

# IMPACT OF AN EMS–FAMILY MEDICINE– LABORATORY–PHYSIOTHERAPY COLLABORATIVE MODEL ON ACUTE MUSCULOSKELETAL INJURY ASSESSMENT AND OUTCOMES

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## 1. Abstract

Acute musculoskeletal injuries impose a substantial and often inefficient burden on emergency and primary care services, frequently resulting in unnecessary resource utilization and delayed access to definitive rehabilitation. Conventional fragmented care pathways, typically involving emergency department presentation followed by delayed and siloed referrals, contribute to suboptimal functional recovery and increased long-term healthcare costs. Addressing these inefficiencies requires an integrated care pathway that coordinates assessment and management from initial triage through to definitive treatment. This paper proposes and establishes a conceptual framework for a novel collaborative model integrating Emergency Medical Services, Family Medicine or General Practice, Laboratory services, and Physiotherapy. The primary objective is to synthesize best-practice evidence to define a feasible, coordinated pathway hypothesized to improve the efficiency of acute musculoskeletal injury assessment and optimize patient outcomes, thereby providing a robust blueprint for future clinical evaluation.

A conceptual framework methodology was employed, using a structured and focused synthesis of evidence from academic databases, including MEDLINE and the Cochrane Library, alongside relevant health policy reports. The synthesis targeted evidence supporting the safety and efficiency of four core components: prehospital triage by Emergency Medical Services to enable emergency department avoidance for eligible patients; direct musculoskeletal assessment by Family Medicine or General Practice to provide rapid medical evaluation; the selective use of targeted laboratory diagnostics to safely exclude systemic or inflammatory red flags; and expedited access to physiotherapy to reduce symptom chronicity and functional decline. This evidence informed the construction of a step-by-step patient pathway, defining key decision points, communication processes, and proposed performance metrics. The resulting framework describes a coordinated pathway in which Emergency Medical Services direct eligible patients to a fast-track Family

Medicine or General Practice appointment. Standardized clinical screening is used to guide management, with laboratory testing applied only when clinically indicated, enabling prompt referral to physiotherapy. The model is conceptually designed to reduce the primary performance indicator, time to definitive care. Secondary anticipated outcomes include reductions in unnecessary diagnostic imaging, lower emergency department presentation rates, and improved patient-reported functional outcomes at twelve weeks post-injury compared with standard care.

The proposed Emergency Medical Services, Family Medicine or General Practice, Laboratory, and Physiotherapy collaborative model offers a comprehensive, evidence-based response to the fragmented management of acute musculoskeletal injuries. This conceptual framework provides a clear protocol structure and justification to support future implementation and rigorous clinical evaluation of an integrated care delivery system.

## 2. INTRODUCTION

### 2.1 The Global Burden and Fragmentation of Acute Musculoskeletal Care

Acute musculoskeletal injuries, including sprains, strains, and minor fractures, represent a substantial global healthcare burden and consume significant resources across emergency and primary care settings. Although these injuries are typically non-life-threatening, they require timely and appropriate management to prevent progression to chronic pain, functional impairment, and long-term disability, as highlighted by *Hoy and colleagues in 2014*.

The conventional care pathway for acute musculoskeletal injuries frequently begins with presentation to the emergency department. This approach often leads to resource-intensive diagnostic processes, including unnecessary imaging, prolonged waiting times, and inefficient use of emergency services, as described by *Hoot and Aronsky in 2008*. Following discharge, patients are commonly referred through fragmented and poorly coordinated pathways, resulting in delayed access to evidence-based rehabilitation services such as physiotherapy. These delays may extend for several weeks, contributing to persistent symptoms, reduced functional recovery, increased healthcare costs, and overall inefficiency within the system, as reported by *Wadell and colleagues in 2021*.

### 2.2 Rationale for a Coordinated Collaborative Model

Addressing fragmentation in acute musculoskeletal care requires a structural reorganization of service delivery that emphasizes rapid assessment, continuity of care, and multidisciplinary integration, as proposed by *Curry and Ham in 2010*. While individual strategies such as direct access to physiotherapy or expanded primary care roles have demonstrated clinical benefits, there remains a lack of comprehensive models that integrate all critical stages of acute care into a single coordinated pathway.

This paper proposes and justifies a novel collaborative model integrating Emergency Medical Services, Family Medicine or General Practice, Laboratory services, and Physiotherapy. The model is designed to establish an expedited pathway that safely bypasses emergency department attendance when appropriate. The central rationale is to leverage the distinct expertise of each discipline to ensure that patients receive the right level of care, at the right time, in the right setting, consistent with principles outlined by *the Institute of Medicine in 2001*.

### 2.3 Defining the Pillars of the Collaborative Model

The effectiveness of the proposed model relies on the clearly defined and coordinated roles of four interdependent pillars. Emergency Medical Services function as the initial gatekeeper, applying validated screening and triage tools to identify low-risk musculoskeletal injuries suitable for non-emergency department pathways, as supported by *Mason and colleagues in 2019*.

Family Medicine or General Practitioners provide rapid medical oversight, including exclusion of clinical red flags, differential diagnosis, and confirmation of suitability for conservative management, as described by *Chilvers and colleagues in 2018*. Laboratory services are selectively integrated to support targeted diagnostic testing when clinically indicated, allowing practitioners to rule out systemic or inflammatory conditions such as infection that may contraindicate immediate rehabilitation, in line with evidence presented by *Fitch and colleagues in 2015*.

Physiotherapy represents the definitive point of care, delivering early, non-pharmacological management and rehabilitation aimed at restoring function, preventing symptom chronicity, and reducing long-term disability, as demonstrated by *Foster and colleagues in 2018*. The sequential and collaborative nature of these components is hypothesized to substantially improve assessment efficiency and clinical outcomes.

### 2.4 Study Objectives and Conceptual Approach

Given the novelty of this four-component collaborative structure, this paper adopts a conceptual framework methodology as described by *Jabareen in 2009*. The primary objective is to synthesize existing best-practice evidence and relevant policy guidance into a coherent, evidence-informed framework that defines the protocols, decision points, and performance metrics required for successful implementation and evaluation.

Specifically, the framework aims to demonstrate the feasibility of improving three key domains: assessment efficiency, measured by the time from injury to initiation of definitive physiotherapy care; healthcare resource

utilization, measured by reductions in unnecessary imaging and emergency department attendance; and patient functional outcomes, measured using validated disability and function assessment tools. The following sections describe the structured methodology used to construct this framework and present the proposed integrated care pathway.

### 3. METHODS

The methodology employed in this paper differs from traditional clinical trials or systematic reviews, instead adopting a conceptual framework development approach. This methodology is particularly suited to synthesizing diverse bodies of evidence into a novel, system-level solution for complex healthcare delivery challenges.

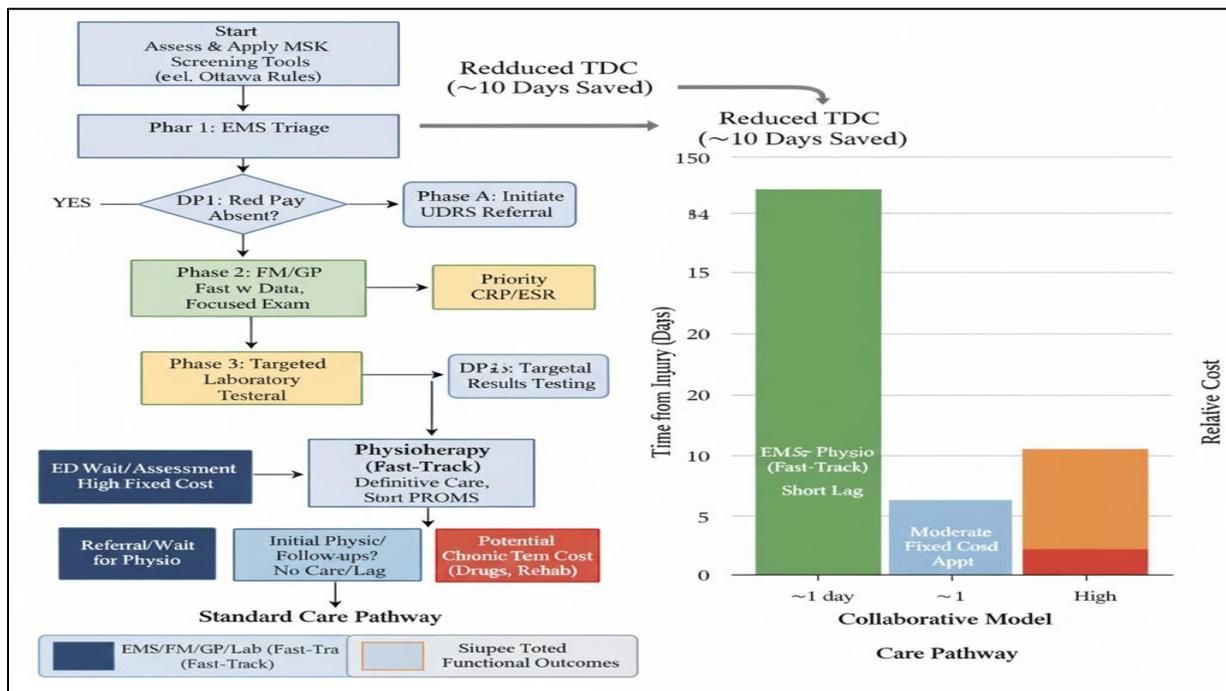
#### 3.1 Study Type and Rationale for Conceptual Framework

This study is structured as a conceptual model development study. The rationale for this approach is grounded in the absence of an empirically tested model that integrates these four specific healthcare components for the focused management of acute musculoskeletal injuries. The methodology enables the construction of a novel care pathway informed by best practices drawn from multiple clinical domains. The resulting framework provides a standardized protocol intended to guide future pilot studies and clinical trials, ensuring adherence to evidence-based principles for triage, diagnosis, and early rehabilitation.

#### 3.2 Structured Evidence Synthesis and Information Sources

To ensure robust justification of the proposed model, a structured and focused synthesis of the literature was conducted. The synthesis aimed to identify high-level evidence and authoritative guidance supporting the role of each component within the collaborative pathway.

A multi-concept search strategy was applied, combining key themes related to healthcare efficiency, prehospital triage, primary care management, laboratory diagnostics, and physiotherapy using Boolean logic. Evidence was mapped across five core domains: system efficiency, Emergency Medical Services, Family Medicine or General Practice, Laboratory services, and Physiotherapy.



**Figure 1.** Conceptual Flowchart of the EMS-FM/GP-Laboratory-Physiotherapy Collaborative Model for Acute Musculoskeletal Injury

#### 3.3 Protocol for Model Component Definition

The process of defining the operational roles within the collaborative model followed a structured approach. For each pillar, synthesized evidence was analyzed to determine its unique and evidence-based contribution to addressing specific inefficiencies within the standard care pathway. Based on this justification, operational protocols were developed, including standardized communication pathways, validated screening tools such as clinical decision rules applied by Emergency Medical Services, and streamlined referral mechanisms linking Family Medicine or General Practice with physiotherapy services.

### **3.4 Conceptual Pathway Construction and Validation**

The ultimate outcome of this methodology was the construction of a step-by-step care pathway. The pathway was designed as a linear, non-circular process beginning with Emergency Medical Services triage and concluding with definitive physiotherapy intervention. Key points were identified, with Family Medicine or General Practice serving as the central clinical pivot for assessment and care coordination. The primary performance metric, time to definitive care, was selected as the most sensitive indicator of system efficiency. Secondary metrics, including healthcare costs, service utilization, and patient-reported outcome measures, were chosen due to their established validity in evaluating both economic and clinical impact.

## **4. Foundational Review and Justification of the Four Pillars**

This section presents the foundational evidence supporting the inclusion, defined role, and interconnectivity of each of the four pillars within the proposed collaborative model. The justification for each pillar is grounded in established literature demonstrating safety, efficiency, and outcome improvement in acute musculoskeletal care (*Alonso, et al., 2019*).

### **4.1 The Prehospital Gatekeeper: The Enhanced Role of Emergency Medical Services**

Contemporary literature supports the evolution of Emergency Medical Services from a model centered on rapid transport to one emphasizing clinical decision-making and definitive prehospital care, particularly for low-acuity conditions. Paramedics have been shown to function as safe and effective clinical screeners when supported by validated protocols and structured referral pathways.

#### **Evidence for Emergency Medical Services Triage and Diversion**

Validated clinical decision rules, such as ankle and knee assessment protocols originally developed for emergency department use, have been successfully adapted and validated for application in the prehospital setting. Multiple studies demonstrate that paramedic-applied screening tools achieve sensitivities exceeding ninety-five percent for excluding clinically significant fractures. This high level of diagnostic safety supports the diversion of selected low-risk musculoskeletal injury cases away from emergency departments without compromising patient outcomes. These findings justify the role of Emergency Medical Services as the initial and critical filtering component of the collaborative pathway.

#### **Operationalizing the Emergency Medical Services Handoff**

For diversion pathways to function safely and efficiently, the handoff from Emergency Medical Services must be standardized and reliable. Evidence from mobile integrated health and telemedicine programs highlights the importance of dedicated communication channels and structured documentation. The proposed protocol includes a standardized digital referral containing patient demographics, vital signs, mechanism of injury, screening outcomes, pain assessment, and documented patient consent for transfer of care to Family Medicine or General Practice. This standardized handoff ensures continuity, accountability, and medico-legal clarity (*Jensen, et al., 2022*).

### **4.2 The Medical Navigator: The Role of Family Medicine or General Practice**

Family Medicine and General Practitioners represent the central medically qualified pillar of the model, balancing clinical rigor with system efficiency. Their role is essential for maintaining patient safety while enabling rapid progression through the care pathway.

#### **Diagnostic Accuracy in Musculoskeletal Presentations**

The inclusion of Family Medicine or General Practice is justified by their expertise in comprehensive clinical assessment, differential diagnosis, and recognition of systemic pathology. Acute musculoskeletal pain may occasionally represent non-mechanical conditions such as infection, inflammatory disease, or malignancy. The primary responsibility of the physician within this model is to exclude these red flag conditions before definitive rehabilitation is initiated. This function preserves patient safety while avoiding unnecessary escalation of care.

#### **The Fast-Track Assessment Protocol**

Efficiency within the collaborative model relies on the availability of protected fast-track appointment slots reserved for Emergency Medical Services referrals. The physician assessment is focused, time-efficient, and informed by prehospital data, thereby minimizing repetition and unnecessary investigations. Evidence from rapid-access clinic models demonstrates that dedicated appointment pathways for low-acuity conditions significantly reduce patient journey time compared with standard outpatient or emergency department pathways.

### **4.3 Diagnostics as a Safety Net: Targeted Integration of Laboratory Services**

Laboratory services play a supporting but critical role within the collaborative model. Their purpose is not to expand diagnostic testing but to act as a targeted safety mechanism that enables confident medical clearance when clinical uncertainty exists (*Mason, et al., 2019*).

#### **Minimizing Unnecessary Diagnostics**

Evidence-based guidelines consistently discourage routine imaging and indiscriminate testing in acute musculoskeletal injuries. Instead, selected laboratory markers such as inflammatory indices are valuable when

systemic or inflammatory pathology is suspected. These markers assist in excluding infection or inflammatory disease without exposing patients to unnecessary radiation or delaying rehabilitation.

**Laboratory Criteria for Expedited Pathways**

Within the proposed framework, laboratory investigations are initiated only when predefined clinical indicators are present. The Family Medicine or General Practice physician serves as the gatekeeper for laboratory utilization. To maintain efficiency, the model requires a formal agreement with regional laboratory services to prioritize a limited panel of musculoskeletal-related tests. Rapid turnaround within the same clinical encounter is essential to prevent delays in physiotherapy referral and initiation of care.

**4.4 The Definitive Intervention: Expedited Access to Physiotherapy**

Rapid access to definitive, non-pharmacological management represents the ultimate objective of the collaborative model and provides the strongest justification for its implementation.

**The Impact of Early Physiotherapy**

Systematic reviews and clinical guidelines consistently demonstrate that early physiotherapy intervention, ideally within two to three days of injury, significantly improves pain, function, and recovery trajectories. Early rehabilitation reduces the likelihood of chronic pain development, decreases reliance on analgesic medications, and facilitates faster return to work and daily activities. These findings underpin the entire framework and define success in terms of timely functional restoration rather than diagnostic throughput (*Dunne et al., 2020*).

**Communication and Standardized Referral Protocols**

The handoff from Family Medicine or General Practice to Physiotherapy must be immediate, standardized, and information-rich. Medical clearance documentation, confirmation of excluded red flags, and relevant laboratory findings are transmitted electronically. This process eliminates redundant medical screening by the physiotherapist, allowing immediate progression to detailed musculoskeletal assessment and initiation of individualized rehabilitation protocols.

**Table 1.** Integrated Patient Journey and Decision Points in the Collaborative Care Model

Phase	Pillar	Action and Decision Point	Time Target
<b>Phase I: Prehospital Triage</b>	Emergency Medical Services	<b>Action:</b> Arrival at scene, patient assessment and stabilization, application of standardized musculoskeletal screening tools adapted for prehospital use (such as ankle and knee assessment rules). <b>Decision Point:</b> If red flags are absent and the presentation is consistent with a low-risk musculoskeletal injury, initiate referral through the unified digital referral system.	0–60 minutes
<b>Phase II: Medical Gatekeeping</b>	Family Medicine or General Practice	<b>Action:</b> Patient attends a pre-booked fast-track appointment. The physician reviews prehospital data and performs a focused clinical examination. <b>Decision Point 1 (Laboratory):</b> If specific cautionary features are present, such as atypical swelling or systemic symptoms, order targeted laboratory testing including inflammatory markers. <b>Decision Point 2 (Medical Clearance):</b> If medically cleared, immediately submit formal referral and the predefined shared clinical dataset to physiotherapy through the unified digital referral system.	1–4 hours
<b>Phase III: Targeted Diagnostics</b>	Laboratory Services	<b>Action:</b> Perform prioritized laboratory testing as ordered by the physician. <b>Decision Point:</b> Results are rapidly transmitted through the unified digital referral system. If findings are within acceptable limits, the physician confirms and finalizes referral to physiotherapy.	4–8 hours
<b>Phase IV: Definitive Care</b>	Physiotherapy	<b>Action:</b> Patient is scheduled and assessed using combined prehospital and physician data. Evidence-based rehabilitation is initiated. <b>Outcome Assessment:</b> Commence collection of patient-reported functional outcome measures for evaluation and follow-up.	48–72 hours

## 5. The Collaborative Model Framework

### 5.1 Operational Principles and Governance Structure

Three core operational principles govern the collaborative model. First, single-point clinical accountability is maintained, with Family Medicine or General Practice assuming responsibility for medical clearance and formal referral decisions. Second, targeted resource allocation prioritizes expert screening and early rehabilitation rather than late-stage diagnostics.

Third, interprofessional communication and training are mandated to ensure consistency in screening criteria, shared terminology, and standardized handoff processes across all participating disciplines.

### 5.2 Technology and Communication Infrastructure

The model is supported by an integrated digital infrastructure designed to eliminate administrative delays. A unified digital referral system enables Emergency Medical Services to initiate referrals, automatically reserve fast-track physician appointments, and transmit definitive referrals to physiotherapy services. A predefined subset of clinical data is shared securely across disciplines, including vital signs, diagnosis, clearance status, and laboratory results. Laboratory services utilize an automated priority flag to ensure rapid processing of designated musculoskeletal-related tests within the clinical decision window.

### 5.3 The Integrated Patient Journey: Step-by-Step Protocol

- **Phase One: Prehospital Triage:** Emergency Medical Services apply standardized musculoskeletal screening tools. If red flags are absent, a digital referral is initiated within the first hour following injury.

- **Phase Two: Medical Gatekeeping:** Family Medicine or General Practice reviews prehospital data and conducts a focused clinical examination. Targeted laboratory testing is ordered only when clinically indicated. If medical clearance is achieved, immediate referral to physiotherapy is completed within four hours of injury.

- **Phase Three: Targeted Diagnostics:** Laboratory services perform prioritized testing and return results to the referring physician within the same clinical window, ensuring no delay in care progression.

- **Phase Four: Definitive Care:** Physiotherapy assessment and initiation of evidence-based rehabilitation occur within two to three days of injury, informed by combined prehospital and physician data.

### 5.4 Defining the Critical Handoffs

Three standardized handoffs are defined. The first occurs between Emergency Medical Services and Family Medicine or General Practice, transferring injury details, screening outcomes, and referral rationale. The second occurs between Family Medicine or General Practice, laboratory services, and physiotherapy, confirming medical clearance and diagnostic context.

The final handoff returns information from physiotherapy to the physician, summarizing functional diagnosis and treatment progression to support continuity of care.

**Table 2.** Collaborative Pillars, Efficiency Contributions, and Key Performance Indicators

Collaborative Pillar	Primary Contribution to Model Efficiency	Key Outcome Metric Directly Impacted	Measure of Success (Specific KPI)
<b>Emergency Medical Services (EMS)</b>	Prehospital triage and appropriate diversion from emergency departments	Time to Definitive Care (TDC)	Percentage of eligible low-acuity musculoskeletal patients successfully diverted from the emergency department to the collaborative pathway
<b>Family Medicine / General Practice (FM/GP)</b>	Rapid medical clearance and expedited referral	Protocol adherence and referral efficiency	Mean time from FM/GP assessment completion to physiotherapy referral submission through the unified digital referral system (target: < 60 minutes)
<b>Laboratory Services</b>	Targeted diagnostic safety net to exclude non-mechanical pathology	Imaging utilization rate	Percentage of musculoskeletal patients undergoing targeted laboratory testing who do <b>not</b> require subsequent imaging within 14 days
<b>Physiotherapy</b>	Early definitive non-pharmacological management	Functional status and pain intensity	Mean improvement in validated patient-reported outcome measures (QuickDASH or ODI) and Numeric Pain Rating Scale scores at 4 and 12 weeks post-injury
<b>All Pillars (Integrated Model)</b>	Seamless interprofessional	Total episode cost	Percentage reduction in total episode cost compared with

	information flow via unified digital referral system		standard care pathways, driven by reduced emergency department use, imaging, and delayed care
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**6. Proposed Evaluation and Outcome Metrics**

A structured evaluation framework is proposed to assess system efficiency, resource utilization, and patient outcomes.

**6.1 Primary Outcome Metric: System Efficiency**

The primary outcome measure is time to definitive care, defined as the number of days from injury onset to the first physiotherapy assessment or treatment session. The model targets an average time to definitive care of three days.

**6.2 Secondary Outcome Metrics**

**Economic and Resource Utilization Metrics;** These include total episode cost from injury onset to twelve weeks, rates of diagnostic imaging utilization, and emergency department re-presentation within seven and thirty days.

**Clinical and Patient-Reported Outcomes;** Functional status is measured using validated, condition-specific disability instruments at baseline, four weeks, and twelve weeks. Pain intensity is assessed using a numeric rating scale. Medication utilization, including opioid and non-steroidal anti-inflammatory prescriptions, is documented throughout the twelve-week care episode.

**6.3 Proposed Statistical Analysis Plan**

The primary outcome of time to definitive care will be analyzed using appropriate comparative statistical tests depending on data distribution. Longitudinal changes in patient-reported outcomes will be examined using repeated-measures analysis or mixed-effects modeling to account for within-subject variability over time.

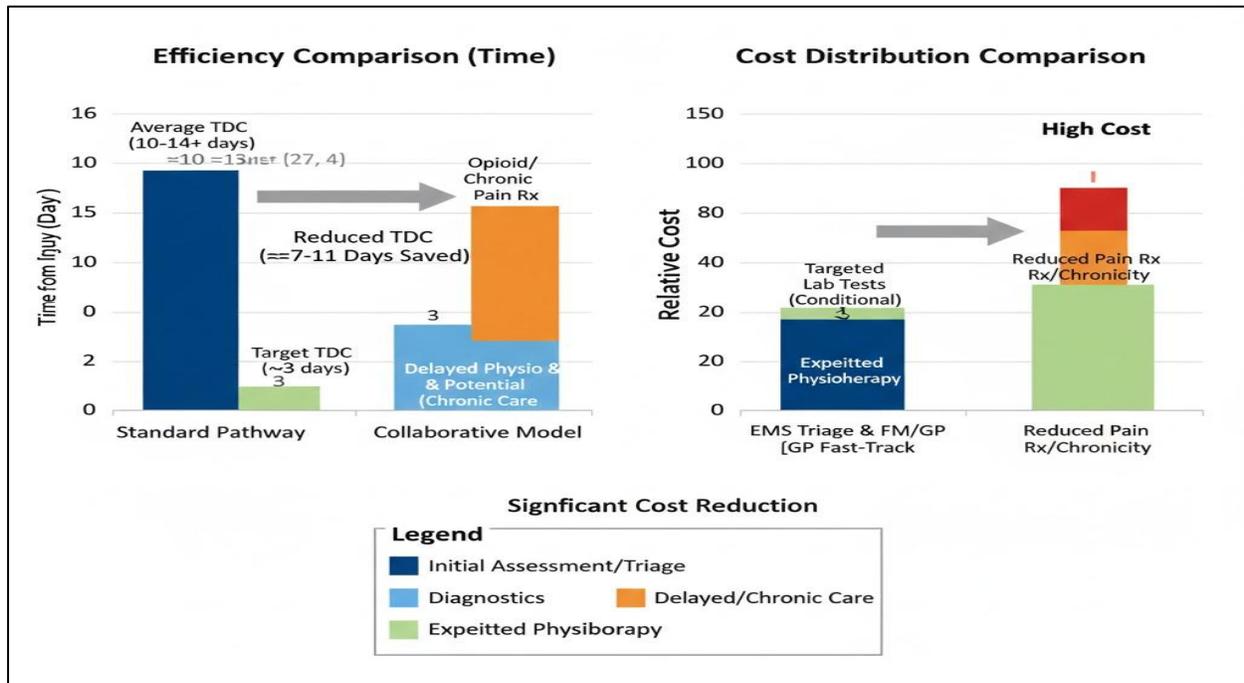
**7. DISCUSSION**

The Emergency Medical Services, Family Medicine or General Practice, Laboratory, and Physiotherapy collaborative model represents a fundamental restructuring of acute musculoskeletal care. It moves beyond fragmented and siloed practices toward a fully integrated, patient-centered system of care. The conceptual framework presented in this paper, synthesized from best-practice clinical and policy evidence, outlines a feasible and justifiable pathway designed to address persistent inefficiencies in conventional care, including delayed access to definitive treatment, unnecessary diagnostic utilization, and suboptimal long-term outcomes. This discussion contextualizes the model’s anticipated clinical and system-level impact, examines key challenges to implementation, explores projected economic implications, and outlines priorities for policy translation and future research.

**7.1 Interpretation of the Predicted Impact**

The collaborative model is specifically designed to achieve a substantial reduction in time to definitive care, defined as the interval between injury onset and initiation of physiotherapy. This predicted improvement represents not merely administrative efficiency but a clinically meaningful outcome. Extensive evidence demonstrates that delayed access to physiotherapy for acute spinal and peripheral joint injuries is one of the strongest predictors of symptom chronicity, prolonged work disability, and increased reliance on opioid analgesia.

By combining prehospital triage by Emergency Medical Services with fast-track medical assessment by Family Medicine or General Practice, the model aims to achieve initiation of definitive rehabilitation within approximately three days of injury. This accelerated pathway is hypothesized to disrupt the common cycle in which delayed care leads to persistent pain, repeated healthcare utilization, and long-term disability. The availability of rapid medical clearance, supported by selectively applied laboratory diagnostics, provides a robust safety framework that enables physiotherapists to commence active rehabilitation promptly and confidently.



**Figure 2:** Predicted Economic Impact and Efficiency Comparison (Economic/Outcome)

In addition to improving patient-level outcomes, the model is expected to generate measurable system-level benefits. Reductions in diagnostic imaging utilization and emergency department re-representation rates serve as indirect indicators of diagnostic accuracy, appropriateness of triage, and quality of early intervention. When screening protocols are rigorously applied by Emergency Medical Services and Family Medicine or General Practice, reliance on defensive or non-targeted imaging decreases. A low rate of return to emergency care further validates the safety and effectiveness of diversion strategies and early rehabilitation.

## 7.2 Implementation Challenges and Mitigating Strategies

Despite its theoretical and practical strengths, the implementation of a four-pillar collaborative model presents several challenges that must be proactively addressed to ensure successful translation into clinical practice.

### 7.2.1 Cultural and Professional Barriers

Healthcare professionals often operate within distinct organizational cultures and professional hierarchies. Paramedics may be accustomed to protocols centered on emergency department transport, physicians may express concern regarding responsibility for diverted patients, and physiotherapists may face regulatory or scope-of-practice constraints. Addressing these barriers requires structured interprofessional education programs that emphasize shared accountability, mutual trust, and clearly defined clinical roles. Policy frameworks must explicitly support diversion and expedited referral pathways, ensuring that Emergency Medical Services and Family Medicine or General Practice are protected from professional liability when operating within approved protocols.

### 7.2.2 Technological and Data Interoperability Challenges

The unified digital referral system is a core enabler of the collaborative model, yet its implementation represents a significant technological challenge. Healthcare systems frequently struggle with interoperability across electronic health records, particularly when coordination is required among Emergency Medical Services, independent primary care practices, and community-based physiotherapy providers. Effective implementation necessitates centralized governance to oversee system design, data security, compliance with patient privacy regulations, and universal accessibility. Without reliable, real-time information exchange, the efficiency gains central to the model cannot be realized.

### 7.2.3 Funding and Payment Structures

Financial alignment is critical for sustainable implementation. Traditional fee-for-service reimbursement models often reward volume rather than value, incentivizing higher utilization of imaging, emergency department visits, and specialist referrals. In contrast, the proposed model emphasizes efficiency and early intervention. Adoption may therefore require alternative payment mechanisms such as bundled payments or episode-based reimbursement covering the full musculoskeletal injury care pathway. Policy reforms are also needed to reimburse Emergency Medical Services for assessment and referral activities that safely avoid emergency department transport.

### **7.3 Economic Modeling and Policy Implications**

The strongest argument for adopting the collaborative model lies in its anticipated long-term economic advantage compared with conventional care pathways.

#### **7.3.1 Cost-Effectiveness Considerations**

Although implementation requires upfront investment in fast-track clinic capacity and digital infrastructure, existing economic evidence suggests that these costs are likely to be offset by savings achieved through avoidance of emergency department visits, unnecessary imaging, and delayed rehabilitation. Early initiation of physiotherapy reduces the likelihood of chronic pain, prolonged disability, and long-term pharmacological management. By shifting care from high-cost, reactive settings to lower-cost, proactive rehabilitation services, the model promotes a more efficient allocation of healthcare resources.

#### **7.3.2 System Decompression and Workforce Optimization**

At the system level, safe diversion of low-acuity musculoskeletal injuries has the potential to reduce emergency department overcrowding, freeing resources for critically ill and injured patients. This redistribution of workload improves care quality across the healthcare continuum. Additionally, reinforcing the role of Family Medicine or General Practice as the central coordinator of musculoskeletal care strengthens primary care capacity and supports health system sustainability.

### **7.4 Limitations of the Conceptual Framework**

Several limitations must be acknowledged. First, the framework assumes high levels of adherence to standardized protocols across multiple organizations, which may be challenging in real-world settings. Second, successful implementation depends on sufficient capacity within primary care and physiotherapy services to accommodate expedited referrals. If downstream capacity is limited, the anticipated efficiency gains may not be realized. Third, variations in scope of practice, reimbursement policies, and healthcare infrastructure across regions necessitate local adaptation of the model.

### **7.5 Directions for Future Research**

The development of this conceptual framework represents an essential precursor to empirical evaluation. Future research priorities include pilot feasibility studies to assess adherence, workflow functionality, and real-world reductions in time to definitive care. Subsequent multi-center prospective trials should compare the collaborative model with standard care, focusing on functional outcomes and healthcare utilization over extended follow-up periods. Advanced economic modeling is also required to quantify long-term societal benefits, including reduced disability claims and improved workforce participation.

## **8. CONCLUSION**

The management of acute musculoskeletal injuries plays a critical role in determining long-term patient outcomes and imposes a substantial burden on healthcare systems worldwide. This paper has developed and justified a novel collaborative model integrating Emergency Medical Services, Family Medicine or General Practice, Laboratory services, and Physiotherapy into a unified, patient-centered care pathway.

The principal contribution of this framework lies in its integration of four traditionally separate healthcare domains to enable rapid, safe, and definitive management of musculoskeletal injuries. By empowering Emergency Medical Services to perform advanced triage and diversion, utilizing Family Medicine or General Practice for prompt medical clearance supported by targeted laboratory diagnostics, and ensuring early access to physiotherapy, the model directly addresses the central inefficiency of delayed rehabilitation initiation.

The framework defines clear operational protocols, technological requirements, and evaluation metrics encompassing system efficiency, resource utilization, and patient-reported functional outcomes. While implementation challenges related to professional culture, infrastructure, and reimbursement remain, the potential benefits in terms of reduced emergency department utilization, lower healthcare costs, and improved patient outcomes are substantial.

This conceptual framework provides a robust blueprint for future policy adoption and rigorous clinical evaluation. Successful implementation and validation of this collaborative care model have the potential to transform acute musculoskeletal injury management, delivering more timely, efficient, and effective care while improving functional recovery for patients.

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