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Abstract. Specific elements of building services such as heating, ventilation or water supply systems can play a key role in infection prevention and control (IPC) within hospital buildings and links between the design of such systems and increased rates of healthcare associated infections (HAI) have been identified. These links are complex and multifactorial and several issues have a bearing on this relationship during the construction of a hospital buildings. One such issue is the nature and efficacy of the engagement of IPC specialists employed by the client end user during the development process. Good management of IPC issues not only supports effective IPC team engagement but depends upon it to achieve key aims. Research suggests, however, that the quality of IPC team engagement is not always optimal and there is a gap in knowledge around how this can be addressed.

This research focuses on a qualitative evaluation of the nature and efficacy of the engagement of IPC teams in the construction lifecycle development of new hospitals. Using in-depth interview data, the experiences of IPC team members will be explored and barriers and facilitators to high quality engagement identified. This data will be used to develop the foundational principles of an improvement strategy for the engagement of IPC teams within the construction lifecycle development of new hospitals in the UK. Post-pandemic, the role of the built environment in the spread of infection and the processes developed to manage this will be under increased scrutiny. This paper adds to this growing body of research.

1. Introduction

The benefits of cleanliness and good ventilation in the control of infection and the health and wellbeing of patients have been acknowledged within the hospital environment since at least the 19th century [1]. Similarly, greater understanding of the modes of transmission of disease-causing microorganisms led to key infection prevention and control (IPC) interventions such as cohorting and the use of isolation rooms for infectious patients [2, 3]. Such approaches tend to look at broad issues of layout and design as the basis for IPC, or at the provision of fixtures and fittings such as the proximity and location of wash hand basins. A number of studies show, however, that specific elements of the building such as the heating,

ventilation and air conditioning (HVAC) or water supply systems can play a key role in the spread or control of infection within hospital buildings. Links between the design of ventilation systems and increased rates of healthcare associated infections (HAI) have, for example, been identified [4, 5, 6]. Similarly, the design of water systems within hospital buildings has been directly implicated in outbreaks of nosocomial infections caused by waterborne organisms such as legionella [7, 8]. Additionally, some research highlights a growing understanding that, in order to promote the best possible outcomes, design and IPC should not be treated as a one-off consideration within the development process, but should instead be closely linked at all stages through collaborative working and knowledge sharing between the core design team and the IPC specialists [9, 10, 11]. This evidence is strongly suggestive of a more complex relationship between the healthcare built environment and IPC which is only beginning to be fully investigated and understood and which forms the background to the research presented in this paper.

Recent high profile cases in Scotland highlight the issues which can arise when aspects of the relationship between IPC and building services are compromised. After opening in 2015, the Queen Elizabeth University Hospital (QEUH) and Royal Hospital for Children in Glasgow encountered problems with rare microorganisms in the hospital environment. The Independent Review into these incidents found that, amongst other issues identified, IPC team involvement, although evident at appropriate stages of the development, was limited in its scope and did not extend to technical and engineering issues [12]. The report also highlighted the lack of clarity in national guidance relating to roles and responsibilities of the IPC team in the commissioning, design and handover of new or refurbished builds. This issue of a lack of clarity in current United Kingdom (UK) and Scottish guidelines is repeated within the report in relation to some aspects of the HVAC system and supported by research which has since been undertaken into infection control risks associated with the chilled beam system used in the new hospital [13, 14]. Similarly, the new Royal Hospital for Children and Young People in Edinburgh experienced a significant delay to its opening due primarily to remedial work to the ventilation system within critical care areas of the hospital which did not meet national standards for air change rates [15]. The report into this incident concluded that ambiguity over the relationship between clinical need and technical guidance and a lack of communication and knowledge sharing between the core design team and clinical and IPC staff employed by the client contributed to the error which resulted in the subsequent delays [16].

2. Literature review

In order to develop a more detailed understanding of these issues and to identify possible gaps in knowledge or research in the field, a review of relevant literature was undertaken. Due to the wide scope of the literature in this area, the review was carried out in two stages. Stage One was a background review intended to highlight broad areas of interest with potential for further study. Stage Two comprised a detailed review of literature relevant to the selected study areas.

2.1. Background literature review

Central to the literature selected at this stage were a number of systematic reviews which focused on the relationship between the built environment of hospitals and infection prevention and control. Review of these studies was undertaken in order to highlight overarching issues for further investigation. Whilst there were variations in the age and specific focus of these reviews, there was some consistency in the central themes which emerged with regard to further research and development. These may be summarised as follows;

- The strength of the evidence base conclusively linking the hospital built environment to outbreaks of HAI is affected by issues with the data. This has implications for the clarity and consistency of some of the recommended environmental parameters within hospital buildings

and for the technical standards and guidance used to regulate and guide important IPC design decisions.
- Knowledge exchange and sustained IPC team involvement in the development process have the potential to enhance measures to address IPC in the design and operation of new hospital buildings.

2.2. Detailed literature review

To refine the scope of the research project and to develop key aims and objectives, both of the issues identified in the background review of literature required more detailed consideration. From the central themes identified in the background literature review, two questions were thus developed as the basis for the detailed literature review, as follows;

- What issues affect the data supporting the link between the specification, design and construction of hospital buildings and the transmission of HAI?
- How do knowledge exchange and sustained IPC team involvement enhance the management of IPC issues in the specification, design and construction of new hospital buildings?

Review of the literature suggested that findings from the background literature review were supported and that both of these matters are significant in their own right. After consideration of the issues linked to data quality, however, it was determined that direct links between the healthcare built environment and reductions in the rates and transmission of HAI are difficult to confirm even for measures which are introduced for this purpose. Too many variables within the healthcare environment which cannot be controlled for make Level 1 evidence in this field very difficult to come by. These issues are inherent due to the multifactorial nature of IPC and lack of standardisation in the management of these issues within the construction lifecycle. Data collection and analysis for any further research in this field would therefore be very challenging. For these reasons, this was not considered to be a productive path to pursue in the context of this research project.

With regard to interdisciplinary working and knowledge exchange, a number of key issues were identified from the literature review. Whilst few papers looked specifically at the issue, several authors considered this matter as part of an overall discussion about the relationship between the built environment and IPC. In some cases, this was a straightforward assessment of the benefits of multidisciplinary working in an outbreak situation. Zimring et al [17] found that these include standardization of methodologies in environmental investigation leading to more robust, evidence-based solutions. This not only improves the reliability of the data but also ultimately enhances the quality of the technical standards and guidance used to build healthcare buildings. The complexity of controlling healthcare-associated infections was acknowledged by several authors and the benefits of using a multimodal approach, including different molecular typing methods combined with epidemiological investigations and observation of psychological, behavioural and work-related factors to enhance outbreak investigations, were highlighted [18, 19, 20].

Rather than reactive investigation of outbreaks, however, this research is focused more specifically on mitigating the risk of outbreaks through action taken at the specification, design and development stages. In this respect, some authors highlighted the need to ensure that IPC measures are “designed in” to new healthcare buildings or, at a minimum, to ensure that standard measures are not “designed out” and suggest that adopting a multidisciplinary approach to the development process is fundamental to achieving this. Incorporating the knowledge and experience of a range of specialist practitioners early in the process and throughout is more likely to result in a design which meets the highest possible IPC standards and which is less likely to require costly revision to accommodate these standards at a later stage [10, 21, 22]. Noskin & Peterson [23] noted that the early involvement of IPC staff in the construction process of hospitals can improve communication and ultimately leads to enhanced patient safety through the incorporation of IPC measures. In the report of their extensive interviews with clinical, administrative and design professionals involved in the development of new

healthcare buildings, Lenfestey et al [24] made similar observations. The experience and knowledge that specialist practitioners bring to bear allows for more careful evaluation of the quality of the evidence and oversight of its appropriate application to critical IPC design decisions. Thus, a collaborative design process based on open dialogue may lead to reductions in design-related HAIs.

Collinge [11], who carried out a four-year study into the management of IPC issues within construction projects, supported the important role of IPC specialists in pre-emptively identifying IPC issues and interpreting evidence and associated guidance, particularly where guidance is too generic for the specific issue at hand. Collinge [11] pointed out, however, that certain barriers exist to the wholesale and ongoing engagement of IPC specialists within the development process. Foremost amongst these are issues of communication and semantics. In order for design teams to function effectively, all members of the team must be able to understand the language of the other team members. If this does not happen, there is a danger that misunderstandings and misinterpretations will occur. This is particularly relevant to IPC issues which, although acknowledged to be of great significance within the specification, design, construction commissioning and operation of new hospital buildings, can be intangible and difficult to define. This may result in important matters being overlooked, potentially causing delays to construction and costly redesign work [11]. Collinge [11] also noted that the way design teams communicate can be problematic, particularly in relation to the technical language used in regulatory guidance and communicative resources such as briefing notes and room data sheets. Inability on the part of IPC specialists to fully understand these communications due to a lack of the required technical knowledge can make it more difficult for relevant issues to be recognised and addressed [25]. This may lead IPC specialists to feel that these matters are beyond the scope of their understanding and experience and result in them becoming disengaged from the process [11]. These perceived disconnects were suggested as one reason why the approach taken to IPC issues may become fragmented over the project lifetime resulting in a disjointed approach based on a combination of technical guidance, personal experience and trial and error [24]. It may also go some way to explaining why the involvement of IPC specialists in the development process may be sporadic or limited to the early stages [26].

In spite of the fundamental importance of these issues, Collinge [11] noted that discussion of the making and sharing of meaning around IPC issues in construction project work is largely neglected in the relevant literature in spite of repeated calls for more knowledge exchange and participatory design practice. This point is supported by the fact that an extensive search of the literature produced only three papers relating to the management of IPC issues and the involvement of IPC specialists at all stages of the development process.

Stockley et al [21] reported the work of a project group established to share experiences of the management of IPC issues in a number of different hospital construction projects in the United Kingdom. The purpose of this work was to gather and learn from these experiences in order to produce guidance on how IPC and other specialists can be more effectively involved at all stages of the development and to raise the profile of IPC within new hospital projects to empower IPC teams within the process. The paper set out guidelines for each stage of the development process from initial expressions of interest to commissioning and post-occupancy [21]. At each stage, key issues were highlighted and recommended infection control action points were identified. Issues of particular relevance included those relating to the level of experience among IPC specialists in interpreting design plans; lack of experience on the part of contractors of the relevant legislation and guidance; poor communication between the design and construction teams and the IPC specialists and significant time and resource constraints placed on those involved. In answer to these, the project group suggested numerous mitigating actions including training for IPC staff in interpreting and signing off design plans; collation of key legislation and guidance to facilitate its use; documentation and sign off by the IPC team of all key decisions and open and ongoing communication amongst all team members [21].

Wilson & Ridgway [22] acknowledged the contribution of the report by Stockley et al [21] and used their experience of building a PFI hospital in London to explore some of the key

recommendations. In particular, the authors concurred that the early and consistent involvement of IPC specialists in the design process provided invaluable opportunities to shape key design decisions and to optimise the final IPC performance of the hospital building. They also highlighted the critical importance of IPC training for architects, engineers and maintenance staff to enable them to meaningfully contribute to discussions of important IPC design issues.

It was noted, however, that implementation of the recommendations made by Stockley et al [21] was complicated on this project by a number of factors which compromised the overall impact of IPC involvement. In spite of early and continuous involvement by IPC specialists and in spite of their views being taken account of during design and construction, financial imperatives associated with the PFI arrangement often dictated final design decisions, sometimes to the detriment of IPC priorities. PFI restrictions led to problems with implementation of the relevant guidance and policy documents, something which undermined efforts by the IPC specialist to enforce important design choices. Lack of awareness of and training in IPC amongst architects, engineers and maintenance staff led to issues with the ventilation system being missed during design and construction, something which compromised the overall IPC performance of the hospital and led to expensive remedial measures [22].

In answer to some of these points, Kidd, Buttner & Kressel [27] outlined in their paper a proposed model for the effective engagement of IPC specialists and a suggested method for ensuring that IPC issues are appropriately understood and prioritised throughout the development process. Acknowledging that establishing collegiality and trust between ICP practitioners and contractors, architects and engineers is challenging, the authors described how the Infection Control Programme at a US teaching hospital facilitated cooperation and communication with building contractors in order to promote IPC measures in the built environment and enhance patient safety. There was, for example, a high level of ongoing contact between the infection control team, in-house design and construction personnel and outside contractors. Early meetings were held in order to anticipate infection control concerns and proactively plan for infection control interventions on the project. Once the project was on site, daily or weekly site inspections were carried out by IPC specialist staff, depending on the size of the project, with these staff having the authority to stop work if necessary. Furthermore, all outside contractors were obliged to undertake in-house IPC training and to demonstrate that this training had been kept up-to-date [27]. The emphasis on training and awareness-raising for all staff which was at the heart of this apparently successful programme strongly supported the points made in this respect by Collinge [11], Stockley et al [21] and Wilson & Ridgway [22].

Taken together, key findings from this literature constituted a useful basis for a model of IPC specialist engagement. It is acknowledged, however, that this was a small body of evidence and that some of these sources were also limited in other ways. Stockley et al [21], for example, made useful high-level recommendations in relation to the management of IPC issues in the development of new hospitals, but provided little detail on implementation. Wilson & Ridgway's [22] discussion had more detail in this respect and the authors highlighted some interesting barriers to the involvement of IPC staff and to the efficacy of this involvement, but the paper was focused on one specific project and efforts to apply these findings at a wider level were less well-developed. Kidd, Buttner & Kressel [27] described a very useful model of engagement, but this project was based in the USA and referenced different financial, legislative and policy frameworks. It was not possible to assess the extent to which this impacted on the development and application of the proposed model and whether this would affect its implementation in a contemporary UK context. All of the papers were also relatively old and clustered around a point in time. It is worth noting, however, that no more recent papers could be found looking at specific examples of IPC engagement in the development process and that discussion of these issues appeared to be otherwise absent within the academic literature. This point is supported by Collinge [11] who observes that within the relevant body of literature there is a lack of clear guidance on these matters, highlighting that there is little discussion of how infection control requirements are communicated within the construction lifecycle and few tangible examples given of how infection control requirements are addressed and resolved.

Interdisciplinary working and knowledge exchange are thus recognised as essential both in relation to the management and investigation of outbreaks and, more pertinently, to the identification and management of building services-related IPC issues throughout the development process. Early and continuous IPC practitioner involvement, together with education and training initiatives for all those involved with the design and construction of new healthcare buildings appear to be the principles which underpin successful approaches. From the evidence reviewed, however, only a few examples of such an approach exist, particularly within the UK. Consequently, questions persist on how to stimulate the continuous engagement of IPC professionals in the development process and on how to facilitate the exchange of experience and knowledge necessary to ensure that all members of the project team have the correct skill set to contribute effectively. The apparent consensus in the available literature that consistent involvement and better communication, training and knowledge exchange are required in order to build safer hospitals is not matched by strong evidence in support of this nor by clear recommendations on how this should be achieved. It is also recognised that the evidence base in support of this consensus is small and under-developed. Nevertheless, the basic principles of this approach are acknowledged as important to patient safety, a position which is increasingly reflected in contemporary policy and guidance. This is summarised by Wilson & Ridgway [22] who note that although the empirical evidence linking the built environment to HAIs is weak, hospital design is considered to be of "paramount importance" in preventing patient ill-health.

3. Research aim

In view of the stage at which the research project currently sits, the aim of this paper is to report on the findings of the literature review, to highlight the gaps in knowledge which have been identified and to demonstrate how these findings have informed the development of a methodology and research methods to address these gaps.

The overall aim of the research project is to build on some of the work identified in the literature review and on the findings of the literature review in relation to both the benefits of IPC engagement and the gaps in knowledge in this field. There is a need for up-to-date research which considers the extent to which IPC teams are consistently and effectively engaged in the development of new healthcare buildings. In particular, an evaluation of the degree to which measures like those recommended by Stockley et al [21] have been implemented and how well existing tools are utilized is required, together with an appraisal of key barriers and facilitators within the process. Better understanding of these issues would serve as a first, important step in developing a strategy to enhance engagement and improve the management of IPC issues within the development process. This work is particularly relevant in Scotland where recent events have focused attention on improving understanding of the physical and procedural links between the specification, design and construction of new healthcare buildings and the transmission of pathogens.

It is not, however, within the scope of this research to address all of these points in detail. A more specific issue, therefore, had to be identified as the basis for the research aim. Silverman [28] suggests that in focusing the research, it is advisable to pick a topic which is not only central to the phenomenon under investigation, but which is also interesting to the researcher and workable in terms of data collection. Using these criteria and taking the precedent of Stockley et al [21] and Wilson & Ridgway [22] as a starting point, a logical focus for the research was, therefore, to consider the views of IPC specialists on the factors which drive or discourage their engagement within the development process and on what is required to improve the quality and efficacy of this. Using this information as a starting point, the basic principles of an engagement strategy could be developed. Thus the key research aim was identified as follows;

To assess the nature and efficacy of the engagement of IPC specialists in the construction lifecycle development of new hospitals in the UK through a critical exploration of the factors which drive this and to utilize these findings to develop a strategy for enhancing engagement.

4. Research methodology

As a first step in meeting the research aims and objectives, a methodology was required to provide the guidance for the research approach and to clarify the lens through which analysis would take place.

4.1. Philosophical perspective and theoretical framework

In terms of the philosophical perspective and theoretical framework for the research, it was decided that a constructivist paradigm would be adopted. In seeking the personal views and experiences of IPC specialists, the notion of pursuing an objective truth in the research was not considered viable and an emphasis on the subjective experience of participants was, therefore, prioritized. The concept of transferability of findings will be used to ensure that research aims relating to the development of an enhancement strategy can be met. Transferability considers only the degree to which the findings of research carried out in one context are applicable to a different context rather than attempting to apply findings in a universally valid form to any other setting. Applying these principles and presenting the research findings as a movement from individual perspectives to broad understandings, allows this part of the research to remain consistent with the overall constructivist paradigm [29, 30].

4.2. Research methodology

To assess and explore the key areas outlined in the research aim requires an inductive approach to data gathering. By using the literature review to highlight the gap in knowledge, a specific focus has been identified. The small evidence base for this field of study which was noted in the literature review, however, means that relatively little is known about the topic and that formulating a starting hypothesis is neither viable nor desirable. The most obvious way to explore the drivers of IPC engagement within the development process is, therefore, to speak to those most closely involved in order to gain an understanding of experiences, motivations, barriers and facilitators. Creswell [31] states that qualitative research is particularly valuable where greater understanding is needed of a complex issue and that this level of detail can only be obtained by, “talking directly with people, going to their homes or places of work and allowing them to tell their stories unencumbered by what we expect to find or what we have read in the literature”. A qualitative methodology also fully aligns with the constructivist paradigm selected for the research. Thus, for this research, the aims and objectives are such that a qualitative methodology was indicated.

In particular, phenomenology was considered to be a suitable research approach. Phenomenology is concerned with how the world is created and experienced through the conscious acts of individuals, rather than through an externally imposed, objective reality. The output from this type of research is, therefore, a collection of descriptions of individual and lived experiences of the phenomenon under investigation [32, 33, 34]. A phenomenological approach allows for deep examination of different perspectives, different experiences and how the particular circumstances of a project or the interactions of the different stakeholders on that project may influence the process [35]. The branch of phenomenology known as interpretive or hermeneutic phenomenology is particularly useful in this respect. Where descriptive phenomenology seeks to objectively study the phenomenon of interest, hermeneutic phenomenology is based on examining the lived experience of the individuals taking part in the research [36]. Max van Manen [37], a leading scholar in the field of hermeneutic-phenomenological research, describes hermeneutic phenomenology as a human science which studies individuals. It is a philosophy of the personal, the individual, which is pursued against the background of an understanding of the whole, the communal and the social. In contrast to descriptive phenomenology, where the idea of a single discoverable reality persists and where the researcher’s job is to objectively document this, the role of the researcher is central to hermeneutic phenomenology. Prior knowledge of the phenomenon of interest and the presuppositions of the researcher are integral to the research process and are seen to enhance both the relationship between researcher and research participant and the research findings [38].

Thus, the reflective interview and observation are proposed as the main data collection tools in hermeneutic phenomenological research to allow this relationship to develop and, in this way, to

deeply explore the experiences, opinions and knowledge of research participants [33]. In common with the emergent approach to research design which is seen in qualitative research generally, there is also a degree of flexibility with regard to the methodology and the structure of the research which may be a planned sequence of steps or a more fluid approach based on early research findings [31]. Both of these features of a hermeneutic phenomenological approach are compatible with the aims and objectives of this research. As noted above, it was anticipated that most of the insights gained would come through talking to those involved with the specification, design and construction of new hospital buildings. Given that evidence in this field is currently limited, however, there is an element of uncertainty around the direction which may be indicated by initial findings and some flexibility in the design of the research is, therefore, an advantage.

van Manen's guidelines for those involved in hermeneutic phenomenological research add a more action-based dimension to the methodology [37]. His view of phenomenology is that it, "aims at gaining a deeper understanding of the nature or meaning of our everyday experiences" [37], not by offering theory with which we explain or control the world, but by offering, "the possibility of plausible insights that bring us in more direct contact with the world" [37]. van Manen's approach offers a set of methodological suggestions and is designed to be used by the researcher in a practical, rather than purely philosophical way, thus providing a useful framework for this research project. Additionally, van Manen's approach to hermeneutic phenomenology not only allows for the input and influence of the researcher, but actively encourages it, taking the view that presuppositions or prior knowledge on the part of the researcher provide valuable direction to the enquiry [39]. Again, this fits well with the research aim and the level of knowledge acquired by the authors through previous experience, literature review and informal discussion prior to the start of data collection and contrasts with approaches such as descriptive phenomenology where the researcher is expected to put aside any such knowledge or grounded theory where background knowledge of this type is considered undesirable.

4.3. Research methods

Development of a plan specifying the procedures and techniques used to identify, collect and analyse data is the stage which this research project has now reached. A brief explanation of early work in this area is, therefore, useful. The literature review highlighted the range and complexity of issues involved when considering IPC engagement in the development process. Attempting to look at these issues at the macro scale would be beyond the scope of the research and would be unlikely to produce findings which were detailed or specific enough to be used in the development of an improvement strategy or as the basis for future research activity. In order to effectively scrutinise these issues and thus to generate useful findings which meet the research aims and objectives it was necessary to narrow the focus. Studying a limited number of separate but comparable examples of IPC engagement in the design and construction of new healthcare buildings appears to offer the best opportunity for achieving deeper analysis and better understanding of key issues, challenges and facilitators in this process.

Detailed decisions on research methods were, however, dictated by the choice of research methodology. van Manen's model of hermeneutic phenomenology provides some guidance in this respect. The emphasis placed by van Manen on the meaning of words and the importance of language as a way of discovering phenomena and establishing truth makes in-depth interviews the primary method of data collection in this model [31, 37]. Interviews must be designed in a way which allows participants to talk freely about experiences relating to the phenomenon, but they should not be allowed to become unstructured or unfocused as this may result in unmanageable amounts of data or data which is limited in its usefulness. Interviews are not simply a data gathering exercise, but also serve as an opportunity for the researcher to reflect with the interviewee on observations made and experiences described. van Manen [37] notes in this respect that the hermeneutic interview tends to turn the interviewee into a participant and a collaborator in the research. Thus, the interview protocol must be designed to allow for this possibility.

Decisions on the topics covered by the interview questions were guided by mapping the gaps identified in the literature review to a relevant theory of behaviour change. In the context of this research, issues of engagement were seen to be inextricably linked to issues of behaviour, particularly in terms of factors such as motivation and opportunity. Using behaviour change theory as a way of examining the determinants of behaviour amongst research participants was, therefore, considered to be a useful approach and provided more structure and focus to the interview protocol. The COM-B model was developed in the field of behavioural science as a means to understanding behaviour in context and identifying what needs to change in order for a behaviour change intervention to be effective [40]. Its focus on analysing the capability, opportunity and motivation of people in relation to their behaviour was seen to be particularly useful with respect to the research aims. Using behaviour change theory in this way also opened up possibilities for exploring behaviour change techniques as the basis of a future strategy or intervention in relation to the management of IPC issues within the development process.

5. Findings and discussion

As highlighted in the literature review, a key finding from the research to date is that, while there is consensus in the available literature that consistent IPC involvement and better communication, training and knowledge exchange are required in order to build safer healthcare buildings, there are gaps in knowledge around the evidence in support of this and in terms of recommendations on how this should be achieved. This is supported by anecdotal evidence gained from discussions with experts in the field of IPC and the built environment. Research focused in this area is, therefore, considered to be a potentially fruitful line of enquiry. By studying current arrangements and identifying areas of strength and deficit, measures can be developed to enhance how these issues are managed within the development process. This in turn forms part of a wider drive to better understand the role of the built environment in relation to healthcare associated infection.

Thus, the points addressed by Stockley et al [21] are brought up to date. Research in this field is, however, further developed by using the information gathered as the basis for a preliminary strategy or intervention to enhance engagement and improve the management of IPC issues within the development process, with potential application across different healthcare projects. Incorporating elements of behaviour change theory within the research methods lays the groundwork for this and provides a robust framework around which future interventions may be designed. It also offers potential for new avenues of research on, for example, stakeholder engagement and the education and training needs of those involved with the development of new healthcare buildings. This work is particularly relevant in Scotland where recent events have focused attention on the physical and procedural links between the specification, design and construction of new healthcare buildings and the transmission of pathogens.

6. Conclusions and further research

Immediate next steps for the research are to seek ethical approval for the work and then to develop a data collection schedule. As noted previously, data collection will take the form of in-depth, semi-structured interviews which will be conducted with participants who have been purposively sampled using existing IPC networks. Participants will be selected on the basis of their role as an IPC specialist practitioner and previous or current experience in the development of new healthcare buildings in the UK. In line with the principles of hermeneutic phenomenology, data analysis will involve looking for recurring themes which are then drawn together in order to identify the “essence” of the experiences of the phenomenon [37, 41].

In conclusion, this research has grown from the gap between the apparent consensus that greater IPC team involvement leads to the design of healthcare buildings which are better equipped to prevent the growth and spread of pathogens and the knowledge of how to make this happen. A key aspect of this is the need for greater understanding of the role of IPC specialists during the specification, design and

development of new healthcare buildings in order to develop ways to enhance this role and thus to better protect the health of building occupants. This research aims to develop this understanding through analysis of the experiences and behaviour of IPC specialists within the development process. These findings will lay the foundation for the design of interventions which seek to improve the way that IPC teams engage with key aspects of the development process as a means to enhancing the IPC performance of the completed building. This will be of benefit to all those involved in the design and development of new healthcare buildings, to those who stay and work in these buildings and to future researchers in this field.

7. References

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