# A SYSTEMATIC REVIEW OF SPATIAL CONFIGURATION AND COMMUNICATION RELATED STUDIES IN HOSPITAL SETTINGS

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## ABSTRACT

*Hospitals are designed to provide efficient healthcare delivery. This has facilitated a lot of research on the spatial configuration of hospitals and the subsequent effect on the delivery of healthcare. Also, research has shown the relationship between the spatial configuration of hospitals and some physical and social outcomes in the hospital environment which contribute in one way or the other to healthcare delivery. Recently, research has pointed out that most errors in healthcare delivery in Nigeria have been attributed to errors in communication.Thus, this study sought to conduct a systematic review of relevant literature on spatial configuration and communication-related concepts in Hospital settings. The systematic review was guided by the following protocols namely: the theoretical framework (approach and focus), the methodology and the findings. Results, divided into two major categories research in spatial configuration and communication. This included a focus on the relationship between space and communication-related concepts and the influence of space on communication-related concepts. Also, this paper found that communication as a concept in Hospital settings can be interpreted into three subcategories namely social (Culture and social interactions), psychological (User Groups) and Technical (work processes and Healthcare outcomes). This paper concluded that most of the studies reviewed had focus on the technical aspects of communication and or its relationship and influence on the spatial configuration of Hospitals with a more comparative approach to gathering, analysing and interpreting data. This paper recommends that the focus of spatial configuration and communication-related studies should shift to the social and psychological categories in the Hospital environment to build and develop more robust and evidence-based theory.*

**Keywords:** *Spatial configuration, Communication, Space syntax, social network.*

## INTRODUCTION

Research on the design of Hospitals has generated a lot of interest in the last two decades. This is partly because of the focus studies have placed on the spatial configuration of hospitals and their relationship to healthcare delivery. Many studies on the spatial configuration of hospitals have focused on the effect of spatial configuration on health care delivery (Pachilova & Sailer, 2020; Ogunola, 2015). A lot of work has highlighted the relationship of spatial configuration to many outcomes that contribute to efficient healthcare delivery (Fay *et al.*, 2019). For example, research has been carried out on how the spatial configuration in hospitals are related to patient falls, medication errors, patient confidentiality and privacy, stress, depression, organisation commitment, organisation performance, job satisfaction and social interaction (Cai and Zimring, 2017).Also, the social interaction within and among professionals in the healthcare institution especially with regards to the efficient delivery of healthcare has come under intense investigation. Both fields in design and medicine have highlighted the contribution of efficient social interaction or otherwise known as communications in delivering healthcare. In the last decade, researchers have pointed out the immense influence of the hospitals' spatial configuration on communications within the hospitals.(Scott, 2017).

In the hospital environment, communication is multi-faceted. One good explanation for that is the different players in the Hospital institution all saddled with the responsibility of delivering efficient healthcare. For example, the hospital houses several professionals like doctors, nurses, pharmacists, technical staff and specialists who have to work harmoniously to deliver healthcare within the same spatial configuration (Spatial layout). This presents a communication complex and many questions have been tailored towards how the spatial configuration has contributed to enhancing or easing this communication complex.

The design of hospital spaces promotes easy accessibility, easy movement and easy communication between health workers and between health workers and patients. From an architecture point of view, the design of a hospital can either enhance or limit the level of communication between health workers and between health workers and patients. When communication is impeded or distorted as a result of the design it could lead to poor healthcare service delivery which translates to increased mortality (Tahir, Haming and Bijaang, 2018; Ogunola, 2015). Barasa, Molyneux, English, and Cleary (2017) noted that communication in a hospital environment is complex because of the different categories of professionals which create communication problems (Sari 2017; Scott, 2017).

Recently a survey in the Ahmadu Bello University teaching hospital showed that 36% of the errors committed in the delivery of Healthcare were traced to poor communication (Jamoh, Abubakar,&Isa, 2018). Besides, a follow-up survey of the Ahmadu Bello University teaching hospital design revealed that it has contributed negatively to the daily communication patterns among medical personnel and between medical personnel and patients. This has resulted in poor service delivery which accounts for over 20% of the mortality rate recorded in the hospital in the last year (Okonofua, Ntoimo, Ogu, Galadanci, Abdus-Salam, Gana, &Randawa, 2018).

With this background, this paper sought to review, systematically,the spatial configuration and communication-related studies in hospital settings and assess what extant research has conducted and documented about the relationship between spatial configuration and communication in Hospitals. The following section proceeds to conceptualize the major concepts in this paper namely, spatial configuration and communication in the Hospital environment.

## CONCEPTUALIZATION

There is a strong link between spatial configuration and communication patterns in spaces and this is linked to how these concepts are interpreted. Like many other institutional buildings, the hospital has its unique building typology that has been developed over many centuries as a result of many factors (Wagenaar and Mens, 2019). Some of these factors include technological development, an increase in demand, scientific innovation to mention a few. This has led to the development of its (hospital) spatial configuration to cater for the dynamic changes throughout these years. These developments in the hospital's spatial configuration have occurred to enhance the operations of hospitals and provide better environments for the delivery of efficient healthcare. Thus, as a result of various research, the spatial configuration in Hospitals provides a range of benefits that are captured in Suvanajata's (2001) positions. Spatial configurations cover four basic dimensions namely, its function, structure, aesthetic and experience. Using a hospital setting as an example, the spatial configuration of space in a hospital has a function, like Treatment and Diagnostics areas, these spaces have a particular structure that guides the sequence healthcare is delivered and this is with unique aesthetics specific to the hospital environment. More importantly, there is an experience that is offered as a result of the function, its

structure, and the Aesthetics of the configured space. Put differently, there is a unique experience offered by a configured space due to its unique function, structure and aesthetics.

On the other hand, the concept of communication in hospitals is often interpreted from its organizational structure. The organizational structure elucidates the way and manner players in an organization should communicate. However, according to Poole, 2014, this does not adequately cater to the way, manner and most importantly, the patterns of communication. Other researchers have preferred to interpret an organization's communication as a subset of the organizational culture (Schiavo, 2013). In other words, the communication among the different players in the hospital environment can be interpreted as social interaction and can be observed by the attitudes, behaviour and values in the hospital environment. This, is a more accurate interpretation of interpersonal communication in the hospital environment as it caters to the dynamic changes over time when people communicate.

## METHODOLOGY

With the interpretation of the concepts in the preceding section, the paper used online databases to search for relevant studies in spatial configuration and communication with a focus on hospital settings. The selection of the databases was based on proven records of research in these areas which were based on Architecture and the social sciences. Three databases were used namely, Google Scholar, Medline and SAGE journals. Keywords words used in the search included spatial configuration, communication, behaviour, and healthcare settings.

A preliminary review of the search results highlighted 102related articles which focused on socially related concepts in healthcare settings. A thorough review of the Abstract highlighted 25 studies that have targeted the investigation of spatial configuration and communication-related concepts in healthcare environments.

## RESULT AND DISCUSSION

Table 1 Summary of Review of Spatial configuration and communication-related Studies. outlines research that has focused on spatial configuration and l communication-related studies especially in healthcare delivery buildings. To analyse the written data in the reviewed literature a summative content analysis was used. This was important to be able to trace the similarities and differences in the studies under review. To do this, this study examined language intensely to classify texts in categories and most importantly interpret the context of text data through systematic classification.

The criteria used to examine the content were based on;

i. The Theoretical framework
ii. The methodology of the Study and
iii. The major findings

The first criteria, which was a review of the theoretical framework was to highlight the background and interpretation of the major concepts used in the study. In this case, the focus was on how each research interpreted and related the concepts of spatial configuration and communication. Secondly, this study looked critically at the methodology adopted in each of the research reviewed. This was done to build data on the methods, instruments and variables used in spatial configuration and communication-related studies. Finally, the major findings were reviewed critically to assess the focus of these studies in healthcare delivery and possibly highlight the recommendations and proposals for further study.

**Table 1:** Summary of Review of Spatial configuration and communication **-related Studies.**

| | Name | Methodology/Techniques | Findings | Approach/Focus |
|---|---|---|---|---|
| 1 | Pachilova&Sailer (2020) | i. Explorative and comparative study of 6 nursing unit wards<br>ii. In-depth study of movement and communication of Healthcare workers<br>iii. 31 selected based on the quality of care<br>iv. Test of these spaces was based on a spatial communication index<br>v. Statistical analysis | i. large viewshedsin visibility and awareness produced more communication<br>ii. the higher Spatial communication index the better the quality of care | Relationship between hospital design and the quality of care and communication among healthcare professionals<br>The influence of nursing unit design on the quality of care |
| 2 | Cai H, Zimring C,.(2017). | i. Comparative study of Chinese and US nursing unit typologies<br>ii. Comparative analysis of unit designs<br>iii. Unemprical Interpretation of National cultures and relationships with unit designs | i. Impact of national culture on the nursing unit design<br>ii. Developed a methodology combining abstract culture, organisational construct and complex spatial relationships into spatial metrics | i. Relationship between culture and nursing unit design<br>ii. Spatial configuration a product of culture<br>iii. How nursing unit design reflect the different work styles and organisational communication which is driven by culture |
| 3 | Real, K., Bardach, S. H., &Bardach, D. R. (2017) | i. Comparative study between centralized and decentralized nursing unit design<br>ii. Focus group discussions<br>iii. Systematic qualitative analysis<br>iv. Quantitative modelling<br>v. Space syntax | i. Highlighted care processes in the frequency of walks and the 2 designs<br>ii. Nursing unit design shapes the communication, processes and outcomes in the nursing wards. | i. The relationship between the spatial layout of hospitals and communication in this case; patient care processes and patient outcomes/quality of care. |
| 4 | Gharaveis, A., Hamilton, D. K., &Pati, D. (2018) | i. A systematic review of the literature with a focus on the impact of hospital design on teamwork and communication (19 studies) | i. Spatial layout is a critical factor that promotesthe efficiency of teamwork and collaborative communication<br>ii. Layout design, visibility and accessibility are the most cited aspect of design which affect Teamwork and Communication in healthcare facilities. | i. An investigative impact of the hospital design layout on teamwork and communication |

| | Name | | Methodology/Techniques | | Findings | | Approach/Focus |
|---|---|---|---|---|---|---|---|
| 5 | Pachilova et al. (2017) | i.<br>ii.<br>iii.<br>iv. | An empirical study of 4 hospital wards in 2 UK hospitals.<br>Comparative study<br>Space syntax analysis<br>Social compartive network analysis | 1. | The distance in the spatial layout influence the frequency and duration of conversation in the wards | i. | Relationships between spatial layout and social behaviour especially ion patient ward and work processes) |
| 6 | Rippin, A. S., Zimring, C., Samuels, O., & Denham, M. E. (2015) | i.<br>ii. | Comparative study of Neuro-Critical Ward design<br>Structured observation | i.<br>ii. | The unit layout did not contribute to easy interactions in the spatial layout<br>Spatial layout recorded influences in communication patterns | i.<br>ii. | Impact of design on caregiver interactions<br>Relationship between spatial design and care (focus on bedside nursing categories |
| 7 | Rashid, M. (2015). | i.<br>ii. | Integrative Review of studies form<br>Review based on a framework consisting of a Technical, Psychological and social orientations. | i.<br>ii.<br>iii.<br>iv. | 21 Technical oriented Studies<br>16 psychological oriented Studies<br>3 Social oriented Studies<br>13 Technical, Psychological and Social oriented studies. | i.<br>ii. | Review of Nursing unit layouts<br>A look at Technical, Psychological and social issues ranging from Behaviour and Perception, Health Outcomes and social and psychological factors. |
| 8 | Hua, Becker, Wurmser, Bliss, Haltz and Hedges (2015). | i. | A comparative study using Pre/post research design where comparison was between centralised and decentralised units. | i.<br>ii.<br>iii. | Patient satisfaction increased substantially<br>Few significant changes in communication patterns<br>No significant changes in nurse satisfaction, patient falls and organisation outcomes | i.<br>ii.<br>iii. | Communication key to quality care<br>How nursing unit layout affect communication patterns and medical and organisational outcomes<br>The focus was on the relationship between spatial layout on communication patterns, nurse satisfaction, distance walked, organisation outcomes, patient safety and satisfaction. |
| 9 | Pachilova&Sailer (2014) | | Comparative study of 2 distinctly organised Hospitals,<br>Using Space Syntax methodology for spatial analysis<br>Staff survey highlighting communication networks | | Hospital organisation with shared facilities increases the frequency of communication<br>Besides space, the workflow and culture affect interaction patterns between users<br>Spatial separation oof user areas | | Evidence-Based Design research in hospital<br>Focus on how hospital layout can affect communication between categories of people especially in the Outpatient clinics |

| | Name | Methodology/Techniques | Findings | Approach/Focus |
|---|---|---|---|---|
| 10 | Liu, Mainas and Gerdtz (2014) | An Explorative study using space syntax methods to analyse spatial layout and observation using movement and behavioural patterns | Highlighted impact on spatial interruption on communication processes<br>Communication difficulty was associated with spatial layout assessed | Hospital design plays a critical role in Health communication processes<br>The research focused on the relationship between hospital design and communication process in acute care hospital settings (Treatment and Diagnostics) |
| 11 | Bayramzadeh, S., &Alkazemi, M. F. (2014). | Explorative Study<br>Comparative cross-sectional study, assessing a total of 70 registered nurses in 2 weeks. | No significant difference between centralised and Decentralised nursing unit layout in relation to the frequency of communication and technology used<br>A significant difference in perception the 2 spatial layouts considered | Relationship between nursing unit design and use of communication technologies/methods<br>How the design of nursing unit can impact on the use of communication technology and methods<br>Strength and weakness in nursing unit design with regard to communication technology |
| 12 | Pachilova, R., &Sailer, K. (2013) | A comparative study analysing 2 hospitals (with 5 clinics each) which differ in the spatial layout<br>Space syntax analysis of spatial layout.<br>Staff survey and direct observation, communication networks and activities of caregivers | Strong differences between the 2 spatial settings. | Evidence-based design for credible design decisions.<br>Communication important for good health provision<br>The relationship between the spatial layout and the way people interact in Wards. |
| 13 | Cai, H., &Zimring, C. (2012) | Comparative study of Neurology intensive care unit<br>A multi-layered approach with spatial analysis, behavioural mapping and co-awareness network analysis | The difference in spatial differentiation between the 2 wings<br>A strong correlation between the spatial metrics and the observed behaviours and co-awareness | Based on the hypothesis that Nursing unit layouts impact the way which nurses interact and maintain co-awareness |

| | Name | Methodology/Techniques | Findings | Approach/Focus |
|---|---|---|---|---|
| 14 | Sailer& Penn, 2009 | A comparative study, questionnaires, social network analysis | Some influence of spatial layout on organisational behaviour was found to be generic<br>Spatial layout influences organisational behaviour is subject to the context, culture and character. | The relationship between spatial layout, social interaction and social structure in an organisation |
| 15 | Wineman et al., 2009 | Explorative study investigating the social dimensions of innovation and its spatial metrics. | Aspects of social networks and spatial layout combine to provide a good indicator for successful collaboration<br>Spatial layouts with higher integration promoted communication<br>Spatial layout plays a strong supportive role in the formation and maintenance of social relations<br>Spatial layout shapes organisation culture and achievement | Relationship between Spatial layout, social networks and innovation. |
| 16 | Sailer, 2007 | An exploratory study, observations (movement patterns), axial and segment analysis of strong and weak programme aspects of office movement patterns | Movement in workplaces may be reflected best by a metric distance,<br>Distance is a key indicator of movement patterns in workplaces<br>Spatial configurations are best used to explain movement flows | The spatial layout can explain movement flows with the focus of complex buildings |
| 17 | Sailer et al., 2007 | | | |
| 18 | Sailer& Penn, 2007 | An exploratory study with an interpretative and phenomenological approach using correlation and syntax analysis | Spatial layout influences the formation of social structure and organisational behaviour | How spatial layout influence social interaction and organisation behaviour. |
| 19 | Rashid et al., 2006 | Exploratory study with Statistical analyses with observation behavioural data | Spatial layout have consistent effects on movement but inconsistent on visible copresence | The effect of spatial layout on face interaction through movement and visible co- |

| | Name | Methodology/Techniques | Findings | Approach/Focus |
|---|---|---|---|---|
| 20 | Rashid & Zimring, 2003 | A comparative study of 5 office layout | Highlighted generic spatial properties of these constructs using space syntax analysis. | Relationship between spatial layout and organisational constructs like, communication control, territoriality, privacy and status |
| 21 | Penn et al., 1999 | A comparative assessment of 2 research-led design projects with space syntax techniques survey. | A spatial layout which dictates movement and patterns of space use has a direct impact on the frequency of contact between workers in the office-based organisation<br>Patterns of communication were a direct result of spatial configuration<br>Spatial integration and differentiation of important spatial metrics to support flexible working and a range of different work activity. | How spatial layout can generate new organisation structure and facilitate individual communication<br>Relationship between spatial layout and pattern of communication |
| 22 | Serrato&Wineman, 1999 | Exploratory study which investigates the relationship between layout and communication patterns<br>Using 2 case studies | The frequencies and location of communication were related to the spatial layout<br>Spatial layout enhanced local networks | Relationship between spatial layout and communication patterns in research facilities |
| 23 | Peatross, 1997 | | Spatial layout influences the spatial patterns of movement and by extension interaction. | Exploring the relationship between spatial layout and control in a restrictive environment<br>Spatial properties of building the effect patterns of space use. |
| 24 | Wineman&Serrato, 1997 | A comparative study with observations (face to face interaction) spatial analyses. | Integrated spatial layout correlated the significantly higher number of face to face communication | Examining interrelationship between spatial layout with face to face communication outcomes |

As highlighted previously, this paper focused on spatial configuration and communication-related research. A summary of the systematic review is seen in Table 2. This study critically reviewed past research based on the focus of these studies, the methodological approach and techniques used and the variables and findings of these studies. Thus, this study discusses the findings from the systematic review as follows.

**Focus of the Study.**

Considering the focus, this study found that all the researches reviewed were based on the relationship and influence of space on many socially related concepts, in this case, communication-related. Table 2 summarises the many communication-related concepts that were associated with the spatial configuration in hospitals. A look at these concepts gave a range of interpretations to the multifaceted concept of communication, especially in Hospitals.

**Table 2:** Main Communication-Related concepts in Hospital Settings

| Space | | Communication-related Concepts |
|---|---|---|
| Spatial Configuration | Relationship | Caregiver Interactions, |
| Spatial layout | | Communication (Outpatient Clinics) of different categories of People |
| Nursing Unit Design, | | Communication (Teamwork), |
| Ward design | | Communication patterns, |
| | | Communication Processes (in Treatment and Diagnostics Areas) |
| | | Culture, |
| | | Different Work Styles, |
| | | Face to Face Interaction |
| | | Interaction and Coawareness |
| | | Interaction in Wards |
| | Influence on | Medical and Organisational Outcomes |
| | | Movement Flows |
| | | Nurse Satisfaction |
| | | Observed behaviours and Environmental Perception |
| | | Organisation communication, Communication (Patient Care processes, |
| | | Organisational Behaviours |
| | | Organisational Constructs (Communication, Control, Privacy, Status, Territoriality) |
| | | Patient Outcome/Quality of Care) |
| | | Patient Safety and Satisfaction |
| | | Productivity (Healthcare Outcome) |
| | | Quality of Care, |
| | | Social Interaction and Social Structure |
| | | Social behaviour (Work processes), |
| | | Social Network and Innovation |
| | | Technical, Psychological and Social orientation |

Source: Author, 2020.

It is important to note the various interpretations of space itemised in the studies under review. Space was interpreted as the designed layout of the hospital. Thus, in the reviewed literature space was defined as spatial layout, spatial configuration and in specific cases, nursing unit design and other specialised spaces in the hospital setting as the case implied. Also, the research reviewed in this paper focused on two major concepts and the focus was on the relationship or influence as the case was presented. In otherwords, the studies reviewed focused on the relationship between spatial configuration and communication, the influence of spatial configuration on communication and the influence of communication on the spatial layout in the Hospital settings. More importantly, each study reviewed conceptualised communication in a unique way that set the pace for this systematic review. From Table 2, the concept of communication can be divided into 3 categories namely Communication defined by Culture and social interactions (Social), communication defined by category of users (Psychological) and Communication-related to work processes and healthcare outcomes (Technical). Contents of these communication definitions are seen in Table 3.

**Table 3:** Conceptualising Communication in Spatial and communication - Related Studies

| | **Communication categories** | |
|---|---|---|
| 1 | Communication: Culture and Social Interaction | Interactions, Patterns, Face -to-face Interaction, Coawareness, Movement Flows, Behaviour, social structure |
| 2 | Communication: User Groups | Nurse Satisfaction, Perception, patient Outcome, Safety and Satisfaction |
| 3 | Communication: Work processes and Healthcare Outcomes | Teamwork, work processes, Different Work Styles, Medical organisational Outcomes, organisational communication, Organisational Constructs; Control, Privacy, Status, Territoriality |

**Source:** Author, 2020.

From Table 3 it is clear that the concept of communication with spatial configuration studies covers a wide range of concepts as seen above. However, most of the studies reviewed in this paper mostly fell in the Technical category. This category accounted for 60% (about 19 of the studies reviewed). The Social and Psychological category accounted for 30% and 10% of the studies reviewed respectively. It should be noted that the studies reviewed was a cross-section of spatial configuration and communication-related studies from over four decades. It is safe to conclude that a majority of the studies in spatial configuration and communication especially in Hospital settings were focused on the technical aspects of communication as related to the Social and psychological interpretations of communication as opined by Rashid (2015).

A closer look at the technically oriented category of communication, this research found out that communication was conceptualised as focusing on areas that had to do with work processes and health care outcomes. In this category, communication was seen to influence the work processes that contribute to healthcare delivery or outcomes (Pachilova & Sailaer, 2020, Cai & Zimring, 2017, Real et al., 2017, Gharaveis & Hamilton, 2018, Pachilova et al., 2017, Hua *et al.*, 2015, Liu et al., 2014, Bayramzadeh, 2014, Peponis et al, 2007, Hanson & Zako, 2005, Rashid and Zimring, 2003). Terms like teamwork, work styles, organisational communication and constructs like control, privacy, status, and territoriality were all concepts that were focused on in this category. In other words, the concepts of communication as seen in the Technical category of this review

focused on healthcare outcomes. Put differently, the relationships investigated in these studies pointed to how communication contributed to efficient healthcare delivery in Hospital Settings. Thus, the concept of communication was used as a variable to understand work processes, teamwork, Control and many other constructs in research. Also, the concept of communication was seen to be an integral part of healthcare delivery.

When considering the social and psychological category of research under review, communication as a concept is seen as a construct on its own. For the Social category of research, communication was interpreted by the organisational culture and the interactions within the spaces. The focus of this category was on the social interactions in the spaces in the hospital environment. Keywords in this category were social interactions, patterns, culture, face to face interactions coawareness, movement flows, behaviours and social structure. In line with these, this study found that this category focused on the behaviour and movement patterns of the users of the spaces being studied. Here, the research pointed to the relationship between the spatial layout and the behaviour and movement patterns of the users of the spaces being investigated. For the Psychological category, the studies focused on specific User-groups and how the spatial configuration in hospital affect these groups, their movement, behaviour, job satisfaction, commitment, and their perception.

In summary, the approach and focus of spatial configuration and communication-related studies provided clear distinctions concerning the interpretation of the concept of communication and providing an insight into the various aspects in the hospital settings that communication can be related to. In short, communication can be socially interpreted focusing on the social interactions and patterns within the spatial layout. It can also be psychologically interpreted with a focus on the User groups in the Hospital especially the relationships between the spatial layout and the perceptions of these groups.

**Review of Methodologies**

As part of this review, this paper also studied the methodology and techniques used to investigate the relationships and influence between spatial layout and communication in the hospital setting.Three distinct methodologies were identified in the review. First, a majority of the research reviewed were comparative studies while a few others were Explorative and Interpretative in their methodological approach. The comparative studies focused on comparing distinct spatial layouts based on established typologies. For example,Pachilova and Sailer's study in 2013, compared the spatial layout of five clinics each in two hospitals other studies focused on comparing the spatial layout across varying cultures as exemplified in Cai and Zimring's (2017) study.

For the exploratory studies, most of the research reviewed focused on case studies which provided a platform for in-depth investigation of the relationships between the spatial layout in hospitals and specific ways the spatial configuration influenced communication. Methods employed in these studies were tailored towards the spatial layout and communication. The space syntax theory andmethodology was used for assessing the spatial layout in all the studies reviewed. First, the theory of Space Syntax provides an interpretation of spatial layout that highlights its social milieu (Hillier and Hanson, 1984). This interpretation provided these studies with the opportunity of highlighting specific properties in the spatial layout that were socially related. Second, the space syntax methodology helped to quantify the spatial properties of the layout related to socially related concepts, in this case, Communication.

This study recorded quite a number of methods to assess communication in the Hospital settings investigated. This paper identified some methods that were used to gather data on communication (Technical, Psychological and Social). For the communication defined by social interaction and culture methods included, non-participant observation of social and communication network within the spaces being investigated, direct observation of

activities in the spaces, and questionnaire survey. The Communication interpreted as Psychological had its data mostly gathered by surveys (Questionnaires) and focused group discussions because of the focus on the perception of unique categories of people. The data gathered for the technically defined communication category were done using both observations (social and communication networks) and survey techniques to accurately assess work processes and organisational outcomes in hospital settings.

Most of the studies (90%) reviewed, used statistical analysis to conclude on the relationship between the spatial layout and communication in Hospitals. A good number using correlation to investigate whether a relationship exists between space and communication while a few used regression models to predict significant influences of variables between space and communication in Hospital environments. It should be noted that the Space Syntax methodology provides a platform for these studies to harmonise the data collected by quantifying space. Other studies in this review used interpretative phenomenology to link the concepts of spatial layout and communication. (Peatross and Peponis, 1995, Allen, 1977)

**CONCLUSION** This study set out to review systematically studies that focused on spatial configuration and communication-related studies for the past four decades. Using content analysis, this study first highlighted relevant studies in this category from key online databases as stated above. Using the approach/focus of research, methodology and findings of the studies, this study proceeded to perform a systematic analysis using the above as content criteria for the assessment. Following the findings, the conclusion of this study are as follows;

i. Studies that have focused on spatial configuration and communication in hospitals can interpret Communication into three categories namely; communication as social interaction and culture, communication as it refers to a specific user group (Psychological), and communication referring to work processes and organisational outcomes (Technical category)

ii. Studies that focused on communication as social interaction and culture are better positioned to develop a theory on behaviour, movement and space usage patterns in the Hospital environment.

iii. Studies that pointed to communication as it refers to specific user groups target the relationship of spatial configuration and perception of these user groups which border on a range of psychological concepts.

iv. Studies that focused on the organisational Outcomes address the processes that lead to the efficient delivery of healthcare.

v. Most of the methodologies in the review are Comparative studies that research on existing typologies with a limitation to building theory in spatial layout and communication-related studies.

vi. Exploratory and Phenomenological Studies provide a solid platform for developing theory in spatial configuration and communication-related studies

vii. Statistical analysis remains a highly patronized method for harmonizing data and investigating the relationship between spatial configuration and communication-related studies

viii. Considering the many theoretical assumptions in spatial configuration and communication-related studies and the bias in comparative studies in healthcare environments, there is a need to focus on in-depth study to better understand the relationship between the two (2) concepts (spatial configuration and communication-related studies)

The study recommends that further studies in this area should be focused on the in-depth study (case studies) to better understand and shed light on new relationships between the concepts under review.

**REFERENCES**

Allen, T. J. (1977). Managing the flow of technology: Technology transfer and the dissemination of technological information within the R&D organisation. *Cambridge, MA: The Massachusetts Institute of Technology*.

Barasa, E. W., Molyneux, S., English, M., & Cleary, S. (2017). Hospitals as complex adaptive systems: a case study of factors influencing priority setting practises at the hospital level in Kenya. *Social Science & Medicine*, *174*, 104-112

Bayramzadeh, S., & Alkazemi, M. F. (2014). Centralized vs. decentralized nursing stations: An evaluation of the implications of communication technologies in healthcare. *HERD: Health Environments Research & Design Journal*, *7*(4), 62-80.

Cai, H., & Zimring, C. (2012). Out of Sight, Out of Reach: Correlating spatial metrics of nurse station typology with nurses' communication and co-awareness in an intensive care unit. In *Proceedings of the 8th International Space Syntax Symposium, Santiago, Chile* 36(1) 381-391.

Cai, H., & Zimring, C. (2019). Cultural impacts on nursing unit design: A comparative study on Chinese nursing unit typologies and their US counterparts using space syntax. *Environment and Planning B: Urban Analytics and City Science*, *46*(3), 573-594.

Fay, L., Cai, H., & Real, K. (2019). A systematic literature review of empirical studies on decentralized nursing stations. *HERD: Health Environments Research & Design Journal*, *12*(1), 44-68.

Gharaveis, A., Hamilton, D. K., & Pati, D. (2018). The impact of environmental design on teamwork and communication in healthcare facilities: a systematic literature review. *HERD: Health Environments Research & Design Journal*, *11*(1), 119-137.

Hanson, J., & Zako, R. (2005). Configuration and design in caring environments: Syntax and quality of life in a sample of residential care homes for older people. TU Delft, TU Delft.

Hua, Y., Becker, F., Wurmser, T., Bliss-Holtz, J., & Hedges, C. (2012). Effects of nursing unit spatial layout on nursing team communication patterns, quality of care, and patient safety. *HERD: Health Environments Research & Design Journal*, *6*(1), 8-38.

Jamoh, B., Abubakar, S., & Isa, S. (2018). Morbidity and mortality profile of patients seen in medical emergency unit of a Teaching Hospital in Nigeria: A 4-year audit. *Sahel Medical Journal*, *21*(4), 213-213.

Liu, W., Manias, E., & Gerdtz, M. (2014). The effects of physical environments in medical wards on medication communication processes affecting patient safety. *Health & place*, *26*, 188-198.

Ogunola, A. A. (2015). The Relationship between Organisational Communication and Job Performance of Employees of Selected Nigerian Brewing Industries, *5*(2), 85–92.

Okonofua, F., Ntoimo, L., Ogu, R., Galadanci, H., Abdus-Salam, R., Gana, M., ...&Randawa, A. (2018). Association of the client-provider ratio with the risk of maternal mortality in referral hospitals: a multi-site study in Nigeria. *Reproductive health*, *15*(1), 32.

Pachilova, R. (2020). *Exploring Quality of Care in Hospital Wards: The Effect of Spatial Layout, Staff Work Activities and Communication Patterns* (Doctoral dissertation, UCL (University College London)).

Pachilova, R., &Sailer, K. (2013). The effect of hospital layout on caregiver-patient communication patterns.

Pachilova, R., &Sailer, K. (2014). Evidence-Based Design: The Effect of Hospital Layouts on the Caregiver-Patient Interfaces. In *Conference on Design 4 Health 2013 Sheffield, 3-5 July 2013* (p. 174).

Pachilova, R., &Sailer, K. (2020). Providing care quality by design: a new measure to assess hospital ward layouts. *The Journal of Architecture*, *25*(2), 186-202.

Pachilova, R., Sailer, K. & King, M. (2017, July). The dynamic nature of caregiver communication networks and spatialised work processes in hospital wards. In *Proceedings of the 11th International Space Syntax Symposium* (Vol. 11, pp. 18-1). Instituto Superior Tecnico, DepartamentodeEngenharia Civil, Arquitetura e Georrecursos, Portugal.

Peatross, F. (1997). The spatial dimension of control in restrictive settings. In *Proceedings of the First International Space Syntax Symposium, London*.

Peatross, F. D., & Peponis, J. (1995). Space, education, and socialization. *Journal of Architectural and Planning Research*, 366-385.

Penn, A., & Hillier, B. (1992). The social potential of buildings: spatial structure and the innovative millieu in scientific research laboratories. Ministère de l? Equipement du Logementet des Transports, Ministère de l? Equipement du Logementet des Transports.

Penn, A., Desyllas, J., & Vaughan, L. (1999). The space of innovation: interaction and communication in the work environment. *Environment and planning B: Planning and design*, *26*(2), 193-218.

Penn, A., Martinez, M., &Lemlij, M. (2007, June). Structure, agency and space in the emergence of organisational culture. In *Proceedings, 6th International Space Syntax Symposium, İstanbul* (pp. 073-1).

Peponis, J., Bafna, S., Bajaj, R., Bromberg, J., Congdon, C., Rashid, M., ...&Zimring, C. (2007). Designing space to support knowledge work. *Environment and Behavior*, *39*(6), 815-840.

Poole,M.S.(2014).Systemstheory.InL.L.Putnam&D.K.Mumby(Eds.),TheSAGEhandbook of organisational communication (pp. 49–74). Thousand Oaks, CA:Sage

Rashid, M. (2015). Research on nursing unit layouts: an integrative review. *Facilities*.

Rashid, M., &Zimring, C. (2003). Organizational constructs and the structure of space: A comparative study of office layouts. In *4th International Space Syntax Symposium: 2003*.

Rashid, M., Kampschroer, K., Wineman, J., &Zimring, C. (2006). Spatial layout and face-to-face interaction in offices—a study of the mechanisms of spatial effects on face-to-face interaction. *Environment and Planning B: Planning and Design*, *33*(6), 825-844..

Rashid, M., Wineman, J., &Zimring, C. (2009). Space, behavior, and environmental perception in open plan offices: a prospective study.

Rashid, M., Zimring, C., Wineman, J., Flaningam, T., Nubani, L., & Hammash, R. (2005). The effects of spatial behaviors and

layout attributes on individuals' perception of psychosocial constructs in offices. In *Proceedings of the Fifth International Space Syntax Conference* (pp. 71-87).

Real, K., Bardach, S. H., &Bardach, D. R. (2017). The role of the built environment: How decentralized nurse stations shape communication, patient care processes, and patient outcomes. *Health communication*, *32*(12), 1557-1570.

Rippin, A. S., Zimring, C., Samuels, O., & Denham, M. E. (2015). Finding a middle ground: Exploring the impact of patient-and family-centered design on nurse–family interactions in the neuro ICU. *HERD: Health Environments Research & Design Journal*, *9*(1), 80-98.

Sailer, K. (2007). Movement in workplace environments–configurational or programmed?. 6th International Space Syntax Symposium.

Sailer, K., & Penn, A. (2007). The performance of space–exploring social and spatial phenomena of interaction patterns in an organisation. In *Proceedings of the Architecture and Phenomenology Conference*. Faculty of Architecture and Town Planning, TheTechnion, Israel Institute of Technology.

Sailer, K., & Penn, A. (2009). Spatiality and transpatiality in workplace environments. Royal Institute of Technology (KTH).

Sailer, K., Budgen, A., Lonsdale, N., Turner, A., & Penn, A. (2009). Comparative studies of offices pre and post—how changing spatial configurations affect organisational behaviours. Royal Institute of Technology (KTH).

Sailer, K., Budgen, A., Lonsdale, N., Turner, A., & Penn, A. (2007). Effective workplaces–bridging the gap between architectural research and design practice.

Sari, Y. K. (2017). Influence of Organisational Culture and Communication on employee performance BolongKaranganyar village through Job Satisfaction and Organisational Commitment. *eAbstract Excellent*, *2*(2)

Schiavo, R. (2013). *Health communication: From theory to practice* (Vol. 217). John Wiley & Sons.

Scott, J. (2017). *Social network analysis*. Sage.

Serrato, M., &Wineman, J. (1999, March). Spatial and communication patterns in research & development facilities. In *Second International Space Syntax Symposium* (Vol. 1, pp. 11-1).

Suvanajata, R. (2001). Relations in architectural space: designs and effects in space of the traditional Thai houses and temples.

Tahir, M., Haming, M., &Bijaang, J. (2018). Organizational communication effect on lecturer performance in Muhammadiyah University of Makassar.

Wagenaar, C., &Mens, N. (2018). *Hospitals: a design manual*. Birkhäuser.

Wineman, J. D., Kabo, F. W., & Davis, G. F. (2009). Spatial and social networks in organizational innovation. *Environment and Behavior*, *41*(3), 427-442.

Wineman, J., &Adhya, A. (2007). Enhancing workspace performance. In *Proceedings 6 th international Space Syntax Symposium, Istanbul, Turkey* (Vol. 66, pp. 1-16)

Wineman, J., &Serrato, M. (1997). Enhancing Communication in Lab-Based Organisations. In *Space Syntax: First International Symposium, London*.