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Finnish Institute of
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Developing risk management practices in a hospital environment

**A comprehensive assessment of the usability of the facilities
at a one Central Hospitals in Finland**

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Introduction

- Finland's hospital buildings are in great need of basic renovation due to their high age and changes in space requirements and processes
- The building technology systems of hospital buildings is often at the end of its life cycle, and buildings often contain risk structures typical of different construction periods
- Construction and renovation of hospital buildings is not usually taken into account the whole building; constructions have been made by departments or layers
- There has been no systematic or sufficiently broad-scoped an assessment method for determining basic renovation needs or for the assessment of the usability of hospital buildings
- There are no official guidelines for the assessment of the health risks related to buildings
- The healthiness and usability of the facilities should be the primary factors for assessing a building's need for basic renovation and its urgency

Aim of study

- Develop an operating model for hospital building risk assessment » **Priorita web tool**
- The tool was used to determine the health risks in hospital buildings by giving each building a Priorita index
 - The index was compared to the results of the technical survey, the views of the indoor air team and occupational healthcare on the usability of the facility and the quality of the indoor environment as well as the results of the staff indoor environment survey
- The objective was to find out the functionality and applicability of the developed tool when assessing the health risks of hospital buildings

Material and methods

- Examined hospital building
 - total number of examined hospital buildings was 22
 - surface 100 000 m²
 - buildings were built in the 1950s, 1960s, 1980s, 1990s and 2000s
 - A total 3,500 people worked in the examined facilities



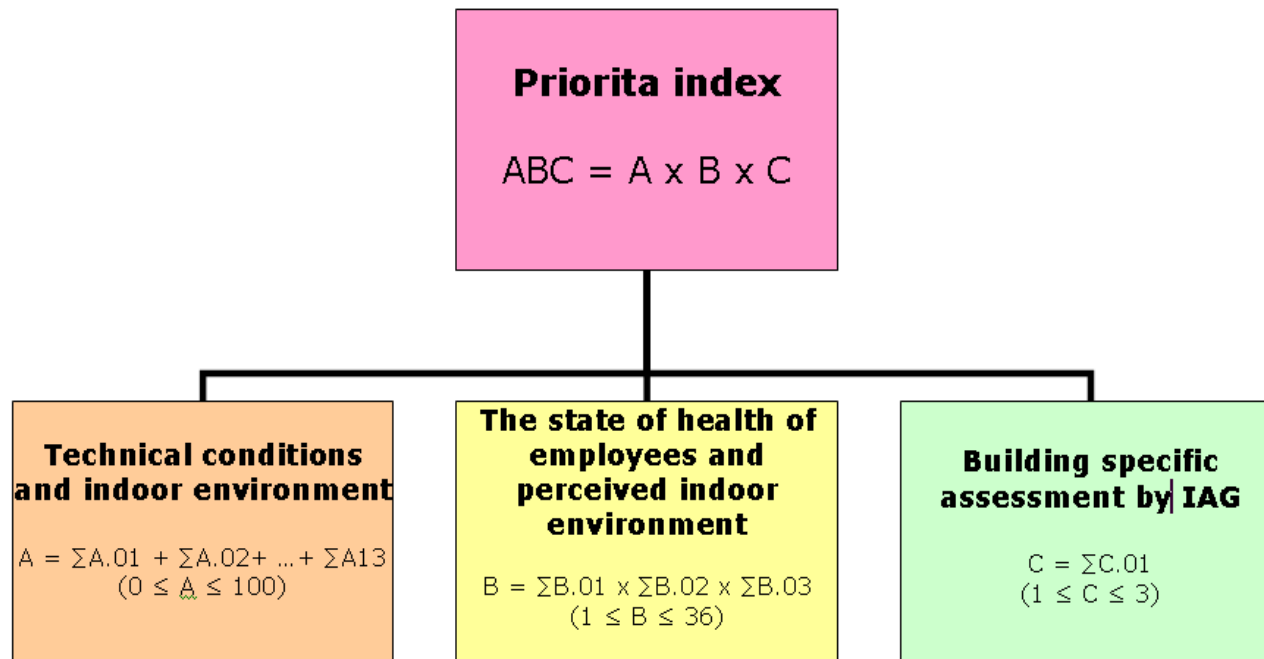
Material and methods

- Priorita assessment
 - web tool (www.ttl.fi/priorita) for comparing of the hospital buildings with one another to the need for renovation on the basis of health requirements
 - calculate the Priorita index, which is comparable to a health risk
 - A. Technical conditions and indoor environment of buildings
 - B. The state of health of employees and perceived indoor environment
 - C. Location specific assessment by indoor air group (IAG)
 - Developed by multi-professional workgroup
 - constructions and ventilation technology experts
 - indoor environment experts
 - physician
 - psychologist
 - Tested on public sector buildings in Finland

Material and methods

- Technical conditions and indoor environment
 - **The risk structure survey for the buildings**
 - cooperations with property services for the hospital districts
- The state of health of employees and perceived indoor environment
 - indoor air survey: work-related illness and conditions
 - occupational healthcare: the state of health of employees
- Location specific assessment by the indoor air group
 - assessment of each buildings indoor environment and the functionality of facilities

Methods of assessment for results



The formula for calculation of the Priorita index. The result for the building's technical condition and indoor environment (A) is determined by adding up the sum of the results for groups A.01 to A.13. The experienced indoor environment (B) is determined by the outcome of groups B.01 to B.03. The result for the indoor air team's assessment (C.01) is determined by the sum of points given per survey question. The Priorita index is determined by multiplying the results for subareas A, B and C with one another.

Results – condition and indoor environment of buildings

- **Properties built in the 1950s**

- cellar wall and floor structures » effect of soil humidity
 - water vapour resistant floor surfaces damaged by soil moisture » (VOC)
 - supporting structure's wall elements touching the ground, which were heat insulated on the inside
- The double slab beams in the intermediate floor structure » organic insulations, boardings
 - non-insulated inlets between work and technical spaces
 - impurities in floor specific structures and moisture prone structures travel between different spaces and floors
- The air quantity in the departments work places (offices, reception points, care facilities) is not sufficient with regard to the number of people that use the facility



Picture 1



Picture 2



Picture 3

Results – condition and indoor environment of buildings

- **Properties built in the 1960s**
 - non-ventilated and ledger structured brick/wool/brick exterior wall construction
 - supporting structure's wall elements touching the ground, which were heat insulated on the inside
 - double slab roof structures, clear signs of microbe damage in the roof boarding
 - roof structures showed visible non-insulated inlets to workspaces



Picture 1



Picture 2



Picture 3

Results - condition and indoor environment of buildings

- **Properties built in the 1980s**

- mineral wool insulation in the double beam structure for socle split » moisture and mould damages
 - no firestops between floors in the double beam structure of the exterior wall construction
 - mould damage to the socle split was connected through airways to upper floors
- water vapour resistant floor surfaces damaged by soil and structure moisture » (VOC)
- The air quantity in the departments work places (offices, reception points, care facilities) is not sufficient with regard to the number of people that use the facility



Picture 1



Picture 2



Picture 3

Results - condition and indoor environment of buildings

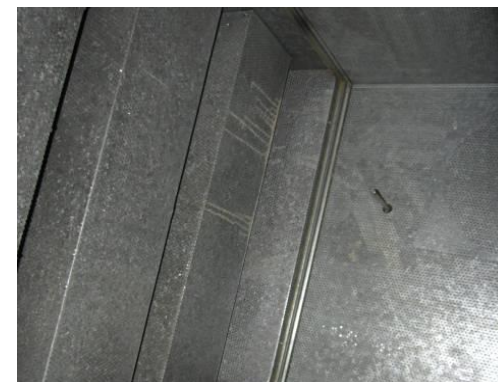
- **Properties built in the 1990s**
 - The ventilation of brick-wool-brick construction of the exterior walls was lacking
 - functionality of moisture technology of the structure required further examination
 - The ground surfaces in the area surrounding the building inclined in the direction of the building
 - visible signs of excessive moisture load
 - Sources of mineral wool fibre were found in silencers for supply air devices, silencers for main air ducts as well as in some supply air terminal devices



Picture 1



Picture 2



Picture 3

Results - condition and indoor environment of buildings

- **Properties built in the 2000s**
 - The air quantity in the departments work places (offices, reception points, care facilities) is not sufficient with regard to the number of people that use the facility
 - water vapour resistant floor surfaces damaged by soil and structure moisture » (VOC)



Picture 1



Picture 2



Picture 3

Results – The state of health of employees and perceived indoor environment



- During the past 14 years the largest occurrence of occupational illnesses that afflicted hospital staff and were caused by indoor environment problems were observed in the old buildings (1950s and 1960s)
- Numerous people and departments have been relocated due to indoor environment problems
- Occupational safety and health authorities have ordered some units to take measures
- The number of sick leave days and occupational healthcare visits due to respiratory disorders caused by indoor environment problems was not considered abnormal.
- Based on the results of the indoor environment survey staff had numerous work related symptoms that surpassed reference values and there were work environment hazards in the hospitals different buildings






Results – Building specific assessment by the indoor air group

- The team's assessment found that there were no deficiencies in the property maintenance or cleaning services for the hospital district
- On the other hand, the assessment found that there were significant indoor environment problems that had lasted for over 5 years in numerous buildings owned by the hospital district.
 - problems had not been solved although corrective measures had been implemented
- The team's assessment determined that there were significant indoor environment problems in nearly all the examined hospital district buildings built between the 1950s and 1990s.

Conclusions

Priorita index	Constructi on period	Condition of building	How the indoor environment was experienced and an assessment by occupational healthcare on the indoor environment	Assessment by the indoor air team on indoor environment
 <p>The Priorita index is 3,470</p>	1950s	numerous risk structures and cases of water damage, some of the structures are at the end of their service life, insufficient ventilation	the symptoms and impediments observed point to a broad-scope indoor environment problem (water damage, insufficient ventilation) occupational illnesses were observed in staff working in the facilities	significant problems
 <p>The Priorita index is 3,056</p>	1950s	numerous risk structures and cases of water damage, some of the structures are at the end of their service life, insufficient ventilation	the symptoms and impediments observed point to a broad-scope indoor environment problem (water damage, insufficient ventilation) occupational illnesses were observed in staff working in the facilities	significant problems
 <p>The Priorita index is 2,277</p>	1960s	numerous risk structures, some of the structures are at the end of their service life, ventilation renewed in the 2000s	the symptoms and impediments observed point to a broad-scope indoor environment problem (water damage, insufficient ventilation) occupational illnesses were observed in staff working in the facilities	significant problems
 <p>The Priorita index is 1,800</p>	1980s	numerous risk structures, insufficient ventilation	the symptoms and impediments observed point to a broad-scope indoor environment problem, occupational illnesses were observed in staff working in the facilities	significant problems
 <p>The Priorita index is 1,370</p>	2000s	the ground supported vinyl floor covering is damaged, insufficient ventilation	Observed symptoms point to an indoor environment problem	significant problems

Conclusions

Priorita index	Constructi on period	Condition of building	How the indoor environment was experienced and an assessment by occupational healthcare on the indoor environment	Assessment by the indoor air team on indoor environment
 <p>The Priorita index is 572</p>	1950s	numerous risk structures and cases of water damage, some of the structures are at the end of their service life, ventilation renewed in the 2000s	the symptoms and impediments observed point to a broad-scoped indoor environment problem (water damage, insufficient ventilation)	significant problems
 <p>The Priorita index is 526</p>	1990s	the exterior wall structure and ground supported floor structure are risk structures, insufficient ventilation	the symptoms and impediments observed point to a broad-scoped indoor environment problem (water damage, insufficient ventilation) occupational illnesses were observed in staff working in the facilities	significant problems
 <p>The Priorita index is 253</p>	1950s	basic renovation carried out and building technology renewed in 2005, unrepaired risk structures, roofing at the end of its service life	observed symptoms point to a moderate indoor environment problem	significant problems
 <p>The Priorita index is 199</p>	2000s	the ground supported vinyl floor covering is damaged	moderate work-related symptoms and work environment impediments observed	minor problems
 <p>The Priorita index is 73</p>	1950s	complete renovation in 2010, renewed building technology, insufficient ventilation for functions	moderate work-related symptoms and work environment impediments observed (insufficient ventilation)	no known problems

Conclusions

- The Priorita index, comparable to health risks, prioritizes buildings in the order in which they must be renovated or other measures must be carried out
- The Priorita assessment assessed not only the need for renovation and its urgency, but also the facility's usability and healthiness
- The assessment is simple to carry out from a technical standpoint with the web tool
- According to the results, the technical and indoor environment assessments carried out did not fully correlate with the work related symptoms nor the impediments experienced by staff
- The results showed that the Priorita method was able to detect acute problem points in indoor environment; air quality was deemed poor or the facilities were in great need of renovation
- The challenge for developing this method was in recognizing those buildings in which flaws and the sources of impurities within the structures had not caused symptoms or occupational impediments for staff, but could become indoor environment problem points in the near future
- The Priorita assessment is a good tool for supporting technical assessments, but Priorita cannot completely replace technical assessments carried out at the workplace

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Thank You!