

Rehabilitation after musculoskeletal injury: European perspective

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Abstract Trauma is one of the main causes of death in younger people and ongoing disability worldwide. In Europe, while there is generally good organization of trauma reception and acute treatment, rehabilitation from major musculoskeletal injuries is less well defined and provided. This article documents the diverse approaches to rehabilitation after major injury in 6 European nations. The recognition of need is universal, but achieving a robust rehabilitation strategy is more elusive across the varying health care systems. Switzerland has the most robust service in the insured population. In the other countries, particularly where there is a reliance on public institutes, this provision is at best patchy. In the Netherlands, innovative patient-empowering strategies have gained traction with notable success, and in the United Kingdom, a recent randomized trial also showed this approach to be reproducible and robust. Overall, there is a clear need for learning across the national systems and implementation of a minimum set of standards.

Key Words: Europe, Multiple injured, Trauma, Rehabilitation

1. Introduction

Trauma remains one of the major causes of disability and death internationally, and where organization of trauma care into specialist centers has been championed, outcomes have improved. In the United Kingdom, Moran et al¹ showed that there was a 19% increase in the odds of survival after a change in the organization of trauma care for severely injured in England, and similar results have also been published from other systems. Unfortunately, rehabilitation postinjury seems to lag behind.² In Victoria, Australia, Gabbe et al³ reported that 80% still had functional limitations at 6 months, and those with noncompensable injuries has little or no access to ongoing rehabilitation. Return to work has often been used a crude indicator of postinjury recovery,⁴ but it may mask additional injury and preinjury factors that could potentially be targeted. The aim of this article was to highlight approaches to rehabilitation after skeletal trauma across the diverse health care systems in Europe.

2. The United Kingdom

The Trauma Audit and Research Network (TARN) is a national-level database in England with data input mandated on all trauma

networks. TARN has been used to chart the progress of care since changes to trauma care delivery were instituted in 2012.¹ It has also been used to highlight disparities, such as trauma in the frail older patient⁵⁻⁷ and the lack of ongoing rehabilitation.^{5,6,8} In 2018, TARN was used to publish the “Major Trauma Rehabilitation Prescription 2019,” a data entry guidance document that set out the minimum database expectations. Recording these measures was linked to payment, as have the other changes to the delivery of trauma care within the system. The document set out 8 core items: patient demographics, actions for the general practitioner and patient, a list of relevant injuries, a management list for each of these injuries, ongoing rehabilitation needs, services the patients have been referred to, contact number for advice, and a section where the patient can record their comments. This was the first robust record of the gap between need and provision of rehabilitation across the nation.

The rehabilitation recommendation then quantified and documented patient need into 1 of 3 categories, from inpatient only to specialist and nonspecialist requirements. While these recommendations represented an acknowledgment about the needs of ongoing care, it did not metric what care was available and how well it was subsequently delivered. The trauma systems

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in England remain very good at recording institutional care, but there are little data on how well ongoing rehabilitation is delivered beyond general statements that it is deficient. The National Institute of Clinical Excellence (NICE) is another national body in the UK health care system that assesses the effectiveness of interventions in health care. In January 2022, NICE published guidelines on rehabilitation after traumatic injury. These guidelines went beyond just the major trauma population and recognized that there was a lack of standards in what was to be expected after any injury. Unfortunately, the process was limited because of a lack good clinical trials in the medical literature, with none specific to the UK population. The document is a comprehensive and detailed account of a patient journey, but because the subject falls across many health care delivery levels, there was not any designated point of responsibility or metrics for the delivery of a programme, which limited its utility.

An earlier document from the British Society of Rehabilitation Medicine set out to embed rehabilitation in the development of trauma networks, with the intention of using this opportunity as a platform to push for rehabilitation after all injuries. However, this effort failed to materialize, other than an expanded use in neurorehabilitation where there is already considerable evidence of effectiveness. Despite these documents, there is really no evidence of any effective rehabilitation strategy for skeletal trauma once patients are discharged. This is in keeping with clinical experience where any pockets of excellence remain just that, with little perceptible improvement in the national picture.

There are individual research ideas that accept the resource limitations for generalized rehabilitation. One national trial, ARTISAN,⁸ looks at empowering patients at their initial point of contact. The results of the study should be reported soon, and it looks like they will mirror the Dutch experience that organized rehabilitation can be an efficient and efficacious approach. These discussions may prove helpful in the future but, to date, have not been successful in progressing delivery of a more robust postinjury rehabilitation strategy or delivery.

3. The Netherlands

In the Netherlands, orthopaedic trauma rehabilitation care encompasses in-hospital care, outpatient clinics, and ultimately the patients' home environment.⁹⁻¹² The Dutch system uses a multidisciplinary approach to achieve optimal transitioning back to function, prioritizing effective communication between health care professionals. However, a national report on continuity of care highlighted concerns about health care sustainability, including rehabilitation care, and proposed a shift from institutional care to home-based care.¹³ Recent innovations have focused increasingly on the empowerment of patients to actively participate in self-care where appropriate.

Rehabilitation modules tailored to various patient groups and injuries have been developed collaboratively (Dutch Trauma Society, the National Associations of Geriatrics, orthopaedists, rehabilitation specialists, neurologists, and physiotherapists) and integrated into scientific national treatment guidelines for traumatic injuries.¹⁴⁻²⁰ These modules include treatment protocols and emphasize a multidisciplinary approach to both inpatient and out-patient rehabilitation. The treating surgeon generally maintains oversight of the process alongside the wider multidisciplinary approach. Current Dutch rehabilitation care focuses on adequately provisioning and empowering patients to facilitate self-directed recovery within their own environment.

An example of specialist inpatient rehabilitation care is found in Geriatric Trauma Units (GTU)²¹⁻²³ that combine orthopaedic trauma surgeons, geriatric medical, and nursing specialists who use specifically designed treatment pathways for geriatric trauma. There is also input from physical therapists and dieticians, with open communication channels between rehabilitation centers and nursing homes with efficient communication, streamlining postdischarge care to the most suitable rehabilitation environment.

3.1. Rehabilitation Centers

The Netherlands has 21 rehabilitation institutions and 15 hospitals with dedicated rehabilitation departments, forming a nationwide network for specialist intensive rehabilitation care (eg, traumatic brain injury rehabilitation, multitrauma rehabilitation).²⁴ These are staffed by multidisciplinary teams (rehabilitation specialists, geriatric medical specialists, physiotherapists, dieticians, psychologists, occupational therapists, and speech therapists). Rehabilitation medicine doctors have been an independent medical specialty since 1977, focusing on the rehabilitation process for a wide variety of patients.²⁵ Oversight is from the rehabilitation specialists. In addition, there are approximately 2400 nursing homes that provide temporary or permanent supportive care for (generally older) patients.²⁶ These are generally staffed by geriatric medical specialists or nursing home doctors who co-ordinate care.

3.2. Outpatient Rehabilitation

In NL, physiotherapy networks have been established to ensure consistently appropriate outpatient care.²⁷ Physiotherapy clinics and physiotherapy networks throughout are widely available across NL.^{28,29} Within these networks, physiotherapy practices closely collaborate with trauma centers, with active feedback loops and organized trauma education programs. In addition, a new method in Amsterdam involves specialist physiotherapists directly participating in hospital outpatient clinics. The preliminary results of this project show improvement of functional outcomes, quality of life, and cost-effectiveness.^{30,31}

3.2.1. Self-Care and Rehabilitation at Home. As noted above, new initiatives in Dutch trauma rehabilitation care focus on patient empowerment.³² An example is the Virtual Fracture Care (VFC) method that consists of 2 major components: The Direct Discharge (DD) protocol and a VFC review protocol using digitally assisted trauma care pathways. The DD protocol was a customization of the Glasgow protocols to the Dutch healthcare system.³³⁻³⁵ It was initially introduced in Amsterdam in 2019 and has been adopted by approximately one-third of hospitals across the Netherlands. Patients with simple and stable musculoskeletal injuries³⁶ are discharged directly from the emergency department (ED), with extensive instructions regarding immobilization, expected recovery, and rehabilitation. All information is summarized in injury-specific discharge folders (in multiple languages). These instructions serve as a valuable resource for patients, providing them with important information to guide their recovery journey. A VFC smartphone application, offering digital versions of informational materials (including instructional videos), has also been developed to enhance patient engagement and support the rehabilitation process. This application provides a comprehensive adaptable resource to empower

patients to actively participate in their own recovery. In addition, patients are provided with a helpline for any concerns.

The initial results of this approach were very promising. The number of outpatient clinic visits decreased by 91%, radiological imaging by 72%, and cost-effectiveness increased, while patients achieved similar functional recovery and expressed satisfaction.^{36,37} These results have been subsequently validated externally, confirming that these patients can adequately recover on their own with appropriate home-based tools.³⁸

3.2.2. Digitally Assisted Trauma Care Pathways. As part of the VFC project, OLVG Hospital in Amsterdam is piloting a new program for the patients who do require follow-up treatment at the hospital. This program consists of digitally assisted follow-up pathways for common extremity injuries (eg, distal radius fractures, ankle fractures, metatarsal fractures). At the start of treatment, patients receive similar individualized digital electronic patient records, information and instructional videos, anticipated progressions, and red flags. It also contains PROMs and questionnaires for remote monitoring recovery and satisfaction. The aim is to again support and inform patients during rehabilitation, empowering them and providing them with the most appropriate care at the right time. Additional rehabilitation approaches being considered include virtual reality (VR) exercise programs, digital care pathways, data-sharing platforms, and artificial intelligence for management of data and patient communication.^{13,39,40}

4. Greece

Rehabilitation services in Greece are primarily governed by national systems, namely the Ministry of Health and the National Health System (NHS). These services are offered through a combination of public and private health care providers; Physical Medicine and Rehabilitation Departments, the Social Centers of Welfare (KKP), and the Recovery Physical and Social Rehabilitation Centers (KAFKA) form the backbone of public provision, and Rehabilitation and Recovery Centers (KAA) provide private rehabilitation services for musculoskeletal as well as a myriad of other conditions.⁴¹

Physical and Medical Rehabilitation Centers (KEFIAP) are linked to their respective hospitals, while the KKKPs are governed by the Ministry of Labor and Social Security and are located in the different administrative regions of Greece. The country's KAFKAs have been incorporated into the Greek NHS and linked with the National Rehabilitation Center.

Despite the wide range of providers, Hatzichristos and Michael⁴² found that Greece's rehabilitation system has lagged behind other European countries, with the importance and complexity of rehabilitation not fully embraced by health policy makers. This has led to a lack of continuity of care pathways as patients move through the system. Naoum et al⁴³ went further, suggesting that rehabilitation services were insufficient because of limited resources including funding, beds, and the failure to maintain and modernize infrastructures of most KAAs. These problems are compounded by a lack of specialist personnel and interdisciplinary teams, as well as the accessibility because of geographical disparities.

Most centers (60%) are located in 3 regions (Attica, Central Macedonia, and Thessaly), and the remainder are scattered all over Greece, with limited access in remote areas or islands. In the hospital settings, physiatrists (rehabilitation specialists) lead an interdisciplinary team of physical, occupational, recreational, and

speech therapists; nurses; psychologists; and social workers. The maximum initial period of hospitalization is limited to 2 months. If an extended period is required, a new request must be submitted by the attending physician of the KAA.⁴⁴

In the outpatient setting, the rehabilitation program includes clinical examination, physical therapy, hydrotherapy, occupational therapy, speech therapy, and psychological support. The sessions last at least 30 minutes, and their number ranges between 60 and 80, depending on the disease staging and resource availability. However, there is a significant lack of data regarding adequacy of both the public and private sector rehabilitation and recovery health services.⁴¹ Opportunities for improvement for Greece's rehabilitation systems include increased collaborations between public and private sectors to enhance services; research initiatives to develop evidence-based practices and innovative interventions; investment in rehabilitation infrastructure, equipment, and workforce; promotion of innovation; public awareness and education regarding the importance of rehabilitation; and rights of individuals with disabilities.

In Greece, a more comprehensive and integrated approach is needed to improve rehabilitation services, with attention to resources to empower patients in taking a lead in their own care.

5. Spain

As with the other European countries, polytrauma is one of the most common causes of death and is the main one in patients younger than 45 years.⁴⁵ Data on the level of disability in polytraumatized patients have only been registered since 2008 by the National Institute of State. These data include disability, personal autonomy, and dependency status.⁴⁶ The main causes of disability have resulted from spinal cord and lower limb injuries sustained from traffic accidents, with a prevalence of 2 per 1000 people.

Although early rehabilitation protocols for hospitalized patients with polytrauma and subsequent coordination with rehabilitation centers have been shown to reduce both negative sequelae and health care costs,^{47,48} there are very few publications on the rehabilitation of these patients in Spain. Furthermore, with the 2002 decentralization of the national health system into 17 autonomous communities, the development of standardized care protocols and ongoing review of programs for rehabilitation of the patient with trauma has been arduous at the national level.⁴⁹ Currently, there is no national governmental registry system that would facilitate the assessment of the effectiveness of rehabilitation systems.

Most studies reporting on patients with trauma have focused on mortality and length of hospital stay, without considering the sequelae and socioeconomic costs associated with recovery and the resulting disability of the survivors. In 2017, a multicenter prospective national registry (RNT) was started.⁵⁰ The registry included patients with polytrauma older than 14 years with an Injury Severity Score >1.5 treated in 17 tertiary hospitals in Spain. The data, evaluated to January 2022, demonstrated that patients were predominantly male (76.4%), with a mean ISS of 22.8 and a mortality rate of 10.2%. The most frequent mechanism of injury was motorcycle accidents. Chest trauma followed by craniocervical and skin injuries were the most frequent injuries. Rib fracture followed by limb fractures were the most common fractures. The mean hospital stay was 11 days, with 72% of patients admitted to the ICU having a mean stay of 5 days. No data were collected on rehabilitation interventions while the patients were on the inpatient ward or on the quality of life and

functional level of the patient after discharge. Several other regional registries exist (TRAUMACAT, GITAN, RETRATO),⁵¹⁻⁵³ as well as a registry of ICU services (RETRAUCI),⁵⁴ with similar analyses and comparable results.

A national survey of 110 trauma care hospitals⁵⁵ found that only 24.5% had a system or center of rehabilitation, with social reintegration of polytraumatized patients after discharge. The dedicated management of patients with polytrauma is not specifically included in the teaching objectives rehabilitation specialty programs; therefore, even where trained specialists are available, they may not be familiar with the treatment of injured patients.

6. Italy

In March 2011, the Italian Ministry of Health published the plan for rehabilitation guidelines in its “Quaderni della salute” or “health notebooks.” This document was conceived as an ambitious project to inform and update the community on major health care issues. The rehabilitation process has historically been regarded as the third component of the health management pathway, with prevention and treatment comprising the first and second components, respectively.⁵⁶

Currently, rehabilitation services are included in the national legislation (DPCM 12, January 2017), which establishes the Basic Assistance Levels. Based on the performed surgical or nonsurgical procedure, rehabilitation services are provided in the following organizations: hospital units for acute conditions (traumas, fractures, strokes); long-term care facilities for managing patients who require additional physical medicine care; and clinics to provide follow-up physical therapy in postacute conditions and for chronic diseases.

The rehabilitation of patients with trauma starts during hospitalization. The physical medicine and rehabilitation (PM&R) specialist, or psychiatrist, assumes care of the patient with trauma as soon as the surgical management episode is completed. The psychiatrist is responsible for defining the following: a tailored rehabilitation program, specific for each patient; a realistic goal for the patient to reach, based on the trauma suffered and potential residual disability; treatment goals to be completed during hospitalization; and treatment goals to be reached after hospitalization, in long-term care facilities or in an outpatient clinic.

The multidisciplinary interaction between the psychiatrist and other involved health care professionals is critical. The rehabilitation team is an essential part of the injured patient’s care, having to integrate with the treatment needs of the patient. The psychiatrist has to coordinate with the surgical team to define the rehabilitation target, including recommendations for postsurgical mobilization; medical specialists and geriatricians for patients who present comorbidities or other pre-existing conditions that may hinder the rehabilitation process; and neurosurgeon/neurologists for patients who present nervous/spinal injuries. In Italian intensive care units (ICUs) and in orthopaedic trauma units, a rehabilitation service is provided Monday to Saturday. Specialized physical therapists oversee this service. In several Italian trauma units, with remarkable variations between regions, an orthogeriatric service is offered for elderly patients with fractures. For the elderly fracture patients, who often have comorbidities, are frail, and can have greater needs than younger patients, there is a need for a combined multidisciplinary approach between the surgeon, anesthetist, geriatrician, physiatrist, and other allied health care professionals.

There is a network of specialized facilities for intensive or extensive rehabilitation for patients with postacute disabilities (traumas, fractures, strokes) posthospitalization. Intensive

rehabilitation facilities are designed for patients with possibly reversible major disabilities who need 24-hour medical nursing assistance. Rehabilitation procedures are performed from Monday to Saturday, for 3 hours per day (at least 18 hours per week).⁵⁷ Extensive rehabilitation facilities are meant for patients with reversible disabilities who cannot endure an intensive rehabilitation program but still require 24-hour medical/nursing assistance. Rehabilitation procedures are performed from Monday to Saturday, for 1 hour per day (at least 6 hours per week).⁵⁷ Long-term care facilities are conceived for patients with stable clinical conditions who need 24-hour nursing assistance due to their degree of disability. Finally, daycare facilities are available for patients who only require a shorter rehabilitation program.⁵⁷

Since 2001, with the approval of DPCM 29.11.2001 on the Basic Assistance Levels, all Italian regions have gradually aligned to the standards described above. Each region has created its own regional network of rehabilitation assistance.⁵⁶ In addition, several regions have developed highly specialized intensive rehabilitation units, such as spinal rehabilitation units, severely brain-injury units, and severe disabilities in developmental age units. The institution of these highly specialized facilities has led to an inter-regional exchange of patients to ensure that patients have the most specific treatments, based on their condition. Patients with trauma who can be discharged to their own home are eligible for rehabilitation in clinics until their treatment goals are achieved. Access to clinic rehabilitation programs is prescribed by the psychiatrist before hospital discharge. It is connected to a waiting list that is unrelated to the standard reservation procedures of the National Healthcare System. This allows for easy access to rehabilitation treatments and, as a consequence, no disruption of the process started during hospitalization.

Rehabilitation programs after hospitalization of patients who are injured at work are the responsibility of INAIL (National Institute of Insurance for Work Injuries). Treatments, included in Basic Assistance Levels, can be provided directly inside INAIL facilities, or indirectly, in National Healthcare System facilities. INAIL has 11 outpatient Physiotherapy Clinics on the Italian territory and 2 main inpatient centers, in Volterra and Budrio. The Volterra center deals predominantly with rehabilitation of polytrauma, severe limb injuries, amputations and reimplantations, spinal injuries, and brain injuries. The Budrio center has specialist expertise in limb prostheses development and production, offering a technical team for the construction of personalized, highly customized prostheses, and a health care team that provides functional rehabilitation and psychological and social support. Individuals are considered in their entirety, to enhance their skills and resources, aiming at the highest possible level of autonomy. This process seeks to optimize patients’ abilities to reintegrate with work, family, and social life.

7. Switzerland

In Switzerland, there are 2 types of rehabilitation centers: those operated by private chains (eg, ZURZACH Care) or by the accident insurance for workers (Suva—prevention, insurance, and rehabilitation). The latter is separated in 2 major rehabilitation hospitals, one in the east (Rehaklinik Bellikon) and one in the French-speaking section (Sion). For patients with posttraumatic paraplegia, there are 2 separate hospitals that include any rehabilitation, including surgical revision options and spine surgeons. For a country of close to 9 million inhabitants, this is deemed to be ample coverage, although the number of units has been reduced.⁵⁸ Any patient who

requires rehabilitation has to be accepted by the insurance company before any transfer occurs.

Rehabilitation programs must be initiated as an inpatient, or there is a risk that the patient will lose financial coverage. The insurance company may refuse or ask the patient to pay a certain amount, especially for short-term assisted living for the elderly. For inpatient rehabilitation, the strategy prioritizes early mobilization of patients. This may even include placing ventilated ICU patients in an upright position.⁵⁹ Subsequently, physical therapy is grouped into several teams (cardiac vs. pulmonary vs. trauma) that visit the patient on a daily basis and perform appropriate degrees of mobilization. In the hospitals, there is usually only a small rehabilitation area that also can also be booked into by outpatients. A rehabilitation goal is to send the patient to an outside rehabilitation center as soon as possible if this is required. The resources in the rehabilitation centers are of a very high quality and follow internationally recognized standards. Those that specialize in spinal and traumatic brain injuries include a research arm that contributes to single and multicenter studies.⁶⁰

The inpatient rehabilitation team is led by a rehabilitation specialist (physiatrist) in larger and Level 1 trauma centers, but this is not universal. In the rehabilitation centers, the presence of a physiatrist is required, and their specific training includes orthopaedics and manual medicine. The greater team is multidisciplinary, with physical and occupational therapists in both hospitals and rehabilitation centers. As a standard, every patient undergoes a physical assessment by the rehabilitation specialist, which continues weekly while the patient is in the unit. The local physician decides on the duration of rehabilitation according to serial quality of life assessments (eg, Euroqol).⁶¹

There are specific institutes that offer more specialist services. For brain and spinal cord injury, there are 3 dedicated hospitals in Switzerland. There are also those that specialize in orthopaedic injury (about 1 per 50,000 inhabitants) and geriatrics, but none that specialize in paediatrics.

Overall, there is a high level of coverage for rehabilitation for the insured population, with several subspecialty centers. Those providing rehabilitation for trauma are certified to offer all necessary therapeutic options. In some of the specialist centers, there is even more comprehensive expertise, ranging from wound care to reoperation options, as well as ambulatory care follow-up.

8. Discussion

Throughout the varying health care systems in Europe, there is a general recognition of the importance of rehabilitation and the need to advocate for it on behalf of orthopaedic patients with trauma. There is a range of rehabilitation services available, ranging from the well-funded centers across Switzerland to the less well-organized systems in the United Kingdom and Spain. Health care advocates continue to lobby their countries' national institutes and legislative bodies to establish base levels or rehabilitative services.

Alternative rehabilitative solutions have been attempted, and it is interesting to see several countries independently try to use alternative avenues to promote patient led approaches. The Dutch system of patient empowerment is promising, particularly because the early data seem to show good efficacy and patient satisfaction. In the same vein, the recently closed UK study⁸ seems likely to show that a slightly more involved first contact and educational direction can mitigate the need for the conventional follow-up and therapist referrals.

The importance of robust data gathering and the power of information to further finesse systems, either locally innovative or

nationally, has been emphasized in the United Kingdom and the Netherlands, just as the lack of available specific data has been lamented in others. Tying novel strategies to data gathering seems to have been an effective way of getting momentum for change in the United Kingdom. However, the issues with cost and infrastructure remain problematic across national approaches to rehabilitation in all but Switzerland.

The European experience with rehabilitation systems does not lead to ready-made answers. There is a consistent level of provider frustration with the national support for rehabilitation centers in countries across Europe. However, there is an emerging pragmatic approach using innovative strategies and technologies that provide a degree of versatility and efficacy. It may be that future directions continue to concentrate on these new approaches.

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