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Low readmission and reattendance rate in day-case total knee arthroplasties

A RETROSPECTIVE CASE SERIES OF 301 CONSECUTIVE DAY-CASE TKAS DELIVERED IN A UK NHS TRUST

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Aims

The rate of day-case total knee arthroplasty (TKA) in the UK is currently approximately 0.5%. Reducing length of stay allows orthopaedic providers to improve efficiency, increase operative throughput, and tackle the rising demand for joint arthroplasty surgery and the COVID-19-related backlog. Here, we report safe delivery of day-case TKA in an NHS trust via inpatient wards with no additional resources.

Methods

Day-case TKAs, defined as patients discharged on the same calendar day as surgery, were retrospectively reviewed with a minimum follow-up of six months. Analysis of hospital and primary care records was performed to determine readmission and reattendance rates. Telephone interviews were conducted to determine patient satisfaction.

Results

Since 2016, 301/7350 TKAs (4.1%) in 290 patients at our institution were discharged on the day of surgery. Mean follow-up was 31.4 months (6.2 to 70.0). In all, 28 patients (9.3%) attended the emergency department or other acute care settings within 90 days of surgery, most often with wound concerns or leg swelling; six patients (2.0%) were readmitted. No patients underwent a subsequent revision procedure, and there were no periprosthetic infections. Two patients (0.7%) underwent secondary patella resurfacing, and one patient underwent arthroscopic arthrolysis after previous manipulation under anaesthetic (MUA). Three patients (1.0%) underwent MUA alone. Primary care consultation records, available for 206 patients, showed 16 patients (7.8%) contacted their general practitioner within two weeks postoperatively; two (1.0%) were referred to secondary care. Overall, 115/121 patients (95%) telephoned stated they would have day-case TKA again.

Conclusion

Day-case TKA can be safely delivered in the NHS with no additional resources. We found low incidence of contact with primary and secondary care in the postoperative period, and high patient satisfaction.

Cite this article: *Bone Jt Open* 2023;4-8:621–627.

Keywords: knee replacement, day case, arthroplasty, TKR

Introduction

More than 100,000 primary total knee arthroplasty (TKA) procedures are performed each year in England and Wales,¹ although the COVID-19 pandemic reduced this by > 57,000 in 2020 to 2021.² Reducing length of stay is one mechanism available to orthopaedic

care providers to improve efficiency, increase operative throughput, and tackle the significant backlog of elective arthroplasty workload created by the ageing population and COVID-19 pandemic.^{3,4}

Shorter inpatient stays are common in many healthcare systems, with potential

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doi: 10.1302/2633-1462.48.BJO-2023-0043.R1

Bone Jt Open 2023;4-8:621–627.

benefits including cost-reduction, improved satisfaction, and faster rehabilitation.⁵ Despite the benefits of reducing time spent in hospital following TKA, the mean length of stay for 79,252 TKA procedures recorded in the NHS Hospital Episode Statistics database during 2018 to 2019 was four days, with over 20% of patients staying for five or more days. The rate of day-case TKA in this national analysis was 0.5%.⁶

There is a significant body of literature demonstrating the safety of outpatient TKA, with low complication and readmission rates,⁷ although interpretation is challenging due to variable definitions of ambulatory or outpatient surgery. These range from discharge on the day of surgery (day-case TKA) to discharge within 24 hours of surgery. Most reports are database studies from insurance registries,⁸⁻¹⁰ which may not detect re-presentations to general practitioners (GPs) or urgent care centres (UCCs) with acute postoperative problems or concerns, such as pain and swelling. Furthermore, while day-case unicompartmental knee arthroplasty (UKA) has been reported in the NHS,¹¹ there are no large series of day-case TKA in the NHS.^{12,13} Key concerns in day-case TKA within the NHS include patient safety and potential for increased levels of re-presentation, readmission, and inadequate pain control on discharge. Here, we report day-case TKA, when patients went home on the same calendar day as their procedure, and interrogate hospital and primary care records to determine the true re-attendance rate following day-case TKA.

The primary aim of this study was to review 301 consecutive day-case TKAs and accurately determine reattendance and readmission rates, and complications within 90 days of discharge. We also investigated patient's experience and satisfaction of day-case surgery.

Methods

Between 2016 and 2021, 290 patients underwent 301 TKAs, and were admitted on the morning of surgery and discharged before midnight on the same calendar day. Day-case patients were not pre-selected; all patients were managed using the same pathway and protocols, and the final decision on day-case discharge was made postoperatively according to universal discharge criteria. However, where patients were identified as potentially suitable for day-case surgery preoperatively, this enabled early exploration of patients wishes and expectations and planning of operating lists. Further details on the day-case process are provided in the next section.

All bilateral procedures were performed as staged operations, with a delay of at least three months between each procedure. Procedures were performed by 13 surgeons in three hospitals (Hexham General Hospital, North Tyneside General Hospital, and Wansbeck General Hospital) within one NHS healthcare trust (Northumbria Healthcare NHS Foundation Trust) in the UK.

Table 1. Characteristics and comorbidities of patients at the time of surgery in 301 day-case total knee arthroplasties.

Variable	Data
Mean age, yrs (range)	65 (41.9 to 83.3)
Sex M:F, n	193:108
Mean BMI, kg/m ² (range)	31.9 (18.5 to 52.3)
ASA grade, n (%)	
1	55 (18.3)
2	220 (73.1)
3	18 (6.0)
Not recorded	8 (2.7)
Comorbidities, n (%)	
Hypertension	113 (37.5)
Chronic obstructive pulmonary disease	11 (3.7)
Ischaemic heart disease	14 (4.7)
Atrial fibrillation	12 (4.0)
Diabetes	34 (11.3)
Asthma	25 (8.3)
Chronic kidney disease	11 (3.7)
Anxiety	19 (6.3)
Depression	31 (10.3)

ASA, American Society of Anesthesiologists.

Patient characteristics, including comorbidities, are shown in Table 1.

All patients had plain radiographs of the operated knee taken in the postoperative period. Patients were routinely followed-up after surgery at approximately two months. Active follow-up beyond this period was dictated by clinical need and surgeon preference; most patients were discharged at two months.

For this retrospective review, in July 2022 all patient records were reviewed for further attendances, complications, readmission, or reoperation. Therefore, minimum postoperative follow-up for the purposes of this study was six months, with a mean of 31.4 months (6.2 to 70.0). This included review of all ED, UCC, and ambulatory care unit (ACU) attendances within 90 days of surgery.

Electronic health information exchange (HIE) GP summary records were available for 293 TKAs (97.3%) and were reviewed for any complications or re-operations. In 206 TKAs (68.4%), full consultation records were available and were reviewed for GP attendances within two weeks of surgery.

The review of routinely collected health records for this study did not require ethical approval or patient consent, but the study received all necessary approvals from the local information governance team. The relevant study reporting checklist is included in Supplementary table i.

The first 165 patients were telephoned as part of an evaluation of the service; 121 (73.3%) were contactable and provided answers to the questions. Patients were asked three questions regarding their experience and satisfaction with the day-case process.

Day-case surgery. Potential day-case surgery candidates were identified in outpatient clinics at the time of being listed for TKA. Alongside patient preference, factors considered included comorbidities and home circumstances enabling safe same-day discharges. However, there were no absolute restrictions placed on any patient factor, including age or American Society of Anesthesiologists (ASA) grade. Where possible, patients identified as likely to be suitable for a day-case procedure were placed in the morning session of the operating list to maximize the opportunity for same day discharge.

All patients undergoing TKA, regardless of length of stay, were managed using the same enhanced recovery

protocol. This has been previously described,¹⁴ but in summary includes preoperative education, preoperative assessment, and optimization, including anaemia screening, low-dose spinal anaesthetic, and intravenous tranexamic acid at induction. Full details of the protocol including postoperative care are provided in Figure 1.

All patients underwent TKA using a cemented prosthesis (NexGen; Zimmer Biomet, USA). After surgery, patients were transferred to an inpatient orthopaedic ward, enabling overnight stay if required. This also allows patients to be managed in the postoperative period by nursing staff and allied healthcare professionals experienced in both TKA and day-case surgery.

Enhanced Recovery Pathway

Preoperative

- Patient education and counselling including booklet, DVD and App and education group
- Occupational Therapy assessment
- Anaemia screening and optimisation
- MRSA and MSSA screening
- Pharmacy team review

Day of surgery

- Pre-warming for at least 30 mins
- Pre-operative Paracetamol (+/- Oxycodone MR)

Anaesthetic

- Low dose spinal anaesthetic 0.25% Bupivacaine
- Prophylactic anti-emetic Ondansetron IV/Dexamethasone IV
- Prophylactic antibiotics (Teicoplanin and Gentamicin)
- Propofol IV infusion +/- Ketamine incremental boluses if risk factors for severe postoperative pain
- Paracetamol IV +/- Parecoxib IV

Intraoperative

- Tranexamic Acid 30mg/kg IV at induction
- Local anaesthetic infiltration 0.125% Levobupivacaine
- AQUACEL SURGICAL dressing (Deeside, UK), left in place for 2 weeks
- Wool and crepe bandage, patient advised to reduce at 24 hours

Postoperative

- Morphine sulfate IV as required in recovery
- Carbohydrate drinks
- Encourage oral fluid intake, postoperative IV fluids avoided where possible
- Regular analgesia (Paracetamol, Oxycodone MR for maximum two days then Codeine phosphate)
- As required analgesia (Oxycodone then stepped down to Morphine sulfate oral solution for discharge)
- Additional analgesics if required include Naproxen, Diclofenac PR and Gabapentin
- As required anti-emetics (Ondansetron IV/Cyclizine IV/PO)
- As required Senna
- Inpatient physiotherapy approximately 2 hours after return from recovery. Nursing staff also trained in day-0 mobilisation
- Unrestricted knee flexion post-operatively
- VTE prophylaxis Aspirin 75mg OD for 14 days
- Outpatient physiotherapy at 2 weeks from surgery

Fig. 1

Details of the enhanced recovery pathway followed for all total knee arthroplasty patients. IV, intravenous; MR, modified-release; MRSA, methicillin-resistant *Staphylococcus aureus*; MSSA, methicillin-sensitive *Staphylococcus aureus*; OD, omni die; PO, per os; PR, per rectum, VTE, venous thromboembolism.

Once the effects of the spinal anaesthetic had resolved, flexion in the knee began and patients were mobilized. Postoperative knee flexion was documented on a standardized proforma. Ordinarily, physiotherapy staff were available until 17.00, although occasionally there was provision of physiotherapy until later in the evening. Nursing staff were also trained in postoperative mobilization to support this process later in the day. The aim is for all patients to mobilize on the day of surgery, regardless of day of discharge. A standardized protocol was followed for mobilization on the day of surgery. Patients were discharged with exercise advice, in the form of a booklet, and a mobility progression plan. Exercises were reinforced to patients by ward staff prior to discharge.

Standardized discharge criteria were used for all patients, and any patient could be discharged on the day of surgery if these were met. Discharge criteria include being comfortable on regular analgesia, spontaneously voiding urine, being independently mobile, able to transfer independently (with any appropriate aids or equipment), and able to negotiate stairs or steps if necessary. The only additional criterion for patients discharged on the day of surgery was that a responsible adult must be present overnight at their discharge destination.

Routine postoperative blood tests were taken prior to discharge. Postoperative radiographs were usually obtained before discharge, but were not deemed essential unless there were intraoperative concerns. Patients discharged before radiographs were obtained returned as an outpatient within the first week postoperatively.

Patients were discharged with a package of postoperative analgesia, including regular paracetamol and codeine. Additionally, as required 'breakthrough' analgesia was provided in the form of oxycodone or oral-morphine sulphate solution. Additional analgesic agents were provided as necessary according to individual patient requirements. Antiemetics and laxatives were also provided.

Patients discharged on the day of surgery were telephoned by the orthopaedic nurse practitioner both that evening and the next morning, to check they remained well and to address any concerns.

All TKA patients received outpatient physiotherapy from two weeks to further support their rehabilitation and monitor range of motion in the operated knee.

Results

Of the 7,350 TKAs performed between 2016 and 2021, 301 (4.1%) were discharged before midnight on the day of surgery. Mean length of stay was 11 hours and 26 minutes (five hours and 30 minutes to 15 hours and 30 minutes). No patients underwent a subsequent revision procedure, and there were no periprosthetic joint infections (PJIs). Three patients (1.0%) underwent further surgery. Two patients (0.7%) underwent secondary

Table II. Reattendances and readmissions within 90 days of 301 day-case total knee arthroplasties.

Reason for ED or acute care attendance	Patients attending, n (%)	Patients admitted, n (%)
Leg swelling	9 (3.0)	0 (0.0)
Wound leak or concerns	8 (2.7)	2 (0.7)
Pain	3 (1.0)	0 (0.0)
Falls	1 (0.3)	1 (0.3)
Injury	1 (0.3)	0 (0.0)
Stroke	2 (0.7)	2 (0.7)
Pulmonary embolism	2 (0.7)	1 (0.3)
Diarrhoea	1 (0.3)	0 (0.0)
Pressure sore	1 (0.3)	0 (0.0)
Total	28 (9.3)	6 (2.0)

ED, emergency department.

patella resurfacing at 17 months and 18 months from surgery, respectively. One other patient (0.3%) underwent manipulation under anaesthetic at seven months after TKA, and subsequently underwent arthroscopic arthrolysis three months later. Three other patients (1.0%) underwent manipulation under anaesthetic alone for postoperative stiffness at three, six, and seven months after TKA, respectively.

Four of the patients who underwent further procedures as detailed above also underwent aspiration of the joint, all of which were negative for infection. Four other patients (1.3%) underwent urgent aspiration of the knee after presenting with acute problems, and four patients (1.3%) underwent planned aspirations as part of investigations for chronic pain, all of whom were negative for infection after extended ten-day culture.

Overall, 28 patients (9.3%) attended the ED or other acute care settings within 90 days of surgery. Reasons for attendance and readmission are detailed in Table II, but were most commonly due to concerns about the wound or leg swelling. No patients had a confirmed deep vein thrombosis, though two patients (0.7%) had a pulmonary embolism. Two patients (0.7%) also had a stroke at 17 and 20 days after surgery, respectively. In total, six patients (2.0%) were admitted to inpatient care within 90 days of their knee arthroplasty surgery.

Of the 206 patients with accessible GP consultation records, 16 (7.8%) contacted or saw their GP within two weeks of surgery. This was most commonly for concerns with pain and for further analgesia. All reasons are detailed in Table III. Two patients (1.0%) required urgent referral to ED or other secondary care services.

Results of the questions on satisfaction with the day-case process and postoperative pain control from the 121 contactable patients are shown in Table IV. Patients reported high levels of satisfaction with day-case TKA, with a mean satisfaction score of 9.6 out of ten, and 95.0% stating they would undergo day-case surgery again for another joint arthroplasty.

Table III. GP contact and attendances within 14 days in 206 patients with accessible records of GP encounters.

Reason for GP contact	Patients contacting or attending GP, n (%)	Patients referred to emergency/secondary care, n (%)
Leg swelling	2 (1.0)	1 (0.5)
Pain	9 (4.4)	1 (0.5)
Sick note	2 (1.0)	0 (0.0)
Constipation	2 (1.0)	0 (0.0)
Gastro-oesophageal reflux	1 (0.5)	0 (0.0)
Total	16 (7.8)	2 (1.0)

GP, general practitioner.

a higher complication rate in outpatient TKA when compared to inpatient procedures, although readmission rates were lower in the outpatient group. Li et al²¹ found a comparable complication rate between day-case TKA and traditional inpatient TKA, but an increased complication rate in day-case TKA when compared to fast-track TKA. However, a systematic review in 2021 found no significant differences in complication rates between outpatient or day-case TKA and inpatient TKA.²² Another systematic review in 2021 found a lower risk of readmission in day-case TKA.²³ The 90-day readmission rate of 2.0% in this study is lower than rates reported in

Table IV. Responses to questions on satisfaction in 121 patients contacted by telephone after day-case total knee arthroplasty.

Question	Yes	No
Would you have a day-case knee arthroplasty again?, n (%)	115 (95.0)	6 (5.0)
Would you recommend day-case knee arthroplasty to a friend or family member?, n (%)	119 (98.3)	2 (1.7)
Was your pain well controlled after the operation?, n (%)	113 (93.4)	8 (6.6)
Mean satisfaction score on a 0 to 10 scale, n (range)	9.6 (4.0 to 10.0)	

Discussion

We have successfully introduced day-case TKA in our trust, completing the first 301 procedures with no revisions or PJI, and low complication rates.

Day-case TKA is not routine practice in the UK⁶; day-case UKA has been reported,^{15,16} but there is limited literature on day-case TKA. We previously reported early results of our first 47 TKAs in 2019.¹³ In 2017, Lovasz et al¹² reported the results of 53 day-case TKAs in the UK, with a low complication rate and high patient satisfaction. To our knowledge, this study presents the largest series of day-case TKAs performed in the NHS.

Day-case surgery has advantages for patients, but also for the health service in terms of cost and resource use. While we do allocate an inpatient bed for all TKA patients to enable an overnight stay if required, a successful same day discharge still means that bed then becomes available for the next day and reduces the inpatient load for the service. Once day-case surgery is established, allocation of inpatient beds can be planned according to the expected proportion of beds that will become available due to same day discharges. A time-driven activity-based cost-analysis of day-case hip and knee arthroplasties in Denmark found minimal difference in cost between day-case procedures performed as an inpatient and procedures performed with the use of an ambulatory surgery unit.¹⁷

Concerns have previously been raised about the safety of day-case TKA. Arshi et al¹⁸ and Nowak et al¹⁹ both reported higher complication rates in outpatient TKAs, using data from high-volume joint arthroplasty databases in 2017 and 2019, respectively. A 2020 systematic review and meta-analysis by Bordoni et al²⁰ found

other literature on day-case TKA. It is also lower than the rates previously reported in our trust using the enhanced recovery protocol,¹⁴ although it should be noted that this is now a historical cohort.

A potential concern with day-case TKA is that patients will subsequently require input from the ED or their GP with pain or other concerns. Through reviewing ED, UCC, ACU, and GP records, we have been able to assess this and establish that only a small minority of patients required further medical input postoperatively. Introducing day-case surgery in our trust has not placed an undue burden on other areas of the health service. Only 4.4% of patients contacted their GP due to pain, suggesting postoperative pain remains well controlled despite discharge on the day of surgery.

Another potential concern with day-case surgery is postoperative stiffness due to less inpatient physiotherapy.¹⁸ A randomized controlled trial in 2017 showed no difference in function, pain or quality of life between inpatient rehabilitation, and home-based rehabilitation after TKA.²⁴ Inadequate pain control and inadequate rehabilitation combined with an unmotivated patient have previously been reported as risk factors for postoperative stiffness;²⁵ to meet the criteria for day-case discharge, pain must be controlled with regular analgesia and patients must be independently mobile, demonstrating early postoperative function and significant motivation in meeting these criteria. Four patients (1.3%) in this study underwent manipulation under anaesthetic, which is lower than the previously reported national rate of 2.22%.²⁶

A limitation of this study is the absence of a direct comparator cohort of patients requiring an overnight stay. Patients discharged on the day of surgery are likely to be patients with a higher level of function and independence preoperatively. As we apply the same protocols and discharge criteria to all patients, we did not feel it was appropriate to directly compare the two groups as day-case patients have already 'self-selected' themselves from the TKA cohort, and therefore are not directly comparable to those requiring an overnight stay. However, the range of comorbidities and ASA grades reported in this cohort (Table 1) demonstrates that day-case TKA is not restricted only to patients with limited medical history or the lowest ASA grades. The primary purpose of this report is to demonstrate the safety and efficacy of day-case TKA in an NHS setting. The low complication rate, readmission rate, and reattendance rate supports this, regardless of comparison with a non-day-case cohort.

We also note that active clinical follow-up for most patients ceased after the first postoperative outpatient review; in line with standard practice in our trust, most patients were discharged at this time if there were no concerns. However, through reviewing all hospital records, including ED, UCC and ACU attendances, and GP records, we endeavoured to capture all reattendances, reoperations, and complications after this. As this study is focused on reporting on the safety of day-case TKA, the minimum of six-months study follow-up is appropriate for this, although many patients had far longer follow-up. There is no reason to suspect that long-term outcomes, such as revision rates would be affected by the day of discharge.

The development of day-case surgery in our trust has been a natural progression from the instigation of the enhanced recovery pathway.¹⁴ It has been an evolution of the existing processes, rather than a revolution, that has enabled day-case TKA to be performed successfully and safely. Applying a comprehensive approach to preoperative preparation, perioperative care, and postoperative rehabilitation, and using defined discharge criteria for all patients, rather than a selected cohort, provides almost any patient with the opportunity to be discharged on the day of surgery. This also means that all patients are transferred to an inpatient bed after surgery and can easily be admitted overnight if required, and therefore avoids placing undue pressure on patients, clinical staff, or the service. Finally, this common approach to all patients, whether day-case or not, avoids concentrating resources on a small cohort of day-case patients at the expense of those staying overnight.

The number of day-case discharges has increased over the study period; in 2017, there were only 27 day-case TKA procedures compared to 2021, when there were 94. As confidence in the process from staff, and in turn patients, has grown, more patients have been able to

meet the required discharge criteria on the day of surgery. Expanding the day-case process is primarily focused on the development of the enhanced recovery protocol, improving recovery time after surgery. However, there will always be a significant proportion of patients who are not able to be discharged on the day of surgery, most frequently due to the timing of surgery and the resolution of spinal anaesthetic.

The introduction of early morning operating lists may increase the opportunity for discharge on the day of surgery, but this is unlikely to be readily achievable in most NHS trusts. We believe the introduction of extended hours physiotherapy will be the strongest driver to further increase day-case discharges in our hospitals. Other reasons for delayed discharge commonly include pain, postoperative hypotension, and wound problems; the enhanced recovery process aims to minimize the incidence of these issues and optimize the management of them.

The process is reliant on clinical staff who are engaged and invested in supporting day-case surgery. The anaesthetic and surgical team, the nursing and ward staff, and the physiotherapy team are all integral to enabling patients to meet the required discharge criteria, and building their confidence in going home on the day of their operation.

We have described the use of day-case surgery in our NHS trust, with an approach that we believe can be applied throughout the NHS. By viewing day-case surgery as an extension of the existing enhanced recovery processes applied to all patients, we have ensured that the whole service and all patients benefit, not just those going home on the day of surgery. The results in this study from over 300 day-case TKAs show that day-case surgery can be performed safely in the NHS, with low rates of complications and readmissions and with high patient satisfaction.



Take home message

- This study describes an approach to safely delivering day-case total knee arthroplasty (TKA) surgery in the NHS. Through reviewing emergency care and primary care records, the authors have endeavoured to estimate the true rates of postoperative contact with the health service.
- The authors found low incidence of contact with primary and secondary care in the postoperative period, and high patient satisfaction in 301 day-case TKAs.

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Supplementary material



STROBE statement: checklist of items that should be included in reports of observational studies.

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Funding statement:

- The authors disclose receipt of the following financial or material support for the research, authorship, and/or publication of this article: Open access funding as per statement below.

ICMJE COI statement:

- W. G. Fishley discloses the BOA/ORUK Research Fellowship grant, and the Zimmer Biomet/Northumbria Educational Fellowship grant. T. Petheram reports payment to provide education from Heraeus for a hip arthroplasty course. M. Reed declares grants or contracts from Stryker, Zimmer Biomet, Heraeus, Link, Depuy, Smith & Nephew, Implantcast, and Biocomposites (made to institution to support the Bone and Joint Infection Registry), from Heraeus (which makes the cement), and from Zimmer Biomet for an educational grant for a fellow within the team; consulting fees from Heraeus and Pharmacosmos; and payment or honoraria for lectures, presentations, speakers bureaus, manuscript writing, or educational events from Zimmer Biomet, Heraeus, Stryker, and Pharmacosmos, all of which is unrelated to this work.

Data sharing:

- The datasets generated and analyzed in the current study are not publicly available due to data protection regulations. Access to data is limited to the researchers who have obtained permission for data processing. Further inquiries can be made to the corresponding author.

Acknowledgements:

- The authors would like to acknowledge the contributions to this work of Hilary Young and Gail Lowdon.

Open access funding:

- The authors report that they received open access funding for this manuscript from Research and Innovation funding, Trauma and Orthopaedics, Northumbria Healthcare NHS Foundation Trust, UK.

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