21ST INTERNATIONAL CONFERENCE ON ENGINEERING DESIGN, ICED17
21-25 AUGUST 2017, THE UNIVERSITY OF BRITISH COLUMBIA, VANCOUVER, CANADA

DESIGNING MENTAL HEALTH DELIVERY SYSTEMS: WHERE DO WE START?

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Abstract

Healthcare services that consistently meet the needs of service users have to be designed. The growing demand for better quality of care, together with an increasing awareness of limited resources, are bringing attention to the need for design in healthcare. In mental health, considered the largest cause of disability in the UK, the need is great. Existing services often fail to meet demands and do not consistently deliver good quality care for all service users. The design of better delivery systems has the potential to improve service user experience and care outcome. But, where do we start? This paper reports the first stage of an ongoing research to co-design a language for designing mental health services. This stage of the research identified, through focus groups and interviews with service users and clinicians, the key components of a mental health service. This paper argues that an appropriate concept of a mental health delivery service as a system, the identification of its key components and an understanding of the association between these components form an essential first step in designing such a system.

Keywords: Service design, Systems Engineering (SE), Design process, Mental health

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Please cite this paper as:
Surnames, Initials: *Title of paper*. In: Proceedings of the 21st International Conference on Engineering Design (ICED17), Vol. 3: Product, Services and Systems Design, Vancouver, Canada, 21.-25.08.2017.

1 INTRODUCTION

Design is the process by which something is created, whether it is a product or service (Clarkson et al., 2004; Dieter and Schmidt, 2012). Design has played a pivotal role in nearly every facet of human experience (IMechE, 2012). From transportation to healthcare, engineering and design have been vital in translating scientific understanding into solutions that address specific human needs (Dubberly and Evenson, 2010; IMechE, 2012). In healthcare, the impact of design is obviously seen in the design of medical devices and medical facilities. In the design of care delivery systems, however, it is emerging that healthcare is far behind in the practice of good design (Clarkson et al., 2004; DoH, 2003). Not only that, but a search of the academic literature reveals that the design discipline has not yet played a leading role in the design and delivery of such systems. Service design research in general appears to have been more actively pursued in the management and marketing disciplines than in the design research community (Morelli, 2002; Verma et al., 2002).

The growing pressures on modern healthcare delivery systems have brought much needed attention to these systems and how they are developed or designed. The ever-increasing need to improve the quality and safety of care delivery has made it a prominent issue particularly in mental health.

Mental health has become one major area of concern for all stakeholders especially policy makers in England. Mental health problems represent the largest single cause of disability in the UK, leading to an estimated cost of £70 - £100 billion a year to the economy (Davis, 2013). At the same time, existing services often fail to meet demands and to consistently deliver good quality care for service users (Mental Health Taskforce, 2016). Three quarters of people with common mental disorders in England receive no support at all (McManus et al., 2009). Among those who get support, very few are able to access the full range of the recommended interventions (Mental Health Taskforce, 2016). It is also estimated that, if prevalence rates stay the same, approximately two million more adults in the UK will have mental health problems by 2030 than there were in 2013 (Mental Health Foundation, 2013).

An essential element in meeting this challenge is to improve our knowledge and understanding of how to achieve sustainable improvements in ongoing and future care delivery. In other words, it is to develop ways of designing better care delivery systems. But where do we start?

The work reported in this paper is part of a bigger project - the DIAGRAMS research project - going on in the University of Cambridge, UK. The DIAGRAMS project is fundamentally concerned with the quality and safety of care delivery. The nature of a care delivery service as a system means that acceptable quality and safe care are emergent properties (Crawley et al., 2015) of the entire system, with its key components and their interactions. Thus, it seems understandable that the ability to effectively describe the components of a system and their interactions is key to designing systems that deliver quality and safe care. Therefore, the specific aim of the DIAGRAMS project is to co-design a diagrammatic language or framework for describing mental health delivery services. The hypothesis is that, a structured and systematic diagrammatic language will engender shared understanding amongst stakeholders and lead to better designed services. This hypothesis is not intended to be tested statistically but to provide a motivation for study design and formulation of research questions. Details of the overall study design and research questions are provided in section 4.

This paper reports on the first stage of the DIAGRAMS research project. This stage of the project used focus groups (workshops) and interviews with service users and clinicians in a local mental health service to identify the key components of a typical delivery system. The paper argues that an appropriate conceptualisation of a mental health delivery service as a system and a way of describing its components is an essential starting point for designing such a system. An analysis of the strength of association between these components is also presented and its significance discussed.

2 SCIENTIFIC CONTEXT

The value of designing service systems and processes by carefully describing their key components through the use of various kinds of representations has been recognised for nearly a century. The pioneering work was done by Frank and Lillian Gilbreth in 1921 (Gilbreth F. and Gilbreth L., 1921). The Gilbreths presented "Process charts: First steps in finding the one best way to do work" at the 1921 annual meeting of the American Society for Mechanical Engineers (ASME). The authors argued that "every detail of a process is more or less affected by every other detail: therefore, the entire process must be represented in such a form that it can be visualised all at once before any changes are made in any of

its subdivisions". Developing effective ways of describing the details of processes, understanding the system as a whole and its subdivisions and identifying service system configurations that yield the greatest value for customers remains the challenge to service design researchers. Indeed as the service sector is now playing a significant role in the economies of the developed world, innovative service design has become key to survival for many organisations (Verma et al., 2002). As Shostack (Shostack, 1984) has argued, there is no way to consistently ensure quality without a detailed design. According to Shostack, the "piecemeal quality controls" available address only part of the service. This idea of a sufficiently complete view of a service is key to the components of a mental health delivery system we identify in this paper as presented in Section 6.

The state-of-the-art in service design research is difficult to identify in just one discipline. Research in this field cuts across several disciplines including production, operations, management, economics and design. In a comprehensive review of the service design literature, Cook et al., (Cook et al., 1999) identified several typologies by which services are classified.

Other key areas identified for service design research are characteristics of service delivery system design and the contingency of the delivery system design on the service concept (Jonsson et al., 2011). Human issues in service design have also been identified as key to service performance. Cook et al., (Cook et al., 2002) have argued that a better understanding of the behavioural scientific principles that underlie human interaction with services will enable approaching service design with the rigour found in product systems design. Most of these research issues have been focused on the business service sector in industry.

Healthcare service design on the other hand is relatively new and has had relatively little attention in the academic literature. The need for design in healthcare has long been identified as key to meeting the challenge of providing better quality and safer care in the context of increasingly limited resources (Clarkson et al., 2004; DoH, 2003). Emerging health service design research appears to fall under Experience Based Design, Development of tools for service design and development of service design language.

2.1 Emerging Healthcare Design Research

Emerging areas in healthcare design research appear to fall under Experience Based Design (EBD), Development of tools for service design and development of service design language.

The key feature of the Experience Based Design (NHS Institute, 2009) approach to health service design is the focus on involving patients or service users. It has been argued that increasing the level at which service users are involved in the design and delivery of services, has the potential to greatly improve their experiences and outcome of care. Researchers working in an NHS hospital in England (Pickles et al., 2008) report significant improvements in the experiences of 43 service users at a head and neck cancer service, as a direct result of an EBD pilot involving patients and staff.

Part of service design research has focused on developing tools to facilitate the design process or evaluating existing tools used in practice. There are several tools used for service design in healthcare but most of them cannot be found in the peer-reviewed academic literature. Jun et al., (Jun et al., 2009) first surveyed a range of the most common tools used in healthcare process modelling and categorised them into a selection framework as a guide for health service designers.

Furthermore, the authors currently have found no design language for healthcare. There are several tools and methods but these have not been developed into a unified language with well-defined semantics and syntax. Jones sees the value of such a language as enabling stakeholders to form new service ecologies, integrating environments, processes, clinical functions, capabilities in design and aligning with the life cycle of the health seeker (Jones, 2013). Dubberly and Evenson (2010) considers such a language as being invaluable for the service sector as a whole.

3 THE CASE FOR DESIGNING MENTAL HEALTH SERVICES

A significant case has been made for design in healthcare with regards to patient safety. This research has focused on mental health service delivery for three reasons: current priorities, nature of its complexity, and opportunity for collaboration.

It is well known that “systems that work do not just happen; they have to be planned designed and built” (Elliot and Deasley, 2007). The challenge, however, is how to achieve the discipline of design, in the engineering sense, in a mental health care delivery system and where to start.

This is not to suggest that a mental health delivery system is like a machine, which can be designed and built by engineers. It is important to re-iterate that this study does not consider the mental health delivery system as a machine but a system with components that interact in complex ways to produce a desired result – good quality care. In other words, the quality care that is often desired from a service cannot be achieved by just a part of the service. For instance, the best clinician acting alone will not provide quality care, neither can the best medication alone nor the best technology alone. It will take all the key components working well together to delivery good quality care. The work reported in this paper only focuses on this basic question at this stage - what are the key components of the system and what are the associations between them?
The basic belief of this research is that the disciplined approach of engineering systems design has a lot to contribute to the design of complex mental health delivery systems in order to achieve sustainable improvements in care quality. This research is about the work required to demonstrate this. Several examples exist in industry.

3.1 Software and systems engineering

The extent to which rigorous design is valued and practiced in an organisation or sector makes a significant difference to quality and performance. One example is the transformation of the software industry from what it was in the 1960s to what it is today through the use of an engineering approach. The first use of the term 'software engineering' in 1968 by F.L. Bauer is quoted by Ludewig (1996): "The whole trouble comes from the fact that there is so much tinkering with software. It is not made in a clean fabricated process, which it should be. What we need, is software engineering." That was the time of what is arguably referred to as the "Software Crisis"(Naur and Randell, 1969). Software projects of this era were known to be full of errors, often hugely over budget, overrun on due date with backlogs of waiting applications(Demarco, 1995). A situation akin to the current challenges facing healthcare delivery not only in America but also in the NHS in England. F.L. Bauer became the chair of the first conference on Software Engineering in 1968, funded by the NATO Science Committee (Naur and Randell, 1969). It is generally agreed that the software/engineering partnership was what transformed the industry. We propose that this type of success is possible in mental health if sufficient attention can be given to the design of services.
Developments in structured approach to design in Systems Engineering (SE) are similar to those in Software Engineering. Service Systems Engineering has a specific focus in SE. Karni and Kaner (2007) defined a service meta-model comprised of nine types of components: 1. **Customers**: customer features, customer attitudes, and customer preferences; 2. **Goals**: business goals, service goals, customer goals, and enterprise culture goals; 3. **Inputs**: physical, human beings, information, knowledge, currency, and constraints; 4. **Outputs**: physical, human beings, information, knowledge, currency, and waste; 5. **Processes**: service provision, service operations, service support, customer relationships, planning and control, and call centre management; 6. **Human Enablers**: service providers, support providers, management, and owner organization (enterprise); 7. **Physical Enablers**: owner organization (physical), buildings, equipment, furnishings, and location; 8. **Informatics Enablers**: information, knowledge, procedures and processes, decision support, and skill acquisition; and 9. **Environment**: political factors, economic factors, social factors, technological factors, environmental factors, legal factors (PESTEL), and physical factors.
The researchers noted that a service or service offering is created by the relationships among these service system entities. These relationships are key to providing superior value to the customer.
We find this work complementary to our finding of the ten key components of a typical mental health delivery service as discussed in section 6.

4 RESEARCH METHODOLOGY AND DESIGN

This research employed a qualitative exploratory design using focus group (Kitzinger, 1994, 1995) and semi-structured interview (Britten, 1995) methodologies. The study was originally designed to use focus groups only but due to the extreme difficulty in finding a good number of clinicians and managers available at the same time, the research protocol was modified to include face-to-face interviews only for the clinicians.
Due to the exploratory nature of the study, this modification was not considered to have a significant impact on the study. The semi-structured interview approach was chosen to ensure that the face-to-face

interviews were as close as possible, in content, to the focus groups. And, since "focus groups are a form of interview" (Kitzinger, 1995) the two methods were complementary.
For the DIAGRAMS research project over all, four focus group sessions involving 6 service users and lasting 2.5 hours each were conducted. 18 in-depth semi-structured interviews lasting about 1 hour each were also conducted with clinicians and managers within the mental health service.
The overall design for the DIAGRAMS research project is shown in Figure 1. To provide a logical flow for the empirical work, we employ a semiological framework – categorisation, semantics, syntactics and pragmatics - for structuring the research workshops. Semiology is the study of how humans communicate with signs (Bertin, 2011). This may be exemplified through a basic semiological examination of the English language. All English nouns represent or suggest objects and ideas in the real world, for example “tree”. Grammar defines how nouns are put together to form a sentence, for example “the tree is tall”. Comprehension is defined as how well readers understand the real-world concepts that the sentence is describing, based on the way the sentence is written. We will develop the diagrammatic language for healthcare following this same semiological framework. In this paper, however, we focus mainly on the first stage (categorisation), exploring the real world (healthcare) domain to identify the "tree" - the key components of a typical mental health delivery system.
At this stage, the focus was on encouraging the service users to tell detailed stories of their experiences receiving care within the mental health service and for clinicians to tell similar stories of their experiences providing care. These stories surprisingly provided an excellent window into the delivery system and helped identify the components.

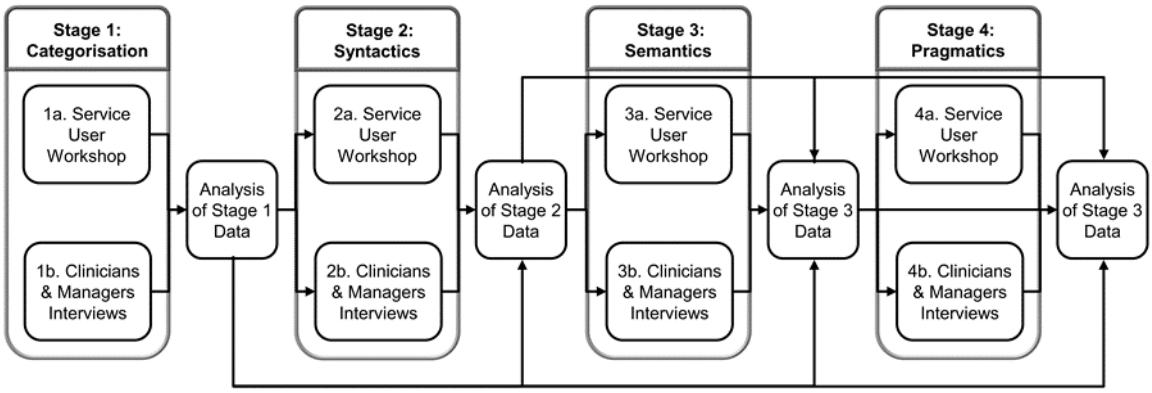

Figure 1. Research design

5 DATA ANALYSIS

All focus group (workshop) and interview sessions were recorded and transcribed verbatim. The method of analysing the data was qualitative with coding for exploratory purposes only and not necessarily in a rigorous thematic manner. The general plan for coding the data is as follows:
The transcribed data was imported into the ATLAS Software package. The first stage of analysis was the identification of "quotations" which represent a meaningful portion of a participant’s narrative. Secondly, we identify, within each "quotation", every element of the care delivery system that occur and assign to it a code according to what the particular element may be referring to. An example of a quotation and its associated codes are shown in Figure 2 below.
The basic principle of this analysis is that the stories that service users tell of their experience receiving care and the stories that staff tell of their experience providing care can give us a window into the healthcare delivery system. This means that the components of the system which we identify are not conceptually imposed on the system but empirically derived from the experiences of major stakeholders.

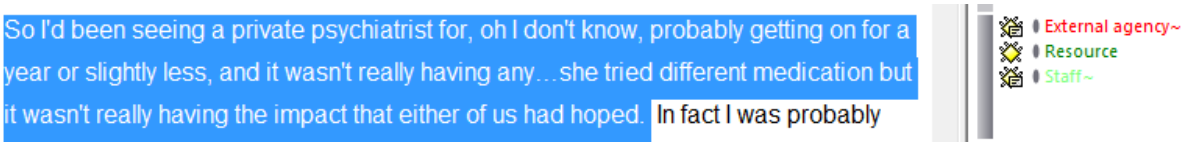

Figure 2. An example of a quotation and associated codes

6 RESULTS

The results at this stage of the research are the identification of the key components of a typical mental health delivery system and the association between these components. Ten system components have been identified as follows:

1. **Staff**: The people who are directly involved in the provision of care.
2. **Processes**: The activities that are done to or for the person with the condition in order to achieve the goals.
3. **External agencies**: Everything else that can have impact on the service but is not directly within it. For example police, schools, the council or even the weather.
4. **Person/Group**: Individual, group or population for whom the service is developed.
5. **Resources**: Money, materials, staff, and other assets that are needed by a person or service in order to function effectively.
6. **Interventions**: Things such as drug treatment, physical activity or psychological therapy which a person needs in order to improve the condition.
7. **Data/Information**: Facts, statistics, current knowledge about conditions which may be provided to a person with the condition or used by staff/carers in doing their work.
8. **Conditions**: A disease, illness or any physical or mental disorder.
9. **Family/Friends**: Friends and family of the individual, group or population for whom the service is developed.
10. **Goals**: The results desired by a person with a condition or the results desired by the service in relation to the condition.

	Staff	Processes	External agency	Person/Group	Resource	Intervention	Information	Condition	Family/Friends	Goals
Staff		0.23	0.25	0.23	0.31	0.09	0.21	0.11	0.06	0.04
Processes	0.23		0.26	0.27	0.14	0.16	0.1	0.17	0.08	0.06
External agency	0.25	0.26		0.17	0.16	0.11	0.1	0.13	0.09	0.08
Person/Group	0.23	0.27	0.17		0.18	0.15	0.12	0.08	0.02	0.06
Resource	0.31	0.14	0.16	0.18		0.09	0.16	0.04	0.04	0.04
Intervention	0.09	0.16	0.11	0.15	0.09		0.04	0.09	0.09	0.04
Information	0.21	0.1	0.1	0.12	0.16	0.04		0.03	0.04	0.03
Condition	0.11	0.17	0.13	0.08	0.04	0.09	0.03		0.04	0.02
Family/Friends	0.06	0.08	0.09	0.02	0.04	0.09	0.04	0.04		0.03
Goals	0.04	0.06	0.08	0.06	0.04	0.04	0.03	0.02	0.03	

Figure 3. Matrix of the components of a mental health service

Within the context of the study, this finding suggests that in order to design a mental health delivery system, those involved must understand each of these components and how their interaction impacts on actual service user experience.

The analysis also included an exploration of the strength of association between the above components as occurred in the participant narratives. The co-occurrence matrix of the result is shown in Figure 3.

The value in each box represents the Co-occurrence Index (C-Index) which is a normalised frequency of the corresponding components occurring together in a "quotation". The higher the value the stronger the association. As can be seen in the figure, the darkest boxes towards the upper left corner have the strongest association whilst the darkest boxes towards the lower right corner have the weakest association. It is important to note that this is not about which component is more or less important but rather a measure of the frequency with which any two components occurred together in a quotation.
Figure 4 summarises how service users in mental health, represented by the Person/Group component, are associated with all other component. Figure 5, similarly, summarises how staff as a component of the system is associated to every other component. In this case, staff have the strongest association with resources.

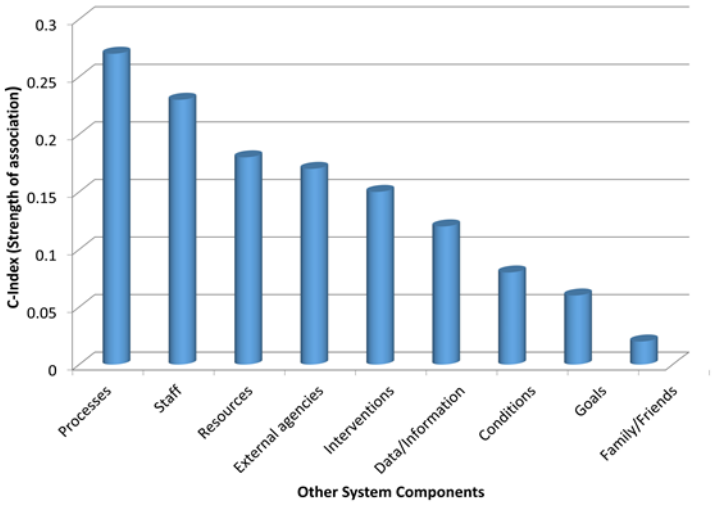

Figure 4. Summary of the strength of co-occurrence of Person with other components

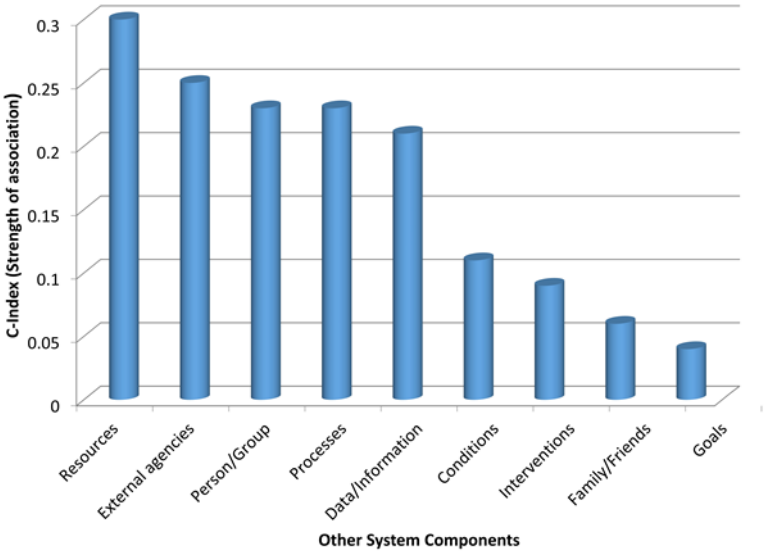

Figure 5. Summary of strength of co-occurrence of staff with other components

7 DISCUSSIONS

It has been suggested, based on evidence from the literature, that the design discipline has not yet played a leading role in service design research in general and is particularly absent in healthcare service design. It is therefore hope that findings reported here will stimulate discussions within the design community

and provide constructive criticism for the on-going research. Interesting consistencies between these results and the works of a few other researchers have been observed.

7.1 System components

Karni and Kaner (2007) proposed a service system meta-model comprising of nine generic system components. They argue that the interactions between these elements is the determinant of the quality of customer experience. The work of these researchers, to a considerable extent, is consistent with the findings in mental health care reported in this paper. Table 1 below summarises the two results. It may be seen that there is similarity between seven pairs of components though they may not be described in the same words. The mental healthcare system has three unique components - Interventions, conditions, and family/friends whilst the business service system has one unique component - Outputs.

Table 1. Comparing components of a mental health service system and business service system

	Mental Health Service System	Similarity	Business Service System*
1	Staff/Carers	Similar	Human enablers
2	Processes	Similar	Processes
3	External agencies	Similar	Environment
4	Person/People/Group	Similar	Customers
5	Resources	Similar	Physical enablers
6	Interventions	Unique	--
7	Data/Information	Similar	Informatics enablers
8	Conditions	Unique	--
9	Family/Friends	Unique	--
10	Goals	Similar	Goals
11	--	Captured in 1,4,5 and 7	Input
12	--	Unique	Output

*Karni and Kaner, 2007

These results show ten components of the mental health delivery system based on the analysis of the stories of service users and clinicians. Like Karni and Kaner, this paper argues that it is the interaction of these components that determine the quality of care, safety and service users' experience.
Based on this, it is suggesting that quality, safety and positive service user experience are emergent properties of the delivery system and cannot be achieved by only focusing on just a few of these components, however important they may be. It is necessary to continue to understand these components and the interactions between them including the mechanism of how changes in these interactions impact on quality care.

7.2 Interaction between components

The complex nature of the interactions between the components of a system is the strongest argument for design. The evidence for the boundedness of human rationality should be clear motivation for seeking and adopting a systematic approach to improving quality of care. As Shostack (1984) has argued, better service design provides the key to market success and to growth.
Our results present a perspective on how we may begin to explore the complex interactions between the components of a delivery system. A number of observations may be made from our results. For example, Figure 4 shows that service users in a mental health delivery service studied have the strongest association with the processes of the service. This makes sense as the focus groups focused on participants describing their experiences of receiving care and providing care. People are more likely to make reference to processes in talking about their experiences of care than for instance their goals or friends and family. Incidentally, these results being as we may expect, is the very reason they provide further insight. For instance, we may also infer that in order to meet the goals of service users and even service goals, we may need to design and deliver better processes thereby improving service user experiences where there is greatest association.

7.3 Emerging service design language

Research into creating a service design language has been identified as invaluable for a while (Dubberly and Evenson, 2010). Jones (2013) has referred to this in the context of healthcare as "a design language for care service". This research is primarily about addressing this need. In presenting this paper it is intended to suggest that the first step in developing such a language is the appropriate conceptualisation of the reference domain and identifying the key components that the language needs to describe. This represents the categorisation stage in the semiological framework. There is still a lot more work to be done in developing the semantics, syntactics and the pragmatics which all form part of our future research work.

8 CONCLUSIONS AND FURTHER WORK

This paper has presented results from the first stage of an on-going research into co-designing a diagrammatic service design language for mental health delivery systems. The paper has focused on stage 1, the qualitative exploratory study aimed at identifying the key components of a typical mental health delivery system and the relationships between these components.

The results show that a typical mental health delivery service has ten key components namely; staff, resources, external agencies, person/groups, processes, data/information, conditions, interventions, family/friends and goals. All of these components are vital to the delivery of good quality and safe care and need to be taken in to account in any service design work.

The results show that all of these components have different levels of association with each other based on the analysis of how frequently they occurred together in participants' narratives. It was found for instance that service users in the service who were represented as the person/group component have the strongest association with processes whilst staff had the strongest association with resources. These associations are not meant to show which components are more or less important but they might be useful in helping service designers better understand the complex inter-component interactions.

In order to develop a complete service design language for mental health delivery systems, there is the need to further develop the semantics, syntactics and the pragmatics which is what our further work is about.

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ACKNOWLEDGMENTS

This Research was supported by the National Institute for Health Research (NIHR) Collaboration for Leadership in Applied Health Research and Care (CLAHRC) for the East of England at the Cambridgeshire and Peterborough NHS Foundation Trust. The views expressed are those of the authors and not necessarily those of the NHS, the NIHR or the Department of Health. The authors will also like to acknowledge the contributions of the Service User Advisory Group (SUAG) and Ms Ruth Holmes for their valuable contributions in shaping the DIAGRAMS research.