2009-08-21

The Nordic Housing Enabler: Inter-rater Reliability in Cross-Nordic Occupational Therapy Practice.

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Intended for SJOT.

Abstract

This study addresses development of a content valid cross-Nordic version of the Housing Enabler and investigation of its inter-rater reliability when used in occupational therapy rating situations, involving occupational therapists, clients and their home environments. The instrument was translated from the original Swedish version of the Housing Enabler, and adapted according to accessibility norms and guidelines for housing design in Sweden, Denmark, Finland and Iceland. This iterative process involved occupational therapists, architects, building engineers and professional translators, resulting in the Nordic Housing Enabler. For reliability testing, the sampling strategy and data collection procedures used were the same in all countries. Twenty voluntary occupational therapists, pair-wise but independently from each other, collected data from 106 cases by means of the Nordic Housing Enabler. Inter-rater reliability was calculated by means of percentage agreement and kappa statistics. Overall good percentage agreement for the personal and environmental components of the instrument was shown, indicating that the instrument was sufficiently reliable for application in practice and research in the Nordic context. The varying kappa results highlights the need for further study in order to understand the influence of prevalence more profoundly, which should be kept in mind when interpreting the results.

Keywords: Accessibility, physical environment, housing adaptation, occupational therapy, translation.

Introduction

For decades, accessibility to the physical housing environment has been of interest internationally, politically, professionally and for people with disabilities. Nevertheless, the process of designing an accessible environment for all has been slow, different and inefficient across Europe. Guidelines, norms and legislation on accessible housing design have gradually been developed, but still, the built environment that has been created to date shows serious deficits when it comes to accessibility (1). In the Nordic countries different initiatives have been taken in order to decrease accessibility problems, but according to an investigation initiated by the Nordic Council (2), existing buildings and public sites are in general so inaccessible that achieving the goal of "accessibility for all" would require exhaustive building alterations and huge costs.

The UN's convention for the rights of persons with disabilities also puts focus on accessibility in the context of human rights (3). The Nordic countries have signed the convention, and when it has been ratified, persons with disabilities will have the right to take legal action, which will require qualified documentation and evidence-based judgements of professionals, including occupational therapists.

In occupational therapy in most countries, individually tailored housing adaptations represent an important intervention, whereas taking action to influence housing provision from a human rights perspective still represents a challenge to the profession. We argue that both housing adaptation and housing provision call for a highly specialised professional service building on scientific evidence, including the use of sound psychometric instruments in order to exercise best practice for citizens, effective societal solutions, and the ability to document services. When it comes to the methods currently used in occupational therapy targeting housing interventions, they are most often built on tacit knowledge and acquired practical experience. That is, despite the fact

that housing interventions are commonly provided by occupational therapists, methods based on research are few and rarely used (4, 5).

Another problem is that accessibility in not a uniform concept with a commonly accepted definition. Definitions vary among architects, health care professionals, planners, researchers of diverse disciplines, different societal stakeholders and disability organizations (6). Consequently, efficient accessibility solutions require complex and challenging interactive multidisciplinary collaboration, both nationally and internationally, when striving for an accessible design and inclusive environments.

There are different theories of relevance for research on accessibility and housing interventions. According to Lawton and Nahemow's "the ecological model of ageing" (7) and "the docility hypothesis" (8), the person is defined in terms of a set of competencies and the environment in terms of environmental demands, focusing on the interaction between person and environment, labelled person-environment fit (P-E fit). Moreover, a balance between the individual's competence and the environmental demands can be gained by altering either one or the other or both, which is in line with the basic notions of occupational therapy theory (9, 10).

Stating that accessibility is a construct based on the assumption that activity limitations and restricted participation arise from the gap between the individual's functional capacity and the environmental demands, accessibility is defined as a relative concept, implying that accessibility problems should be expressed as a person-environment relationship. Accessibility refers to compliance with official norms and standards, thus being mainly objective in nature (11).

This definition has increasingly gained acceptance and was operationalised in the standardised instrument available to occupational therapists targeting housing interventions, namely the Housing Enabler (12). This instrument measures the accessibility problems of the physical housing environment. It gives predictive and objective assessments and analysis based on existing

norms and guidelines for housing standards. The target population is people with functional limitations due to disease, injury, or the natural process of ageing. The methodology is intended for both housing adaptation and housing provision. It has the potential to make housing adaptation case management more efficient and is also potential for housing planning at municipality level (13).

The Housing Enabler instrument has proved useful in research, education and practice contexts (12). The Swedish original version (12) was translated into English, German, Hungarian, and Latvian, involving cross-national adaptation to the norms and guidelines for housing design in these countries, for research purposes in the European ENABLE-AGE (EA) Project (13). Since the Nordic countries traditionally have broadly similar housing and accessibility policies (1, 2) based on shared fundamental values, providing a valid and reliable cross-Nordic version and making it available in the Nordic languages would be an important step towards developing more efficient housing interventions within occupational therapy across the Nordic countries. A common effort by means of pooling Nordic resources into one joint project would make it possible for more countries to have access to a standardised instrument. From a research perspective, using the same instrument has obvious advantages, since it would make cross-Nordic research possible. Comparing studies across countries enables the study of differences and similarity of outcomes, nurturing definition and qualification of best practice, subsequently creating scientific evidence. Accordingly, a Nordic instrument has the potential to advance and promote accessibility at the Nordic policy level, and would also qualify occupational therapists to support the development towards fulfilment of the requirements of the UN convention (3).

Applying an instrument developed in one national context to a cross-national context challenges validity. A basic prerequisite is translation, and when it comes to the Housing Enabler, to guarantee content validity, also cross-national adaptation of norms and guidelines within housing design is necessary. In a previous project, such cross-national adaptation of the Housing Enabler

was accomplished, resulting in a project-specific version with sufficient inter-rater reliability, but intended for research purposes only (13). Using an instrument in clinical situations differs from data collection accomplished for research purposes only, since such situations are more complex. Accordingly, there are many factors potentially impacting on the reliability results. To date, no cross-national version has been tested within occupational therapy practice situations. Consequently, the aim of this study was to develop a content valid cross-Nordic version of the Housing Enabler and investigate its inter-rater reliability when used in realistic rating situations in occupational therapy practice.

Methods and Materials

Project organisation

At the prospect of this cross-Nordic collaboration project, interested parties in all five Nordic countries were approached by the principal investigator (SI). After a period of negotiations leading up to collaboration agreements, a project partnership was established engaging mainly occupational therapists, but also architects and building engineers in Sweden, Denmark, Finland and Iceland. Despite repeated efforts, we did not succeed in engaging a Norwegian partner.

The first author (TH) served as coordinator of the cross-Nordic project and national coordinators were appointed in Finland (AP), Sweden (BS), Iceland (EP) and Denmark (TH). A folder for the national coordinators was developed, comprising of all necessary information and materials for the study, such as a checklist of about what, when and how to inform the national raters, illustrations of housing designs, templates for information to participants. The responsibility of the national coordinators was to ensure equivalence among the Nordic countries as concerned the study design, data collection and quality control. Throughout the project period, they all participated regularly in project consortium meetings.

The Housing Enabler instrument

The Housing Enabler book (12) is comprised of an introductory descriptive section concerning individual or group data and housing standards, followed by the manual, the rating forms and finally the programme manual of the Housing Enabler 1.0 software. In brief, the instrument is administered in three steps (for a complete description, see Iwarsson et al., 2005, pp. 29-39) (13):

Step 1. Assessment of functional limitations and dependence on mobility devices (personal component of accessibility):

The first step of the assessment is a combination of observation and interview, aiming at dichotomous assessments of the person's functional limitations (13 items) and dependence on mobility devices (2 items).

Step 2. Assessment of physical environment barriers (environmental component of accessibility):

The second step is a detailed on-site observation of physical environmental barriers in the home and the immediate outdoor environment. This dichotomous assessment comprises of 188 items, grouped into outdoor environment (part A: 33 items), entrances (part B: 49 items), indoor environment (part C: 100 items) and communication (part D: 6 items). Eighty-nine of the items are norm-based and the remaining 99 are not. Norms are defined as measurable items and items (barriers) obvious by observation.

Step 3. Calculation of accessibility score (P-E) fit:

The third step is a quantitative accessibility analysis resulting in a total accessibility score based on the combination of functional limitations and any physical environmental barriers identified. Each item has been allocated predefined points (1-4), adopted from the original Enabler Concept (14), quantifying the severity of the problems predicted to arise in specific cases. This analysis is run item by item and the sum of all the predefined points yields a score summing up the accessibility problems anticipated. Instrument-specific software (15) is available and recommended for this step.

Since the item-wise severity grading is fixed in the instrument format, this part of the procedure cannot be affected by inter-rater disagreement. Consequently, step 3 was not included in the current study.

In a Swedish context, the Housing Enabler has demonstrated content validity (12), construct validity (16) and good inter-rater reliability (17). Further, a research version of the instrument has been tested for inter-rater reliability and applied in cross-national research (13).

The Nordic Housing Enabler instrument

Following the systematic procedures developed in the previous cross-national inter-rater reliability study (13), translation and comparison of national norms for housing design were accomplished in an iterative process, lasting for approximately one year. That is, translation and comparison of norms were interwoven, successively leading up to an instrument available in four Nordic languages - Danish, Finnish, Swedish and Icelandic. In the Nordic Housing Enabler instrument, the manual and the personal component are identical to the original Swedish version, while the environmental component is a result of this cross-Nordic project.

The translation process was performed in two steps with minor variation between countries according to national prerequisites. First, a professional translator translated the entire instrument, which was critically reviewed and compared to the original version by a number of occupational therapists and architects in each country, including forward and backward translations until consensus was reached. For the translation of the core parts of the instrument, namely the manual and the rating forms, a so called two panel approach was applied (18-20). Panel one worked with translation from the original language into the new language while panel two worked only with the translated new version, in order to enhance language validity (21) and face validity (22). Panel one consisted of a professional translator and a number of occupational therapists, familiar with the Housing Enabler and the Swedish language. The panel one members made independent translations

for comparison, aiming at reaching consensus. Panel two consisted of professionals with competencies in housing design (one architect and one building engineer) and three occupational therapists, with the respective national coordinator as process leader.

Secondly, since the Swedish national norms and guidelines for housing design constitute crucial components of the definitions of the environmental items of the original Housing Enabler, in order to develop a content valid Nordic Housing Enabler, a cross-Nordic harmonisation based on a systematic comparison of national norms was required. That is, based on the approach and experiences from the EA (13), a systematic comparison of norms was made, item by item. That is, an in-depth and iterative analysis process took place over several meetings during a period of eight months. Different constellations of professionals (occupational therapists, architects, building engineers) collaborated nationally and as well as cross-Nordic. The 188 environmental items were analysed and allocated into five different categories according to the previous project (13), as listed below:

1) Minor differences between the countries that have norms and regulations; rating in accordance with the original instrument (n=73).

2) Great variation among the countries; A: decision to register detailed measures in addition to rating in accordance with the original instrument (n=11). B: decision not to register detailed measurements (n=2).

3) Norms or descriptions are lacking in one or more of the countries; rating in accordance with the original instrument (n=55).

4) Norms lacking in all four countries, the original items were developed according to Swedish praxis; rating in accordance with the original instrument (n=34).

5) Change based on the other countries norms and regulations or change in the Swedish specification due to changed national (Swedish) norms since 2001 (n=13).

This revision process resulted in 13 items of the environmental part being changed compared to the original instrument (see Table I). Among the 188 environmental items, there are 89 items that are norm-based, which we define as measurable or obvious by observation and 99 items that are not norm-based, which requires a professional judgement based in the norm's definition.

[Table I in here]

Sampling and study design

At the prospect of this study, there were different prerequisites among the four countries for collecting the data. In Sweden the raters had up to three years of experience working with the original Swedish instrument and possessed previous experience of working in a research project. In Iceland the raters were the same persons involved in the translation and adaptation procedures. The Finish and Danish raters had no previous experience of using the Housing Enabler instrument, and only a few of the raters were used to employ standardised instruments, however, they each had many years of experience within housing adaptation.

A two-step sampling strategy following joint principles was applied in all four countries. First, 20 occupational therapists (10 rater pairs), who volunteered to participate as data collectors (raters), were identified and recruited among participants in national Housing Enabler courses. Applying geographic criteria, the raters in each country were paired. Each pair of raters identified their sample from client lists at their workplace consisting of 10-15 voluntary adult persons with different functional limitations and / or mobility devices and living in ordinary but different types of housings. A matrix sample table was designed for each pair of raters to organise and strive for the largest possible diversity concerning type of housing (e.g. terraced housing, flats and single family housing) and functional limitations (e.g. cognitive, physical) (see Table II).

[Table II in here].

Each rater pair assessed 8-14 cases, independently from each other. The target sample was 135 cases; 40 each for Sweden, Finland and Denmark, while for Iceland 15 cases were

regarded as sufficient due to the small population size and that there are few occupational therapists within the country. However, due to logistic problems, only 14 cases from Sweden were included. There were two drop-outs in Finland and one on Iceland, resulting in a total sample of 106 cases (see Table III.).

[Table III in here].

Procedures

Based on the existing Housing Enabler rating forms, study-specific rating forms in the respective language were designed for the data collection. Data was collected by a group of raters in each country, organised by the national co-ordinators. All raters had completed a four-day Housing Enabler course, including independent training tasks in between sessions. Courses were conducted by the same course leaders, following the same format.

Data collection was performed at home visits, over a two month of period, to people with functional limitations. The sample was assessed independently by each of the two raters of a rater pair within one week. Immediately after the home visits the raters entered their data into the Housing Enabler 1.0 software (15). After completion of all the assessments the raters sent their database and rating forms to the national co-ordinators for final quality control, which was accomplished by means of 100% proof reading. The detected error rate was below 0.5% in each country.

The study complied, in all aspects, with the formal requirements for research on humans. In Iceland formal ethical consent was applied for and granted, whereas this was not necessary in the other countries.

Data analysis

Since the national samples were small, the data from all countries were merged into one data set. Inter-rater reliability of the personal and the environmental component was analysed separately. Agreement was calculated in two ways; by means of percentage agreement and Cohen's kappa (23). Kappa statistic is the strongest approach to analysis of agreement of the two, as it corrects for chance agreement. However, since one of the well known limitations of kappa is its dependence on prevalence (28, 29), based on earlier experiences (13), it was considered necessary to employ a complementary analysis approach

Percentage agreement was calculated for each rater pair, item by item. Next, the mean percentage agreement of the ten rater pairs was calculated for each item. Furthermore, the mean percentage agreement for the 15 items in the personal component was calculated, as was the mean percentage agreement for all the 188 items in the environmental component, and for the four sub-sections and by norm-based / not norm-based items. A common definition of good agreement is 80% and above (17). Following the same procedures, kappa values were calculated and interpreted according to Altman's guidelines (24); Values <0.20 = poor agreement, 0.21-0.40 = fair, 0.41-0.60 = moderate, 0.61-0.80 = good and 0.81-1.00 = very good agreement.

Results were organised in 2X2 contingency tables and calculations were made using SAS software (25).

Results

On an overall cross-Nordic level, the mean percentage agreement exceeded 80% for both components of the instrument, while the mean kappa values indicated moderate agreement for the personal component and fair agreement for the environmental component of the Nordic Housing Enabler.

The personal component

As shown in Table IV, the item-wise analysis of the percentage agreement revealed that 13 of the total 15 items demonstrated good agreement, while for the item; "Difficulty in handling and fingering" the agreement was 79% and for the item "Limitations of stamina" the agreement was below good (64%). The latter item also had the lowest kappa value. The item-wise kappa analysis of the personal component revealed that 73% of the items showed moderate to very good, and 27% fair or poor agreement.

[Table IV in here]

The environmental component

The item-wise analysis of percentage agreement and kappa values demonstrated that for 128 items, the agreement was ≥ 80%, and for another 35 the agreement was 70-79%. In terms of kappa values, the agreement was moderate to very good for 68 items (see Table V). The mean percentage agreement was good for all sub-sections A-D (see Table VI). In terms of mean kappa values, sub-section B demonstrated moderate agreement, while the remaining sub-sections showed fair agreement (see Table VI). One kappa value was indefinable. Further, it was found that both norm-based as well as not norm-based items demonstrated good percentage agreement, while norm-based items had a higher mean kappa value (moderate) compared to those that were not norm-based (fair) (see Table VI)

[Table V and VI in here]

Discussion

Following a systematic, previously applied procedure for translation and cross-national harmonisation of norm-based items, the cross-Nordic collaboration project underlying this study produced a content valid instrument for housing accessibility assessments – the Nordic Housing Enabler. The results show that the inter-rater reliability of the instrument, when tested in realistic

clinical occupational therapy practice, is good in terms of percentage agreement and moderate to fair in terms of kappa values. Considering that the instrument is complex and multi-dimensional, and since practice situations are challenging in terms of contextual factors potentially impacting on assessments results, we regard the Nordic Housing Enabler as sufficiently reliable for application in Nordic contexts. However, it should be emphasised that the somewhat discouraging results in terms of kappa values can be discussed. Depending on factors such as prevalence (29, 30), there might be different possible explanations behind these results, while in-depth statistical exploration to reveal underlying reasons is beyond the scope of the current paper.

It should be noted that there was a specific overall pattern in the cross-tables with a good percentage agreement and low kappa values, particularly for the environmental part. When it comes to the personal component, for several reasons the level of agreement was expected to be higher than for the environmental component. First of all, occupational therapists are used to accomplish this kind of assessment of the person by means of observation and interviews, while they are less used to perform assessments of environmental barriers based on norms and clear-cut definitions. Further, the fact that the environmental component comprises of a higher number of items implies that it is more demanding to reach high inter-rater reliability for this part of the instrument (13).

As demonstrated by our results, analysing inter-rater reliability poses methodological challenges. Results reported in terms of percentage agreement alone are only based on the frequency of observation and have been criticised for not taking chance agreement into account (26). Kappa, on the other hand, measures chance-corrected agreement and has been widely used (27). One of the well-known limits of kappa is its dependence on prevalence (29, 30), i.e. when prevalence is very high or low, the influence of chance agreement increases, resulting in lower kappa values. Based on earlier studies on the agreement of the Housing Enabler (13), we were well

aware of the fact that very high as well as very low prevalence occurs for a substantial proportion of the items in the environmental component, making it imperative to not rely solely on kappa statistics to estimate agreement. As demonstrated by the results of the current study, this assumption was confirmed. That is, already when browsing through the cross-tables it was evident that unbalanced marginal totals, despite good percentage agreement, lowered the kappa values. To exemplify this prevalence effect; with the same observed agreement (e.g. 100 out of 106) in combination with either a balanced or unbalanced prevalence, it is possible to obtain a kappa value on 0.89 for the balanced and 0.26 for the unbalanced, e.g. from very good agreement to fair. Similar patterns were found in the EA study on Housing Enabler inter-rater reliability (13).

Well aware of these potential problems already at the prospect of the current study, the matrix sample table developed to systematise the sample procedure was one way to strive for attaining balanced prevalence. By doing this, we sought to improve our study design, anticipating kappa's dependence on prevalence and hence, optimise the conditions for estimating agreement (30). Despite these precautions, as demonstrated by the results, we did not succeed as intended (see Table I). Considering this further, it should be emphasised that it is very challenging to sample both persons with different functional limitations, who are being dependent on diverse mobility devices and living in different types of housing. Summing up on this, study limitations resulting in unbalanced prevalence should be kept in mind when interpreting the results.

As the personal component was not changed from the original instrument, our current investigation of inter-rater reliability only targeted translation as a potential source of variation. The item "Limitation of stamina" had a poor observed agreement and the lowest kappa value, which indicates poor reliability (see Table IV). This finding was in line with the result of the EA study (13), and we conclude that a more precise definition of this item is required. Since the environmental component was also revised according to harmonisation of guidelines and norms for

housing design among the four countries involved, for this component inter-rater reliability was examined for a version translated to the languages involved as well as revised in terms of item definitions. The fact that only 13 items had to be revised confirmed our assumption that the Nordic countries are similar in this respect. Commenting further on the environmental component, as could be expected, the 89 norm-based items had a higher mean percentage agreement and mean kappa value compared to the items not based on norms, as the first type of item is more precisely defined (measurable or obvious by observation). Out of the 25 environmental items with an agreement <70%, only four were norm-based. It should also be noted that another four items were repeated three times, e.g. for different parts of the housing environment.

The fact that parts of the results were not very convincing in terms of kappa values is evidence that the need of up-dated and persistent rater training should not be underestimated, but rather a definite prerequisite for the ability to conduct reliable Housing Enabler assessments. Due to the small sample size of the current study, it did not make sense to scrutinize the results separately for each of the countries. However, although not reported, we know that the Icelandic and Swedish raters demonstrated better agreement compared to the Finnish and Danish. The Icelandic raters were involved in the whole process of translation and adaptation of the current project, while the Swedish raters were not; they had previous experience in using the instrument and had served as data collectors in another research project. The Danish and Finnish raters completed their Housing Enabler course six to nine months before the data collection was made and most of them were not used to employ standardised assessments. This could mean that the training was not sufficiently fresh in their minds. That is, as this instrument is comprehensive, it is a necessity that raters continuously maintain their competence (12). Raters volunteered as data collectors and most of them collected the data during a couple of consecutive days and hence did not learn from experience over time. Raters of the EA (13) were trained especially for data collection in research

(not for occupational therapy practice) and their training was carried out immediately prior to the data collection. In contrast, the raters of the Nordic study were trained with the aim that they would learn the methodology for use in their ordinary practice. During a Housing Enabler course, they were asked to participate as volunteer data collectors. It is possible that these different circumstances were reflected in the lower inter-rater reliability results of this study compared to the somewhat higher values of the similar EA project (13). It is also important to note that because kappa is impacted by prevalence, it is difficult to compare agreement between different studies (29).

Another important issue to pay attention to when comparing these results is that in this study we calculated the kappa values and the percentage agreement differently. In EA (13) all raters were pooled into one group of raters and then kappa values were calculated without taking into consideration how the different pairs of raters were labelled, which does impact on the results. That is, in the previous EA study rater 1 and rater 2 could be different persons in the different pairs involved. The most appropriate way to perform this kind of analyses is to calculate the pair-wise kappa values first, and in the current study we therefore ended up with slightly lower kappa results.

As this study targeted the use of the Nordic Housing Enabler in clinical practice, we were aware of the fact that contextualised assessments imply a diversity of challenges, not necessarily revealed in an inter-rater reliability study. Such challenges, e.g. disturbance from the user and / or other persons present in the assessment situations, should be documented and reflected upon. Such challenges might have implications for how to instruct health care professionals to act in realistic rating situations and should be targeted in future rater training courses.

In this study a so called two panel approach (18-20, 33) was employed for the translation process, involving both professional translators and lay people with different professional experiences in housing design. They worked together on forward and backward translations in an iterative process, aimed at reaching consensus and enhancing language validity

(21). However, neither the principal researcher (SI) nor the Nordic co-ordinator (TH) possesses the necessary language skills to be able to scrutinise all of the versions. Although careful attention was paid to the translation process, smaller but misleading language mistakes were identified during the course of the project, proving how challenging this really is. This is an additional potential threat to reliability. The state of the art in evidence-based translation methods is not consistent (19, 31-33). Thus, even though the model used in the current project worked quite well, there are alternatives and more empirical research is needed to understand which translation methods yield the best results.

The implications of this study are four-fold, as it targeted both the cross-Nordic level and each of the national contexts and practice as well as research. In order to make reliable and valid applications possible in housing research and occupational therapy practice, there is a need for standardised methodology such as the Nordic Housing Enabler. The availability of this kind of methodology creates possibilities for policy and practice implementation and is intended to support quality development. One of the spin-off effects of this study was that we now can present a strategy for how to make cross-national translation and comparison of guidelines and norms for housing design, interwoven into an iterative process.

In conclusion, the Nordic Housing Enabler was examined for reliability in terms of inter-rater reliability within Denmark, Sweden, Finland and Iceland. Based on an overall good percentage agreement for the personal and environmental components of the instrument, it is considered sufficiently reliable for application in practice and research in the Nordic context. As concerns the varying results in terms of kappa values, study limitations should be kept in mind when interpreting the results. We also found that there are threats to inter-rater reliability when examining an instrument in clinical practice, not necessarily due to the instrument itself but to the complex rating situation involving person and environment. Finally, the need for updated rater

training as well as instructions on how to collect data for research purposes should not be underestimated.

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Table I. Items changed in the Nordic Housing Enabler compared to the original Swedish instrument, n=13.

	Environmental Barrier Item	
Environmental Component Sub-section [a]	**Nordic Housing Enabler version**	**Original Swedish version**
A. Outdoors	A1. Narrow paths (less than 1.5m)	1.3m
	A5. Steep gradients (more than 1:20)	1:12
	A8. High kerbs (more than 3cm)	4cm
	A17. Narrow parking spaces (narrower than 3.6 and shorter than 5m)	3.6m
	A25. Extremely low, high or narrow seating surfaces (sitting height 45-50cm)	50cm
	A31. Refuse bin and / or letterbox difficult to reach (not at 80-120cm above ground)	90-120cm
	A33. Overhanging objects along path of travel / passage etc (less than 2.2m above ground)	2.1m
B. Entrances	B18. Handrails placed too high / low (higher / lower than 90cm)	80-90cm
	B23. Steep gradients (more than 1:20)	1:12
	B28. Lift does not stop at the same level as building floor (more than 1cm difference)	0cm
	B39. Controls and operable hardware placed too high / low (90-120cm above ground)	90-110cm
C. Indoors	C20. Handrails placed too high / low (higher / lower than 80-90cm)	90cm
	C54. Grab bars at low position (lower than 80cm)	90cm

[a] None of the sub-section D items were changed.

Table II. Case characteristics, N=106.

Characteristic	N (%)
Personal component	
Wheelchair dependent, partly / totally	60 (56.6)
Dependent on walking sticks	24 (22.6)
Dependent on walking frame / rollator	41 (38.7)
Cognitive impairment	19 (17.9)
Visual impairment	18 (17.0)
Hearing impairment	12 (11.3)
Environmental component	
Living in a rural area	19 (17.9)
Living in a town / city	83 (78.3)
Ordinary block of flats	45 (42.5)
Ground-floor flats / one floor terrace house	16 (15.1)
Ground-floor dwellings with ordinary flats above	11 (10.4)
Balcony access block	15 (14.2)
Multi dwelling blocks	34 (32.1)
Single family house	27 (25.5)
Single house / semidetached house	3 (2.8)
Ground-floor flats with own upstairs	0 (0.0)
Two dwelling / semidetached / terraced building	1 (0.9)

Table III. Rater pairs and assessments performed, N=106 cases.

	Country				Cross-Nordic
	Denmark	Finland	Iceland	Sweden	Total sample
Raters, no.	8	8	2	2	20
Rater pairs, no.	4	4	1	1	10
Cases, no.	40	38	14	14	106

Table IV. Cross-Nordic inter-rater agreement of the personal component of the Nordic Housing Enabler among ten pairs of raters, N=106 cases.

Personal Component Item	**Agreement**	
	Kappa	**%**
A Difficulty interpretation information	0.22	80
B1 Severe loss of sight	0.49	83
B2 Total loss of sight	1.00	100
C Severe loss of hearing	0.46	91
D Prevalence of poor balance	0.42	81
E Incoordination	0.60	85
F Limitations of stamina	0.10	64
G Difficulty in moving the head	0.46	89
H Difficulty in reaching with arms	0.51	81
I Difficulty in handling and fingering	0.52	79
J Loss of upper extremity skills	0.43	83
K Difficulty in bending, kneeling etc.	0.30	88
L Reliance on walking aids	0.69	87
M Reliance on wheelchair	0.90	95
N Extremes of size and weigh	0.40	93

Note: κ values 0.21-0.40 indicate fair agreement, 0.41-0.60 moderate agreement, 0.61-0.80 good agreement and 0.81-1 very good agreement (Altman, 1999).

Table V. Agreement for the 188 environmental items in the Nordic Housing Enabler, N=106 cases.

Agreement	No. of items
Kappa [a]	
Very good	8
Good	19
Moderate	41
Fair	56
Poor	64
Percentage	
≥ 80%	128
70-79%	35
< 70%	25

[a] Interpretation according to Altman (1999).
Kappa was indefinable for one item.

Table VI. Cross-Nordic inter-rater agreement of the environmental component of the Nordic Housing Enabler among ten pairs of raters, N=106 cases.

Environmental barrier	**Agreement**	
Sub-section / type of item	**Mean kappa**	**Mean %**
A) Outdoor environment (n=33)	0.32	80
B) Entrances (n=49)	0.46	87
C) Indoor environment (n=100[a])	0.28	83
D) Communication (n=6)	0.22	80
Norm-based items (n=89)	0.44	86
Not norm-based items (n=99[a])	0.23	81
Total	0.33	83

[a] Kappa was indefinable for one item.