# Weight-Bearing in Ankle Fractures: An Audit of UK Practice


## Abstract

### Introduction

The purpose of this national study was to audit the weight-bearing practice of orthopaedic services in the National Health Service (NHS) in the treatment of operatively and non-operatively treated ankle fractures.

### Methods

A multicentre prospective two-week audit of all adult ankle fractures was conducted between July 3rd 2017 and July 17th 2017. Fractures were classified using the AO/OTA classification. Fractures fixed with syndesmosis screws or unstable fractures (>1 malleolus fractured or talar shift present) treated conservatively were excluded. No outcome data were collected. In line with NICE (The National Institute for Health and Care Excellence) criteria, "early" weight-bearing was defined as unrestricted weight-bearing on the affected leg within 3 weeks of injury or surgery and "delayed" weight-bearing as unrestricted weight-bearing permitted after 3 weeks.

### Results

251 collaborators from 81 NHS hospitals collected data: 531 patients were managed non-operatively and 276 operatively. The mean age was 52.6 years and 50.5 respectively. 81% of non-operatively managed patients were instructed for early weight-bearing as recommended by NICE. In contrast, only 21% of operatively managed patients were instructed for early weight-bearing.

### Discussion

The majority of patients with uni-malleolar ankle fractures which are managed non-operatively are treated in accordance with NICE guidance. There is notable variability

amongst and within NHS hospitals in the weight-bearing instructions given to patients with operatively managed ankle fractures.

**Conclusion**

This study demonstrates community equipoise and suggests that the randomized study to determine the most effective strategy for postoperative weight-bearing in ankle fractures described in NICE research recommendation is feasible.

**Keywords: "Fractures, ankle"; "Weight-bearing", "Early", "Delayed", "NICE"**

## Introduction

Each day approximately 200 patients sustain an ankle fracture in the United Kingdom (UK).[**1]** The National Institute for Health and Care Excellence (NICE) guideline (NG38)[**2**] recommends that patients with uni-malleolar ankle fractures that are managed non-operatively should be advised to weight-bear as tolerated immediately or return within 2 weeks for further assessment if stability is uncertain. The most effective strategy for weight-bearing for patients with operatively managed ankle fractures remains uncertain and is one of the NICE priority recommendations for research in trauma. Current national practice is unknown. The purpose of this multicentre, prospective audit is to determine the weight-bearing practice for both conservative and operatively managed ankle fractures within orthopaedic services in the setting of the UK National Health Service (NHS).

## Methods:

A multicentre, prospective two-week audit of all adult ankle fractures was conducted between July 3rd 2017 and July 17th 2017. Collaborators were recruited and

coordinated via the |**Blinded**| on behalf of the |**Blinded**|.[**3**] Research and Ethics Committee approval was not required under assessment of the Health Research Authority decision tool (http://www.hra-decisiontools.org.uk/research/). All collaborators obtained local approval from their respective institutions.

In line with NICE definitions, "early" weight-bearing was defined as unrestricted weight-bearing on the affected leg within 3 weeks of injury or surgery and "delayed" weight-bearing as unrestricted weight-bearing permitted after 3 weeks. [**4**] Restricted weight-bearing was defined as partial weight-bearing, touch weight-bearing, non-weight-bearing or protected weight-bearing. Unrestricted weight-bearing was defined as full weight-bearing or weight-bearing as tolerated.[**4**] These definitions applied whether or not the patient was in a splint or form of immobilisation.

Fractures were classified by AO/OTA classification (**Figure 1**) [**5**] Both non-operatively and operatively managed cases were included. Within the operative group, only fractures treated with open reduction and internal fixation (ORIF) were included. Fractures fixed with syndesmosis screws or unstable ankle fractures (>1 malleolus fractured or talar shift present) treated conservatively were excluded. Participants exited the study when they were allowed to weight-bear without restriction or a future date to do so was indicated in the clinical record.

Data were collected on patient demographics, method of treatment, time to surgery, time to unrestricted weight-bearing, form of immobilisation, time and method of repeat radiographic assessment if stability was uncertain. Time to unrestricted weight-bearing was recorded both from date of injury and from date from first review by orthopedic services. Patient factors including documented diabetes, osteoporosis, peripheral neuropathy or mobility concerns (e.g. previously requiring mobility aids or

assistance, or sustaining multiple injuries limiting mobility) were recorded. In addition, injury factors including open fracture, gross comminution or soft tissue compromise documented on the operation note were recorded. No outcome data were collected.

**Statistical analysis:**

Count data were summarised as absolute numbers and proportions; continuous data as means and ranges. Data were analysed using IBM SPSS Statistics v.21 (IBM, Armonk. New York). No inferential statistical analyses were performed.

## Results

251 collaborators from 81 NHS hospitals provided data from 996 adults with 996 ankle fractures before application of the exclusion criteria. A participant flow diagram is presented at **Figure 2.**

**Non-operatively treated fractures:**

Data from 531 patients with a mean age of 52.6 [16-97]. The mean time restricted weight-bearing from date of injury was 12.4 days [0-63] and from date of first assessment by orthopaedic services was 8.4 days [0-63]. 103 (20%) patients were advised delayed weight-bearing and 428 (81%) patients were allowed to weight-bear without restriction less than 3 weeks from injury. **Table 1** demonstrates weight-bearing practice by fracture classification. **Figure 3** demonstrates the weight-bearing practice across participating hospitals. The proportion of patients permitted to weight-bear early with diabetes, osteoporosis, peripheral neuropathy or mobility concerns was 13/17 (77%), 21/26 (81%), 9/9 (100%) and 30/41 (73%) respectively. For those allowed to weight-bear early, the method of immobilisation was a boot in 284 (66%) cases, plaster

in 72 (17%), nothing in 39 (9%), aircast stirrup in 22 (5%), tubigrip in 6 (1%), and other in 5 (1%).

311 (59%) patients had a check radiograph within 2 weeks to confirm stability, of which 131 (42%) were weight-bearing radiographs. 80 (61%) of those that had a weight-bearing radiograph had them whilst in their respective form of immobilisation; 51 (39%) had no immobilisation whilst having their radiograph taken.

**Operatively treated fractures:**

Data from 276 patients. The mean age was 50.2 [16-92], and the mean days from injury to definitive fixation was 5.1 [0-24]. The mean time restricted weight-bearing postoperatively was 35.9 days [0-92]. 217 (79%) patients were advised delayed weight-bearing, with 59 (21%) allowed to weight-bear without restriction less than 3 weeks postoperatively. **Table 2** demonstrates weight-bearing practice for post-operative patients by fracture classification. **Figure 4** demonstrates the weight-bearing practice across participating hospitals. **Table 3** demonstrates how patient comorbidity or fracture factors influenced weight-bearing decisions. For those allowed to weight-bear early, 35 (59%) did so in a boot, 20 (34%) in plaster, and 4 (7%) other.

## Discussion.

The clinical and economic impacts of delayed weight-bearing are not fully understood.[**2**] NICE identified no randomised controlled trials (RCTs) evaluating weight-bearing practice in conservatively managed adult ankle fractures. In the absence of robust evidence, the recommendation was that patients with non-operatively managed uni-malleolar fractures should be allowed to weight-bear without restriction immediately.[**2**]

A variety of factors may influence a clinician's weight-bearing decision when

treating fractures conservatively: clinical examination, medial tenderness, gravity stress and supination-external rotation stress views have all been used.[**6,7,8**] According to Egol et al. **[6]**, medial tenderness and swelling have a low predictive correlation with positive stress tests, with sensitivity of 56% and 55%, and specificity of 80% and 71% respectively. Positive stress views do not predict deltoid ligament insufficiency, with Koval et al. **[7]** finding only 2 of 21 patients with positive stress tests having complete deltoid rupture on MRI scanning. Gill et al. [**8]** found that gravity stress views are equivalent to stress tests, but Weber et al. [**9**] proposed that these tests overestimate the need for surgery. They used weight-bearing radiographs to determine stability, producing excellent clinical results with a low risk of complications. Dawe et al. **[10]** replicated these results, finding that a shift in protocol from using stress tests, to using weight-bearing radiographs greatly reduced the proportion of patients undergoing surgery and the rate of complications overall. Using the same method for determining stability, Hastie et al. **[11]** found that bracing and encouraging an early range of motion has a low risk of complications and good clinical results. Our study suggests that there is a greater inclination for clinicians to allow early weight-bearing for conservatively managed uni-malleolar fractures, but there is still variety in thinking for the best form of bracing in the early setting. Furthermore, whilst Hoshino et al. **[12]** demonstrated that a weight-bearing radiograph without immobilisation after 1 week is a robust method of predicting the success of conservative treatment for fractures of uncertain stability, our study has shown there is no uniformity for radiographically assessing stability within clinical practice at present.

A 2012 Cochrane review[**13**] examined rehabilitation for ankle fractures and NICE[**2**] has set a priority to investigate postoperative weight-bearing; they identified 6

and 8 RCTs respectively. Only Ahl et al. (1986)[**14**], Ahl et al. (1987)[**15**] and Finsen et al. [**16**] had a common form of immobilisation (plaster cast) in each group. In these studies, no difference in adverse events were found; early weight-bearing favoured improved dorsiflexion at 6 months but no difference in activity limitation at 1 year. Ahl et al. (1993)[**17**] compared a weight-bearing orthosis versus a non-weight-bearing dorsal splint and found more minor adverse events (e.g. skin irritation, superficial infection) in the early weight-bearing group. The trend of early functional improvements but an increase in minor wound healing adverse events was mirrored in the RCTs that focused on early-exercise postoperatively.[**13**] This would seem to reflect the findings of our study suggesting that 79% of clinicians may be anxious about the risk of adverse events compared to the minimal clinical gains of early weight-bearing. Overall NICE**[2]** and the Cochrane review[**13**] concluded that the studies were underpowered and had high risk of bias, serious imprecision and heterogeneity in outcomes measures, recommending further high-quality studies on the topic.

Kier et al [**18**] found the treatment of unstable ankle fractures required an average length of hospital stay of nine days and an associated mean cost of £4,491 per patient. In patients over sixty, Keene et al [**19**] found this increased to a mean NHS cost of £6,648 and mean societal cost of £7,684 per patient. No studies have identified the economic implications of prolonged restricted weight-bearing, but it is likely to have direct and indirect effects. It can diminish independence and, particularly in the elderly, comorbid patient, may lead to prolonged hospital or institutional care.[**20,21**] Younger patients can often mobilise with walking aids but it can affect their return to work, with Simanski et al. [**21]** and Gul et al. [**22**] suggesting a trend towards earlier return to work with early weight-bearing post-operative regimes.

Recent qualitative studies have shed light on the psychosocial effects of ankle fractures with patients having to "endure" a period of non-weight bearing. While some patients adjust, many find the experience "terrifying" and put their life on hold, even avoiding showering or bathing altogether until allowed to weight-bear.[**23,19**]

This study has a number of limitations. It reports only the decisions of the treating clinicians; it did not collect data on patient outcomes, complications or cross over from the conservative into the operative group. It is not known if patients adhered to their weight-bearing instructions or if they were allowed to exercise their ankle. We used the AO/OTA classification as it has better intraobserver and interobserver reliability than the Lauge-Hansen classification.[**24**] However, its reliability and reproducibility was not independently assessed throughout all 81 participating centres. While patient comorbidity and injury factors were analysed, information on other factors such as whether some components of the fracture were left unfixed (e.g. posterior malleolus) was not, and could have influenced weight-bearing decisions.

This study is the first to prospectively look at weight-bearing decisions. A previous American survey of clinicians views towards postoperative ankle fractures found a preferred average time non-weight-bearing of 4.9 weeks in young healthy patients, increasing to 7.6 weeks in older, comorbid patients with complex fractures.[**25**] We wanted to examine what clinicians did in practice, faced with real patients and audit this against NICE guidelines.[**2**] A developing trainee collaborative provided the infrastructure to enable this.[**3**] Nationally, this study demonstrates 81% adherence to NICE guidelines for non-operatively treated uni-malleolar ankle fractures though found considerable variability in the early radiographic reassessment. It establishes a national baseline with 21% of clinicians allowing early weight-bearing postoperatively. We

found no evidence that fracture classification or patient factors such as diabetes or osteoporosis deterred clinicians from weight-bearing patients early. Fracture specific factors, particularly soft tissue compromise, were associated with a greater reluctance to allow early weight-bearing. Though numbers were too small to infer causation, these insights are useful if considering when and which patients' clinicians will be willing to randomise in future RCTs.

## Conclusion

This study demonstrates the willingness of clinicians to allow early weight-bearing in conservatively managed AO44A1 fractures, the relative uncertainty in AO44B1 fractures and the reluctance to weight-bear early in operatively treated adult malleolar ankle fractures.

It is unclear if early or delayed weight-bearing influences late functional outcome. The economic and social cost may emerge as the key argument in the weight-bearing debate.

## Summary

- The standard of care for weight-bearing after ankle fracture was previously unknown.
- 81% of non-operatively managed patients with uni-malleolar fractures are advised early weight-bearing.
- 21% of operatively managed patients are advised early weight-bearing.
- There is community equipoise and a randomized study examining weight-bearing in ankle fractures is feasible.

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## Tables:

**Table 1** Weight-bearing by fracture classification for patients managed conservatively

| Time till unrestricted weight-bearing | 44A1 | 44B1 | Isolated posterior malleolus | Isolated medial malleolus | Total |
|---|---|---|---|---|---|
| < 3 weeks | 225 (94%) | 181 (69%) | 4 (80%) | 18 (72%) | 428 (81%) |
| > 3 weeks | 15 (6%) | 80 (31%) | 1 (20%) | 7 (28%) | 103 (19%) |

**Table 2** Weight-bearing by fracture classification for operatively managed patients

| Time till unrestricted weight-bearing | 44A1 | 44A2 | 44A3 | 44B1 | 44B2 | 44B3 | 44C1 | 44C2 | 44C3 | Isolated medial mallelous | Posterior & medial mallelous | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| < 3 weeks | 1 (14%) | 6 (33%) | 1 (20%) | 10 (24%) | 19 (23%) | 14 (22%) | 4 (16%) | 2 (12%) | 1 (14%) | 1 (11%) | 0 (0%) | 59 (21%) |
| > 3 weeks | 6 (86%) | 12 (67%) | 4 (80%) | 31 (76%) | 63 (77%) | 50 (78%) | 21 (84%) | 15 (88%) | 6 (86%) | 8 (89%) | 1 (100%) | 217 (79%) |

**Table 3** Patients permitted unrestricted weight-bearing <3 weeks post-operatively by comorbidity/ fracture factors

| Diabetes | Osteoporosis | Peripheral Neuropathy | Mobility Concerns | Open Fracture | Soft Tissue Compromise | Gross Comminution | Total |
|---|---|---|---|---|---|---|---|
| 3/10 (30%) | 5/14 (36%) | 1/8 (13%) | 6/20 (30%) | 1/11 (9%) | 1/14 (7%) | 4/29 (14%) | 59/279 (21%) |

**Figures**

Figure 1: AO/OTA 44 classification

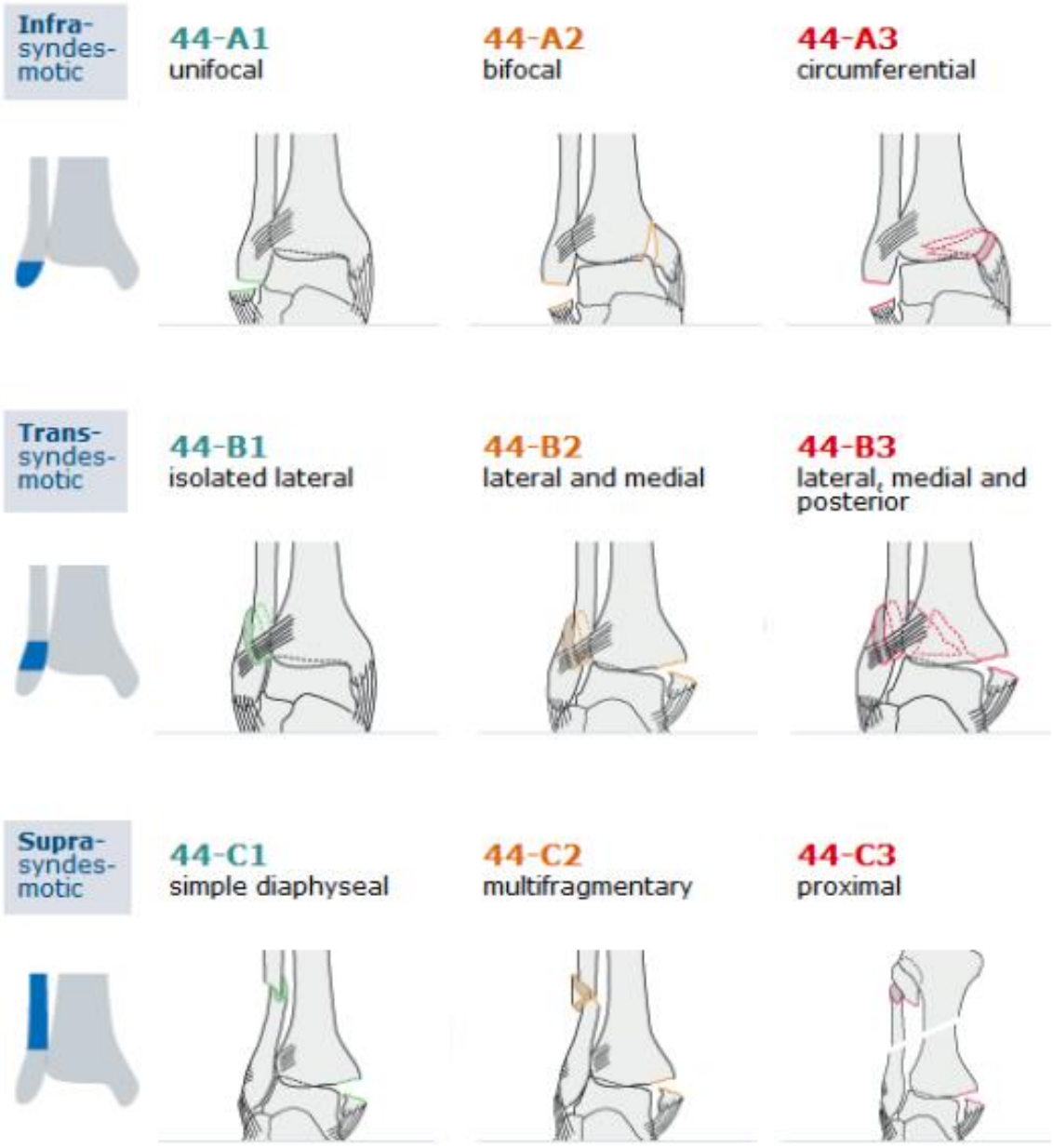


Figure 2: Participant Flow Diagram

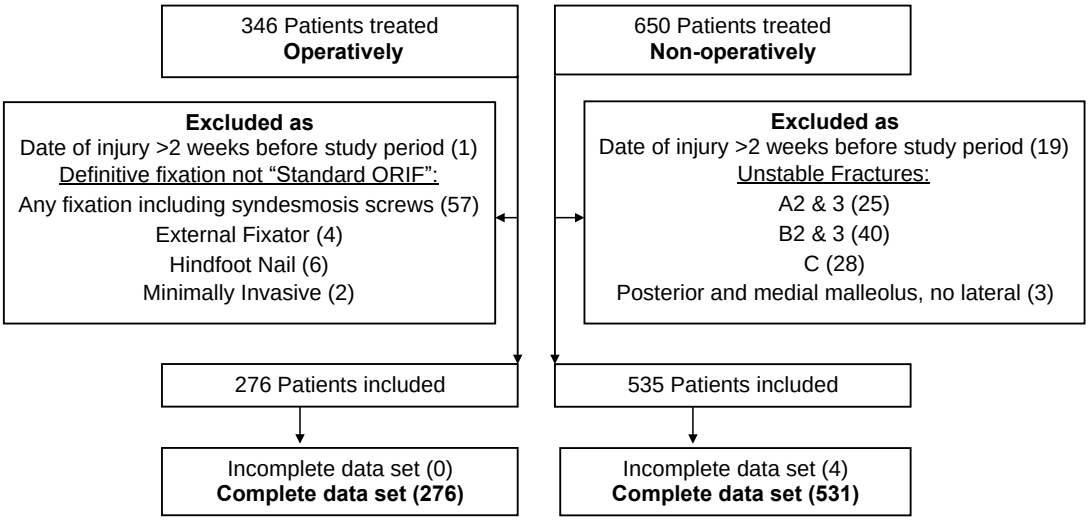



Figure 3: Weight-bearing by hospital for patients managed conservatively

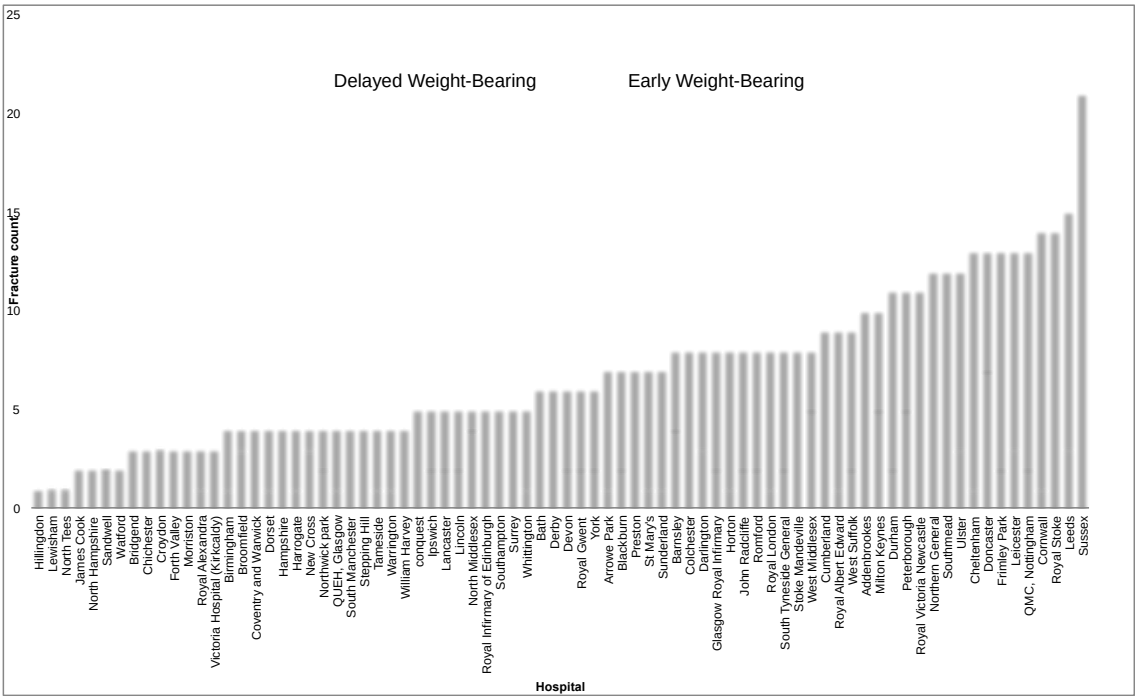
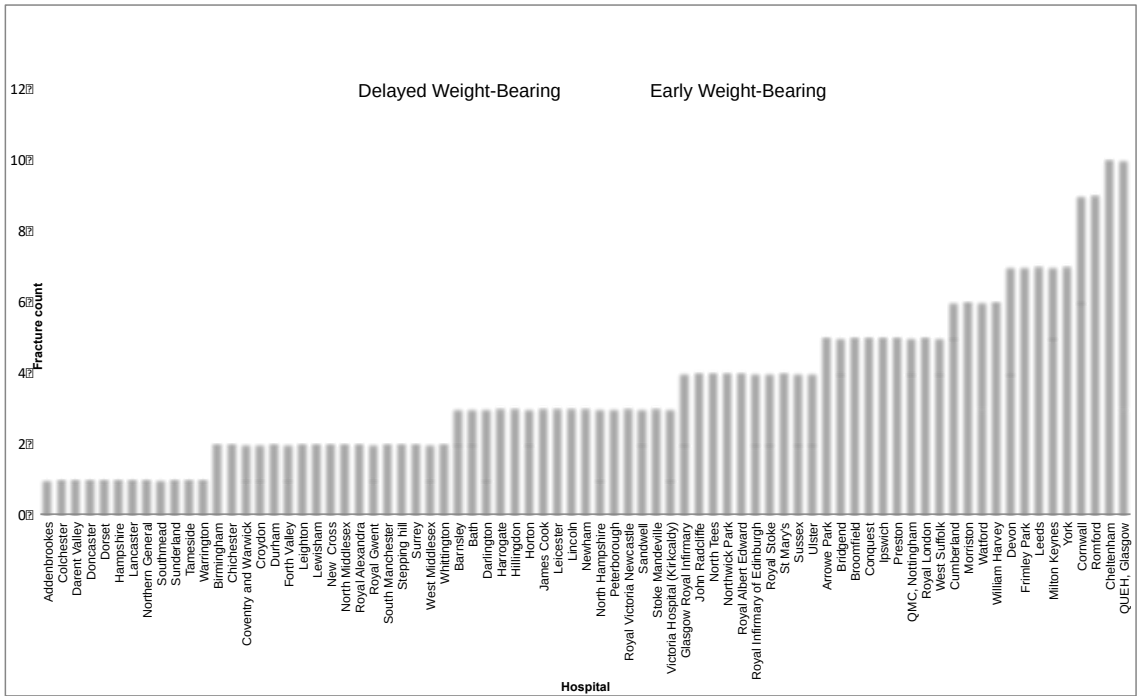


Figure 4: Weight-bearing by hospital for patients managed operatively

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