



## Multidisciplinary Sports Medicine Services: An Institutional Case Study of Indonesia Sport Medicine Centre

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### ABSTRACT

**Purpose of the study:** This study examines the institutional structure, operational mechanisms, service programs, and contributions of the Indonesia Sport Medicine Centre (ISMC) Jakarta in managing sports injuries and supporting national athletic performance.

**Methodology:** A descriptive qualitative case study design was employed. Data were collected through in-depth semi-structured interviews with key institutional informants, direct field observations of ISMC facilities and operational processes, and systematic analysis of institutional documents including patient records and rehabilitation logs. Source triangulation and the Miles and Huberman interactive analysis model were applied to ensure validity and credibility of findings.

**Main Findings:** ISMC operates as Indonesia's first integrated private sports medicine clinic under PT Indonesia Sport Venture (ISV), supported by a multidisciplinary team of sports medicine specialists, physiotherapists, and sports science graduates. Core services include injury rehabilitation, Direct VO<sub>2</sub>max testing, biomechanical and postural assessment (DIERS Formetric 4D), medical fitness, and corporate wellness. Between 2012 and 2015, ISMC treated 1,484 patients, including national athletes from multiple sports. Partnerships with PB PABSI, PRSI, PB Djarum, and PERSIB supported elite athlete screening and injury management.

**Novelty/Originality of this study:** This study contributes to the limited literature on sports medicine institutions in Indonesia by providing an institutional analysis of ISMC integrated with recent developments in global sports medicine. The study highlights the strategic importance of multidisciplinary sports medicine systems in enhancing athlete rehabilitation, injury prevention, and national sports performance.

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## 1. INTRODUCTION

The role of sports medicine in supporting elite athletic performance has expanded substantially in recent decades. Contemporary evidence indicates that the integration of sports medicine, physiotherapy, and sports science within a coordinated multidisciplinary framework is essential for optimizing athlete health outcomes, reducing injury burden, and accelerating safe return-to-sport processes [1]-[4]. Countries with well-established

sports medicine systems such as the United Kingdom, Australia, and the United States consistently demonstrate superior athlete performance outcomes in international competitions, suggesting that institutional capacity in sports medicine is a critical determinant of national sporting success [5], [6].

Sports injuries remain a persistent challenge in both elite and developmental sport contexts. Beyond the physical consequences, injuries impose significant psychological distress on athletes and disrupt team performance and long-term athlete development pathways [7]-[10]. Evidence-based rehabilitation approaches, including functional movement training and neuromuscular control interventions, have been shown to reduce reinjury risk and improve return-to-sport efficiency [11]-[14]. In parallel, advances in sports science technologies such as three-dimensional biomechanical analysis, direct  $\text{VO}_2\text{max}$  assessment, and movement screening systems have improved the precision of injury diagnosis and rehabilitation monitoring [15], [16].

Despite these advancements, the effectiveness of sports medicine systems is highly dependent on institutional organization and service integration. In many countries, including developing sport systems, sports medicine services are still fragmented, with weak coordination between medical, physiotherapy, and performance units [17]-[19]. This fragmentation often leads to inconsistent rehabilitation pathways and suboptimal decision-making in athlete return-to-play processes.

In Indonesia, the development of sports medicine infrastructure remains limited compared to the growing demands of elite and competitive sport participation. National sport development programs such as PRIMA have emphasized technical and physical training aspects, while structured integration of sports medicine services is still concentrated in major urban centers and elite institutions [20], [21]. As a result, many athletes face delayed access to specialist care, inconsistent rehabilitation protocols, and premature return-to-sport decisions influenced more by competition schedules than clinical readiness criteria [22], [23]. These conditions highlight a systemic gap between performance demands and medical support systems in Indonesian sport.

Within this context, the Indonesia Sport Medicine Centre (ISMC) Jakarta represents a pioneering private institution that attempts to address these structural limitations through an integrated sports medicine model. Established in 2012 under PT Indonesia Sport Venture (ISV), ISMC provides multidisciplinary services including sports injury rehabilitation, preventive screening, performance testing, and health promotion programs for both elite athletes and active populations [24], [25]. The institution is uniquely positioned within a broader sports business ecosystem, enabling direct access to professional teams and national athletes.

However, despite its strategic role, ISMC has received limited academic attention in indexed scientific literature. Existing research in sports medicine predominantly focuses on injury epidemiology, biomechanical risk factors, and the effectiveness of specific rehabilitation interventions, while institutional-level analyses of how sports medicine centers operate within national sport ecosystems remain scarce, particularly in Indonesia [26]-[29]. This represents a significant knowledge gap, especially given the increasing policy emphasis on sports science and medicine as essential components of elite performance systems [30], [31].

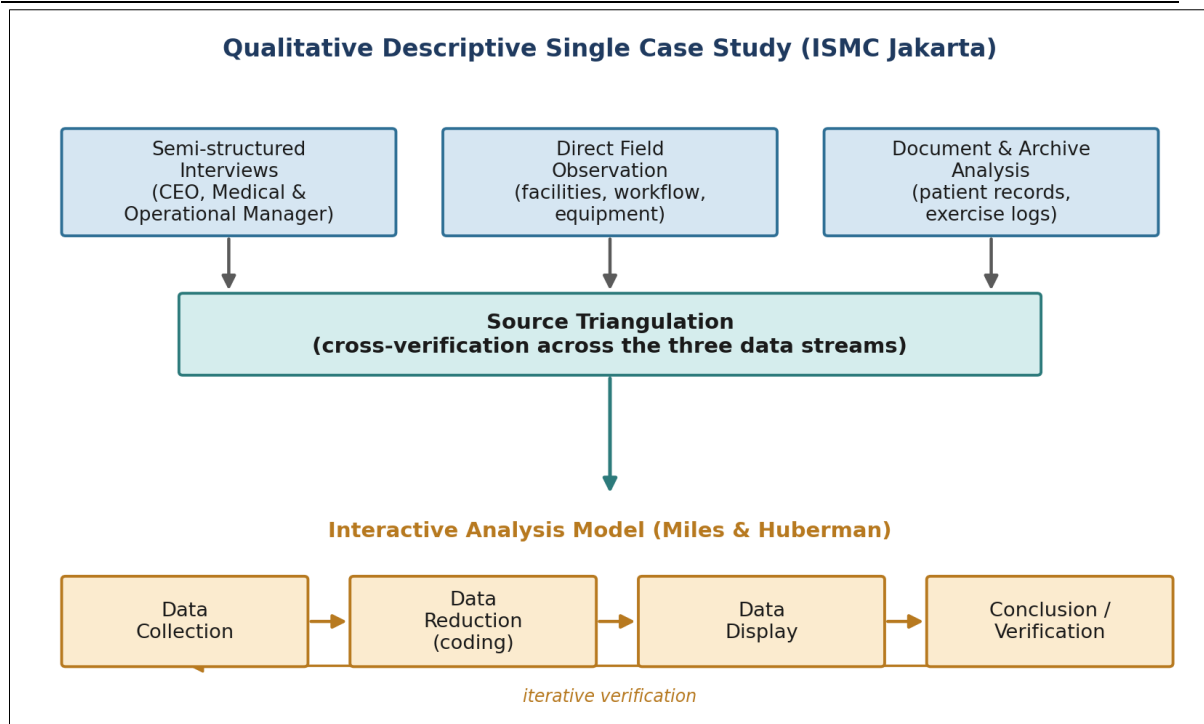
The urgency of this study lies in the need to understand how integrated sports medicine institutions function in resource-constrained and developing sport systems, and how such models contribute to athlete care and national sports performance. Addressing this gap is essential for informing evidence-based policy development and improving the structural integration of sports medicine services within national sport systems.

Accordingly, this study aims to provide an in-depth institutional case analysis of ISMC Jakarta with the following objectives: (1) to describe its institutional structure and governance model; (2) to examine its operational mechanisms and service delivery system; (3) to analyze its contribution to national athlete rehabilitation and sports performance; and (4) to identify systemic challenges and policy implications for the development of sports medicine infrastructure in Indonesia. This study contributes to the limited body of literature on sports medicine institutions in developing countries and provides practical insights for strengthening integrated sports medicine systems at both institutional and national levels.

## 2. RESEARCH METHOD

### 2.1 Research Design

This study employed a qualitative descriptive design using a single-institution case study approach, with the Indonesia Sport Medicine Centre (ISMC) Jakarta as the unit of analysis. A descriptive qualitative design was selected because the research questions required a contextually grounded account, expressed in words rather than numerical measures. Case study methodology is particularly appropriate when investigating contemporary phenomena within real-world contexts in which the boundaries between phenomenon and context are not clearly defined [32]-[36], of how the institution exists, how it is structured, and how it functions within the Indonesian sports medicine ecosystem. The case study method is particularly suited to investigating a contemporary phenomenon within its real-world context, where the boundaries between phenomenon and context are not clearly delineated, and ISMC was chosen purposively as the country's first integrated private sports medicine clinic. The overall design, data sources, triangulation strategy, and analytic workflow are summarised in Figure 1.



**Figure 1.** Research design and analytic workflow of the study.

As illustrated in Figure 1, the study drew on three parallel streams of evidence that converged on a single point of cross-verification before analysis. Semi-structured interviews with the CEO, the Medical Manager, and the Operational Manager captured the institution's governance, clinical function, and service delivery from those with direct managerial knowledge. Direct field observation documented the physical infrastructure, equipment, and operational workflows as they occurred in practice, while document and archive analysis examined patient records, rehabilitation exercise logs, and organisational reports. Each stream was treated as an independent line of inquiry so that claims emerging from one source could be tested against the others.

These three streams fed into source triangulation, in which the interview, observational, and documentary data were systematically compared to confirm convergent findings and to flag any inconsistencies for further scrutiny. This step was central to establishing the credibility of the account, ensuring that conclusions rested on corroborated evidence rather than on any single informant or document.

The triangulated material was then analysed using the interactive analysis model of Miles and Huberman, which proceeds through four interrelated stages: data collection, data reduction through coding, data display, and conclusion drawing and verification. Crucially, these stages were not strictly linear but iterative; as the diagram indicates, the verification stage fed back into earlier stages, allowing emerging interpretations to be re-examined against the data and refined until the findings were internally consistent and stable. This cyclical movement between reduction, display, and verification continued until no substantively new insight emerged, providing the analytic basis for the results presented in the following section.

## 2.2 Research Setting and Subject

The research was conducted at ISMC, located at the Senayan Golf Driving Range, Gelora Bung Karno Sports Complex, Jl. Pintu V, Central Jakarta. The subject of the study was ISMC as an institution, examined in terms of its existence as a sports medicine centre, its organisational form, and the function and working mechanisms of the institution in supporting national sporting achievement.

## 2.3 Informants and Sampling

Informants were selected using purposive sampling combined with a snowball (respondent-driven) technique [37], in which initial key informants identified further individuals with direct knowledge of the institution's management and clinical operations. Sampling continued until data saturation, the point at which additional sources yielded no substantively new information. The principal data sources are listed in Table 1.

Table 1. Informants and primary data sources.

| Source                  | Role / Type                                 | Information obtained  |
|-------------------------|---|---|
| Chief Executive Officer | Sports medicine specialist; founder of ISMC | Institutional existence, vision, role in national achievement |

| Source                  | Role / Type  | Information obtained                                      |
|-------------------------|--|---|
| Medical Manager         | Sports medicine specialist                         | Clinical function, service programmes, working mechanisms |
| Operational Manager     | Operations lead                                    | Organisational form, governance, staffing                 |
| Institutional documents | Patient records, exercise logs, reports, brochures | Patient profile, partnerships, clinical workflow          |

As shown in Table 1, the three human informants were selected for their complementary vantage points strategic, clinical, and operational, so that the institution could be examined from leadership, medical, and managerial perspectives at once. The institutional documents served as a fourth, non-reactive source, allowing the informants' accounts to be checked against contemporaneous records. Together these sources provided the breadth and corroboration needed to address the research questions, and the data drawn from them were gathered through the techniques described below.

## 2.4 Data Collection Techniques

Three complementary techniques were used to enable methodological and source triangulation. First, in-depth semi-structured interviews were conducted with the key informants using an open-ended, conversational format guided by a pre-prepared instrument; sessions were audio-recorded with consent and transcribed verbatim, supplemented by field notes. Second, direct field observation was undertaken across multiple visits to document the physical infrastructure, rehabilitation equipment, clinical workflows, and operational processes [38]. Third, document and archive analysis was performed on patient records, rehabilitation exercise logs, service brochures, and records of partnerships with sports federations. To strengthen the validity of the findings, data-source triangulation was applied, cross-verifying information obtained from interviews, observation, and documents [39].

## 2.5 Data Analysis

Data were analysed using the interactive analysis model of Miles and Huberman, comprising four iterative stages: data collection, data reduction, data display, and conclusion drawing and verification [40]-[42]. During data reduction, raw material from interviews, observation, and documents was coded according to a classification scheme aligned with the research questions and then categorised to build coherent thematic units. The reduced data were organised into structured descriptive displays to facilitate pattern identification, and conclusions were drawn progressively and verified through triangulation across the multiple data sources, ensuring the internal consistency and credibility of the findings.

## 3. RESULTS AND DISCUSSION

### 3.1 Institutional Profile and Governance

ISMC was established in 2011–2012 as a private sports medicine clinic operating under PT Indonesia Sport Venture (ISV), a subsidiary of the Mahaka Group. Within this ecosystem, ISV also oversees the Satria Muda Pertamina basketball club, Indonesia Warriors, and the Indonesia Basketball Camp, so that ISMC is institutionally embedded within a larger sports conglomerate. This configuration provides the clinic with a stable operational base and direct access to elite athlete populations that are not commonly available to stand-alone facilities. The clinic occupies a 400 m<sup>2</sup> facility within Jakarta's principal sports district and is led by a CEO who is a sports medicine specialist, supported by a multidisciplinary team of sports medicine specialists, licensed physiotherapists, and sports science graduates. The governance and team structure are presented in Figure 2.

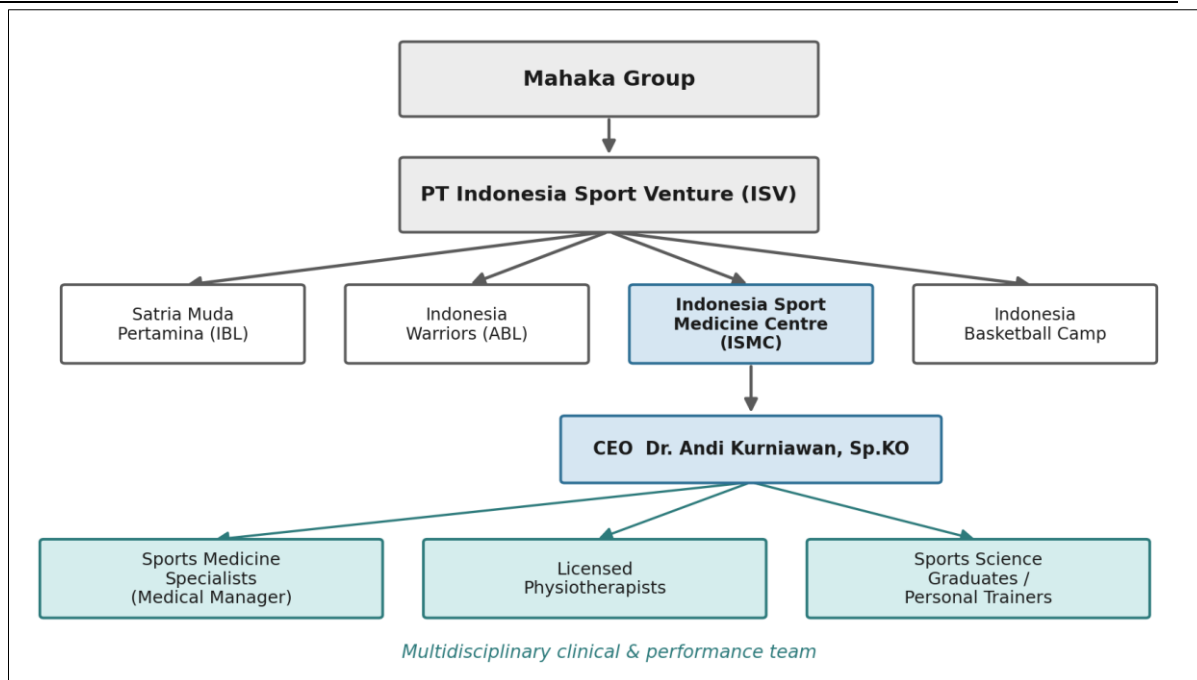


Figure 2. Institutional governance and multidisciplinary team structure of ISMC.

This organisational configuration, in which medical, physiotherapy, and sports science expertise are integrated within a single team, aligns with the integrated performance-health management model advocated in contemporary elite sports medicine literature, and reflects a deliberate attempt to embed a functioning health system within the sporting organisation rather than relying on ad hoc consultation.

**3.2 Facilities and Service Programmes**

ISMC delivers six categories of integrated sports medicine services, supported by both conventional physiotherapy modalities and advanced diagnostic technology. The facility includes a purpose-built 20 m shock-absorbing jogging track, two physician examination rooms, an eight-bed therapy and sports-massage room equipped with therapeutic ultrasound, TENS and short-wave diathermy, and a strength and conditioning area with treadmills, static cycles, and resistance machines. The service portfolio is summarised in Table 2.

Table 2. Service programmes and supporting technology at ISMC.

| Service programme                     | Description  | Key technology                        |
|---------------------------------------|--|---------------------------------------|
| Sports injury management              | Diagnosis, therapeutic modalities, functional rehabilitation and return-to-sport programming | Ultrasound, TENS, SWD                 |
| Medical fitness programme             | Exercise-based health programmes under the “Exercise is Medicine” framework                  | Fitness assessment                    |
| Corporate wellness programme          | Workplace health and fitness services  | —                                     |
| Supplementary examination & treatment | Platelet-rich plasma (PRP), isometric muscle-strength testing                                | DIERS Myoline                         |
| Direct VO <sub>2</sub> max testing    | Direct cardiorespiratory performance assessment  | H/P Cosmos treadmill; Cortex software |
| Foot scan & postural analysis         | Three-dimensional optical stereographic spinal and postural measurement                      | DIERS Formetric 4D                    |

The presence of three-dimensional postural analysis (DIERS Formetric 4D) and direct VO<sub>2</sub>max testing represents a notable competitive advantage in the Indonesian context. Evidence from high-performance environments indicates that biomechanical assessment and functional movement screening substantially improve the identification of injury-risk factors and the precision of individualised rehabilitation programming.

**3.3 Clinical Operations and Injury-Management Pathway**

The injury-management protocol at ISMC follows a structured, evidence-based clinical pathway. Care begins with anamnesis and physical examination, proceeds through supporting diagnostics where indicated (MRI or X-ray, laboratory tests, and fitness or functional movement screening), and leads to a formal injury diagnosis. An individualised therapy programme is then formulated, combining physiotherapy modalities with a functional

rehabilitation programme built on kinetic-chain exercise, core stabilisation, neuromuscular efficiency, and integrated movement. Progress is monitored through a documented exercise log that records each therapy session under physician supervision, providing a traceable record and a transparent mechanism of physician–physiotherapist coordination. Return-to-sport decisions are made on the basis of clinical readiness testing. This pathway is depicted in Figure 3.

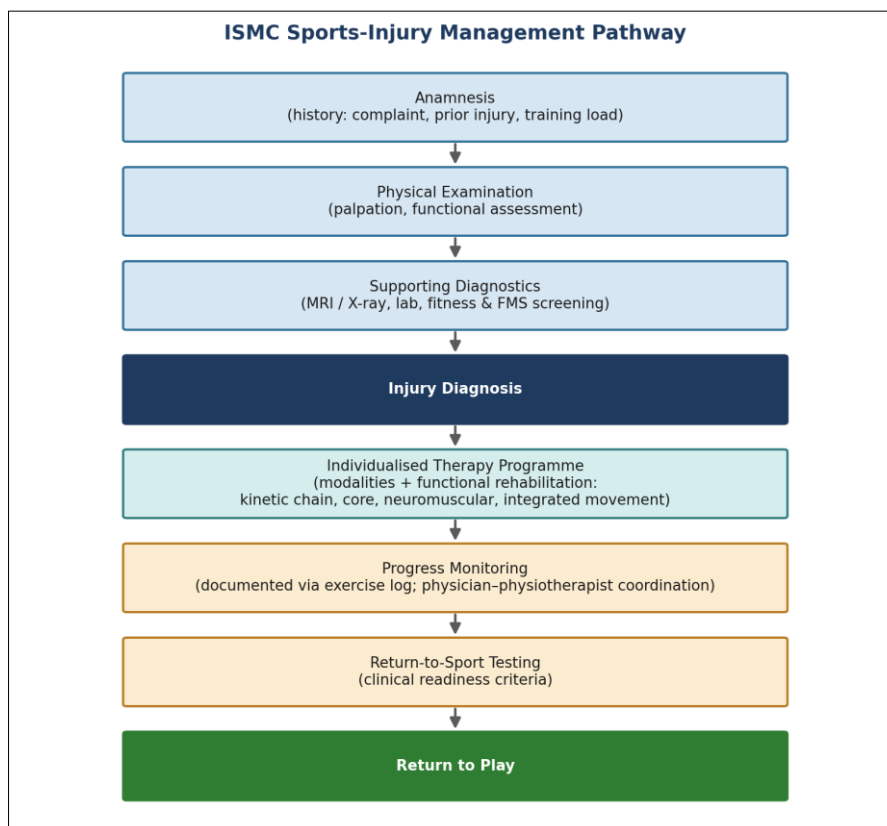


Figure 3. Clinical sports-injury management pathway at ISMC, from intake to return to play

A central aim of injury management at ISMC is not merely to relieve pain and symptoms but to restore the client’s capacity to return to normal activity, with the functional rehabilitation programme simultaneously reducing the risk of future injury. The exercise-log mechanism is consistent with best-practice standards in athlete health management, in which written documentation underpins interprofessional coordination and continuity of care.

### 3.4 Patient Profile and National Athlete Rehabilitation

Between June 2012 and June 2015, ISMC treated a total of 1,484 patients, encompassing both elite athletes and the general sports-active population. Among these, 29 national-level athletes were documented across eight sports. To preserve patient confidentiality, individual identities and case-level diagnoses are not reproduced; instead, the documented national-athlete cases are summarised in aggregate by sport in Figure 4 and by anatomical region of injury in Table 3.

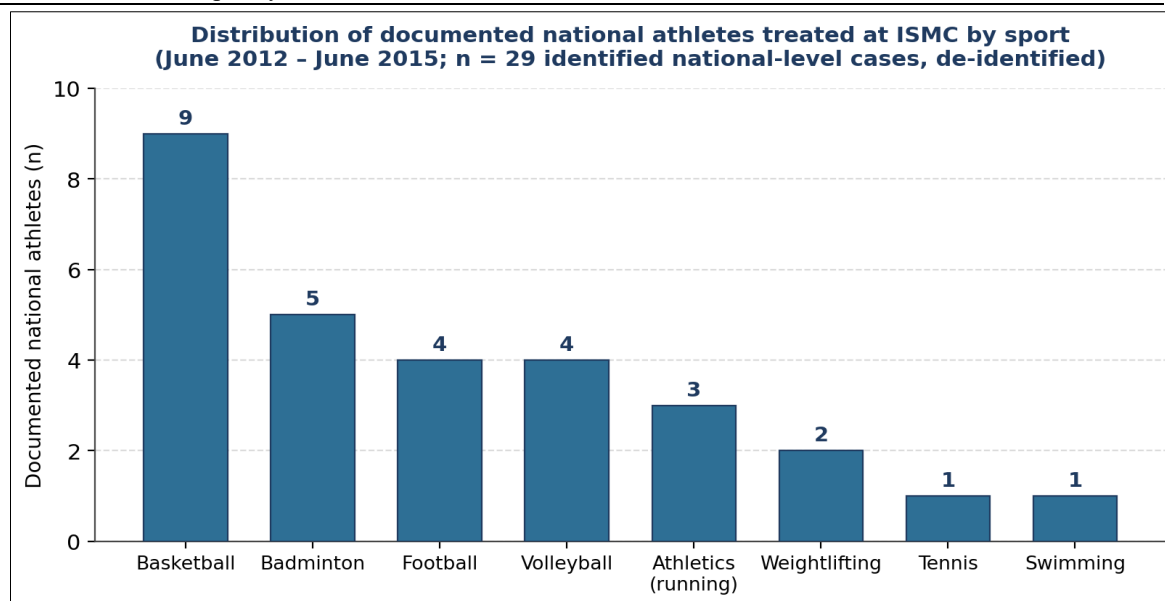


Figure 4. Distribution of documented national-level athletes treated at ISMC

Table 3. Distribution of documented national-athlete cases by anatomical region of injury (de-identified; n = 29)

| Anatomical region   | Cases (n) | Share (%) |
|---|-----------|-----------|
| Knee (ACL, meniscus, cartilage, PFPS, OA, jumper's knee, MCL/LCL) | 14        | 48.3      |
| Hip / groin   | 4         | 13.8      |
| Ankle   | 3         | 10.3      |
| Foot (plantar fascia, metatarsal)                                 | 2         | 6.9       |
| Shoulder  | 2         | 6.9       |
| Wrist   | 2         | 6.9       |
| Lower leg (tibial stress fracture)                                | 1         | 3.4       |
| Lumbar spine  | 1         | 3.4       |
| Total   | 29        | 100.0     |

The case profile is dominated by knee pathology, which accounts for almost half of the documented national-athlete cases, followed by hip/groin and ankle injuries. This pattern is consistent with the well-documented epidemiology of lower-limb injuries in jumping, sprinting, and cutting sports, and reflects the institution's prominent role in post-surgical knee rehabilitation, including anterior cruciate ligament reconstruction, among elite athletes.

### 3.5 Institutional Partnerships and Contribution to National Achievement

ISMC's contribution to national sporting achievement is operationalised through formal partnerships with national federations and elite clubs, each taking a different form along a preventive–curative–rehabilitative continuum, as summarised in Table 4.

Table 4. Institutional partnerships and modes of collaboration.

| Partner                          | Sport         | Mode of collaboration  |
|----------------------------------|---------------|--|
| PB PABSI                         | Weightlifting | Primary injury-management referral; support in preparation for the 2016 Rio Olympics |
| PRSI                             | Swimming      | Injury-risk screening and prevention programmes for developing athletes              |
| PB Djarum                        | Badminton     | Injury management for club athletes referred to ISMC                                 |
| PERSIB Bandung                   | Football      | Pre-contract health and injury-risk screening, including foreign recruits            |
| Satria Muda / Indonesia Warriors | Basketball    | Ongoing integrated team athlete-health management                                    |

These partnerships demonstrate a functioning continuum of care: preventive screening for federations such as PRSI and PERSIB, curative and rehabilitative management for PABSI and PB Djarum, and continuous in-

house athlete-health management for the affiliated basketball clubs. Collectively they illustrate how a single multidisciplinary institution can be integrated into the national sports ecosystem to support athlete availability and competitive readiness.

### 3.6 Discussion

ISMC Jakarta represents an integrated sports medicine institution embedded within a structured sports business ecosystem under PT Indonesia Sport Venture (ISV), a subsidiary of the Mahaka Group. Established in 2012 in Jakarta's central sports district, the clinic operates through a multidisciplinary governance structure involving sports medicine physicians, physiotherapists, and sports science professionals. This configuration reflects an integrated performance health management model widely recommended in elite sport systems, where medical and performance services are coordinated within a unified framework to optimize athlete care, rehabilitation, and return-to-sport processes [43], [44]. Its positioning within a broader sports conglomerate further strengthens institutional capacity by enabling direct access to elite athlete populations that are typically unavailable to independent clinical facilities [45], [46].

The service model implemented at ISMC demonstrates a comprehensive and evidence-based approach to sports medicine, integrating injury management, rehabilitation, performance monitoring, and preventive health services. Clinical care follows a structured pathway beginning with anamnesis, physical examination, and diagnostic imaging where necessary, followed by individualized rehabilitation programming. Rehabilitation is grounded in functional movement principles, including kinetic chain training, core stabilization, neuromuscular control, and sport-specific movement integration. Continuous documentation through structured exercise logs ensures transparency and interprofessional coordination, aligning with contemporary standards in athlete health management [47], [48]. Beyond injury care, ISMC also provides medical fitness programs, corporate wellness services, and advanced diagnostic modalities such as platelet-rich plasma therapy, direct  $\dot{V}O_{2\max}$  testing, isometric strength analysis using DIERS Myoline, and three-dimensional postural assessment using DIERS Formetric 4D systems [49], [50].

The integration of advanced diagnostic technologies represents a significant development in the Indonesian sports medicine context, particularly in improving diagnostic precision and rehabilitation planning. Evidence from high-performance sport systems indicates that biomechanical and physiological assessment tools play a critical role in identifying injury risk factors and optimizing individualized recovery strategies [51], [52]. However, despite this technological advancement, access remains geographically concentrated in Jakarta, highlighting persistent inequalities in sports medicine distribution across regions in Indonesia [53], [54].

Between 2012 and 2015, ISMC treated 1,484 patients, including 29 national-level athletes across multiple sports. The dominance of lower-limb injuries, particularly knee-related pathology, reflects established epidemiological patterns in high-intensity sports involving jumping, sprinting, and cutting movements. These cases illustrate ISMC's central role in managing complex sports injuries, including post-operative rehabilitation and return-to-competition preparation for elite athletes, thereby contributing to national athlete availability and performance continuity.

ISMC also functions as a strategic node within Indonesia's elite sport ecosystem through formal collaborations with national federations and professional clubs. These partnerships span preventive screening (e.g., swimming and football), curative rehabilitation (e.g., weightlifting and badminton), and integrated athlete health management (basketball clubs). This continuum of care reflects modern sports medicine systems in which prevention, treatment, and rehabilitation are structurally integrated to support long-term athlete development and competitive readiness [55], [56].

Overall, the findings indicate that ISMC represents a functional model of integrated sports medicine that addresses a structural gap within Indonesia's sport healthcare system. Its multidisciplinary configuration aligns with international best practices emphasizing collaboration between medical, therapeutic, and performance science professionals to optimize athlete health outcomes [57], [58]. The institution also implicitly reflects a biopsychosocial understanding of sports injury, acknowledging the interaction between physical, psychological, and social factors in rehabilitation and return-to-sport processes.

A critical challenge identified in this institutional model is the pressure exerted on medical teams to authorize premature return-to-sport decisions driven by competitive scheduling rather than clinical readiness criteria [59], [60]. This phenomenon reflects a broader and well-documented ethical tension in elite sport, where athlete health protection responsibilities may conflict with performance and competitive demands [61], [62]. The absence of standardized clinical outcome tracking systems such as reinjury rates, rehabilitation timelines, and return-to-sport success rates, further limits the institution's ability to demonstrate evidence-based effectiveness and strengthen clinical decision-making processes.

Despite these challenges, the study identifies important practical implications. First, ISMC demonstrates that integrated multidisciplinary collaboration enhances continuity and efficiency in athlete care delivery. Second, the integration of advanced diagnostic technologies supports more precise and individualized rehabilitation planning. Third, embedding sports medicine services within a broader sports ecosystem enhances access to elite

athletes and strengthens coordination between medical and performance systems. Collectively, these findings support the relevance of integrated sports medicine models in improving athlete health management in high-performance sport environments.

Finally, several limitations must be acknowledged. As a single-case study conducted in one institution in Jakarta, the findings are context-specific and cannot be broadly generalized, although they may be transferable to similar high-performance sport settings [63]. The retrospective nature of the data (2012–2015) limits the ability to capture recent institutional developments, including governance changes or external disruptions such as the COVID-19 pandemic. Furthermore, the limited number of key informants restricts the diversity of stakeholder perspectives, particularly from frontline clinicians, athletes, and federation administrators. In addition, the absence of standardized quantitative outcome measures limits the ability to evaluate clinical effectiveness in measurable terms. Future research should adopt mixed-methods and multi-site designs incorporating standardized performance and rehabilitation outcome indicators to strengthen evidence-based evaluation of integrated sports medicine systems.

#### 4. CONCLUSION

This study provides the first systematic institutional analysis of ISMC Jakarta as Indonesia's pioneer integrated private sports medicine clinic. The findings demonstrate that ISMC has established a functionally effective multidisciplinary sports medicine model, encompassing sports injury rehabilitation, biomechanical assessment, cardiorespiratory performance testing, and comprehensive partnerships with national sports federations. Between 2012 and 2015, ISMC treated 1,484 patients including 12 identified national athletes from badminton, weightlifting, swimming, athletics, and football, contributing directly to athlete recovery and competitive readiness.

Six principal conclusions are drawn from this study. First, ISMC's institutional structure under PT Indonesia Sport Venture provides organizational stability and elite athlete access within the Mahaka Group sports ecosystem. Second, the multidisciplinary team configuration integrating sports medicine specialists, physiotherapists, and sports science graduates enables comprehensive, evidence-aligned injury management. Third, ISMC's clinical protocols follow structured, evidence-based pathways from initial assessment to return-to-sport determination, with inter-professional coordination documented through exercise logs. Fourth, institutional partnerships with PB PABSI, PRSI, PB Djarum, and PERSIB Bandung demonstrate a functioning preventive-curative-rehabilitative continuum of care. Fifth, premature return-to-sport pressure from team management remains the principal ethical and clinical challenge to optimal rehabilitation outcomes. Sixth, the absence of systematically collected clinical outcome data limits ISMC's capacity for evidence-based institutional evaluation and quality improvement.

Based on these findings, the following recommendations are proposed. For national sports policy: the Ministry of Youth and Sports should develop an explicit policy framework incentivizing the establishment of integrated sports medicine clinics across all provinces, utilizing public-private partnership models analogous to ISMC. For sports organizations: the integration of sports medicine medical teams as permanent structural components rather than ad hoc consultants of athlete development programs is essential. For educational institutions: curricula integrating sports medicine, physiotherapy, and sports science should be developed to expand the pipeline of qualified multidisciplinary practitioners. For future research: longitudinal mixed-methods studies examining clinical rehabilitation outcomes, athlete satisfaction, and institutional effectiveness across multiple Indonesian sports medicine centers are urgently needed to build a robust evidence base for policy development.

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#### AUTHOR CONTRIBUTIONS

Conceptualization, A.N.W.; Methodology, A.N.W. and U.C.B.; Investigation, A.N.W., M.M.K., Z.M.N., and U.C.B.; Data Curation, A.N.W. and M.M.K.; Formal Analysis, A.N.W.; Literature Review and Synthesis, A.N.W., M.M.K., Z.M.N., and U.C.B.; Writing – Original Draft Preparation, A.N.W.; Writing – Review & Editing, A.N.W., M.M.K., Z.M.N., and U.C.B.; Visualization, M.M.K. and Z.M.N.; Project Administration, A.N.W.; Supervision, A.N.W.

**CONFLICTS OF INTEREST**

The authors declare no conflict of interest.

**USE OF ARTIFICIAL INTELLIGENCE (AI)-ASSISTED TECHNOLOGY**

Not applicable.

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