A rapid review of the effectiveness, efficiency, and acceptability of surgical hubs in supporting planned care activity.

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Abstract: The COVID-19 pandemic further exacerbated disruptions to elective care services in the UK, leading to longer waits for treatment and a growing elective surgery backlog. There have been growing calls for the creation of surgical hubs to help reduce this backlog. Surgical hubs aim to increase surgical capacity by providing quicker access to procedures, as well as facilitate infection control by segregating patients and staff from emergency care. This rapid review aimed to assess the effectiveness, efficiency, and acceptability of surgical hubs in supporting planned care activity, to inform the implementation of these hubs in Wales.

The review identified evidence available up until January 2023. Twelve primary studies were included, eight of which used comparative methods. Most of the studies were conducted during the COVID-19 pandemic and described surgical hubs designed mainly to mitigate the transmission of the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). Outcome measures reported included clinical, performance, economic, and patient reported outcomes across a variety of different surgical disciplines. Most of the studies did not describe surgical hubs based on their structure, i.e., standalone, integrated, or ring-fenced hubs.

The evidence relating to the impact of surgical hubs on clinical outcomes appeared to be heterogenous and limited. Included studies did not appear to control for the impact of the COVID-19 pandemic on outcomes. Evidence of the impact of surgical hubs on performance outcomes such as efficiency, utilisation/usage, volume of surgeries/treatments, performance, cancellations, and time from diagnosis to treatment is limited. Evidence relating to the economic impact of surgical hubs is also limited, however there is evidence to suggest that total average costs are lower in surgical hubs when compared to general hospitals. Evidence relating to the impact of surgical hubs on patient reported outcomes is limited but indicates there may be a positive effect on patient satisfaction and compliance.

Considerable variation in the types of surgical hubs reviewed, surgical disciplines, along with the small number of comparative studies, as well as methodological limitations across included studies, could limit the applicability of these findings.

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Health and Care Research Wales Evidence Centre

Canolfan Dystiolaeth Ymchwil Iechyd a Gofal Cymru

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FULL REPORT

EXECUTIVE SUMMARY

What is a Rapid Review?

Our rapid reviews (RR) use a variation of the systematic review approach, abbreviating or omitting some components to generate the evidence to inform stakeholders promptly whilst maintaining attention to bias. They follow the methodological recommendations and minimum standards for conducting and reporting rapid reviews, including a structured protocol, systematic search, screening, data extraction, critical appraisal, and evidence synthesis to answer a specific question and identify key research gaps. They take 1- 2 months, depending on the breadth and complexity of the research topic/ question(s), extent of the evidence base, and type of analysis required for synthesis.

Who is this summary for?

Royal College of Surgeons of Edinburgh and the Delivery & Performance Division at Welsh Government.

Background / Aim of Rapid Review

The COVID-19 pandemic further exacerbated disruptions to elective care services in the UK, leading to longer waits for treatment and a growing elective surgery backlog. **Surgical hubs are a key element of the elective recovery strategy for the NHS and can play a vital role in reducing the elective care backlog**. These hubs aim to increase surgical capacity by providing quicker access to procedures, as well as facilitate infection control by segregating patients and staff from emergency care. This rapid review aimed **to assess the effectiveness, efficiency, and acceptability of surgical hubs** in supporting planned care activity, to inform the implementation of these hubs in Wales.

Key Findings

Extent of the evidence base

- Twelve **primary studies** were identified: six quasi-experimental, two cohort and four case series. Eight of these **used comparative research methods**.
- Studies were conducted in the UK (n = 7), the Netherlands (n = 3), and Italy (n = 2).
- **Most of the studies were conducted during the COVID-19 pandemic** (n = 7) and described surgical hubs designed mainly to mitigate the transmission of the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2).
- Surgical hubs reported in studies included **COVID-19 free hubs (n = 5), Independent Treatment Centres (n = 3), Independent Sector Treatment Centres (n = 2), and Protected Elective Surgical Units (n = 2)**.
- Most of the studies **did not describe surgical hubs based on their structure**, i.e., standalone, integrated, or ring-fenced hubs.
- Outcome measures reported included **clinical, performance, economic, and patient reported outcomes** across a variety of different surgical disciplines.

Recency of the evidence base

- The review identified evidence available up until January 2023. Included studies were published between 2015 and 2022.

Evidence of effectiveness

- Surgical hubs may be effective at improving clinical outcomes such as length of hospital stay, operative and post-operative complications, and cataract surgery quality measures in certain surgical fields. However, **the evidence is heterogenous and limited**.
- Evidence on the impact of surgical hubs on performance outcomes such as efficiency, utilisation/usage, volume of surgeries/treatments, performance, cancellations, and time from diagnosis to treatment is limited.
- Evidence relating to the economic impact of surgical hubs is limited.
- Evidence relating to the impact of surgical hubs on patient reported outcomes is limited but indicates there **may be a positive effect on patient satisfaction and compliance**.

Best quality evidence

- All the studies had methodological limitations. Many used weak methods that may not be appropriate for inferring effectiveness, as such we have only analysed comparative studies when evaluating effectiveness outcomes.

Policy and Research Implications

- This report has provided insights to how surgical hubs delivered services in distinct surgical areas. This may be **useful when designing research or services to assist with the recovery of planned care services** in the UK.
- Considering the paucity of robust evidence, further well-designed, higher quality comparative research from the UK and similar countries is needed to better understand the effectiveness of surgical hubs in Wales.

Strength of Evidence

Most of the evidence identified were derived from studies with weak methodologies and there was considerable variation in the types of surgical hubs reported. This review's findings should therefore be interpreted with caution.

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Abbreviations:

Acronym	Full Description
ACL	Anterior Cruciate Ligament
AHT	Acute Hospital Trust
ASA	American Society of Anaesthesiologists
BPH	BUPA Cromwell Hospital
CND	Cataract National Dataset
CI	Confidence Interval
COVID-19	Coronavirus Disease 2019
CPG	Clinical Prioritisation Group
CRS	Colorectal Surgery
CTS	Cataract, and Carpal Tunnel Surgeries
DRG	Diagnostic-Related Group System
ERP	Enhanced Recovery Protocols
GO	Gynaecological Oncology
ISTC	Independent Sector Treatment Centres
ITC	Independent Treatment Centres
JBI	Joanna Briggs Institute
MRSA	Methicillin-Resistant Staphylococcus Aureus
NHS	National Health Service
NPS	Net Promoter Score
OR	Odds Ratio
OSH	Oncological Surgical Hub
PbR	Payment by Results
PESU	Protected Elective Surgical Units
PPW	Pre-Pandemic Ward
PROM	Patient Reported Outcome Measures
RMH	Royal Marsden Hospital
RR	Rapid Review
SARS-CoV-2	Severe Acute Respiratory Syndrome Coronavirus 2
THR	Total Hip Replacement
TKR	Total Knee Replacement
UK	United Kingdom
UKSH	UK Specialist Hospitals

1. BACKGROUND

1.1 Who is this review for?

This Rapid Review was conducted as part of the Health and Care Research Wales Evidence Centre work programme. The above question was suggested by the Royal College of Surgeons of Edinburgh to inform resilient elective care strategies and to support the implementation of surgical hubs across Wales.

1.2 Background and purpose of this review

Over the last decade, the elective care waiting list in the UK has grown substantially. Prior to the COVID-19 pandemic, there were already 4.43 million people waiting for elective care services (British Medical Association, 2023). A combination of reduced NHS funding, staffing, and capacity were likely causes of this disruption in services (Mallorie, 2023). The COVID-19 pandemic significantly added to these disruptions, creating an unprecedented backlog in elective care.

Dealing with the backlog of elective surgical services is a critical concern for the NHS in the UK. The ability to have a resilient elective care system during emergency pressures, such as the yearly winter pressures, is also pressing.

There have been growing calls for separation of elective and emergency care, and the creation of surgical hubs to help deal with the elective care backlog (Royal College of Surgeons of England, 2022). Surgical hubs are a key element of the elective recovery strategy for the NHS and are defined as protected facilities dedicated entirely to elective care, with ring-fenced resources that allow them to stay active even when emergency pressures arise (Briggs et al., 2022). These hubs aim to increase surgical capacity by providing quicker access to procedures, and to facilitate infection control by segregating patients and staff from emergency departments (Royal College of Surgeons of England, 2022).

There are three main types of elective surgical hubs (GIRFT, 2022). These are:
• ‘Stand-alone hubs’ (i.e., elective surgical unit in a dedicated building fully separate from any acute provision)
• ‘Integrated hubs’ (i.e., elective surgical unit within an existing acute hospital site)
• ‘Ring-fenced hubs’ (i.e., elective surgical unit exists as dedicated area within an existing acute hospital)

There are currently 91 operational surgical hubs in England, with over 50 new hubs set to open across the country by 2024 (Department of Health and Social Care, 2022). In Wales, the rollout of surgical hubs has been envisioned in the Welsh Government Planned Care Plan (Welsh Government, 2022). However, little is currently known about their effectiveness.

The purpose of this rapid review is to assess the effectiveness, efficiency, and acceptability of surgical hubs in supporting planned care activity, to inform the implementation of these hubs in Wales. In assessing this, the review will attempt to address the following review sub-questions:

- What is the effectiveness of surgical hubs in delivering elective care (e.g., treatment numbers, timing, and clinical outcomes), in particular during periods of emergency or high pressure?
- What is the most effective model (stand-alone, integrated, or ring-fenced) for surgical hubs in maintaining resources and to stay active when emergency pressures rise?
- What is the most effective work force model for surgical hubs?
- How far are people willing to travel/what is the travel experience?
- What innovative roles have been developed to deal with any workforce challenges?
- In the UK, have any contract/practice adaptions been made to attract staff e.g., travel time, training opportunities, mixed model of private and NHS staff?
- What is the most effective governance model for commissioning and running a surgical Hub, in particular when covering populations outside of one or more health organisation boundaries and when cross-organisational working is required?
- Which speciality or for which procedure is the surgical hub model most effective and efficient?
- What are patients views of surgical hubs (pros and cons)?
- Have surgical hubs been able to recruit to full headcount and what roles have proved more challenging?
- How far are staff willing to travel?

2. RESULTS

2.1 Overview of the Evidence Base

Twelve primary studies were eligible for inclusion in this rapid review (six quasi-experimental, two cohort and four case series). Eight studies used comparative research methods, i.e., compared surgical hubs with other surgical units or compared the period a surgical hub was in operation with the period predating the establishment of the surgical hub, while five studies were non-comparative, i.e., described a single centre.

Included studies were conducted in the UK (n = 7), the Netherlands (n = 3), and Italy (n = 2). Two studies each were focussed on orthopaedic surgery, colorectal cancer surgery, and ophthalmic surgery, while one study each focussed on gynaecological oncology surgery, head and neck cancer surgery, and robotic surgery for colorectal and urological cancer. Three studies were focussed on multiple surgical specialities as opposed to a single specialty. A detailed summary of included studies can be found in Table 1.

The majority of included studies were conducted during the COVID-19 pandemic (n = 7) and reported on surgical hubs designed mainly to mitigate the transmission of SARS-CoV-2. As a result, COVID-19 free hubs or COVID-19 protected sites were the most common surgical hubs reported in the included studies (n = 5). Other surgical hubs included independent treatment centres (ITC) (n = 3), independent sector treatment centres (ISTC) (n = 2) and protected elective surgical units (PESU) (n = 2). Most of the included studies did not describe surgical hubs based on their structure, i.e., standalone, integrated, or ring-fenced hubs. Only two studies (Joseph et al., 2022, Minto et al., 2022) explicitly described surgical facilities with ring-fenced or dedicated capacity/resources. Joseph et al (2022) explored outcomes at a dedicated orthopaedic PESU with ring-fenced resources, embedded within a

district general hospital. Minto et al (2022) also evaluated a PESU which was self-contained, separated from emergency care, and had staff and resources ring-fenced from other hospital units. Due to the heterogeneity of surgical facilities included in this review, a narrative synthesis approach was used to analyse data and present findings.

The methodological quality of included studies was assessed using the appropriate Joanna Briggs Institute (JBI) critical appraisal tool (for quasi-experimental studies, cohort studies and case series). Quality appraisal identified all studies had some methodological limitations. Further details of the quality appraisal can be found in section 6.

For this review, only comparative studies comparing surgical hubs with other surgical units or comparing time periods before and after establishment of a surgical hub, were analysed when evaluating effectiveness outcomes, as these studies are better placed to determine cause and effect relationships (Joseph et al 2022, Kruse et al 2019a, Kruse et al 2019b, Minto et al 2022, Spinelli et al 2021, Syed et al 2015, Tulp et al 2020 Vanhegan et al 2015). For patient-reported outcomes such as patient satisfaction and compliance, data from both comparative and non-comparative studies were utilised (Huddy et al 2022, Joseph et al 2022. Kruse et al 2019a, Kruse et al 2019b, Perrone et al 2020).

Figure 1 outlines the outcome measures reported in all 12 included primary studies. The primary studies have been split into comparative and non-comparative and the outcomes categorised as clinical, performance, economic and patient-reported outcomes.

2.2 Impact of surgical hubs on clinical outcome measures

Ten studies (six comparative and four non-comparative) reported a range of clinical outcomes. These included length of hospital stay, mortality, complications (non-specific and COVID-19 related), SARS-CoV-2 transmission, COVID-19 mortality, clinical outcome measures for cataract surgery (postoperative dioptre of target refraction and postoperative improved visual acuity), postoperative infections, readmissions, and reoperation rate. Only findings from comparative studies are reported here. The results of the non-comparative studies are provided in Table 1.

Length of hospital stay

Length of hospital stay was reported in two studies which compared outcomes between patients undergoing surgery at surgical hub facilities during the COVID-19 pandemic with patients who had undergone surgery pre-pandemic.

Joseph et al (2022) compared the functioning and efficiency of an orthopaedic PESU instituted during the COVID-19 pandemic with the pre-pandemic elective service at a general hospital ward. The **length of hospitalisation was significantly reduced at the PESU compared to the pre-pandemic ward** (mean length of hospitalisation 3 days vs 4.8 days). However, this study did not appear to control for the impact of the pandemic in trying to speed up hospital discharge.

Spinelli et al (2021) compared outcomes of patients undergoing major colorectal surgery with an enhanced recovery protocol during the COVID-19 pandemic (group A) with those from an equivalent timeframe before the pandemic in 2019 (group B). This study found a **significantly shorter overall duration of stay for group A patients compared to group B** (mean duration of stay 4.3 days vs 6.2 days; $p < 0.001$). Uncomplicated patients from

group A also had a shorter duration of stay when compared to uncomplicated patients from group B (Mean duration of stay 3.3 days vs 4.1 days; p = 0.008). This study did not control for the impact of the pandemic on outcomes.

Readmission rates

Only one study provided data comparing readmission rates in surgical hub patients during the COVID-19 pandemic with patients who had undergone surgery pre-pandemic.

Spinelli et al (2021) found that readmission rates were similar between surgical hub patients undergoing surgery with enhanced recovery protocols during the peak phase of pandemic, compared to patients who had undergone surgery before the pandemic (n = 6 [4.4%] vs n = 5 [2.8%]; p = 0.95).

Reoperation rate/revision surgery

Reoperation rates or revision surgeries were reported in two comparative studies.

Tulp et al (2020) compared quality of care and price differences between Dutch ITCs and general hospitals. This study found that ITCs have a higher revision rate (within one year) for total hip replacement (THR) (1.93% ± 2.06 vs 1.69% ± 1.06) and total knee replacement (TKR) (2.72% ± 3.29 vs 1.28% ± 0.89), but a lower revision rate for anterior cruciate ligament (ACL) surgery (2.92% ± 5.73 vs 3.75% ± 2.75), when compared with general hospitals. However, these differences did not persist after robustness checks (use of quality data from 2016, exclusion of specialist and academic hospitals, and inclusion of outliers) were performed.

Spinelli et al (2021) found that reoperation rates were higher in surgical hub patients undergoing surgery with enhanced recovery protocols during the peak phase of pandemic, compared to patients who had undergone surgery before the pandemic (4% vs 1.4%; p = 0.09). This study did not control for the impact of the pandemic on outcomes.

Complications (non-specific operative/post-operative)

Surgical complications were reported in two comparative studies.

Syed et al (2015) reviewed cataract surgery outcomes at three ISTCs established by the UK Specialist Hospitals (UKSH) and compared these with recognised benchmarks previously reported from NHS facilities. When compared to published benchmarks from the Cataract National Dataset (CND), UKSH had **significantly lower rates of several operative complications**. These included choroidal or suprachoroidal haemorrhage (odds ratio [OR] 14.09; 95% confidence interval [CI] 2.38 - 569.53; p<0.05), hyphaema (OR 2.81; 95% CI 1.10 - 9.16; p<0.05), intraocular lens complications (OR 7.2; 95% CI 4.18 - 12.549; p<0.05), iris damage from phacoemulsification (OR 9.25; 95% CI 5.74 - 14.91; p<0.05), nuclear fragment into the vitreous or dropped nucleus (OR 5.16; 95% CI 2.55 - 10.43; p<0.05), phacoemulsification wound burn (OR 50.35; 95% CI 8.88 - 1983.24; p<0.05), PCR or vitreous loss or both (OR 2.67; 95% CI 2.18 - 3.27; p<0.05), vitreous in anterior chamber (OR 1.99; 95% CI 1.17 - 3.38; p<0.05), and zonular dialysis (OR 4.41; 95% CI 2.93 - 6.66; p<0.05). Similarly, when postoperative complications were compared with data from the CND, UKSH had **significantly lower rates** of corneal decompensation (OR 9.62; 95% CI 8.27 - 11.19; p<0.05), cystoid macular oedema or macular oedema (OR 7.32; 95% CI 5.66 - 9.46; p<0.05), iris to wound (OR 4.02; 95% CI 2.02 - 8.00; p<0.05), posterior capsule

opacification with yttrium aluminium garnet indicated (OR 3.63; 95% CI 2.87 - 4.59; p<0.05), raised intraocular pressure (>21 mm Hg) (OR 8.37; 95% CI 6.77 - 10.35; p<0.05), retained soft lens matter (OR 2.32; 95% CI 1.66 to 3.23; p<0.05), uveitis (OR 14.18; 95% CI 11.40 - 17.65; p<0.05), vitreous to section (OR 4.36; 95% CI 2.79 - 6.81; p<0.05), and wound leak or rupture (OR 7.0; 95% CI 2.64 - 26.52; p<0.05).

Spinelli et al (2021) found that post-operative complication rates were comparable between surgical hub patients undergoing surgery with enhanced recovery protocols and patients who had undergone surgery before the pandemic [24% (n = 33) vs 30% (n = 53); p = 0.21].

COVID-19-related outcomes

A single comparative study, from the UK, reported SARS-CoV-2 transmission rates at a surgical hub facility.

Minto et al (2022) assessed whether the development of a PESU can minimise SARS-CoV-2 transmission and mortality. The results showed that **SARS-CoV-2 postoperative transmission was significantly lower in the PESU than in the non-PESU** facility (0.42% vs 3.2% p < 0.001). COVID-19 mortality was not measured in the non-PESU units, therefore a comparison between PESU and non-PESU units for this outcome was not reported.

Optical biometry outcomes

One UK comparative study reported optical biometry outcomes related to cataract surgery.

Syed et al (2015) found that biometry outcomes at ISTCs established by the UK Specialist Hospitals (UKSH) **were significantly better than published benchmarks previously reported from NHS facilities**. At UKSH, 66.76% of eyes were within 0.5 dioptres (D) of predicted spherical equivalent compared with the 55.0% benchmark proposed by the Leeds Teaching Hospital NHS Trust (OR 1.64; 95% CI 1.488 - 1.81; p<0.01). In addition, 89.90% of eyes were within 1.0 D of predicted spherical equivalent at UKSH compared with the 85.0% benchmark value proposed by the Leeds Teaching Hospital NHS Trust (OR 1.56; 95% CI 1.35 - 1.82; p<0.01). Both differences were statistically significant.

Cataract quality measures

One Dutch comparative study reported quality measures for cataract surgery (postoperative improved visual acuity and postoperative dioptre of target refraction).

Tulp et al (2020) compared quality differences between Dutch ITCs and general hospitals and found that ITCs outperformed general hospitals on postoperative improved visual acuity (85.58% ± 9.81 vs 83.10% ± 7.25) and postoperative dioptre of target refraction (94.87% ± 3.32 vs 93.78% ± 3.45), however differences were small.

Postoperative infections

One Dutch study made comparisons on postoperative infections between a surgical hub facility and other clinical settings.

Tulp et al (2020) found that the chance of developing postoperative infections within 30 days of carpal tunnel syndrome surgery was less at ITCs compared to general hospitals (0.15% ± 0.31 vs 0.28% ± 0.46).

2.2.1 Bottom line results for the impact of surgical hubs on clinical outcome measures

There is evidence to suggest that surgical hubs can be effective at improving clinical outcomes such as length of hospital stay, operative and post-operative complications, and cataract surgery quality measures in certain surgical fields. However, the evidence supporting the use of these facilities in reducing readmission rates appears to be limited as each of these outcomes were often only reported by a single comparative study. Included studies did not control for the impact of the pandemic on outcomes.

2.3 Impact of surgical hubs on performance outcome measures

Six studies (Four comparative and two non-comparative) reported a range of performance outcomes. These included efficiency, utilisation/usage, volume of surgeries/treatments, performance, cancellations, and time from diagnosis to treatment. Only findings from comparative studies are reported here. The results of the non-comparative studies are provided in Table 1.

Efficiency

Two comparative studies (one from the Netherlands and the other from the UK) reported efficiency measures.

Kruse et al (2019a) focussed on cataract care and sought to identify differences between Dutch independent treatment centres (ITCs) and general hospitals regarding costs, quality of care, and efficiency. Efficiency in this study was defined as the number of activities in a surgical claim, where fewer activities are perceived as more efficient. ITCs were found to be more efficient than general hospitals in providing cataract surgery, i.e., ITCs carried out fewer health care activities within each surgical cataract claim compared to general hospitals – [Total activities within complex cataract surgery - ITCs 4.27 (2.02) vs general hospitals 5.48 (2.30)], [Total activities within standard cataract surgery – ITCs 4.14 (1.70) vs general hospitals 4.56 (2.07)]. Differences persisted even when adjusted for case mix.

Vanhegan et al (2015) investigated the effect on productivity of operating theatres working in an independent sector treatment centre (ISTC) compared with those working in the Acute Hospital Trust (AHT). Efficiency in this study was assessed in terms of the number of patients per surgeon list – with a 'list' defined as a half-day operating session. The implementation of the ISTC was found to be detrimental to departmental efficiency, with <50% of the number of patients being treated. For upper limb surgery, a mean of 3.7 patients per list were treated at the AHT (pre-ISTC) compared to a mean of 1.8 patients per list treated at the ISTC. This represented a reduction of 48.5% at the ISTC compared to the acute hospital. For foot and ankle surgery, a mean of 5.2 patients per list were treated at the acute hospital, compared to a mean of 2.5 patients per list at the ISTC. This represented a 47.5% reduction in previous levels of patients being treated.

Utilisation/Usage

One study (from the UK) assessed the performance of surgical hubs by reporting on their utilisation or usage and made comparisons between surgical hub facilities and other clinical settings.

Vanhegan et al (2015) used the absolute number of lists as a reflection of a consultants' timetabled use of the ISTC, and found that for upper limb surgery, there were 18 lists with 66 patients pre-ISTC and 18 lists with 32 patients post-ISTC. The case-mix was similar in both periods, but numbers decreased across all types of upper limb and foot and ankle surgeries for work done after introduction of the ISTC. For foot and ankle surgery, there were 13 lists with 67 patients pre-ISTC and 20 lists with 49 patients post-ISTC. The case-mix between the two periods was found to be comparable, but the overall volume of procedures was less.

Volume

Two comparative studies reported the volume of surgeries or treatments as an assessment of a surgical hub's performance.

Kruse et al (2019a) used the total number of surgeries and surgical claims during a care pathway as a proxy for volume. ITCs were found to submit a slightly higher number of claims during a care pathway than general hospitals (Mean) 1.45 (SD 0.63) vs 1.41 (SD 0.63). The average number of surgeries was also found to be higher in ITCs with a mean of 0.91 (SD 0.81) cataract operations on average per care pathway, compared to a mean of 0.84 (SD 0.77) in general hospitals.

Kruse et al (2019b) used the number of invasive treatments as a proxy for volume and investigated how low-volume and high-volume ITCs performed relative to each other. ITCs with higher volumes were found to score better on structure, process and outcome indicators compared to low-volume ITCs (Mean) 502.40 (SD 1269.82).

Cancellation of procedures

One comparative study (from the UK) reported comparative data on the cancellation of procedures as an assessment of a surgical hub's performance.

Joseph et al (2022) compared outcomes between an orthopaedic PESU instituted during the COVID-19 pandemic and a pre-pandemic elective service at a general hospital ward. The study found that cancellations were four times higher in the pre-pandemic ward. The **PESU had a significantly better conversion rate with only 12.5% being cancelled**, compared with 48% of procedures cancelled at the pre-pandemic ward. In the pre-pandemic ward, 49% of procedures (n = 87) were cancelled due to unavailability of beds compared to less than 2% (n = 3) in the PESU for this reason. Thirty cancellations in the pre-pandemic ward were due to emergency case prioritisation compared to zero in the PESU (due to strict ring-fencing). Twenty-eight patients in pre-pandemic ward, and nine in the dedicated unit, had surgery cancelled because of medical reasons.

2.3.1 Bottom line results for the impact of surgical hubs on performance outcome measures

Evidence on the impact of surgical hubs on performance outcomes such as efficiency, utilisation/usage, volume of surgeries/treatments, performance, cancellations, and time from diagnosis to treatment is limited. Evidence in relation to the efficiency of these hubs is inconsistent and from a range of surgical disciplines. There is evidence to suggest that surgical hubs are effective at reducing the surgical cancellations, however, this outcome was reported by a single comparative study and as such firm conclusions cannot be made.

2.4 Economic outcomes associated with surgical hubs

Three studies (all comparative) reported economic outcome measures. These outcomes included cost differences, total costs and financial productivity.

Cost differences

Two Dutch studies compared cost differences between ITCs and general hospitals.

Kruse et al (2019a) found that the price per diagnostic-related group (DRG) care product were substantially lower at ITCs than general hospitals for standard cataract surgery (1009.22 Euros (SD 46.07) vs 1095.15 Euros (SD 110.51) and complex cataract surgery (1250.58 Euros (SD 114.99) vs 1391.07 Euros (SD 154.93) using 2015 data. Similarly, total costs were lower at ITCs than general hospitals for patients with one cataract operation (1057.38 Euros (SD 109.38) vs 1151.20 Euros (SD 164.47) and for patients with two cataract operations (2085.43 Euros (SD 167.86) vs 2272.05 Euros (SD 287.40) – both accounting for approximately 8% in cost savings. These differences persisted even after adjusting for case mix.

Tulp et al (2020) found no differences in list price surgery between ITCs and general hospitals after correction for additional factors: Cataract surgery (1230.37 ± 116.00 Euros vs 1235.89 ± 212.94 Euros); carpal tunnel syndrome (998.03 ± 180.81 Euros vs 926.11 ± 215.33 Euros); total knee replacement (10 402.41 ± 1115.47 Euros vs 10 079.14 ± 920.37 Euros); total hip replacement (9905.91 ± 1125.74 Euros vs 9344.06 ± 887.66 Euros); anterior cruciate ligament (4208.94 ± 425.02 Euros vs 4243.23 ± 726.79 Euros). List prices of the first quarter of 2017 were used in the analyses.

Financial productivity

One comparative UK study reported on financial productivity.

Vanhegan et al (2015) compared productivity outcomes before and after the establishment of an independent sector treatment centre (ISTC) and found that the financial value of operating for upper limb surgery was higher pre-ISTC compared to post-ISTC (£169,695 vs £95,760; p = 0.21). Similar findings were reported for foot and ankle surgery (£97,801 vs £91,960; p = 0.30). The operative case-mix was comparable between the two periods. The analyses of financial productivity were based on Payment by Results (PbR) data for 2012–2013.

2.4.1 Bottom line results for the impact of surgical hubs on economic outcome measures

Evidence relating to the economic impact of surgical hubs is limited. There is evidence to suggest that surgical hubs may not be financially productive. However, this outcome was reported by a single study and as such firm conclusions cannot be made. There is evidence to suggest that total average costs are lower in surgical hubs when compared to general hospitals.

2.5 Impact of surgical hubs on patient reported outcomes

Five studies (three comparative and two non-comparative) assessed patient reported outcomes. These outcomes included quality of cataract care (patient satisfaction and perceived outcomes after surgery), Oxford Hip Score, patient satisfaction, and patient compliance. Both comparative and non-comparative study findings are described below.

Quality of cataract care

One Dutch comparative study reported on quality of cataract care using quality indicators Net Promoter Score (NPS) and a patient-reported outcome measure (PROM) – both of which measure patient satisfaction and the perceived outcome of patients four weeks after cataract surgery respectively.

Kruse et al (2019a) reported mixed findings with respect to quality of care. ITCs scored significantly better on the NPS compared with general hospitals, while differences in the PROM scores were inconsistent and marginal. Based on PROM scores, ITCs seemed to perform better on patient satisfaction compared with general hospitals, but there were no differences in the patient-reported outcomes after cataract surgery.

Oxford Hip Score

One UK comparative study reported on the Oxford Hip Score, which is a joint-specific, patient-reported outcome measure designed to assess disability in patients undergoing total hip replacement.

Joseph et al (2022) found that the Oxford Hip Score improvement at 6 weeks' post-operative period was marginally higher in the pre-pandemic ward (18.8) compared to the protected elective surgical unit (16.4). This study did not control for pandemic-related factors.

Patient satisfaction and compliance

Three studies (one comparative and two non-comparative studies) reported on patient satisfaction and compliance.

Kruse et al (2019b) aimed to explore a range of quality measures in Dutch independent treatment centres (ITC). Patient satisfaction ratings were based on location regarding treatment, information provision, listening competency, handling by staff, accommodation, and experience in scheduling an appointment. The study found that patients attending ITCs had an average satisfaction score of 8.74 ± 1.17. Chain membership (i.e., chain-affiliated ITCs) was found to have a negative influence on patient satisfaction.

Huddy et al (2022) reported the experience and patient outcomes from setting up a 'COVID protected' robotic unit for colorectal and renal surgery in a day-surgical unit attached to a hospital in UK. The study found that patient satisfaction on the 'COVID protected' unit was high, indicating that patients felt confident to undergo surgery at a time of increased risk.

Perrone et al (2020) described the experience of a Gynaecologic Oncology Unit's reallocation of resources in a COVID-19 free surgical oncological hub to guarantee standard quality of surgical activities. This study explored patient's compliance and satisfaction with the new COVID-19 free care setting and found that patients were compliant and well accepted the lifestyle restrictions and reorganisation of the care.

2.5.1 Bottom line results for the impact of surgical hubs on patient reported outcome measures

The evidence relating to the impact of surgical hubs on patient reported outcomes is limited but indicates there may be a positive effect on patient satisfaction and compliance. However, this evidence originates mostly from non-comparative studies.

Table 1: Summary of included studies

Citation (Country)	Study Details	Participants & setting	Key findings	Observations/notes
Carvalho et al (2022). Feasibility and usability of a regional hub model for colorectal cancer services during the COVID-19 pandemic. Updates in Surgery, 74(2), 619-628. United Kingdom	**Study Design:** Case series **Intervention/comparator:** Bespoke 'COVID-19 free' cancer hub model/No comparator **Study aim:** To investigate the feasibility and usability of a bespoke Cancer Hub model in delivering elective colorectal and anal cancer surgery services as a regional collaborative network at the height of the first wave of the COVID-19 pandemic **Data collection methods:** Baseline patient characteristics, tumour-related information, and perioperative events were obtained from a prospectively maintained database **Outcomes stated in methods:** Cancer hub performance (assessed using the time from referral to patient prioritisation, time from referral to anaesthetic assessment, and time from referral to surgery as proxies) Theatre utilisation, cancellations Patient operative outcomes (complication rate, mortality rate, readmission rate, COVID-19 specific complications)	**Sample size:** 176 patients were referred through online referral for Clinical Prioritisation Group (CPG) discussion, however only 168 patients were eligible to undergo surgery **Participants:** Patients with colorectal or anal cancer who were deemed suitable for surgery **Setting:** Two designated 'COVID-19 free' surgical sites - The Royal Marsden Hospital (RMH) and BUPA Cromwell Hospital (BPH). **Surgical speciality:** Colorectal cancer	**Primary Findings:** Cancer hub performance Mean time from referral to CPG discussion = 5.7+/- 0.7 days Mean time from referral to anaesthetic assessment = 9.0 +/- 1.3 days Mean time from referral to surgery (all priorities) = 16.3 +/- 1.8 days Theatre utilisation A total of 168 patients underwent colorectal or anal cancer surgery at the RM Partners Cancer Hub during the study period (88 RMH and 80 BCH). Approximately five percent of cases (n = 8) were cancelled within 48 hours prior to surgery, meaning that ninety-five percent of the 239 available theatre sessions were utilised. Operative outcomes Thirty-day complication rate, for Clavien–Dindo IIIA and above, was 4.2% (seven patients), and 30-day mortality rate was 0.6% (one patient). Readmission rate, within 30 days post-discharge, was 1.8% (three patients), however, no patient developed COVID-19 specific complications post-operatively and up to 28 days post-discharge	Non-comparative study This study was conducted during the peak of the first wave of the COVID-19 pandemic (Study period from April 1st - June 30th, 2020). The cancer hubs were not explicitly described as surgical hubs and there was not much detail given on the structure of these hubs. However, various measures were put in place to ensure that both the RMH and BPH could function independently from other NHS units. These included mostly measures to prevent the spread of COVID-19, hence the description of these hubs as 'COVID-19 free'.
Huddy et al (2022). Experiences of a "COVID	**Study Design:** Case series	**Sample size:** 60 patients underwent elective robotic surgery in the unit between 12th May and 30th July 2020 (10 colorectal procedures and 50 urology procedures).	**Primary Findings:** Patient outcomes	Non-comparative study A standard operating procedure was

protected" robotic surgical centre for colorectal and urological cancer in the COVID-19 pandemic. Journal of Robotic Surgery, 16, 59-64. United Kingdom	**Intervention/comparator:** COVID-protected unit for elective robotic surgery/No comparator **Study aim:** To report the early experience of establishing a "COVID-protected" unit for elective robotic surgery at a large acute care district general hospital with an established robotic surgery programme and a tertiary referral service for renal cancer. **Data collection methods:** A prospective database of all patients admitted to the unit was maintained. Patients were also asked to complete a trust in-patient survey on discharge. **Outcomes stated in methods:** Time from diagnosis to treatment Length of stay SARS-CoV-2 transmission Post-operative complications Patient satisfaction Readmission rate	**Participants:** Patients undergoing robotic colorectal and urological procedures **Setting:** A "COVID-protected" site for major elective surgery, including all robotic procedures, at Frimley Park Hospital established in a purpose-built day surgery unit. This unit was attached to the main hospital building but had a separate entrance for patients and staff. **Surgical speciality:** Elective robotic surgery (colorectal and urological cancer)	There were no known instances of patients included in this study developing coronavirus during their peri-operative in-patient stay. Median time from diagnosis to treatment for colorectal patients (excluding one patient who underwent neoadjuvant chemoradiotherapy) was 94 days (inter-quartile range 51–105). Median length of stay for robotic colorectal cancer procedures was 4 days, both Versius cases (one sigmoid cancer and one upper rectal cancer) were discharged on day 2 without stomas and no post-operative complications. This compares to a median length of stay of 6 days for patients having surgery for rectal cancer before the coronavirus pandemic. Median length of stay for robotic urological procedures remained unchanged from before the pandemic (one day). For urology procedures, all measured outcomes including length of stay were unchanged from before the pandemic. All post-operative complications, including both post-operative CT scans, occurred in patients receiving a robotic nephroureterectomy. There were no cases of readmissions for both patients undergoing robotic colorectal and urological procedures. Patient satisfaction on the unit was high, demonstrated by the in-patient survey data collected on patient discharge	developed to manage priority two (urgent) and three (elective surgery within 4 weeks) cases in a protected area, while acute services continued in the hospital. Being a "COVID protected" unit, measures were put in place to mitigate the transmission of infection such as the exclusion of staff working in the unit from the main hospital building, weekly testing for COVID-19, staff being asked to minimise contact with likely COVID-19 patients and isolate for at least 48 hours prior to their first shift. A cohort of 'clean' staff was created to work solely in the COVID-19-protected elective site. Although this study is mostly descriptive, the authors have highlighted comparisons for some outcomes (e.g., length of stay) between the pandemic and pre-pandemic periods, however baseline data has not been provided for most of these outcomes.
Jeanon et al (2021). Head and neck cancer surgery	**Study Design:** Case series	**Sample size:** 69 patients.	**Primary Findings:** Complications were seen in 16% of patients (n = 11). There were no deaths. The mean length of	Non-comparative study Conducted during the peak of the Covid-19

during the coronavirus pandemic: a single-institution experience. J Laryngol Otol; 135:168–172. doi.org/ 10.1017/S0022215121000426 United Kingdom	**Intervention/ comparator:** A head and neck cancer surgery hub. No comparator group. **Study aim:** To report the experience of elective complex major head and neck cancer surgery during the Covid-19 pandemic, at Guy's and St Thomas' NHS Foundation Trust (South East London) **Data collection methods:** Not stated, however the period of reporting was from 17 March 2020 to 17 May 2020 **Outcomes stated in methods:** COVID-19 infection (patients and staff) Complications Mortality Length of hospital stay Post-operative nosocomial infection with COVID-19	**Participants:** Head and neck cancer patients operated on at the Guy's Cancer Centre between March and May 2020. **Setting:** The Guy's Cancer Centre, a self-enclosed building commandeered to provide a coronavirus-free environment. Within the building there are three in-patient wards, four operating theatres and a four-bed critical care unit facility. **Surgical speciality:** Head and neck cancer	hospital stay was 4 days (range 1-35 days), and all patients successfully discharged home. Post-operative nosocomial Covid-19 infection detected in two patients (3%), neither required critical care unit admission and both recovered and were discharged home. One member of staff tested positive for Covid-19 during the study period but made a full recovery. **Additional Findings:** Two patients did not accept surgery because of fears of contracting COVID-19, and three tested positive and had their surgery postponed. Eleven patients required an elective stay in the critical care unit post-operatively, with a mean length of stay of 2 days (range, 1–6 days). Ten of the eleven had a covering tracheostomy inserted at the time of surgery. All were successfully de-cannulated; the mean time for removal of the tube was 3 days.	pandemic. The cancer hub was set up as a covid free care pathway for cancer. Additional measures were put in place to minimise the risk of acquiring COVID-19 infection during both the pre-operative and peri-operative periods. Due to the adoption of these measures, there was a significant increase in the time taken before, during, and after surgery, which led to a reduction in operating theatre productivity compared to pre-COVID-19 times. The surgical team was restricted to consultant surgeons only. Junior doctors were excluded to reduce the number of staff in the operating theatre. Not much detail was provided on the structure of the cancer surgery hub, however, it was described to be a separate, self-enclosed COVID-19 free building within the hospital campus. It is unclear whether resources and staff were ring fenced.
Joseph et al (2022). Dedicated orthopaedic elective unit: our	**Study Design:** Quasi-experimental study	**Sample size:** 192 patients listed in the protected elective surgical unit, and 339 in the pre-pandemic ward (PPW)	In order to assess the efficiency of the PESU, data from patients undergoing the same procedure (primary total hip replacement) by the same	Comparative study This study focusses on the activities of a

experience from a district general hospital. Ir J Med Sci: 29;1-4. doi: 10.1007/s11845-022-03174-9 United Kingdom (Wales)	**Intervention/ comparator:** An orthopaedic protected elective surgical unit (PESU) compared with the district hospital's routine elective service prior to the pandemic. **Study aim:** To compare the functioning and efficiency of an orthopaedic protected elective surgical unit instituted during the pandemic with the pre-pandemic elective service at a district general hospital. **Data collection methods:** Not explicitly stated, however the data collected included retrospectively collected data of all patients listed for all elective orthopaedic procedures under PESU between March 2020 and June 2020, and a similar period of time immediately prior to the pandemic from the pre-pandemic ward between October 2019 and February 2020. **Outcomes stated in methods:** Length of stay Patient reported outcome measures (PROMs) – Oxford Hip Score Readmissions Complications Cancellations Reasons for cancellations	**Participants:** Study participants included all patients listed for elective orthopaedic procedures under PESU between March 2020 and June 2020, and all patients listed for same procedures from the PPW between October 2019 and February 2020. **Setting:** An orthopaedic protected elective surgical unit with a ring-fenced, mixed-sex, eight-bed facility within one of three District General Hospitals within the Health Board. Dedicated staff with no cross-covering, surgery undertaken within a dedicated laminar air flow theatre, remote from the hospital general theatre suite. **Surgical speciality:** Orthopaedic surgery	surgeon pre-pandemic and during the pandemic via the PESU were compared. **Primary Findings:** The length of hospitalisation was significantly reduced via the PESU, with the average length of stay being three days compared to 4.8 days in the pre-pandemic ward. The Oxford Hip Score improvement at 6 weeks' post-operative period was marginally higher in the pre-pandemic ward (18.8) compared to the protected elective surgical unit (16.4). There were no cases that required readmission or revision in the protected elective surgical unit cohort. **Additional Findings:** 162 procedures were performed in the protected elective surgical unit compared to 168 in the pre-pandemic ward, but cancellations were four times higher in the pre-pandemic ward. There were 24 cancellations from the total of 192 patients listed in the protected elective surgical unit (12.5%), compared with 177 of 339 cancelled in the pre-pandemic ward (48%). In the pre-pandemic ward, 49% were cancelled due to unavailability of beds, the figure for this reason in the dedicated unit was 3(less than 2%). 30 cancellations in the pre-pandemic ward were due to emergency case prioritisation, compared to zero in the dedicated unit (due to strict ring-fencing). 28 patients in pre-pandemic ward, and 9 in the dedicated unit, had surgery cancelled because of medical reasons.	dedicated elective unit set up during the Covid-19 pandemic. This facility is described as being ring-fenced, with dedicated staff (with no cross-covering), and protocols put in place to minimise the risk of acquiring COVID-19 and Methicillin-resistant Staphylococcus aureus (MRSA) infections. Complications was listed as an outcome measure but was not reported in the results
Kruse et al (2019a). Do independent treatment centers offer more value than general hospitals? The case of cataract care.	**Study Design:** Quasi-experimental study **Intervention/ comparator:** Independent treatment centres (ITCs) vs general hospitals	**Sample size:** 11,526 patients from 29 independent treatment centres and 20,901 patients from 52 general hospitals. **Participants:** Patients diagnosed with cataract. **Setting:** 29 independent treatment centres, and 52 general hospitals	**Primary Findings:** Volume Number of DRGs and surgical claims show ITCs submit a slightly higher number of claims during a care pathway than general hospitals. But average number of surgeries is higher in ITCs; average, 0.91 cataract operations on average per care pathway, compared to 0.84 in general hospitals.	Comparative study ITCs as described in this paper appear to be involved mainly with delivering outpatient services.

Health Serv Res; 54:1357–1365. The Netherlands	**Study aim:** To identify differences between independent treatment centres (ITCs) and general hospitals regarding costs, quality of care, and efficiency. **Data collection methods:** Data were collected from anonymous insurer claims collected between 2013-2015. Data was collected for people who had ophthalmological claims with a cataract diagnosis, within a single year. Data on quality of care were obtained from a platform that collects quality measures for health insurers. The quality data were obtained by means of a mixed-mode survey (not part of the current study), contracting two different external parties to manage the data collection. Patient-reported data on quality of cataract surgery were collected from the Dutch Consumer Quality Index Cataract Questionnaire (CQI Cataract). **Outcomes stated in methods:** Price per diagnostic-related group system (DRG) Volume (using number of surgical claims and number of surgeries in one pathway as proxies) Efficiency (using number of health care activities in one surgical reimbursed DRG as a proxy) Health care activities (diagnostic, anaesthetic, surgical, consultation activities, day care admission activity)	**Surgical speciality:** Ophthalmic surgery (Cataract surgery)	<u>Price and total claims costs</u> The DRG prices at ITCs were found to be substantially lower for cataract surgery than general hospitals: on average 85.9 euros less for standard cataract surgery (ITC 1009.22 Euros (46.07) vs general hospital 1095.15 Euros (110.51) and 140 euros for complex cataract surgery (ITC 1250.58 Euros (114.99) vs general hospital1391.07 Euros (154.93). For patients with one cataract operation, the total cost differences are on average 94 euros per care pathway (ITC 1057.38 Euros (109.38) vs general hospital1151.20 Euros (164.47), and for patients with two cataract operations, 187 euros (ITC 2085.43 Euros (167.86) vs 2272.05 Euros (287.40)—both accounting for approximately 8% in cost savings. When adjusted for case mix, cost difference is 5% (instead of 8%) in favour of ITCs for 2015, but in 2013 ITCs were more expensive than general hospitals. <u>Efficiency</u> Efficiency in this study was defined as the number of activities in a surgical claim, where fewer activities are perceived as more efficient. ITCs were found to be more efficient in providing cataract surgery. ITCs carry out fewer health care activities within each surgical cataract DRG compared with general hospitals [Total activities within complex cataract surgery - ITCs 4.27 (2.02) vs general hospitals 5.48 (2.30)], [Total activities within standard cataract surgery – ITCs 4.14 (1.70) vs general hospitals 4.56 (2.07)]. The day care procedures (i.e., number of hours of nursing care spent within a nursing ward) were significantly shorter in ITCs for both complex cataract surgery (ITCs 0.31 (0.47) vs general hospitals 0.72 (0.48) and standard cataract surgery (ITCs 0.36 (0.48) vs general hospitals 0.57 (0.52). These differences between ITCs and general hospitals persisted even when adjusted for case	Not much detail provided on the structure of ITCs. It is unclear whether resources and staff are ring-fenced. The study authors noted that the proxy for efficiency – the number of health care activities – may not fully capture the differences in the resources used since this could vary by the different health care activities.

	Quality of cataract surgery [assessed using quality indicators Net Promoter Score (NPS) and a patient-reported outcome measure (PROM) – both of which measure patient satisfaction and the perceived outcome of patients four weeks after cataract surgery respectively].		mix. The efficiency gained by ITCs seems to be higher with complex cataract surgical claims compared with standard cataract surgical claims. Adjusted for case mix, ITCs perform on average 0.5 fewer activities compared with general hospitals; for complex cataract surgical claims, this is approximately 1 activity fewer (both statistically significant <0.01) Patient value After controlling the model for quality, claims costs in ITCs remain lower compared with general hospitals for both 2013 and 2014 with 7%. This is higher than the model with the adjusted claims costs which does not control for quality differences, meaning ITCs perform better when quality of care is also taken into account. With respect to quality of care, the results are mixed. ITCs score significantly better on the Net Promoter Score compared with general hospitals, while differences in the PROM scores are inconsistent and marginal. Based on PROM scores, ITCs seem to perform better on patient satisfaction compared with general hospitals, but there are no differences in the patient-reported outcomes after cataract surgery. In other words, patients' experiences are better in ITCs, but the differences in patient-reported improvement after cataract surgery are opaque and do not seem to differ.	
Kruse et al (2019b). Is there a volume-quality relationship within the independent treatment centre sector? A longitudinal analysis. *BMC Health Services Research, 835(19),* pp.1-13	**Study Design:** Cohort study **Intervention/comparator:** Independent treatment centres (ITCs) performing ophthalmology, dermatology, orthopaedics or aesthetic surgery. ITC models (ownership status, chain-affiliation) are compared. **Study aim:** this study aims to explore the question of whether volume is associated with quality	**Sample size:** 80 ITCs with a total of 19,294 ratings **Participants:** Patients undergoing elective surgery at ITCs from 2014-2017 **Setting:** ITCs in the Netherlands **Surgical speciality:** ITCs that performed invasive treatments and offered one of the following specialties: ophthalmology, dermatology, orthopaedics or aesthetic surgery.	**Primary Findings:** ITCs with higher volumes scored better on structure, process and outcome (i.e., postoperative infections) indicators compared to the low-volume ITCs. Volume is associated with better performance on the structural and process indicators and on the number of postoperative infections. However, because the number of postoperative infections is generally low in low-risk surgical procedures, any increase in volume is associated with only a small decrease in the number of postoperative infections	Comparative study. Multiple ITCs are grouped, and outcomes are compared based on their model Multiple Dutch ITCs were assessed in this study. Not much detail given in terms of the structure of ITCs, including whether

The Netherlands	in the ITC sector and, in addition, identify possible mediating structural factors (i.e., workforce size, chain membership and ownership status). **Data collection methods:** A dataset of ITCs ranging from 2014-2017 was constructed using data from the Dutch Health and Youth Care Inspectorate (IGJ). The IGJ collects ITC data through issuing a mandatory quality assessment questionnaire, completed by ITC locations themselves. This was merged with patient satisfaction data from the Dutch Patients Association (Patientenfederatie). ITCs that met the inclusion criteria and had 30 or more patient ratings were included. **Outcomes stated in methods:** Volume (number of invasive treatments) Outcome indicators (postoperative infections) Patient satisfaction		**Additional Findings:** Compliance with composite quality indicators: • Reachable 24/7 0.67 ± 0.47 • Personnel functioning system 0.78 ± 0.41 • Personnel malfunctioning system 0.78 ± 0.41 • Patient satisfactory questionnaire 0.88 ± 0.33 • ASA classification known 0.48 ± 0.50 • Screening delirium 0.34 ± 0.48 • Collaboration with (a) hospital(s) 0.64 ± 0.48 • Structural and process composite −0.00 ± 3.31 The percentage of postoperative infections is low with approximately 3 in 1000 invasive treatments resulting in postoperative infections ITCs with higher volumes were found not to have higher patient satisfaction. Patient satisfaction (score out of 10), 8.7 ± 1.2 • Variation between number of invasive treatments show substantial variation between ITCs (1572 ± 1882) • Physicians FTE: 2.3 ± 2.5; nurse FTE: 1.5 ± 3.6 • Most centres are non-profit: 32% are for-profit • non-profit ITCs completed a higher number of invasive treatments. Non-profit ITCs are also more often chain-affiliated, and non-profit chains have more ITC locations than the for-profit chains. In addition, sole-proprietorship ITCs perform a lower number of invasive treatments than the chain-affiliated ITCs, and this is the case for both for-profit ITCs and non-profit ITCs. • The FTE of physicians and nurses seems to be unrelated to the structural and	resources and staff are ring-fenced.

			process quality indicators, rate of postoperative infections and patient satisfaction • Chain membership has no effect on performance • Patient satisfaction data illustrate a negative and consistent relationship with chain membership, but only on a 90% confidence interval • No association was found between ownership and the structural and process indicators or postoperative infections	
Minto et al (2022). Safety of maintaining elective and emergency surgery during the COVID-19 pandemic with the introduction of a Protected Elective Surgical Unit (PESU): A cross-specialty evaluation of 30-day outcomes in 9,925 patients undergoing surgery in a University Health Board (Wales). *Surgery Open Science, 10,* pp.168-173 United Kingdom (Wales)	**Study Design:** Cohort study **Intervention/comparator:** Introduction of Protected Elective Surgical Units (PESUs), called hospital green zones. The COVID-19 outcomes for Green zones were compared to amber zones (representing non-protected areas providing both elective and emergency surgery). **Study aim:** The aim of this study was to assess the perioperative risk of SARS-CoV-2 transmission and mortality during the pandemic and whether the development of a PESU can minimise COVID-19–related morbidity **Data collection methods:** Electronic theatre records were used to collect information on patient demographics, operation performed, and length of hospital stay. 30 day-mortality data was obtained electronic patient records and patient notes. For the first 3 months of the study window, data was verified by subspecialty clinical leads, and all positive swabs were cross-checked with	**Sample size:** 9,925 patients (elective= 6,464, 65.1%) **Participants:** All patients undergoing emergency and elective surgery under general, spinal, or epidural anaesthetic across a single Health Board between 15 March 2020 and 14 March 2021 **Setting:** All but 2 of the 20 surgical specialties within the health hoard were included in this study (paediatric and obstetric surgery were both excluded). Green zones and amber zones. Green zones were units inside two hospitals that had separate entrances, designated changing rooms, wards, corridors, postoperative high-dependency care areas and operating theatres referred to as PESUs. Staff were restricted to the unit for the day and rules were designed for PPE and movement in and out of the unit. Patients in green zones self-isolated for 14 day pre-operatively and were tested for COVD-19 72 hours prior to admission. Elective patients in amber areas were predominantly low-risk day-case individuals or those unable to follow green zone isolation policies. Designated COVID-19–positive areas were separated from the other areas and included 2 operating theatres and parts of the critical care unit.	**Primary Findings:** Elective surgery accounted for 6,464 (65.1%) of the cases; of these, 4,495 (69.5%) were performed in the PESU and 1,969 (30.5%) in the amber stream due to inability to fulfil the preoperative requirements. SARS-CoV-2 transmission Total postoperative SARS-CoV-2 transmission was higher in the emergency stream than in the combined green and amber elective streams (3.4% [116 of 3461] vs 1.2% [79 of 6464], P < 0.001). SARS-CoV-2 postoperative transmission was lower in the green elective pathway (PESU) than in the combined elective and emergency amber pathway (non-PESU) (0.42% [19 of 4495] vs 3.2% [176 of 5430], P < 0.001). This was also significantly lower when compared to the amber elective stream only (3.0% [60 of 1969], P < 0.001). COVID-19 mortality The overall all-cause 30-day mortality was 1.7% (3.6% [124 of 3461] emergency vs 0.79% [51 of 6464] elective, P <0.001). Mortality was higher in patients that had contracted COVID-19 perioperatively (14.6% [41 of 280] vs 1.4% [134 of 9645], P < 0.001). There were no COVID-19–related mortalities in patients within the "green" elective stream. There was one recorded green zone postoperative COVID-19–related mortality, however, this patient tested positive	Comparative study COVID-19 related study. SARS-CoV-2 transmission was compared between Green zone (with PESUs) and amber zones The Protected Elective Surgical Units assessed in this study were self-contained and separated from emergency care. Measures were put in place to mitigate the spread of COVID-19. Being a 'protected' unit, staff and resources were ring-fenced from the rest of the hospital units. COVID-19 mortality was not measured in the non-PESU units, therefore a comparison between PESU and non-PESU units for this outcome was not reported. Length of hospital stay and critical care

	Public Health Wales to ensure data accuracy Pre- and postoperative SARS-CoV-2 PCR swab results and test dates were recorded from the Welsh Clinical Portal IT system, which captures any test taken across Wales **Outcomes stated in methods:** SARS-CoV-2 transmission 30-day postoperative SARS-CoV-2 transmission rate 30-day mortality associated with perioperative SARS-CoV-2 transmission Hospital and Protected Elective Surgical Unit transmission rates Critical care admission Length of hospital stay	These patients are included within the "amber" category. **Surgical speciality:** Breast, cardiac, colorectal, endocrine, ENT, general surgery, gynaecology, hepatobiliary/pancreatic, neurosurgery, ophthalmology, OMFS, renal/transplant, spinal, thoracic, T + O, UGI, urology, vascular (note: all specialties had both elective and emergency cases)	after being transferred out of the green zone, with the death occurring 23 days after entering the amber stream. Therefore, this is likely to be a mortality related to amber zone transmission. **Additional Findings:** Adjusted secondary analysis of the postoperative green zone positive results to ascertain likely hospital green zone transmission led to the exclusion of 17 patients (16 likely community transmissions and 1 amber zone transmission for additional cardiac requirements), leaving only 2 postoperative transmissions. Of the 2 remaining cases, 1 patient tested positive with symptoms 4 days postoperatively; however, the second patient tested "low-level" positive only 4 days postoperatively while being asymptomatic as part of standard protocol at their dialysis unit.	admission were listed as outcome measures but were not reported in the results
Perrone et al (2020). COVID-19 free oncologic surgical hub: The experience of reallocation of a gynecologic oncology unit during pandemic outbreak. *Gynecologic Oncology, 161,* pp.89-96 Italy	**Study Design:** Case series **Intervention/comparator:** Reallocation of gynaecological oncology (GO) surgical activities to a COVD-19 free oncological surgical hub (OSH)/ no comparator **Study aim:** To describe the experience of a Gynaecologic Oncology Unit's reallocation of resources in a COVID-19 free surgical oncological hub in order to guarantee standard quality of surgical activities **Data collection methods:** Data on COVID-19 epidemic in Emilia Romagna Region and Italy was collected from the official Italian Civil Protection website. Reallocation of resources data was taken from official hospital documentation. Patient	**Sample size:** 51 patients undergoing surgery **Participants:** All patients undergoing surgical evaluation and treated for gynaecological cancers during the lockdown period (March 9th – May 4th, 2020) pandemic. Only patients with certain or strongly suspected malignant cancer started the surgical pathway. **Setting:** OSH were reorganised private hospitals. The operating room was upgraded with surgical instruments provided by the University hospital. GO activity was divided into two locations: patient's selection for surgery, pre-operative assessment and post-surgical activities remained in the outpatient clinic and in pre-operative section of the University Hospital, while surgical activities and ICU were planned and performed in one of the OSHs. The surgical activity was performed three times a week from 8 AM to 7 PM.	**Primary Findings:** 63 surgical procedures were performed. No patient COVID-19 infection was recorded. The compliance questionnaire was completed by 41 patients (80%). The relocation of surgical activities in the COVID-19-free OSH and the adopted restrictive measures were positively accepted in more than 65% of patients **Additional Findings:** From March 9th to 23rd the GO reduced the operating sessions by 50% until closure due to lack of available beds in the ward, operating room, medical staff (anaesthesiologists) and nurses. All resources were committed to COVID-19 infected patients. Surgical parameters results showed medium to high surgical complexity and required ICU in 25% of patients in ovarian cancer cases. Serious complications were observed in three (6%) cases. 63% of patients lived outside the Bologna area and 14% came from "red zones" (cities with isolation sanctions). No changes in the decision-	Non-comparative study Covid-19 related study The OSH building was dedicated only to patients with gynaecological cancers who were accommodated in single rooms. Access to relatives was prohibited. OSH's provided anaesthesiologists, nurses and paramedics, as well as instruments and consumables. The GO medical team worked in the two facilities without interactions with the COVID departments activities and staffs General measures to reduce SARS-CoV-2 transmission were

	information was taken from a data archive. **Outcomes stated in methods:** SARS-CoV-2 transmission Surgical complications associated with the pathway or treatment Patient compliance and satisfaction with COVID-19 free care setting	**Surgical speciality:** Gynaecological oncology surgery	making process on surgical strategies due to the risk of COVID-19 infection were recorded.	implemented including: different entry and exit routes, temperature measurement and lifestyle restrictions. Restrictive lifestyles were recommended for members of staff including the option to isolate themselves in hotel rooms. These measures, though targeted at mitigating SARS-CoV-2 transmission, suggests a possible ring-fencing of resources and staff.
Spinelli et al (2021). Reduced duration of stay after elective colorectal surgery during the peak phase of COVID-19 pandemic: A positive effect of infection risk awareness? *Surgery*, *170*(2), pp.558-562. Italy	**Study Design:** Quasi-experimental study **Intervention/comparator:** Designated colorectal surgical hubs with enhanced recovery protocols (ERP) during COVID-19 pandemic/comparator period in 2019 **Study aim:** To investigate how the pandemic impacted the quality of care in two ERP-CRS programmes by comparing short-term outcomes achieved during the COVID-19 pandemic with those from the equivalent timeframe in 2019, with a special focus on duration of stay and readmission rate. **Data collection methods:** Data were collected from prospectively maintained electronic datasets **Outcomes stated in methods:**	**Sample size:** 136 consecutive patients in group A and 173 consecutive patients in group B **Participants:** Patients undergoing major colorectal surgery during the peak phase of the pandemic (Feb –May 2020) (group A) and patients undergoing major colorectal surgery during the same time period in 2019 (Feb –May 2019) **Setting:** Two tertiary academic hospitals of Lombardy and Emilia Romagna were designated colorectal surgical hubs during the COVID-19 pandemic **Surgical speciality:** Colorectal surgery	**Primary Findings:** No differences were found in the type of surgeries performed in group A and B (P = 0.32). There was a significantly higher proportion of oncological patients in group A compared to group B (73.5% vs 61%; p = 0.01) although between the groups there was no significant difference in tumour stage for oncologic patients. Post-operative complications were comparable between the two groups (Group A 24% (n = 33) vs Group B 30% (n = 53); p = 0.21). Reoperation rates were higher in group B compared to group A (4% vs 1.4% respectively; P =0.09), and readmission rates were similar between the groups (group A: 4.4% vs group B: 2.8%; P = 0.95). A significantly shorter overall duration of stay was found for group A compared to group B (mean 4.3 vs 6.2 days, respectively; P < 0.001). Uncomplicated patients from group A also had a shorter duration of stay when compared to uncomplicated patients from group B (Mean duration of stay was 3.3 vs 4.1 respectively; P = 0.008). In the subgroup analysis of patients operated for oncologic or benign conditions,	Comparative study Covid-19 related study. Patients in group A were undergoing colorectal surgery during the peak phase of the COVID-19 pandemic (Feb2020-May 2020). Measures were put in place at both colorectal surgical hubs to limit the chances of operating elective patients infected with COVID-19. These included routine testing and questioning surgical candidates about high-risk contacts and presence of symptoms. Additional measures at hospital level included access restriction for visitors and nonessential personnel, universal use of the appropriate personal protective

	Post-operative complications Reoperation rate Readmission rate Duration of stay 90-day morbidity and mortality		duration of stay was shorter for group A than group B (P = 0.2). **Additional Findings:** Perioperative mortality was nil in both groups. The multivariate linear regression model showed that cohort group (group A versus group B; coefficient = -1.41; 95% confidence interval [CI] = -2.5 to -0.29; P = 0.014) and occurrence of complications (complicated versus uncomplicated; coefficient = 5.62; 95% CI = 4.39 to 6.86; P < 0.001) were significant factors influencing the difference in duration of stay.	equipment, and temperature screening checkpoints for patients and staff. Not much detail given on the structure of these hubs. It is unclear whether resources and staff are ring-fenced 90-day morbidity was listed as an outcome measure but not reported in the results
Syed et al (2015). Cataract surgery outcomes at a UK independent sector treatment centre *British Journal of Ophthalmology*, *99*(11), pp.1460-1465. UK	**Study Design:** Quasi-experimental study **Intervention/comparator:** Independent sector treatment centres (ISTCs) at UK Specialist Hospitals (UKSH) compared to the Cataract National Dataset (CND). **Study aim:** To review cataract surgery outcomes at three independent surgery treatment centres over an eight-year period and to compare these outcomes with recognised benchmarks (previously reported from NHS facilities). **Data collection methods:** Annual quality reports, logbooks and electronic medical records were reviewed between July 2005 and March 2013. **Outcomes stated in methods:** Complication rate (operative and postoperative) Biometry outcomes	**Sample size:** 20,070 cataract extractions were performed between July 2005 and March 2013. **Participants:** All patients who underwent cataract surgery at UK specialist hospitals between July 2005 and March 2013 were included. Patients had a lens opacity causing interference in vision with confirmation of cataract by slit lamp biomicroscopy. **Setting:** Three independent sector treatment centres which included Shepton Mallet Treatment Centre (SMTC), Emersons Green Treatment Centre (EGTC), and the Devizes Treatment Centre (DVTC). EGTC and DVTC are collectively referred to as AGW due to overlapping services within the same areas. **Surgical speciality:** Ophthalmic surgery (Cataract surgery)	**Primary Findings:** Operative complications The most frequent operative complication at UKSH was posterior capsule rupture (PCR) or vitreous loss or both, occurring in 107 cases with a total incidence of 0.53%. This includes cases involving anterior vitrectomy, zonular dialysis with vitreous loss, and vitreous to section at the end of surgery. When compared to the national survey (CND), UKSH had significantly lower rates of several operative complications. These included choroidal or suprachoroidal haemorrhage (OR 14.09; 95% CI 2.38-569.53), hyphaema (OR 2.81; 95% CI 1.10 - 9.16), intraocular lens complications (OR 7.2; 95% CI 4.18 -12.549), iris damage from phacoemulsification (OR 9.25; 95% CI 5.74 - 14.91, nuclear fragment into the vitreous or dropped nucleus (OR 5.16; 95% CI 2.55 - 10.43), phacoemulsification wound burn (OR 50.35; 95% CI 8.88 - 1983.24), PCR or vitreous loss or both (OR 2.67; 95% CI 2.18 - 3.27), vitreous in anterior chamber (OR 1.99; 95% CI 1.17 - 3.38), and zonular dialysis (OR 4.41; 95% CI 2.93 - 6.66). . Postoperative complications	Comparative study (i.e., outcomes at ISTCs vs national benchmark outcomes previously reported from NHS facilities). Data collected pre-2015. Not much detail given on the structure of the ISTCs. It is unclear whether resources and staff are ring-fenced.

			The most common postoperative complication at UKSH was corneal decompensation, occurring in 119 cases with a frequency of 0.59%. When postoperative complications were compared with data from the CND, UKSH had significantly lower rates of corneal decompensation (OR 9.62; 95% CI 8.27 - 11.19), cystoid macular oedema or macular oedema (OR 7.32; 95% CI 5.66 - 9.46), iris to wound (OR 4.02; 95% CI 2.02 - 8.00), posterior capsule opacification with yttrium aluminium garnet indicated (OR 3.63; 95% CI 2.87 - 4.59), raised intraocular pressure (>21 mm Hg) (OR 8.37; 95% CI 6.77 - 10.35), retained soft lens matter (OR 2.32; 95% CI 1.66 to 3.23), uveitis (OR 14.18; 95% CI 11.40 - 17.65), vitreous to section (OR 4.36; 95% CI 2.79 - 6.81), and wound leak or rupture (OR 7.0; 95% CI 2.64 - 26.52). <u>Biometry outcomes</u> Biometry outcomes at UKSH were significantly better than published benchmarks from the NHS. At UKSH, 66.76% of eyes were within 0.5 dioptres (D) of predicted spherical equivalent compared with the 55.0% benchmark proposed by the Leeds Teaching Hospital NHS Trust (OR 1.64; 95% CI 1.488 - 1.81). In addition, 89.90% of eyes were within 1.0 D of predicted spherical equivalent at UKSH compared with the 85.0% benchmark value proposed by the Leeds Teaching Hospital NHS Trust (OR 1.56; 95% CI 1.35 - 1.82). Both of these differences were statistically significant.	
Tulp et al (2020). Independent Treatment Centres Are Not a Guarantee for High Quality and Low Healthcare Prices in The Netherlands – A Study of 5 Elective Surgeries *International Journal of Health*	**Study Design:** Quasi-experimental study **Intervention/comparator:** Independent treatment centres (ITCs) vs general hospital **Study aim:** The aim of this study is to compare ITCs to general hospitals on quality of care and price. The main research questions include:	**Sample size:** Not stated **Participants:** Patients who had one of five selected elective surgeries **Setting:** Dutch hospitals and ITCs **Surgical speciality:** Five elective surgeries were selected [total hip replacement (THR) and total knee replacement (TKR), anterior cruciate ligament (ACL), cataract, and carpal tunnel surgeries (CTS)].	**Primary Findings:** Quality differences between ITCs and general hospitals were found to be small and inconsistent. ITCs outperformed general hospitals on cataract care, CTS and ACL surgery, but performed on average worse. on THR and TKR. ITCs were estimated to have a higher revision rate for THR (ITC 1.93 ± 2.06 (9) vs general hospital 1.69 ± 1.06 (69) and TKR (ITC 2.72 ± 3.29 (10) vs (general hospital 1.28 ± 0.89 (69), but a lower revision rate for ACL (ITC 2.92 ± 5.73 (14) vs general hospital 3.75 ± 2.75 (66).	Comparative study. For each medical procedure, five regressions were run: three models with quality as a dependent variable, one with list price as a dependent variable and one with the number of insurance contracts as a dependent variable.

Policy and Management, *9*(9), p.380. The Netherlands	- Do quality outcomes differ between ITCs and general hospitals? - Do prices differ between ITCs and general hospitals? Additional research questions include: - Which underlying factors are associated with quality outcomes or prices? - Is selective contracting within the ITC sector based on quality outcomes of the previous year? **Data collection methods:** Quality data of Dutch hospitals and ITCs for 2017 was extracted from the public dataset of the Dutch National Health Care Institute. Robustness checks were performed by repeating the analysis using quality data from 2016. **Outcomes stated in methods:** Postoperative infections after carpal tunnel syndrome (CTS) Revision surgery for total knee replacement (TKR), total hip replacement (THR), and anterior cruciate ligament (ACL) surgery Cataract quality measures (Postoperative improved visual acuity, postoperative dioptre of target refraction) Price differences between ITCs and general hospitals		ITCs performed 2.21 percentage point fewer revision surgeries than general hospitals for ACL. However, these differences did not persist after robustness checks were performed. The chance of developing postoperative infections declines when more CTS surgeries are performed (ITC 0.15 ± 0.31 (20) vs general hospital 0.28 ± 0.46 (69). However, a volume-quality relationship was not found for any of the other procedures. Similarly, the process and structure indicators are only related to one procedure: they are positively associated with the increase of postoperative dioptre of target for cataract care. No differences in list prices were found between ITCs and general hospitals after correction for additional factors: Cataract surgery (ITC 1230.37 ± 116.00 Euros (31) vs general hospital 1235.89 ± 212.94 Euros (64)) CTS (ITC 998.03 ± 180.81 Euros (20) vs general hospital 926.11 ± 215.33 Euros (69)) TKR (ITC 10 402.41 ± 1115.47 Euros (14) vs general hospital 10 079.14 ± 920.37 Euros (68)) THR (ITC 9905.91 ± 1125.74 Euros (12) vs general hospital 9344.06 ± 887.66 Euros (68)) ACL (ITC 4208.94 ± 425.02 Euros (14) vs general hospital 4243.23 ± 726.79 Euros (67)) High volume is related to a lower list price for standard cataract surgery, although the effect is limited: each additional surgery lowers the list price by approximately €0.05. Furthermore, good performances on process and structure measures are related to higher surgery prices for CTS surgery. This means that one standard-deviation increase in process and structure indicators increases list prices by €121. No relationship was detected between the number of insurance contracts for 2018 and quality data of ITCs in 2017. The authors suggest that insurance contracts are independent of quality of care within the ITC sector.	Not much detail given on the structure of the ITCs, however in the paper's introduction section it states that ITCs are much smaller than hospitals and offer primarily elective ambulatory care.

Vanhegan et al (2015). Effect of an Independent-Sector Treatment Centre on provision of elective orthopaedic surgery in East and North Hertfordshire. Ann R Coll Surg Engl; 97: 519–525 doi 10.1308/rcsann.2015.0029. United Kingdom	**Study Design:** Quasi-experimental study **Intervention/ comparator:** Independent Sector Treatment Centre (Post-ISTC data) vs Acute Hospital Trust (Pre-ISTC data) **Study aim:** To compare productivity of individual surgeons before and after the introduction of an Independent Sector Treatment Centre (ISTC) for elective orthopaedic procedures **Data collection methods:** Pre-ISTC data were collected from the base NHS hospital using surgeon's logbooks between May 1st and July 31st, 2011, using the Clinical Information and Patient Tracking System. Post-ISTC data were collected from the PROXIMA Patient Administration System, from May 1st and 31st of July 2012. Only data for upper limb and foot and ankle surgeries were reviewed. **Outcomes stated in methods:** Absolute number of lists (half-day operating session – usage outcome) Patients per list (efficiency) Financial productivity (Payment by Results data for 2012-2013)	**Sample size:** 66 patients pre-ISTC, 32 patients post-ISTC for upper-limb surgery, 67 patients pre-ISTC and 49 post ISTC for foot and ankle surgery. **Participants:** Patients who underwent elective upper limb and foot and ankle surgeries at the Acute Hospital Trust between May 1st and July 31st, 2011, and at the ISTC between May 1st and July 31st, 2012. **Setting:** An Independent Sector Treatment Centre for elective general surgery, including orthopaedics and ophthalmology, set on hospital grounds but managed independently of the Acute Hospital Trust. **Surgical speciality:** Orthopaedic surgery	**Primary Findings:** Usage and efficiency of the ISTC and AHT *Upper limb surgery* The upper limb surgeon carried out 18 lists (half-day operating sessions) both pre and post ISTC. In 2011, 66 patients were treated (mean 3.7 patients per list), and in 2012, 32 patients were treated (mean 1.8 patients per list). This represents a reduction of 48.5% at the ISTC compared to the acute hospital. *Foot and ankle surgery* There were 13 lists with 67 patients (mean 5.2 patients per list) at the acute hospital, compared to 20 lists with 49 patients (mean 2.5 per list) at the ISTC. The adjusted volume of operating in 2011 was 103, a 47.5% reduction in previous levels of patients being treated. The case-mix was similar between the two periods, but the overall volume of procedures was less. Financial analysis *Upper limb surgery* The financial value of operating by the upper limb surgeon was £169,695 pre-ISTC and £95,760 post-ISTC, a deficit in productivity of £73,935 over the 3-month period. *Foot and ankle surgery* The financial value of operating for the foot and ankle lists was £97,801 and £91,960, respectively. Correcting for the fact that 1.5-times more lists were undertaken during the post-ISTC period, this equated to a loss of £54,742. This represents a combined loss of £128,677 over 3 months; £514,708 extrapolated over 1 year, for the two surgeons. The mean value of an upper limb case was higher than a foot and ankle case. The range in cost of the procedures carried out before and after ISTC opening were very similar: the standard deviation	Comparative study Surgical procedures with an anticipated duration of >5-nights hospital stay (e.g., revision arthroplasty) were not undertaken at the ISTC, neither were trauma or pediatric surgery. Spinal surgery was also excluded because there was no access to MRI facilities out of hours. Patients were moved to the acute hospital if their admission extended to the weekend. Only fit and healthy patients of American Society of Anesthesiologists (ASA) grades 1 or 2 were treated. Only data from the Consultants for upper limb (UL) as well as foot and ankle (F&A) surgery were reviewed because most of such these patients were expected to be transferred to the ISTC given the high proportion of day-case and short-stay procedures The ISTC was opened on the grounds of an Acute Hospital Trust but

			and mean cost of the procedures were similar in value for both periods. The case-mix was comparable, there was no statistical difference between the two periods for upper limb (p=0.21) or foot and ankle (p=0.30). **Additional Findings:** <u>Upper limb surgery</u> In both periods, the highest volume of surgeries was arthroscopic (subacromial decompression and repair of rotator cuff). Biggest difference in the volume of procedures was seen in decompression of the carpal tunnel (17 vs 3). The case-mix was similar in both periods but numbers decreased across all types of surgery after introduction of the ISTC.	managed independently – surgeons seconded to the ISTC from the AHT and managerial staff recruited from the private sector. This suggests a possible ring-fencing of staff and resources. Study authors acknowledged that certain structural and patient-care pathway differences between the ISTC and AHT may have contributed to the results. These included inflexibility in terms of re-ordering a list and lack of separate anesthetic rooms in the ISTC.

Figure 1. Outcomes map

	Comparative studies								Non-comparative studies				Total
	Joseph et al (2022)	Kruse et al (2019a)	Kruse et al (2019b)	Minto et al (2022)	Spinelli et al (2021)	Syed et al (2015)	Tulp et al (2020)	Vanhegan et al (2015)	Carvalho et al (2022)	Huddy et al (2022)	Jeanon et al (2021)	Perrone et al (2020)	
Clinical outcomes													
Complications (non-specific)					X	X			X	X	X	X	6
COVID-19 specific complications									X				1
SARS-CoV-2 transmission (operative/postoperative)				X						X	X	X	4
COVID-19 mortality				X									1
Length of stay	X				X					X	X		4
Mortality rate					X				X		X		3
Optical biometry outcomes						X							1
Cataract quality measures (Postoperative dioptre of target refraction and postoperative improved visual acuity)							X						1
Postoperative infections			X				X						2
Readmission rate	X				X				X	X			4
Revision surgery/reoperation rate					X		X						2
Performance outcomes													
Cancellations	X								X				2
Cancellation reasons	X												1
Efficiency (number of health care activities in one surgical claim)		X											1
Efficiency (number of patients per list i.e., half-day operating session)								X					1
Performance (Time from referral to patient prioritisation, time from referral to anaesthetic assessment, and time from referral to surgery)									X				1
Theatre utilisation									X				1
Time from diagnosis to treatment										X			1
Usage (Absolute number of lists – half-day operating session)								X					1
Volume (Number of invasive treatments)			X										1
Volume (Number of surgical claims and number of surgeries in one pathway)		X											1
Economic outcomes													
Financial productivity								X					1
Price differences between ITCs and general hospitals		X					X						2
Patient reported outcomes													
Oxford Hip Score (Patient reported outcome measure)	X												1
Patient compliance												X	1
Patient satisfaction			X							X		X	3
Quality of cataract surgery (patient satisfaction + perceived outcomes 4 weeks after surgery)		X											1

3. DISCUSSION

3.1 Summary of the findings

There is evidence to suggest that surgical hubs can be effective at improving a range of clinical, performance, and patient reported outcomes in patients undergoing certain types of surgery. However, the evidence relating to the efficiency and financial productivity of these hubs is inconsistent. Considerable variation in the types of surgical hubs reviewed, surgical disciplines, along with the small number of comparative studies, as well as methodological limitations across included studies, could limit the applicability of these findings. It is worth noting that some of the outcomes reported in this review are likely to have been impacted by the COVID-19 pandemic. More urgent cases with higher rates of complexities and difficulties, were more likely to get referred for surgery during this period. These could account for findings such as the high reoperation rates reported during the peak phase of the pandemic, as well as quicker than usual discharge from hospital.

3.2 Limitations of the available evidence

This rapid review has highlighted several evidence gaps and areas of uncertainty. These include:

A small number of comparative studies were included in this review, and evidence for many outcomes were derived from single studies.

There appears to be a paucity of robust study designs in this area of research. The majority of included studies utilised weak research methodologies that may not be appropriate for inferring effectiveness. Some studies may be at risk of selection bias as details on patient characteristics are lacking. The methodological reporting in the included studies was also often inadequate, preventing a fully informed assessment of quality.

Included studies were focussed on various surgical specialties – some studies included a mix of surgical specialities. It is unclear whether the evidence derived from this review can be applied to other surgical fields.

Key details pertaining to information about the structure of surgical hubs were often lacking or poorly described in the included studies. Only two studies explicitly described surgical facilities with ring-fenced or dedicated capacity/resources.

The surgical hubs identified in this rapid review were varied in structure, function, and location. This could limit the generalisability of our findings.

The majority of included studies described surgical hubs that were established during the COVID-19 pandemic and designed mainly to mitigate the spread of COVID-19. This review may therefore not be able to address issues such as those pertaining to the impact of emergency/winter pressures.

Included studies that were conducted during the COVID-19 pandemic did not appear to control for the impact of the pandemic on outcomes such as length of hospital stay and reoperation rates.

This review initially sought to address a focussed review question and several sub-questions. However, no evidence was identified for most sub-questions. Furthermore, this review did not identify any evidence relating to resource use, safety outcomes, or willingness to travel (staff/patient) to surgical hub facilities.

3.3 Implications for policy and practice

This report has provided insights into how surgical hubs deliver services in distinct surgical areas. This may be useful when designing research or services to assist with the recovery of planned care services in the UK. Considering the paucity of robust evidence, further well-designed, higher quality research from the UK and similar countries is needed to better understand the effectiveness of surgical hubs in Wales.

3.4 Strengths and limitations of this Rapid Review

The studies included in this rapid review were identified through an extensive search of electronic databases, grey literature and the use of supplementary methods. Despite making every effort to capture all relevant publications and reduce the risk of bias in our review process, it is possible that additional eligible publications may have been missed and that biases do exist in this review.

To ensure the usefulness of our findings, only comparative studies were analysed when evaluating effectiveness outcomes, as these are better placed to determine the presence of cause-and-effect relationships. However, data from both comparative and non-comparative studies were used to provide insight into patient-reported outcomes such as patient satisfaction and compliance.

Due to the variability and paucity of evidence for particular outcomes, we did not attempt to undertake any assessment of the outcomes using GRADE. However, given the paucity of the evidence and the methodological limitations inherent in our included studies, caution needs to be applied when interpreting the findings of this review.

4. REFERENCES

British Medical Association (2023). NHS backlog data analysis. Available at: https://www.bma.org.uk/advice-and-support/nhs-delivery-and-workforce/pressures/nhs-backlog-data-analysis [Accessed 13 March 2023].

Briggs T, Kay P, Vig S, et al. (2022). Optimising surgical hubs for staff: case studies on training, wellbeing and retention. *British Journal of Healthcare Management,* 1-9.

Department of Health and Social Care (2022). Over 50 new surgical hubs set to open across England to help bust the COVID-19 backlogs. Available at: https://www.gov.uk/government/news/over-50-new-surgical-hubs-set-to-open-across-england-to-help-bust-the-covid-backlogs. [Accessed 10 December 2022].

GIRFT (2022). Design and layout of elective surgical hubs - a guide for NHS systems and regions to support planning of effective surgical hubs. NHS.

Huddy J R, Crockett M, Nizar A S, et al. (2022). Experiences of a “COVID protected” robotic surgical centre for colorectal and urological cancer in the COVID-19 pandemic. *Journal of Robotic Surgery,* 16, 59-64.

Joseph V, Boktor J G E, Roy K, et al. (2022). Dedicated orthopaedic elective unit: our experience from a district general hospital. *Journal of Medical Science,* 1971-.

Mallorie, S. (2023). What caused the UK’s elective care backlog, and how can we tackle it? The King's Fund. Available at: https://www.kingsfund.org.uk/blog/2023/02/what-caused-uks-elective-care-backlog-how-can-we-tackle-it [Accessed 13 March 2023].

Minto T, Abdelrahman T, Jones L, et al. (2022). Safety of maintaining elective and emergency surgery during the COVID-19 pandemic with the introduction of a Protected Elective Surgical Unit (PESU): A cross-specialty evaluation of 30-day outcomes in 9,925 patients undergoing surgery in a University Health Board. *Surg Open Sci,* 10, 168-173.

Royal College of Surgeons of England (2022). The case for surgical hubs. London: The Royal College of Surgeons of England. Available at: https://www.rcseng.ac.uk/about-the-rcs/government-relations-and-consultation/position-statements-and-reports/the-case-for-surgical-hubs/

Welsh Government (2022). Our programme for transforming and modernising planned care and reducing waiting lists in Wales. Available at: https://www.gov.wales/transforming-and-modernising-planned-care-and-reducing-nhs-waiting-lists

5. RAPID REVIEW METHODS

5.1 Eligibility criteria

We searched for primary sources to answer the review question: "what is the effectiveness, efficiency, and acceptability of surgical hubs in supporting planned care activity, and how best should they be established and run?" The following eligibility criteria were used to identify studies for inclusion in the rapid review:

Table 2: Eligibility criteria

	Inclusion criteria	Exclusion criteria
Population	Surgical patients of all ages (children and adults) All elective surgical fields	Emergency or transplant surgery
Intervention / exposure	Elective surgical hubs defined as protected facilities dedicated entirely to elective care, with ring-fenced resources that allow them to stay active even when emergency pressures rise (Briggs et al., 2022) To include stand-alone, integrated, and ring-fenced surgical hubs. Can be privately or NHS-run facilities or mixed models Surgical hubs can include day cases, one or more specialties, short stay units with or without enhanced recovery	Facilities dedicated to non-elective surgical care Outpatient surgical facilities e.g., ambulatory surgery centres, outpatient surgery centres Referral to an alternative surgical site, which does not meet the definition of a surgical hub, for example due to an excessive waiting list
Comparison	No comparison Usual care Other service/governance or workforce models Other time period or non-emergency situation	
Outcome measures	Studies reporting any of the following outcomes will be considered for inclusion in the review: • Clinical outcomes • Performance outcomes • Economic outcomes • Safety outcomes • Resource use • Patient experience/attitudes • Acceptability (patients/staff) • Willingness to travel	
Study design	Primary studies: comparative and non-comparative quantitative studies or qualitative studies, full economic evaluations	Secondary/tertiary research Commentaries, Editorials
Countries	High-income countries	
Language of publication	English	
Publication type	Published, preprint	
Other factors *Any other key points to note*	Papers published since 2015	

5.2 Literature search

The studies included in this rapid review were identified through a systematic literature search. General repositories of evidence noted in our resource list were searched between the 13th and 17th of January 2023. Grey literature searching and citation tracking of the secondary sources included in scoping work were also conducted to identify any additional studies. An audit trail of the search process is provided within the resource list (Appendix 1). Searches were limited to English-language publications that were published since 2015 and included searches for primary studies.

Search concepts and keywords around surgical hubs/ centres and elective surgery were utilised. The searches included free text words and we deliberately kept our search strategy broad to capture as much evidence on surgical hubs as possible. The search strategy used to search MEDLINE is available in Appendix 2.

5.3 Study selection process

The 513 studies identified through the database and grey literature searches were uploaded to the systematic reviewing platform Rayyan for title and abstract screening. Two independent reviewers screened title and abstracts against the eligibility criteria in Table 2, with disagreements resolved by a third reviewer. Sixty-two articles were screened at full text by two independent reviewers with disagreements resolved by a third reviewer. In total, 12 studies were included following full text screening. A visual representation of the flow of studies throughout the review can be found in Figure 2.

5.4 Data extraction

One researcher performed the data extraction and a second researcher carried out consistency checks. Information extracted includes:

- Reference (author, year, country)
- Study design
- Intervention / comparator
- Aim
- Data collection methods (and dates)
- Outcome(s) measured
- Study participants (e.g., sample size)
- Setting
- Surgical speciality
- Key findings
- Additional notes/comments to report key information not captured in the above, and to record any limitations of the included sources.

5.5 Quality appraisal

A range of JBI quality appraisal checklists (which were selected based on the study design used) were used to assess the methodological quality of each included study. Quality

assessment was undertaken by a single reviewer, with verification of all judgements by a second reviewer. Any discrepancies were discussed and resolved amongst the review team. The results of the quality appraisals can be seen in Tables 3, 4, and 5.

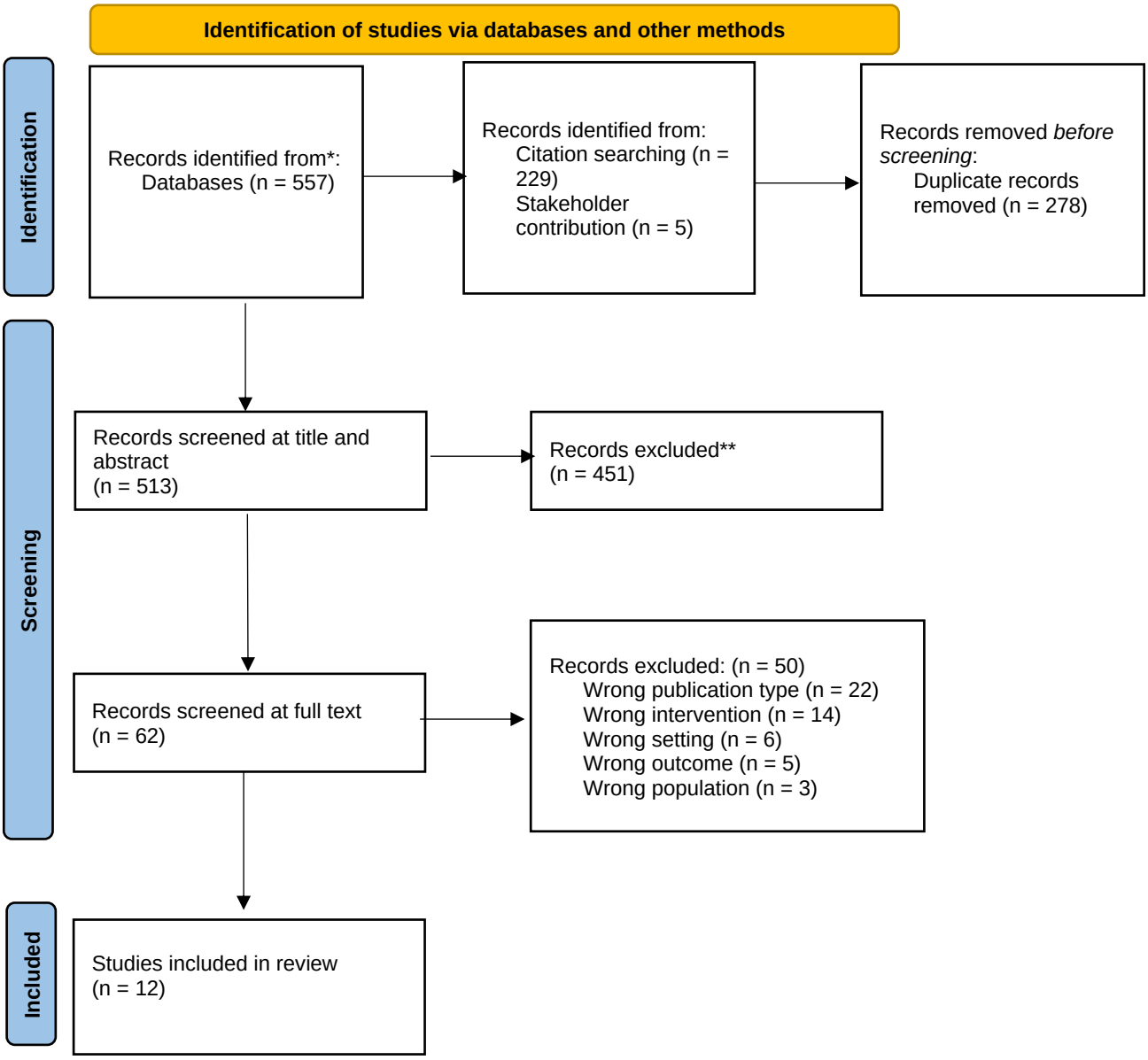
5.6 Synthesis

A narrative synthesis was conducted reporting results from included studies with a comparative element. A map outlining outcomes assessed in the included studies was created in order to visualise the breadth of the evidence identified and the evidence gaps (Figure 1).

6. EVIDENCE

6.1 Study selection

Figure 2. PRISMA flow chart



6.2 Quality appraisal tables

Table 3. Quality appraisal results for quasi-experimental studies

Study	JBI Appraisal Items – Quasi-experimental studies								
	Q1.	Q2.	Q3.	Q4.	Q5.	Q6.	Q7.	Q8.	Q9.
Joseph et al 2022	Y	Y	N	Y	N	N	Y	Y	Y
Kruse et al 2019a	Y	N	N	Y	N/A	N/A	Y	Y	Y
Spinelli et al 2021	Y	Y	Y	Y	N/A	Y	Y	Y	Y
Syed et al 2015	Y	U	U	Y	N	Y	N	Y	Y
Tulp et al 2020	Y	U	Y	Y	N	N	Y	Y	Y
Vanhegan et al 2015	Y	U	Y	Y	N	N/A	Y	Y	Y
Key: Y=Yes, N=No, U=Unclear, N/A=not applicable									

1. Is it clear what is the cause and what is the effect?
2. Were the participants included in any comparisons similar?
3. Were the participants included in any comparisons receiving similar treatment/care, other than the exposure or intervention of interest?
4. Was there a control group?
5. Were there multiple measurements of the outcome both pre and post the intervention/ exposure?
6. Was follow up complete and if not, were differences between groups in terms of their follow up adequately described and analysed?
7. Were the outcomes of participants included in any comparisons measured in the same way?
8. Were outcomes measured in a reliable way?
9. Was appropriate statistical analysis used?

Table 4. Quality appraisal results for Cohort studies

Study	JBI Appraisal Items – Cohort studies										
	Q1.	Q2.	Q3.	Q4.	Q5.	Q6.	Q7.	Q8.	Q9.	Q10.	Q11.
Kruse et al 2019b	Y	Y	Y	Y	Y	Y	Y	Y	N	U	Y
Minto et al 2022	Y	Y	Y	U	N	N/A	Y	Y	Y	N/A	U
Key: Y=Yes, N=No, U=Unclear, N/A=not applicable											

1. Were the two groups similar and recruited from the same population?
2. Were the exposures measured similarly to assign people to both exposed and unexposed groups?
3. Was the exposure measured in a valid and reliable way?
4. Were confounding factors identified?
5. Were strategies to deal with confounding factors stated?
6. Were the groups/participants free of the outcome at the start of the study (or at the moment of exposure)?
7. Were the outcomes measured in a valid and reliable way?
8. Was the follow up time reported and sufficient to be long enough for outcomes to occur?
9. Was follow up complete, and if not, were the reasons to loss to follow up described and explored?
10. Were strategies to address incomplete follow up utilized?
11. Was appropriate statistical analysis used?

Table 5. Quality appraisal results for case series studies

Study	JBI Appraisal Items – Case series studies									
	Q1.	Q2.	Q3.	Q4.	Q5.	Q6.	Q7.	Q8.	Q9.	Q10.
Carvalho et al 2022	Y	Y	Y	N	N	Y	Y	Y	Y	Y
Huddy et al 2022	Y	Y	Y	N	U	Y	N	Y	Y	Y
Jeanon et al 2021	Y	Y	Y	Y	N	N	Y	Y	Y	Y
Perrone et al 2021	Y	Y	Y	N	N	Y	Y	N	Y	Y
Key: Y=Yes, N=No, U=Unclear, N/A=not applicable										

1. Were there clear criteria for inclusion in the case series?
2. Was the condition measured in a standard, reliable way for all participants included in the case series?
3. Were valid methods used for identification of the condition for all participants included in the case series?
4. Did the case series have consecutive inclusion of participants?
5. Did the case series have complete inclusion of participants?
6. Was there clear reporting of the demographics of the participants in the study?
7. Was there clear reporting of clinical information of the participants?
8. Were the outcomes or follow up results of cases clearly reported?
9. Was there clear reporting of the presenting site(s)/clinic(s) demographic information?
10. Was statistical analysis appropriate?

7. ADDITIONAL INFORMATION

7.1 Conflicts of interest

The review team declares no conflicts of interest.

7.2 Acknowledgements

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7.3 Disclaimer

The views expressed in this publication are those of the authors, not necessarily Health and Care Research Wales. The Health and Care Research Wales Evidence Centre and authors of this work declare that they have no conflict of interest.

8. ABOUT THE HEALTH AND CARE RESEARCH WALES EVIDENCE CENTRE

The Health and Care Research Wales Evidence Centre integrates with worldwide efforts to synthesise and mobilise knowledge from research.

We operate with a core team as part of Health and Care Research Wales, Welsh Government and are led by Professor Adrian Edwards of Cardiff University.

The core team of the centre works closely with collaborating partners in the Bangor Institute for Health and Medical Research (BIHMR), Bangor University, which includes the Centre for Health Economics and Medicines Evaluation (CHEME) working in collaboration with Health and Care Economics Cymru, Health Technology Wales, Public Health Wales Evidence Service, Population Data Science, Swansea University using SAIL Databank, the Wales Centre for Evidence Based Care (WCEBC), the Specialist Unit for Review Evidence (SURE) and CASCADE, Cardiff University.

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9. APPENDIX

APPENDIX 1: Resources searched during Rapid Review Searching

Table 6: Resources searched

Resource	Number of hits
Core COVID-19 specific resources	
Cochrane COVID Review Bank https://covidreviews.cochrane.org/search/site	Not searched
WHO Global Coronavirus Database https://search.bvsalud.org/global-literature-on-novel-coronavirus-2019-ncov/	Not searched
L*OVE COVID https://app.iloveevidence.com/loves/5e6fdb9669c00e4ac072701d?utm=aile	Not searched
Cochrane COVID-19 Study Register https://covid-19.cochrane.org/	Not searched
VA-ESP https://www.covid19reviews.org/index.cfm https://www.covid19reviews.org/index.cfm	Not searched
Core non-COVID-19 specific resources	
Medline/PubMed	123
Embase	199
Cochrane Central Register of Controlled Trials (CENTRAL)	41
Cochrane Library	Not searched
Ongoing clinical trials	
clinicaltrials.gov http://clinicaltrials.gov/	Not searched
WHO ICTRP http://apps.who.int/trialsearch/	Not searched
Additional COVID-19 resources	
Trip – for guidelines	Not relevant
COVID-END https://www.mcmasterforum.org/networks/covid-end	Not searched
COVID-19 Evidence Alerts from McMaster PLUS™ https://plus.mcmaster.ca/COVID-19/	Not searched
Secondary resources for reviews relevant to local/UK context	
United Kingdom Health Security Agency (UKHSA) – COVID-19 Rapid Reviews https://ukhsalibrary.koha-ptfs.co.uk/covid19rapidreviews/	Not relevant
NICE resources for COVID reviews https://www.nice.org.uk/guidance/conditions-and-diseases/respiratory-conditions/covid19/products?Status=Published	Not relevant
Healthcare Improvement Scotland – COVID-19: Evidence for Scotland http://www.healthcareimprovementscotland.org/our_work/coronavirus_covid-19/evidence_for_scotland.aspx	Not relevant
Ireland, HSE Library, COVID-19 Summaries of Evidence https://hselibrary.ie/covid19-evidence-summaries/	Not relevant
HIQA Health Information and Quality Authority (Ireland) – Rapid reviews https://www.hiqa.ie/reports-and-publications/health-technology-assessments?tid_1=All&field_hta_topics_target_id=112	Not relevant

Secondary resources for reviews produced by key international organisations	
NCCMT COVID-19 rapid reviews (Canada) https://www.nccmt.ca/covid-19/covid-19-rapid-evidence-service	Not relevant
ECDC European Centre for Disease Prevention and Control (COVID-19 outputs) https://www.ecdc.europa.eu/en/publications-data	Not relevant
CDC centre for Disease Control and Prevention - Guidance for COVID-19 (US) https://www.cdc.gov/coronavirus/2019-ncov/communication/guidance.html	Not relevant
AHRQ Agency for Healthcare Research and Quality (US) https://www.ahrq.gov/coronavirus/health-systems-research.html	Not relevant
NASEM The National Academy of Sciences Engineering Medicine - Coronavirus Resources Collection (US) https://www.nap.edu/collection/94/coronavirus-resources	Not relevant
Australian National COVID-19 Clinical Evidence Task Force - Living Guidelines https://covid19evidence.net.au/	Not relevant
Secondary research resources for (non-COVID-19) reviews	
Trip – for guidelines	Not relevant
Campbell Collaboration	Not relevant
JBI (via OVID)	Not relevant
Epistemonikos	Not relevant
International HTA database (INAHTA-HTA)	Not relevant
PROSPERO	Not relevant
Additional resources searched	
Google Advanced Search	Not searched
Google Scholar	0
Scopus	194

APPENDIX 2: Search strategy used for MEDLINE

Set#	Searched for	Results
1	(green pathway and surg*).tw.	4
2	(surg* adj2 hub*).tw.	32
3	(elective adj2 surg* adj2 (centre* or center* or clinic or clinics or unit or units)).tw.	101
4	(elective adj2 orthop?edic* adj2 (centre* or center* or clinic or clinics or unit or units)).tw.	34
5	(elective centre* or elective center* or elective care centre hub*).tw.	6
6	"out of hospital surgical facilit*".tw.	0
7	chartered surg* facilit*.tw.	0
8	"non hospital surg* facilit*".tw.	1
9	hospital associated surg* cent*.tw.	0
10	(independent adj2 treatment adj (center* or centre*)).tw.	47
11	minor surg* setting*.tw.	3
12	or/1-11	220
13	limit 12 to (english language and yr="2015 -Current")	123