids, as they have been found to be an effective way of capturing key concepts about a topic.[17,18] They have also been used in research as a means of data analysis.[19] When drawn, Mind Maps are free flowing, thereby allowing knowledge to be reconstructed in a way that best suits the drawer's thinking style. Maps start from a single central concept which is broken down into key words and ideas. The branches of the map can denote a hierarchical arrangement of ideas, and links can be drawn to show association.[17] An alternative would have been concept maps, which have been widely used in medical education research to assess the conceptual knowledge structures of medical trainees[20,21] and how concepts inter-relate within specific domains of competence.[22] However, the concept map is formally structured and set within a pre-established knowledge structure where links are already known or predetermined,[23,24] which was not in keeping with our research aim. Further we wanted an approach to data collection that lent itself to both quantitative and qualitative analysis.[25] Therefore we felt that Mind Maps would allow the participants to express their knowledge in an unconstrained, graphical style; for their particular view to be captured, in order to demonstrate the structure of their individualised clinical thinking, comprising their thoughts, ideas and feelings about the case; and minimise our researcher impact on that thinking through a structured approach to data collection.

The aim of this small-scale exploratory investigation was to identify whether there was a significant change in the themes or key features of trainees' thinking about a clinical case scenario before and after an attachment in general practice. It was anticipated that change in the composition of map items would reflect a movement away from a purely clinical focus on thinking about the case, towards a more holistic view of it.

The research questions addressed were:

1. What is the value of experience in general practice in terms of learning for foundation year 2 trainees?
2. How does GP experience influence their clinical thinking?

Participants

Participants (n.11) were recruited from the Foundation School of the Wessex School of General Practice, Wessex Deanery by invitation. Participants received project information sheets and gave informed consent. Each participant was given a unique identifier code number so that the maps and data collected could be matched to the participant by the main researchers only (SK and SS) during analysis.

Data collection procedure

Participants were provided with A4 paper and four-coloured biros. They were given a twenty minute presentation on the structure of Mind Maps and how to draw one. Once participants were confident with the Mind Map procedure, they were presented with the clinical case scenario (see box 1). They were given ten minutes, a standard consultation length, to draw their mind maps based on the scenario developed by the GP Educators at Southampton as being a typical clinical presentation to general practice.

[Insert **Box 1** here]

The second data collection event four months later comprised a reminder presentation about how to draw a Mind Map, followed by the clinical case scenario. They were again given ten minutes in which to draw their second mind map.

Analysis

The analysis of the maps was a complex and iterative process, requiring each to be considered in depth from a number of perspectives. A major aspect of the data analysis concerned untangling the different forms of knowledge that were represented in the trainees' maps in

order to identify change. Simply by looking at the maps it was clear that the information they contained went beyond the purely clinical. It became apparent that the free-flowing and unproscribed structure of the Mind Maps was allowing the participants to 'dissect' the case in a range of ways that did not fit neatly in to a particular approach to consulting. We could find no 'cook book'[26] approach that was common, so whilst there were common elements of thinking and structure across all the maps (e.g. history taking, examination), there was no pattern that could lead us to link the maps to particular consulting styles, as set out in Bevington (1997) for instance.[13]

We returned to the literature to think again about how we were coding the map items, and were drawn to the work of Della Fish and Linda de Cossart.[2,3,10] Their analysis of clinical thinking sees it as a pathway with two parts to the process, which together lead to a doctor's professional judgement about a patient. These are 'clinical reasoning' and 'deliberation.' 'Clinical reasoning' speaks to the technical side of clinical judgement. It considers the aspects of a case that relate to medical models of illness and disease, and predictable categories found within such models. It is scientific in nature and as such is usually objective, precise, deductive and analytical. It is based on evidence and in its barest form may be assumed to be the sum of what a doctor does. In contrast 'deliberation' takes into account the more complex aspects of any clinical problem and views its human side. Deliberative thinking takes into consideration the social and contextual aspects of the case and allows the doctor to use intuitive skills and experience alongside knowledge. It considers ethical and moral judgements and appreciates illness in the particular and how this impacts in many different ways on patients' lives. Consequently 'deliberation' is the most difficult area of clinical thinking to unveil as it does not depend on a conscious thought process that has structure in actions, rather it is tacit in nature.[27] Through their research with surgeons, Fish and de Cossart argue that these aspects of professional practice can be revealed.[2] They provide evidence for their analysis based upon

the practice of surgeons, who 'captured elements of their clinical work' and explored them with Fish and de Cossart in detail though interview. In doing this they sought to:

> " … tease apart clinical reasoning from deliberation, as two very different thinking processes, which result in two very different kinds of decisions about practice, and which need each other, but which, initially at least, can usefully be understood, taught and assessed, separately." (de Cossart & Fish, 2005, p. 135).[2]

The work of de Cossart and Fish provided us with a lens through which we wished to view our data. They describe the 'clinical thinking pathway' as providing "a language and framework for clinicians to use every day in clinical practice" (de Cossart and Fish 2011: 21).[10] It is a "novel presentation of how doctors think" that can be used in many ways "to organise thoughts when writing about cases" (de Cossart and Fish 2011: 21).[10] We hoped that it would provide us with a framework to allow us to examine trainees' clinical thinking and give insight to the development of thinking about different aspects of the case, particularly the deliberative elements.

Our analysis therefore evolved to describe the content of the maps both in terms of a qualitative, thematic way framed by the work of de Cossart and Fish, as well as in terms of a statistical perspective. The coding manual was developed from the maps in the first instance, and then each map item was categorised into thematic groups under the headings of "*Clinical Reasoning*" and "*Deliberation,*" as described by de Cossart and Fish (2005; 2011) (available from the authors on request).[2,10] This resulted in a coding manual with two main sections: "*Clinical Reasoning*" referring to items relating to clinical aspects of the case and decision making procedures and "*Deliberation*" referring to items that related to the context of the patient's circumstances and guiding principles of medical and professional practice. We used this as our overarching structure, and within each were themes, comprising main branch

keywords radiating from the central map concept (the case). Flowing from the themes were subcategories which captured more specific items found on the maps. See table 1 for the themes and their subcategories for both *"Clinical Reasoning"* and *"Deliberation."*

[Insert **Tables 1** and **2** here]

Each item appearing on the trainees' maps was coded by the researchers (SK and SS) using the coding manual. As a team we were conscious that each map should be coded as if it were the first, so to mitigate against researcher 'coding fatigue' and to ensure we coded critically rather than by pattern recognition, maps were coded by more than one researcher and sampled for consistency. To check consistency, a third researcher (CL), coded a sample of the maps from first sight and this was confirmed by statistical validity check with the maps coded by SK and SS.

Once the maps were coded they were then considered in respect to:

1. The volume of map items pre- and post- GP experience for each trainee;
2. The 'thinking processes' presented – could they be identified as 'clinical reasoning' and 'deliberation' given their differing characteristics?

To do this we used statistical analysis in order to develop a statistical interpretation of the data. Our approach to analysis mirrored the modes of thinking that informed our theoretical understanding: the first strand relied on a quantitative analysis of the foundation trainees' map items to generate a generalised view of change. The following strand was deliberative, and sought to interpret the map items in the context of linked ideas and the whole. This had to be done in the context of all the items and branches to show the scope of the trainee's thinking and to what it related.

Results

All statistical analysis was undertaken using SPSS version 18.0 and Microsoft Excel.

Coding manual validation

Inter-rater reliability analysis to determine consistency amongst the two raters and validity of the coding manual was performed on 11 of the mind maps which provided 416 coding events to be analysed. Each theme that contained more than 1 code value was subject to Kappa statistical analysis and the themes with only 1 code were analysed using Holsti's (1969) formula for the calculation of percentage agreement between two coders. These results are presented in the Appendix.

One-tailed related *t* tests were performed to investigate and identify differences in the total number of items found under each theme area in *clinical reasoning* and *deliberation* and their appearances in Map 1 and Map 2. They were then performed to investigate the number of appearances of each code theme and their subcategories between maps 1 and 2. By reporting one-tailed related t tests we could also determine the direction of the change between maps 1 and 2. The results of the *t* tests performed on the total number of appearances of each theme for *clinical reasoning* are presented in table 3 and for *deliberation* in table 4.

Clinical Reasoning

The total number of appearances of all items within a theme found in maps 1 and 2 are presented in figure 1 for *clinical reasoning*.

[Insert **Figure 1** here]

There was no significant difference found in the total number of items that appeared under the *clinical reasoning* theme group for the foundation year trainees. In looking into the total number of appearances of all codes within the themes, only the total number of appearances of the *examination* theme codes showed a significant difference with an increase in number of these codes appearances in Map 2 ($p<0.01$) (see table 3).

[Insert **Table 3** here]

Looking at each individual theme code and their subcategories, some areas of difference were

indicated. The foundation year trainees had a significant decrease in the sub-category of *causes* code C5 (*neurological causes*) in map 2, (t=1.93; df=10; p<0.05; r=.52). The trainees had a highly significant increase overall in the theme code of *examination* in map 2 (t=-3.6; df=10; p<0.005; r=.75). Within this theme, two of the sub-category codes for *examination* showed highly significant increases in map 2. The code of E1 (*clinical examination*), (t=-3.1; df=10; p<0.005; r=.69), and the code of E2 (*cardiovascular /respiratory)*, (t=-2.4; df=10; p <0.005; r=.60) respectively.

The trainees had a significant increase in the appearance of the theme code of *history* in map 2, (t=-2.6; df=10; p<0.05; r=.63) although none of the subcategories within this theme indicated any significant increase or decrease in appearances between map 1 or 2.

Deliberation

The total number of appearances of all items in each theme found in maps 1 and 2 are presented in figure 2 for *deliberation*.

[Insert **Figure 2** here]

The trainees had a highly significant increase in the total number of appearances of *deliberation* items in map 2, compared to map 1 (t=-6.17; df=10; P<0.0001; r=.88). Looking at the total number of appearances of all the codes within the theme there was also a highly significant increase in the total appearance of *management*, *prevention* and *time* codes in map 2 (see table 4).

[Insert **Table 4** here]

Looking at the theme sub-categories within *deliberation*, areas of difference were indicated. The foundation year trainees had a significant increase in the *management* theme in map 2, compared to map 1 (t =-1.88; df=10; p<0.05; r=.51). Within this theme the sub-category code of M1 (*multi-system approach*) had a highly significant increase in map 2, compared to map 1 (t=-5.67; df=10; p<0.001; r=.87). The trainees had a significant increase in the *people*

perspective theme code P3 (*doctor*) in map 2, compared to map 1, (t=-1.83; df=10; p<0.05; r=.50). The trainees had a significant increase in the *prevention* theme code *Pre3* (*Doctor help, follow up*) in map 2 compared to map 1(t =-2.28; df=10; p<0.05; r=.58). The trainees had a significant increase in the *time (specific)* theme in map 2 compared to map 1 (t=-1.9; df=10; p<0.05; r=.51).

Discussion

The innovative use of Mind Maps in this study has provided us with a wealth of information regarding how each individual trainee interpreted the clinical scenario they were given. The maps of the foundation trainees demonstrated highly significant changes between maps 1 and 2, and in particular a significant increase in the number of items within *deliberation* which appeared in their second maps. We believe that experience in general practice helps to promote more patient-centred thinking about a case, adding breadth to a bio-medical model that is taught in medical school and perhaps required in other clinical settings. This is evidenced amongst participants who, by map 2, we argue had grown to taking a more patient–centred, holistic approach to this case scenario. Such growth is illustrated by the two figures (3 and 4), maps from the same trainee. Figure 4 demonstrates a much broader understanding of the case, both in terms of the number of items included on the map and in specific areas, 'management' in particular.

[Insert **Figures 3 & 4** here]

Clinical Reasoning

The foundation year trainees increased slightly in the number of items they included under *clinical reasoning*, and again by looking at the overall breakdown, it is possible to see how just a few months in general practice had an impact. For example most areas of *history taking* dropped in their second maps but their types of *examinations* rose. This could be due to a realisation of the importance of *examination* having spent time in general practice.

Deliberation

For the trainees, the use of deliberation themes and subcategories increased the most. They showed significant increase in *patient management* in map 2, especially in a multi-system approach by considering other services and referral to others. This is a very clear indication of their learning about these types of care and support in general practice. This group also had a significant increase in *people perspectives* especially in recognising doctors concerns, and an increase in the inclusion of *time-related* considerations.

This research has addressed the following two questions:

What is the value of experience in general practice in terms of learning for foundation trainees?

The value of experience in general practice in foundation training is well-recognised in the literature, however research in this area has come to be dominated by self-reported perceptions of learning and accounts of experience. This project took a different perspective on the question and gathered data prior to and after the attachment. Instead of asking participants to reflect on and identify change, their thinking was captured in relation to a case. Through doing this, the project has illustrated the value of case experience to developing thinking and charted the nature of change in thinking, allowing trainees and their educators to see their learning. This enables educational supervisors to identify further areas of learning need and development.

How does GP experience influence clinical thinking?

Our analysis indicates that the value of GP experience in the foundation years is that it provides depth and breadth to thinking, in that their interpretation of a case becomes wider and consideration is given to a holistic view of the case, extending beyond simple diagnosis and treatment, to an appreciation of the contextual factors of the case and how these may influence patient need and the doctor's management of the case. Thus experience in general practice helps trainees to tune into the situated-nature of each case, and, we argue, exposes

some of the steps in the development of professional judgement.

Limitations

The primary aim of this investigation was to make visible changes in clinical thinking amongst participants after experience in general practice. Our results demonstrate change in clinical thinking; however our results need to be read in the context of the small sample size drawn from a single locality. More research is needed to monitor the extent and duration of such change, and differences across specialties.

Conclusions

Clinical thinking is by nature an invisible process and yet it is the heart of professional practice.[3,4] In this investigation we have tried to make visible and interpret what goes on when an individual trainee doctor thinks about a case. To do this we chose to use Mind Maps as the method of data collection, as we felt they offered an unproscribed and creative means for capturing thoughts in the whole. In conducting our analysis we drew on thematic and statistical interpretations of the data and this has helped us to be more precise about the areas in which change occurs. Our analysis has suggested additional ways to look at the maps; other elements which could be considered in future research might be how the main branches grow in terms of organisational skills and a way of identifying the level of focus on the problem - a preoccupation with woods rather than trees. A further dimension could be added to the work by interviewing the trainees and asking them to comment on their maps over a period of time.

Whilst we have been able to explore changes in clinical thinking amongst foundation trainees, this study is limited and would benefit from more extensive work. A significant part of this project was to develop and refine the method of data collection and analysis, which we feel is a significant contribution to this field of research. This was a novel and unusual approach, which we feel has much future potential in guiding the formative development of trainees.

Our work indicates that Mind Maps offer educational supervisors a way to map and review learning with their trainees over time, facilitating the development of skills and knowledge to recognise the values inherent in professional judgement.

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Contributors: SW and SS were responsible for the conception of the project. SS was responsible for the design of the approach to data collection. RO facilitated access to the foundation trainees. SK developed the process of data collection, undertook data collection and data handling. Data coding was undertaken by primarily by SK with SS and CL, with input from JLM and RO. Statistical analysis of the dataset was performed by SK along with initial drafting of results. SK and SS interpreted the results. SS, SK and SW were responsible for drafting and revising the paper. All authors contributed to the critical revision of the daft paper and gave final approval to the version to be published. SK is guarantor. All authors had full access to all of the data.

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Tables, **figures** and **boxes** to be inserted in the text

An 89 year old lady, accompanied by her daughter, consults you. She has had several falls in the last two months and had a particularly bad one yesterday; she hit her head and has a black eye. How do you proceed?

Box 1: *The clinical case scenario presented to all participants.*

Clinical Reasoning		
Theme	Subcategories	Definition
Causes/Diagnosis (medical)	C1	Biomedical/Organic causes of falls
	C2	Cardiac or respiratory causes
	C3	Infection causes
	C4	Mechanical Causes
	C5	Neurological causes
Examinations/Investigations	E1	Clinical examination or investigations
	E2	Cardiovascular or respiratory system examinations
	E3	Musculoskeletal examinations
	E4	Neurological examinations
History (medical)	H1	Falls History
	H2	Past medical conditions
	H3	Symptoms
	H4	Drug history
	H5	Cardiac and respiratory symptoms
	H6	Urinary symptoms

Technical terms		Technical medical terms or procedures that are not required or unclear.
Treatment (medical)	TR1	Treatment options for patient
	TR2	Do nothing
Uncoded		Illegible Items

Table 1: *Thematic codes under 'clinical reasoning'*

Deliberation		
Causes (Non Medical)	CD1	Environmental
	CD2	Abuse
Ethics		Items that have ethical implications
History (social)		Patients past or current social history
Management	M1	Use or referral to other services
	M2	Medications review
People Perspectives	P1	Patient specific
	P2	Family specific
	P3	Doctor specific
Prevention	Pre1	Equipment options for patient
	Pre2	Nutrition/Alcohol

	Pre3	How we can help/follow up
	Pre4	Future risks
Psychological	Ps1	Patients emotional state
	Ps2	Psychosocial factors or implications
Social	S1	Social services
	S2	Social support
	S3	Nursing or rest home
Time		Time specific breakdowns
Treatment (non-medical)	TRD1	Reassure patient
	TRD2	Provide falls information to patient & family

Table 2: *Thematic codes under 'deliberation'*

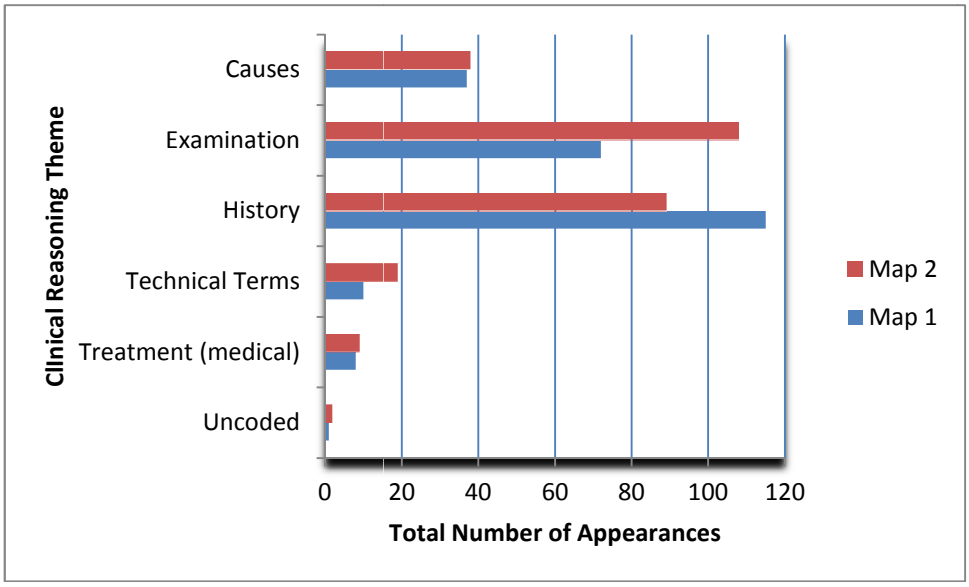

Figure 1: *Total number of appearances of all items for each **clinical reasoning** theme found in map 1 and maps 2*

Theme	Map 1			Map 2				
	Total Appearances (%)	Mean	SE	Total Appearances (%)	Mean	SE	T test (df=10)	P value
Causes	37(15.2)	3.36	1.05	38(14.3)	3.45	0.89	-0.091	>0.05
Examination	72(29.6)	6.54	0.87	108(40.8)	9.81	0.96	-2.729	<0.01*
History	115(47.3)	10.45	2.32	89(33.6)	8.09	1.40	1.122	>0.05
Technical Terms	10(4.1)	0.90	0.31	19(7.2)	1.72	0.27	-1.632	>0.05
Treatment	8(3.3)	0.72	0.33	9(3.4)	0.81	0.37	-0.219	>0.05
Uncoded	1 (0.4)	0.09	0.09	2(0.8)	0.18	0.18	-0.430	>0.05
Totals	243	22.09	2.27	265	24.09	2.12	-1.099	>0.05

Table 3: ***Clinical Reasoning*** *- each theme total appearances with percentage, mean, standard error, t tests and significance*

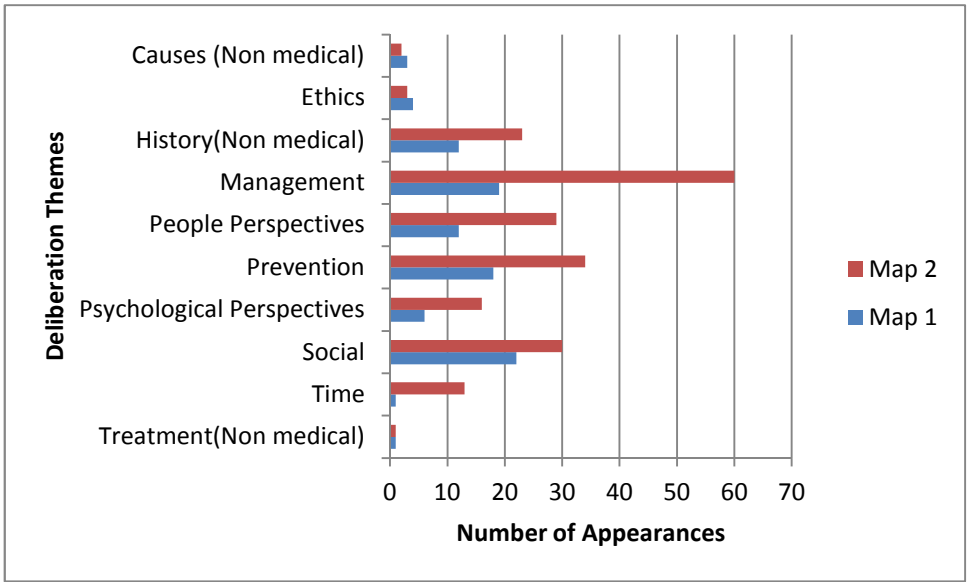

Figure 2: *Total number of appearances of all items in **deliberation** themes found in Map 1 and Map 2*

Theme	Map 1			Map 2				
	Total Appearances (%)	Mean	SE	Total Appearances (%)	Mean	SE	T test (df=10)	P value
Causes (non-medical)	3(3.1)	0.27	0.19	2(0.9)	0.18	0.12	0.559	>0.05
Ethics	4(4.1)	0.36	0.36	3(1.4)	0.27	0.27	1.000	>0.05
History/Collateral	12(12.2)	1.09	0.63	23(10.9)	2.09	0.34	-1.354	>0.05
Management	19(19.4)	1.72	0.50	60(28.4)	5.45	0.80	-4.734	<0.0001*
People Perspectives	12(12.2)	1.09	0.54	29(13.7)	2.63	0.82	-1.782	>0.05
Prevention	18(18.4)	1.63	0.49	34(16.1)	3.09	0.86	-2.281	<0.05*
Psychological	6(6.1)	0.54	0.31	16(7.6)	1.45	0.47	-1.392	>0.05
Social	22(22.4)	2.0	0.50	30(14.2)	2.72	0.75	-0.886	>0.05
Time	1(1.0)	0.90	0.90	13(6.2)	1.18	0.53	-1.936	<0.05*
Treatment (Non- medical)	1(1.0)	0.90	0.90	1(0.5)	0.90	0.90	0	>0.05
Totals	98	8.90	1.36	211	19.18	1.80	-6.178	<0.0001*

Table 4: ***Deliberation*** *- each theme total appearances with percentage, mean, standard error, t tests and significance*

Figures 3 & 4

To illustrate the changes observed between maps 1 and 2 we give two examples below.

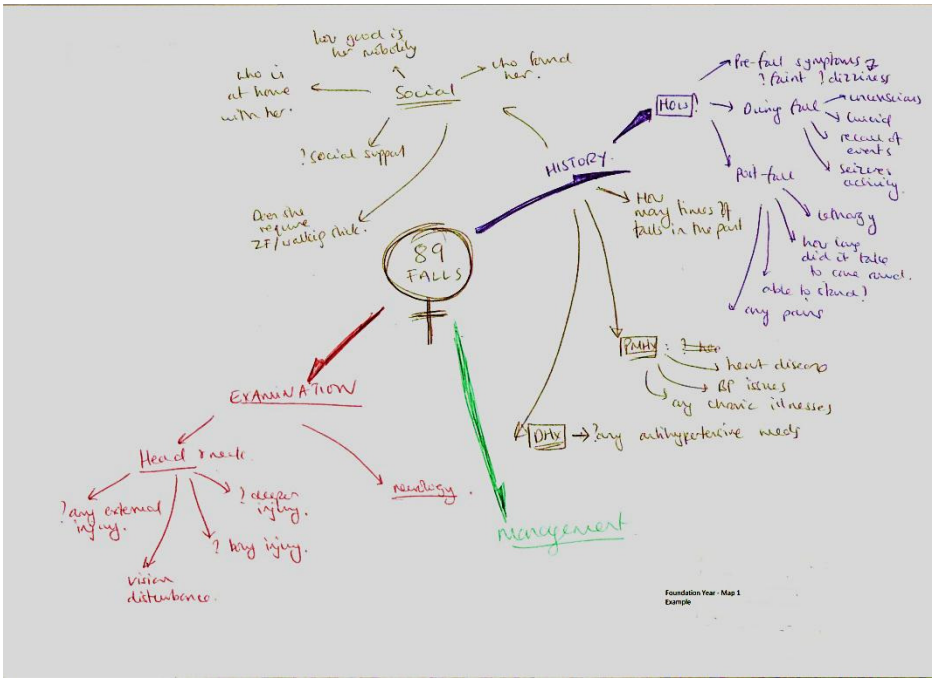

Figure 3: Example of Mind Map 1

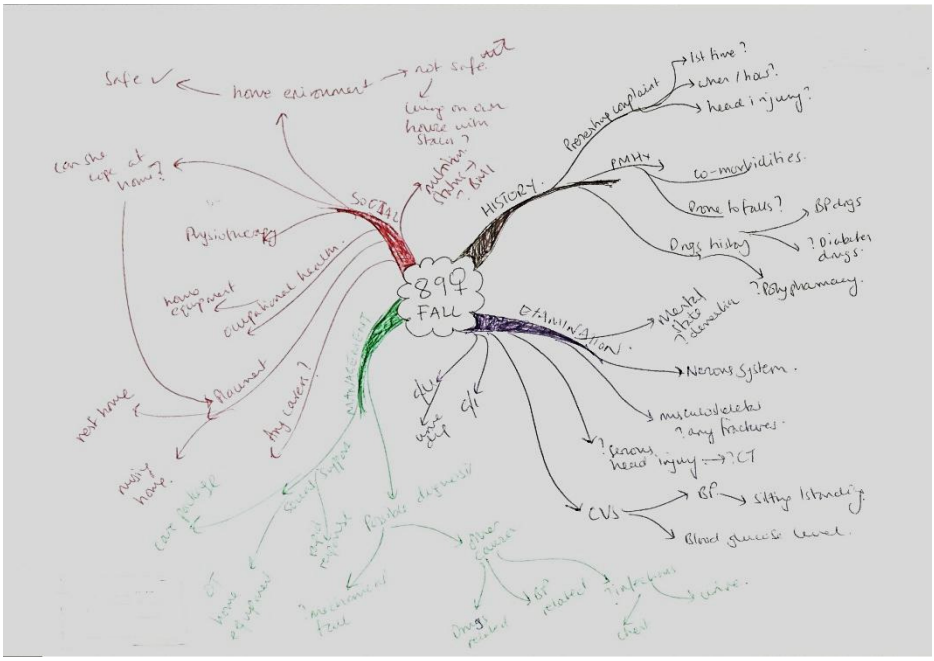

Figure 4: Example of Mind Map 2

Appendix 1 **Inter-rater Coding Manual Validity Analysis** (n= 11 maps)

Table A: *Kappa statistical analysis for all themes clinical reasoning and deliberation with more than 1 code*

Theme	Number of valid cases	Number of missing cases	Kappa result
Causes (clinical reasoning)	32	384	.962 (96%)
Examination (clinical reasoning)	56	360	.907 (91%)
History (clinical reasoning)	126	290	.947 (95%)
Management (deliberation)	31	385	1.00 (100%)
People Perspectives (deliberation)	17	399	1.00 (100%)
Prevention (deliberation)	23	393	.815 (81%)
Psychological (deliberation)	10	406	.844 (84%)
Social (deliberation)	30	386	.841(84%)

Table B: *Holsti statistical analysis for all themes clinical reasoning and deliberation with only 1 code:*

Theme	Number of code events	Number of disagreements	Holsti result
Technical terms (clinical reasoning)	15	5	0.666 (67%)
Treatment (clinical reasoning)	10	6	0.4 (40%)
Uncoded (clinical reasoning)	2	0	1.0 (100%)
Causes (non-medical) (deliberation)	5	3	0.4 (40%)
Ethics (deliberation)	0	0	
History Theme (deliberation)	20	6	0.7 (70%)
Time (deliberation)	5	0	1.0(100%)
Treatment (non-medical) (deliberation)	0	0	