

ORIGINAL ARTICLE

The physical environment is essential, but what does the design and structure of stroke units look like? A descriptive survey of inpatient stroke units in Sweden

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Abstract

Background: The design of the physical environment is a critical factor in patient care and is known to influence health, well-being, clinical efficiency, and health-related outcomes. To date, there has been no general review of the physical environment of modern Swedish stroke units.

Aim: To explore the physical environment of inpatient stroke units in Sweden and describe the design and structure of these units.

Methods: This was a cross-sectional study. Data were collected in Sweden from April to July 2021 via a survey questionnaire.

Results: The layout of the stroke units varied broadly, such as the number of single-bed and multi-bed rooms. More than half the stroke units comprised spaces for rehabilitation and had an enriched environment in the form of communal areas with access to computers, games, books, newspapers, and meeting places. However, they offered sparse access to plants and/or scenery.

Conclusions: Healthcare environments are an essential component of a sustainable community. From a sustainability perspective, healthcare facilities must be built with high architectural quality and from a long-term perspective. Research on the physical environment in healthcare should contribute to improved quality of care, which can be achieved through building healthcare facilities that support the performance of care and recovery. Therefore, mapping of areas of interest for further investigation is crucial.

KEYWORDS

enriched environment, healthcare, physical environment, stroke unit

INTRODUCTION

The physical environment can affect health and well-being; the design of hospital buildings has been shown to

produce clinical effects and affect health outcomes [1–4]. For example, the physical environment influences nurses' practices because limited spaces make it difficult to move around, use and relocate equipment, transfer patients,

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and interact with patients and other team members [1, 5]. In stroke care, studies have shown that the design of hospital buildings affects patients' activity levels [6–9] and their feelings of loneliness [10], as well as staff's opportunities to provide optimal care [11]. Despite this, the only design recommendations in Swedish guidelines for stroke units are that the unit should be a geographically delimited area [12]. There are also no specific building guidelines for stroke units other than technical building recommendations such as room size, ventilation, and the number of windows. This means that the stroke units can be designed differently and not based on the evidence that exists about stroke. This study mapped the physical environment of stroke units via a national survey to understand the current design of stroke units and identify areas for research and improvement.

BACKGROUND

Healthcare facilities are among the most complex and expensive buildings to construct, maintain, and operate [13]. The design of hospital buildings affects several people in the society, including patients and their relatives [4, 14, 15]. Decisions about the design must be well substantiated in evidence of the users' needs, patients' experiences with the existing infrastructure, and economic conditions, and anchored in the context in which the building needs to be constructed [16, 17]. Over the last decade, Sweden and other OECD countries have witnessed an expansion in investments for new hospital buildings, and this trend continues. Many existing facilities cannot match the new requirements of healthcare design, such as rooms that support patients' rights to safe and person-centred care, in which integrity and control are vital aspects [18].

Unfortunately, there is no central organisation in Sweden that is responsible for standardisation and transfer of knowledge of design and quality of healthcare environments. Different platforms enable collegial exchange of information—for example, the Swedish PTS forum (Program for Technical Standards), which works to find standard routines for building health facilities [19], and the National Board of Housing, Building, and Planning [20]—but there is no comprehensive platform. Thus, there is a lack of clarity about the national building stock of stroke units. An overall picture of the facilities could provide a basis for decisions regarding new healthcare facilities. Thus, the current study aimed to gather information about the design of stroke units in Sweden and identify areas for investigation and improvement.

The process of development of new healthcare environments is incredibly complex; however, it generally

occurs in three overlapping stages: (i) the planning stage, in which architects collaborate with healthcare providers to understand users' needs, the model of care, and the clinical programme using a functional brief that summarises the requirements for the new hospital; (ii) the design stage, in which architects interpret these requirements to develop an initial concept which is then refined into a detailed design; and (iii) the delivery stage.

One consequence of the lack of knowledge, transfer of design, and quality could be difficulties in timely detection of deficiencies or problems, thus affecting the quality of care. The Institute of Medicine's (IOM) overall quality objectives are summarised in the concept of good care, where the environment is seen as an essential part of achieving good and high-quality care [21]. Building design can promote health and well-being and is now considered an important part of high-quality healthcare. However, there is a need to define the quality of care in relation to the physical environment [22]; for example, the way we address safety concerns, such as the risk of falling, needs to be defined in relation to different contexts. By mapping the areas of interest, we are building a foundation for research in these areas.

As one of the leading causes of disability, stroke can cause health impairments and increase patient dependence on daily life support, creating challenges for patients, caregivers, and society [23]. Brain damage resulting from stroke can have consequences for patients' health and ability to perform activities of daily living (ADLs) and participate in social life [24, 25]. National guidelines for stroke care recommend that rehabilitation should start in a stroke unit and be individually adapted based on prevalent symptoms and disabilities [12]. Early mobilisation after a stroke has been reported to be an important factor in the patient's recovery [26]. Patient-initiated early mobilisation, which can include physical activity, is associated with improved mobility [12, 23, 27] and a positive long-term effect on a patients' ability to perform ADLs and participate in society [28].

A stroke unit is a geographically defined area in the hospital, and there is strong evidence that it provides benefits—such as lower mortality and morbidity—for patients [29]. Factors contributing to superior care outcomes in stroke units include multidisciplinary stroke expertise, early rehabilitation plans, avoidance of bed rest, and early and comprehensive assessment of health status [23]. In a stroke unit, nurses play a central role in all care-related activities [30, 31], which include maintaining functions, preventing complications, encouraging patients to form social relations [30], assessing patients' skin, blood pressure, and body temperature, and mobilising patients [31].

The design of healthcare environments has been shown to affect patient outcomes, staff satisfaction, and financial performance of the facility [14, 32]. It also has a significant impact on the staff's ability to provide person-centred care [33, 34]. Person-centred care includes supporting interactions, enabling joint decision-making while respecting patients' privacy, and empowering them. This approach requires creation of spaces that support mental health and well-being and provide a therapeutic environment for emotional, cognitive, and physical recovery. Additionally, the possibility for patients to be able to look out of windows and let daylight into the room has been proven to be important for recovery [14], and poor lighting can further lead to an increase in fall accidents [17].

From a sustainability perspective, it is essential to develop functional healthcare facilities. The Swedish Government emphasises that research on the physical environment in healthcare should contribute to sustainable community building where quality of care is achieved by designing buildings that are conducive to security, well-being, and trust [18]. Furthermore, universal access to safe, inclusive, and accessible public spaces, particularly for older adults and people with disabilities, is one of the goals of sustainable development. The design of hospital buildings must be part of society's aim to build accessible healthcare environments. The Swedish Government has decided that Sweden will play a leading role in global work with the 2030 Agenda for Sustainable Development [35]. The agenda aims to transform Swedish society into a modern and sustainable welfare state. Goal 11 of sustainable development aims to foster inclusive and sustainable urbanisation and generate capacity for participatory, integrated, and sustainable human settlement planning and management in all countries. This includes universal access to safe, inclusive, accessible, and green public spaces, particularly for women, children, older adults, and people with disabilities [36].

A physical environment that can support patient care and activities in a stroke unit is referred to as an enriched environment (EE). An EE is described as an environment that is appropriate and stimulating, contains challenges for patients [37, 38], and focuses on enrichment via communal areas that have access to computers, games, books, newspapers, and meeting places, such as sofa groups [38–40]. Studies have shown that EEs can increase patient activity in acute and rehabilitation settings after stroke [38, 41] and may have a positive effect on functionality and mood [42]. However, the concept of EE has only been vaguely defined; there is considerable variability in the conceptual definitions, contexts of studies, and outcome measures [37, 43, 44].

In summary, a well-designed, stimulating, and attractive physical environment is essential for patient

care. Currently, there is no overarching review on the design of modern Swedish stroke units. Therefore, this study aimed to explore the physical environment of stroke units in Sweden and describe the design and structure of these facilities; we collected data on their size, decade of establishment and year of renovation, collocation status with other hospital care, availability of communal areas and rooms for rehabilitation, the number of single-bed and multi-bed rooms, ward layout, and enrichment of the environment. By describing these stroke units, we hope to identify areas for further investigation and improvement and inform future research priorities.

METHODS

Study design

This was a cross-sectional study. We conducted a survey to collect data from stroke units in all Swedish regions.

Sample

We aimed to include stroke units from all Swedish regions, and there are 21 regions in Sweden. These regions are responsible for crucial financial decisions and resources for various purposes—including healthcare—in each county. Each region includes at least one larger hospital with access to full-scale stroke care and several smaller hospitals with limited access to full-scale care. There are a total of 72 units that provide care for people that have had a stroke [45]. Stroke units are available almost exclusively at the largest hospitals. The definition of a stroke unit used in the Swedish national stroke guidelines published by the National Board of Health and Welfare [12] is based on definitions agreed upon by the Stroke Unit Trialists' Collaboration [29] and the European Stroke Initiative [46]. The majority (94%) of the people who have had a stroke in Sweden today are cared for in stroke units, intensive care units, or neurosurgical units at some point during the care period; an average of 7 days are spent at specific stroke units [45]. Therefore, we intended to include one stroke unit from the largest hospital in each region. These units were either acute stroke units, or rehabilitation stroke units, or both, or a mixed ward with a combination of stroke and neurology. To identify eligible facilities, we cross-referenced the list of stroke units to the Swedish Stroke Register [45], which is a national quality register for stroke care, primarily aimed for healthcare staff and decision-makers in healthcare.

Data collection

After identifying the largest hospital in each region, we sought contact information, including telephone numbers and e-mail addresses of the heads of these departments. The head of the department was asked to identify any of the staff who could be suitable to answer the questionnaire. The questionnaire was sent by post and e-mail to the largest hospital in each region ($n = 21$). The respondents were asked to provide information about the ward according to the parameters listed in [Table 1](#).

Questionnaire

The survey was a descriptive study that aimed to describe the physical environment at a stroke unit. The questionnaire focused on 10 areas with questions about the physical environment. It was inspired by an Australian study on the physical environment in rehabilitation centres [6]. Furthermore, questions about communal areas and environmental enrichment were added to the questionnaire. Space was provided to answer each question.

Statistical analysis

The collected data were analysed using descriptive statistics, such as frequency, percentages, and medians. Respondents were also allowed to provide a detailed description; these data were used to illustrate the quantitative findings.

RESULTS

Age (decade of establishment and year of renovation)

Out of the 21 stroke units, 20 stroke units responded to the survey. The ages of the stroke units varied; the units were built between 1940 and 2011. In the last 20 years, 12 units were partly or fully renovated, of which, nine stroke units had been renovated or newly built since 2010.

Size of and type of care provided in the stroke units

Data on the number of patient beds were collected for all stroke units. The stroke units ($N = 20$) provided 377 beds altogether. The number of beds allocated to each unit varied between 10 and 29; the median number of beds per stroke unit was 19. The number of single-bed and multi-bed rooms varied across stroke units. Two stroke units had only single-bed rooms and the remaining 18 units had a combination of rooms ([Figure 1](#)). Of the 377 beds, the single-bed rooms comprised 190 (50.4%) beds, and multi-bed rooms comprised 187. Several respondents stated that single-bed rooms were preferable for infection control, but it was difficult to oversee patients with anxiety and/or cognitive impairment in these rooms.

There were six acute stroke units, 10 acute, and rehabilitation stroke units, and four mixed stroke units with facilities for stroke and internal medicine ([Figure 2](#)).

TABLE 1 Parameters for information collected from each stroke unit included in the study

Variable	Description
Location	Name of the hospital
Type of stroke unit	Acute, rehabilitation, both acute and rehabilitation, or a combination of stroke and internal medicine
Age (and year of renovation)	Decade of establishment of the stroke unit and year of renovation
Size:	The number of beds dedicated to stroke patients and design of the room
• Number of beds	
• Number of single-bed rooms vs multi-bed rooms	
Space for rehabilitation	Whether there is space for rehabilitation in or in direct relation with the unit
Ward layout (in general)	Description of the stroke unit
Communal space	Availability of indoor and/or outdoor communal areas to patients
Daylight	Whether the rooms, corridors, and communal areas have daylight
Enrichment of the environment	Enrichment of the physical environment through communal areas with access to computers, games, books, newspapers, and meeting places, such as sofa groups, etc
Nature	Presence of plants, scenic view, and/or paintings with natural motifs in the stroke unit

FIGURE 1 Number of single-bed and multi-bed rooms in each stroke unit

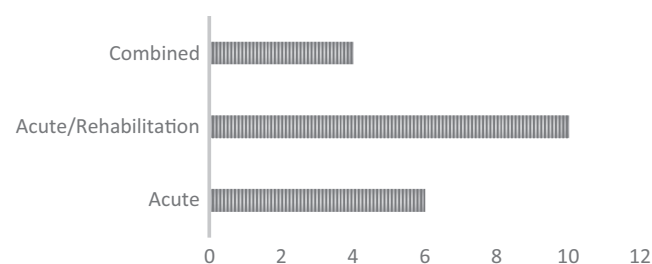
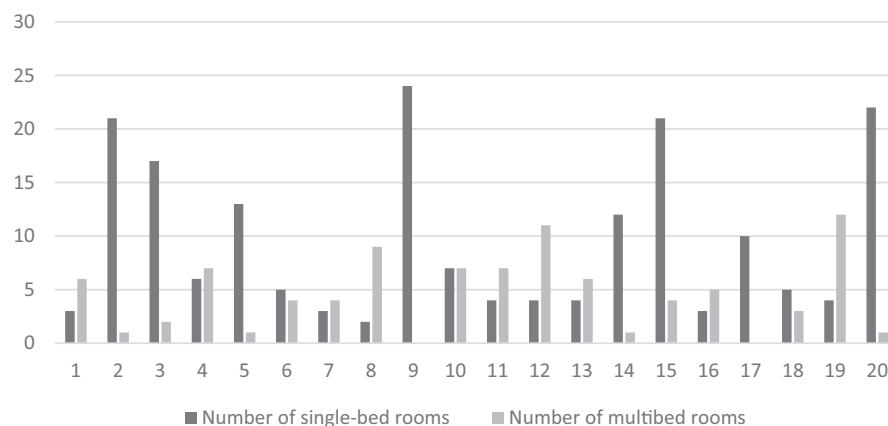


FIGURE 2 Type of stroke unit

Layout of and daylight in the stroke units

The layouts of the stroke units varied significantly; some units followed the standard format of spatial organisation with a single corridor; whereas, other units had two corridors built parallelly or at an angle. Some stroke units were built with three corridors around a courtyard.

Daylight in rooms, corridors, and communal areas varied from full daylight in all areas to limited by daylight in corridors (Figure 3).

Space for rehabilitation and communal areas

Thirteen units (65%) comprised space—in relation to the unit—for rehabilitation, such as therapy gym. It is unclear whether the rooms for rehabilitation were located somewhere else or rehabilitation activities were conducted in patients' rooms. One unit used the corridor as a rehabilitation room. Some stroke units had rooms for rehabilitation in the ward, but they were not built for rehabilitation purposes; quoting a respondent, "a former multi-bed room is used as a rehabilitation room. It is located in the ward. There are two workplaces (computers) with the option to close the sliding door. The room has exercise equipment, but the room is not built for rehabilitation; during crisis, we can transform the room into a patient room".

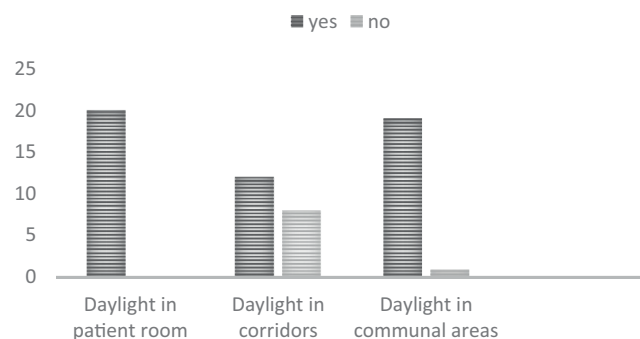


FIGURE 3 Daylight in rooms, corridors, and communal areas

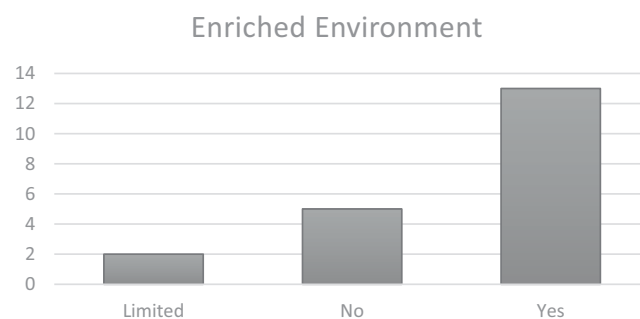


FIGURE 4 If there were any enrichment of the physical environment in the form of communal areas

All stroke units had communal areas but their design and location varied. These areas included a special dining room with only tables and chairs or a special room with tables, sofa groups, books, magazines, and different types of games. Some units had sofa groups, where patients could socialise with others.

Enrichment of the environment

The stroke units were asked about the status of enrichment of their environment in the form of communal areas

with access to computers, games, books, newspapers, and meeting places, such as sofa groups (Figure 4). Some units reported that they had a communal area with tables, sofa, and television; however, they did not permit access to books, Wii-play, etc. due to risk of infection.

Nature

Some stroke units reported that they had plants ($n = 3$) or plastic plants ($n = 8$); whereas other units reported having no plants (living or plastic) for health- and hygiene-related reasons. Eleven stroke units had paintings with natural motifs. One unit had access to a balcony with plants and a view of nature.

DISCUSSION

To the best of our knowledge, this is the first cross-sectional study focusing on the physical environment of Swedish stroke units. To gain more knowledge and identify the best environment design for a stroke unit, the different parts of the physical environment of stroke units should be mapped out. Currently, there is no Swedish organisation that is responsible for the standardisation and transfer of knowledge of building design inwards as of stroke units. In other words, here is lack of clarity about the overarching picture of the quality and standards of stroke units in Sweden.

Stroke units ensure the co-location of people affected by stroke, who are treated in a geographically bounded area by multidisciplinary staff with specific expertise in stroke care [23]. However, not all stroke units could fit the definition in the current study, and there was considerable variation in the design and layout of the stroke units included in the study. This is a striking result for it was crucial for healthcare institutions to run stroke units according to the recommendations 10–15 years ago [46]. In our study, several units had combination of facilities for stroke care and other internal medicine, such as kidney disease care. The fact that the principals of the healthcare system have abandoned pure stroke units is serious and probably a result of cuts in care, and that the healthcare system is forced to limit the available space and merge units to save resources like nurses. Research shows that acute care and rehabilitation in stroke units (vs. in general wards) lead to an increase in the number of patients surviving, returning home, and regaining independence in ADLs [29, 46]. Stroke units ensure the co-location and treatment of people with stroke in a geographically bounded area by multidisciplinary staff with expertise in stroke care [23]. Therefore, it is crucial that all stroke units

in large hospitals are formal stroke units. A mapping such as that in the present study can be helpful in informing policymakers about the current healthcare situation in Sweden.

The number of single-bed rooms and multi-bed rooms varied. It is surprising that the percentage of single-bed rooms is low, considering the policy recommendations and arguments about the advantages of single-bed rooms in Sweden and elsewhere [47]. Building recommendations for new healthcare environments comprise a single-bed room design. However, the benefits of single-bed versus multi-bed rooms are currently being discussed. A recent literature review on effects of the design of patient room (single-bed vs. multi-bed room) on older adults with neurological diseases (aged above 60 years) in hospitals showed that apart from slightly better infection control in single rooms, there was no evidence that single rooms were better for older adults with neurological diseases [8]; in fact, multi-bed rooms may aid in reducing falls [46] and promoting social interactions [9, 47]. Our survey showed that Sweden has a mix of different types of rooms. However, the radical policy recommendation to build only single-bed rooms must be a subject of further investigation in terms of its consequences for organisations and for care of patients. The results underline the importance of an overarching picture in understanding the design of and standardising Swedish stroke units. Currently, there is no central organisation to provide clarity on and control the design and standards of stroke units.

The survey results showed that more than half the units had enriched their physical environment in the form of communal areas with access to computers, games, books, newspapers, and meeting places, such as sofa groups, etc. EE has been mainly explored through animal models [48] and is a growing area of research in which critical issues are now about the concept to people in different contexts [37]. Activity is an important driving force for recovery after stroke [23, 49, 50], and the physical environment of stroke units can both limit and increase activity. Therefore, it is essential to continuously study the effects of different embodiments of the physical environment, such as enriched environments. Further research is needed to study the effects of enrichment of a domain on an activity and the experience of loneliness among stroke patients. It is essential to understand the concept and components of EEs. Several stroke units included in the study comprised some form of enrichment of their environments. However, future research must not only conduct detailed examinations of the type of enrichment that may be beneficial to patients in stroke units but also study the broad meaning of the concept, including the physical environment's design and architecture. For example, all stroke units included in the current study

had common spaces; however, two interesting questions to answer would be how physically and visually accessible these spaces are, and is it tempting to go to these common spaces?

From a nursing perspective, stroke units can either hinder or facilitate rehabilitation nursing practice, ultimately affecting patient care. Contextual factors impacting nurses' practices include organisation, leadership, and utility of the physical environment [51]. The results of this study can aid in setting an agenda for further investigation; the basis of further investigation could be that the design of stroke units is an important part of nursing practice, patient care, and activities performed by patients, and the interaction between healthcare and physical environment can promote health and well-being. Unfortunately, Sweden does not have national standards to regulate the design of the physical environments in healthcare environments, beyond technical aspects. Ultimately, the design process requires knowledge to make informed decisions regarding the design of the environment. It is essential to gauge the structure and design of different units to foster optimal distribution of resources among different healthcare facilities with the ultimate objective of improved quality of healthcare. In order to build healthcare facilities with a long-term perspective and high architectural quality, there is a need for in-depth knowledge of the building design. Hospital design and enriched physical environments are essential for patients, significant others, and healthcare professionals in stroke units.

Study limitations

The results of this study should be interpreted in light of certain limitations. Although a strength of this study is that almost all Swedish regions responded, it would be desirable to include all hospitals that provide care for stroke patients. The stroke units included in the study varied in size, decade of establishment and renovation, and types of care provided, which should make the selection representative in a Swedish context. One limitation is that the survey may have weaknesses in terms of data reliability because we do not know the role and expertise of the respondents; we have no knowledge, for example, about who answered the survey, their profession, or their knowledge of design and architecture. The responses contained a variety of examples ranging from summary responses to extended texts and architectural drawings of the unit. It is possible that we missed some parts of the data, and the respondents could have misunderstood the survey questions. However, a strength of the study is that several units were involved in providing detailed descriptions of the building designs.

CONCLUSION

Healthcare environments are an important part of a sustainable community. From a sustainability perspective, healthcare facilities must be built with high architectural quality and from a long-term perspective. Research on the physical environment of stroke units should contribute to could contribute to the building of a physical environment supports the performance of care, leading to improvement in the quality of care. Mapping areas of interest for further investigation is crucial. This study showed that research on building design of stroke units should continue to focus on methods of creating an enriched environment for patients, staff, and visitors, contributing to a positive environment in stroke units.

AUTHOR CONTRIBUTIONS

AA, HM, and ME worked closely to create the manuscript. They contributed in conceptualisation of the research and discussion of its methodology. AA was involved in data collection, analysis, and interpretation, and drafted the manuscript in collaboration with ME. All authors have read, revised, and approved the final manuscript.

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CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest.

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REFERENCES

1. Anåker A, von Koch L, Sjöstrand C, Heylighen A, Elf M. The physical environment and patients' activities and care: a comparative case study at three newly built stroke units. *J Adv Nurs*. 2018;74:1919–31.
2. Malenbaum S, Keefe FJ, Williams ACC, Ulrich R, Somers TJ. Pain in its environmental context: implications for designing environments to enhance pain control. *Pain*. 2008;134(3):241–4.
3. Steinke C. Assessing the physical service setting: a look at emergency departments. *HERD*. 2015;8(2):31–42.
4. Ulrich RS, Bogren L, Gardiner SK, Lundin S. Psychiatric ward design can reduce aggressive behavior. *J Environ Psychol*. 2018;57:53–66.
5. Seneviratne CC, Mather CM, Then KL. Understanding nursing on an acute stroke unit: perceptions of space, time and inter-professional practice. *J Adv Nurs*. 2009;65(9):1872–81.

6. Lipson-Smith R, Zeeman H, Bernhardt J. What's in a building? A descriptive survey of adult inpatient rehabilitation facility buildings in Victoria, Australia. *Arch Rehabil Res Clin Transl*. 2020;2(1):100040.
7. Anåker A, von Koch L, Sjöstrand C, Bernhardt J, Elf M. A comparative study of patients' activities and interactions in a stroke unit before and after reconstruction-the significance of the built environment. *PLoS One*. 2017;12(7):e0177477.
8. Shannon MM, Elf M, Churilov L, Olver J, Pert A, Bernhardt J. Can the physical environment itself influence neurological patient activity? *Disabil Rehabil*. 2019;41(10):1177–89.
9. Shannon MM, Lipson-Smith R, Elf M, Olver J, Kramer S, Bernhardt J. Bringing the single versus multi-patient room debate to vulnerable patient populations: a systematic review of the impact of room types on hospitalized older people and people with neurological disorders. *Intell Build Int*. 2020;12(3):180–98.
10. Anåker A, von Koch L, Heylighen A, Elf M. "It's lonely": patients' experiences of the physical Environment at a newly built stroke unit. *HERD*. 2019;12(3):141–52.
11. Nordin S, Swall A, Anåker A, von Koch L, Elf M. Does the physical environment matter? - A qualitative study of healthcare professionals' experiences of newly built stroke units. *Int J Qual Stud Health Well-being*. 2021;16(1):1917880.
12. Socialstyrelsen. Nationella Riktlinjer för Vård Vid Stroke. Swedish National Guidelines for Stroke Care. Stockholm: Socialstyrelsen; 2018.
13. Bernhardt J, Lipson-Smith R, Davis A, White M, Zeeman H, Pitt N, et al. Why hospital design matters: a narrative review of built environments research relevant to stroke care. *Int J Stroke*. 2021;17(4):370–7.
14. Ulrich RS, Zimring C, Zhu X, DuBose J, Seo HB, Choi YS, et al. A review of the research literature on evidence-based healthcare design. *HERD*. 2008;1(3):61–125.
15. Gharaveis A, Hamilton DK, Pati D. The impact of environmental design on teamwork and communication in healthcare facilities: a systematic literature review. *HERD*. 2018;11(1):119–37.
16. Hamilton DK, Watkins DH. Evidence-based design for multiple building types. Hoboken: John Wiley & Sons; 2009.
17. Gharaveis A, Kirk Hamilton D, Shepley M, Pati D, Rodiek SJI, Environment B. Design suggestions for greater teamwork, communication and security in hospital emergency departments. *Indoor Built Environ*. 2019;28(8):1126–9.
18. Socialdepartementet. *God Och Nära vård. En Reform för Ett Hållbart Hälso- Och Sjukvårdssystem* (Good and Close Care. A Reform for a Sustainable Health Care System). SOU. Vol 19. Stockholm: Socialdepartementet; 2020.
19. PTS. Program for technical standards. 2021. <https://www.pts.se/sv/bransch/internet/arrangemang-och-forum/pts-sakerhetsforum/sakerhetsforum-2020/>. Accessed Jan 11, 2022.
20. Boverket. National Board of housing, building, and planning. <https://www.government.se/government-agencies/swedish-national-board-of-housing-building-and-planning/>. Accessed Jan 11, 2022.
21. Wolfe A. Institute of medicine report: crossing the quality chasm: a new health care system for the 21st century. Policy, politics, and nursing practice. *Policy Polit Nurs Pract*. 2001;2(3):233–5. Washington (DC).
22. Anåker A, Heylighen A, Nordin S, Elf M. Design quality in the context of healthcare environments: a scoping review. *HERD*. 2017;10(4):136–50.
23. SUTC. Organised inpatient (stroke unit) care for stroke. *Cochrane Database Syst Rev*. 2013;2013(9):CD000197.
24. Douiri A, Rudd AG, Wolfe CDA. Prevalence of poststroke cognitive impairment: South London stroke register 1995-2010. *Stroke*. 2013;44(1):138–45.
25. Donnan GA, Fisher M, Macleod M, Davis SM. Stroke. *Lancet*. 2008;371(9624):1612–23.
26. Billinger SA, Arena R, Bernhardt J, Eng JJ, Franklin BA, Johnson CM, et al. Physical activity and exercise recommendations for stroke survivors: a statement for healthcare professionals from the American Heart Association/American Stroke Association. *Stroke*. 2014;45(8):2532–53.
27. Scrivener K, Sherrington C, Schurr K. Exercise dose and mobility outcome in a comprehensive stroke unit: description and prediction from a prospective cohort study. *J Rehabil Med*. 2012;44(10):824–9.
28. Kwakkel G, van Peppen R, Wagenaar RC, Wood Dauphinee S, Richards C, Ashburn A, et al. Effects of augmented exercise therapy time after stroke: a meta-analysis. *Stroke*. 2004;35(11):2529–39.
29. Langhorne P, Langhorne P, Ramachandra S. Stroke unit trials C. organised inpatient (stroke unit) care for stroke: network meta-analysis. *Cochrane Database Syst Rev*. 2020;4(4):CD000197.
30. Kirkevold M. The role of nursing in the rehabilitation of stroke survivors: an extended theoretical account. *ANS Adv Nurs Sci*. 2010;33(1):E27–40.
31. Summers D, Leonard A, Wentworth D, Saver JL, Simpson J, Spilker JA, et al. Comprehensive overview of nursing and interdisciplinary care of the acute ischemic stroke patient: a scientific statement from the American Heart Association. *Stroke*. 2009;40(8):2911–44.
32. Sadler BL, Berry LL, Guenther R, Hamilton DK, Hessler FA, Merritt C, et al. Fable hospital 2.0: the business case for building better health care facilities. *Hastings Cent Rep*. 2011;41(1):13–23.
33. Sjögren K, Lindkvist M, Sandman PO, Zingmark K, Edvardsson D. Organisational and environmental characteristics of residential aged care units providing highly person-centred care: a cross sectional study. *BMC Nurs*. 2017;16:44.
34. McCormack B, Dewing J, McCance T. Developing person-centred care: addressing contextual challenges through practice development. *Online J Issues Nurs*. 2011;16(2):3.
35. Regeringen. Handlingsplan Agenda 2030. (2030 Agenda for Sustainable Development). Stockholm: Finansdepartementet; 2018.
36. Regeringen. Sustainable development Goals 2019. <https://www.un.org/sustainabledevelopment/>. Accessed Jan 11, 2022.
37. McDonald MW, Hayward KS, Rosbergen ICM, Jeffers MS, Corbett D. Is environmental enrichment ready for clinical application in human post-stroke rehabilitation? *Front Behav Neurosci*. 2018;12:135.
38. Rosbergen IC, Grimley RS, Hayward KS, Brauer SG. The impact of environmental enrichment in an acute stroke unit on how and when patients undertake activities. *Clin Rehab*. 2019;33(4):784–95.

39. Rosbergen IC, Grimley RS, Hayward KS, Walker KC, Rowley D, Campbell AM, et al. Embedding an enriched environment in an acute stroke unit increases activity in people with stroke: a controlled before–after pilot study. *Clin Rehab*. 2017;31(11):1516–28.
40. Janssen H, Ada L, Middleton S, Pollack M, Nilsson M, Churilov L, et al. Altering the rehabilitation environment to improve stroke survivor activity: a phase II trial. *Int J Stroke*. 2022;17(3):299–307.
41. Janssen H, Ada L, Bernhardt J, McElduff P, Pollack M, Nilsson M, et al. An enriched environment increases activity in stroke patients undergoing rehabilitation in a mixed rehabilitation unit: a pilot non-randomized controlled trial. *Disabil Rehabil*. 2014;36(3):255–62.
42. Khan F, Amatyia B, Elmalik A, Lowe M, Ng L, Reid I, et al. An enriched environmental programme during inpatient neuro-rehabilitation: a randomized controlled trial. *J Rehabil Med*. 2016;48(5):417–25.
43. Morichetto H. Bostadens arkitektur och berikad miljö (Residential architecture and enriched Environments). Gothenburg: Chalmers; 2019.
44. Morichetto H, Nilsson M. Can residential architecture constitute a part of a human-enriched environment and contribute to recovery, prevention and stress reduction? In: Gromark S, Andersson B, editors. *Architecture for Residential Care and Ageing Communities: Spaces for Dwelling and Healthcare*. New York, NY: Routledge/Taylor & Francis Group; 2021. p. 53–64.
45. Riksstroke. The Swedish stroke register. 2021. <https://www.riksstroke.org/eng/>. Accessed Jan 11, 2022.
46. Ringelstein EB, Chamorro A, Kaste M, Langhorne P, Leys D, Lyrer P, et al. European stroke organisation recommendations to establish a stroke unit and stroke center. *Stroke*. 2013;44(3):828–40.
47. Strid M, Schmitt K. Enpatientrum i Sverige, En förstudie om vårdavdelningar mod fokus på nuläge Single-bed room in Sweden. Gothenburg: Centrum För vårdens arkitektur; 2017.
48. Kempermann G. Environmental enrichment, new neurons and the neurobiology of individuality. *Nat Rev Neurosci*. 2019;20(4):235–45.
49. Saunders DH, Greig CA, Mead GE. Physical activity and exercise after stroke: review of multiple meaningful benefits. *Stroke*. 2014;45(12):3742–7.
50. Gallanagh S, Quinn TJ, Alexander J, Walters MR. Physical activity in the prevention and treatment of stroke. *ISRN Neurol*. 2011;2011:953818.
51. Clarke DJ. Nursing practice in stroke rehabilitation: systematic review and meta-ethnography. *J Clin Nurs*. 2014;23(9–10):1201–26.

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