

Digital-serology triage gets the right patients seen sooner, cutting delays while making better use of limited specialist capacity

HSD 21

Redesigning Musculoskeletal Referral Pathways in Europe: System-Level Effects of a Digital-Serology Triage Model

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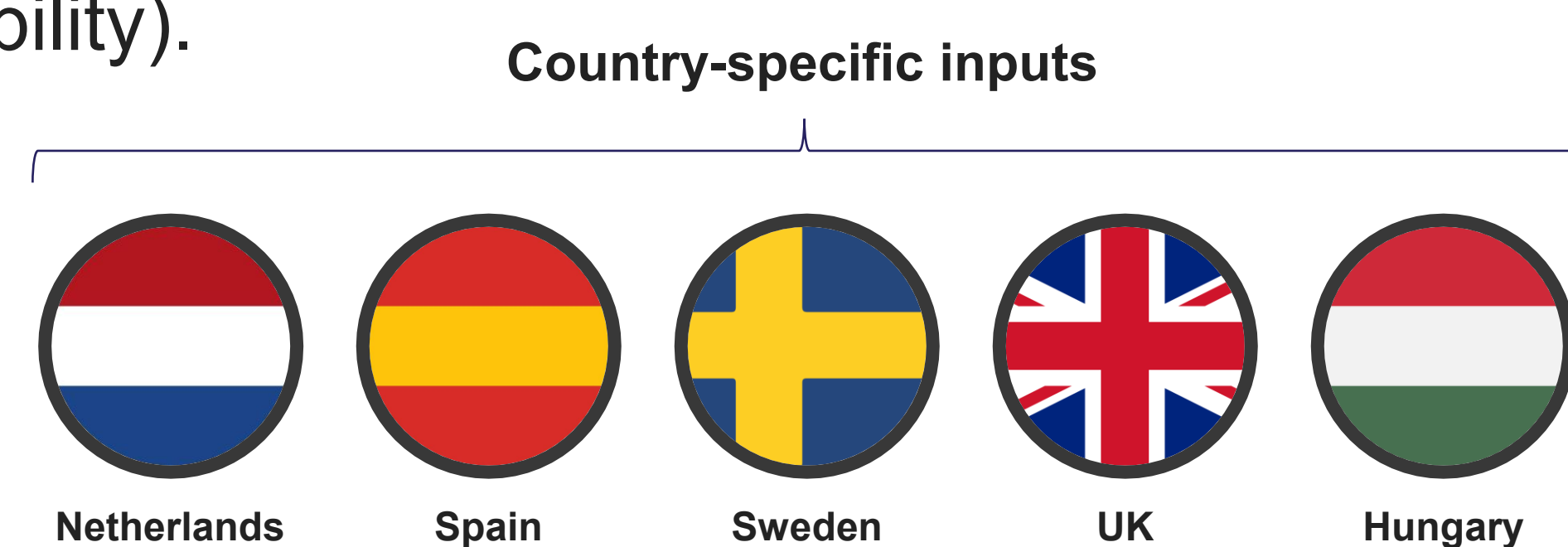
BACKGROUND: Musculoskeletal (MSK) complaints are a major system-level burden, affecting ~120 million in Europe and 1.71 billion globally, accounting for ~1/3 of GP visits and driving disability and healthcare costs¹⁻⁴. Referral pathways are inefficient: only 0.9–3.3% of MSK GP visits are referred to rheumatology, yet 45–64% are returned within ≤3 months, and ~60% of specialist visits yield no inflammatory diagnosis⁵⁻⁷.

Early treatment "window of opportunity" for RA is weeks to months; many proposed as soon as 12 weeks⁸. Yet, delays extending months to years lead to worse outcomes, irreversible damage, and reduced remission⁹⁻¹¹. These issues are compounded by a worsening rheumatologist shortage, further constraining access and system efficiency¹².

OBJECTIVE: Through early modeling, this study evaluates the potential system-level impact of an integrated digital-serology triage pathway (IDSTP) on diagnostic efficiency, referral appropriateness, and resource allocation in primary care MSK pathways based on data for the SPIDeRR project (figure 1).

METHODS: We constructed a discrete event simulation (DES) model to represent patient flow through primary care, referral, and specialist care under capacity constraints, comparing usual care versus decision-supported triage (figure 2).

- The model captures time dynamics (queues, waiting times), referral patterns, and resource limitations (limited specialist availability).
- Referral patterns and pathway parameter inputs from published SPIDeRR data^{5,6}.
- Scenario analyses varied diagnostic accuracy, gatekeeping behavior, and specialist capacity.



About the project: SPIDeRR (2023-2028)



Stratification of Patients using advanced Integrative modelling of Data Routinely acquired for diagnosing Rheumatic complaints



Project Objective

- Improve care and disease classification for patients with MSK and rheumatic complaints
- Improve diagnosis and referral decisions
- Shorten the patient journey

Three Key Deliverables

- 1. For Patients and Primary Care: "Rheumatic?"** – an online symptom checker that differentiates inflammatory vs non-inflammatory conditions
→ Provides disease risk scores and guides whether to seek GP or specialist care
- 2. For Primary Care: "Modular-SPIDeRR"** – a decision-support tool integrating symptoms (questionnaire), electronic health records, blood tests (serology)
→ Estimates disease probabilities and need for further testing or referral
- 3. For Specialists: "Rheumatic Digital Twin"** – an advanced model using multimodal data (clinical, biological, patient-reported)
→ Identifies subtypes, supports diagnosis and treatment decisions, predicts outcomes

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Figure 1. Background information on the SPIDeRR project

RESULTS:

System Impact (Pathway Efficiency)

Model-based results show that IDSTP improves triage efficiency, with **~25% reduction in referral rates** and **diagnostic delay reduced by ~1–2 months** in strong systems and up to 5–10 months in weaker systems.

Robustness of Findings

Direction of effect was **consistent across key scenarios**, including variations in gatekeeping strength and specialist capacity, indicating stable system-level benefits despite uncertainty.

Resource Utilization

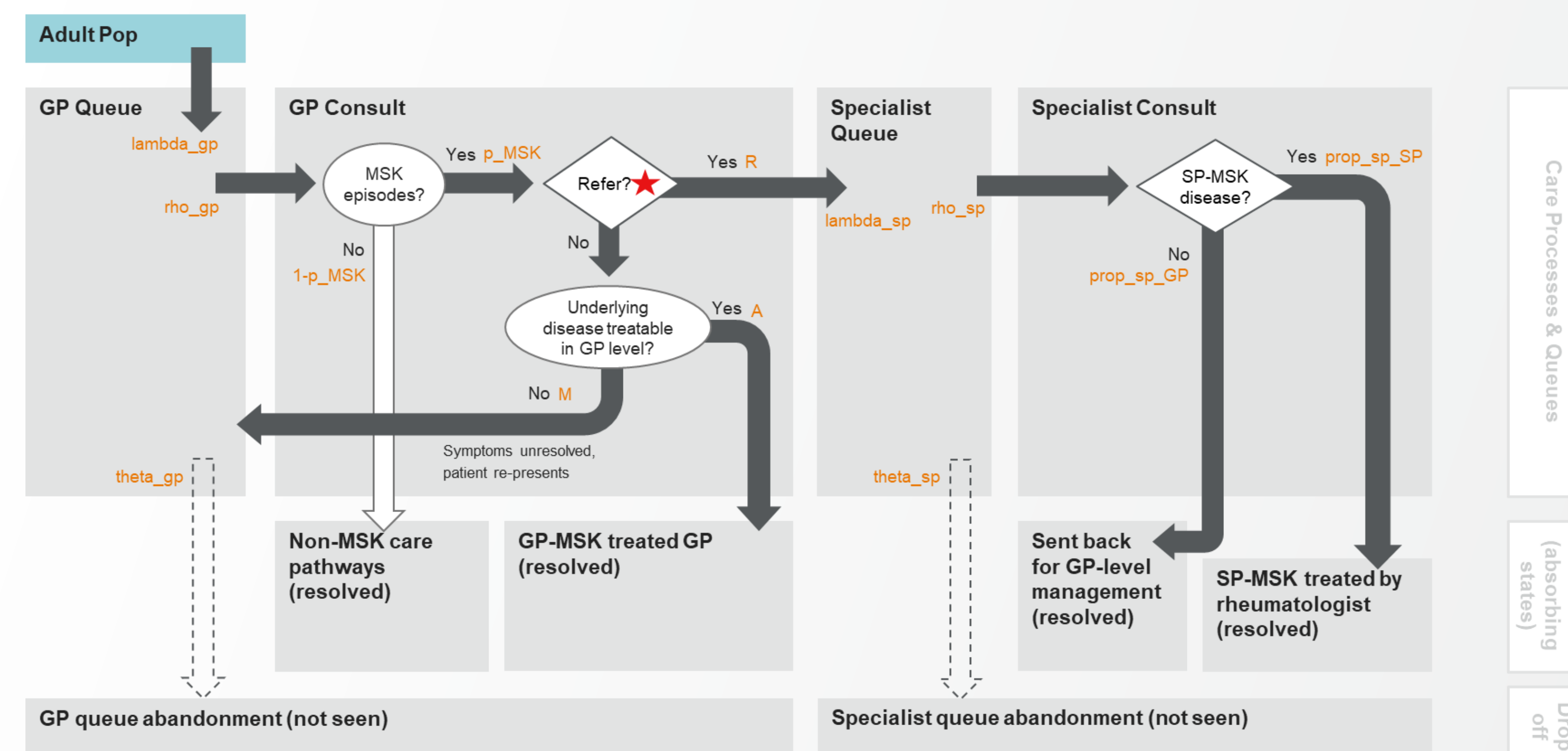
Total **specialist encounters remained unchanged**, but referrals improved, with more appropriate patients seen by specialists

CONCLUSIONS:

- IDSTP improves allocation, not volume. Value is driven by better targeting of care rather than reducing total visits.
- Shifting triage upstream shortens the patient journey, reduces delays, and increases appropriate referrals
- Early modeling findings are directional; real-world impact will depend on GP behavior and system context.

NEXT STEPS AND FUTURE STUDIES:

- Measure real-world GP referral behavior with IDSTP
- Calibrate model to local observed practice pattern
- Assess time-to-diagnosis, capturing repeated GP visits
- Capture downstream effects of earlier diagnosis on quality of life, costs, and utilization



Learn more at spiderr-project.eu

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