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Rīgas Stradiņa universitāte

Guna Bērziņa

# COMPARISON OF REHABILITATION OUTCOMES FOR PERSONS AFTER STROKE IN LATVIA AND SWEDEN

Summary of Doctoral Thesis
for obtaining the degree of Doctor of Medicine
Speciality – Physical and Rehabilitation Medicine

Riga, 2016

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The Doctoral Thesis was carried out at the Department of Rehabilitation, Rīga Stradiņš University, Latvia in collaboration with the Institute of Neuroscience and Physiology, University of Gothenburg, Sweden, with the support of the Swedish Institute, the Visby Programme.

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Doctoral thesis is available in the RSU library and at RSU webpage:
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# 1 INTRODUCTION

Despite increasing focus on evidence-based primary and secondary prevention, stroke still occurs. The lifetime risk for stroke to occur is 1 in 6 persons worldwide as reported by the World Stroke Organisation. (Seshadri et al., 2006) In addition to being major cause of death, stroke is the most common cause for disability in the adult population. (Mackay and Mensah, 2004, *WHO STEPS stroke manual*, 2006) Even with optimal acute care, less than one in 3 patients fully recovers from stroke. (Hacke et al., 2004) The World Health Organisation (WHO) predicts that there will continue to be large increase in non-communicable diseases (including stroke) related to years lived with disability in rapidly developing regions. (*World Report on Disability*, 2011)

In order to provide a universal language understood by health professionals, researchers, policymakers, patients and patient organizations, as well as ensure comprehensive framework of care, International Classification of Functioning, Disability and Health (ICF) was developed and approved of in 2001. (*International Classification of Functioning, Disability and Health*, 2001, Geyh et al., 2004) ICF defines disability as the umbrella term for impairments, activity limitations and participation restrictions, referring to the negative aspects of interaction between and individual and that individual´s contextual factors (environmental and personal). It is called a “bio-psycho-social model” of disability. (*World Report on Disability*, 2011) The concept of the ICF is showed in Figure 1.1. (*International Classification of Functioning, Disability and Health*, 2001)

WHO emphasizes that disability is a part of human condition, which is complex and dynamic interaction between health condition and contextual factors. It is a cause for economic and social burdens for individuals, families, communities and nations. WHO reports prevalence of disability being 15 % of

world's population, as well as underlines its relation to human rights and developmental (social and political) issues that leads to increased direct and indirect costs. (*World Report on Disability,* 2011)

Rehabilitation is a tool that addresses the issue of disability. It aims to improve person's independence as much as possible through minimizing negative effects of stroke and/or enabling adaptation strategies. (PRM, Section of UEMS 2006, Quinn et al., 2009) Rehabilitation should start as soon as possible after an event, such as stroke, and continue as long as necessary even when the person has already returned to his/her customary environment in community. (Ward et al., 2012) The content of the rehabilitation varies depending on the time since the stroke (acutely, sub-acutely or in the later phases) as well on organisational factors. (Gutenbrunner et al., 2010, Ward et al., 2012) The recommendations on structure of rehabilitation organisation provide the theoretical continuity of rehabilitation. The rehabilitation phase between early rehabilitation in acute setting and community based follow-up rehabilitation is defined as post-acute rehabilitation. It is goal-oriented and multi-professional in- or outpatient rehabilitation service and is based on patients' needs. (Ward et al., 2012) However, these inclusion criteria for patients' selection are suggested, not internationally accepted. (Ward et al., 2010) The availability and effectiveness of rehabilitation services in different countries varies depending on local policy and available resources. (De Wit et al., 2007, Putman and De Wit 2009) However, the comparison of the systems and outcomes would provide a knowledge that guides towards more optimal stroke care.

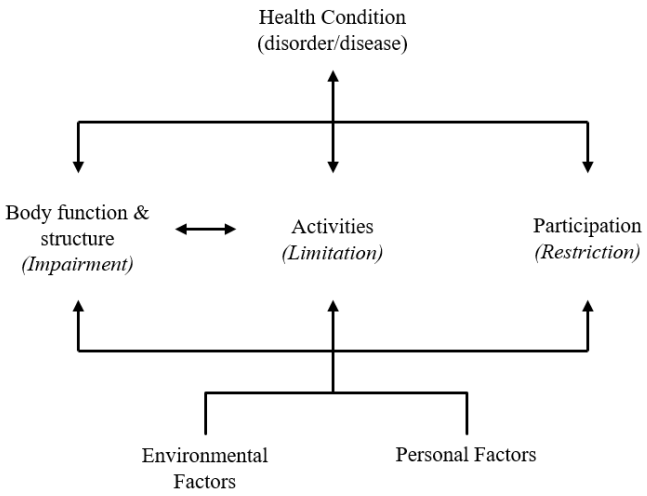



Figure 1.1 **The concept of the ICF**

In the development of specialised stroke care units during 1970s, Sweden has been among the pioneers. In addition, this process and the outcomes have been well documented. In Latvia similar approach of stroke care was adapted approximately 25 years later. Unfortunately, there is only one publication available that describes experiences of stroke survivors in Riga. (McKevitt et al., 2003)

### *Scientific novelty and importance*

This research adds knowledge on outcomes of stroke rehabilitation in two European countries (Latvia and Sweden) and differences between them. The evaluation and comparison between outcomes after stroke, both, after specialised in-patient rehabilitation and in a long-term perspective, is important for improving the process of continuous care after stroke and for adequate

planning and involvement of services needed. That is in line with the World Stroke Organization Global Stroke Services Guidelines and Action Plan. The study also highlights the problems of this approach.

In this thesis the results of specialised-inpatient rehabilitation are treated as complex intervention and analysed accordingly, also taking into account the significance of other related factors. Moreover, it is based on clinical data from daily practice, thus representing the outcomes of two systems that are currently in use. In the statistical analysis, the ordinal approach to the data has been used and shift analysis has been done as a part of statistical analysis. That is in line with the main assumptions and up to date approach for analysis of functional outcomes. This has not been presented in rehabilitation research before.

The self-perceived disability is used as another outcome in this work. This concept has received little interest in the field of research. However, restrictions and limitations that a person experiences in everyday life due to the consequences of stroke, are important in determination of care needs and in planning interventions. Therefore, this research work focuses on systemic issues of care after stroke, rather than individual effectiveness of rehabilitation.

# 2 LIST OF ORIGINAL ARTICLES

The thesis is based on the following studies:

1. Guna Bērziņa, Anita Vētra, Katharina Stibrant Sunnerhagen. A comparison of stroke rehabilitation; data from two national cohorts. *Acta Neurologica Scandinavica*. Article first published online: 15 December 2015
2. Guna Bērziņa, Baiba Smilškalne, Anita Vētra, Katharina Stibrant Sunnerhagen. Living in Latvia after stroke; the influence of functional, social and personal factors on the level of self/perceived disability. *BMJ Open* 24 June 2016; *6(6).*
3. Guna Berzina, Markku Paanalahti, Åsa Lundgren-Nilson, Katharina Stibrant Sunnerhagen. Exploration of some personal factors of the International Classification of Functioning, Disability and Health Core sets for stroke. *Journal of Rehabilitation Medicine, 2013; 45: 609-615*.

# 3 AIMS AND HYPOTHESIS

The aim of the thesis was to explore the determinants of rehabilitation outcomes for persons after stroke and compare them between those who lives in Latvia and Sweden, using the bio-psycho-social model suggested by the World Health Organisation.

Tasks:

- To compare available information on Latvian and Swedish in-patient rehabilitation systems.
- To compare the characteristics and functional independence at admittance and discharge of populations that have received in-patient rehabilitation in Latvia and Sweden.
- To explore the impact of possible differences on functional independence for persons after stroke.
- To investigate whether functional limitations in the post-acute phase of stroke (at the time of inpatient rehabilitation) have an influence on self-perceived level of disability in the late phase of stroke in a Latvian population living in the society (at home).
- To investigate the role of social and personal factors in explaining the self-perceived level of disability in the chronic phase of stroke in persons living Latvia.
- To investigate whether such personal factors as age, gender, place of living and time since onset have a predictive value for functioning and environmental factors in chronic phase of stroke for persons living in Sweden.

- To investigate whether there are relationships between personal factors as mentioned above and certain categories of functioning and environmental factors for persons living in Sweden.
- To explore how these personal factors interact to influence self-perceived functional outcome and perception of environmental factors as barriers or facilitators in persons, living in Sweden.
- To explore if personal factors identified to be important in a Swedish population, are also relevant for a Latvian population of stroke survivors.

General hypothesis:

Different aspects of WHO's suggested bio-psycho-social model will influence rehabilitation outcome for persons after stroke and the results will depend on country of residence (Latvia or Sweden).

# 4 METHODS

The research is conducted in conformity with the ethical principles of Declaration of Helsinki. Part 1 and 2 of the study are approved by the Ethics Committee of Rīga Stradiņš University, Latvia (27.09.2012.); Part 3 is approved by the Regional Ethical Review Board in Gothenburg, Sweden (No. T129-05/Ad 419-04 and 390-05).

## 4.1 Study designs

This project was organized in four parts. The following designs were used for the studies, included in this PhD project (Carter et al., 2011):

- Part 1: Comparative cohort study; data gathered retrospectively from medical charts and from stroke data registry
- Part 2: Cross-sectional study
- Part 3: Cross-sectional study
- Part 4: Comparison based on the results of part 2 and 3.

## 4.2 Study population

The populations for each part of the project are demonstrated on a Figure 4.1.

### *4.2.1.1. Data on comparison of stroke rehabilitation in Latvia and Sweden*

All persons who were at least 18 years of age and received specialised in-patient rehabilitation after stroke in Latvia or Sweden between January 1, 2011 and December 31, 2013 were included in this study. From the study were

excluded patients if rehabilitation started less than 1 week or more than 1 year post stroke, there were lack of information regarding time between stroke onset and start of specialised in-patient rehabilitation or patient was discharged from rehabilitation centre due to death or acute health problem that required re-hospitalization in acute setting.

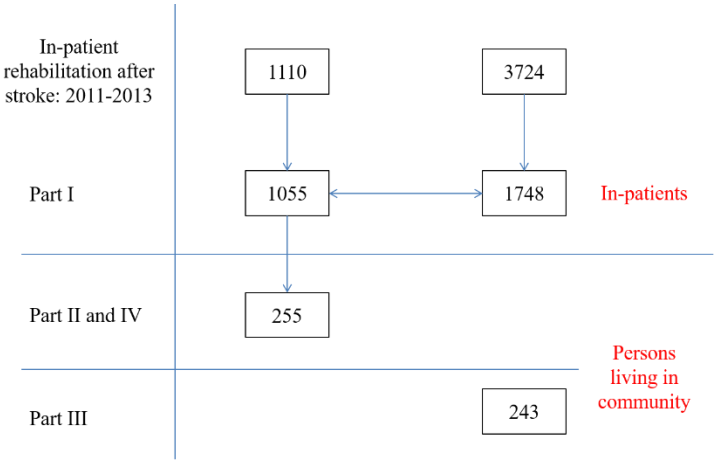



Figure 4.1 **The number of patients included in the project**

The data on Latvian population were identified through the computerized register of National Rehabilitation Centre "Vaivari" for given period of time. Pre-specified data were gathered from the charts and entered into a computer file. This is the only rehabilitation centre in Latvia that provides public funded specialized in-patient rehabilitation in the post-acute phase of stroke. The data on Swedish population were obtained from the Swedish rehabilitation quality register "WebRehab Sweden" (Sunnerhagen et al., 2014) for the same period of time. This registry has a >95% coverage of in-patients rehabilitation units in Sweden. (Sunnerhagen et al., 2014)

To compare the Latvian and the Swedish stroke care, a qualitative description of systems was completed. Basic medical (type of stroke diagnosis and side of lesion in the brain), and sociodemographic information (age and gender), as well as organizational aspects of rehabilitation (time since onset of stroke (weeks) until rehabilitation and length of in-patient rehabilitation (days)) was used to describe both populations. The Functional Independence Measure (FIM) (VistA System , 2003, Cournan 2011), which assess dependency in activities of daily living, was used as an outcome variable.

The FIM scores at admittance and discharge were grouped into six domains: 'Personal care' (FIM A – FIM F); 'Sphincter' (FIM G – FIM H); 'Transfer' (FIM I – FIM K); 'Locomotion' (FIM L – FIM M), 'Communication' (FIM N – FIM O) and 'Social Cognition' items (FIM P – FIM R). Data were trichotomized, based on the extent of the person's need for help to fulfil the activity in the following manner: 'Total dependence' (1) was defined by any score being 1 or 2; 'Partial dependence' (2) if any score was 3, 4 or 5, without 1 or 2; 'Independent' (3), if all items got a score of 6 or 7.

Shifts in proportions of these 3 levels of functioning were analysed for Latvia and Sweden at admittance and discharge and reported using bar graphs. As an outcome for analysis, trichotomized FIM discharge scores for 6 domains were used. For each of outcome, the common odds ratio and 95% confidence intervals were reported for the shift in the direction of a better outcome towards either populations. The odds ratio was estimated using ordinal regression analysis. For each outcome three analyses were conducted: unadjusted analysis (without covariates); adjusted for admittance scores (the score shift of the trichotomized scale for the corresponding domain evaluated at the admittance to rehabilitation); and a "fully" adjusted analysis. Controlling factors for the last model were chosen based on the unique contribution for each factor when conducting an analysis with age, gender, type of diagnosis, side of lesion in the brain, time since onset, length of rehabilitation and proportions of levels of

dependence at admittance for the corresponding domain as covariates. The results with a significance level <0.01 were reported. The conceptual model for ordinal regression analysis is showed in Figure 4.2.

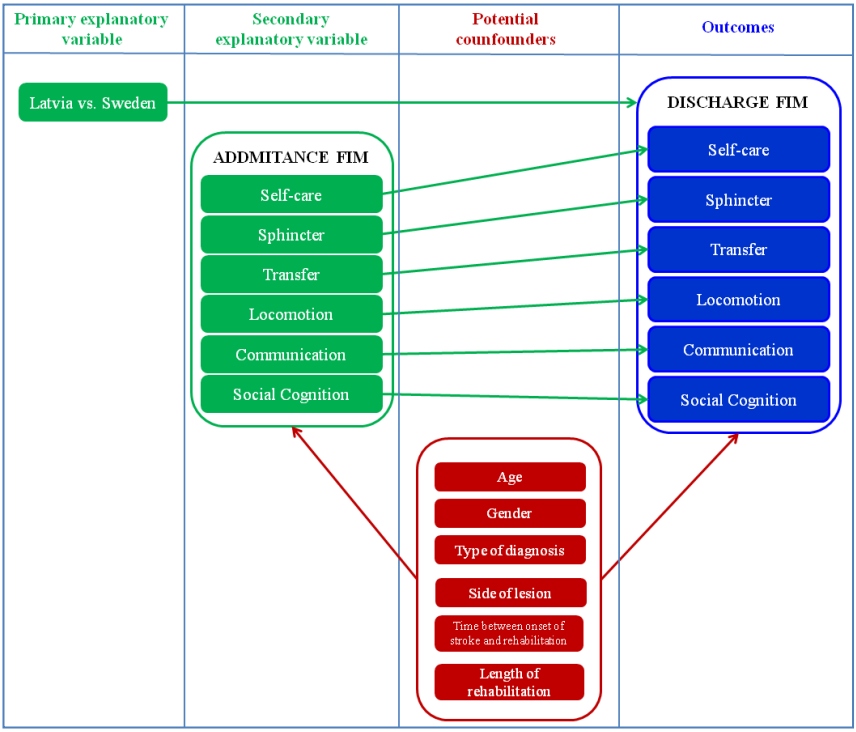



Figure 4.2 **The conceptual model for ordinal regression analysis in Part 1**

### *4.2.2 Data on self-reported disability for persons living in Latvia*

In the Part 2 and Part 4 of this study were included persons who had been included in the Latvian population in the Part 1 of this study and were at the time, at least 9 months post stroke, living in their own home community.

Based on information gathered from medical charts, the persons were asked to participate in the study by telephone. After informed consent, a set of questions that included current socio-demographic information, as well as WHO Disability Assessment Schedule 2.0 (WHODAS 2.0) *(Measuring Health and Disability,* 2010) were sent by mail or e-mail. The questionnaires sent by mail also contained return envelope. The e-mail to respondents contained an on-line link to the questionnaire, which if fulfilled, automatically sent the reply to the researcher. There were no reminders sent to the respondents. During the phone conversation, the preferred responding language (Latvian or Russian) was asked for. This was done because 37 % of population in Latvia use Russian as their primary language. (*2011. gada tautas skaitīšanas rezultāti īsumā,* 2011) If the person could not fill out the questionnaire himself or herself, their next of kin could perform it.

The World Health Organization Disability Assessment Schedule 2.0 (WHODAS 2.0) 36-item self-assessment questionnaire was used as an outcome variable. For the WHODAS 2.0 data set, the simple approach to missing data and the complex scoring method were used where the scores of each item were recoded according to the suggested algorithm (*Measuring Health and Disability,* 2010). The scores were summed and converted into a metric ranging from 0 (no disability) to 100 (full disability) (*Measuring Health and Disability,* 2010) for the following domains: ‘Cognition,’ ‘Mobility’, ‘Self-care’, ‘Getting along’, ‘Household activities’, ‘Work or school activities’; ‘Participation’ and total WHODAS 2.0 score.

The FIM was used as an independent variables to define the levels of independence at discharge from rehabilitation in the domains of *’Self-care’, ’Sphincter’, ’Transfer’, ’Locomotion’, ’Communication’* and *’Social Cognition’.* The overall results for each domain were presented in a trichotomized way as described in the data analysis for Part 1 of this study. Further independent variables were *status of employment* (working or not after

stroke), *time after discharge from rehabilitation (months).* "Working" was defined as persons who had paid or unpaid work, were self-employed, studied or were performing household duties. *P*ersonal factors, such as *age*, *gender*, *preferred language* (Latvian or Russian), *education*, *place of living* (city or countryside) and *living situation* (alone or in a family) were used as secondary explanatory variables. *Time* (weeks) *from stroke onset until start of rehabilitation*, *length of rehabilitation* (days) and *type of diagnosis* according to ICD-10 were seen as potential cofounding variables. The conceptual model for variables, used in the analysis for Part 3 is showed in Figure 4.3.

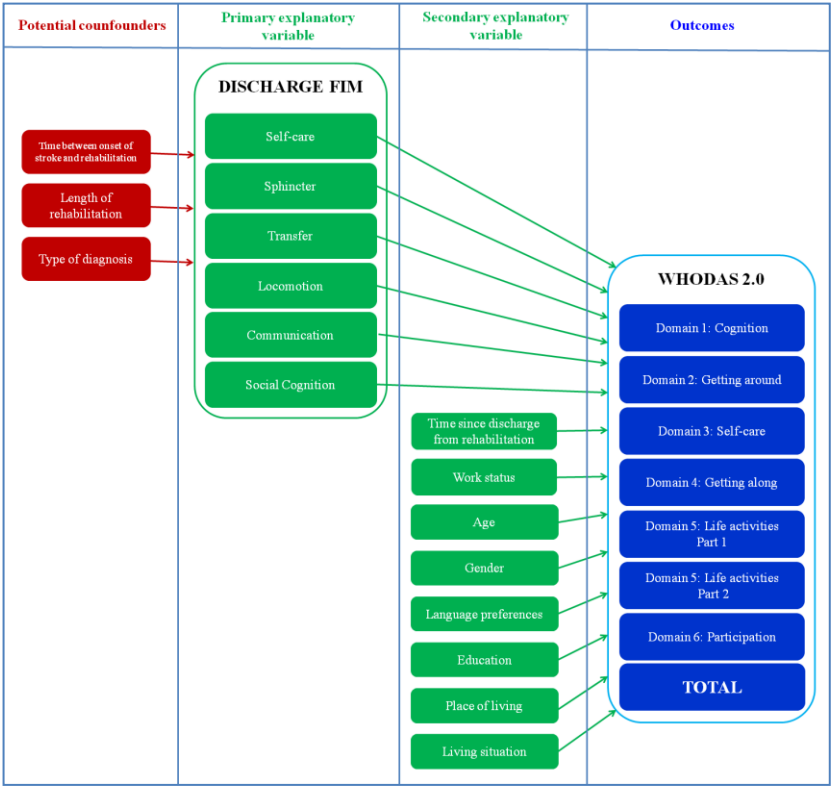



Figure 4.3 **The conceptual model for the initial model of the analysis for Part 2**

General linear models for stepwise regression analysis (Bursac et al., 2008) was used to predict the summary scores for each of the seven domains and the total score of the WHODAS 2.0. For each of the final models, analyses were conducted to ensure no violation of the assumptions of normality, linearity, multi-co-linearity and homoscedasticity. Each of the significant factors in the final model in turn, were excluded from the model and changes of $R^2$ were reported, to illustrate the factors' unique contributions to the model. Work as an explanatory factor was excluded from the analysis of Domain 5.2 since this domain evaluates the ability to work and thus were not answered by those who were unemployed.

For Part 4 the unique contribution of age, gender, place of living and time since rehabilitation on the WHODAS 2.0 domains were reported in terms of Beta values, 95% confidence intervals and p values. Results are based on the final models of linear regression analysis conducted for Part 2 of this study.

### *4.2.3 ICF data on persons living in Sweden*

A convenience sample of persons living in Sweden after stroke were recruited among former patients from stroke units or a rehabilitation clinic, or among those in a contact with a physical therapist in the community or through patient organizations. The data in this study was gathered between May of 2003 and June of 2007. Data was gathered for two different scopes; a trial with the aim to validate the ICF Core Sets (part of an international project) as well as a project where the ICF data was gathered longitudinally. Additional inclusion criteria were: having given written informed consent (or consent given by next to kin); living in community; at least 6 month from onset of stroke.

Participants were seen either at home or at hospital and interviewed by using semi-structured questions based on the extended version of Comprehensive ICF Core Set for Stroke (Ewert et al., 2005). After the

interview was completed, the core set was filled in using all the received information and impressions of interviewed patient.

The extended version of ICF Core Set for Stroke consists of 59 categories of body functions, 11 categories of body structures, 59 activities and participation categories and 37 environmental factors) (Glassel et al., 2012, Glassel et al., 2014).

The qualifier scale of the ICF categories for 'Body Functions and Structures' and 'Activities and Participation were dichotomized: "0" as 'no problem' and '1' as problem., 'Environmental factors' were analyzed separately as barriers ("0" – not a barrier and "1" – a barrier) and facilitators ("0" – not a facilitator, "1" – facilitator). The problems were counted under different levels of functioning and facilitators and barriers were counted according to main groups of environmental factors.

Standard multiple regression was used to predict the number of problems in functioning in the levels of 'Body Functions' and 'Activities and Participation', as well as the number of barriers and facilitators in environmental factors divided in the five main groups: '*Products and technology'*; '*Natural environment and human right*'; '*Support and relationships*'; '*Attitudes'*; '*Services, systems and policies*'.

Direct logistic regression was performed to assess the impact of personal factors on the selected domains of 'Activities and Participation' and 'Environmental factors' in the context of ICF.

- '*Moving around in different locations*' (d469)
- '*Toileting*' (d530);
- '*Dressing'* (d540);
- '*Doing housework*' (d640);
- '*Recreation and leisure*' (d920);
- '*Physical geography*' (e210);

- ‘*Immediate family*’ (e310).

In both cases standard multiple regression analysis and direct logistic regression analysis same independent variables were used: Age; Gender; Place of living (countryside or city); Time since onset of stroke.

# 5 RESULTS

Baseline characteristics of all study populations are presented in Table 5.1.

Table 5.1

**Baseline characteristic of study populations**

| | | | Study 1 | | Study 2 | Study 3 |
|---|---|---|---|---|---|---|
| | | | Latvia n=1055 | Sweden n=1748 | Latvia n=255 | Sweden n=242 |
| Age (years) | | Mean (Min–Max) | 64.7 (18–92) | 58.0 (18–91) | 62.7 (22–92) | 69.4 (24–95) |
| | | Median (IQR) | 66 (57–74) | 59 (51–64) | 64 (56–73) | 71 (62–80) |
| Gender | n,% | Male | 556 (52.7) | 1059(60.6) | 134 (52.5) | 129 (53.1) |
| | | Female | 449 (47.3) | 689 (39.4) | 121 (47.5) | 114 (46.9) |
| ICD-10 diagnosis* | n (%) | I60 | 20 (1.8) | 353 (7.7) | 3 (1.2) | 14 (5.8) |
| | | I61 | 141 (12.7) | 779 (20.9) | 34 (13.3) | 26 (10.7) |
| | | I62 | 5 (0.4) | 68 (1.8) | 1 (0.4) | 0 |
| | | I63 | 924 (83.1) | 2275(61.1) | 215 (84.3) | 155 (63.8) |
| | | I64 | 18 (1.6) | 20 (0.5) | 2 (0.8) | 48 (19.8) |
| | | Other | 4 (0.4) | 228 (6.1) | 0 | 0 |
| Time since onset of stroke | | Mean (Min–Max) | 13.8 (1–51) | 4.0 (1–52) | 25.5 (9–176) | 33.3 (6–175) |
| | | Median (IQR) | 13 (9–18) (weeks) | 2 (1–8) (weeks) | 23 (16–32) (months) | 14 (12–44) (months) |
| Length of rehabilitation (days) | | Mean (min–max) | 14.6 (0–65) | 57.8 (2–346) | | |
| | | Median (IQR) | 12 (9–18) | 48.50 (31–76) | | |

*ICD–10 Diagnosis: I60 – Subarachnoid haemorrhage, I61 – Intracerebral haemorrhage; I63 – Cerebral infarction; I64 – Stroke, not specifies as haemorrhage or infarction
IQR – interquartile range

## 5.1 Comparison of stroke rehabilitation in Latvia and Sweden

A qualitative comparison between stroke care systems in Latvia and Sweden is shown in the Table 5.2.

The description of age, gender, type of diagnosis and timing of rehabilitation is described in Table 5.1. The shift of proportions in ‘totally dependent’, ‘partially dependent’ and ‘independent’ groups between admittance to and discharge from rehabilitation for the Latvian and the Swedish stroke populations is illustrated in Table 5.3.

The odds ratio’s between both populations for all 6 domains are reported in Figure 5.1. Results show that the odds for achieving a better level of independence at discharge from rehabilitation in ‘self-care’, ‘locomotion’, communication’ and ‘social cognition’ were higher for Latvian patients, before the adjustment for significant factors. After adjustment for admittance scores for the corresponding domain (evaluated at the admittance to rehabilitation), the odds considerably changed in favour of the Swedish population. The odds of a better outcome for the Swedish population remained the same or somewhat decreased after full adjustment.

The dependence level for the corresponding domain at admittance, age, time since onset and length of rehabilitation were the significant contributing factors in almost all domains. In the domain ‘Communication’ a contribution of length of stay, while controlling for other factors, was not significant, therefore it was excluded from the analysis. All estimated odds for a better outcome between populations in the analysis were statistically significant, except the unadjusted odds ratio for ‘sphincter’ (p=0.13) and the “fully” adjusted odds ratio for ‘communication’ (p=0.67).

## 5.2 Self-reported disability for persons living in Latvia

The final models of stepwise multiple regression analysis explained 23–43.5 % of the variance in the outcomes. Overall results are reported in Table 5.4. by each domain and total score of WHODAS 2.0. The dependence level of ‘Self-care’ at discharge from rehabilitation was included and

significant in the final explanatory model in five out of the seven analysed domains, as well as in the total WHODAS 2.0 score. Results indicated that being dependent at discharge led to a higher level of perceived disability. ‘Locomotion’ was significantly related to the ‘Mobility, ‘Self-care’, ‘Life activities: Work or school’ and ‘Participation’ domains. Similarly, persons recognized by rehabilitation professionals as independent in ‘Communication’ at discharge, perceived fewer problems in the domains of ‘Cognition’, ‘Getting along’ and the total WHODAS 2.0 scores.

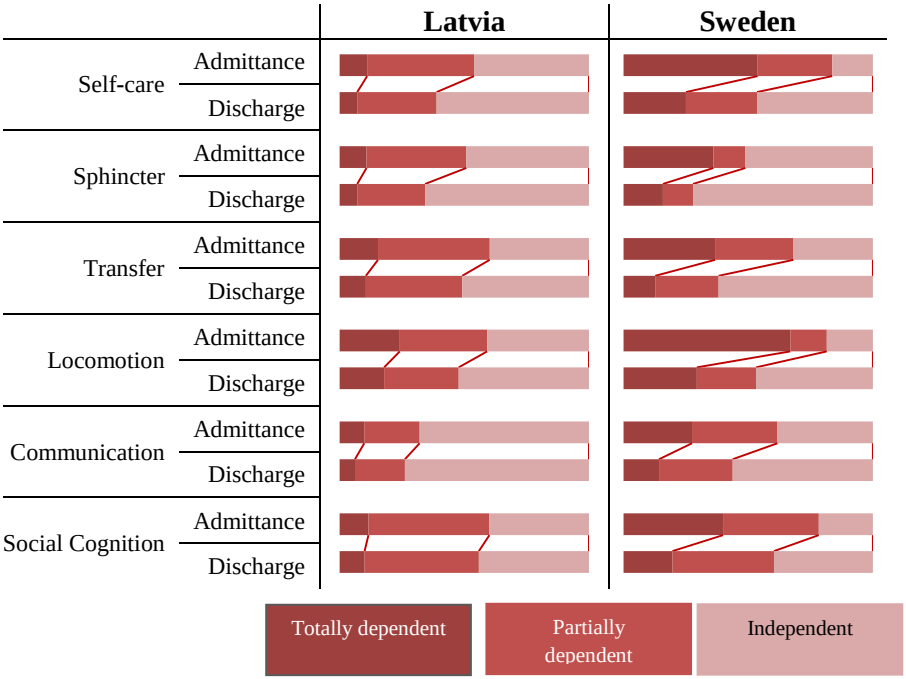
Table 5.2

**Qualitative description of rehabilitation systems**

| | | **Latvia** | **Sweden** |
|---|---|---|---|
| 1. | Stroke units | Since June 1, 2000 | Since 1990s |
| 2. | % treated at the stroke unit | No exact data available | 91% |
| 3. | Stroke rehabilitation available since | 1995 | 1970s |
| 4. | Initial functional assessment to determine rehabilitation needs and receive an individualized rehabilitation plan | 100 % in stroke units | 100 % in stroke units |
| 5. | Post-acute rehabilitation: All patients who are admitted to inpatient rehabilitation following stroke are treated in a specialized stroke rehabilitation unit | No | No |
| 6. | Multi professional team | Yes | Yes |
| 7. | Funding | Public | Public |
| 8. | Patient borne costs | Yes 13.50 Euro, except persons with severe disability, low-income and other social groups | Yes Depend on the county, but not more than 10 Euro |
| 9. | Follow-up | Some | Yes |
| 10. | Other options for rehabilitation | Home based rehabilitation; Day rehabilitation units; Out-patient rehabilitation | Home based rehabilitation; Day rehabilitation units; Out-patient rehabilitation |
| 11. | Quality registers | No | "Riks-Stroke", the Swedish stroke register since 1994; "WebRehab" since 1997 |

Table 5.3

**Shift of proportions in level of dependence between admittance and discharge from rehabilitation**



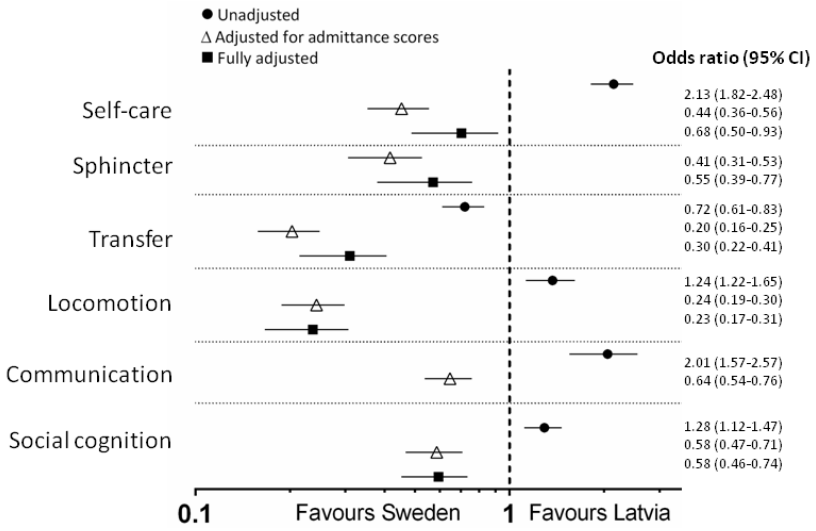



Figure 5.1 **Forest plot for odds in favour of being more independent between Latvia and Sweden**

## 5.3 Contribution of personal factors for persons living in Sweden

Higher age indicated a greater number of problems in functioning, and age also had an influence on most of the areas in the environmental factors. Reports of restrictions in ‘activities and participation’ were more typical in older patients. Time since onset was found to be a factor that influences only the perception of attitudes. Living in a rural setting was associated with perceiving facilitators in ‘natural environment and human made changes in the environment’. On the other hand, those who lived in the city reported facilitators in ‘support and relationships’ and ‘attitudes’. The results of the complete analyses of the regression analyses are shown in Tables 5.5, 5.6 and 5.7, where only independent variables with a p-value of less than 0.05 are included.

Table 5.4

**Results of final models of stepwise multiple regression analysis**

| | **Cognition** | **Getting around** | **Self-care** | **Getting along** | **Household activities** | **Work or school activities** | **Participation** | **Total WHODAS 2.0** |
|---|---|---|---|---|---|---|---|---|
| **Adjusted $R^2$** for final model* | **23.0%** | **43.5%** | **40.0%** | **28.0%** | **28.0%** | **39.7%** | **35.9%** | **40.8%** |
| FIM Self-care | ✓ | ✓ | ✓ | 5.0% | ✓ | - | - | 6.2% |
| FIM Sphincter | - | - | - | - | ✓ | - | - | - |
| FIM Transfer | - | - | - | - | - | - | - | - |
| FIM Locomotion | - | 5.7% | 2.9% | - | - | 24.7 % | 7.9% | - |
| FIM Communication | 4.7% | - | - | 5.5% | ✓ | - | - | 2.3% |
| FIM Social Cognition | ✓ | - | - | ✓ | - | - | - | - |
| Work status | ✓ | 5.7% | 9.8% | - | 3.7% | - | 7.6% | 4.9% |
| Time since discharge | - | - | 1.2% | - | - | - | - | ✓ |
| Type of diagnosis | ✓ | - | - | ✓ | - | - | - | - |
| Length of rehabilitation | - | - | - | - | - | - | - | - |
| Time since onset of stroke | - | ✓ | - | - | ✓ | - | ✓ | ✓ |
| Age | - | 2.1% | - | 1.9% | ✓ | ✓ | - | 1.7% |
| Gender | 1.5% | - | - | 6.1% | - | - | - | - |
| Language preferences | - | - | - | 4.3% | 2.9% | 5.9% | 10.9 % | 3.7% |
| Education | - | - | - | ✓ | - | - | - | - |
| Place of living | - | - | - | - | - | - | ✓ | - |
| Living in family | - | 1.0% | - | - | - | - | 1.4% | - |

*The p values for final model in all outcomes were <0.0005; % of unique contribution are reported for all variables that showed significant contribution to the final model ($p<0.05$). Independent variables that did not show significant contribution to the model are marked as "✓". Variables that were not included in the final model for explanation of outcome variance are marked as "-"

Table 5.5

**Results of standard multiple regression analysis for the ICF components of functioning**

| Components | Model | | Factors | *β* |
|---|---|---|---|---|
| Sum of problems in 'Body functions' | $R^2$<br>$P^*$ | 4.5%<br>0.026 | Gender | 0.16 |
| Sum of problems in 'Activities and Participation' | $R^2$<br>$p^*$ | 0.102<br><.0005 | Time<br>Age<br>Gender | 0.22<br>0.13<br>0.11 |

Table 5.6

**Results of standard multiple regression analysis for chapters of the ICF environmental factors**

| | Facilitators | | | | **Barriers** | | | |
|---|---|---|---|---|---|---|---|---|
| Chapters | **Model** | | **Factors** | ***β*** | **Model** | | **Factors** | ***β*** |
| 'Products and technology' | $R^2$<br>p | 21.4%<br><0.001 | Age<br>Gender | 0.40<br>0.13 | $R^2$<br>p | 4.9%<br>0.017 | Age<br>Place of living | -0.14<br>-0.20 |
| 'Natural environment and human made changes in environment' | $R^2$<br>p | 4.2%<br>0.038 | Place of living | -0.16 | $R^2$<br>p | 5.3%<br>0.012 | Age | -0.22 |
| 'Support and relationships' | $R^2$<br>p | 11.9%<br><0.001 | Place of living | 0.320 | $R^2$<br>p | 7.6%<br>0.001 | Age | -0.27 |
| 'Attitudes' | $R^2$<br>p | 9.4%<br><0.001 | Time<br>Age<br>Place of living | 0.19<br>-0.20<br>0.13 | $R^2$<br>p | 9.0%<br><0.001 | Time<br>Age | 0.14<br>-0.27 |
| 'Services, systems and policies' | $R^2$<br>P | 9.8%<br><0.001 | Age<br>Gender | 0.24<br>0.15 | $R^2$<br>p | 4.9%<br>0.017 | Age | -0.19 |

Table 5.7

**Results of direct logistic analysis for seven chosen categories of the ICF**

| ICF code | ICF category title | Correctly classified* | Time, OR (95%CI) | Age, OR (95%CI) | Gender, OR (95%CI) | Place of living, OR (95%CI) |
|---|---|---|---|---|---|---|
| d460 | 'Moving around in different locations' | 75.2% | – | 1.06 (1.03-1.08) | – | – |
| d530 | 'Toileting' | 74.3% | 1.01 (1.00–1.02) | 1.05 (1.02–1.08) | 0.5 (0.29–1.09) | 0.44 (0.21–0.94) |
| d540 | 'Dressing' | 69.5% | 1.01 (1.00–1.02) | 1.01 (1.01–1.06) | – | 0.35 (0.18–0.71) |
| d640 | 'Doing housework' | 75.8% | 1.02 (1.00–1.03) | 1.04 (1.01–1.06) | 1.94 (1.02–3.67) | 0.24 (0.08–0.74) |
| d920 | 'Recreation and leisure' | 63.9% | – | 1.03 (1.01–1.05) | – | 0.36 (0.15–0.87) |
| e210 | 'Physical geography' (barriers) | 89.0% | – | – | – | 0.22 (0.08–0.61) |
| e310 | 'Immediate family' (facilitators) | 88.4% | – | 1.04 (1.04–1.08) | – | 8.25 (2.86–23.8) |

*The p values for all reported models were <0.0005

## 5.4 Contribution of personal factors for persons living in Latvia

Personal factors identified as important in Swedish stroke population, were also of importance in determining the level of self-perceived disability in persons living in Latvia. At least one of the factors was important factor in almost every domain and total score of WHODAS 2.0. Detailed results of unique contribution of each factor are showed in the Table 5.8.

Table 5.8

**Unique contribution of time since rehabilitation, age, gender and place of living to WHODAS 2.0 in Latvian population**

| | **Time since rehabilitation** | | **Age** | | **Gender** | | **Place of living** | |
|---|---|---|---|---|---|---|---|---|
| | B (95%CI) | p | B (95%CI) | p | B (95%CI) | p | B (95%CI) | p |
| **‘Cognition’** | – | – | – | – | 7.1 (−0.05–14.2) | 0.05 | – | – |
| **’Self-care’** | 0.4 (0.0–0.8) | 0.05 | – | – | – | – | – | – |
| **‘Mobility’** | – | – | 0.4 (0.1–0.7) | 0.01 | – | – | – | – |
| **‘Getting along’** | – | – | 0.33 (0.0–0.6) | 0.03 | 15.0 (6.6–23.4) | 0.01 | – | – |
| **Household activities** | – | – | 0.3 (−0.1–0.7) | 0.10 | – | – | – | – |
| **Household activities** | – | – | 0.4 (−0.2–1.0) | 0.19 | – | – | – | – |
| **‘Participation’** | – | – | – | – | – | – | 5.5 (−1.3–12.2) | 0.11 |
| **Total WHODAS 2.0** | 0.3 (0.0–0.6) | 0.04 | 0.3 (0.0–0.5) | 0.03 | – | – | – | – |

# 6 DISCUSSION

The results of this research shows that different aspects of WHO's bio-psycho-social model influence rehabilitation outcomes for persons after stroke and results depends on the country of residence (Latvia or Sweden). Functional, organizational, social and personal factors are of importance. Some of the factors are modifiable by the healthcare system, but some are the responsibility of society as a whole.

## 6.1 Comparison of stroke rehabilitation in Latvia and Sweden

When theoretically comparing stroke care systems in Latvia and Sweden it seems that the components of stroke care are similar. They also seem to be in line with the suggestions of European Union of Medical Specialists Section of Physical and Rehabilitation Medicine. (Gutenbrunner et al., 2010) However, both populations vary in their basic medical and socio-demographic characteristics, as well as in the level of independence at admittance and discharge. This suggests that there are potential differences in its content and organizational aspects of rehabilitation.

In both countries, Latvia and Sweden, in-patient rehabilitation is organised through a multi-professional team, with nursing and medical care available 24 hours a day. However, information about the exact content of rehabilitation and its intensity is lacking in both countries. There still are no agreed selection criteria for in-patient rehabilitation. So the decision whether to admit a patient or not to the rehabilitation facility is made by rehabilitation specialists in both countries. Also the funding of in-patient care comes both from the public purse and from contributions from the patients themselves in Latvia as well as in Sweden. Additionally, according to the World Bank reported data from 2013, the gross domestic product in Sweden was 4.2 times

higher than in Latvia. Therefore, the cost to patients in Latvia places a higher financial burden on affected families. Thus, the patient's cost for rehabilitation at an in-patient facility per day, when comparing this to average wages of each country, is proportionately different between Latvia and Sweden, with higher percentage costs for people in Latvia. While in Sweden this fee might serve as motivation for participation in the rehabilitation process, in Latvia it could be the reason behind a family's decision to decline this service.

In Latvia, for certain categories (such as status of severe disability or low income), all patient's cost is covered by public resources. This can provide an explanation for possible differences in the incentive for rehabilitation. The CERISE study has previously underlined that selection criteria for rehabilitation are not solely clinical and could depend on organizational and financial aspects. (Putman and De Wit 2009)

The organization of acute care is important because this is where stroke rehabilitation starts. In Sweden, almost all patients after stroke are treated in stroke units. (Appelros et al., 2014) In Latvia, the information for the percentage of patients treated in a stroke unit in not available. Without clear and precise measurement and assessment of stroke care pathways, persons who likely would benefit from in-patient rehabilitation may end up excluded from rehabilitation. Systematic and standardised data collection could provide reliable information for comparing different systems thus avoiding speculations on the quality and efficacy of the services.

The contrast between the lengths of rehabilitation in both study populations is large. In the Latvian population, the duration of in-patient rehabilitation is approximately two weeks and is relatively fixed. The median length of stay in Sweden, even when compared to other countries, is rather long. (Grant et al., 2014, Atalay and Turhan, 2009) The length of rehabilitation cannot be used as a tool to describe clinical success. According to accepted standards of rehabilitation, the rehabilitation plan should be individualized and

based on the expected improvement, which is not time limited. (PRM Section of UEMS, 2006) However, time is used as a tool to estimate the costs of the health care process and in some countries can be used to limit the amount of rehabilitation. (Atalay and Turhan 2009)

While most of the patients in Sweden were admitted to rehabilitation within the first month after the event, patients in Latvia usually started after 2 to 3 months. These figures are in favour of the Swedish system, since the best results can be achieved at earlier phases after stroke onset. (Quinn et al., 2009, Meyer et al., 2014) There is also no data on whether persons after stroke in Latvia received treatment in the period between acute care and being admitted to rehabilitation. There are several options available: rehabilitation in the home, privately funded rehabilitation at in- or outpatient wards, day care units or no formal rehabilitation and the pathway is not known.

The Latvian population were more independent at the time of admission and discharge. But the shift between proportions of the levels of dependence from admittance to discharge is more notable in the Swedish population.

Considering the level of independence at admittance to rehabilitation, the patients in Sweden were more likely to improve. This advantage of Swedish stroke population slightly decreased when adjusting for age, time since onset and length of rehabilitation. These factors have previously shown as significant predictors of rehabilitation effectiveness and efficacy.(Koh et al., 2012) However, they explained rather small part of differences between countries indicating, that there is other factors that should be considered as significant. The intensity (Putman et al., 2006) and content (De Wit et al., 2006) of rehabilitation could explain the variance of outcomes. However, none of this information was available for current analysis, which is the limitation of this study.

Since the Latvian population was more independent at admittance, there is a possibility that improvement during rehabilitation is not detected due to a ceiling effect of the FIM. Thus, FIM does not reflect actual gain of rehabilitation due to difference of rehabilitation aims in Latvia, compared to ones in Sweden. The goals of the process and the achievement of them is not available in any of study populations, which is also a global problem. (Hakkennes et al., 2011) This, in turn, highlights the need for the assessment tools that reflect clinically meaningful changes during the process. (Beninato et al., 2006, Kucukdeveci et al., 2011)

## 6.2 Self-reported disability for persons living in Latvia

The level of independence or amount of care needed in six domains of daily activities was used as explanatory factors in the self-perceived disability in persons living in community. The results suggest that levels of independence in daily activities at discharge from rehabilitation are significant factors that influenced perception of disability in the chronic phase of stroke.

Either ‘Self-care’ or ‘Locomotion’, or both were important in explaining all analysed outcomes. Being independent in locomotion is of importance not only for the ‘Mobility’ domain of WHODAS 2.0, where there is direct theoretical relationship, but it is also related to perception of problems in ‘Participation in society’, as well as allowing those who are employed to be able to work.

These results are in line with recently published part of the CERISE study (Stummer et al., 2015) that also suggests better participation outcomes for those who are more independent early after stroke. They are also in line with overall principles of physical and rehabilitation medicine. The process of medical rehabilitation directly after stroke is oriented to the medical assessment and the functional aspects and focuses mainly on the improvement of

independence in basic daily activities. These aspects, in turn, give a basis for better participation in society (Mayo et al., 2014, Skolarus et al., 2014), and, thereby, on quality of life. Moreover, enabling person's ability to live a meaningful life according to his/her wishes is the overall goal of rehabilitation. (PRM Section of UEMS, 2006)

However, the ability to perform activities independently cannot give the whole picture of the disability experience. (Mayo et al. 2014) Other factors, such as social and personal ones, are of similar importance. Functional, social and personal factors chosen for the analysis could explain up to almost half of the variance in a person's experience of life after stroke, depending on the analysed life aspect. These factors explained such domains as 'Mobility' and 'Self-care' rather well. Both these domains represent the issues of basic skills of physical functioning. The models explained considerably less well the perception of 'Understanding and Communication', as well as 'Interaction with other people'. These tasks require complicated multilevel skills that are more challenging to evaluate than physical functioning. Persons after stroke could experience failure by health professionals to identify those needs. (Peoples et al., 2011) Non-physical aspects of stroke consequences has been described as less related to stroke severity and recognized as more important from perspective of stroke patients. (Owolabi, 2011)

'Participation in society' was also rather poorly explained in comparison to other domains. Moreover this domain, along with 'Household activities', was reported as most problematic for the study population. That is of interest and importance because participation in society involves the usage of complex skills and navigation in everyday live.

## 6.3 Contribution of personal factors

Age and gender as socio-demographic factors are mentioned in the definition of personal factors in the framework of ICF. Even though they are not classified in the ICF, they might influence the domains, as shown in this study. Factors such as place of residence and time since onset seem to not be mentioned in a review that dealt with personal factors (Geyh et al. 2011), although they are not classified under any other components of ICF. The results of Part 3 of the study suggest that personal factors such as age, gender, place of residence and time since onset of stroke can influence self-perceived functioning and environmental factors defined in the framework of the ICF is persons living in Sweden.

The chosen personal factors model showed a predictive value in functioning and environmental factors. The two highest predictive values in this model were noted foremost for environmental factors (facilitators of 'products and technology' and 'support and relationships') and then for number of restrictions in 'activities and participation'. All other groups analysed also showed statistically significant predictive values. These results are supported by other studies in terms of emphasizing that modifying environmental factors can be beneficial for stroke patients in the chronic phase, while approaches at other levels of individuals' problems are more likely to fail to achieve any satisfactory goal. (Bouffioux et al., 2011, Goljar et al., 2011, Alguren et al., 2012).

Seven selected categories were analysed in this part of the study: five in the components of 'activities and participation' and two in environmental factors. The model of personal factors was found to have highly significant relations to all five domains of 'activities and participation'. For environmental factors, this model was seen to be significant only for barriers in 'physical geography' and facilitators for 'immediate family', which is understandable,

because both ‘immediate family’ as a barrier and ‘physical geography’ as a facilitator are considered only in exceptional cases.

Although this model of personal factors showed an influence of all the components, domains and categories that were used for analysis, the influence of each single factor and interaction of these factors differed widely between different components, domains and categories. For example, the domain of ‘moving around in different locations’ was found to be only little influenced by age, whereas ‘doing housework’ was influenced by a combination of all the factors selected in this study.

Four personal factors were included in the analysis of outcomes Part 2 of this study. However, it is impossible to perform a direct comparison of outcomes in the ICF component of ‘Activities and Participation’ between Latvia and Sweden. The concept of outcome is the same, but different assessment tools have been used, which could lead to bias of interpretation of results. (Stallinga et al., 2014) Aspect that also could lead to presentation of different influence of the factors is the method used for statistical analysis. While in the Swedish population, pure statistical influence of factors was explored, in the Latvian population, the results were controlled for other factors, such as level of independence at discharge and working status. That could also lead to differences in results in both populations.

However, there were some similarities in the results. Time since rehabilitation, age and gender where significant factors also in the model that evaluated problems in ‘Activities and Participation’ using WHODAS 2.0 in stroke population in Latvia. But in both populations the role of those factors where rather small. More time spent living in community and higher age where related to more problems reported in different aspects of ‘Activities and Participation’ in both populations. But place of living turned to be a factor that has no significant influence on self-perceived functioning, when controlling for other significant factors.

## 6.4 Methodological considerations and limitations

Observational (non-experimental) design of the study has been chosen for framework of this thesis. Considering the nature of rehabilitation, other types of research could fail in answering the current research questions. Rehabilitation as a complex intervention (Quinn et al., 2009) includes number of interactions between different components. (Craig et al., 2008) The key components is patient characteristics, all treatment and care process, as well as variability of outcomes. (Horn et al., 2005, Craig et al., 2008) Associations between these components are complicated, thus it is rather challenging to report the effectiveness of everyday practice. (Craig et al., 2008, Datta and Petticrew, 2013, Craig et al., 2014) However, this information is necessary, in order to compare results between settings and, therefore, seek for optimal models for stroke rehabilitation. (De Wit et al., 2007)

The critics that could be addressed for the observational studies include the lack of confidence that evidence is based on causal relationships rather than accidental associations due to other reasons. (Horn et al., 2005) To address this issue, the case-mix adjustment was used in the Part 1 and Part 2 of the study to control for possible confounding factors. (Craig et al. 2008, Teale et al., 2012) There have been attempts to find standardized model for confounders in stroke outcomes. (Segal and Whyte, 1997, Berlowitz and Stineman, 2010, Teale et al., 2012) However, these models mainly address such outcomes as mortality and dependency. (Teale et al., 2012) Therefore, it is now suggested that it is better to treat confounders according to the individual needs of the study than use standardized model of it. (Garofolo et al., 2013) This approach was also the used in Part 1 and Part 2 of the current study.

Another issue, worth to discuss is the nature and interpretation of outcome measures, that determines the choice of data analysis. Most of the instruments that are used for assessment in rehabilitation contain ordinal data.

(Kucukdevec, et al., 2011) There have been several widely used approaches for reporting outcomes, such single scale scores, score changes or percentile ranks, based on population norms. However, the interpretation of the outcomes is more mathematical and less focuses on clinically meaningful changes. (Jette et al., 2007) Moreover, it also violates the mathematical assumptions of the outcomes and thus, the conclusions, drawn from them. (Hobart and Cano, 2009, Grimby et al., 2012) Common way of addressing this problem, is by dichotomisation of the data by using cut-off points (Optimising Analysis of Stroke Trials et al., 2007), that could lead to loose of clinically relevant information and statistical power. (Roozenbeek et al., 2011) Therefore, it was decided to use shift analysis and ordinal regression analysis. (Saver, 2007, Bath et al., 2012) Shift analysis so far mainly has been used for mRS, when presenting the outcomes for acute stroke trials. (Saver 2007, ATC group et al., 2015) To avoid violations of the assumptions mentioned before and meanwhile preserve clinical relevance of the outcomes, FIM domains were trichotomized according to level of assistance needed. That is in line with the tasks of in-patient rehabilitation. (Quinn et al., 2009, Ward et al., 2012) To our knowledge, this type of analysis has not previously been used in a rehabilitation population with clinical data.

Same arguments as for use of the FIM would be valid also for the outcomes of WHODAS 2.0 and ICF Core Set for Stroke. WHODAS 2.0 is self-reported assessment tool and the actual order of response categories is unknown. (Kucukdeveci et al., 2013) Perception of disability experience and recognition of problems can differ between the persons experiencing the condition and the professionals who perform the evaluation. (Robinson et al., 2011) That can lead to a random variance due to the personal attitudes towards the situation. However, it has been developed based on extensive review and field-testing procedure (Ustun et al. 2010) and the suggested scoring algorithm was used. (*Measuring Health and Disability*, 2010) The distribution of

residuals in final statistical models was normal and assumptions for analysis were not violated. The bias of results due to usage of two translations of WHODAS 2.0 also cannot be excluded. However, using two translations allowed capturing a realistic picture of the post stroke population living in Latvia, regardless of language preference.

To avoid analysing data that would not represent the actual changes in components of, the qualifiers of the ICF Core Set for stroke were dichotomized. Thus the results show the possibility of having or of not having a problem in a certain domain of functioning by the facilitators or barriers that are reported or of having a number of problems below these levels. It does not say anything about the extent of the problem.

When discussing study limitations, the data gathering procedures need to be mentioned. The data gathering for study population in Latvia was retrospective. The evaluation on daily basis is done by rehabilitation professionals from the specialized in-patient rehabilitation unit. Due to the fact that more than one person is assessing patients there is risk of bias in the results generated from this evaluation. However, FIM scoring are detailed and the excellent inter-rater reliability has been reported for the instrument (Ottenbacher et al., 1996) and the ordinal response categories where collapsed. Both those aspects would allow addressing the issue of bias. The participants were included in the study if they were connected to rehabilitation facilities. Since there is possible bias of patient selection, study population may not represent the true population of persons who would benefit from in-patient rehabilitation after stroke.

There was missing data regarding the patients (i.e. stroke-subtypes, smoking) and the content of rehabilitation in the data sets in first part of the study, which might have an impact on the results. The data on content or intensity of rehabilitation interventions was not included in the study. Data on involved specialists and amount of sessions per week was anyhow available in

medical records of the Latvian population. Similar information were available in the data set of the Swedish populations, however, for limited number of cases. All these cases were omitted from the study due to early beginning of rehabilitation. In none of populations information on the content of therapies was available.

There was no information available of environmental factors in the Latvian population. Environmental factors are important for functioning (Bostan et al., 2015) and could explain the determinants of observed results. However, due to bi-directional values of environmental factors (as barriers or facilitators) the analysis of it is encumbered.

# 7 CONCLUSIONS

1. The components of the rehabilitation are reported to be similar in Latvia and Sweden, but there is lack of information on the content of these complex interventions.
2. Characteristics and the outcome of the in-patient rehabilitation are different.
3. Showing improvement during rehabilitation is easier if the patient is more dependent and receives rehabilitation earlier after stroke onset.
4. However, majority of factors that explain the differences in functional outcome after rehabilitation between countries remains unknown.
5. Higher level of independence at discharge from rehabilitation leads to lower levels of self-reported disability in chronic phase of stroke in persons living in Latvia.
6. However, social and personal aspects showed equal contribution to the self-reported disability.
7. Personal factors such as age, gender, place of living and time since onset has a predictive value for functioning and environmental factors for persons in chronic phase of stroke living in Sweden.
8. There are relationships between personal factors as mentioned above and certain categories of functioning and environmental factors.
9. These factors interact to influence self-perceived functional outcome and environmental factors as barriers or facilitators in persons living in Sweden.
10. Age, gender and time since onset are also independent factors that are of importance in predicting the self-reported disability in chronic phase of stroke for persons living in Latvia. However, the perception of problems in functioning does not differ between those living in countryside and those in a city.

# 8 FUTURE CONSIDERATIONS

This study highlights the importance of multiple aspects of in-patient rehabilitation as a complex intervention. The necessity for a complex approach leads to difficulties and restrictions for comparison of the results of the interventions between populations, which are essential for quality assessment in rehabilitation. Having good data gathering in the acute setting as well as in the rehabilitation setting could make comparisons possible in the future. There is also a need for structured data gathering regarding the content of the complex interventions within stroke rehabilitation, in order to fully evaluate the efficacy. It would also serve as a tool for improvement of quality of care, resource coordination and basis for development of the care process. (Sunnerhagen, 2014)

The results of the present study simultaneously underlines the importance of the rehabilitation process and points out the lack of its ultimate implication on the outcome. The consequences of stroke and its impact on lives depend on a complex entirety that is formed by interactions of different factors. Both modifiable and non-modifiable factors are included.

Therefore, both medical and social systems are important in modification of important factors towards better outcomes and as well as being continuous, the process should be interactive. However, more research is needed to identify other important factors and determine the best approaches for addressing the problems in the most productive manner.

## *Clinical implications and recommendations*

1. Each patient after stroke should be evaluated for further planning of rehabilitation services at acute stage of stroke.

2. Systematic and standardised data collection procedure with clear and precise measurement and assessment system should be developed and used in national level as a quality register. That would provide reliable information on stroke care pathways, as well as evaluation on quality and efficacy of the services.
3. Since post-acute in-patient rehabilitation after stroke is delivered by a multi-professional team, with nursing and medical care available 24 hours a day, the selection criteria and clear goals for those who receive the service should be developed accordingly:
    a. Person should be dependent in basic activities of daily living and mobility and, therefore, in need for constant nursing care; Gained independence in these domains are essential for better long-term outcome after stroke in terms of self-perceived disability;
    b. The need for multi-professional rehabilitation or constant medical care should also be evaluated and justified.
4. Post-acute in-patient rehabilitation should be started as early as possible after stroke, preferably, directly after discharge form acute care hospital, since the best results can be achieved at earlier phases after stroke onset;
5. The length of rehabilitation cannot be fixed and should depend on individual needs and prognosis of the person.
6. The information on content and intensity of rehabilitation programmes should be available for detailed evaluation of efficacy of in-patient rehabilitation;
7. Close collaboration with social services and early planning of social integration options are also essential for the outcome. Special attention should be paid to issues related to return to work.

# Personal contribution

The author of this thesis has performed an analysis of medical records and collection of data on patients from Latvia. The author independently has performed systematization of data, statistical analysis and interpretation of results, as well as wrote the publications that are included in the thesis.

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> "*Nav nekāda lielā lieta peldēt labklājībā, kad viss jau nolikts līdzsvarā. Grūts ir jaunais. Jaunais ledus. Jaunā gaisma. Jaunās izjūtas*."
>
> /Pēters Hēgs/
>
> "*It's not difficult to coast along when things are going well, when balance has been established. What's difficult is the new. The new ice. The new light. The new feelings*."
>
> /Peter Høeg/

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