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Original Research Article

APPROACH AND UNDERSTANDING OF SURGICAL TRAINEES TOWARDS THE USE OF UNIVERSAL ACS-NSQIP SURGICAL RISK CALCULATOR, AND CLINICAL DATA KEEPING AND ITS AUDIT

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Abstract: *Clinical audit methods and surgical risk calculators are paramount in advancing surgical protocols and enhancing patient outcomes. The objective is to assess surgical trainees' approach and understanding of using the Universal ACS-NSQIP Surgical Risk Calculator and clinical data keeping and its audit to improve surgical practices and patient outcomes. A cross-sectional study was administered among 71 surgical trainees at Dr. Ruth K. M. Pfau Civil Hospital Karachi to assess their understanding, perspectives, and behaviors about using the risk calculator and procedures for data management. To gather this information, a questionnaire-based survey was utilized to collect data, which was analyzed via SPSS. The participants displayed limited familiarity (9.9%, n=7) and implementation (0%) of the ACS-NSQIP Surgical Risk Calculator in the clinical practice of surgical trainees. Despite most participants expressing confidence in the calculator's reliability (71.4%) and advocating for its integration into surgical practice (85.7%), its utilization remains non-existent. Moreover, while every participant acknowledged the significance of mantaining patient records and conducting audits, only 22.5% reported participating in clinical data audits. Furthermore, most surgical residents relied on clinical intuitions and conventional sources such as textbooks for patient consultations. There is a notable gap between the comprehension and utilization of the Universal ACS-NSQIP Surgical Risk Calculator among surgical residents. This research emphasizes the necessity to comprehend and utilize for incorporating evidence-based instruments such as the Universal ACS-NSQIP Surgical Risk Calculator and implement rigorous data management and review protocols to cultivate a culture of quality enhancement and optimize patient outcomes. This can be attained through initiatives such as educational programs, enhanced availability of resources, and improved assistance for the compilation and evaluation of data.*

Keywords: Surgical Risk Calculator, ACS-NSQIP, Clinical Audit, Surgical Trainees, Patient Outcomes, Data Management

Introduction

The concept of clinical audit is as old as Florence Nightingale's when she showed in the early 1850s that improved sanitation decreases mortality rates. However, the idea of routine clinical audit did not become a norm of our clinical practice until the late 20th and early 21st century when the United Kingdom (UK) made it mandatory at a national level for its hospitals to collect and report all their patients' related data to National Health Service (NHS) for its centrally regulated clinical audit integrated into 'clinical governance'. Conversely, in the United States of America (USA), the work related to clinical audit is generally self-regulated and performed by individual institutions' leadership and healthcare insurance companies. While the rest of the world lies somewhere between these two ends of the spectrum (Boult and Maddern, 2007).

Clinical audit is even more critical in the setting of surgical patients because surgical treatments are almost always at risk of specific potential undesired outcomes. Historically, these risks and their chances were subjectively guessed by the surgeons on their surgical intuitions with no statistical data in the background. These guesses were then used to counsel the patient as part of the decision-making process before proceeding with surgery. With the advent of a dynamic and modern healthcare system, the sustenance of best practices through protocol-driven medical practice and accountability has become standards of care that are challenging to achieve without objectivity. So, collecting and maintaining data on surgical patients and its routine audit has become paramount for surgical practices. This continuous objective data assessment allows for periodic improvement in surgical practices to improve patient outcomes. It also enables surgeons and their patients to decide whether to adopt a surgical approach by providing more accurate expectations from surgery in terms of complications, surgical morbidity and mortality and outcomes of the said operation (Chand et al., 2007).

One such example of a surgical clinical audit is the American College of Surgeons – National Surgical Quality Improvement Program (ACS-NSQIP), the largest international database, which was initiated in 1991 in the Department of Veteran Affairs (VA) as a response to the Congress law to report their annual risk-adjusted surgical outcomes and compare them to national averages. A National VA Surgical Risk Study (NVASRS) was started, which collected data on major surgeries from VA hospitals and developed a risk-adjusted model for 30-day morbidity and mortality. This led to the establishment of the Veteran

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Affairs - National Surgical Quality Improvement Program (VA-NSQIP) at all the VA hospitals, which over the following years showed a 45% decrease in morbidity, a 27% reduction in mortality and significant cost savings. This remarkable achievement of such a program sparked interest in private-sector hospitals. By 2004, ACS initiated ACS-NSQIP and started enrolling private hospitals and receiving their surgical data, including patient demographics, laboratory values, comorbidities, and 30-day post-operative outcomes, for audit (Pitt et al., 2009). It works by incorporating newly received data from hospitals into its database on a 6-monthly basis, re-calibrating its risk-adjusted models, and reporting the data of overlapping twelve months in a Semi-Annual Report (SAR) to its participating hospitals. These hospitals then can compare their surgical performance with their own from the previous year and to other average NSQIP hospitals in a patient and procedure-specific manner. The research by Cohen et al. (2015) showed that continuous participation in ACS-NSQIP leads to improving performances of hospitals with improved surgical outcomes and reductions in surgical site infections, morbidity and mortality (Cohen et al., 2016).

In 2013, Bilimoria et al. made a Universal ACS-NSQIP Surgical Risk Calculator based on the database of ACS-NSQIP, which at that time had more than 1.4 million patients' data. This can report individualised 30-day post-operative risks for almost all the operations by factoring in the planned surgery based on its Current Procedure Terminology (CPT®) code and patient-specific pre-operative predictor variables. This calculator also allows the Surgeon to adjust the score for any predictor variable not included in the calculator model. The purpose of building such a tool was to break away from the historic risk prediction system of personal surgeons' experience, augmented with rates published in isolated institutional studies, without considering patient-specific risk factors. Thus, it allows surgeons the ability to objectively calculate personalised patient and surgery-specific post-operative risks, which can then be presented to patients and their caregivers in a reproducible and easy-to-understand manner, giving them the opportunity of shared decision-making with better understanding and involvement along with more realistic expectations from the surgery (Bilimoria et al., 2013). A striking feature of the ACS-NSQIP calculator is that it constantly updates its risk calculator, calculating risks from its constantly evolving database of cases, last updated in June 2023 using 4.3 million cases in the ACS-NSQIP database (Miller et al., 2023; Rozeboom et al., 2022). This makes it the risk calculator backed by the most significant number of cases from more than 700 hospitals worldwide (Mon).

The preceding discussion showed the importance of surgical datakeeping, clinical audits and risk calculators in improving surgical practices and patient outcomes. However, we have observed that in our part of the world, there is no practice of rigorous datakeeping of our patients, and very rarely any clinical audits are performed. A very handful of clinical audits from the hospitals in our country are published, and even those are from isolated singular hospitals done in a single time frame with no follow-up audits. Similarly, surgeons here still rely on historical methods of intuition and figures from isolated studies without patient specificity when estimating the outcomes of a particular surgery. Very rarely does any institution have enough complete patient data to allow them to evaluate their yearly performance for quality improvement purposes. So, we have designed this study to assess the approach and understanding of surgical trainees towards using surgical risk calculators, particularly the Universal ACS-NSQIP Surgical Risk Calculator, and clinical data keeping and its audit. The reason for selecting the Universal ACS-NSQIP Surgical Risk Calculator for the study purpose is the sheer magnitude of this calculator, where it can be used in almost every surgical scenario and its backed by the largest and most dynamically evolving surgical database to date. Surgical trainees are the target of this study because they are future surgeons and will be holding leadership roles in their respective prospective institutions, and having such critical concepts of clinical audit among them will allow us to progress on this crucial front in the future. Thus, this study aimed to assess surgical trainees' approach and understanding towards using the Universal ACS-NSQIP Surgical Risk Calculator and clinical data keeping and its audit to improve surgical practices and patients' outcomes.

Methodology

A cross-sectional study method was utilised to examine surgical residents' prevailing patterns and qualities in the Department of Surgery at Dr. Ruth K. M. Pfau Civil Hospital Karachi. This approach allowed for a comprehensive overview of this population's demographic and professional characteristics over a designated three-month period. This design facilitated an efficient and thorough analysis of the collective attributes within our study cohort by focusing on data collection at a specific moment, (Setia, 2016) providing valuable insights into the current landscape of surgical trainees at our hospital.

The research encompassed all surgical residents working in the general surgery units of the hospital, resulting in a total sample size of 71 individuals. This comprehensive methodology ensured that all pertinent participants within the targeted population were included, enhancing the representativeness and scope of the data gathered. The chosen sample size was deemed suitable for fulfilling the research objectives, facilitating a thorough examination of these trainees' demographic and professional attributes.

The utilisation of consecutive sampling served as the method for participant selection, offering a systematic approach to include surgical residents sequentially as they presented themselves within the study setting. This pragmatic technique was deemed suitable due to its practicality and effectiveness in enrolling individuals based on their availability during data collection (Emerson, 2015). By using this sampling technique, The researchers tried to mitigate potential bias and secure an all-encompassing representation of the entire cohort of surgical trainees throughout the study period.

The selection criteria for the sample population comprised all surgical trainees from the six units within the hospital's surgical department. Significantly, no exclusions were imposed on any demographic or professional characteristics, granting unrestricted participation to all resident surgeons. This inclusive approach was implemented to uphold integrity and comprehensiveness in

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research findings, thereby augmenting study outcomes' overall robustness and validity.

The data was collected after ethical approval from the Civil Hospital Karachi's IRRB. Principle investigator (PI) approached residents of all the surgical wards sequentially and informed them of the purpose and procedure of the research. Then, the PI presented them with the study's consent form to obtain their informed consent. Participants giving consent were given hard copies of the study proforma. Participants were given an adequate amount of time to fill the Performa. However, the Performa were collected in a single sitting from them to ensure the credibility of the response from them. All hard copies of the data are stored under lock and key, while all soft copies will be password-protected. In addition, the confidentiality and anonymity of the participants were maintained to ensure ethical principles (Naidu, 2018).

The questionnaire was developed, reviewing the literature related to the subject. Moreover, topic experts were consulted to create items for the questionnaire, which increases the research's validity, as Patten suggested (Patten, 2016). A pilot study was also conducted by implementing the questionnaire among a limited number of surgical trainees. It was essential to identify potential ambiguities and discrepancies within the survey items. Furthermore, the initial study facilitated revisions to specific questions and response choices, ensuring clarity and comprehensibility for its intended respondents. This preliminary evaluation prompted modifications to be made to the questionnaire, thereby improving its overall reliability and validity in capturing the viewpoints and approaches of surgical trainees within the designated research location.

The questionnaire consists of 3 sections. The first section is related to demographic information, whereas section 2 consists of 3 subsections: knowledge, attitude, and practices with items related to the Universal ACS-NSQIP Surgical Risk Calculator. The third section is general and related to patient data maintenance, auditing, and surgical risk assessment.

The data of the study was encoded and analysed through SPSS version 26. Demographic variables were analysed using descriptive statistics. Moreover, responses to items in section 2 and section 3 were also analysed using descriptive statistics in frequencies and percentages.

Results

This research was carried out at the Department of Surgery, Dr. Ruth K.M. Pfau Civil Hospital Karachi, and involved a sample size of 71 surgical trainees. Demographic variables such as age and years of experience were conveyed as Median (Interquartile range) as these continuous data had skewed distribution as per the Kolmogorov–Smirnov test (p-value 0.01), whereas gender and residency year were conveyed as percentages and frequency. The demographic profile of the participants revealed that their median age was 27 years (with an interquartile range of 26-28), and their median years of experience were found to be three (with an interquartile range between 2 to 4). Notably, a total number of twenty-two individuals, constituting approximately 31% of the sample, were male, while forty-nine individuals, representing about 69%, were female. Regarding their residency status, it emerged that more than one-third (39.4%, n=28) of the participants belonged to the first-year category, whereas 22.5% (n=16), 18.3% (n=13), and 19.7%. (n =14) belonged to the second-year, third-year, and fourth-year residences, respectively (see Table 1).

Table 1: Demographic Information of the Participants

Variable	Participants (n=71)
Age, years	27 (26-28) *
Experience, years	3 (2-4) *
Gender	
Male, n (%)	22 (31)
Female, n (%)	49 (69)
Year of residency	
1, n (%)	28 (39.4)
2, n (%)	16 (22.5)
3, n (%)	13 (18.3)
4, n (%)	14 (19.7)
**= Median (Interquartile Range)*	

The level of familiarity with the Universal ACS NSQIP Surgical Risk Calculator among participants was low, as only 9.9% reported knowing the tool.

Among those who were familiar with it, there was variation in their understanding of its specific parameters. Only 2 participants recognised that the calculator could be utilised for elective and emergency surgeries; others correctly identified that it is applied pre-operatively (n=4) and incorporates 20 factors for calculating surgical risk (n=3). It can be seen that 5 of 7 participants demonstrated accurate comprehension of essential variables within the calculator, such as age, ASA status, BMI, diabetes mellitus and sepsis, which impact surgical outcomes. Additionally, an equivalent number (5 out of 7 participants) acknowledged its primary purpose in predicting morbidity and mortality; in contrast, only a participant knew about the Surgical Risk Calculator's follow-up period post-operatively, permitting risk adjustment for parameters not included in the calculator. Moreover, 3 of 7 and 4 of 7 participants showed that they knew the calculator's ability to assess geriatric factors affecting the surgical outcome and calculate constantly updating risks from an evolving database (Table 2). Regarding attitudes toward the calculator, a significant majority expressed confidence in the validity of outcomes and risks determined by the ACS-NSQIP (5 participants) and applicability to their specific patient population (4 participants). It advocated for its integration into surgical practice (6 participants). Additionally, 6 of 7 respondents believed that utilisation of this tool could aid in informing patients about potential post-operative complications. However, it should be noted that only 2 participants thought that the calculator was user-friendly (Table 3). Remarkably, the utilisation of the ACS-NSQIP Surgical Risk Calculator was not reported by any participants in their clinical practice. All of the 7 participants said that they do not use the ACS-NSQIP surgical risk calculator in their practice. Hence, the participants did not answer the practice component of section 2 in the questionnaire. Nevertheless, all participants (100%, n=71) agreed to preserve patient data and conduct audits to enhance quality improvement (Table 4).

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Table 2: Summary of Knowledge Component of Questionnaire (Section 2)

Knowledge variable	Frequency
I knew it was used for both elective and emergency surgeries.	2
Knew it is applied pre-operatively	4
Knew it has 20 factors which are used to calculate surgical risk.	3
Correctly identified its parameters.	5
Knew it is used to predict morbidity and mortality.	5
I knew that its follow-up period was 30 days postoperatively.	1
I knew that it allows risk adjustment for parameters not included in the calculator.	1
I knew that it allows for the assessment of geriatric factors affecting the surgical outcome.	3
I knew that it was a dynamic calculator calculating risks from a constantly evolving database.	4

Table 3: Summary of Attitude Component of Questionnaire (Section 2)

Attitude variable	Frequency
Thinks the outcomes and risks calculated by this calculator are reliable.	5
Thinks the risk calculated by ACS-NSQIP can apply to our population	4
Thinks this calculator should be used in our surgical practice	6
Thinks it can help surgeons counsel patients about the risks of post-operative complications	6
Find this calculator easy to use	2

A noteworthy proportion (54.9%) stated that they regularly maintain patient records within their ward/hospital for auditing purposes. In comparison, a lesser percentage (22.5%) confirmed having conducted audits to improve quality, indicating the need for greater emphasis on this essential practice within the surgical context. Furthermore, it was found that none of the participants incorporated surgical risk calculators in practice, pointing towards a possible gap in incorporating evidence-based tools. Moreover, only a minority (15.5%, n=11) reported using validated figures or percentages while counselling patients about potential risks associated with their respective surgeries. Out of these participants, ten individuals acknowledged utilising information sourced from textbooks. In contrast, one participant cited published literature to convey the risks involved in surgical procedures to their patients. This demonstrates the scope for enhanced patient education and communication strategies. Fifty-nine participants (83.1%) reported that they counsel patients against undergoing surgery due to underlying disease burden and co-morbidities. However, all of them relied on clinical judgment when doing so. Emphasising the significant reliance on individual clinical expertise in decision-making processes among surgical residents.

Table 4: Summary of Section 3 of Questionnaire

Variables	Frequency (Percentage)
Think patient data should be maintained	71 (100)
Think maintaining and auditing patient data can help in improving overall patient outcome	71 (100)
Routinely maintains a record of their patients and their outcomes inward/hospital, which can be readily used for audit purposes	39 (54.9)
Audited the data of your patients for quality improvement purposes	16 (22.5)
Use any surgical risk calculator in your routine clinical practice	0 (0)
Use validated figures/percentages when counselling patients regarding the risks associated with their surgeries	11 (15.5)
Counsel patients against proceeding with surgery due to their underlying primary disease burden and co-morbidities.	59 (83.1)

The primary results suggest a notable disparity between knowledge and application of the Universal ACS-NSQIP Surgical Risk Calculator among surgical trainees and an inadequate recognition of the significance of consistently maintaining and evaluating patient data for quality improvement objectives. A thorough examination of the underlying factors contributing to these disparities may yield valuable perspectives on potential methods for promoting a more robust integration of evidence-based tools and protocols within surgical environments.

Discussion

The study aimed to assess the approach and understanding of surgical trainees towards using the Universal ACS-NSQIP Surgical Risk Calculator, and clinical data keeping and its audit to improve surgical practices and patients' outcomes. The results of this research indicate a lack of knowledge and application of the Universal ACS-NSQIP Surgical Risk Calculator among surgical trainees within our setting. Such findings align with prior research conducted in other developing nations, which have likewise documented low levels of awareness and utilisation of surgical risk calculators among surgeons (Carter et al., 2010). However, the existing literature emphasises adopting clinical audit practices (Boult and Maddern, 2007; Carter et al., 2010; van

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Leersum et al., 2011). This shows a substantial gap in implementing these protocols among surgical residents at our medical facility. The participants in the study exhibited limited proficiency with the ACS-NSQIP Surgical Risk Calculator, which contrasts with the increasing body of research supporting its effectiveness in enhancing patient outcomes and promoting collaborative decision-making (Bilimoria et al., 2013; Marković et al., 2018; McMillan et al., 2017). Our results align with the findings of Cohen et al. (2015), who highlighted how failure to engage with risk calculators and contemporary data-driven methods may hinder advancements towards improved surgical practices and patient care consequences (Cohen et al., 2016).

One probable rationale for insufficient understanding and utilisation of surgical risk calculators in developing nations is that surgeons operating in these regions may encounter challenges accessing essential resources, such as computers and internet connectivity, needed to utilise such tools properly (Waqar et al., 2022). Another potential factor could be a lack of awareness or acknowledgement among surgeons regarding the substantial evidence supporting the effectiveness of surgical risk calculators, or they may not believe that these calculators apply to their patient population (Eamer et al., 2018; Osborne et al., 2021).

Additionally, the findings highlight a disparity between the reported attitudes and actual utilisation of the risk calculator. Despite expressing confidence in its reliability and applicability to their patient population, the participants did not incorporate the ACS-NSQIP Surgical Risk Calculator into their clinical practice. This indicates potential limitations in effectively implementing evidence-based tools and emphasises the need for targeted interventions to bridge the gap between knowledge and practice. These findings are consistent with Bilimoria et al. assertion that incorporating data-driven tools is crucial for providing patients with more accurate risk assessments, promoting shared decision-making, and setting realistic expectations (Bilimoria et al., 2013).

Moreover, findings from our study indicate a predominant reliance on clinicians' expertise and traditional approaches when providing patient counselling. However, this approach lacks sufficient utilisation of validated statistical data and percentages from the current literature. This highlights the necessity for healthcare professionals to incorporate evidence-based communication techniques into patient consultations to facilitate informed decision-making regarding surgical interventions (Adams and Drake, 2006; Edwards and Elwyn, 2009). Additionally, the fact that surgical residents heavily rely on textbooks for patient counselling emphasises the importance of integrating contemporary research findings and evidence-based recommendations into educational curricula. These practices of predicting outcomes and risk of adverse events from isolated studies and figures can be misleading in the majority of scenarios as they fail to take into consideration the holistic status of patients, including their age, disease severity, the burden of underlying co-morbidities, etc., which are unique to a specific patient and has a significant impact upon their surgical outcomes. That is why many surgical risk calculators, such as ACS NSQIP, Portsmouth Physiological and Operative Severity Score for the Enumeration of Mortality and Morbidity (P-POSSUM), Revised Cardiac Risk Index (RCRI), Charlson Comorbidity Index, Surgical Apgar Score, etc., has been established to calculate patient-specific outcomes based on a multitude of variables (Jindal et al., 2023; Wijeysundera, 2016).

This investigation also reveals significant discrepancies between perceived attitudes towards accurate patient data maintenance and audits to enhance healthcare quality and their actual implementation within hospital settings. These results emphasise the need for increased recognition of the value of collecting and analysing data in medical education programs and clinical practice environments. Despite unanimously acknowledging their importance, only a few participants consistently adhered to these practices. Moreover, it is essential to note that the data recorded by these professionals is not usable for auditing purposes, as the data is usually incomplete or insufficient. This inconsistency underscores the necessity for institutional interventions that promote a culture conducive to data-informed quality improvement in surgical units (Kristensen et al., 2020). This is a critical area for improvement, as frequent reviews of patient data assist surgeons in identifying opportunities for enhancing their practice (Bosse et al., 2006).

Existing literature emphasises the critical role of clinical audits in optimising overall patient outcomes (Carter et al., 2010; Davies and Wilson, 2004). However, this study's findings indicate that the surgical residents within the context of public sector hospitals in Karachi do not actively participate in clinical data audits and implementation of surgical risk assessment tools while relying heavily on their clinical judgment, which leads to an absence of data for clinical auditing and identifying the improvement in patient outcomes.

The clinical implications of this study are multifaceted, indicating the necessity for comprehensive interventions within surgical training programs and healthcare institutions. There is a critical need for educational initiatives aimed at familiarising surgical trainees with contemporary data-driven tools. Emphasis should be placed on practical applications of the validated surgical risk assessment tools, such as ACS NSQIP, in making informed surgical decisions and conducting patient consultations. Additionally, institutional efforts must prioritise systematic collection and maintenance of patient data to facilitate regular clinical audits. This will aid in identifying opportunities for quality improvement in surgical practices and enhancing patient outcomes. Furthermore, effective communication strategies between surgeons and patients should take precedence. These communication methods should incorporate validated statistical data and evidence-based literature to support informed patient consent and shared decision-making processes.

This study is subject to several limitations. Primarily, the limited sample size and singular institutional setting may restrict the generalisability of the results to other surgical trainees. Additionally, reliance on self-reported data introduces the potential for bias in the findings. Hence, participants were asked to complete the questionnaire within a single setting to reduce bias. Furthermore, this study did not investigate the underlying reasons behind trainees' inadequate use of surgical risk calculators.

Future investigations should prioritise conducting expansive, multi-institutional research to evaluate the understanding, perspectives, and behaviours of surgical

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trainees regarding incorporating surgical risk calculators. Furthermore, future studies must investigate the underlying rationales behind why surgical trainees do not utilise these calculators and devise effective interventions aimed at mitigating these hindrances.

Conclusion

The results indicated a significant lack of knowledge and implementation of the ACS-NSQIP Surgical Risk Calculator in the clinical practice of surgical trainees. Our research emphasises the necessity to comprehend and utilise for incorporating evidence-based instruments such as the Universal ACS-NSQIP Surgical Risk Calculator and implement rigorous data management and review protocols to cultivate a culture of quality enhancement and optimise patient outcomes. This can be attained through initiatives such as educational programs, enhanced availability of resources, and improved assistance for the compilation and evaluation of data. (18) The results emphasise the significance of targeted instructional and institutional measures to promote adherence to contemporary best practices and informed decision-making among trainee surgeons. Additionally, this study underscores the significance of comprehensive reforms in surgical training programs to equip future practitioners with the requisite tools and expertise to embrace cutting-edge data-centric approaches in their practice.

Declarations

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All data generated or analyzed during the study are included in the manuscript.
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The authors declared absence of conflict of interest.

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