THE USE OF EVIDENCE BASED DESIGN IN NHS CONSTRUCTION

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Evidence Based Design (EBD) is a process that bases design decisions on credible research and data to produce the best possible environments and outcomes. This process is most effective in hospital design where it can improve patient and staff outcomes and save the organisation money over time. Information regarding the processes and benefits of EBD is readily available, but there is a lack of knowledge on whether it is actually being implemented in the NHS. This paper explores the use of EBD in NHS construction and seeks to determine whether the value adding opportunities it offers are being utilised. An examination of the relevant literature revealed the processes of EBD, the contrasts to traditional hospital design and the barriers to its implementation. These primary themes were further explored through interviews with NHS professionals, researchers and designers, and the use of EBD was investigated via a nationwide survey of architects. The findings show that NHS Trusts have little awareness of the importance of the built environment in hospitals and are sceptical towards the value that EBD offers. This, along with the higher cost of EBD and the current economic climate, contributes to the use of EBD being relatively rare within the NHS, especially on smaller scale construction projects. With a predicted shift away from large hospital projects, the future of EBD in the NHS looks bleak, and therefore this research raises the question of whether the NHS is really striving to get the best value from its construction projects.

Keywords: briefing, design management, evidence based design, procurement.

INTRODUCTION

"Patients with access to daylight and external views require less medication and recover faster". (Royal Institute of British Architects 2011)

Research studies undertaken over the past 30 years have shown the extent to which the built environment can impact the outcomes of its occupants (see, for example Ulrich *et al* 2008), and more so in healthcare facilities than in any other setting, where patient wellbeing and staff effectiveness can be enhanced (Kroll 2005). The process of converting scientific research into the design of a facility is called Evidence Based Design (EBD). As well as improving patient and staff outcomes, EBD has been proven to have a beneficial effect on business performance, with vast potential monetary gains linked to improvements in patient stay times, medical errors and staff absenteeism (Ulrich *et al* 2008). With NHS Trust budgets being reduced in recent years (HM Treasury 2012), EBD has the potential to offer long-term efficiencies.

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This study reveals that whilst there is a plethora of information on design research studies (see, for example Ulrich *et al* 2008) as well as the process, benefits and barriers to EBD from institutions including the Health and Care Infrastructure Research and Innovations Centre (HaCIRIC) and the Department of Health (DOH), there is lack of literature addressing the extent of EBD adoption within the healthcare sector in the UK. The only institution that has researched the adoption of EBD in healthcare specifically is the US Centre of Health Design (CHD) and whilst leading the way globally on the issue, sheds little light on the situation in the UK.

This research study aims to investigate the current use of EBD within the NHS to determine whether the value-adding opportunities it offers are being harnessed in public health sector projects. To achieve this aim, the research will explore the EBD process, evaluate its potential benefits and assess the awareness of EBD, as well as appreciation of design generally, with NHS professional and designers. The extent to which EBD is used on NHS projects will be evaluated, with special consideration given to the project's size. Finally, working from a speculative hypothesis that EBD is not widely used within the UK, the barriers to its implementation will be examined and discussed.

RESEARCH BACKGROUND

Design and Construction of Healthcare Facilities

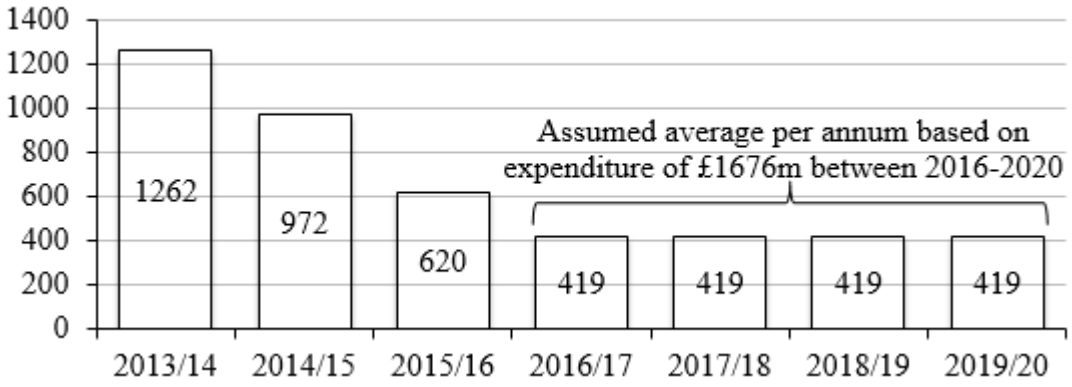
According to HaCIRIC (2009) and Ulrich (2000) decisions regarding healthcare design are often made with little consideration of their potential impact on building performance, occupancy and patients. One possible explanation for this is that until relatively recently the evidence of environmental impact on occupants was somewhat anecdotal in nature. This was until 1984 when Dr. Roger Ulrich carried out a seminal study that scientifically proved the physical environment could help or hinder patients recovery (Zimmerman 2009) and led to the emergence of the field now known as Evidence Based Design (EBD).

CHD (2010) define EBD as *"basing design decisions on credible research and data to produce the best possible environments and outcomes"* and many believe that the implications of EBD are more acute in healthcare facilities than any other type of building (Kroll 2005). Ulrich *et al* (2008) carried out an extensive review of evidence based research in hospital design and organised the potential areas of improvement into three categories; patient safety, other patient outcomes and staff outcomes. The first category includes reducing hospital acquired infections, medical errors and patient trips, slips and falls. The second includes reducing the requirement for drugs, reducing patient stay time and improving the overall patient satisfaction. The last category includes reducing staff absenteeism and turnover. These factors combined currently cost the NHS billions of pounds each year (Patient Safety Agency 2007/ 2013; Association of the British Pharmaceutical Industry 2012; Deltex Medical Group 2013; NHS 2009) so improving them could provide the NHS with significant cost savings. This concept was put to the test by Berry *et al* (2004) who carried out 'The Fable Hospital' study. This estimated that implementing EBD in a fictitious healthcare facility would add £7.8m to the construction cost, but result in an annual operational saving of £1.6m. With a payback period of 5 years, this example makes a strong business case for the use of EBD.

Hoover *et al* (2006) explain that, unlike a traditional healthcare project brief which would usually comprise of a functional list of physical and spatial requirements, EBD

adds a set of results-oriented objectives, such as reducing hospital acquired infections. Once these objectives have been set, EBD follows a four stage process, starting off with rigorous evidence acquisition, followed by design hypothesis development, which is when the collated research is implemented in the design (Hamilton *et al* 2009). Post Occupancy Assessments (POAs) then takes place to see whether the outputs delivered match the hypothesis, before finally reporting and publishing the findings. These stages all require commitment and crucially, sufficient resources invested in them. However, with Government expenditure on healthcare construction expected to steadily reduce until 2020 (HM Treasury 2012) as illustrated by Figure 1, AMA Research (2012) and Kappa Consulting (2011) predict that NHS Trusts consider smaller refurbishment schemes rather than larger projects in the future.

Figure 1: Government expenditure on healthcare projects (£m). Source: HM Treasure 2012)



Despite the decreasing budgets, the NHS Business Case Approvals Process (2013) states that despite the *"already stretched and finite resources for investment... the NHS is committed to providing best value for taxpayers' money"*, which includes taking into account lifecycle costing as well as initial Capital Investment.

Current Use of EBD in Healthcare

Two surveys commissioned by CHD in 2009 and 2010 indicated that whilst the use and acceptance of EBD has grown over recent years**,** it is unknown how this knowledge is being translated into the design of new healthcare facilities. Whilst the findings indicated that 71% of respondents 'sometimes' or 'regularly' used EBD, this may not be a true representation of the industry, as the survey sample was *"heavily weighted towards those already familiar with the work of the CHD"* (CHD 2010). Also, whilst the surveys were intended to be international, over 85% of the respondents were from the USA or Canada, and only 1.8% from the UK. CHD also collate and document examples of EBD in use, via their 'pebble project' which invites members to submit projects. Of a total of 37 collated projects, only one is in the UK compared to 31 in the USA (CHD 2013). This implies that either EBD is not as widely used outside of the USA, or that other countries are not as aware of this CHD initiative, which is likely considering that less than 10% of its members are from outside the USA (CHD 2014). It is noteworthy that all 37 examples of facilities using EBD are new build hospitals, implying that the use of EBD on refurbishment projects is non-existent. Anecdotal reports support the opinion that EBD use is still in its infancy, with Stall (2012) referring to it as *"embryonic in practice"* and Goodman stating that *"we've only scratched the surface with healthcare providers to actually practice evidence-based design"* (see Stall 2012).

Barriers to EBD Use in Healthcare

There is doubt over the reliability of research evidence used in EBD and Kroll (2005) states that much of it transpires to be more anecdotal than scientific. Ulrich *et al* (2008) explain that this is partly due to the complex nature of hospital environments, making it impossible to isolate the effect of one particular environmental change. Doubts have also been cast over the accuracy of measuring outcomes when they relate to people, as they can be difficult to quantify (HaCIRIC 2008) and are subject to variables such as age, gender and illness (Codinhoto *et al* 2010).

Another hurdle for EBD is investigating the design research. Sailer (see Brooks 2012) warns that scientific research may not be understandable to average designers and Kastner (see Kroll 2005) agrees, stating that their lack of experience may present an obstacle. It doesn't help that the research, often presented in the form of academic papers, is rarely user-friendly and tends to be full of academic jargon (Brooks 2012).

Sailer (see Brooks 2012) highlights the difficulty in persuading clients on a tight budget and timescale to carry out an EBD process. Nussbaumer (see Whitemyer p12) concurs, stating that clients often cannot afford pre-design research. In addition, EBD often leads to a higher capital cost and as such requires a longer term view towards potential operational savings, rather than short term cost (Kroll 2005).

Summary of Research Background

EBD differs from traditional hospital design, partly by its outcome driven nature and by the four stage process it follows. It appears that the use of EBD is not widespread in the UK and possible reasons for this are the difficulty of carrying out the research process as well as the cost and time associated to it. The literature surrounding the current use of EBD, however, is limited and centered largely in the USA.

METHODOLOGY

Theoretical Perspective

Epistemology is principally concerned with the theories of knowledge (Knight and Ruddock 2008). This study is based on a Constructivist epistemological approach, which is the view that all knowledge and meaning is derived from human practices and interaction (Crotty 1998). This concept of knowledge and meaning existing within a social context has clear links to an ontological perspective that Bryman and Bell (see Knight and Ruddock, p7) describe as the world being formed of social constructions built up from the actions and perspectives of the people in it. As such, in order to gain understanding, an Interpretivist approach is needed where the researcher places themselves in the research and makes subconscious judgements based on past experiences and values (Strauss *et al* 2008).

This research study began with the tentative hypothesis that EBD was not widely used in the UK and from this point an exploratory study, using a primarily qualitative research approach, took place in an attempt to formulate a theory. This process followed one particular Inductive approach called Grounded Theory; where theory is seen as growing out of data rather than starting from a specific hypothesis (Costley *et al* 2010). This study loosely followed a Corbin and Strauss form of Grounded Theory, which contains more specific research techniques and procedures than the original Strauss and Glazer approach. Due to the initial tentative hypothesis however, this study can be considered to follow a modified Grounded Theory approach.

Quantitative research techniques were utilised in order to triangulate the data to ensure that a robust argument and theory was formed.

Methods

A literature review was undertaken initially to identify the key areas of relevance. The themes that developed focussed the study in the data collection stage and the review continued concurrently with other data collection so that concepts were constantly updated and compared between sources.

A theoretical sampling approach was taken during the research, allowing emerging concepts to be followed that are not predetermined (Strauss *et al* 2008). The resulting final sample of interviewees included:

- Three Members of NHS Management
- One academic researcher specialising in healthcare design
- One DOH executive, but not in an official capacity
- Three architects involved in healthcare design

The significant amount of data gathered from the interviews was analysed by 'coding' following the format set by Corbin and Strauss (2008), which splits data into higher-level categories and lower level concepts. Memo writing, a specialised type of written record that contains the products of analysis and captures the evolving thoughts of the researcher (Strauss *et al* 2008), was utilised alongside this process.

A survey sought to verify or dispute concepts derived from the interview process by using a larger sample. This took the form of an online questionnaire sent to architects on the RIBA Chartered Practice Register (healthcare projects), the Procure 21 framework, and the 'Architects for Health' register. In total, an invitation to complete the online survey was emailed to 1150 individuals and practices. From the sample, 63 responses were logged and confirmed to be valid, and went on to be analysed. The inferential statistics Chi-squared (X^2) method was used to analyse the survey data, which was deemed appropriate due to the relatively large sample and because the data is nominal. Other elements of the survey were analysed and referred to via a descriptive statistics method.

RESULTS

Current Use of EBD

The literature highlighted that the use of EBD in the UK and in refurbishments is limited **(**Stall 2012; CHD 2010**)**. The survey showed that 84% of respondents have used traditional design guidance on hospital projects, compared to 37% of respondents who have used EBD, illustrating that traditional design tools are much more common method of informing design and that the majority of healthcare designers are not using EBD at this time.

A tentative hypothesis at the beginning of this research was that EBD is not used as widely on smaller hospital projects as it is on larger ones. Using Chi-Squared analysis, table 1 shows that the frequency (O) of large projects (over £20m in value) that are subject to EBD (box 5) was significantly higher than expected, whereas small projects (less than £1m in value) was much lower than expected (box 1). The adverse was true when examining projects that have not used EBD. The calculated X^2 falls higher than $P = 0.001$ meaning that there is less than 0.1% probability that these results would occur by chance.

Table 1: Contingency Table Between EBD use and Project Size

	EBD has been used	EBD has not been used	
Small project	1 O = 10 E=20.7	2 O = 48 E=37.3	58
Medium project	3 O = 20 E=17.1	4 O = 28 E= 30.9	48
Large project	5 O = 16 E=8.2	6 O = 7 E=14.8	23
	46	83	129

O = Actual occurrence E = Expected occurrence

It is interesting to note that of the 10 cases of small projects using EBD, seven of these were carried out by architects who have also carried out projects of £20m or more, suggesting that architects who have implemented EBD on large projects have then decided to apply it to their smaller projects. There were only two cases of architects carrying out EBD who worked solely on small value projects.

The significance of these results is revealed when viewed in the wider context of construction in the NHS. The literature states that due to Government budget cuts the number of large scale projects is likely to drop and be replaced by more refurbishment work of a smaller nature **(**Kappa Consulting 2011; AMA research 2012) which suggests that the use of EBD will decline as a result.

Barriers to Use of EBD

Lack of Awareness

Fundamental to EBD is the belief that the built environment can have an impact on the wellbeing of its occupants. Interviews with NHS professionals showed that there was some knowledge of this concept, albeit not an in-depth one. The academic researcher believed that "people don't think that the environment is important', which reflects a frustration that was found amongst all the interviewees who were advocates of EBD. There was speculation that this could be because those managing projects have little experience or training in design and therefore do not realise its importance. Associated with this finding, there was a distinct lack of awareness of EBD, specifically within NHS Trusts. The architects were more aware of EBD, but one stated that "there are many architects who aren't aware of the research out there", which appeared to be the case with one of the architects interviewed.

The study found that the extent of awareness amongst architects of EBD seemed to have a relationship with the size of projects worked on, with 75% of respondents who had only worked on projects under £1m being aware of it, compared to 91% of respondents who had worked on projects with a budget of over £20m. A possible explanation for this is that DOH funded capital projects over a value of £20m are required to undergo an NHS design review, and this more in-depth consideration of design is conducive to an EBD approach. Another possible explanation is that larger projects are more likely to have the resource to facilitate an EBD approach.

Lack of Client Support

It is significant that this study found that support of EBD within NHS Trusts is relatively rare. The academic researcher expressed that there was *"no will to build the Fable Hospital"* in this country because of the attitudes of the NHS Trusts, who are rigid in their ideas, closed to new methods and too focussed on the initial cost of implementing EBD and not enough on the long-term gain. Also attributed to the lack of client support was *"the constant NHS capacity pressure"*, as described by one of the interviewees. All of the NHS staff interviewed noted that patient throughput and number of beds tend to take priority over the nature of the environment, noting that *"The clinical need will always override the environment"*. One NHS manager had seen an example of where views of outside from patient bedrooms were obstructed by a development to increase additional capacity. These issues indicate a lack of desire by NHS Trusts to invest in good design practice, both because they do not believe in the benefits that it can create and also because they are prioritising other factors such as capacity ahead of the environment.

The Nature of The Evidence

A limitation of EBD is that it relies on research that is often considered anecdotal rather than scientific. Scepticism towards EBD from the NHS Managers centred on the difficulty of quantifying the benefits that it brings, particularly when you are referring to factors relating to patient wellbeing and stress. It is likely that this opinion is be echoed by clinicians who are used to dealing with robust scientific evidence. Even when there are measurable improvements to outcomes, the question of how they can be attributed to a particular design element was raised. For example, one NHS Manager stated that patient stay length has been decreasing steadily over recent years, so if an open ward was changed to single rooms and the length of stay reduced, you could not know that it was as a result of this change rather than the trend that would have occurred anyway. The academic researcher admitted that this was an impossible task since it requires a completely controlled environment, which a hospital can never be. These issues were highlighted by Codinhoto *et al* (2010) and Ulrich *et al* (2008) and have proven to be a significant barrier to EBD.

The Process of EBD

A prominent barrier that emerged when discussing EBD was the cost and time of carrying out the research stage. This was raised by Sailer (see Brooks 2012) and Nussbaumer (see Whitemyer, p12) as a potential issue and was highlighted by the architects and academic researcher as well. This stage of the EBD process was described as *"time consuming"* and *"laborious"* and in a world of competitive tendering for architectural services, the fees associated with carrying out this process can make it unappealing to NHS clients. The length of time to carry out the research stage on hospital projects is also deterring NHS Trusts from using it.

The issues of quality and accessibility of research was also raised, with one interviewee referring to many of the research papers as *"rubbish"*, which made the process of finding the relevant evidence difficult and time consuming. Some spoke of the difficulties in retrieving information, as research is often *"buried in journals"* which not all architects have access to. This corresponds with the findings of Sailer (see Brooks 2012), Kastner (see Kroll 2005) and Brooks (2012) in who raised the difficulty of the research process as a barrier to its use. The CHD database attempts to overcome these barriers by collating credible research studies, but it would appear from the findings that this is not well-known or used by UK architects.

Many felt that there was a reluctance to carry out Post Occupancy Assessments with any degree of rigour, largely because there are rarely fees allocated to this stage and there was also mention of the difficulty in accessing the areas and staff in order to be able to carry them out. POAs are an essential part of EBD as it establishes if the design hypothesis has been proved true, and will enable the expansion of knowledge for future design research, which is integral to EBD. Therefore the lack of enthusiasm for undertaking them is another barrier to the implementation of EBD.

Economic Climate

The current financial state of the NHS and the impact this is having on capital projects was highlighted as a problem by most of the interviewees. With many NHS Trusts expected to make savings, all spending is being heavily scrutinised and anything conceived as unnecessary is being scrapped. This can present a conflict for NHS Managers, who often recognise that there are long term cost saving initiatives to be utilised from capital projects, but have no capital to invest in them at the moment. The extreme pressure of the current financial situation for many NHS Trusts therefore means that investment in using an EBD approach is unlikely, and the slow economic recovery means it is difficult to know when that situation might improve.

Poor Planning

EBD is based on the concept of using design as a tool for achieving long-term outcome improvements and efficiency savings. For this approach to be adopted it requires the client to have a long-term plan for their business. All of the NHS managers felt that there was a lack of leadership from central government regarding the long-term building programme for the NHS, and that healthcare was used as a tool for the short-term gain of political parties, with one stating *"because there's no long term planning, it's very knee jerk....that's from the government, that's lack of leadership"*. The lack of long term planning may stem from the regular shifts in power of political parties, leading the priorities and objectives for healthcare to change frequently and the decisions of previous governments to be altered. The academic researcher was concerned that politicians do not realise that current hospital projects are built for 10–20 years in the future and that waiting until that time to act will result in the current hospitals being unable to cope with advancing medical processes. The lack of strategic planning and the fast track approach to building is not conducive to an EBD approach as it does not allow sufficient time in the process for it to take place.

CONCLUSION

The aim of this research study was to investigate the current use of EBD in the NHS to determine whether the value adding opportunities it offers are being harnessed in public health sector projects. The EBD process has been explored via the use of interviews with people who have researched it, used it or have either been unable to, or chosen not to, use it. The benefits it can offer have been evaluated and it is apparent that EBD can provide significant advantages over traditional hospital design. When taken in context with some of the problems that the NHS encounters surrounding patient and staff safety there is potential for significant wellbeing and financial improvements for the NHS by implementing EBD in their capital projects.

However, the results of this study suggest that EBD is not widely used in the NHS, particularly in smaller construction projects. Barriers to its use that have been explored included a lack of awareness and client support, the expense and time of undertaking it, the current economic climate and poor planning, all of which account for its low level of use. Most of the barriers to EBD stem from the attitudes of the

NHS towards it and the lack of recognition of the importance of design and the environment. Attitudes are often deep rooted and difficult to change, which casts doubts over the future for EBD in NHS construction.

The original hypothesis that EBD is not widely used in the NHS has been supported and it can therefore be concluded that the NHS is not fully reaping the potential benefits that EBD can offer. These benefits relate not only to patient and staff wellbeing, but to long-term financial gains also. The apparent dismissal of the Fable Hospital model implies that the NHS is not seeking the best value for money in accordance with its own Business Case Planning Process. As such, the topic of life cycle costing in NHS construction is one which would benefit from further research.

It is recommended that steps be put in place to help facilitate the use of EBD within the NHS on all, or at least most, of their construction projects. Central government have a key role to play in this initiative, by ensuring that investment is put in place for its delivery, and that training and education for NHS Trusts is not only available, but actively encouraged. Undertaking trial EBD projects and using these as educational resources for NHS Trusts would raise awareness amongst NHS Managers of the potential impact and importance of design. Changing attitudes to healthcare design is essential for the success of EBD in the UK, and this will only be achieved through long-term buy in and commitment from all parties involved in NHS Construction.

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