



# UEMS PRM Section & Board

## Clinical Affairs Committee

*New accreditation procedure*

### **Programme N009**

**PRM programme for patients with  
traumatic and hypoxic brain injury**

***Accredited : 31/10/2012***

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16

**Content :**

1		
2		
3		
4	<b>I. IDENTIFYING DATA.....</b>	<b>4</b>
5	<b>II. SUMMARY.....</b>	<b>5</b>
6	<b>III. GENERAL BASES OF THE PROGRAMME.....</b>	<b>6</b>
7	A. PATHOLOGICAL AND IMPAIRMENT CONSIDERATIONS.....	6
8	1. <i>Aetiology and pathogenesis</i> .....	6
9	2. <i>Natural history and relationship to impairment</i> .....	6
10	3. <i>Medical diagnosis and prognosis</i> .....	7
11	4. <i>Treatments</i> .....	8
12	B. ACTIVITY LIMITATIONS.....	8
13	C. PARTICIPATION RESTRICTIONS.....	9
14	C. SOCIAL AND ECONOMIC CONSEQUENCES.....	10
15	1. <i>Epidemiological data</i> .....	10
16	2. <i>Social data</i> .....	10
17	3. <i>Economic data</i> .....	10
18	D. MAIN PRINCIPLES OF YOUR PROGRAMME.....	11
19	<b>IV. AIMS AND GOALS OF THE PROGRAMME.....</b>	<b>12</b>
20	A. TARGET POPULATION.....	12
21	1. <i>Inclusion criteria</i> .....	12
22	2. <i>Exclusion criteria</i> .....	12
23	3. <i>Referral of patients</i> .....	12
24	4. <i>Stage of recovery</i> .....	13
25	B. GOALS OF THE PROGRAMME.....	13
26	1. <i>In terms of body structure and function</i> .....	13
27	2. <i>In terms of activity</i> .....	13
28	3. <i>In terms of participation</i> .....	14
29	<b>V. ENVIRONMENT OF THE PROGRAMME.....</b>	<b>15</b>
30	A. CLINICAL SETTING.....	15
31	B. CLINICAL APPROACH.....	15
32	C. FACILITIES.....	15
33	<b>VI. SAFETY AND PATIENT RIGHTS.....</b>	<b>17</b>
34	A. SAFETY.....	17
35	B. PATIENT RIGHTS.....	17
36	C. ADVOCACY.....	18
37	<b>VII. PRM SPECIALISTS AND TEAM MANAGEMENT.....</b>	<b>19</b>
38	A. PRM SPECIALISTS IN THE PROGRAMME.....	19
39	B. TEAM MANAGEMENT.....	19
40	<b>VIII. DESCRIPTION OF THE PROGRAMME.....</b>	<b>21</b>
41	A. TIME FRAME OF THE PROGRAMME.....	21
42	B. ASSESSMENT.....	21
43	1. <i>Impairment</i> .....	21
	a) <i>Clinical assessment</i> .....	21
	b) <i>Diagnostic tools</i> .....	21
44	2. <i>Activity and participation</i> .....	21
	a) <i>Capacity evaluation (what somebody can do)</i> .....	21
	b) <i>Performance (what somebody is actually doing)</i> .....	21
45	3. <i>Environmental and personal factors ; assessment, questionnaire</i> .....	22
46	C. INTERVENTION.....	22
47	1. <i>PRM specialist intervention</i> .....	22

1	2.	<i>Team intervention</i> .....	22
2	3.	<i>Interventions which are part of the program and that need to be mentioned separately and</i>	
3		<i>are regularly available for the patients and relatives:</i> .....	24
4	D.	FOLLOW UP AND OUTCOME .....	25
5	1.	<i>Review and progress through the programme</i> .....	25
6	2.	<i>Criteria for progress measurements</i> .....	25
7	E.	DISCHARGE PLANNING AND LONG TERM FOLLOW UP .....	25
8	<b>IX.</b>	<b>INFORMATION MANAGEMENT</b> .....	<b>26</b>
9	A.	PATIENT RECORDS .....	26
10	B.	MANAGEMENT INFORMATION .....	26
11	C.	PROGRAMME MONITORING AND OUTCOMES .....	27
12	<b>X.</b>	<b>QUALITY IMPROVEMENT</b> .....	<b>28</b>
13	A.	WHICH ARE THE MOST POSITIVE POINTS OF YOUR PROGRAMME? .....	28
14	B.	WHICH ARE THE WEAK POINTS OF YOUR PROGRAMME ?.....	28
15	C.	WHICH ACTION PLAN DO YOU INTEND TO IMPLEMENT IN ORDER TO IMPROVE YOUR PROGRAMME ?	28
16	1.	<i>Extrinsic requests (equipment, manpower)</i> .....	28
17	2.	<i>Intrinsic improvements of the programme (organisation, training, assessment)</i> .....	28
18	<b>XI.</b>	<b>REFERENCES</b> .....	<b>29</b>
19	A.	LIST OF REFERENCES .....	29
20			
21			
22			
23			
24			

1

## I. Identifying data

---

2

Title	M.D., M.Sc.
Family name	GRABLJEVEC
First name	KLEMEN
Position	Head of the Unit
Phone	+ 386 1 4758 184
Email	<a href="mailto:klemen.grabljevec@ir-rs.si">klemen.grabljevec@ir-rs.si</a>
Year of Board Certification	2002
Name of unit - program	Department for Traumatic Brain Injury Rehabilitation
Hospital (facility)	University Rehabilitation Institute
Address	Linhartova 51
Post code	SI-1000
City	Ljubljana
Country	SLOVENIA

3

4

5

6

7

8

1

## II. Summary

2 Traumatic brain injury represents one of greatest national health problems in Slovenia, since it is  
3 closely related to low traffic safety (1) and high alcohol consuming ratio (2) in the country.  
4 Approximately two out of three patients with brain injury were injured in any kind of traffic accident.  
5 The current incidence of traumatic brain injuries in the country is 200/100.000 (population of 2 million),  
6 from which 90 % of them representing mild brain injury (3). There are approximately 350 moderate  
7 and severe brain injuries a year, with 30 – 50 % mortality in first week and 15 % mortality in first month  
8 after severe brain injury, giving the number of 150 – 200 patients surviving long term after injury.

9  
10 This programme for Rehabilitation after traumatic brain injury takes place at the **Department for**  
11 **rehabilitation of patients with brain injury, multiple sclerosis and neuro-muscular diseases**, which is part  
12 of **University Rehabilitation Institute Ljubljana**. Department serves as a national referral centre for  
13 people after severe and moderate traumatic as well as hypoxic-anoxic brain injury. By the mean time,  
14 the same Department runs three other programmes – for rehabilitation of patients with Multiple  
15 Sclerosis, patients with Parkinson Disease and patients with Neuro-Muscular diseases.

16  
17 There are **20 beds available (out of 38 in the department)** for inpatient rehabilitation and there is a  
18 day-hospital accommodation available. The programme is run in a comprehensive and  
19 interdisciplinary way, with a rehabilitation team consisting of one PRM specialist, 1 neuro-psychologist,  
20 1 Speech and Language therapist and 1 registered nurse. Those staff members are dedicated to the  
21 programme of traumatic brain injury rehabilitation only. Other staffs are shared with other  
22 programmes. Rehab-nursing care is provided by 14 nurses and two nurse-assistants, but they are  
23 also responsible for all patients in the department (38 patients). A social worker is available for  
24 patients with brain injury together with the programme for spinal cord injury rehabilitation. There are 5  
25 physiotherapists in the department, performing the therapy for the patients of other rehabilitation  
26 programmes as well (for together 38 patients) and 4 occupational therapists also performing the  
27 therapy for the patients of other rehabilitation programmes as well (for together 38 patients).

28  
29 Acute surgical and intensive treatment of people with moderate to severe brain injury is performed at  
30 one of the three neurosurgery clinical departments in the country (Ljubljana, Maribor, Celje) or at the  
31 Level I Trauma Centres. If further prolonged intensive care is needed, patients are later transferred  
32 from neurosurgical department to local acute hospitals, nearest to the region where they live.

33  
34 Patients are admitted to the Rehabilitation Institute directly from acute hospitals as soon as their vital  
35 signs are stable and when they do not need intensive care interventions any more. In rare situations,  
36 patients in suitable conditions are discharged from acute hospitals to home care and are admitted to  
37 Rehabilitation Institute later. Generally it is favourable that patients regain their full consciousness,  
38 before they are included in the Rehabilitation programme, but there is also a special programme for  
39 early neurostimulation therapy available. Patients in Minimal Conscious State (MCS) are admitted for  
40 a three to six week period of “observation – therapy – observation” programme, but currently only one  
41 such patient at a time. It has been decided that patients in Permanent Vegetative State (PVS) were  
42 not suitable for the existing rehabilitation programme and so they are transferred for permanent and  
43 long term care to dedicated institutions or nursing homes.

44  
45 Patients are admitted into the rehabilitation programme after being presented to a department  
46 specialist with a standardized referral letter where his/her clinical/functional status has been described  
47 by the PRM specialist of the acute hospital. If there is no PRM specialist in the acute hospital, the  
48 patient is invited to come to an outpatient evaluation, performed by the PRM specialist at the  
49 Rehabilitation Institute. In some cases, the department specialist performs a consulting visit in the  
50 acute hospital. After outpatient evaluation, patients suitable for the programme are informed about the  
51 waiting period for admission, and those patients not suitable for the programme are informed about  
52 the reasons for that and provided with written information and suggestions for further treatment.

53

### 1 III. General bases of the Programme

---

#### 2 A. PATHOLOGICAL AND IMPAIRMENT CONSIDERATIONS

##### 3 1. *Aetiology and pathogenesis*

##### 4 Aetiology:

5  
6 a) Main reason for traumatic brain injury is a motor vehicle accident (40%), followed by bicycle  
7 and pedestrian accident (20%), falls at sport or leisure time (20%), falls at working place (15%)  
8 and tentamen suicidi or violent act by another person (5%).

9 b) Main reason for hypoxic brain injury is cardiac arrest with resuscitation.

##### 10 Pathogenesis:

11  
12 a) Severe and moderate (GCS 3 – 12) brain injury of traumatic origin, caused by blunt trauma to  
13 the head associated with acceleration and/or deceleration forces resulting in a combination of  
14 translation and rotation, which may or may not cause skull fracture and shifting of the  
15 intracranial contents.

16 b) Diffuse hypoxic brain injury with global cessation of cerebral blood flow, resulting in severe  
17 hypoxia and generalized brain ischemia. This occurrence causes a complex cascade of events  
18 that leads to excito-toxic damage from excitatory amino acids, a derangement in calcium  
19 homeostasis, and further neuronal damage from oxygen-derived free radicals.

##### 20 2. *Natural history and relationship to impairment*

21  
22 The clinical natural history of TBI is defined in the context of focal or diffuse neuro-pathologic  
23 events (4). The critical pathologic factors are the type, distribution, severity and location of these  
24 combined neuro-pathological events after brain injury.

25 Diffuse injury is mainly expressed as diffuse axonal injury, which is characterizes by a  
26 recognizable pattern of stages that occur across the wide spectrum of severity. Since the  
27 patients in phase of Loss of Consciousness (LoC) and phase of post-traumatic amnesia and  
28 confusion are not ideally suitable for comprehensive rehabilitation intervention, the later phase  
29 of post-confusional restoration of cognitive functions is the right moment to involve with  
30 comprehensive rehabilitation interventions.

31 Patients are usually admitted into programme in the phase of post-confusional/emerging  
32 independence and in some cases in confusional state or minimally conscious state. Patients  
33 impairment in post-confusional phase is on attention level, memory retrieval and executive  
34 functioning. There are deficits in self-awareness, social awareness, behavioural and emotional  
35 regulation. In this very phase, patients are ready to achieve functional independence in daily  
36 self care, improve social interactions and start developing independence at home.

37 Focal cortical contusions, deep cerebral haemorrhages and extra-axial (subdural and epidural)  
38 haemorrhages make up the majority of focal lesions in TBI patients. Damage to limbic  
39 neocortical and heteromodal areas of frontal and temporal lobes determines the usual effects of  
40 focal brain injury on cognitive and behavioural functions. The residual syndromes of prefrontal  
41 lesions include alterations in affect and behaviour (disinhibition / apathy), impairment in  
42 attention, working memory and memory retrieval, as well impairment of high level cognition  
43 (executive functions, insight, social awareness. Larger lesions extending to medial temporal

1 areas may produce specific impairments in memory encoding and retrieval (amnesia). Other  
 2 localizing temporal syndromes involve extension of lesions into auditory association areas –  
 3 causing aphasia and visual association areas – causing visual impairments.

### 6 **3. Medical diagnosis and prognosis**

8 Leading ICD-10 medical diagnoses at admission include:

- 9 • Fracture of the skull and Fracture of base of the skull (codes S02.0, S02.1),
- 10 • Traumatic brain oedema, Diffuse and Focal brain injury, Traumatic epidural  
 11 haematoma, Traumatic subdural haematoma, Traumatic subarachnoidal haematoma,  
 12 Intracranial injury with prolonged comma and Cerebellar intracranial injuries (codes  
 13 S06.1 – S06.8),
- 14 • Anoxic brain injury (code G93.1).

15 It is difficult to predict short as well long-term outcome after severe brain injury (5). Among  
 16 reliable general and unfavorable predictors of prognosis are: age over 40 (especially non-  
 17 favorable over 65), previous brain injury, alcohol and drug abuse, low educational level, any  
 18 presence of psychiatric disorders, violent etiology of injury and presence of E4 allele of  
 19 apolipoprotein E (6-12).

20 Among the predictors for separate domains of activity and participation are: marital status, full-  
 21 time employment at the time of injury, level of financial income and valid health insurance (6).  
 22 Sex is not a reliable prognostic factor for long term outcome after brain injury (6). The above-  
 23 mentioned elements are mostly not known at the beginning or even at the end of the  
 24 rehabilitation program. It should be considered that the influence of pre-injury (socio-  
 25 demographic) elements is complex and that the above-mentioned statements are a result of  
 26 multivariate analysis. Predicting long- as well short-term outcome of rehabilitation solely on the  
 27 presence of individual above-mentioned factors is not reliable.

28 Contrary to socio-demographic data, the clinical data are usually well checked and documented  
 29 in acute wards. Reliable predicting factors that can be confirmed immediately after the injury or  
 30 soon later are: PTA duration, age at time of injury, pupillary reactions, motor response as part of  
 31 GCS, associated anoxic brain injury, type of injury (closed / other), CT scan pathology (midline  
 32 shift), brainstem involvement, seizures after injury and urinary tract infection as well sitting  
 33 balance at the end of acute rehabilitation (5, 6, 13-16). The total GCS score is not a reliable  
 34 prognostic factor due to early intubation and sedation.

35 The predictors described are very reliable for early outcome (six and 12 months after injury) and  
 36 this is a period when patients after severe injury in Slovenia are usually transferred from a  
 37 rehabilitation unit to home. A combination of non-favorable predictors means an even worse  
 38 outcome after brain injury.

39 Despite some promising reports about the effect of the early intensive neuro-stimulation  
 40 program (17), all patients admitted in **Minimally Conscious State of traumatic or hypoxic**  
 41 **etiology** remained in the same state of minimal response and complete dependence in all daily  
 42 activities.

43 Patients admitted after **severe diffuse traumatic brain injury** (GCS 3-8) regain limited  
 44 dependence (FIM 3 - 5) or independence (FIM 6 and 7) in motor DA in 50 % of cases, but  
 45 majority (> 90 %) remain completely dependent in cognitive daily activities. The return to work  
 46 ratio in those patients is close to nothing.

1 Patients admitted after **severe focal traumatic injuries and deep hemorrhages** (GCS 3-8)  
 2 show better improvement and regain limited dependence (FIM 3 - 5) or independence (FIM 6  
 3 and 7) in motor DA in 75 % of cases and are able of independent two-way communication and  
 4 simple problems solving in at least 50 %. Approximately 50% of those patients working pre-  
 5 injury, are in long term employed through government supported programs, but they are not  
 6 able to return to previous job.

7 Patients admitted after **moderate focal traumatic injuries and deep hemorrhages** (GCS 9-  
 8 12) show good improvement in age period from 18 – 50 years. They regain limited or complete  
 9 independence (FIM 5 and 6) in almost all daily motor activities and limited dependence (FIM 3 -  
 10 5) or independence (FIM 6 and 7) in cognitive activities in 50 % of cases. Approximately 50% of  
 11 those patients working pre-injury, are in long term employed at the same position – with or  
 12 without job modification. The rest of them are employed through government supported  
 13 programs or are in some cases retired.

#### 14

#### 15 **4. Treatments**

16 All patients after severe brain injury are treated in Level I Trauma Centers, where neurosurgical  
 17 interventions are available. Urgent and acute treatment follows the “*National Guidelines for the*  
 18 *management of severe brain injury*” which were edited and published by the Slovenian Society for  
 19 intensive medicine in 2004 (18).  
 20

21 After stabilization of vital signs in ICU, patients are included in early neuro-physiotherapy programs at  
 22 acute surgical wards. Those programs vary in intensity and frequency of therapy between hospitals,  
 23 but generally patients after brain injury have physiotherapy every week-day. If respiratory  
 24 physiotherapy is needed, they get it on every day basis. All hospitals in Slovenia that are Level I  
 25 Trauma centers, have rehabilitation specialists, who are responsible for rehabilitation programs.  
 26

27 Patients are later transferred from acute surgical ward to the rehabilitation program at University  
 28 Rehabilitation Institute after the level of their wakefulness allows active participation in following  
 29 treatments:  
 30

- 31 - medical treatment run by PRM specialist,
- 32 - nursing treatment and care run by registered nurse and nursing staff
- 33 - physiotherapy treatment run by neuro-physiotherapists,
- 34 - respiratory therapy run by certified respiratory therapist,
- 35 - occupational treatment run by occupational therapists,
- 36 - speech and language treatment run by S&L therapist psychological treatment run by  
 37 neuropsychologist

## 38 **B. ACTIVITY LIMITATIONS**

39	40	41	42
	ICF code	ICF label	
43	d110	Watching	
44	d115	Listening	
45	d155	Acquiring skills	
46	d160	Focusing attention	
47	d163	Thinking	
48	d166	Reading	
49	d170	Writing	
50	d175	Solving problems	
51	d177	Making decisions	
52	d210	Undertaking a single task	
53	d220	Undertaking multiple tasks	
54	d230	Carrying out daily routine	



1	d240	Handling stress and other psychological demands
2	d310	Communicating with - receiving - spoken messages
3	d315	Communicating with - receiving - nonverbal messages
4	d330	Speaking
5	d335	Producing nonverbal messages
6	d345	Writing messages
7	d350	Conversation
8	d360	Using communication devices and techniques
9	d410	Changing basic body position
10	d415	Maintaining a body position
11	d420	Transferring oneself
12	d430	Lifting and carrying objects
13	d440	Fine hand use
14	d445	Hand and arm use
15	d450	Walking
16	d455	Moving around
17	d465	Moving around using equipment
18	d470	Using transportation
19	d475	Driving
20	d510	Washing oneself
21	d520	Caring for body parts
22	d530	Toileting
23	d540	Dressing
24	d550	Eating
25	d560	Drinking

## 26 C. PARTICIPATION RESTRICTIONS

27

28	ICF code	ICF label
29		
30	d570	Looking after one's health
31	d620	Acquisition of goods and services
32	d630	Preparing meals
33	d640	Doing housework
34	d660	Assisting others
35	d710	Basic interpersonal interactions
36	d720	Complex interpersonal interactions
37	d730	Relating with strangers
38	d740	Formal relationships
39	d750	Informal social relationships
40	d760	Family relationships
41	d770	Intimate relationships
42	d825	Vocational training
43	d830	Higher education
44	d840	Apprenticeship (work preparation)
45	d845	Acquiring, keeping and terminating a job
46	d850	Remunerative employment
47	d855	Non-remunerative employment
48	d860	Basic economic transactions
49	d865	Complex economic transactions
50	d870	Economic self-sufficiency
51	d910	Community life
52	d920	Recreation and leisure
53	d930	Religion and spirituality

54

## C. SOCIAL AND ECONOMIC CONSEQUENCES

### 1. *Epidemiological data*

Program for rehabilitation after brain injury is dedicated to adult (over 18 years of age) population. Exceptionally patients under 18 years are admitted. Children after traumatic and hypoxic brain injury are admitted and treated at Children rehabilitation department.

Current average age of patients at department is 43 years. There is a tendency to admittance of older population, since in last two years traffic safety improved markedly in Slovenia, resulting in less head and brain injuries among male population in third decade of life.

Ratio between female and male patients is 1 : 3, which is consistent to general data about female : male ratio (1 : 2.5) in traumatic brain injury population (19).

Geographically, there is distribution of admitted patients from the regions of the country as expected due to number of population. There is no region being represented above average.

### 2. *Social data*

- 10 % of patients admitted are involved in education of any kind (high school, professional college, university).
- 60 % of patients admitted are permanently or temporarily employed. We do not separately collect data about the kind of the occupation patient had before injury.
- 15% of patients are unemployed at the time of injury (which is above regular unemployment ratio in the country).
- 15 % of patients are retired at the time of injury.
- We do not separately collect data about the marital status, but 70 % of patients live with family (partners/spouse or parents) and 30 % of patients live alone as single member community at the time of injury.

### 3. *Economic data*

In some part, brain injuries are connected with the life-style as well as occupation. We do not collect separate data about the economic status of the patients, but in major part, their income is below the country's average wage of net 976 EUR.

Only financial condition for the patient to be admitted to the rehabilitation program is having a valid so called "*additional*" health insurance (NB: standard health insurance do not fully cover the treatment in the University Rehabilitation Institute). This additional insurance costs 24 EUR / month and is voluntary available to every citizen. Children insured through parents participation are excepted from this insurance. If patient has no valid additional insurance, he/she can arrange it before admission to department, but there is a three months "carence" period before the insurance becomes valid. If patient insists on admittance despite the non-valid additional insurance, he/shi is obliged to pay one third of complete costs (approx. 2.700 EUR). There is a government plan to re-organize the insurance system, with abolition of "additional" insurance and putting rehabilitation services under standard insurance.

For the patients with valid additional insurance, whole rehabilitation program, drugs, examinations and all technical aids prescribed by the PRM specialist is financially covered by the National Health Insurance and on "case – closed" basis in amount of roughly 7.600 EUR.

**D. MAIN PRINCIPLES OF YOUR PROGRAMME**

Principles of the program include:

- assessment and evaluation of impairment,
- stabilization of clinical status of the patients,
- treatment of any consequent clinical complications,
- therapeutic interventions mentioned to reach or improve independency in mobility and basic daily activities,
- therapeutic interventions mentioned to improve cognitive functions as well patients behaviour and emotional status,
- education of relatives and carers,
- preparation for independent living in home environment after discharge - including return to school, work and driving and
- prescription of technical aids.

## IV. Aims and goals of the Programme

### A. TARGET POPULATION

#### 1. Inclusion criteria

- Adult patients after moderate or severe traumatic or hypoxic brain injury resulting in any kind of impairment of movement and/or cognition and with evident need of rehabilitation with expected favorable prognosis.
- Stable vital functions without need for intensive medicine interventions, that allows immediate beginning of therapies.
- Clinical status allows the temporary cessation of therapeutic programs and respiratory physiotherapy during weekends and public holidays.
- Sustained attention that allows at least minimal two-way communication of any kind (except for patients in MCS)
- Patients relatives or carers are ready to cooperate within the programme
- Patient has a clear possibility for accommodation in home or institutional environment after discharge.

#### 2. Exclusion criteria

- Patients after moderate or severe traumatic or hypoxic brain injury with unfavorable prognostic factors and with expected unfavorable prognosis from other reasons.
- Patients in the vegetative state
- Patients in minimally conscious state more than 2 months after the injury.
- Children and young adults (below 18 years of age)
- Psychiatric complications of brain injury

#### 3. Referral of patients

Direct access to the PRM programme	No
Referral from general practitioners	Yes
Referral from other specialists	Yes
Referral from specialists in PRM	Yes

1 **4. Stage of recovery**

2

Within two weeks of onset	Yes
2 weeks to 3 months after onset	Yes
3 months or longer after onset	Yes

3 **B. GOALS OF THE PROGRAMME**

4 **1. In terms of body structure and function**

5 ICF code	ICF label
6 b164	Higher-level cognitive functions
7 b114	Orientation functions
8 b122	Global psychosocial functions
9 b152	Emotional functions
10 b130	Energy and drive functions
11 b144	Memory functions
12 b280	Sensation of pain
13 b140	Attention functions
14 b110	Consciousness functions
15 b710	Mobility of joint functions
16 b760	Control of voluntary movement functions
17 b735	Muscle tone functions
18 b770	Gait pattern functions
19 s110	Structure of brain

21

22

23 **2. In terms of activity**

24 ICF code	ICF label
25 d230	Carrying out daily routine
26 d349	Communication - producing, other specified and unspecified
27 d350	Conversation
28 d410	Changing basic body position
29 d415	Maintaining a body position
30 d420	Transferring oneself
31 d450	Walking
32 d475	Driving
33 d5	Self care

34

35

1            d630            Preparing meals

2            **3. In terms of participation**

3

4            **ICF code            ICF label**

5

6            d720            Complex interpersonal interactions

7            d845            Acquiring, keeping and terminating a job

8            d920            Recreation and leisure

9            d760            Family relationships

10          d820            School education

11

## V. Environment of the programme

### A. CLINICAL SETTING

Individual practice or part of a doctor's group practice	No
Individual practice in a private hospital	No
Part of a local (public) hospital	No
Part of a regional hospital (or rehabilitation centre)	No
Part of a university or national hospital	Yes*

\* University Rehabilitation Institute is non-private and non-profit independent setting, not attached to any acute hospital.

Inpatients in beds under PRM responsibility	Yes
Inpatient beds belonging to other departments	No
Day programme (most of the day in outpatient setting, not home)	Yes
Outpatient clinic (assessment and/or treatment, for up to 3 hours/day)	Yes
Community based (in the patient's home or workplace or other relevant community location, e.g. sports centre)	No

### B. CLINICAL APPROACH

Uniprofessional	No
Multiprofessional	Yes

All patients are treated by a multi professional team (MD, PRM specialist, PT, OT, psychologist, social worker, CPO, nurses).

### C. FACILITIES

Program runs at the same department (1<sup>st</sup> floor), but separate to three other programmes – for rehabilitation of patients with Multiple Sclerosis, patients with Mb. Parkinson and patients with Neuro-Muscular diseases.

Department is divided to the patients ("hospital") ward, therapeutic facilities and part for administration, out-patient work and doctors offices. The overall net surface of department is 2.140 m<sup>2</sup>.

1 The ward corridor consists of 11 rooms for patients, which are basically three-bedded. There are  
 2 also nurses station, examination room, psychology cabinet and "Snoezelen" cabinet (external  
 3 sensory stimulation cabinet) in that ward.

4 Each room surface is 62 m<sup>2</sup> and is divided into a sleeping part (43 m<sup>2</sup>), anteroom with two  
 5 sinks and separated adapted bathroom and closet. There are no balconies in the room due to  
 6 safety reasons. Three out of 11 rooms are equipped with night vision cameras for transmitting  
 7 video signal to the nurses station during the night, with aim to react in case of epileptic seizures  
 8 and to prevent falls, infusion and PEG tube extraction or any other incident. Video signal is not  
 9 stored.

10 Patients have meals together in the dining room, which is also a day activities room.

11 Physiotherapy and occupational facilities are separate places on the same floor.

12 Administration corridor consists of doctors' cabinets, S&L therapy cabinet, administration and  
 13 documentation office, outpatient office and two rooms for day hospital patients.

14 All facilities are completely wheelchair accessible. There are two elevators in the building.

15 Robotic assisted gait training, swimming pool therapy and diagnostic procedures are performed  
 16 in different settings outside the Department.  
 17  
 18  
 19

<b>Does your programme have a designated space for :</b>	
For assessments and consultations?	Yes
For an ambulatory or day care programme?	Yes
For inpatient beds?	Yes
For therapeutic exercises?	Yes
For therapeutic exercises?	Yes
For training in independence and daily living?	Yes
For vocational and/or recreational activities?	Yes



## VI. Safety and patient rights

### A. SAFETY

<b>The safety concerns of persons in the unit where the programme takes place, relate to :</b>	
Emergencies (fire, assault, escape)	Yes
Medical emergencies*	Yes
Equipment	Yes
Handling of materials	Yes
Transports	Yes
<b>The safety of persons in the programmes of your unit is provided by :</b>	
Written standards from National Safety Bodies	Yes
Written standards from National Medical Bodies	Yes
Unit-specific written rules	Yes
<b>Periodic inspection</b>	
Internal	Yes
External	Yes

\*Department is serviced by 24/24 doctor and registered nurse presence with night shift organised for the whole Rehabilitation Institute. Mobile resuscitation station is available for life support situations. Emergency medicine service and urgent transport to acute hospital is available through external general emergency service from the University Clinical Centre. Respond time for emergency call for the house doctor is 2-3 minutes and for the external emergency service is 6-7 minutes.

### B. PATIENT RIGHTS

Has your programme adopted a formal policy or statement of patients' rights?	Yes
Does this statement specify the influence that the patient should have in the formulation and implementation of the programme?	Yes
Is the statement known to all personnel involved in delivering the programme?	Yes
Is this checked periodically?	Yes
Is the statement made known to and is available to all persons visiting your unit?	Yes

1 The Act on Patients Rights of the Republic of Slovenia was accepted on 29 January 2008  
2 and has been used in everyday practice from 26 August 26 2008. The content of the act is  
3 available for all patients and employees through the brochures and posters.

#### 4 **C. ADVOCACY**

5

<b>Give at least one example of how your organisation advocates for people your programme deals with:</b>	
Acquaintance of brain injury patients with the possibilities of affiliation to Brain Injury Association of Slovenia	Yes
Participation of medical doctor in Professional Council of Brain injury association of Slovenia - VITA	Yes

6

## VII. PRM Specialists and team management

### A. PRM SPECIALISTS IN THE PROGRAMME

Does your PRM physician have overall responsibility and direction of the multi professional team?	Yes
Does your PRM physician have overall responsibility and direction of the rehabilitation programme, not only medical responsibility?	Yes
Does he/she have a European Board Certification in PRM?	Yes
Does he/she meet National or European CME/CPD Requirements?	Yes
Number of CME or EACCME points earned in the last 3 years:	NA
<b>The two primary functions for the PRM specialist in your Programme are to :</b>	
Treat co-morbidity	No
Assess the rehabilitation potential of the patient	Yes
Analyse & treat impairments	No
Coordinate inter professional teams	Yes

All mentioned functions are equally important and ratio between them varies from day to day.

### B. TEAM MANAGEMENT

<b>Which rehabilitation professionals work on a regular basis (minimum of once every week) in your programme? (give the number)</b>	
Physiotherapists	2.5
Occupational therapists	2
Psychologists	1
Speech & Language therapists	1
Social workers	0.5
Vocational specialists	0.25
Nurses	16
Orthotist / prosthetist assistive technicians/engineers	1
Other (please specify)	Respiratory physiotherapist (covering all patients at the Institute)
<b>How often does your staff receive formal continuing education (mark as is) ?</b>	
In team rehabilitation :	Every year

In their own profession :	Every year
<b>Do team activities in your rehabilitation programme include the following?</b>	
Is the patient at the centre of a multi professional approach?	Yes
Do you always give informed choices of treatment?	Yes
Do you regularly promote family involvement?	Yes
<b>Does your organisation of multi professional team working include :</b>	
Holding regular team meetings with patient's records only (more than 2 members)	Yes
Holding regular team meetings (more than 2 members) with the presence of the patients	No
Joint assessment of the patient or joint intervention	Yes
Regular exchanges of information between team members*	Yes

1

2

3

4

\*Daily ward round of department doctors and head nurse is scheduled every morning. Each patient status and his daily improvement is discussed bedside, quick clinical examination is done if needed, daily plan of diagnostics is set down and patients questions are answered.

5

6

Another round is done later in therapeutic facilities, discussing progress of the patients with the therapists and planning further therapeutic interventions.

## VIII. Description of the programme

---

### A. TIME FRAME OF THE PROGRAMME

The average length of stay is 60 days. Minimum length of stay is one week and maximal up to 6 months. Each patient has therapy programs prescribed by the PRM specialist. Therapy runs on week-day basis, there is no therapy during weekends or public holidays and at afternoon (after 15.00).

### B. ASSESSMENT

#### 1. *Impairment*

##### a) **Clinical assessment**

Clinical neurological exam  
Rancho Los Amigos scale  
Glasgow coma scale  
Mini mental state examination

##### b) **Diagnostic tools**

EEG  
EMG  
MEP, SEP  
Diagnostic musculoskeletal and cardiovascular ultrasound  
Urodynamic laboratory  
Laboratory for blood and urine diagnostics (in other hospital)  
Microbiology diagnostics (in other hospital)  
CT, MRI (in other hospital)  
RTG (in other hospital)  
ADG, VTG (in other hospital)  
Ophtalmometric diagnostics (in other hospital)

#### 2. *Activity and participation*

##### a) **Capacity evaluation (what somebody can do)**

Capacity evaluation is done during the observational period and is discussed at the team meetings

##### b) **Performance (what somebody is actually doing)**

FIM, 10 Meters WT, 6 Minutes WT, Berg balance scale, COPM, psychological battery, Test for assessment of speech and language abilities of persons after TBI (self-developed)

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42

### **3. Environmental and personal factors ; assessment, questionnaire**

Self prepared questionnaire for assessment of environment at home, community, school/work place. Personal factors are assessed by a psychologist.

## **C. INTERVENTION**

### **1. PRM specialist intervention**

**Department PRM specialist is competent for the following interventions:**

- a) Treatment with medications for consequent complications: Local and generalized infection, epilepsy, severe spasticity, hypotension and hypertension, diabetes, pressure ulcers, pain, posttraumatic depression, circadian rhythm disturbances, deep vein thrombosis, malnutrition.
- b) Intrathecal application of Lioresal as part of testing before baclofen pump insertion, programming of intrathecal pump, intrathecal baclofen pump refill.
- c) Botulinum toxin injections.
- d) Necrectomy of wounds and minor surgical interventions.
- e) Neurogenic bladder training, replacement of urine catheters, the first intermittent catheterization after removal of the catheter, US measurement of the residual urine in the bladder.
- f) Replacement of the endotracheal tube.
- g) Digital rectal examination
- h) Insertion and replacement of nasogastric tube..
- i) Musculoskeletal US diagnostics
- j) Intra articular blocks
- k) Basic life support interventions

### **2. Team intervention**

**Regular members of the team:**

#### **Physiotherapy:**

Muscle strength testing, ROM testing, Gait and ambulance training, standing and balance training, FES testing and application, electrotherapy and ultrasound therapy, spasticity relaxation with PNF techniques, lower limb orthotic testing and fitting, serial plaster casting, treadmill walking with body weight support, bedside neurosensory stimulation, "Snoezelen" environment controlled sensory stimulation, hydrotherapy and hydro-gymnastics.

#### **Occupational Therapy:**

Upper limb functional therapy, upper limb training with a haptic robot, ADL training and adaptation strategies, neuro sensory stimulation, wheelchair and scooter testing and training of wheelchair propulsion, advanced assistive technology testing, counselling and training, environmental adaptations – including home visits, splinting and taping for upper limbs, construction of small devices for every day activities management, organisation of leisure activities, CIMT – constrained induced movement therapy, art therapy.

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47

**Psychologist:**

Assessment and treatment of cognitive dysfunctions (ie. attention, memory, communication, visual-spatial orientation, executive functions...), psychological support for patients and relatives, assessment and support of school reentrance, assessment of cognitive functions related to driving.

**Social worker:**

Counselling and help in provision and claiming for financial benefits from health and working compensation funds, cooperation with the family – including home visits, cooperation with local Centres for social work, arranging the post – discharge institutional accommodation.

**Speech and language therapist:**

Training of vocalization and proper speech techniques, testing and implementing of alternative communication options and devices, re-learning of writing and functional reading, learning of breathing and swallowing techniques, assessment and support of school reentrance.

**Nurses:**

Intermittent catheterisation, wound care, pressure sore prevention program, bowel management, positioning in bed, use of acquired independence in ADL at the department, cooperation in and performance of assisted respiratory functions, teaching self catheterization, venous blood sample collection, intramuscular and venous injections. Dietary nurse is available for nutritional matters and consultations.

**External members of the team:**

**Neurologist (being present at the department):**

Detailed neurologic examinations, drug therapy consultation, SEP, MEP, EMG and EEG interpretation.

**Specialist of internal medicine (being present at the University Rehabilitation Institute):**

Detailed internist examinations, drug therapy consultation, cardiac and vascular US, pulmonary tests, spirometry, cycloergometry, ECG monitoring, ECG interpretation.

**Specialist of occupational and traffic medicine (being present at the University Rehabilitation Institute):**

Return to work capacity assessment, counselling in return to work problems, leading vocational rehabilitation program.

**Psychiatrist (available on department every 14 days):**

Psychiatric diagnostic evaluation, medication adaptation, counselling.

1           **Neurosurgeon (available on department on demand):**

2           Neurosurgical evaluation for central and peripheral neurosystem, need for surgery  
3           assessment, epidural tube insertion for baclofen test, performing baclofen pump  
4           implantation at neurosurgical department.

5

6           **Plastic surgeon (available on department appx. once in a month):**

7           Plastic surgery evaluation, need for surgery assessment, performing surgical treatment of  
8           pressure ulcers.

9

10          **Orthopaedic surgeon (available on department every 14 days):**

11          Orthopaedic evaluation, need for surgery assessment, joint and soft tissue surgical  
12          corrections (e.g. AT elongations).

13

14          **Certified Prosthetist and Orthotist (being present at the University Rehabilitation  
15          Institute):**

16          Manufacturing and fitting of lower limb and spinal orthoses.

17

18          **Respiratory physiotherapist:**

19          Breathing techniques, suctioning, positioning, postural drainage, inhalations for patients  
20          with airway problems or respiratory insufficiency..

21

22          **3. Interventions which are part of the program and that need to be  
23          mentioned separately and are regularly available for the patients and  
24          relatives:**

25          Intrathecal baclofen therapy

26          Treatment of focal spasticity with botulinum toxin in combination with or without serial  
27          plaster casting

28          Robotic assisted treadmill therapy - Lokomat®, robotic assisted arm functional  
29          rehabilitation

30          “Snoezelen” environment controlled sensory stimulation.

31          Bedside early intensive neurosensory stimulation for patients in MCS

32          Therapy with dogs

33          Educational curriculum for relatives and carers of the patients – program for education and  
34          counselling

35          Driving capabilities assessment by certified multidisciplinary team with standardized  
36          mechanical driving simulator (Mediatester), psychological assessment and vehicle  
37          adaptations counselling – with licensed written report valid as part of the driving license for  
38          disabled drivers.

39          CIMT – constrained induced movement therapy for upper limb

40          Hydrotherapy and hydro gymnastics in the swimming pool and Hubbard bath

41          Demonstration apartment (“Smart Home”) is available for visit of patients and relatives,  
42          fitted with equipment and technical aids, from the simple to the most advanced, assisting  
43          the elderly and persons with various disabilities.

44          Sports/recreational activities for people with special needs



## **D. FOLLOW UP AND OUTCOME**

### **1. Review and progress through the programme**

Regular weekly team meetings are led by a PMR specialist.

Regular follow-up of the short-term and long-term goals are reviewed by each member of the team working with the patient.

Before the end of the rehabilitation, patients who seem potentially able to return to work are referred to the Specialist for occupational medicine for the evaluation of the work abilities or possible training program or counselling on education. If the ability to work again is confirmed, he is invited to the special vocational rehabilitation program at the Centre for vocational rehabilitation inside University rehabilitation program.

### **2. Criteria for progress measurements**

Numerous assessment scales are used to evaluate the patient's progress and condition, such as FIM, MMT, ROM, 10MWT, 6MWT, BBS

## **E. DISCHARGE PLANNING AND LONG TERM FOLLOW UP**

The patient is discharged after reaching the long-term goals set at the beginning of the rehabilitation programme, or when there has been no progress recorded in rehabilitation for three consecutive weeks, or when he or she is not able to participate in the rehabilitation program due to worsening of his or her health condition or at the onset of co-morbidity.

Before discharge, meeting with patients' relatives is organized to discuss any question and explain the expected prognosis in home environment. If needed, home visit of an occupational therapist and a social worker for possible adaptations is performed.

If the patient is wishing to drive a car after injury and there is no clinically evident reason against that, he is referred to a certified multidisciplinary team for standardized mechanical driving simulator test and additional psychological testing.

If the patient is in phase of any education and he/she is capable to re-entry, the meeting between department psychologist and S&L therapist and school authorities is organised in order to explain patient's participation restriction and set up the educational program necessary for successful return to school/university. All adaptations are written down in a so called "educational contract" and both sides (ie school authorities and patient) are obliged to respect them.

All patients are invited to the out-patient clinic three to six months after discharge for an interview, medical and functional checking, and vocational/educational outcome checking. Treatment and rehabilitation interventions are updated and another follow up visit is scheduled later on, if needed.

If the patient is facing negative environment factors or additional functional problems in his environment, we schedule for him an additional rehabilitation programme, at hospital or on an out patient basis (depending on distance from home and transport possibilities).

## IX. Information management

### A. PATIENT RECORDS

<b>Do the rehabilitation records have a designated space within the medical files ?</b>	Yes
<b>Do you have written criteria for :</b>	
• Admission	Yes
• Discharge	Yes
<b>Do your rehabilitation plans include written information about aims and goals, time frames and identification of responsible team members ?</b>	Yes
<b>Do you produce a formal discharge report (summary) about each patient?</b>	Yes

Each patient has his or her own medical file used exclusively in the rehabilitation program.

### B. MANAGEMENT INFORMATION

<b>Does your programme show evidence of sustainability ?</b>	
• Established part of public service :	Yes
• Has existed for more than 3 years :	Yes
• Has received national accreditation (where available) :	Yes
<b>How many new patients (registered for the first time) are treated in your programme each year :</b>	100-120
<b>In your day care or inpatient programme :</b>	
• What is the mean duration spent in therapy by patients on this programme	65 days
• How many hours a day do the patients spend in therapy.	1.5 – 3 hours
<b>Give the mean duration of stay spent in the programme :</b>	90 days

Program for brain injury rehabilitation is only post acute rehabilitation facility in the country.

1 **C. PROGRAMME MONITORING AND OUTCOMES**

2

<b>Does your programme have an overall monitoring system in addition to patient's records?</b>	Yes
<b>Are the long term outcomes of patients who have completed your programme regularly monitored?</b>	
• Impairment (medical) outcomes :	Yes
• Activity/Participation (ICF) outcomes :	Yes
• Duration of follow up of the outcomes :	longer
<b>Do you use your outcome data to bring about regular improvements in the quality of your programme's performance?</b>	Yes
<b>Do you make the long term overall outcomes of your programme available to your patients or to the public?</b>	No

3

1

## X. Quality improvement

---

2

### A. WHICH ARE THE MOST POSITIVE POINTS OF YOUR PROGRAMME?

3

Interdisciplinary team-working approach in the provision of the rehabilitation programme.

4

Possibility of consultations with other specialists in the department.

5

Offering the optimal programme in regard to the patients abilities

6

Multiple additional therapies are part of the regular programme and are available directly at the department (i.e. .neuromodulation, robot assisted treadmill therapy, neurosensory stimulation, dog therapy, constrained induced movement therapy, educational curriculum for relatives)

7

8

9

10

Use of safety video transmission for patient surveillance during the night.

11

12

### B. WHICH ARE THE WEAK POINTS OF YOUR PROGRAMME ?

13

Staff shortage

14

Low amount of net time patients spend in therapy (as a consequence of staff shortage)

15

Therapy is not available during weekends

16

Department is currently completely "open-type". Confused and agitated patients need to be under constant supervision to prevent them to leave the department. ***At the time of revision of this document, the security doors were installed at the main entrance that actually brought safety of disoriented persons into safe frames.***

17

18

19

20

Botulinum toxin applications are performed without EMG assistance, rarely under ultrasound guidance. ***At the time of revision of this document, all botulinum toxin applications are performed under ultrasound guidance***

21

22

23

### C. WHICH ACTION PLAN DO YOU INTEND TO IMPLEMENT IN ORDER TO IMPROVE YOUR PROGRAMME ?

24

25

#### 1. Extrinsic requests (equipment, manpower)

26

The one way opening door will be installed until end of 2011 at the hospital ward. – ***Action done in May 2012!***

27

28

There is a long term plan to implement a department only for brain injury rehabilitation.

29

One PRM specialist will be employed by department, with contribution to brain injury rehabilitation programme.

30

31

#### 2. Intrinsic improvements of the programme (organisation, training, assessment)

32

33

There is continuous education running on basic respiratory techniques for nurses

34

Every year fresh nursing and therapeutic staffs get educational course on FIM assessment

35

Botulinum toxin application with EMG assistance will be implemented until end of 2012

1

## XI. References

2

### A. LIST OF REFERENCES

3

4

1. [http://www.who.int/substance\\_abuse/publications/global\\_alcohol\\_report/profiles/svn.pdf](http://www.who.int/substance_abuse/publications/global_alcohol_report/profiles/svn.pdf)

5

6

2. [http://www.euro.who.int/\\_data/assets/pdf\\_file/0015/43314/E92789.pdf](http://www.euro.who.int/_data/assets/pdf_file/0015/43314/E92789.pdf)

7

8

3. Tagliaferri F., Compagnone C., Korsic M., Servadei F., Kraus J. A systematic review of brain injury epidemiology in Europe. *Acta Neurochirurgica (Wien)*. 2006;148:255—68.

10

11

12

4. Kochanek PM, Clark RSB, Jenkins LW. TBI: Pathobiology. In: Zasler ND et al, eds. *Brain Injury Medicine*. New York: Demos; 2007.

13

14

15

16

17

18

5. Hukkelhoven CWPM, Steyerberg EW, Habbema JDF, Farace E, Marmarou A, Murray GD, Marshall LF, Maas AIR. Predicting outcome after traumatic brain injury: Development and validation of a Prognostic Score based on admission characteristics. *J Neurotrauma* 2005; 22: 1025-39.

19

20

21

22

6. Bender-Pape TL, Lundgren S, Heinemann AW, Guernon A, Giobbie-Hurder A, Wang J, Roth H, Blahnik M, Williams V. Establishing a prognosis for functional outcome during coma recovery. *Brain Inj* 2006; 20: 743-58.

23

24

25

26

7. Hoofien D, Vakil E, Gilboa A, Donovan P, Barak O. Comparison of the predictive power of socio-economic variables, severity of injury and age on long term outcome of traumatic brain injury: sample specific variables versus factors as predictors. *Brain Inj* 2002; 16: 9-27.

27

28

29

8. Macmillan P, Hart RP, Martelli MF, Zasler ND. Pre-injury status and adaptation following traumatic brain injury. *Brain Inj* 2002; 16: 41-9.

30

31

32

33

9. Novack TA, Bush BA, Meythaler JM, Canupp K. Outcome after traumatic brain injury: Pathway analysis of contributions from premorbid, injury severity and recovery variables. *Arch Phys Med Rehabil* 2001; 82: 300-5.

34

35

36

37

10. Harrison-Felix C, Zafonte R, Mann N, Dijkers M, Englander J, Kreutzer J. Brain injury as a result of violence: preliminary findings from the traumatic brain injury model systems. *Arch Phys Med Rehabil* 1998; 79: 730-7.

38

39

40

41

11. Crawford F, Vanderploeg R, Freeman M, Singh S, Waisman L, Abdullah L, Warden D, Lipsky R, Salazar A, Mullan M. APOE genotype influences acquisition and recall following traumatic brain injury. *Neurology* 2002; 58: 1115-8.

42

43

44

45

12. Bushnik T, Hanks R, Kreutzer J, Rosenthal M. Etiology of traumatic brain injury: Characterisation of differential outcomes up to 1 year post injury. *Arch Phys Med Rehabil* 2003; 84: 255-62.

46

47

48

49

13. Brown AW, Malec JF, McClelland RL, Diehl NN, Englander J, Cifu DX. Clinical elements that predicts outcome after traumatic brain injury: a prospective multicenter recursive partitioning (decision tree) analysis. *J Neurotrauma* 2005; 22: 1040-51.

50

51

52

14. Wedekind C, Lippert-Gruener M. Long-term outcome in severe traumatic brain injury is significantly influenced by brainstem involvement. *Brain Inj* 2005; 19: 681-4.

- 1 15. Susman M, Di Russo S, Sullivan T, RisucciD, Nealon P, CuffS, Haider A, Benzil D. Traumatic  
2 brain injury in the elderly: Increased mortality and worse functional outcome at discharge  
3 despite lower injury severity. J Trauma 2002; 53: 219-24.  
4
- 5 16. Kilaru S, Garb J, Emhoff T, Fiallo V, Simon B, Swiencicki T, Lee F. Long term functional status  
6 of elderly patients with severe closed head injuries. J Trauma 1996; 41: 957-63.  
7
- 8 17. Eilander HJ. Children and young adults in a vegetative or minimally conscious state after brain  
9 injury. Diagnosis, rehabilitation and outcome. Disertation. Utrecht: Utrecht University; 2008.  
10
- 11 18. Špec-Marn A et al. Priporočene smernice za ukrepe in zdravljenje poškodovancev s hudo  
12 poškodbo glave. Zdrav Vestn 2004; 73: 31–6.  
13
- 14 19. Thurman DJ, Coronado V, Selassie A. The epidemiology of TBI: Implications for Public  
15 Health. In: Zasler ND et al, eds. Brain Injury Medicine. New York: Demos; 2007.  
16  
17  
18  
19