Characteristics of Included Studies Additional Tables

Participants additional table:

Source	*Location and Setting*	*Inclusion Criteria*	*Exclusion Criteria*	*Ages involved*	*Gender*	*Exclusion of important groups*	*Numbers involved*
Callaghan, Lynch et al. 2005	Addenbrooke's Hospital. Cambridge, United Kingdom. Cambridge vascular unit, OIR (based in PACU) and ICU, within a major teaching hospital and research centre.	All patients undergoing elective open aortic surgery between 1/01/98 and 31/12/02.	Patients with missing case notes.	Median age for all patients was 72 (66-77)	Intervention group: 88% males Comparison group: 85% males	No group appears to be excluded from the study. However, some multi-morbid patients were not offered surgery.	Intervention group n=152 Comparison group n=26
Eichenberger, Haller et al. 2011	Geneva hospital Switzerland. Post Anaesthesia Care Unit (PACU), within a tertiary teaching hospital.	All elective and non-elective inpatients, who underwent a surgical or endoscopic procedure under anaesthesia (including major surgery and high risk surgical patients required temporary NIV, haemodynamic support and continuous monitoring).	Exclusion: multi-trauma, persistent intraoperative shock, transplants, cardiac surgery and intra-operative respiratory failure.	Before period: <49yo 34.25%, 49-67yo 32.6%, >67yo 33.3% After period: <49yo 34.7%, 49-67yo 32.5%, >67yo 32.8%	Intervention group: male 56.3%, female 43.7% Comparison group: male 55.9%, female 44.1%	No groups excluded apart from those patients already specified in the exclusion criteria.	Intervention group n=3345 Comparison group n=3030
Fraser and Nair 2016	Northern General Hospital Sheffield, England. Extended recovery unit within a tertiary teaching hospital, major trauma centre.	Elective surgical patients who would have previously been booked for level 2 care post-operatively. Including patients with significant comorbidities, endovascular AAA repair, carotid endarterectomy and revision arthroplasty.	Not stated	Not stated	Not stated	No apparent exclusion of specific population groups. Not specifically addressed.	Intervention group n=119
Kastrup, Seeling et al. 2012	The Charite-University Hospital Campus Mitte Berlin, Germany. PACU within a large tertiary teaching hospital.	All patients undergoing a surgical procedure (adults and children) between 1/01/08 – 30/04/11	Ambulatory surgical patients, patients who were readmitted to hospital for the same reason as the initial admission (due to issues with accuracy of the administrative database)	Not given	Not stated	No apparent exclusion of specific population groups. Not specifically addressed.	Intervention group n=26118 Comparison group n=24972
Schweizer, Khatchatourian et al. 2002	The University Hospital of Geneva, Switzerland. PACU within a tertiary teaching hospital.	Adult patients undergoing abdominal aortic reconstruction or resection of lung cancer.	Exclusion criteria not stated	Not stated	Not stated	No apparent exclusion of specific population groups. Not specifically addressed.	Intervention group n= 485 Comparison group n= 448

Street, Phillips et al. 2017	Three hospitals within one Australian metropolitan healthcare organisation. PACUs within the three hospitals.	All adult patients undergoing elective surgery on days of data collection before and after the implementation of PACT (before period July-Oct 2012) (after period July-Sept 2014). (Half the patients were day surgery cases.)	Emergency surgery, minor procedure only requiring sedation, post-operative planned admission to ICU.	Intervention group: mean= 50.87 (SD 17.4) Comparison group: mean= 52.14 (SD 18.6)	Intervention group: male= 38.8%, female= 61.2% Comparison group: male=41.6%, female= 58.4%	No specific groups appear to have been excluded from the study.	Intervention group n=694 Comparison group n=723
Tayrose, Newman et al. 2013	NYU hospital for Joint Diseases, New York. Recovery room and general orthopaedic ward.	900 consecutive hip and knee arthroplasty patients.	Not stated	Intervention group: mean= 63.7 Comparison group: mean= 64.3	Intervention group: male=125, female=206 Comparison group: male= 216, female=353	Unable to assess, and exclusion criteria are not stated.	Intervention group n=331 Comparison group n=569
Zoremba, Dette et al. 2009	University of Marburg, Germany. PACU within a tertiary teaching hospital.	60 obese adult patients (BMI 30-40) ASA 2-3, scheduled for minor peripheral surgery. Minimum surgery duration=40min, maximum surgery duration= 120 min.	Abdominal surgery, surgery requiring head-down tilt, history of GORD, hiatus hernia, likely difficult intubation, pregnancy, emergency operation, severe renal dysfunction, asthma requiring therapy, cardiac disease associated with dyspnoea (NYHA >2), severe psychiatric disorders or difficulties in cooperating during measurements.	Intervention group: mean 52 years Control group: mean 53 years	Not stated	Multimorbid patients with ASA >3 have been excluded (this is stated specifically in the exclusion criteria). All major surgery (including abdominal surgery) has also been intentionally excluded.	Intervention group n=30 Control group n=30

Interventions additional table:

Source	*Intervention name*	*Aims and rationale*	*Methods*	*Intervention delivery (staff and location)*	*Timing of intervention*	*Tailoring of intervention*	*Modifications made*	*Assessment of fidelity*
Callaghan, Lynch et al. 2005	Introduction of OIR (Overnight Intensive Recovery)	The majority of vascular surgical patients were routinely admitted to ICU post-operatively. However, several studies have demonstrated that extubation in theatre after AAA repair is safe[1] and that routine admission to ICU after infra-renal aortic surgery is unnecessary [2, 3].	Surgical patients assessed preoperatively by vascular surgeon and anaesthetist (ECG and full bloods). Patient referred to specialist if further pre-operative assessment is required. OIR located in theatre recovery. Maximum stay 24 hours. No facilities for mechanical ventilation or renal replacement therapy. Patients reviewed in the morning by surgical teams, and discharged to the ward if stable. If ongoing instability, patients transferred to ICU Face to face delivery of intervention No co-interventions apparent	Nurse to patient ratio 1:1 Day time medical coverage provided by PACU anaesthetist and vascular surgical teams. Overnight medical care provided by the on-call anaesthetist and general surgical teams. No specific training or upskilling period detailed. Pre-existing medical and nursing skills required	Intervention provided post-operatively for a maximum of 24 hours.	Post-operative medical care tailored to each patient. However, the OIR environment was not changed during the study.	OIR does not appear to have been modified or adapted during the study	No specific mention of steps taken to ensure fidelity in the OIR pathway. Anaesthetic techniques do appear to have been standardised, as well as post-operative analgesia.
Eichenberger, Haller et al. 2011	Introduction of a two-track clinical pathway that clearly defined & coordinated medical and nursing interventions.	Post-operative complications have a major impact on survival, especially in the older population [4, 5]. A clinical review of current practices prior to implementation of the pathway showed that poorly defined	Fast track pathway: nurse driven, ASA 1-2. At 15min intervals nursing staff evaluate patients' vitals using Aldrete score, and pain is assessed using verbal numeric rating scale. Slow track pathway: physician driven, ASA 3-	Fast-track programme: initial post-operative care prescribed by the anaesthetist and provided by the PACU nursing staff. Ongoing care is delivered by the PACU nursing staff only (unless	Fast-track programme: care provided immediately post-operatively. Discharge performed without further communication with the PACU anaesthetist if	Initial post-op treatment plan prescribed by the treating anaesthetist was tailored to the patient and their specific medical needs.	No adaptations appear to have been made to either pathway during the study period. However, this is not specifically discussed	Fast track pathway: methods of ensuring adherence to the pathway not discussed. Slow track pathway: adherence to the clinical pathway was ensured during daily rounds by the

		management and discharge criteria resulted in insecurity of the PACU physicians, nursing staff stress and delayed admission of patients from theatre. Evidence suggests that significant post-operative complications can be detected and successfully treated in well-organised PACUs, resulting in increased survival [6-9].	5 who have undergone minor or major surgery, or developed post-op complications. Formal handover to PACU anaesthetist. Standardised investigations and treatment guidelines for early post-operative complications. Intervention delivered face-to-face in PACU No co-interventions identified	there is evidence of a complication). Slow-track programme: care provided by the PACU anaesthetist with the help of nursing staff Pre-existing skills required: PACU specialist nursing staff (overnight nurse also ICU qualified). No specific training for either nursing staff or medical staff is detailed in the study.	Aldrete score is ≥ 8 and the verbal numeric rating scale is ≤ 3 Slow-track programme: care provided immediately pos-operatively. Discharge based on Aldrete score ≥8 and normal blood gas analysis. PACU physician in charge decides on discharge			medical head of the PACU, and during weekly quality control, feedback and information meetings.
Fraser and Nair 2016	Opening of an extended recovery unit	Was felt that some patients admitted to critical care post-operatively only required short term monitoring and optimisation [10]. Unnecessary admissions of patients to critical care increases bed occupancy in the unit, and was contributing to significant numbers of OT cancellations.	Extended Recovery Unit was opened in Oct 2014. Patients booked into the unit in advance. 4-6 hour stay. Standard form was completed by nursing staff for every patient: recording time and place of discharge, complications encountered and medical assistance required. (Recorded how many patients were assessed as safe to return to ward, and how many still required level 2 care) Nil co-interventions evident	Anaesthetists provided post-op medical care/ plans in the extended recovery unit. Recovery nursing staff provided care and completed the standard service evaluation form.	Patients stayed in the extended recovery unit for 4-6 hours post-op.	Not tailored	No	No mention of steps taken to ensure standardisation of treatment. Standard form provided to nursing staff, but no mention if forms were audited to ensure correct data collection.
Kastrup, Seeling et al. 2012	Introduction of intensivist coverage in PACU	Increasing demand for critical care, which can lead to capacity limitations in the ICU. This causes	PACU physician is in charge of allocation of patients to the PACU, ICU and IMCU (intermediate care unit)	Staffing of the PACU was changed so that both the nursing and physician staffing are covered by the ICU	Intervention provided immediately post-operatively.	Immediate post-operative care tailored to each patient by the treating	No apparent modification to the intervention were made	There is no mention of fidelity assessment. As intervention was a change in staffing

		delay in admissions of patients from ED, cancellation of surgery[11, 12], early discharge from ICU [11, 13-15], initiation of treatment in ED or on a standard ward and inter-hospital transfers [12, 16].	in collaboration with the surgeons. If no intensive care bed available, patients can be treated in the PACU for up to 24 hours (independent of the degree of organ failure) There are 6 beds with complete intensive care monitoring and respiratory care possibilities available. Face to face delivery of intervention No co intervention evident or discussed	team. The physician staffing was changed to a 24hr in-house critical care physician and nurse presence for the PACU. 1:3 nurse, patient ratio. 1 physician for all PACU patients.	Patients can be immediately admitted to the PACU around the clock (without any delays).	anaesthetist and surgeon.	during the study period.	model, this would have been monitored by the anaesthetist/ ICU physician in charge.
Schweizer, Khatchatourian et al. 2002	Opening of a new PACU (post-anaesthesia care unit)	Utilisation of the ICU for routine post-op care is commonplace, however ICUs account for an increasing proportion of a hospitals budget [17-19].	PACU moved to an area closer to theatres and the ICU, and was expended with additional beds to provide overnight care following major, non-cardiac surgery. Standardised rounding (morning and evening), with review of patient's clinical status, laboratory results and chest radiographs. Co-interventions: Preoperative risk assessment guidelines of the American Heart association and the American College of Cardiology (AHA/ACC) were introduced, and antiadrenergic medications (beta-blockers and alpha-2-agonists) were	New PACU staffed with anaesthesia-trained nurses (1:3 ratio), post-operative care coordinated by cardiothoracic surgical and anaesthesia teams, 24-hour medical coverage provided by one PACU resident (supervised by an attending).	New PACU provided 24-hour medical coverage. Patients were admitted immediately post-operatively. (Time limit on PACU admission not specified)	Post-operative care standardised as much as possible, but ongoing care tailored to each patient based on pre-existing medical comorbidities, intra-operative events and post-op complications	Intervention does not appear to have been altered during the study period	Variations in medical practice were minimised using standard protocols for blood test analysis, CXR orders, antibiotic prophylaxis, pain control, fluid administration, respiratory therapy, nutrition and mobilisation. All surgical procedures and approach standardised as much as possible. General anaesthesia standardised. Post-operative analgesia regimen also standardised.

			increasingly administered peri operatively					
Street, Phillips et al. 2017	Implementation of a Post Anaesthesia Care Tool (PACT)	Current post-operative death rate of 0.4-4%, and major complication rate of 3-17%. 40% of in-hospital complications are associated with surgery [20, 21]. Hospital costs for surgical patients experiencing a complication are significantly higher than for patients without complications [22-24]. Intensive observation of patients in PACU by nurses can help with the early detection of complications [25].	Implementation of the tool was supported by peri-operative nursing educators. Materials included posters summarising how to complete the PACT, and feedback sessions between the nurses using the tool and the perioperative team. PACT was included in the revised 'Post-anaesthetics care record' Working party was established to develop the tool. Extensive review of the current processes at each of the hospitals was done. Researchers conducted a systematic review and an expert consensus statement to evaluate the current evidence. PACT tool developed in line with the National Consensus Statement on the essential elements for recognising and responding to clinical deterioration. Face to face delivery of the intervention. No co-interventions apparent.	Perioperative nurse educators trained recovery nurses in the use of the tool. Feedback sessions during the training period were attended by the perioperative team including, educators, nurse unit managers and the quality unit of the organisation. Recovery nursing staff used the PACT in recovery. Medical staff responded to concerns that were triggered by the PACT	PACT used immediately post-operatively, until patient was safe for discharge to the ward (of home for day surgery patients). Patient readiness for discharge from PACU was recorded by a checklist of criteria: last 2 sets of observations were not within the MET criteria, no active vomiting, pain management ordered and all surgical concerns had been met.	Intervention does not appear to be tailored.	No modifications appear to have been made once the study period commenced.	Feedback sessions during the training period were attended by the perioperative team including, educators, nurse unit managers and the quality unit of the organisation. However, there is no mention of fidelity assessment or auditing once the tool was in use.
Tayrose, Newman et al. 2013	Rapid rehab patients started as part of a pilot	Previous studies have shown that early mobilisation after	Therapy program was the same for each group: therapist would	Physiotherapists delivered the intervention	Therapy commenced in the	Intervention was tailored to the speed of recovery	No adaptations or modifications appear to have	No assessment of fidelity reported. Unclear how the

	program where the first 2 cases of the day were mobilised in the recovery room.	total joint replacement enhances post-op recovery and promotes faster rehabilitation [26, 27]. Previous studies have also demonstrated early mobilisation leads to a decreased LOS, improve patient outcomes, and demonstrate cost savings [28-30]. However, it's unclear if early mobilisation that starts in the recovery room will lead to a reduction in LOS while maintaining patient outcomes.	start with having patients hang their legs over the side of the bed. Therapy would then progress with transferring to a chair, ambulation, and climbing stairs. The expectation for a patient was to ambulate 100 feet or greater, and climb 6 stairs, prior to discharge. Face to face delivery of intervention by physiotherapists No co-interventions described	Standard rehabilitation program implemented. Reliance of physiotherapists pre-existing skills and training.	recovery room on the day of surgery	of each patient. If a patient was unfit to mobilise on the day of surgery in PACU (as per the anaesthetist, surgeon or ICU doctor), they were not mobilised despite being one of the first 2 cases for the day.	occurred during the study.	standardisation of the rehabilitation program was ensured.
Zoremba, Dette et al. 2009	Patients performed incentive spirometry in the PACU	Even several days after surgery, obese patients exhibit a measurable amount of atelectasis, predisposing them to post-op pulmonary complications [31-35].	Physiotherapist supervised the respiratory physiotherapy treatment at all times. Exercises were started approximately 15 minutes after extubation, and the patients were encouraged to perform 15 deep breaths (incentive spirometry) every 10-15 minutes within the first 2 hours after surgery. If needed, patients were asked to cough during the pause to mobilise secretions. All therapy was performed in the sitting position if possible.	Physiotherapists supervised the respiratory physiotherapy treatment at all times Pre-existing skills required to deliver the intervention. No mention of specific training provided to the physiotherapists apart from the study protocol.	Intervention was delivered commencing 15 minutes post-operatively, continuing until 2 hours after surgery.	Intervention does not appear to have been tailored	No change to intervention during the study	Spirometry was standardised as much as possible. At each assessment time, spirometry was performed at least 3 times, and the best measurement was recorded (in line with the criteria of the European Respiratory Society). Factors that interfered with breathing (eg pain, shivering) were eliminated, or minimised to produce reliable measurements)

			No co-interventions described					

Outcomes and comparison groups additional table:

Source	*Primary outcomes*	*Method of assessing primary outcome measure*	*Timing of primary outcome assessment*	*Adverse events*	*Secondary outcomes*	*Method of assessing secondary outcome measure*	*Timing of secondary outcome measure*
Callaghan, Lynch et al. 2005	In hospital mortality In hospital morbidity Mean postoperative stay, days Mean ICU stay, days Median POSSUM operative severity score	Patients who had surgery were identified using a combination of computerized theatre records, surgeon's logbooks, and theatre booking diaries. Case notes analysed retrospectively. POSSUM variables collected prospectively (during the pre-operative assessment)	Retrospective analysis No follow-up required	OIR group: Admission to ICU within 48 hours of surgery	Operative characteristics. Common post-operative complications.	Case notes analysed retrospectively. Only complications occurring on more than four occasions during the study period are included.	Retrospective analysis of notes. No follow-up required.
Eichenberger, Haller et al. 2011	PACU length of stay	Anaesthetic Information system (computerize patient information system. PACU data entered by PACU nurses and PACU secretary)	Data entered in real time in PACU. Data reviewed retrospectively by investigators.	Nil reported	Nil reported	NA	NA
	In-hospital mortality	The hospital administrative database (administrative information used for financial purposes). Cause of death extracted from patient discharge reports, and entered into the administrative database by professional coders.	Data entered throughout the post-operative period until discharge. Data reviewed retrospectively by investigators				
	Unplanned ICU admissions after PACU stay	The hospital administrative database. Reason for unplanned ICU admission extracted from patient discharge report and entered into database by professional coders.	Data entered throughout the post-operative period. Reason for ICU admission entered after patient discharge.				
Fraser and Nair 2016	Discharge destination after extended recovery unit admission	Standard form completed by nursing staff in extended recovery, documenting time and place of discharge, complications encountered and medical assistance required.	Assessment made at time of extended recovery discharge. No follow-up done.	Nil reported	Nil reported	NA	NA

Kastrup, Seeling et al. 2012	LOS in PACU (days) LOS in ICU (all types of ICU's)(days) Pre operative days (all patients) Pre operative day (PACU-patients) Pre operative day (ICU-patients) Days on normal ward LOS hospital (days) CMI (case mix index) normal ward CM ICU CW (cost weight) per hospital stay (overall)	Data collected from the hospital administration system. All clinically relevant data are documented in a patient data management system (PDMS) and can be extracted for evaluations. Every patient admitted to the ICU in included in the system (COPRA-System® GmbH, Sasbachwalden, Germany). 24-hours after patient discharge, the record is changed to a read-only version so that no modifications can be made.	Retrospective analysis of data. Data continuously collected until patient discharge. No follow-up post-discharge.	Nil reported	General descriptive variables for the ICU, before and after the introduction of the PACU (ICU patients only).	Data extracted from patient data management system (PDMS). DRG system allows for coding of the intensive care as DRG procedure, making the severity of disease relevant for reimbursement. The "Complex intensive care treatment" is based on several scores, which are collected within the PDMS system.	Retrospective analysis of data. Data continuously collected until patient discharge. No follow-up post-discharge.
Schweizer, Khatchatourian et al. 2002	Mortality	Data prospectively collected on standardized worksheets describing the pre-operative, intraoperative and postoperative periods. One investigator also reviewed all nursing charts, medical records and hospital discharge letters.	Outcome assessments done during inpatient stay, and on review of the hospital data base. No follow-up required after hospital discharge	Nil reported	Identification of independent risk factors for mortality and major complications following thoracic surgery	Data abstracted from two institutional databases	Patient risk factors reported pre-operatively and intraoperatively (prospective data collection). Analysed at a later date
	Re-operation	Data abstracted from two institutional databases					
	Secondary admission to ICU (either from PACU or from the ward)	Data obtained from the hospital computer			Identification of independent risk factors for mortality and major complications following major vascular surgery		
	Cardiac complications • Myocardial infarct • Arrhythmias • Pulmonary oedema	Data were prospectively collected on standardized worksheets describing the pre-operative, intraoperative and postoperative periods. One investigator also reviewed all nursing charts, medical records and hospital discharge letters.					
	Respiratory complications • Atelectasis • Bronchopneumonia	As above			Evaluation of perioperative antiadrenergic treatment administration		
	Mechanical ventilation >6 hours	As above					
	Renal dysfunction	As above					

	Hospital length of stay	Data obtained from the hospital computer					
Street, Phillips et al. 2017	Nursing management of patient symptoms Rates of adverse events Mortality Length of stay in PACU Length of hospital admission Discharge destination	Data collected by research nurses from the medical record following patient discharge. Severity of each adverse event was graded using the Common Terminology Criteria for Adverse Events (V.4.03) and grouped into mild (no or minimal effect to the patient and resolved spontaneously), moderate (event with resolved after intervention, with no lasting effect for the patient) and severe (required intervention and caused harm to the patient, including death).	Data reviewed from case notes on patient discharge. No longer term follow-up required.	Nil reported	Health service usage and healthcare costs	Economic evaluation done from organization data that were routinely submitted to the regional health department for benchmarking. Healthcare costs for each patient admitted to hospital are calculated on a cost-weight analysis using the Australian Refined Diagnostic-Related Groups (AR-DRGs). The AR-DRG was used to calculate the costs for all initial admissions and unplanned readmission, using the nations efficient price determination.	Data reviewed from case notes on patient discharge. No long term follow-up required.
Tayrose, Newman et al. 2013	Overall hospital length of stay Hip arthroplasty subgroup length of stay Knee arthroplasty subgroup length of stay	Retrospective review of cases, however it is not stated how this was done (case note reviews versus use of the hospital's database)	At time of discharge	Nil reported	Percentage completion of the rapid rehabilitation program	Progression of rehab was followed, however methods for assessing this were not stated.	Followed as an inpatient until the time of discharge.
Zoremba, Dette et al. 2009	Pulse oximetry at 1hr, 2hr, 6hr and 24hr post-operatively Spirometry at 1hr, 2hr, 6hr and 24hr post-operatively	Assessed face to face by an investigator. The investigators were blinded.	At 1hr, 2hr, 6hr and 24hr respectively	Nil reported	Nil reported	NA	NA

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