

Research

The Transmural Trauma Care Model can be implemented well but some barriers and facilitators should be considered during implementation: a mixed methods study

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KEY WORDS

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ABSTRACT

Questions: What is the reach, dose delivered, dose received and fidelity of the Transmural Trauma Care Model (TTCM)? What are the barriers and facilitators associated with the implementation of the TTCM? **Design:** Mixed-methods process evaluation with quantitative evaluation of the extent to which the TTCM was implemented as intended and qualitative evaluation of barriers and facilitators to its implementation. **Participants:** Focus group participants included trauma patients, trauma surgeons, hospital-based physiotherapists and primary care network physiotherapists. **Outcome measures:** Implementation was assessed with reach, dose delivered, dose received and fidelity. **Data analysis:** A framework method was used to analyse the focus groups and the 'constellation approach' was used to categorise barriers and facilitators into three categories: structure, culture and practice. **Results:** The TTCM's reach was 81%, its dose delivered was 99% and 100%, and its dose received was 95% and 96% for the multidisciplinary TTCM consultation hours at the outpatient clinic for trauma patients and the primary care network physiotherapists, respectively. Various fidelity scores ranged from 66 to 93%. Numerous barriers and facilitators associated with the implementation of the TTCM were identified and categorised. **Conclusion:** This process evaluation showed that the TTCM was largely implemented as intended. Furthermore, various facilitators and barriers were identified that need to be considered when implementing the TTCM more widely. Differences were found among stakeholders but they were generally of the opinion that if the barriers were overcome, the quality of care and patient satisfaction were likely to improve significantly after implementing the TTCM. **Registration:** NTR5474. **[Wiertsema SH, Donker MH, van Dongen JM, Geleijn E, Bloemers FW, Ostelo RWJG, de Groot V (2021) The Transmural Trauma Care Model can be implemented well but some barriers and facilitators should be considered during implementation: a mixed methods study. *Journal of Physiotherapy* 67:298–307]**

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Introduction

Traumatic injury accounts for 9.6% of global mortality.^{1–3} Major trauma, in particular, is the most important cause of long-term functional limitations in adults younger than 45 years.⁴ Traumatic injury mainly affects younger individuals and, as a consequence, accounts for the highest number of lost productive years of life compared with other conditions.⁵ During the last two decades, mortality due to traumatic injury has decreased considerably by between 15 and 25%.^{6–8} Consequently, the focus of trauma care has moved from reducing mortality to improving quality of life and outcome, which in turn has resulted in a growing interest in improving the quality of trauma rehabilitation.⁹

To improve the rehabilitation process of trauma patients, the Transmural Trauma Care Model (TTCM) was developed and implemented at a Level 1 trauma centre in the Netherlands. The TTCM is an advanced rehabilitation model consisting of a continuous feedback loop, in which a multidisciplinary hospital-based team supervises a network of primary care physiotherapists during the rehabilitation process of trauma patients.¹⁰ Evidence on the effectiveness and cost-effectiveness of the TTCM compared with regular care has been published elsewhere.^{11,12} The results showed that the TTCM was associated with better patient outcomes and that it may be considered cost-effective compared with regular care, depending on the decision-makers' willingness to pay and the probability of cost-effectiveness that they perceive as acceptable.

It is recommended that process evaluations be conducted alongside clinical trials, as process evaluations can provide important information for interpreting their results.^{13–16} Moreover, process evaluation results can be used to further improve the intervention and facilitate the transition of research evidence into clinical practice.^{17,18} In the field of trauma treatment and trauma rehabilitation, process evaluations are rarely performed. One mixed-method study assessed the relationship between participant-related factors and adherence to osteoporosis medication, vitamin D supplementation, and participation in physical activity in older patients with fragility fractures.¹⁹ Moreover, a recent focus group study among trauma patients suggested that inadequate aftercare negatively influenced trauma patients' perceived quality of life at least 1 year after trauma.²⁰ It is noteworthy that the majority of patients participating in this study were aged > 65 years and it is believed that process evaluations in younger patients with traumatic injury are lacking.

Even though results suggest that the TTCM could improve patient outcomes and healthcare efficiency,^{11,12} it is less clear how to implement this model in practice. It is unknown how the TTCM could be implemented in other trauma regions with their own structures, cultural norms/values and practical routines.²¹ These considerations led to the current study and process evaluation being performed.

Therefore, the research questions for this mixed-methods process evaluation were:

- 1) What is the reach, dose delivered, dose received and fidelity of the TTCM?
- 2) What are the barriers and facilitators associated with the implementation of the TTCM?

Method

Design

This process evaluation was conducted alongside a clinical trial evaluating the effectiveness and cost-effectiveness of the TTCM compared with regular practice.²² The clinical trial was conducted at the outpatient clinic for trauma patients of a Level 1 trauma centre (Amsterdam UMC, location VUMc, Amsterdam, the Netherlands). In this study, operatively and non-operatively treated trauma patients with at least one fracture and aged ≥ 18 years were included. This process evaluation used a mixed-methods design. Quantitative process evaluation data were collected from the intervention group participants' electronic patient records to assess the TTCM's reach, dose delivered, dose received and fidelity. Additionally, qualitative data were collected by conducting focus groups among various stakeholders to explore the barriers and facilitators related to the implementation of the TTCM.

The Transmural Trauma Care Model

The TTCM consists of four linked components shown in Table 1. A more detailed description of the TTCM is provided elsewhere.¹⁰

Quantitative assessment

The extent to which the TTCM was implemented as intended was explored by assessing four process evaluation components of Linnan and Steckler, including its *reach*, *dose delivered*, *dose received* and *fidelity*.²³ *Reach* was defined as the proportion of the intended target audience that participated in the intervention (ie, the proportion of potentially eligible trauma patients who eventually participated in the TTCM during the clinical trial period). *Dose delivered* was defined as the number of units of the intervention delivered (ie, the proportion of intended multidisciplinary TTCM consultation hours that eventually took place at the outpatient clinic and the proportion of included TTCM participants who were eventually referred to a primary-care network physiotherapist, PCNP). *Dose received* was the

extent to which trauma patients actively engaged in the intervention (ie, the proportion of included TTCM participants who eventually visited their scheduled multidisciplinary TTCM appointment at the outpatient clinic and the proportion of included TTCM participants who eventually visited the PCNP they were referred to). *Fidelity* was defined as the extent to which the intervention was delivered as planned (ie, the extent to which the intervention protocol was followed by the various care providers). Various fidelity scores were assessed (eg, whether a secure email was sent from the hospital-based physiotherapist (HBP) to the PCNP after each multidisciplinary TTCM visit and vice versa). A complete overview of all the criteria used to assess fidelity is presented in Table 2. To explore the four process evaluation components, data were collected from the patients' electronic patient records (eg, the number of secure emails, the use of standardised referral forms, the setting of individual functional goals) and from the care providers' schedules.

Qualitative assessment

Barriers and facilitators are defined as 'factors that hampered or enhanced the implementation of an intervention', respectively.²⁴ To explore the barriers and facilitators associated with the implementation of the TTCM, homogeneous focus groups were conducted among trauma patients, trauma surgeons, HBPs and PCNPs. Participants were selected purposively. This sampling method allows researchers to use their own judgement to select individuals who are able to provide in-depth information pertaining to the research questions. This study used focus groups instead of in-depth interviews because more in-depth information can be obtained from a group context, in which members influence each other ('the whole is greater than the sum of its parts').^{25,26} Another strength of focus groups is that they provide access to shared social meaning and norms, and how these are enacted.²⁷ This study used homogeneous focus groups to avoid existing professional and/or personal hierarchy structures (eg, between surgeons and physiotherapists and patients) to influence the results. Homogeneous focus groups create a safe environment in which participants are more likely to speak freely and openly.²⁸

Focus groups were conducted at a time and location convenient to the participants. Prior to the focus groups, participants were assured of confidentiality and were asked to provide informed consent. Focus groups were guided by two experienced qualitative researchers who were familiar with the TTCM, but were not involved in the TTCM as a care provider. During each focus group, three round table discussions were held: the first aimed to identify possible facilitators, the second aimed to identify possible barriers and the third aimed to complement and validate the barriers and facilitators identified in the first two rounds of discussion. During all round table discussions, a topic list was used as a guide. Every round started by asking participants to independently write down facilitators and barriers on adhesive notes to frame the personal perspective of the participants and avoid groupthink. Subsequently, participants were free to discuss all topics they considered important. All focus groups were audiotaped and transcribed verbatim.

Data preparation and analysis

Quantitative analysis

To assess the reach, dose delivered, dose received and fidelity of the TTCM, summary statistics were prepared in commercial software^a.

Qualitative analysis

Focus group data were analysed using the framework method. This is a hierarchical, matrix-based method for ordering and synthesising qualitative data.^{29,30} The framework method enables systematic exploration of the data while simultaneously maintaining an effective and transparent examination path.³¹ In this study, an 'analytical framework' was constructed iteratively from the research aims, existing literature and the data derived from the focus groups.

Table 1
Components of the Transmural Trauma Care Model (TTCM).

TTCM component	Description
A multidisciplinary TTCM consultation hour at the outpatient clinic for trauma patients by a trauma surgeon and a trauma-specialised hospital-based physiotherapist.	During the trauma patients' outpatient visits, the trauma surgeon evaluated the bone and wound healing process and acted as the chief consultant. The hospital-based physiotherapist assessed physical function and acted as case manager throughout the rehabilitation process. During a shared decision-making process, the trauma surgeon, hospital-based physiotherapist and patient determined whether and when physiotherapy in primary care was required.
Coordination and individual goal setting for each patient by the multidisciplinary hospital-based team.	The hospital-based team coordinated the patients' rehabilitation process in primary care by repeatedly defining individual treatment goals in close cooperation with the patient. To support this process, 10 rehabilitation protocols were developed for the most common fractures (eg, hip fractures, tibial plateau fractures). These protocols were customised for each individual patient by the hospital-based physiotherapist.
A network of specialised primary care physiotherapists.	This Network Trauma Rehabilitation VUmc consisted of 40 physiotherapists, all of whom worked in a primary care practice in the region of Amsterdam and were specifically trained to rehabilitate trauma patients (www.traumarevalidatie.nl).
Secure email traffic between the hospital-based physiotherapist and the primary care network physiotherapist.	A secure email system (Zorgmail), developed for healthcare professionals, was linked to both the electronic patient records of the hospital-based physiotherapist and the primary care network physiotherapist, so that regular communication was guaranteed throughout the rehabilitation process.

For constructing the analytical framework, the 'constellation perspective', as described by Van Raak, was used as the theoretical framework.²¹ The constellation approach will be described briefly below, followed by a stepwise description of the way the framework method was used for analysing the data.

The constellation approach as a theoretical framework: The constellation approach has its origins in organisational research and assumes that a healthcare system consists of so-called constellations, defined as a set of interrelated practices and relevant, interrelated, structuring elements that together both define and fulfil a function in the larger system. The needs of healthcare systems are diverse and therefore the system consists of a multitude of nested complementing and competing constellations and (sub)constellations.³² Within a constellation there is a continuous interaction between the three elements of the 'structure, culture and practice triplet', introduced by Rotmans and Loorbach in 2009³³ and adapted by Van Raak (Appendix 1).²¹ *Structure* consists of the physical structures and resources, enforced regulations and legal rights, economic resources and other material elements that structure behaviour within a constellation. *Culture* refers to the paradigms, norms and values and other immaterial elements that structure behaviour in practices. *Practice* involves the typical routines on the operational level, which are undertaken by the actors within the constellation. Actors are the individuals (eg, patients, physicians, managers) or groups (eg, insurance companies, departments) who work or act in a certain constellation. Please notice that actors are not part of a constellation, but shape its culture and structure (and vice versa) through practice.

For the TTCM, several nested constellations can be recognised, for example: the outpatient clinic for trauma patients on the one hand and the primary care network practices on the other hand. Moreover, both the hospital and the primary care network practices are part of a bigger constellation, in which insurers and policymakers act in a certain structure and culture. Dynamics, such as those created by the implementation of the TTCM, provide an opportunity for change. When the change process leads to a fundamental shift in structure,

culture and practice, a transition of the constellation has occurred. In general, the driving force of change is the sense of urgency for change by 'key actors' within a constellation.³² These actors initiate and push for change on the structural, cultural and practical levels.³⁴ To achieve a transition, the relevant actors need to develop a collective sense of urgency to change and they need to develop new competences (knowledge, attitude and skills). Scaling up involves implementing the results of niche experiments in the existing structure, culture and practice.³⁵

Stepwise procedure of the framework method to construct an analytical framework: This study iteratively constructed an 'analytical framework' from the literature and the focus group data. For building this analytical framework, the 'constellation perspective', as described above, was used as the 'theoretical framework'. The first step of the framework method³⁰ consisted of a verbatim 'transcription' of the audiotaped focus groups, followed by the second step, which was 'familiarisation' with the data by listening and rereading the transcripts. The third step was 'coding' and was aimed at classifying the data in such a way that it could be systematically compared with other parts of the data set. For this purpose, all transcripts were manually coded line by line by applying a paraphrase or label to relevant parts of the text (the 'code') using word processing software^b. This started with open coding, meaning that anything that could be possibly relevant was coded independently by two of the researchers (SW and MD). Subsequently, both researchers independently generated descriptive themes and subthemes. The fourth step was the 'development of an analytical framework', in which codes were grouped into categories on the structural, cultural and practical level of the theoretical framework (ie, the constellation approach). Subsequently, the final codes were developed through discussion between the two researchers. During these discussions, similar codes were grouped into main topics and subtopics in order to identify important themes (ie, selective coding), resulting in the initial analytical framework. Then, both researchers independently coded

Table 2
Process evaluation components, definitions and scores.

Assessment component	Definition	Score (%)
Reach	The proportion of potentially eligible trauma patients who eventually participated in the TTCM during the clinical trial.	81
Dose delivered	The proportion of intended multidisciplinary TTCM consultation hours that eventually took place at the outpatient clinic for trauma patients.	99
Dose received	The proportion of included TTCM participants who were eventually referred to a primary care network physiotherapist.	100
	The proportion of included TTCM participants who eventually visited their scheduled multidisciplinary TTCM appointment at the outpatient clinic for trauma patients.	95
Fidelity	The proportion of included TTCM participants who eventually visited the primary care network physiotherapist they were referred to.	96
	The use of the standardised referral form for the primary care network physiotherapist.	89
	A secure email was sent from the hospital-based physiotherapist to the primary care network physiotherapist after each multidisciplinary TTCM visit.	93
	A secure email was sent from the primary care network physiotherapist to the hospital-based physiotherapist prior to each multidisciplinary TTCM visit.	76
	Individual functional goals were set for the patient by the multidisciplinary hospital-based team during each multidisciplinary TTCM visit.	89
	Specific feedback from the primary care network physiotherapist to the hospital-based team whether the functional goals have been achieved or not (and why).	66

all remaining transcripts of the focus groups using the initial framework. Subsequently, they met again and, following discussion, revised the initial framework to incorporate new and refined codes. The process of refining, applying and refining the analytical framework was repeated until no new codes were generated.

Note that the process of developing the analytical framework was a combined deductive and inductive approach. On one hand, pre-selected themes and codes of Van Raaks' theoretical framework were used (deductive), while on the other hand, themes and codes were generated from the data (inductive). The final framework consisted of 16 themes, clustered into six categories (facilitators and barriers on the structural, cultural or practical level). In the fifth step, called 'indexing', both researchers systematically went through each transcript again, highlighting each meaningful passage of text and selecting and attaching an appropriate code from the final analytical framework. At this stage, each code was assigned an abbreviation for easy identification (eg, FST1 = Facilitator Structural Theme 1). Indexing involves the comparison of data within and between focus groups.

The sixth step is called 'charting', in which a spreadsheet was used to generate a framework matrix. During this stage, data were summarised by category and subsequently categorised into the matrix, followed by adding illustrative and interesting quotes from participants in the focus groups. During the seventh step, 'interpretation of the data', the framework matrix was used to interpret the data together with some notes that were made during the focus groups and the coding process. This interpretation process was an iterative process and relied on a consultation between both researchers about the relevance and strength of a theme. The intensity, frequency, persuasiveness and contrast with which statements were made by the participants determined the value that was given to them. To ensure rigor and credibility of the findings, another researcher (JvD) reviewed the generated matrix and checked whether the selected quotes were of relevance to the themes. Disagreements were resolved by discussion. To guarantee quality of study reporting, the CONSolidated criteria for REporting Qualitative research (COREQ) checklist was used.³⁶

Results

Quantitative results

An overview of the quantitative results of the process evaluation are presented in Table 2 and will be briefly discussed below.

Reach. Of the 1,993 trauma patients who were assessed for eligibility at the outpatient clinic for trauma patients between June 2014 and April 2015, 103 potentially eligible patients were identified. Reasons for not being eligible included (amongst others) sprains, orbital fractures, bone bruises or no need for physiotherapy. Of the potentially eligible patients, 20 were excluded because they did not provide informed consent ($n = 9$), had no internet access ($n = 2$), were not willing to participate ($n = 4$) and had other reasons ($n = 5$). The remaining 83 patients were allocated to the TTCM (Box 1). The reach of the TTCM was therefore 81% (83 of 103).

Dose delivered

During the intervention period, 544 multidisciplinary TTCM consultation hours at the outpatient clinic were scheduled. During four of these multidisciplinary TTCM consultation hours, the HBP was absent due to personnel shortage ($n = 1$), illness of a care provider ($n = 2$) and scheduling problems ($n = 1$). Thus, the dose delivered of the multidisciplinary TTCM consultation hours was 99% (540 of 544). During the intervention period, all of the 83 TTCM participants were referred to a PCNP. Thus, the dose delivered of primary care network physiotherapy was 100%.

Dose received

During the intervention period, all of the 83 TTCM participants visited at least two of their scheduled multidisciplinary TTCM appointments at the outpatient clinic. The mean number of actual visits

Box 1. Recommendations for implementation and scaling up of the TTCM.

- Form a steering group with all stakeholders to take everyone's interests into account.
- Describe clear organisational structures for care providers at the outpatient clinic and for primary care network physiotherapists (eg, communication pathways and templates for standardised documentation).
- Describe duties and responsibilities of the participating care providers in a manual and organise training courses for the primary care network physiotherapists.
- Organise reflection meetings with stakeholders (homogeneous as well as heterogeneous) per trauma centre and respect local differences.
- Arrange an appropriate and structural embedded reimbursement system for the hospital-based physiotherapist, who acts as case manager within the TTCM.

per participant was 4.7 (range 2 to 10). In total, 407 multidisciplinary TTCM appointments were scheduled, of which 387 visits eventually took place. Participants did not show up or cancelled their appointments due to not having complaints anymore ($n = 4$), being ill ($n = 10$) and other reasons ($n = 6$). Thus, the dose received of the multidisciplinary TTCM visits was 95% (387 of 407). The proportion of participants who eventually visited the PCNP they were referred to was 80 of 83, which made the dose received of this component of the TTCM at 96%.

Fidelity

The extent to which the intervention protocol was followed by the various care providers was expressed in terms of several fidelity scores, all of which are shown in Table 2. Fidelity scores ranged from 66% (ie, specific feedback from the PCNP to the HBP about whether functional goals were achieved) to 93% (ie, secure email was sent from the HBP to the PCNP after each visit).

Qualitative results

Participants

In total, 28 potential participants were purposively selected and invited to take part in the focus groups, including six trauma patients, six trauma surgeons, five HBPs and 11 PCNPs. Of them, two trauma patients, two trauma surgeons, one HBP and one PCNP declined to participate for various reasons (eg, unwilling, unavailable). Finally, five homogeneous focus groups (FGs) took place, consisting of four trauma patients (FG1), four trauma surgeons (FG2), four HBPs (FG3) and 10 PCNPs (FG4 and FG5).

Barriers and facilitators associated with the implementation of the TTCM

Various barriers and facilitators associated with the implementation of the TTCM were identified (Table 3). Stakeholders generally perceived the TTCM to be an improvement from usual care, enhancing both the quality and efficiency of care. However, differences were observed among stakeholders. Below, identified barriers and facilitators will be discussed per level of the constellation approach. First, similarities and differences between the various stakeholders will be described, followed by the within-group differences per focus group.

Structural level

On the structural level, six overarching themes were identified, which were categorised into facilitators and barriers (Table 3). During all focus groups, the 'communication structure of the TTCM', including its use of a secure email system and standard referral forms, was mentioned as an important improvement compared with usual care.

Table 3
Facilitators and barriers expressed by care-providers and patients regarding the implementation of the TTCM, related to structure, culture and practice. Quotes are from of trauma patients (P), trauma surgeons (T), hospital-based physiotherapists (HBP) and primary care network physiotherapists (PCNP).

Level	Theme	Facilitator	Barrier	Illustrative quote
Structure	Communication structure	<ul style="list-style-type: none"> Use a secure email system from file to file between primary and secondary care (and vice versa) Use a standardised template for the secure email Use a standardised referral form The network practice receives an email from the HBP when a new trauma patient is referred The HBP sets functional goals for trauma patients after each visit at the outpatient clinic 	<ul style="list-style-type: none"> Feedback from PCNP lingers with HBP and does not reach trauma surgeon The standardised email template is too standardised 	<ul style="list-style-type: none"> 'There is a lot of regular email contact between the hospital physical therapist and the network physical therapist but that does not always reach us' (T) 'Yes, the referral form has become a lot more efficient. Which makes the care better. But certainly more efficient' (T) 'The next goal was very clear for everyone, for the surgeon, for the patient, for the physical therapist in the hospital and for us. If that succeeds, we continue to the next goal and otherwise it will be evaluated and adjusted. This is a very clear structure, making the process very satisfying for everyone' (PCNP)
	Infrastructure and working agreements at the outpatient clinic	<ul style="list-style-type: none"> Trauma surgeon and HBP prepare the consultation hour individually Trauma surgeon and HBP briefly discuss the patients prior to the consultation hour Trauma surgeon and HBP regularly work together 	<ul style="list-style-type: none"> The occurrence of software failures The incompatibility of electronic patient records in primary and secondary care 	<ul style="list-style-type: none"> 'I am usually 15 minutes/half an hour earlier to look at the difficult cases. It would be nice if they (the HBP) were already there' (T) 'For your own expertise it is good to work with multiple trauma surgeons, but in the context of efficiency and work relationship it is better to work in regular couples' (HBP)
	Financial structures	<ul style="list-style-type: none"> Let the network practices pay an annual fee for education and accreditation 	<ul style="list-style-type: none"> The absence of reimbursement for the HBP at the outpatient clinic 	<ul style="list-style-type: none"> 'What worries me even more is the uncertainty how the network will survive without money. Because it takes a lot of time and a lot of effort to take good care of our network' (HBP)
	Organisation of the primary care network	<ul style="list-style-type: none"> Having an appropriate and up-to-date website 	<ul style="list-style-type: none"> Patients are not treated by the trained PCNP, due to inadequate logistic pathways within the network practice 	<ul style="list-style-type: none"> 'Yes, that's partly our fault. I think we have around 19 physical therapists working in our practice and sometimes trauma patients are scheduled with a non-trauma physical therapist. That is a logistic problem' (PCNP)
	Training and education	<ul style="list-style-type: none"> Organise a two-day training for the PCNPs prior to joining the network Organise regular meetings for PCNPs and the complete hospital team (eg, twice a year) Request accreditation for PCNPs and HBPs 		<ul style="list-style-type: none"> 'I can imagine that we organise theme meetings with the network physical therapists twice a year to discuss specific topics concerning our patient category, which also makes them more involved' (T)
	Guidelines	<ul style="list-style-type: none"> Availability of guidelines for the most common fractures 	<ul style="list-style-type: none"> Guidelines are too detailed and do not apply in case of deviant course in fracture healing 	<ul style="list-style-type: none"> 'Yes, the protocols are so incredibly concrete that you can only use it for one specific condition. You can no longer use it in case of a slightly different fracture or a deviate course of the recovery' (PCNP)
Culture	Awareness of responsibilities and leadership	<ul style="list-style-type: none"> Shared decision-making process at the outpatient clinic Care providers share responsibility for treatment options Care providers at the outpatient clinic act as a team and are unambiguous 	<ul style="list-style-type: none"> There is ambiguity about ownership in the consultation room Care providers contradict each other 	<ul style="list-style-type: none"> 'I really liked having a voice in formulating my own goals. During the visits there was time to think and talk about what is important to me, that I wanted to play tennis again. And whether it was actually achievable what I wanted. It really helped me to discuss these issues with the surgeon and the physical therapist' (P) 'You really have to achieve that balance, it is true that if you are very comfortable, you reinforce each other. But it is not good if the patient feels that we do not agree with each other' (T) 'I also like that you can deliberate together, not out of uncertainty, but the fact that the hospital physical therapist is actively involved in the decision-making process positively affects the patient' (T) 'You must be able to adapt to the situation and to various trauma surgeons' (HBP) 'I think you should be able to express what you stand for at the outpatient clinic, what your vision is... of course well substantiated, but you should not be too anxious to say what you think...' (HBP)

Table 3 (Continued)

Level	Theme	Facilitator	Barrier	Illustrative quote
	Awareness of professional boundaries	<ul style="list-style-type: none"> Care providers at the outpatient clinic (trauma surgeon and HBP) take professional boundaries into account 	<ul style="list-style-type: none"> Care providers go across the boundaries of their profession 	<ul style="list-style-type: none"> 'We are usually on the same line about normal content. That may vary, but we do manage that. But it is a problem if they come outside their domain' (T) 'Discomfort arises when the hospital physical therapist makes a statement about non physical therapy topics' (T) 'Once, the physical therapist was not present during my visit. The advice the surgeon gave me about walking with crutches was not really clear for me at that point' (P)
	Job satisfaction	<ul style="list-style-type: none"> Increased job satisfaction for all care providers 		<ul style="list-style-type: none"> 'It's just really nice to work this way' (HBP)
	Contact between HBP and PCNP	<ul style="list-style-type: none"> The possibility of low- threshold contact between HBP and PCNP via email and telephone, in addition to the structural forms of communication The PCNPs feel that they are a substantial part of the care chain 		<ul style="list-style-type: none"> 'Yes, I am really happy that the network physical therapist can easily contact the hospital physical therapist' (P) The primary care physical therapist finds us quicker and easier than before in case they have an acute problem with a patient' (HBP) 'Yes, you are now being encouraged to contact the hospital, the threshold has been lowered enormously' (PCNP)
	Patients' experience	<ul style="list-style-type: none"> Large acceptance of care outcome by the patients due to clear expectation management Patients experience a clear treatment plan and strategy Patients experience it as positive to be treated by a specialised PCNP, having a high level of knowledge and skills Patients are satisfied with care 	<ul style="list-style-type: none"> Receiving conflicting statements regarding prognosis by doctors who do not work according to the TTCM (eg, emergency department) 	<ul style="list-style-type: none"> 'Yes, patients receive better care. At least, that is what we usually hear; that they are satisfied with the care' (T) 'Yes, there is more focus on the everyday things that patients have to deal with' (T) 'The doctor at the emergency department told me very crudely that I would never regain full function again' (P) 'Nobody told me that such a simple fracture could affect my daily live in such an enormous way' (P)
Practice	Practical concerns at the outpatient clinic	<ul style="list-style-type: none"> Availability of a separate consultation room for the HBP Trauma surgeon and HBP work overlapping at outpatient clinic 	<ul style="list-style-type: none"> The HBP who acts as case manager is poorly accessible by telephone for PCNP 	<ul style="list-style-type: none"> 'I really didn't have to wait long, it was my turn quickly' (P) 'Usually, the hospital physical therapist continues to explain exercises and then I start up with the next patient' (T) 'The surgeon spends less time with a patient, he can proceed with the next patient, while I give some extra advice' (HBP) 'For example, I see a patient who comes for wound control without the hospital physical therapist. She does something behind the computer or already examines a new patient with a knee distortion, and then I walk in later' (T)
	Practical concerns at the primary care network	<ul style="list-style-type: none"> In total there is a higher number of referrals for members of the network 	<ul style="list-style-type: none"> The presence of quality differences between PCNPs (both in terms of knowledge and equipment) The absence of a social media platform for HBPs and PCNPs The lack of guarantee on a high number of referrals 	<ul style="list-style-type: none"> 'I think the quality of the connected network practices still varies, and that is regrettable, because the patients expect a lot from such a practice' (HBP)
	Quality and efficiency of care	<ul style="list-style-type: none"> Due to the specialised primary care network, some patients can rehabilitate at home instead of in a clinical rehabilitation setting Patients with simple fractures receive compact advice from HBP and do not need a referral to a PCNP 	<ul style="list-style-type: none"> Absence of awareness of the TTCM in other relevant departments in the hospital (eg, emergency department) 	<ul style="list-style-type: none"> 'Well, we have to realise that we are doing something very special. This is the future of healthcare' (PCNP)
	Workload	<ul style="list-style-type: none"> Lower administrative workload for trauma surgeon 	<ul style="list-style-type: none"> High administrative workload for HBP 	<ul style="list-style-type: none"> 'That means that you have to prepare well, and that preparation takes quite a lot of time. So the TTCM takes more time than just being present at the outpatient clinic' (HBP)
	Knowledge	<ul style="list-style-type: none"> Increased level of knowledge and skills PCNPs have increased expertise in trauma rehabilitation because they treat more trauma patients Trauma surgeon and HBP at outpatient clinic learn from each other's field 		<ul style="list-style-type: none"> 'Yes, I have seen a lot of ankle fractures lately and I noticed that I now have a better view of the course and whether it deviates or not. I recognise certain patterns. I used to have more difficulties with that before' (PCNP)

Yes, the referral form has become a lot more efficient, which makes the care better. But certainly more efficient (trauma surgeon).

The most frequently mentioned barrier on the structural level was 'the absence of reimbursement for the HBP at the outpatient clinic'. This was identified as an important barrier because it seriously hampers broader implementation of the TTCM. Another facilitator that was mentioned by all focus groups on the structural level was the 'availability of guidelines for the most common fractures'. Some participants, however, thought that 'these guidelines are too detailed and do not apply in case of a deviant course in fracture healing'.

Different structural aspects of the TTCM were considered to be more or less important by the various stakeholders. Trauma surgeons, for example, were pleased with the fact that there now was 'a clear infrastructure and clear working agreements at the outpatient clinic'. They liked, for example, that they could briefly discuss the list of patients prior to the multidisciplinary TTCM consultation hour with the HBP. However, they did mention that feedback from the PCNPs sometimes lingered with the HBP and did not reach them. For the HBPs, the 'absence of reimbursement for the HBP at the outpatient clinic' was the most important barrier, and was also mentioned as a barrier by most of the other stakeholders. Another frequently mentioned barrier by the HBPs was 'the occurrence of software failures'. PCNPs indicated that they were very satisfied with the 'use of a standardised referral form' and with the fact that 'the network practice receives an email from the HBP when a new trauma patient is referred'. Furthermore, they highly appreciated the 'functional goals they received from the HBP for trauma patients after each visit at the outpatient clinic'.

The next goal was very clear for everyone, for the surgeon, for the patient, for the physical therapist in the hospital and for us. If that succeeds, we continue to the next goal and otherwise it will be evaluated and adjusted. This is a very clear structure, making the process very satisfying for everyone (PCNP).

Patients were most satisfied with the fact that 'the HBP sets functional goals for trauma patients after each visit at the outpatient clinic'. This functional goal setting provided the trauma patients with clear expectations on their recovery and their expected outcome.

The within-group differences on the structural level were negligible, meaning that the participants of one homogeneous focus group agreed on most themes and subthemes.

Cultural level

On the cultural level, five overarching themes were identified, which were further specified in subthemes, categorised into facilitators and barriers (Table 3). During all focus groups, the 'shared decision-making process at the outpatient clinic' was mentioned as an important facilitator for the implementation of the TTCM. Another theme that was frequently mentioned during all focus groups was the 'contact between the HBP and PCNP' with 'the possibility of low-threshold contact between HBP and PCNP via email and telephone, in addition to the structural forms of communication' as the most mentioned facilitator.

Yes, you are now being encouraged to contact the hospital, the threshold has been lowered enormously (PCNP).

The most mentioned barrier by all focus groups was that sometimes 'care providers contradict each other'.

You really have to achieve that balance, it is true that if you are very comfortable, you reinforce each other. But it is not good if the patient feels that we do not agree with each other (trauma surgeon).

Some differences between the focus groups were noteworthy. Trauma surgeons, for example, emphasised the importance of the 'awareness of professional boundaries', meaning that they perceived

it to be important that the healthcare providers who are present during the outpatient consultations are aware of the boundaries of their own discipline. They sometimes found it hard to strike a balance in co-working with the physiotherapist at the outpatient clinic. After an adequate balance was achieved, trauma surgeons were of the opinion that the quality of care and patient satisfaction increased significantly, and working closely with a HBP became one of the most important assets of the TTCM.

I also like that you can deliberate together, not out of uncertainty, but the fact that the hospital physical therapist is actively involved in the decision-making process positively affects the patient (trauma surgeon).

The HBP also perceived the 'awareness of responsibilities and leadership' to be important. For them, it was at times complicated to adapt to their new role and position within the existing hierarchical culture of the hospital. Despite these challenges, the most important asset of the TTCM according to the HBPs was the fact that 'care providers at the outpatient clinic now act as a team and are unambiguous'.

You must be able to adapt to the situation and to various trauma surgeons (HBP).

PCNPs most frequently indicated that they now felt like 'a substantial part of the care chain'. That is, they now perceived themselves as a member of the trauma patients' treatment team instead of working alone, which was the case before implementation of the TTCM. Another facilitator that was frequently mentioned by the PCNPs was 'the possibility of low-threshold contact between HBPs and PCNPs via email and telephone, in addition to the structural forms of communication'.

Trauma patients were very pleased with the existence of a 'shared decision-making process at the outpatient clinic'. For them, the experience of being involved in the decision-making process and having a voice in formulating their own functional goals was of great importance. This is evidenced by the following quote of a participating patient:

I really liked having a voice in formulating my own goals. During the visits there was time to think and talk about what is important to me, that I wanted to play tennis again. And whether it was actually achievable what I wanted. It really helped me to discuss these issues with the surgeon and the physical therapist (patient).

However, some of the trauma patients indicated that they had 'received conflicting statements regarding prognosis by doctors who do not work according to the TTCM', including those working at the emergency department or trauma ward of the hospital. This was therefore considered to be an important barrier to the implementation of the TTCM.

Within the focus groups there were minor differences among stakeholders. For example, some HBPs indicated that they preferred working with the same trauma surgeon every week, while others preferred to work with various trauma surgeons. The same applied to the trauma surgeons.

Practical level

On the practical level, five overarching themes were identified, which were further specified in subthemes and categorised into facilitators and barriers (Table 3). All healthcare providers indicated that they liked their 'increased level of knowledge and skills' resulting from working with the TTCM. That is, many of them repeatedly stated that they learned a lot from the other healthcare providers they collaborated with.

Stakeholders differed in terms of the practical aspects of the TTCM that they considered to be important. Trauma surgeons and HBPs were of the opinion that the 'availability of a separate consultation room for the HBPs' would improve their way of working. Then, the physiotherapist could examine patients (eg, for function-control or

instructions), while the trauma surgeon could proceed to the next patient.

For example, I see a patient who comes for wound control without the hospital physical therapist. She does something behind the computer or already examines a new patient with a knee distortion, and then I walk in later (trauma surgeon).

Trauma surgeons also indicated that they had a 'lower administrative workload' due to the TTCM, as the HBP was now responsible for the communication with the PCNPs. HBPs, on the other hand, experienced a 'higher administrative workload at the outpatient clinic'. That is, all HBPs indicated that their workload increased due to their new role as case manager, but that working according to the TTCM also gave them energy because they perceived it to be inspiring.

That means that you have to prepare well, and that preparation takes quite a lot of time. So the TTCM takes more time than just being present at the outpatient clinic (HBP).

The PCNPs also indicated that they gained an 'increased level of knowledge and skills' and 'increased expertise in trauma rehabilitation' due to their involvement in the TTCM. As a consequence, they really enjoyed working according to the TTCM.

Yes, I have seen a lot of ankle fractures lately and I noticed that I now have a better view of the course and whether it deviates or not. I recognise certain patterns. I used to have more difficulties with that before (PCNP).

However, for them, 'the lack of guarantee of a high number of referrals' was an important barrier because they preferred a continuous number of new referrals, perceived from a business perspective. For trauma patients, an important barrier was the 'absence of awareness of the TTCM at other relevant departments in the hospital (eg, emergency department)'. As a consequence, they sometimes received conflicting information regarding their treatment and prognosis from physicians from other departments.

The doctor at the emergency department told me very crudely that I would never regain full function again (patient).

The within-group differences were small for the trauma surgeons and HBPs. For the PCNPs, within-group differences were also small, but depending of the number of new referrals they received during the intervention period, they were more or less satisfied with the TTCM. The within-group differences for trauma patients were negligible.

Discussion

This paper describes the results of a process evaluation exploring the extent to which the TTCM, an advanced rehabilitation model for trauma patients, was implemented as intended, and identifies barriers and facilitators associated with its implementation.

The results showed that the TTCM was largely implemented as intended, with a moderate reach (81%), a high dose delivered (99% and 100%) and high dose received (95% and 96%) for the multidisciplinary TTCM consultation hours at the outpatient clinic and the primary care network physiotherapists, respectively. Moderate to high fidelity scores were found (66 to 93%), indicating the extent to which the intervention protocol was followed by the care providers. The fidelity scores regarding the secure email traffic from the PCNPs to the HBP provided the most room for improvement. That is, no secure email was sent to the hospital in 24% of the cases and it was not clearly reported whether functional goals of the patient were achieved or not in 34% of cases.

Focus groups indicated that on the structural level, the 'communication structure of the TTCM' was found to be an important theme,

expressed in several facilitators (eg, the 'use of a secure email system'). The 'absence of reimbursement for the HBP at the outpatient clinic' was identified as a main barrier at the structural level. At the cultural level, the existence of a 'shared decision-making process at the outpatient clinic' was found to be an important facilitator, and the fact that 'care providers sometimes contradict each other' to be a barrier. At the practical level, the 'increased level of knowledge and skills' was an important facilitator and the 'absence of awareness of the TTCM in other relevant departments' was recognised as a barrier. In general, stakeholders were of the opinion that if the barriers were overcome, the quality of care and patient satisfaction were likely to significantly improve after implementing the TTCM.

In trauma surgery and trauma rehabilitation, process evaluations are rare, and therefore an appropriate substantive comparison with the literature is difficult to perform. However, process evaluations have been described in adjoining fields. For example, a mixed-method study of older patients with fragility fractures was found that assessed the relationship between patient-related factors and adherence to 'healthy bone advice' (ie, taking osteoporosis medication and participating in physical activity). The qualitative interviews in this study suggested that feedback from case managers helped participants understand the underlying cause of their fragility fractures and helped them to adhere to the advice.¹⁹ We found similar results regarding the role of the HBP, who acted as case managers. Next to other components of the TTCM, having an appropriate case manager was found to be a crucial factor for successful implementation of the TTCM. Another process evaluation, which was conducted alongside a randomised controlled trial, evaluated the implementation of RESPOND.³⁷ This is a telephone-based falls prevention program including person-centred education and goal setting, designed for older patients visiting an emergency department after a fall, but not necessarily with a fracture. The results from this process evaluation, in which focus groups were held with participants and interviews were conducted with clinicians, provided detailed information to guide future implementation of RESPOND. One of the main findings was that implementation of the intervention was facilitated by the use of 'positive and personally relevant health messages'.³⁷ Parts of the RESPOND intervention program are comparable with the TTCM (eg, personal goal setting), whereas the scope of the TTCM differed from RESPOND (ie, trauma rehabilitation versus prevention). Furthermore, a recently published focus group study among trauma patients, aiming to describe their perceived quality of life at least one year after trauma, found that inadequate aftercare negatively influenced the trauma patients' perceived quality of life.²⁰ However, in contrast to the present study, this focus group study was of a descriptive nature and was not aimed at identifying facilitators and barriers of an intervention. While the aforementioned process evaluations are meaningful and important in their own field, they differ in terms of their design, population and intervention and are therefore not entirely comparable. However, they all confirm or suggest that various elements of an intervention such as the TTCM, aiming to improve rehabilitation and outcome after (major) trauma, are of great importance and that its implementation should be evaluated quantitatively as well as qualitatively, as was done in this study.

This study had several strengths. First, it is believed that it is one of the first studies to apply qualitative research methods in the field of trauma rehabilitation. The use of a mixed-methods approach enabled assessment of both the implementation of the TTCM and its associated barriers and facilitators.³⁸ Second, five homogeneous focus groups were chosen, including a broad range of stakeholders, which had several advantages. That is, according to the literature, five is the optimal number of focus groups for analysis.³⁹ It is important for a broad range of stakeholders to have a voice in focus groups, in order to obtain the maximum amount of information necessary to optimise the possible implementation of the TTCM. Moreover, the use of homogeneous focus groups created a safe environment, in which participants were most likely to speak freely and openly.²⁸ Third, data derived from the focus groups were analysed systematically, using a well-founded theoretical model (ie, the framework method).^{29,30} This

method enabled systematic exploration of the data, while simultaneously maintaining an effective and transparent examination path.³¹ Finally, to optimise the implementation of the TTCM, reflection meetings for the HBPs were held during the implementation phase of the TTCM. These meetings were valuable in gaining insight to their new role and in matching professional responsibilities and borders.

The study also had some limitations. Participants in the focus groups were purposively selected and participated voluntarily, which may have resulted in participants being more content with the TTCM than the average care provider and/or trauma patient. This could have resulted in an overestimation of positive opinions regarding the TTCM, especially in the focus group with trauma patients (FG5). Another limitation was the absence of healthcare decision-makers and insurers in the focus groups; therefore, there was a lack of input from a relevant group of stakeholders regarding the theme 'financial structures' on the structural level. Furthermore, more detailed information could probably have been obtained if interviews were conducted in addition to the focus groups, since in-depth interviews can provide more detailed information on specific topics.²⁵

Information derived from the current process evaluation can be used to further improve the TTCM and to enable the transition of research evidence into clinical practice.^{17,18} The TTCM seems feasible in practice and was implemented as intended for nearly all participants (ie, appropriate reach, dose delivered, dose received and fidelity). Important needs for a successful implementation of the TTCM were 'having an appropriate communication structure' and 'reimbursement for the HBP at the outpatient clinic' on the structural level; the presence of a 'shared decision-making process at the outpatient clinic' on the cultural level; and an 'increased level of knowledge and skills' on the practical level. Additionally, it is known from the literature that other important needs for successfully scaling up and deepening of a new practice include: the establishment of coalitions among strategically chosen parties; transparent organisational structures; a clear division of responsibilities; a change in mind set; and an appropriate legal and financial framework.^{35,40} When these needs are specified, complemented with the results of the current process evaluation, the recommendations for implementation and scaling up of the TTCM shown in Box 1 can be made.

As mentioned above, an important limitation of the current study was the lack of input from healthcare decision-makers and insurers. Their input is important because a structurally embedded reimbursement system for the HBP is required for successful implementation of the TTCM. Consequently, a final recommendation for future research is to include these stakeholders in the focus groups, or to conduct semi-structured interviews with them to obtain a complete overview of facilitators and barriers for implementation of the TTCM.

This process evaluation showed that the TTCM was largely implemented as intended. Various barriers and facilitators were found to be associated with the implementation of the TTCM. Moreover, some differences were found among stakeholders, but they were generally of the opinion that if the barriers were overcome and a good working balance was achieved, the quality of care and patient satisfaction would significantly improve after implementing the TTCM.

What was already known on this topic: Traumatic injury commonly results in long-term functional limitations. The Transmural Trauma Care Model involves a multidisciplinary hospital-based team supervising a network of primary care physiotherapists during the rehabilitation process of trauma patients. This cost-effective model is associated with better patient outcomes.

What this study adds: The Transmural Trauma Care Model can be implemented with good fidelity. Stakeholders recommend that greater fidelity could be achieved with a steering group, clear communication pathways, clear description of responsibilities, reflection meetings and appropriate reimbursement.

Footnotes: ^aSPSS software, SPSS, Chicago, USA. ^bWord software, Microsoft, Redmond, WA, USA.

eAddenda: Appendix 1 can be found online at <https://doi.org/10.1016/j.jphys.2021.08.017>.

Ethics approval: The Medical Ethics Committee of the Amsterdam UMC, location VUmc, assessed the present study and decided that the Dutch Medical Research Involving Human Subjects Act (WMO) was not applicable (registered under number 2013.454). All participants gave informed consent. The trial is registered at the Dutch Trial Register (NTR5474).

Competing interests: Nil.

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