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REVIEW

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Integrated clinical pathways for lower limb orthopaedic surgeries: An updated systematic review

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Abstract

Objective: The objective of the study was to comprehensively synthesise the components of integrated clinical pathways (ICPs) and post-operative outcomes of patients undergone total hip and knee arthroplasty (THA & TKA) and hip fracture surgeries.

Background: Previous systematic reviews examined components and effectiveness of ICPs for lower limb joint replacement and hip fracture surgeries.

Design and Methods: An updated systematic review guided by the Whittemore and Knafl (2005) framework. Electronic databases, Ovid MEDLINE, EBSCOhost-CINAHL, the Cochrane Reviews and Trails, EMBASE and PubMed, were searched from 2007 to 31 January 2021. Due to the heterogeneity of the methods and data collection tools of included studies, pooling of the quantitative data was not possible. Therefore, the included studies were synthesised and presented narratively under subthemes of arthroplasty and hip fracture surgeries. The PRISMA checklist for systematic reviews was used.

Results: Twenty-four studies met selection criteria with 11 examined ICPs for hip fracture and 13 for the THA and TKA. Twenty-one ICPs were reviewed, and 33 components were extracted. The most frequently included components for hip fracture subgroup were 'discharge disposition arrangement' and 'dedicated personnel and resources'. 'Exercise plan' and 'pain management' were for the arthroplasty subgroup. A significant reduction in the length of stay and post-operative complications were associated with the ICPs. Results were mixed for the effectiveness of ICPs in reducing unplanned hospital admissions, mortality rates, post-operative complications and hospital costs.

Conclusion: The number of ICP components varied across studies. This review could not recommend a one size-fits-all ICP that could be adapted for use for patients undergoing hip fracture and joint replacement surgeries.

Relevance for clinical practice: This review identified research evidence-based components considered as essential for the inclusion in ICP's for hip fracture and arthroplasty surgeries. Further research is suggested to determine the patient experience and healthcare providers' acceptance of ICPs.

KEYWORDS
components, effectiveness, hip fracture, integrated clinical pathway, joint replacement, post-operative outcomes, systematic review

1 | INTRODUCTION

Integrated care pathways (ICPs) developed for patients undergoing surgical procedures have been defined as evidence-based interventions and management to improve health outcomes post-operatively (De Bleser et al., 2006; Lawal et al., 2016; Rawlinson et al., 2011). The ICPs consist a set of specific care components that enhance continuum of care through pre-admission, peri-operative and discharge (De Bleser et al., 2006; Rawlinson et al., 2011). For patients undergoing orthopaedic surgery, ICPs are referred to as either clinical pathway (CP) or enhanced recovery after surgery (ERAS) protocols (De Bleser et al., 2006; Kinsman et al., 2010). One common component of orthopaedic ICPs is patient education on the expected outcomes of surgery, pain management, mobilisation following surgery, prevention of post-operative complications and arrangement of continuity of care after discharge (De Bleser et al., 2006).

Two literature analyses on effectiveness (Leigheb et al., 2013; Rotter et al., 2012) of ICPs for patients with hip fracture and joint replacement surgeries were identified. The reviews examined the effectiveness of ICPs in hip fractures (Leigheb et al., 2013; Rotter et al., 2012) and lower joint replacement surgeries (Leigheb et al., 2013) and linked the use of ICPs to better coordination and integration of care for patients between acute hospital and primary care settings (Rotter et al., 2012). For emergency orthopaedic surgery, such as hip fractures, ICPs were mainly associated with reduced post-operative complication rates, costs and hospital length of stay (Leigheb et al., 2013; Rotter et al., 2012). Rotter et al. (2012) conducted a meta-analysis on studies from 1966–2006 examining pathways used to manage both fractures and lower limb joint replacement. However, Leigheb et al. (2013) presented a narrative summary on effectiveness of ICPs in hip fracture management. There is a need to conduct an updated systematic review on the use of ICPs for orthopaedic patients undergoing surgery with a focus on total knee (TKA) and hip arthroplasty (THA) and hip fractures.

Two literature reviews (Scott et al., 2013; Wainwright et al., 2020) examined components of ICPs for patients with lower joint replacement surgeries. Wainwright (2020) focused on the pharmacological aspects of patient management perioperatively (Wainwright et al., 2020). Soffin and YaDeau (2016) did not provide a structured literature search criteria and critical appraisal of the evidence (Soffin & YaDeau, 2016). There is, however, significant variations across the studies in terms of the numbers and types of components included in the ICPs. To date, there is no comprehensive review on ICP components in the continuum of care for patients undergoing lower limb joint replacement and hip fracture surgeries.

What does this paper contribute to the wider global clinical community?

- The essential components of care to be included in ICPs for hip fracture are 'discharge disposition arrangement', 'dedicated healthcare providers and other resources', 'time to surgery', 'time to complete diagnostic investigations' and 'the time to complete screening for post-operative complications'.
- The essential components of care to be included in the ICPs for the TKA and THA are 'exercise plan', 'patient education on expected management plan', 'pain management' and 'expected date of discharge'.
- Integrated clinical pathways ensure quality of care, reduce inconsistency of care provided for patients, improve patient health outcomes in all phases of hospitalisation including pre-, intra- and post-surgery.
- This review suggests the length of stay (LOS) as an outcome measurement of ICP effectiveness should be reviewed and standardised as date of operation to date of discharge from the primary hospital.
- Future evaluation of the ICPs should also consider examining LOS in conjunction with other outcomes such as hospital costs, unplanned re-admissions and post-operative complications.

2 | AIM

The overall aim was to present an updated systematic review of the components and effectiveness of ICPs for THA and TKA and hip fracture surgeries. The objectives were to collate the components of reported ICPs and to critically review research evidence on post-operative outcomes of using ICPs.

3 | METHODS

The Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) checklist for systematic reviews was used (Refers to Supplementary file). Research evidence from a diverse range of studies was mapped, assessed and systematically synthesised according to Whittemore and Knafl (2005) framework. The framework consists of five stages including problem identification, literature search, data evaluation, data analysis and

TABLE 1 Characteristics of the included studies

1st Author/Year Country	Procedure	Study design	Study setting	Sample size (patients)	Participants age (year)	ASA at surgery	Comorbidities
Anighoro 2020 USA	Hip Fracture	Retrospective cohort study Pre-post-test study	A Tertiary Hospital	ICP = 147 NICP = 116;	ICP = 83 ± 9 NICP = 82 ± 9;	ASA = 2 (NICP = 10; ICP = 9) ASA ≥ 3 (NICP = 116; =106; ICP = 138) CCI (NICP = 116; =3.10 ± 3.11; ICP = 3.80 ± 3.18)	Not reported
Jackson 2019 USA	Hip Fracture	Comparative prospective design	3 Hospitals	ICP = 2069 NICP	Mean age ± SD: ICP = 82.3 ± 7.1 NICP = 82.8 ± 7.6	Not reported	Not reported
Kalmet 2019 The Netherlands	Hip Fracture	Retrospective cohort	A Tertiary Hospital	ICP = 182 NICP = 216	Mean age ± SD: ICP = 82.4 ± 7.4 NICP = 82.2 ± 7.5	NICP = 81(44.5%)—ASA 1–2; NICP = 101(55.5%) ASA 3–4: ICP = 168(44.2%)—ASA 1–2; ICP = 230 (57.8%) ASA 3–4:	Not reported
Murphy 2019 Ireland	Hip Fracture	Comparative prospective design	Multiple site (notational database)	ICP = 146 NICP = 139	Age ICP = 82.8 NICP = 79.6	Not reported	Not reported
Lau 2017 Hong Kong	Hip Fracture	Comparative prospective design	A Tertiary Hospital	2006-base line (*n* = 319) versus 2008–2011 (*n* = 1415)	Average age: 2006 = 82.12 2008–2011 = 83.28–83.8	Not reported	Not reported
Kalmet 2016 The Netherlands	Hip Fracture	Retrospective	6 Hospitals	ICP = 665 NICP = 528	Mean age ± SD: NIC = 80.7 ± 9.4; ICP = 80.5 ± 9.6	ASA 1–2: NICP = 223 (42%); ICP = 265 (40%) ASA 3–4: NICP = 305 (58%); ICP = 400 (60%)	Not reported
Burgers 2014 The Netherlands	Hip Fracture	Retrospective; Before and after	A Tertiary Hospital	526 (ICP = 212; NICP = 314)	Median age (range) NICP = 84 (77–89); ICP = 84 (79–89)	ASA 1 (NICP = 19; ICP = 20) ASA 2(NICP = 130; ICP = 161) ASA 3(NICP = 60; ICP = 121) ASA 4 (NICP = 1; ICP = 10)	Not reported
Flikweert 2014 The Netherlands	Hip Fracture	A clinical trial versus Historical controls	A Tertiary Hospital	ICP = 256 NICP = 145	Mean age: ICP = 78 ± 9; NICP = 80 ± 10	Both group: Mean ASA = 3	ICP = 87%; NICP = 88% with comorbidities
Suhm 2014 Switzerland	Hip Fracture	Comparative prospective design	A Tertiary Hospital	493 (NICP = 269; ICP = 224)	Mean age: NICP = 83.9 ± 7.5; ICP = 84.3 ± 7.4)	Not reported	Charlson Comorbidity Index (NICP = 2.1 ± 1.6; ICP = 2.5 ± 2.0); Dementia (NICP = 94 (35%); ICP = 74 (33%))

(Continues)

TABLE 1 (Continued)

1st Author/Year Country	Procedure	Study design	Study setting	Sample size (patients)	Participants age (year)	ASA at surgery	Comorbidities
Niemeijer 2013 The Netherlands	Hip Fracture	Retrospective and Prospective, Non-experimental study	A Tertiary Hospital	NICP = 137; ICP = 195	Mean age ± SD: UC = 79.43 ± 9.77; ICP = 78.3 ± 9.38	ASA 1–2: NICP = 47 (34%); ICP = 94 (48%) ASA 3–4: NICP = 90 (66%); ICP = 101 (52%)	Not reported
Lau 2010 Hong Kong	Hip Fracture	A retrospective review of records	A Tertiary Hospital	964	Mean age = 83	ASA = 1 (<3%) ASA = 2 (46%) ASA = 3 (52%)	97% with comorbidities (commonly includes Diabetes; Hypertension; Dementia)
Mascioli 2021 USA	TKA	Retrospective cohort study	2 freestanding ambulatory surgery centres	386 patients	Mean age: Overall (58.8)	ASA ≤ 2 Overall = 70.2% ASA ≥ 3—quantified as 1/3 of all procedures	Hypertension = 60.1%); Diabetes = 17.8%; Osteoarthritis = 16.9%; Depression = 10.6% Cancer = 10.1%
Ripolles-Melchor 2020 Spain	TKA & THA	Comparative prospective design	131 Centres	6146 (ICP = 1592; NICP = 4554)	Median age ICP = 70; NICP = 71	ASA 1–2 (NICP = 3281; ICP = 1246) ASA 3–4 (NICP = 1273; ICP = 345)	Hypertension: NICP = 60%; ICP = 57%; Diabetes: NICP = 19%; ICP = 18% COPD: NICP = 12%; ICP = 11%
Gwyne-Jones 2017 New Zealand	THA & TKA	Historical cohort study	A Community hospital	1035 (ICP = 528; NICP = 507)	Mean age: THA = 68.3; TKA = 70.4	ASA Grades 3 & 4: 32% of patients	Not reported
Stowers 2016 New Zealand	TKA & THA	Quasi-experimental control group	A Community hospital (satellite hospital)	206 (ICP = 106; NICP = 100)	Mean age ± SD: ICP = 66.70 ± 9.20; NICP = 65.40 ± 12.50	ASA 1–3 in the ICP ASA 1–4 in the NICP	Hypertension: NICP = 66%; ICP = 70%; Diabetes: NICP = 21%; ICP = 23% Cholesterol: NICP = 33%; ICP = 37% COPD: NICP = 7%; ICP = 15% Ischaemic heart disease: NICP = 17%; ICP = 17%
Scott 2013 UK	THA & TKA	Retrospective Audit	22 Scottish orthopaedic units (2010 the follow-up in 2011)	2623 (ICP = 687; NICP =)	Mean age: ICP = 68 NICP = 68	Mean ASA: ICP = 2.1 NICP = 2.2	Percentages with comorbidities ICP = 36%. NICP = 26%
den Hertog 2012 Germany	TKA	Prospective randomised case control study	A Tertiary Hospital	147 (ICP = 74; NICP = 73)	Mean age ± SD: NICP = 68.25 ± 7.91 ICP = 66.58 ± 8.21	Excluded patients with ASA = 3	Commonly includes Gastrointestinal; Allergies; Cardiac comorbidity

TABLE 1 (Continued)

1st Author/Year Country	Procedure	Study design	Study setting	Sample size (patients)	Participants age (year)	ASA at surgery	Comorbidities
Gooch 2012 Canada	TKA & THA	Randomised Control Trial	Multisite (Urban and Rural)	1570 (NICP = 504; ICP = 1066)	Mean age: NICP = 69 ± 10.4 ICP = 69 ± 11.1	ASA≥3: NICP = 24.2%; ICP = 21.6%	Hypertension: NICP = 52.2%; ICP = 51.1%. Diabetes: NICP = 11.7%; ICP = 12.9% Chronic Disease Score: NICP = 3185 ± 2403.9; ICP = 3132.5 ± 2270.6
McDonald 2012 UK	THA & TKA	Comparative prospective design	A tertiary hospital	1816 (NICP = 735; ICP = 1081)	Mean age ± SD: ICP = 70 ± 13; NICP = 69 ± 11	Not reported	Not reported
Lin 2011 Taiwan	TKA	Quasi-experimental control group	Single site - type of site not specified in this study	83 (ICP = 39; NICP = 44)	Mean age ± SD = 72.73 ± 8.42)	Not reported	Not reported
Malviya 2011 UK	THA&TKA	Comparative prospective design	A Tertiary hospital	4500 (NICP = 3000; ICP = 1500)	Mean age: NICP = 69; ICP = 68	Mentioned but not specified	Commonly includes Hypertension; AF; IHD; IDDM; COPD; Alzheimer
Raphael 2011 Canada	THA&TKA	historical cohort study	A Community hospital	200 (ICP = 100; NICP = 100)	Mean age ± SD: ICP = 65 ± 9; NICP = 69 ± 8	Not reported	Commonly includes COPD; Diabetes: Hypertension; Renal disease; Obstructive sleep apnoea
Xu 2008 Singapore	TKA	A retrospective review of records	A Tertiary Hospital	1371 patients (1663 knees)	Mean age = 65.2 (22–90)	Not reported	49.4% had comorbidities, of which 1/3 had at least one comorbidity; Mostly Hypertension (45.9%); Dyslipidaemias (16.9%); Diabetes mellitus (13%)
Walter 2007 USA (29)	THA&TKA	Prospective consecutive study	A Tertiary Hospital	1680 (NICP = 315; ICP = 1365)	Average age: NICP = 68. ICP = 65 (Year 1 & 2) ICP = 67 (Year 3)	Not reported	Not reported

Abbreviations: ICP, Integrated Clinical Pathway group; NICP, Non-ICP group; THA, Total Hip Replacement; TKA, Total Knee Replacement.

presentation. Five electronic databases were searched on 15th February 2021 including Ovid MEDLINE, EBSCOhost-CINAHL, the Cochrane Reviews and Trails, EMBASE and PubMed from 1 January 2007 to 31 January 2021. The key search terms using Medical Subject Headings (MeSH) were Critical Pathways/[mh] OR guideline/or practice guideline/[mh] OR Patient Care Planning/Enhanced Recovery Protocol After Surgery/AND; Hip replacement [mh] OR hip arthroplasty/AND; Knee replacement [mh] OR knee arthroplasty AND; Hip fracture/[mh] AND; "length of stay"/[mh] OR patient admission/[mh] OR patient readmission/[mh] OR patient transfer/AND; "costs and cost analysis"/[mh] OR health care costs/AND; Hospital Mortality/AND Postoperative Complications/[mh].

Key words were complemented by a search of grey literature sourced from the Curtin University library. When the full text of a relevant article was not found, the authors were contacted for further information through the university librarian. If the requested information was not available or not suitable for inclusion, the article was excluded.

3.1 | Selection of studies

Two reviewers independently assessed the sourced titles and abstracts. Full texts were then retrieved and evaluated using the following inclusion criteria:

- The article employed a quantitative research design to evaluate post-operative outcomes of using ICPs; and
- Studies described the components of the ICPs;
- The research context was a hospital; that is, settings in which ICPs for orthopaedic surgery were implemented.
- Participants were hospitalised or admitted to inpatient wards.

Exclusion criteria include conference abstracts or grey literature. Grey literature is materials and research produced by organisations outside of the traditional academic publishing and distribution channels, for example government documents, white papers and PhD thesis.

Articles were excluded if they did not meet the inclusion criteria. Different opinions were resolved by reviewing the full text of the article to determine whether it met the selection criteria.

From the identified articles, the following information was extracted (when available) and tabulated for interpretation: Study design and methods; surgical procedure(s) (knee or hip arthroplasty and hip fracture repair); and patient demographic and clinical characteristics (Table 1). Components of the ICPs for pre-operative, intra-operative and post-operative care were summarised in Table 2. Additionally, the effectiveness of ICPs such as functional measures, length of hospital stay (LOS), hospital costs, mortality, morbidity and unplanned hospital re-admissions was extracted and presented in Table 3.

3.2 | Critical appraisal of included studies

All the studies included in this review were assessed for potential risk bias including selection bias, performance bias, detection bias and attrition bias (Porritt et al., 2014) and were evaluated as low. All studies provided sufficient details of the study population, information related to inclusion criteria was clearly described, control and intervention groups were comparable at entry (if applicable to the study design), the outcomes were measured in the same way for all the groups, and statistical analysis was appropriate for the design of the study (Rotter et al., 2012).

3.3 | Data synthesis

Due to the heterogeneity of the methods and data collection tools of included studies, pooling of the quantitative data was not possible (Harden & Thomas, 2010). Therefore, the included studies were synthesised and presented narratively under the themes of arthroplasty and hip fracture surgeries using the synthesis without meta-analysis (SWiM) (Campbell et al., 2020;.

4 | RESULTS

A total of 1526 papers were identified from the five academic databases, namely Ovid (Medline/Embase) (n = 700), the Cochrane Library (reviews and trials; n = 110) and EBSCOhost (CINAHL) (n = 716). Ten additional records were also identified from grey literature. A total of 1059 were considered not relevant to this review and excluded. After removing 375 duplicates, 104 records with full text were assessed against selection criteria. Fifty-seven conference abstracts and two letters to the editor were excluded. Full texts of the remaining 47 articles were retrieved and assessed against the selection criteria. Twenty-three studies were further excluded as the studies did not provide details on the components of orthopaedic clinical pathways. A hand search of reference lists of the remaining 24 articles did not yield any further studies for inclusion. Figure 1 demonstrates the consensus process used by the reviewers to identify the 24 studies included in this review. Of the included 24 studies, eleven focused on hip fractures, and the other 13 studies were for THA and TKA.

4.1 | Characteristics of included studies

Table 1 shows the features of the included studies. Studies were conducted in a variety of countries: Netherlands (n = 5), UK (n = 3), Canada (n = 2), New Zealand (n = 2), Hong Kong (n = 2), USA (n = 3), one from Singapore, Ireland, Switzerland, Taiwan, Spain and Germany. The included 24 studies consisted of 12 prospective comparative study designs and 12 retrospective. Of the 12 prospective studies, there were two random control trial (Gooch et al., 2012; den Hertog et al., 2012) and quasi-experimental studies (Lin et al., 2011; Stowers et al., 2016).

Due to variations in the methodology of each study and in how the findings were analysed and reported, a meta-analysis was not feasible even for studies with similar outcome measures (Harden & Thomas, 2010). In addition, all the studies included in this review were conducted in different countries with very different healthcare systems.

The ICPs was mostly implemented in tertiary hospitals rather than in community/district hospitals (Gwynne-Jones et al., 2017; Raphael et al., 2011; Stowers et al., 2016) or ambulatory setting (Mascioli et al., 2021). The sample size varied from 147 (den Hertog et al., 2012) to 4500 (Malviya et al., 2011). The target population for all included studies was adult patients (aged ≥18 years), and the mean age for patients in the ICP group ranged from 65–84.3 years. In twelve studies where comorbidity was reported, the most common conditions were diabetes and hypertension. More than half of the patients in the ICP group were classified as fit for surgery based on the American Society of Anaesthesiologists (ASA), a method of characterising patient operative risk based on a scale of 1–5, where 1 is normal health and 5 is moribund (Hackett et al., 2015).

4.2 | Components of the ICP

Eleven studies used ICPs in the management of hip fractures (Anighoro et al., 2020; Burgers et al., 2014; Flikweert et al., 2014; Jackson et al., 2019; Kalmet et al., 2016; Lau et al., 2010, 2017; Murphy et al., 2019; Niemeijer et al., 2013; Suhm et al., 2014) and thirteen in TKA and THA (Gooch et al., 2012; Gwynne-Jones et al., 2017; den Hertog et al., 2012; Lin et al., 2011; Malviya et al., 2011; Mascioli et al., 2021; McDonald et al., 2012; Raphael et al., 2011; Ripollés-Melchor et al., 2020; Scott et al., 2013; Stowers et al., 2016; Walter et al., 2007; Xu et al., 2008). Two of the 10 hip fracture studies used the same ICP and three of the 11 THA and TKA used the same ICP. Therefore, a total of 21 ICPs were reviewed, and 33 components of ICP were extracted. The 33 extracted components were then organised according to phases of hospitalisation (pre-operative, intraoperative and post-operative; Table 2). The analysis of these components was then based on the subgroups of hip fracture and TKA and THA.

4.2.1 | Hip fracture ICP subgroup

In the hip fracture subgroup, two clinical pathways had 11 ICP components (Lau et al., 2017; Niemeijer et al., 2013; Suhm et al., 2014). These were then followed by another ICP with nine components (Flikweert et al., 2014). Two other studies in comparison, only reported four components (Burgers et al., 2014; Kalmet et al., 2019). The most frequently reported component of ICP in this subgroup was 'discharge disposition arrangement' (Burgers et al., 2014; Flikweert et al., 2014; Kalmet et al., 2016, 2019; Lau et al., 2010, 2017; Murphy et al., 2019; Niemeijer et al., 2013; Suhm et al., 2014), followed by 'time to surgery' (Flikweert et al., 2014; Jackson et al., 2019; Kalmet et al., 2016, 2019; Niemeijer et al., 2013; Suhm et al., 2014), 'the time to complete screening for post-operative complications' (Flikweert et al., 2014; Kalmet et al., 2016; Lau et al., 2010, 2017; Niemeijer et al., 2013; Suhm et al., 2014) and 'dedicated health care providers and other resources' (Anighoro et al., 2020; Flikweert et al., 2014; Jackson et al., 2019; Kalmet et al., 2016; Murphy et al., 2019; Niemeijer et al., 2013; Suhm et al., 2014).

For the pre-operative phase, 'time to surgery', 'time to complete screening for post-op complications' and 'dedicated healthcare providers and other resources' were the most included components of the hip fracture ICP.

Only one component reported in the intra-operative phase for hip fracture subgroup (Anighoro et al., 2020). Post-operatively, all ICPs except Jackson et al. (2019) had a component of 'arranged discharge disposition'; and four ICPs included 'multidisciplinary team consultation' (Burgers et al., 2014; Murphy et al., 2019; Niemeijer et al., 2013; Suhm et al., 2014), 'exercise plan' (Burgers et al., 2014; Kalmet et al., 2019; Lau et al., 2010, 2017) and 'complications prevention and management' (Lau et al., 2010, 2017; Murphy et al., 2019; Suhm et al., 2014).

4.2.2 | THA and TKA ICP subgroup

For the TKA and THA subgroup, one study included 12 ICP components (Raphael et al., 2011) and another with ten components (McDonald et al., 2012). One other study identified four components (Gwynne-Jones et al., 2017) in the ICP. The most reported component of care was 'exercise plan' (Gooch et al., 2012; Gwynne-Jones et al., 2017; den Hertog et al., 2012; Malviya et al., 2011; Raphael et al., 2011; Scott et al., 2013; Stowers et al., 2016; Walter et al., 2007; Xu et al., 2008), followed by 'patient education on expected management plan' (Gooch et al., 2012; Gwynne-Jones et al., 2017; Malviya et al., 2011; McDonald et al., 2012; Raphael et al., 2011; Scott et al., 2013; Stowers et al., 2016). The third commonly reported ICP components were 'pain management' (Malviya et al., 2011; Mascioli et al., 2021; McDonald et al., 2012; Raphael et al., 2011; Scott et al., 2013; Stowers et al., 2016; Walter et al., 2007; Xu et al., 2008) and 'expected date of discharge'(Gwynne-Jones et al., 2017; Lin et al., 2011; Malviya et al., 2011; McDonald et al., 2012; Scott et al., 2013; Stowers et al., 2016; Xu et al., 2008).

For the pre-operative phase, the most included component was 'education on expected management plan' (Gooch et al., 2012; den Hertog et al., 2012; Lin et al., 2011; Malviya et al., 2011; McDonald et al., 2012; Raphael et al., 2011; Stowers et al., 2016; Xu et al., 2008) followed by 'pain management' (Gooch et al., 2012; den Hertog et al., 2012; Malviya et al., 2011; Raphael et al., 2011; Ripollés-Melchor et al., 2020; Scott et al., 2013; Stowers et al., 2016), 'dedicated healthcare providers and other resources' (Gooch et al., 2012; den Hertog et al., 2012; Lin et al., 2011; McDonald et al., 2012; Raphael

TABLE 2 Components of integrated clinical pathways

Phases of ICP	Components of ICP	Hip Fracture ICPs									
		Jackson 2019	Kalmet 2019	Murphy 2019	Lau 2017 Lau 2010	Kalmet 2016	Burgers 2014	Flikweert 2014	Suhm 2014	Anighoro 2020	Niemeijer 2013
Pre-operative	Time to surgery	✓	✓			✓		✓	✓		✓
	Time to complete diagnostic investigations				✓			✓	✓	✓	✓
	Time to complete screening for post-op complications				✓		✓	✓	✓		✓
	Pain management				✓			✓		✓	
	Education on the expected management plan	✓			✓		✓				
	Dedicated healthcare providers and other resources	✓		✓		✓		✓	✓	✓	✓
	Coordinated MDT Assessment	✓	✓	✓						✓	
	Discharge and follow-up planning	✓			✓	✓			✓		
	Optimisation: Stopped smoking and alcohol consumption 4 weeks before surgery										
	Carbohydrate drinks preload (50g in 400ml fluid)										
	Avoidance of long-acting sedative premedication										
	Thromboprophylaxis (Low-molecular-weight heparin and compression stockings)										
Intra-operative	Standardised type of surgery and anaesthesia										
	Complication prevention										
	OR prepared and implants verified available by OR charge nurse									✓	
	Designated physician									✓	
	IV fluids management										
	Pain management including multimodal pain management									✓	

	Joint Replacement ICPs											
Total counts	den Hertog 2012	Gwynne-Jones 2017	Gooch 2012	Kin 2011	Stowers 2016 Malviya 2011 Scott 2013	McDonald 2012	Raphael 2011	Xu 2008	Walter 2007	Ripolles-Melchor 2020	Mascioli 2021	Total counts
6	✓		✓		✓					✓	✓	5
5										✓		1
5	✓		✓				✓					3
3	✓		✓		✓		✓				✓	5
3	✓		✓	✓	✓	✓	✓			✓		7
7	✓		✓	✓		✓	✓					5
4						✓						1
4			✓			✓	✓					3
										✓		1
										✓		1
										✓		1
										✓		1
					✓	✓	✓			✓	✓	5
	✓				✓					✓	✓	4
2												
2												
						✓				✓		2
2	✓				✓		✓				✓	4

TABLE 2 (Continued)

Phases of ICP	Components of ICP	Hip Fracture ICPs Jackson 2019	Kalmet 2019	Murphy 2019	Lau 2017 Lau 2010	Kalmet 2016	Burgers 2014	Flikweert 2014	Suhm 2014	Anighoro 2020	Niemeijer 2013
Post-operative	Pain management				✓					✓	
	Activities of daily living plan				✓		✓				
	Exercise plan		✓		✓		✓				
	Wound drain/ urinary catheter management				✓						
	Dedicated case manager										
	Multidisciplinary team (MDT) Consultation			✓			✓		✓	✓	✓
	Pre-arranged imaging and laboratory tests										
	Complications prevention and management			✓	✓				✓		
	Early introduction of diet										
	Commencement of the discharge process							✓			✓
	Expected date of discharge								✓		
	Pharmacist to perform medicine reconciliation									✓	
	Arranged discharge disposition		✓	✓	✓	✓	✓	✓	✓	✓	✓
	Availability of MDT rehabilitation programme							✓	✓	✓	✓
	Mode and scheduled follow-up							✓	✓	✓	
Total items included in each ICP		5	4	5	11	4	6	9	11	6	8

et al., 2011)and 'time to surgery' (Gooch et al., 2012; den Hertog et al., 2012; Malviya et al., 2011; Mascioli et al., 2021; Ripollés-Melchor et al., 2020; Scott et al., 2013; Stowers et al., 2016). Two studies did not have components of ICP in the pre-operative phase (Walter et al., 2007; Xu et al., 2008).

For intra-operative phase, the most reported components were 'standardised type of surgery and anaesthesia' (Malviya et al., 2011; Mascioli et al., 2021; McDonald et al., 2012; Raphael et al., 2011; Ripollés-Melchor et al., 2020; Scott et al., 2013; Stowers et al., 2016) and 'pain management' (den Hertog et al., 2012; Malviya et al., 2011; Raphael et al., 2011; Scott et al., 2013; Stowers et al., 2016).

Overall, most ICP's in the THA and TKA group focused on the post-operative phase including components of 'exercise plan' (Gooch et al., 2012; Gwynne-Jones et al., 2017; den Hertog et al., 2012; Malviya et al., 2011; Raphael et al., 2011; Ripollés-Melchor et al., 2020; Scott et al., 2013; Stowers et al., 2016; Walter et al., 2007; Xu et al., 2008), 'pain management' (Malviya et al., 2011; Mascioli et al., 2021; McDonald et al., 2012; Raphael et al., 2011; Ripollés-Melchor et al., 2020; Scott et al., 2013; Stowers et al., 2016; Walter et al., 2007; Xu et al., 2008) and 'expected date of discharge' (Gwynne-Jones et al., 2017; Lin et al., 2011; Malviya et al., 2011; McDonald et al., 2012; Scott et al., 2013; Stowers et al., 2016; Xu et al., 2008).

4.3 | Post-operative outcomes of integrated clinical pathways

The post-operative outcome measures included function measures, length of hospital stay (LOS), hospital costs, unplanned hospital

	Joint Replacement ICPs											
Total counts	den Hertog 2012	Gwynne-Jones 2017	Gooch 2012	Kin 2011	Stowers 2016 Malviya 2011 Scott 2013	McDonald 2012	Raphael 2011	Xu 2008	Walter 2007	Ripolles-Melchor 2020	Mascioli 2021	Total counts
2					✓	✓	✓	✓	✓	✓	✓	7
2		✓	✓				✓		✓			4
3	✓	✓	✓		✓	✓	✓	✓	✓	✓		9
1								✓	✓			2
		✓		✓								2
5												
						✓						1
3							✓	✓	✓	✓	✓	5
										✓		1
2									✓		✓	2
1		✓		✓	✓	✓		✓			✓	6
1												
9												
4												
3				✓			✓					2
	8	4	8	5	9	10	12	5	6	10	9	

readmissions, mortality rates and post-operative complications. Table 3 presents a summary of the outcomes.

4.3.1 | Function measures

Three of the 13 included studies under the TKA and THA subgroup measured patients' mobilisation and joint flexion following the surgery. Scott et al. (2013) reported that 36% of patients in the ICP group mobilised day zero post-operatively compared with 4% in the NICP group ($p < .01$). Patients' joint flexion were assessed using American Knee Society Score (AKSS), Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) or Post Oxford Score by two studies. Two studies reported significantly improved joint flexion at discharge was reported with implementation of the ICP (den Hertog et al., 2012; McDonald et al., 2012). However, McDonald et al. (2012) did not find any significant difference between the two groups six weeks post-discharge.

4.3.2 | Length of hospital stay

Length of hospital stay was examined by 22 out of the 24 included studies. Sixteen studies detected statistically significant shorter LOS in the patient group who had used an ICP group compared with the Non-ICP group.

For the hip fractures subgroup, analysis of outcomes found 23% (18) to 47% (Lau et al., 2017) reduction in LOS (days) in the ICP group.

Similarly, THA and TKA subgroup identified a reduction in LOS by 16%–59% (Gwynne-Jones et al., 2017; den Hertog et al., 2012; Lin et al., 2011; Malviya et al., 2011; McDonald et al., 2012; Raphael et al., 2011; Scott et al., 2013; Stowers et al., 2016; Walter et al., 2007; Xu et al., 2008). However, LOS was calculated differently across studies. In particular, one study measured LOS from admission to discharge from the acute hospital (Lau et al., 2017), another calculated LOS in the ambulatory setting (Mascioli et al., 2021), while two others calculated LOS from admission to the acute hospital to discharge from the convalescent hospital (Lau et al., 2010; Niemeijer et al., 2013).

4.3.3 | 30-day unplanned hospital re-admissions

Six studies in the TKA and THA subgroup and four in the hip fracture examined 30-day re-admission rates; however, none of the studies found significant differences between the ICP and NICP groups. The main reasons for re-admission in both the joint replacement and hip fracture sub-groups included deep venous thrombosis (DVT; Xu et al., 2008), post-operative haematoma (Raphael et al., 2011), blood loss (Anighoro et al., 2020) and wound infection (Raphael et al., 2011; Xu et al., 2008).

4.3.4 | Mortality rates

Twelve of the 24 included studies assessed 30-day mortality rates. One study (Flikweert et al., 2014) in the hip fracture subgroup and another (Malviya et al., 2011) in the TKA and THA subgroup, reported a statistically significant reduction in mortality rates in the ICP group. The remaining ten found no statistical difference between the ICP and NICP groups.

Two studies also examined 90-day or 1-year mortality rate. Malviya et al. (2011) reported a significantly lower 90-day mortality rate in the ICP group, while Lau et al. (2017) found no difference in the 1-year mortality rate between the two groups.

4.3.5 | 30-day post-operative complications

Seven studies in the hip fracture subgroup and five in the TKA and THA subgroup reported 30-day post-operative complications. One study in the TKA and THA group descriptively reported 90-day post-operative complications (Mascioli et al., 2021). Overall, there were decreased post-operative complications in the ICP group compared with the NICP group. Five studies reported a statistically significant reduction in post-operative complications (Kalmet et al., 2016, 2019; Malviya et al., 2011; Ripollés-Melchor et al., 2020; Suhm et al., 2014). Specifically, in the TKA and THA subgroup, two studies found a 13% reduced demand for blood transfusions post-operatively ($p < .001$) (Jackson et al., 2019) and 5% reduction in post-operative delirium ($p = .02$) (Kalmet et al., 2016). The reported complications included wound infection (den Hertog et al., 2012; Stowers et al., 2016), pulmonary embolism (Malviya et al., 2011; Stowers et al., 2016; Xu et al., 2008), DVT (Malviya et al., 2011; Mascioli et al., 2021; Stowers et al., 2016; Xu et al., 2008), urinary tract infection (Stowers et al., 2016; Xu et al., 2008), stroke (Malviya et al., 2011; Stowers et al., 2016), fractures (Gwynne-Jones et al., 2017), falls (Mascioli et al., 2021), myocardial infarction (Malviya et al., 2011; Stowers et al., 2016), tibial fissure (den Hertog et al., 2012), arthrofibrosis (Mascioli et al., 2021) and subluxation of the patella (Anighoro et al., 2020; den Hertog et al., 2012).

In the hip fracture subgroup, two studies found a 14%–54% decrease in the overall in-hospital post-operative complication ($p < .01$) (Kalmet et al., 2016; Suhm et al., 2014). The post-operative complications for hip fracture, if reported, were hospital acquired pressure sores (Lau et al., 2010), wound infection (Lau et al., 2010, 2017), blood loss (Malviya et al., 2011), delirium (Kalmet et al., 2016, 2019), pneumonia (Lau et al., 2017) and stroke (Kalmet et al., 2016).

4.3.6 | Hospital costs

Six out of the 21 included studies examined hospital costs. The specific indicators assessed were costs related to shorter LOS (Malviya et al., 2011; Walter et al., 2007), workforce costs (Lau et al., 2017), medical costs (Lin et al., 2011) and overall cost savings (Niemeijer et al., 2013; Stowers et al., 2016). Although there was a trend towards savings across all indicators, only one study showed a statistically reduction in medical costs in the ICP group (t-6.03, $p < .001$) (Lin et al., 2011).

5 | DISCUSSION

This paper has presented an updated review on components of ICPs and post-operative outcomes of using ICPs for patients undergoing hip fracture and THA and TKA surgeries. A total of 24 studies were reviewed. The overall findings support the use of ICPs in the management of THA and TKA and hip fractures surgeries. The results revealed that the essential components of care to be included in ICPs for Hip fracture are ‘discharge disposition arrangement’, ‘dedicated health care providers and other resources’, ‘time to surgery’, ‘time to complete diagnostic investigations’ and ‘time to complete screening for post-operative complications’. The essential components of care to be included in the ICPs for the TKA and THA are ‘exercise plan’, ‘patient education on expected management plan’, ‘pain management’ and ‘expected date of discharge’. This review has found that implementation of ICPs significantly reduced LOS and post-operative complications. However, other outcome measures were inconclusive, such as unplanned hospital admission rate, mortality rates, post-operative complications and hospital costs.

5.1 | Components of ICPs

Overall, the comprehensiveness in the descriptions of ICPs components for both hip fracture and arthroplasty varied across the studies. Only two studies focusing on arthroplasty surgery provided specific and detailed information about patient care plan during the perioperative, post-operative phases (Gooch et al., 2012; Raphael et al., 2011).

Components of ICPs in this review were categorised according to phases of hospitalisations (pre-, intra- and post-operative). Worth noting was the smaller number of ICP components in the intra-operative phase compared to the other two phases. In particular, there was no intra-operative ICP component in the hip fracture group. In the THA and TKA group, only five studies had intra-operative ICP components including 'pain management' and 'standardised surgical procedure and anaesthesia' (den Hertog et al., 2012; Malviya et al., 2011; Raphael et al., 2011; Scott et al., 2013; Stowers et al., 2016). The plausible reason why the studies had few or no intra-operative components is that they might have reported them as part of pre- or post-operative phases.

5.1.1 | Essential ICP components for hip fracture surgery

This review identified discharge arrangement as crucial component of ICP. Research evidence showed that majority (82%) of patients admitted to the hospital with hip fracture are directly from home, but only a third of these patients are discharged directly home following the fracture (Ferris et al., 2021). These patients end up in rehabilitation and residential facilities. Having a setting to transit patients from acute care to these facilities, it is critical to minimise disruption to the patients' social circumstances and quality of life post fracture (Ferris et al., 2021).

A designated healthcare provider was cited as one of the most common ICP components in this review. The designated staff to coordinate the care from admission till post-discharge follow-up. Care required for patients with hip fracture involves multidisciplinary team members across acute care services and primary care settings. Therefore, having a care coordinator enables each healthcare provider and services effectively and collaboratively play its substantial role in delivering integrated care for patients. Research evidence has demonstrated that care coordination was associated with improved patient experiences and lower cost of healthcare settings (Mohr et al., 2019).

Additionally, the reduced time from admission to hip fracture surgery improves patient's health outcome especially, post-operative functional outcomes (Seong et al., 2020). Other outcomes include reduction of mortality, length of hospital stay and post-operative complications. It is, therefore, critical, to organise timely pre-operative medical evaluation and it is suggested that surgery be performed within 24 hours of admission.

5.1.2 | Essential ICP components for arthroplasty surgery

Total hip replacement (THR) and total knee replacement (TKR) are commonly performed elective surgical procedures. The importance of physical activity has been widely recognised in resumption of active lifestyle, prevention of disability for patients underwent arthroplasty (Almeida et al., 2018). Most studies in this review also provided detailed information of a 4–6 weeks 'exercise plan' and/or 'activities required of a daily living plan'.

Pain management throughout patient's hospitalisation for arthroplasty surgery was also identified in a previous review and linked to early patient recovery, reduced LOS and post-operative complications (Rotter et al., 2012). This review also emphasised the importance of detailing an exercise plan and safe, effective use of analgesia (Rotter et al., 2012). Although 'pain management' is critical component of care for patient undergoing arthroplasty, only two studies detailed pain management plan that specified amount and type of analgesia to be used (Mascioli et al., 2021; Walter et al., 2007).

Research evidence has shown that pre-operative patient education programme is significantly associated with positive outcomes post-operatively. The outcomes include shorter LOS and cost of care (Hass et al., 2015). However, it is critical to provide effective and well-structured education materials and way of delivery ensuring patient's comprehension of pre-admission, peri-operative treatment and rehabilitation process and requirement.

Discharge planning is cited as an essential ICP component for patient undergo arthroplasty in this review. Hass et al. (2015) also suggested early engagement of both patient and multidisciplinary healthcare providers to proactively plan out patient's discharge needs and map process and resources accordingly. This approach in return reduced patient's LOS.

5.2 | Post-operative outcomes of ICPs

Post-operative outcomes were measured in terms of hospital costs, unplanned admissions, LOS, mortality and morbidity. The use of ICPs was associated with overall reduction in hospital costs; however, not all findings were significant. This suggests cost savings need to be interpreted with caution when implementing ICPs. Clinicians intending to use these results to guide their management of costs need to consider the benefits and costs under different circumstances (e.g. market forces for specific countries; Rotter et al., 2012).

Similar to a previous systematic review (Rotter et al., 2012), the findings of this review showed consistent reductions in LOS with the use of ICPs. The measurement of LOS does however, need to be standardised to reflect the specific period when the ICPs are implemented. Scott et al. (2013) calculated the LOS from date of operation to the date of discharge from the acute hospital. By calculating LOS post-operatively offers a comparable measure to assess effectiveness of using ICPs. At times patient's surgery is delayed due

TABLE 3 Comparisons of patient health outcomes measures between integrated care pathway and routine care groups

Author/Year Country	Procedure	Function measures	Time to surgery	Hospital Length of Stay (LOS)—in Days	Readmission
Anighoro 2020 USA	Hip Fracture	Not examined	Average time to surgery RC = 0.89 days ICP = 0.75 days ($p = .25$)	Length of stay was ICP = 7.1 + 6.7 days NICP = 6.6 + 4.4 days ($p = .25$)	ICP = 0.8+1.5 NICP = 1.5 + 1.8 $p = .002$
Jackson 2019 USA	Hip Fracture	Not examined	Not examined	Mean LOS ± SD ICP = 4.7 ± 2.9. NICP = 5.6 ± 4.0 ($p < .05$)	Not examined
Kalmet 2019 The Netherlands	Hip Fracture	Not examined	Not examined	Mean LOS ± SD ICP = 12.3 ± 7.3. NICP = 15.1 ± 15.7 ($p < .02$)	Not examined
Murphy 2019 Ireland	Hip Fracture	Not examined	Not examined	Mean difference in LOS = 3.5 days (NICP = 19; ICP = 15); ($p < .05$)	Not examined
Lau 2017 Hong Kong	Hip Fracture	Not examined	Not examined	Baseline 2006: NICP = 12.7. 2008: ICP = 7.6 2011: ICP = 6.7 ($p < .001$)	Not examined
Kalmet 2016 The Netherlands	Hip Fracture	Not examined	Not examined	Average LOS NICP = 12; ICP = 9.7 ($p < .01$)	Not examined
Burgers 2014 The Netherlands	Hip Fracture	Not examined	Not examined	Median LOS: NICP = 9; ICP = 6 ($p < .001$)	Re-admission ICP = 17%; NICP = 16%, ($p = .720$)
Flikweert 2014 The Netherlands	Hip Fracture	Not examined	Not examined	Median LOS: ICP = 7; NICP = 11 ($p < .001$)	Not examined
Suhm 2014 Switzerland	Hip Fracture	Not examined	Not examined	ICP = 8.6; NICP = 11.3 ($p < .01$)	30-day and 1-year re-admission rates were not significant
Niemeijer 2013 The Netherlands	Hip Fracture	Not examined	Not examined	Average LOS: NICP = 13.5; ICP = 9.3 ($p = .000$)	Not examined
Lau 2010 Hong Kong (16)	Hip Fracture	Not examined	Not examined	Baseline (2006)—NICP = 6.1; 2007: ICP = 2.53 2009: ICP = 1.42	28 days re-admission rate for both periods = 15%

Hospital costs	Mortality	Post-operative complications
Thirty-day re-admissions RC = 10.3% ICP = 10.9% $p = .428$	Not examined	Thirty-day mortality ICP = 2% NICP = 6.9% $p = .0644$
Not examined	Not examined	Not examined
Not examined	30 Mortality ICP = 15(8.2%) NICP = 17 (7.9%) $p < .90$ 1-year mortality ICP = 61 (33.5%) NICP = 80 (37.0%) $p < .50$	Total post op complications ICP = 82 (45.1%) NICP = 179 (82.9%) $p < .01$ Post-op delirium ICP = 35 (19.2%) NICP = 98 (45.4%) $p < .01$
Not examined	Not examined	Not examined
Baseline 2006: NICP = $23,907 2008: ICP = $16,198. 2009: ICP = $17,447 2010: ICP = $16,190 2011: ICP = $16,448	In patient mortality: Baseline 2006: NICP = 2.86%; 2008: ICP = 2.5%; 2011: ICP = 0.95%; 30-day mortality: Baseline 2006: NICP = 5.36% 2008: ICP = 3.5%; 2011: ICP = 1.67%; 1-year mortality: Baseline 2006: NICP = 23.93%; 2008: ICP = 18%; 2011:ICP = 13.81%; Not statistically significant	Wound infection rate: Baseline (2006): NICP = 1.57%; 2011: ICP = 1.43% Pneumonia rate: Baseline (2006): NICP = 1.57%; 2011: ICP = 0.24% Not statistically significant
Not examined	30-day mortality was not significant ICP 38 (6%); NICP 28 (5%)	Overall post-op complications - lower in the ICP = 351 (51); NICP = 322 (63) $p < .01$ Post-op delirium ICP = 192 (30); NICP = 186 (37) $p = .02$ Post-op stroke ICP = 4 (1); NICP = 9 (2) + not significant
Not examined	30-day mortality not significant	214 pts (42%) had at least one complications NICP = 95; ICP = 119
Not examined	Significant 30-day mortality: ICP = 2%; NICP = 6% ($p < .05$)	Not significant
Not examined	Not significant	In-hospital complication ICP = 59%; NICP = 73%, ($p < .01$)
Annual cost savings of €120 000.	Not examined	Not examined
Not examined	30-day mortality not significant	Hospital acquire pressure sore: 2007 = 4.3%; 2009 = 0.3% Infection rate of internal fixation: Baseline (2006)—NICP 0.81%; 2008/2009: ICP = 0% Infection rate of hemi-arthroplasty Baseline (2006)—NICP = 2.61%; 2008/2009: ICP = 0.98%

(Continues)

TABLE 3 (Continued)

Author/Year Country	Procedure	Function measures	Time to surgery	Hospital Length of Stay (LOS)—in Days	Readmission
Mascioli 2021 USA	TKA	Not examined	Not examined	Mean 500 (±107) minutes	Emergency presentations within 90 days ($n = 4$); hospital admissions were due to arthrofibrosis, falls, and infection ($n = 3$ pts)
Ripoles-Melchor 2020 Spain	TKA & THA	Not examined	Not examined	Not examined	Not examined
Gwyne-Jones 2017 New Zealand	TKA & THA		Not examined	Average LOS NICP = 5.6 (hip) ICP = 4.3 (hip) NICP = 5.7 (knee) ICP = 4.8 (knee) ($p < .001$)	30-day re-admission rate not significant (3.2% to 5.5% $p = .065$)
Stowers 2016 New Zealand	TKA & THA		Not examined	LOS Median (IQR) NICP = 5 (3) (hip) ICP = 4 (2) (hip) NICP = 5 (2) (knee) ICP = 4 (2.5) (knee) ($p < .001$)	30-day re-admission rate not significant ($p = .258$)
Scott 2013 UK	TKA & THA	Same day mobilisation ICP = 36%; NICP = 4% ($p = .008$)	Not examined	Median post-operative LOS ICP = 4; NICP = 5 ($p = .001$)	Not examined
Den Hertog 2012 Germany	TKA	American Knee Society Score (AKSS) ICP = 80.52; NICP = 122.25; Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) (at 5–7 days post op [ICP = 6.19 ± 1.79; NICP = 4.24 ± 1.94; $p < .0001$])	Not examined	Average LOS: ICP = 6.75; NICP = 13.20 ($p = 0001$)	Not examined
Gooch 2012 Canada	TKA & THA		Not examined	Not examined	Not examined
Lin 2011 Taiwan	TKA		Not examined	Average LOS ICP = 4.92 NICP = 7.09 ($p < .001$).	Not examined
Malviya 2011 UK	THA&TKA		Not examined	Average LOS NICP = 6 ICP = 3 ($p < .001$)	Not significant (4.7%–4.8%, $p = .8$).

Hospital costs	Mortality	Post-operative complications
Not examined	Not examined	ICP only = six (1.4%) one contusion, one partial laceration to the patellar tendon, and four palsies Estimated blood loss (ml) = ≤100 = 402 (91.6%); 100–400 = 37 (8.4%) Transfer to hospital from ambulatory = 4 (0.9%) delaying discharge = 13 (3.0%)
Not examined	Not examined	30-day post-operative complications ICP = 10.2% RC = 11.4% ($p = .22$) Moderate to severe complications ICP = 4.6%; RC = 6.1% ($p = .02$)
Not examined	There was no increase in mortality or early revision rate.	Not examined
Cost in NZD$ Not significant THA ICP = $10,638.66; NICP = $13,216.89, ($p = .057$) TKA ICP = $11,804.80; NICP = $12,045.35 ($p = .326$)	Not examined	Post-operative complications ($p = .258$)
Not examined	Not examined	Blood transfusion rates ICP = 2%; NICP = 13 ($p = .002$)
Not examined	No mortality	The intensity of the procedure-related AEs was assessed as severe ($N = 2$) and minor ($N = 18$).severe AEs were: deep infection (fast-track rehabilitation group) and humerus fracture (standard rehabilitation group). Minor AEs ($N = 7$ in the fast-track rehabilitation group, $N = 11$ in the standard rehabilitation group) were: stiffness ($N = 13$), urinary tract infection ($N = 2$), subluxations of the patella ($N = 2$), tibial fissure ($N = 1$)
Not examined	Not examined	Hip dislocation = 1.1%, (5/451) within 30 days of surgery
Significant reduced costs for ICP ($p < .001$)	Not examined	Not examined
Saving of 5418 bed days	30-day death rate (0.5%–0.1%, $p = .02$) 90-day death rate (0.8%–0.2%, $p = .01$).	Requirement for blood transfusion was reduced (23%–9.8%, $p < .001$). There was a trend of a reduced rate of 30-day myocardial infaNICPtion (0.8%–0.5%. $p = .2$) and stroke (0.5%–0.2%, $p = .2$). The 60-day deep vein Thrombosis figures (0.8%–0.6%, $p = .5$) and pulmonary embolism figures (1.2%–1.1%, $p = .9$) were similar.

(Continues)

TABLE 3 (Continued)

Author/Year Country	Procedure	Function measures	Time to surgery	Hospital Length of Stay (LOS)—in Days	Readmission
McDonald 2012	THA&TKA	Discharge maximum flexion (ICP = median 85 [IQR −10]; NICP median 80 [IQR −7], p < .001) Follow-up maximum flexion (ICP = median 95 [IQR −12]; NICP median 95 [IQR −15], *p* = .009) Post Oxford score—not significant.	Not examined	Median LOS NICP = 6 (post op) ICP = 4 (post op) (*p* < .001)	Not examined
Raphael 2011 Canada	THA&TKA		Not examined	Average LOS ICP = 1.96 NICP = 4.83	30-day re-admission rates were not significant
Xu 2008 Singapore	TKA			The average LOS showed a decreasing trend as increased pts only admitted on the day of surgery	0.4%–1% per year from 2003–2005
Walter 2007 USA	Knee &Hip Arthroplasty			Average LOS: NICP = 4.41 (Hip) ICP = 3.24 (Hip) NICP = 3.92 (Knee) ICP = 2.98 (Knee) (*p* < .001)	Mentioned in the methods but not results

Abbreviations: ICP, Integrated Clinical Pathway group; NICP, Non-ICP group; THA, Total Hip Replacement; TKA, Total Knee Replacement.

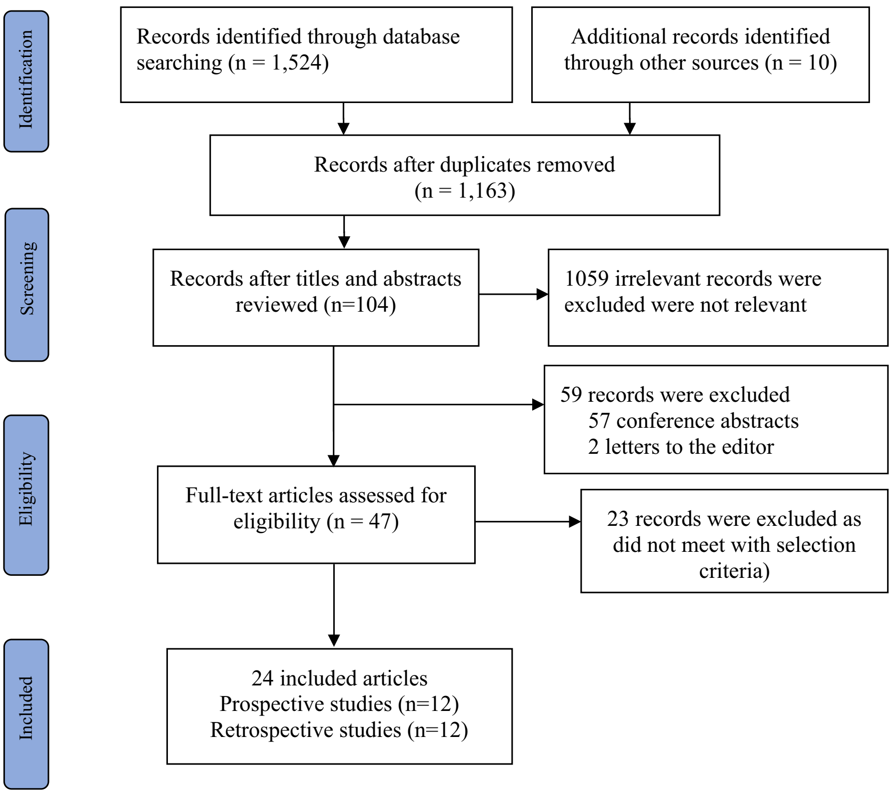

FIGURE 1 Screening process in PRISMA flowchart

Hospital costs	Mortality	Post-operative complications
Not examined	90-day mortality rate of 0.2% ICP 0.1% NICP Not significant	Requirement for blood transfusion was reduced (3.7%–0.6% patients, $p < .001$). Deep vein thrombosis (DVT), infections, Pulmonary embolism (not significant)
Not examined	Not examined	Pain scores trended lower in the fast-track patients, both at rest and with activity than in patients in the standard group (median 7.5 vs 35 mg, respectively)
Not examined	The 30-day mortality rate of 0.11%. Not significant	Overall complication rate 2%; Cumulative complication rate 3.72%; Top three were (DVT); UTI; Wound infection
Savings of 20%	Not examined	Not specified although mentioned in the methodology

to unpredictable circumstances such as health system accessibility. Therefore, this delay in time to surgery could result in increased LOS that can be erroneously linked to the use of ICPs.

Overall, there was a significant reduction in post-operative complication rates in the ICP group. A meta-analysis reported association between the use of ICPs and lower post-operative complications for non-invasive procedures (Rotter et al., 2012). Leigheb et al. (2013) also found that ICPs reduce complications.

There were inconsistent results regarding unplanned hospital admissions and mortality. Studies where unplanned admissions were examined, identified no difference in rates of re-admission between the ICP and NICP groups. One study that examined a 28-day re-admission rate found that they remained the same even after introducing the ICP (Lau et al., 2010). Another study reported a non-significant increase in re-admission rate in the ICP group (Xu et al., 2008). Partially, these results echo those of Leigheb et al. (2013) that found ICPs did not affect re-admission to hospital or mortality.

5.3 | Study limitations and implications for future research

The lack of a standardised definition of ICP could have hindered the inclusion of more studies in this review due to the use of phrases such as 'protocol' or 'guideline'. Therefore, it is plausible that some studies were filtered at the initial screening if they did not use the search terms used for this review. It is imperative that a universally accepted definition of ICP be embraced to make it straightforward for clinicians to access information to guide clinical practice and for literature to be easily and widely accessed and compared.

Two authors independently screened search results, selected inclusion studies and extracted data; however, statistical inter-rater reliability was not conducted statistically (Belur et al., 2021). This review only included quantitative studies examining health outcomes following implementation of the ICPs. Future reviews on the effectiveness of ICPs should also consider summarising evidence on perspectives and experiences of patients and healthcare providers.

6 | CONCLUSION

The number of components included by the ICPs varied across the reviewed studies. Therefore, this review could not recommend a one size-fits-all ICP that could be adapted for use for patients undergoing hip fracture and joint replacement surgeries. This review has however identified essential ICP components that need to be included in ICPs for patients undergoing hip fracture and THA andTKA surgeries.

Post-operative outcomes of ICPs also varied across the studies. ICPs were found to reduce the LOS and post-operative complications significantly. There were mixed results in terms of ICPs reducing unplanned hospital admission, hospital costs and mortality rates. Some studies showed no significant difference between the use of ICP and NICPs.

7 | RELEVANCE TO CLINICAL PRACTICE

This review has established that ICPs are associated with reduced LOS and post-operative complications. However, to determine the effectiveness of the ICPs, it is essential to standardise how LOS is measured. Included studies measured LOS in different ways. Some studies measured LOS from acute hospital admission to discharge from the acute hospital (Lau et al., 2017), while others calculated LOS from entry to discharge from the convalescent hospital (Lau et al., 2010; Niemeijer et al., 2013). With the studies that measured LOS from admission to discharge from the convalescent hospital, it was unclear how long patients stayed at the convalescent hospital and if additional resources were used for patient care. Therefore, this review suggests the LOS as an outcome measurement of ICP effectiveness should be reviewed and standardised as date of operation to date of discharge from the primary hospital. Secondly, clinical settings should consider examining LOS in conjunction with other outcomes such as hospital costs, unplanned re-admissions and post-operative complications.

AUTHOR CONTRIBUTIONS

HZ and IN conceptualised, conducted the conducted the integrative review and developed the manuscript. Articles included in the integrative review were independently assessed by HZ and IN then consulted with PAR and PD to research consensus regarding inclusion. HZ and IN independently extracted the data. PAR and PRD critically reviewed the manuscript.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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