

# Intramedullary nailing of tibial shaft fractures: a scoping review

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## Introduction

Intramedullary (IM) nailing is the typical fixation for adult tibial shaft fractures, the most common long bone fracture [1]. Long-term anterior knee pain (AKP) is a well-recognised disadvantage of IM nailing, and kneeling is known to cause the most severe AKP in this cohort [2]. Techniques to perform IM nailing vary, and studies comparing different approaches show conflicting results for AKP and knee function. The absence of a validated, cohort-specific outcome measure has led to a wide range of outcome measures reported, making comparisons difficult. The true extent and prevalence of outcome measures in use is currently not known.

## Aims

- Summarise the outcome measures reported in the assessment of tibial shaft fractures treated with IM nailing.
- Provide insight into the extent, range, and nature of the publications.
- Identify any gaps in the literature and provide recommendations for future work.

## Methods

PubMed and Embase databases were searched in November 2021. Covidence™ was used for article screening and data extraction. All study designs and populations were included. *Ex vivo* studies without the presence of tibial shaft fracture were included; studies reporting on open or intra-articular fractures only, or other fracture fixation were excluded. The methodology followed current scoping review guidelines [3, 4]. Extracted data were collated and summarised using R and RStudio.

## Results

- 165 papers included for data extraction** (Figure 1):
  - 137 *in vivo* studies, 26 *ex vivo* studies, two papers included both study types.
- 47% of papers were published within the last decade (Figure 2).
- 27 different countries of origin:
  - most (35%) were from the USA. (supplementary material)

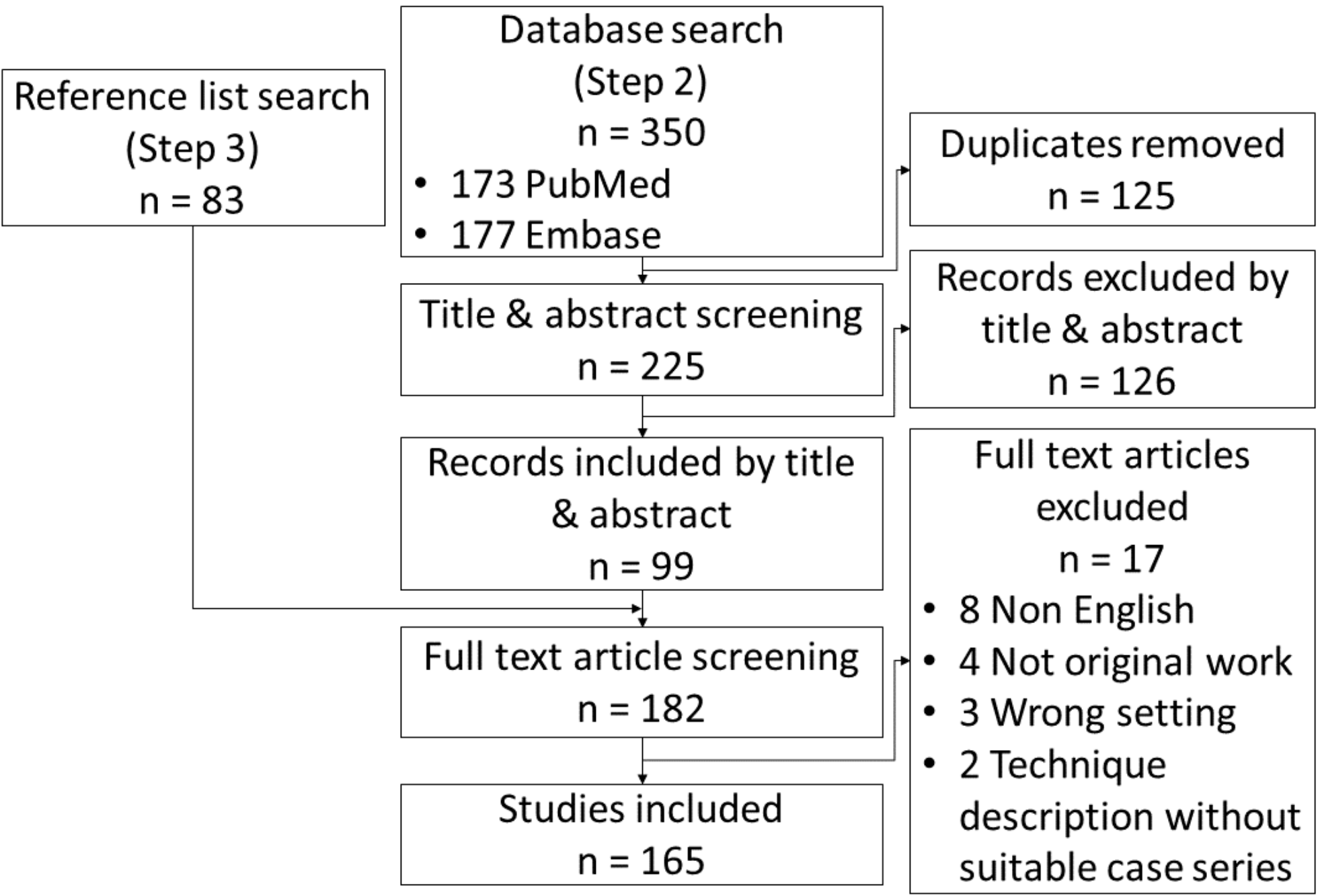


Figure 1: Preferred Reporting Items for Systematic Reviews and Meta-Analyses flowchart.

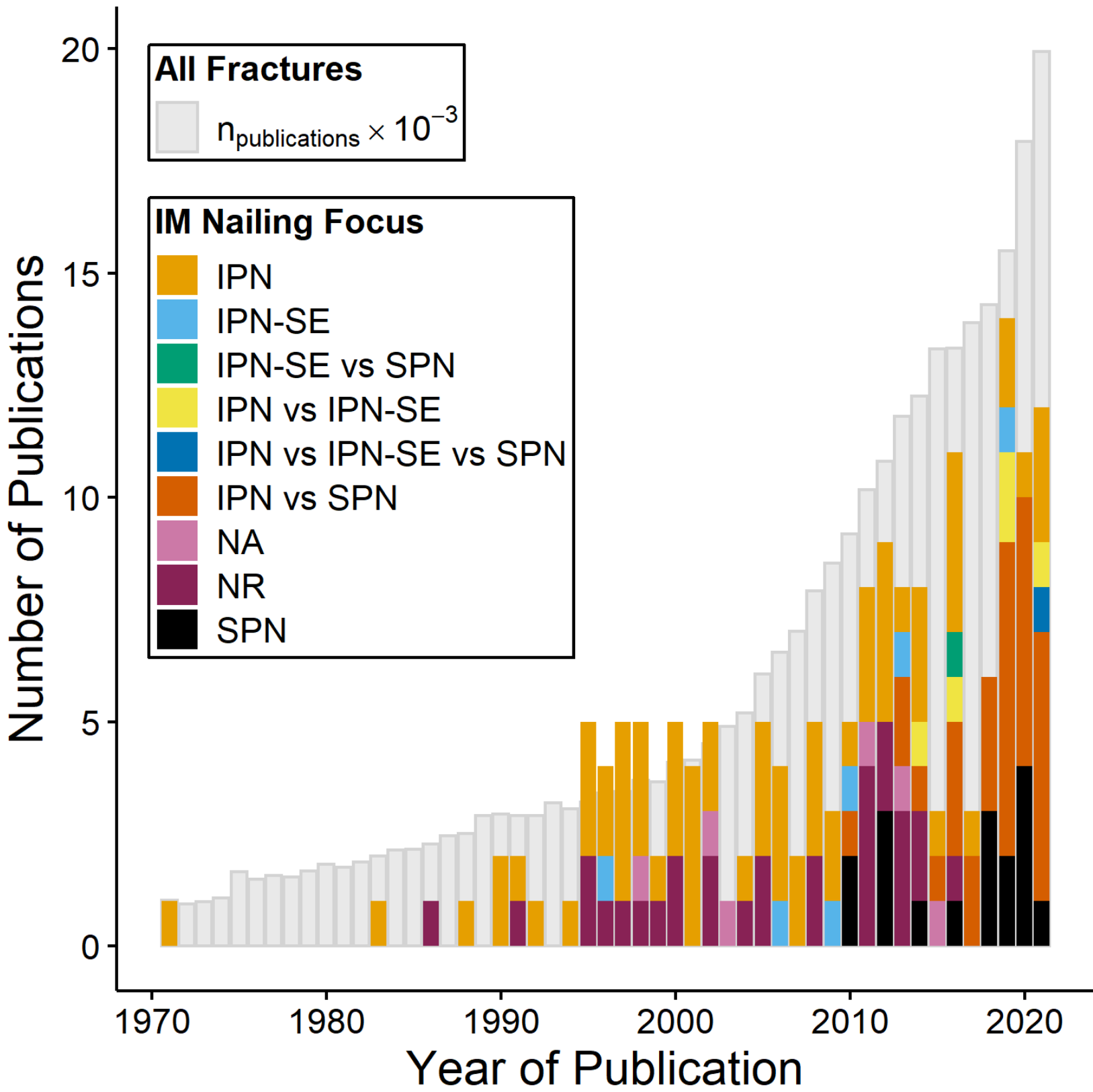


Figure 2: Number of publications per year grouped by IM nailing focus. All "fracture" publications in PubMed also presented.

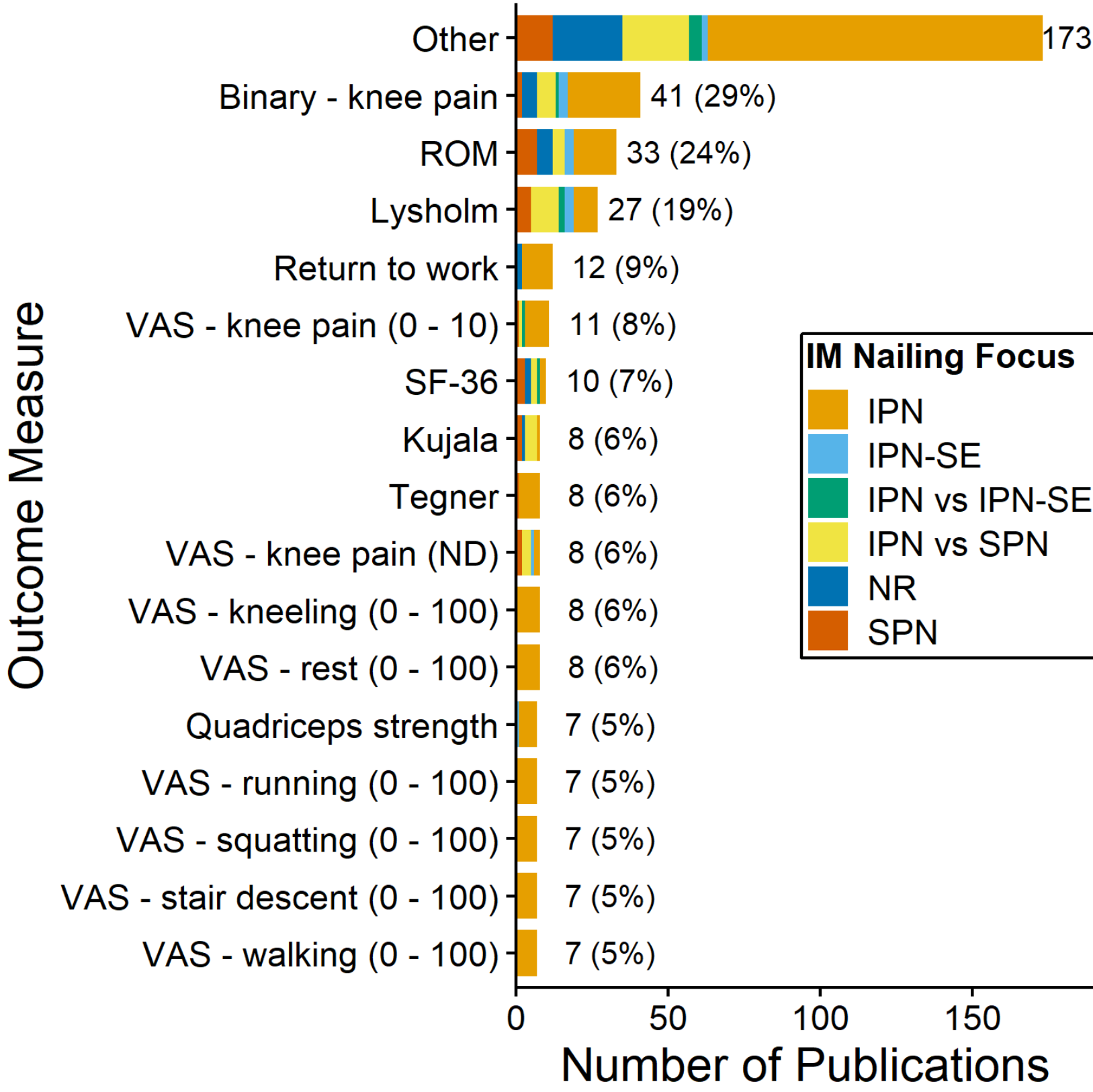


Figure 3: Patient outcomes for in vivo studies grouped by IM nailing focus. See supplementary material for full list of patient outcomes.

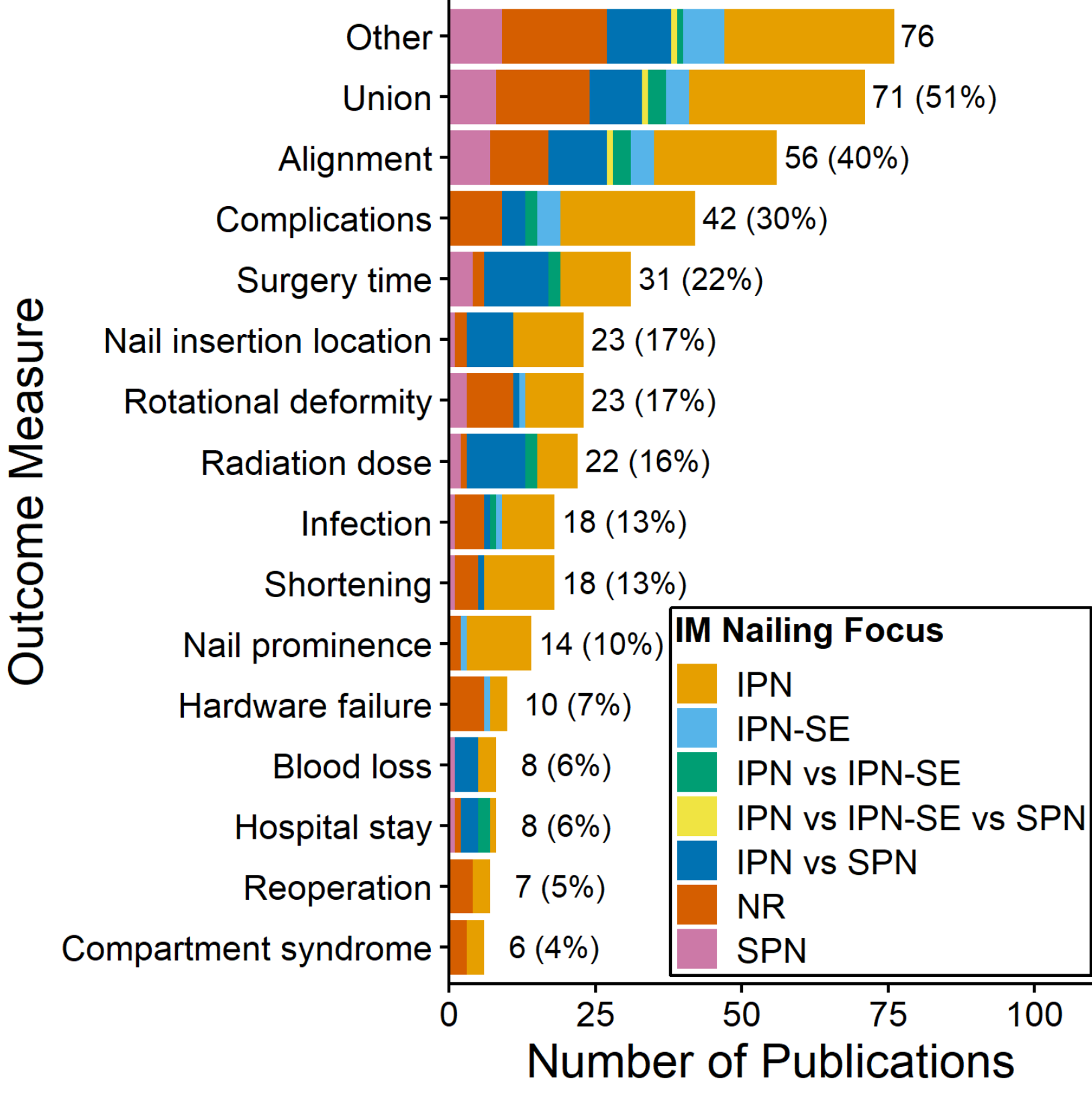


Figure 4: Clinical outcomes for in vivo studies grouped by IM nailing focus. See supplementary material for full list of clinical outcomes.

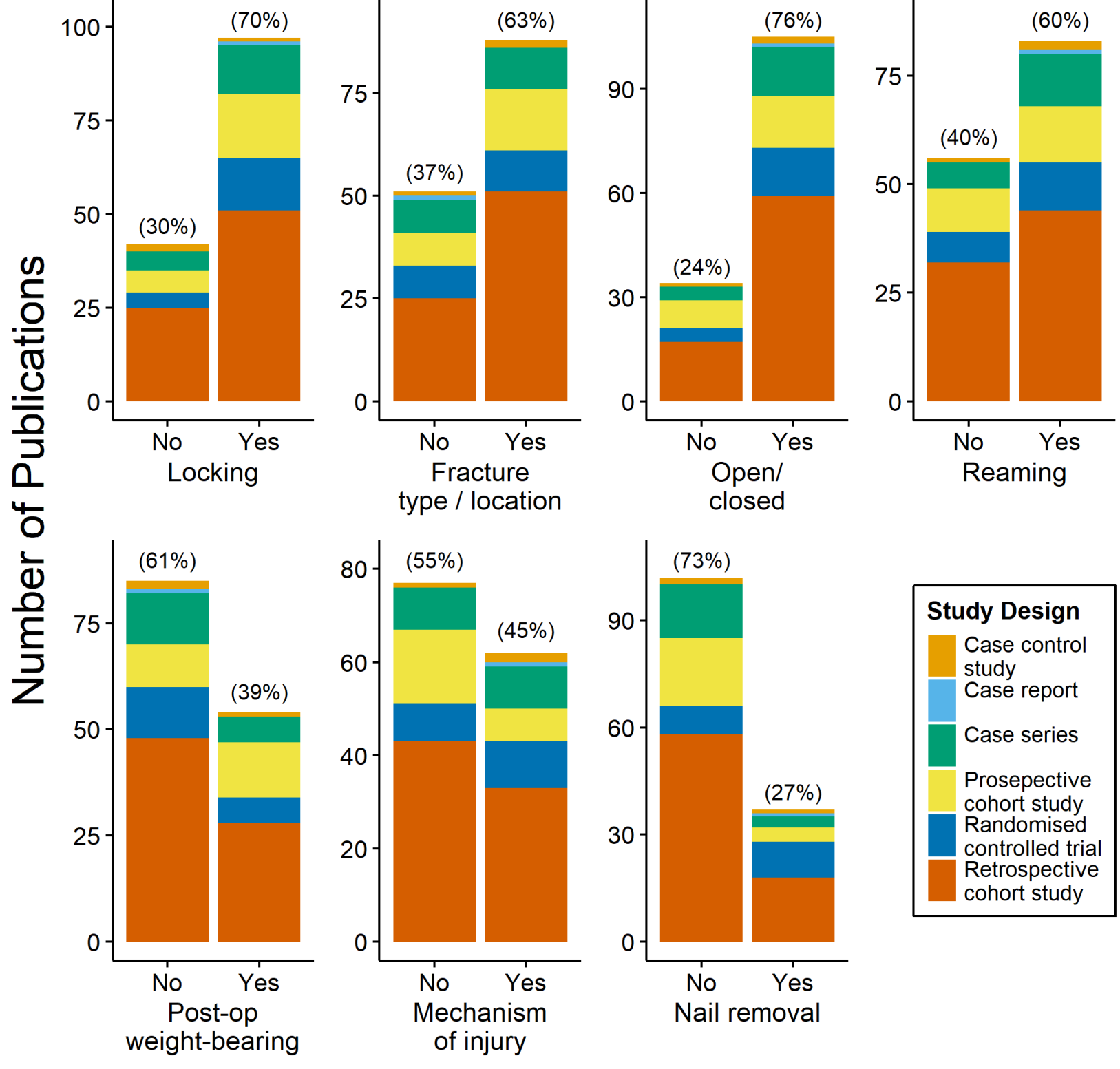


Figure 5: Distribution of papers describing important study characteristics.

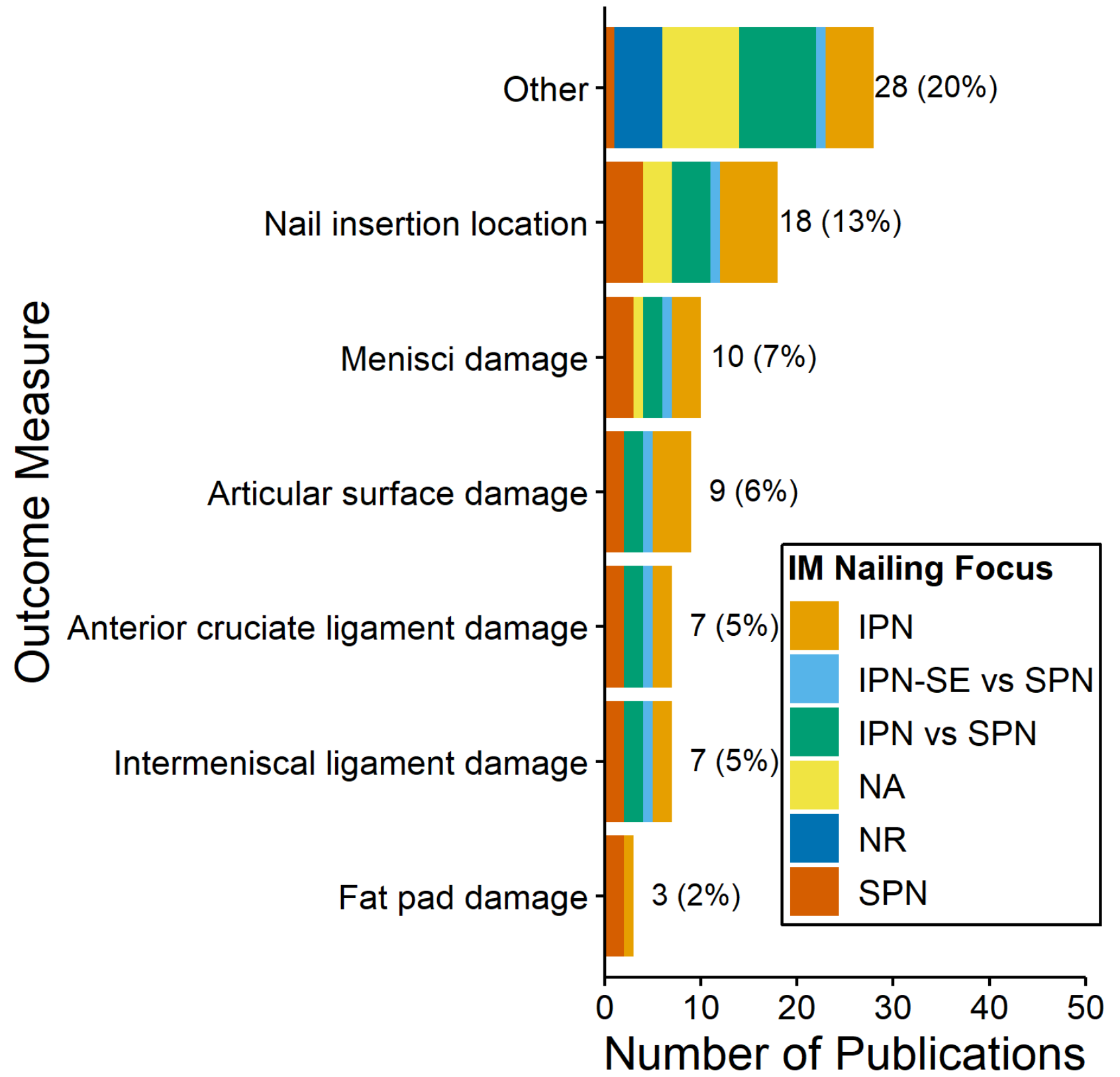


Figure 6: Outcomes for ex vivo studies grouped by IM nailing focus. See supplementary material for full list of outcomes.

### In Vivo Studies

- 12,589 fractures reported:
  - 33% of fractures did not describe the nailing approach,**
  - medial parapatellar IPN approach was most common (21%).(see supplementary material for detailed nailing approach numbers)
- 126 unique patient outcomes (Figure 3):
  - A binary (yes/no) assessment of knee pain was most common (29%),**
  - VAS and NRS scores accounted for 46% of all unique patient outcomes.
- 69 unique clinical outcomes (Figure 4):
  - fracture union was most common (51%).
- Most studies did not describe:**
  - post-operative weight-bearing regime (61%), or**
  - the mechanisms of injury (55%)** (Figure 5).
- Most frequent follow-up times were 6 and 12 months (22% each). (supplementary material)
- 47% were III evidence. (supplementary material)

### Ex Vivo Studies

- 365 tibias included.
- (see supplementary material for detailed nailing approach numbers)
- 33 unique outcomes (Figure 6):
  - nail insertion location was most common (13%).

## Conclusion

This is the first study to detail the outcome measures used in the assessment of tibial shaft fractures treated with IM nailing. There was found to be considerable heterogeneity in reporting. The most frequent modality was simply asking whether any knee pain exists. Notably, a number of the scores routinely used were designed for other pathologies and do not assess kneeling, the most painful activity in this cohort. **These results have highlighted a number of gaps in the literature and provide motivation for a validated, cohort-specific outcome measure.**

### Supplementary Material

Scan the QR code below to access the supplementary material and to find out more!

### Acronyms

IM – intramedullary; AKP – anterior knee pain; IPN – infrapatellar nail; SE – Semi-extended; SPN – suprapatellar nail; ND – no description; NA – not applicable; ROM – range of motion; VAS – visual analogue score; NRS – numerical rating score.

### References

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