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Needs for Community-Based Rehabilitation Services and Support 12 Months After Moderate and Severe Physical Traumatic Injuries

A Brief Report

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Abstract: Patients with physical traumatic injuries frequently require long-term rehabilitation services. To strengthen rehabilitation services in the postacute phase, we need to assess characteristics of this population and their healthcare and rehabilitation needs in the community. This brief report summarizes the frequency of unmet rehabilitation needs in community-based rehabilitation during the first year after moderate and severe trauma. Additionally, the associations between sociodemographic, injury severity factors and unmet needs were examined. Data from a prospective multicenter cohort study of patients with moderate and severe trauma (New Injury Severity Score > 9) of all ages, discharged alive from two regional trauma centers in 2020 were used. Needs were estimated using the Needs and Provision Complexity Scale. Overall, 46% of patients had unmet needs at 12-mo postinjury, particularly related to the provision of rehabilitation services, specialist follow-ups, and social and family support. The probability of unmet needs was associated with age, preinjury comorbidities, and impaired functioning. Our findings support strategies targeting younger patients, those with preinjury comorbidities, and those with higher levels of disability and provide a starting point for the development of standardized rehabilitation needs assessment and guidelines after injury.

Key Words: Physical Trauma, Multiple Trauma, Postacute Phase Rehabilitation, Health Service Needs

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The most common physical traumatic injuries occur in the limbs, head, thorax, and spine. These injuries are the leading causes of physical, cognitive, emotional, and behavioral impairments interfering with daily life activities, cause work disabilities, and reduce quality of life.[1] Half of patients with traumatic injury have persistent disability at 12-mo postinjury.[2] Functional outcomes after injuries depend on interactions between injury severity, preinjury comorbidity, and postinjury factors including availability of healthcare services.[3] Rehabilitation has an independent effect on patient outcomes and societal benefits, although this remains somewhat controversial as many studies have a nonexperimental design.[4,5] A need for rehabilitation refers to "any need an individual with a health condition may have that requires rehabilitation management, interventions, and use of rehabilitation services or programs" in acute and postacute phases.[6] A discrepancy between the need for healthcare and rehabilitation services and availability of community-based rehabilitation services has been documented internationally.[6] In Europe, postacute rehabilitation services, typically provided in community settings, receive less support compared to specialized inpatient rehabilitation during the acute phase.[6] Few studies have assessed unmet rehabilitation needs in general trauma populations in the postacute phase.[7–9] Hence, studies from different countries are required to provide a more accurate reflection of population needs and international differences in the trauma care and rehabilitation. More comprehensive knowledge about rehabilitation needs in the postacute phase of trauma will improve our understanding of existing service provision, as well as gaps between needs and provided services. This knowledge can be used to guide rehabilitation, healthcare resource planning, and allocation.

This study aimed to assess the frequency of unmet rehabilitation needs in the postacute phase after physical trauma in a

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country with universal public health care. Additionally, we examined sociodemographic and injury severity characteristics associated with unmet needs.

METHODS

The study design and participant characteristics have been reported in detail previously.[10–12] In short, we conducted a prospective cohort study in which trauma patients of all ages (0–93 yrs) with a New Injury Severity Score > 9,[13] discharged alive from two regional trauma centers in Norway over a 1-yr period (2020) were included and followed up at 6 and 12 mos after injury. Informed consent was obtained before inclusion in the study, in accordance with Norwegian legislation. The Regional Committee for Medical and Health Research Ethics (approval no. 31676), the Institutional Data Protection Officers at Oslo University Hospital, and the University Hospital of North Norway (approval no 19/26515 and 02423) approved the study. This study conforms to all Strengthening the reporting of observational studies in epidemiology guidelines and reports the required information accordingly (see Supplementary Checklist, http://links.lww.com/PHM/C366).

Sociodemographic and injury related data were recorded during the acute stage (see Table 1). Geographical region of residency was based on the Norwegian Centrality Index (location of municipalities in terms of service functions and workplaces accessible within 90 min) categorized as central (Centrality index 1–2) and less central (Centrality Index 3–6).[10] The Glasgow Outcome Scale-Extended (GOSE) score[14] was used to assess functional outcomes at 6 and 12 mos.[15]

The need for community-based rehabilitation and healthcare service delivery in the postacute phase (6–12-mo postinjury) was estimated using the Needs and Provision Complexity Scale (NPCS) Clinician version.[16] This is a brief instrument for measuring individuals' needs for rehabilitation and support (NPCS-needs) and the level of services provided (NPCS-gets) within a given time. The NPCS has been used in routine clinical practice to measure the extent of the need to be met in patients with neurological disabilities. The NPCS is a 15-item measure with a total score range of 0–50.[16] It consists of two domains: 'Health and personal care needs' with the subscales 'Health care,' 'Personal care,' and 'Rehabilitation'; and 'Social care and support needs' which includes the subscales 'Social and family support,' 'Equipment,' and 'Environment.' In the current project, specialists in rehabilitation medicine estimated the needs at the 6-mo follow-up based on interviews with the patient/relatives using the NPCS Patient version as well as patient-reported symptoms and functioning. The NPCS-gets at 12 mos were estimated based on the information provided by patients/relatives at the 12-mo follow-up. Unmet needs were calculated by subtracting the NPCS gets scores at 12 mos from the NPCS needs scores at 6 mos.

Statistical analyses were performed using SPSS 29.0 (IBM Corp., Armonk, NY). The characteristics of the patients were summarized using descriptive statistics. The main outcome was unmet needs according to the NPCS calculation at 12 mos, which was dichotomized into 0 (met or exceeded

TABLE 1. Demographics and injury characteristics of 415 participants with moderate-severe trauma

Variable	Groups/Values	Total All Participant *n* (%)
Gender	Male	311 (75)
	Female	104 (25)
Age in yrs	Mean (SD)	47 (22.0)
Age categories	0–15 years	41 (10)
	16–64 yrs	265 (64)
	65 + yrs	109 (26)
Living status	Living alone	124 (30)
	Living with others (partner/parents)	290 (70)
Geographical region	Central	235 (57)
	Less central	180 (43)
Comorbidity (ASA-PS)	Healthy	243 (59)
	Systemic disease	172 (41)
Preinjury psychiatric diagnosis/substance abuse	Yes	63 (16)
	No	319 (84)
Cause of injury	Fall	167 (40)
	Transportation accident	159 (38)
	Sport accident/others	78 (19)
	Violence	11 (3.0)
New Injury Severity Score	Moderate injury (score 10–15)	98 (24)
	Severe injury (score 16+)	317 (76)
No. injuries	Mean (SD)	6 (4.0)
Length of hospital stay in days	Median (IQR)	5 (3–10)
Discharge place	Home/local hospitals/other	312 (75)
	Specialized rehabilitation	103 (25)

IQR, interquartile range.

needs ≤0) and 1 (unmet needs >0) in a multivariable logistic regression model. Results are presented as odds ratios with 95% confidence intervals. To control for sample heterogeneity and identify predictor variables, the model was adjusted for age (years), sex (male vs. female), marital status (cohabitating vs. living alone), geographical region (living in central/less central regions), preinjury comorbidity (American Society of Anesthesiologists [ASA]'s Physical Status Classification System (systemic disease [score 2–6] vs. healthy [score 1]),[17] psychiatric comorbidity/substance abuse (yes vs. no), severity of injured regions based on Abbreviated Injury scale scores (AIS),[13] (≥3 [severe/critical severity] vs. <3 [minor and moderate severity]), discharge destination (specialized rehabilitation unit vs. home/other hospitals) as well as unmet rehabilitation needs (NPCS) and functional level (GOSE) at 6 mos after injury. Statistical significance threshold was <0.05.

RESULTS

A total of 415 participants (70% of the total sample) were assessed at the 12-mo follow-up. Most patients were male (75%), the mean age at the time of injury was 47 (SD 22) yrs, and 63 patients were children or adolescents (age <18 yrs at the time of injury) (Table 1). Most patients were injured because of falls or transportation accidents. The mean New Injury Severity Score was 25 (SD 13), which corresponds to profound injury severity; 48% had a traumatic brain injury with a median Glasgow Coma Scale score of 14 (interquartile range 6); 25% of the patients were discharged from acute care units to specialized rehabilitation including 24% of those with preinjury comorbidity.

The mean age of nonresponders at the 12-mo follow-up was lower than that of responders 43 (SD 19) yrs vs. 47 (SD 22) yrs, $P = 0.05$. The differences between responders and nonresponders in the proportion of males or severe injuries were not significant.

The mean GOSE scores at 6- and 12-mo follow-up were 6.3 (SD 1.4) and 6.6 (SD 1.3), respectively, which correspond to upper moderate disability. At 6 mos, 10% had severe disability, 47% had moderate disability, and 43% had good recovery. At 12 mos, half of the patients had good recovery (53%), 40% had moderate disability, and 7% had severe disability.

Overall, 46% of the patients had unmet needs on the NPCS at 12 mos, in contrast to 59% at 6 mos. The largest proportion of unmet needs at 12 mos was found in the rehabilitation subscale (33%), which included the number of therapy disciplines (one, 8%), several noncoordinated (4%) or coordinated disciplines (3%), and intensity, once a month (11%), regular every week or second week (6%) or frequent, several times weekly (0%). Needs for vocational rehabilitation such as assessment, advice, support, or formal rehabilitation were unmet in 1%. In the healthcare domain, we found unmet needs in 28% mainly related to the lack of regular follow-up by specialists (21%). In the social care and support subscales, we found unmet needs in 20% (see Fig. 1).

Patients with moderate and severe disability at 12 mos reported a higher percentage of unmet needs than those with good recovery on the GOSE scale (see Fig. 2).

The results from the multivariable regression analysis (Table 2) demonstrated that a 1-yr increase in age corresponded to a 2% decrease in unmet needs for community-based services ($P = 0.028$). Preinjury comorbidities increased the odds of unmet needs by 77% ($P = 0.044$). There were no significant predictors of acute injury severity. With every point increase in global functioning at 6 mos, the odds of having unmet needs at 12 mos decreased by 27% ($P < 0.001$).

DISCUSSION

The results indicated a high frequency of unmet needs in the provision of health care, rehabilitation, and social support services in the community in the trauma population; 46% of patients had unmet needs at 12-mo postinjury, particularly related to the provision of rehabilitation services, specialist follow-ups, and social care and support needs.

The high rate of unmet needs for community-based services in this study population was somewhat unexpected, as the healthcare system in Norway is publicly funded and aims to provide universally accessible healthcare and tax-based benefits for disability, sickness and unemployment, old-age pensions, and resource allocation for comprehensive health care and rehabilitation for patients with long-term disabilities. Rehabilitation services are provided at both the specialist level (specialized multidisciplinary rehabilitation such as cognitive/neuropsychological and vocational rehabilitation) and the primary care level (services required by law: physiotherapy, occupational therapy, speech therapist, psychologist). Primary and specialized care levels are responsible for the coordination of rehabilitation services, but some challenges exist; several professions are often missing in small municipalities, and the

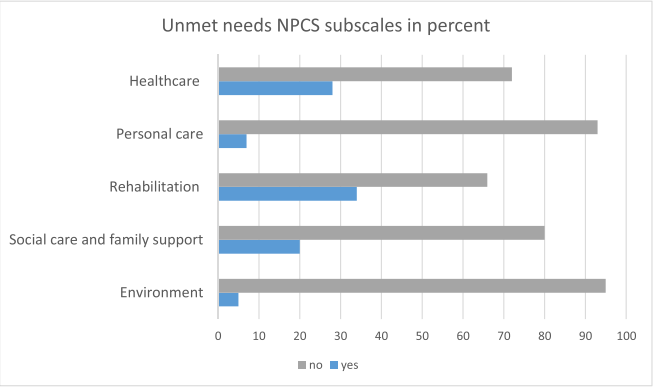

FIGURE 1. Unmet rehabilitation needs on the five NPCS subscales at 12-mos postinjury.

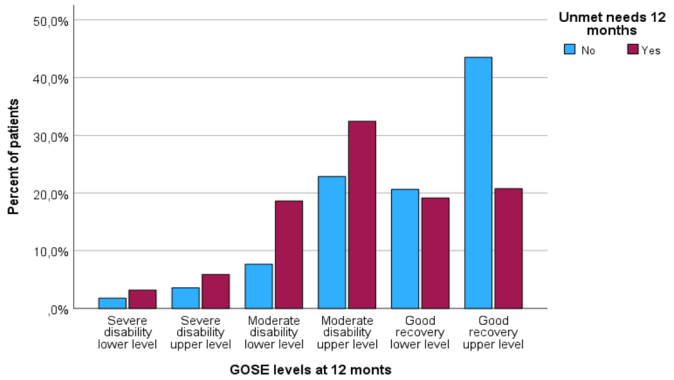

FIGURE 2. Distribution of unmet needs on NPCS by global functioning on the GOSE at 12 mos.

organization is fragmented, which may help explain the findings in the study. Although the unmet needs uncovered in the current study and their predictors may apply most closely to other countries with socialized healthcare systems, they may also apply to publicly funded healthcare systems in countries with large privatized systems, including within the Department of Veterans Affairs Health Care System or Medicare in the United States.

In general, unmet needs for medical care in Norway in 2019 (1%) were at the lowest rate among Nordic countries and approximately half the European Union average, with waiting times as the main reason.[18] However, there are some possible explanations for the high rates of unmet needs found in this study. First, the global functional level, as assessed using the GOSE mean score, did not change substantially from 6 to 12 mos. This can be understood as the patients' ongoing needs for rehabilitation and support services in two ways: it indicates that improving functioning and returning to work requires continued professional effort and that returning to everyday life and work might require the involvement of and rehabilitation from psychological, social, vocational, and employment services. Second, rehabilitation specialists may have underestimated the improvements that may occur in the postacute phase and thus overestimated rehabilitation needs for the following 6–12 mos. However, their estimations were based on patient-reported impairments and disability, as well as assumptions that the appropriate ongoing services would be provided in the postacute phase of injury; in the case of an absence of these services, patients still had unmet needs.[16] Third, there might be a recall bias in that patients may have difficulties to remember all the services received from 6 to 12 mos, this pertains to those with traumatic brain injury. Nonetheless, the results are in line with a study on the longitudinal needs of patients with long-term neurological disabilities, which identified significant gaps in service provision in comparison to patients' needs within the first year after discharge from inpatient neurorehabilitation.[19]

The regression model indicated that the probability of unmet needs primarily depended on age, preinjury comorbidities, and impaired functioning. Younger age increased the probability of unmet needs, which was somewhat unexpected when compared to functional outcome studies after trauma.[3] This

TABLE 2. Multivariable logistic regression of unmet rehabilitation needs at 12 mos

Variables	OR (95% CI)	*P*
Gender female vs. male[a]	1.026 (0.628–1.706)	0.920
Age	***0.984 (0.972–0.997)***	***0.018***
Cohabitating vs. living alone[a]	1.286 (0.795–2.081)	0.305
Less central vs. central region[a]	1.232 (0.785–1.934)	0.365
Preinjury ASA systemic disease vs. healthy[a]	***1.769 (1.016–3.079)***	***0.044***
Psychiatric comorbidity/substance abuse no vs. yes[a]	0.811 (0.440–1.497)	0.503
Head AIS > = 3 vs. <3[a]	1.007 (0.590–1.719)	0.979
Thorax AIS > = 3 vs. <3[a]	1.012 (0.620–1.652)	0.962
Abdomen AIS > = 3 vs. <3[a]	0.527 (0.251–1.107)	0.091
Spine AIS > = 3 vs. <3[a]	0.990 (0.503–1. 949)	0.979
Lower limbs AIS > = 3 vs. <3[a]	1.064 (0.552–2.049)	0.853
Discharge destination rehab. unit vs. home/other hospitals[a]	0.744 (0.417–1.324)	0.314
GOSE 6 mos	***0.735 (0.615–0.877)***	***<0.001***
NPCS unmet needs total score 6 mos	1.040 (0.985–1.098)	0.160

[a]OR, odds ratio. Reference group: OR > 1 increases the odds of having unmet needs; OR < 1 decreases the odds of having unmet needs; Hosmer and Lemeshow goodness-of-fit test χ^2 0.78; −2 log likelihood 489.505; Cox and Snell R^2 0.08; Nagelkerke R^2 0.11.

finding could be related to a lower ability to adapt to stressful events and greater support needs in younger patients in the trauma population.[20] A recent study on needs after spinal cord injury reported that younger persons had higher odds of unmet needs.[7] Additionally, older persons with disability might be less likely to report unmet needs having lower expectations and higher patient satisfaction.[21] Furthermore, preinjury comorbidities also increase the probability of unmet rehabilitation needs. Studies on functional outcomes after trauma[2,22] have highlighted the importance of assessing preinjury disorders when evaluating posttraumatic outcomes and rehabilitation. The direct impact of preinjury comorbidity on functional consequences of injuries cannot be excluded.

The most important predictor of unmet needs at 12 mos was global function on GOSE at 6 mos. More severe disability increased the probability of having unmet needs, which is in line with previous studies on traumatic brain injury.[8,23] Although in a previous study, initial injury aspects may have a negative effect on outcome during the first years after moderate-to-severe trauma,[2] the results at the 12-mo follow-up suggest that this effect seems to decrease over time.

The strengths of this study include its prospective design, the large sample of patients of all ages, the use of trauma registries in hospitals to verify the injury severity scores, acceptable dropout rates, and the small amount of missing data. A limitation is that the patient inclusion took place during the first wave of the COVID-19 pandemic, which could have influenced services received.[10] However, the health system remained relatively flexible throughout the pandemic and rapid expansion of telehealth ensured continuity of ambulatory care.[18] Furthermore, the design assumed that the needs for services would be stable from 6 to 12 mos; however, the trajectory of potential changes in functional level and service needs was not specifically included. Based on the functional levels on GOSE, nonsubstantial functional changes from 6 to 12 mos were captured; however, service needs might have changed from ongoing and persistent to intermittent, from professional support to self-management strategies. Others have shown that physiotherapy is a frequently provided rehabilitation service[23]; however, over time, there might be needs, and hence also unmet needs, for vocational rehabilitation services, mental health services, or social support measures[9] that arise, which would facilitate improved global function.

Taken together, the present study highlights a high prevalence of unmet rehabilitation and support needs in the first year after trauma. Although this study has identified some predictors of unmet needs, it does not answer how best to intervene in closing the gaps between unmet needs and services. However, our findings support a strategy to particularly target younger patients, those with higher levels of preinjury comorbidities, and those with higher levels of disability, and provide a starting point for further development of standardized rehabilitation needs assessments and protocols after injury.

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