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Quality Improvement Initiatives to Reduce CLABSI Do They Really Work?

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Crash Introduction on CLABSI Prevention

- CLABSI ➔ morbidity
  ➔ healthcare costs
  ➔ mortality

- Evidence-based prevention guidelines
  ➔ broad spectrum of measures
  ➔ nurses / clinicians' knowledge is poor
  ➔ adherence is low

- Quality improvement interventions = solution?

Blot S, et al. Clin Infect Dis 2005
Labeau S, et al. Crit Care Med 2009
Cabana MD, et al. JAMA 1999

Crash Introduction on Quality Improvement (QI) Interventions

- Definition of QI interventions
  - Versatile method
  - Clustering a variety of interventions; the most important:
    - personnel education
    - care bundles
    - checklists

Intermezzo on **Essentials** of Quality Improvement (QI) Interventions

- **Education**
  - Cornerstone of QI
  - Insights in…
    - "Why it is important"
    - Rational behind a preventive approach
    - Repetition ➔ awareness **(!)**

Intermezzo on **Essentials** of Quality Improvement (QI) Interventions

- **Care bundles**
  - Set of 3 to 5 EB-interventions
  - Executed:
    - always (daily, per shift,…)
    - together
    - by everyone
  - Better impact on patient outcomes (compared with separated application)
  - Monitoring of the adherence!

Intermezzo on **Essentials** of Quality Improvement (QI) Interventions

- **Checklists**
  - Simple business process improvement tool
  - Control of routine tasks to be executed
  - No “all or nothing” philosophy
  - Not necessarily based on scientific evidence
  - Awareness!

Crash Introduction on Quality Improvement (QI) Interventions

- Objective of QI interventions
  - ↑compliance with infection prevention measures

Preventive interventions (5 IHI care items)
• Hand hygiene • Chlorhexidine-gluconate skin antisepsis • Maximal sterile barriers • Optimal catheter site selection • Daily review of line necessity

Literature check

INVITED ARTICLE QUALITY IMPROVEMENT

Trish M. Perl, Section Editor

Prevention of Central Line–Associated Bloodstream Infections Through Quality Improvement Interventions: A Systematic Review and Meta-analysis

Blot K, et al. Clin Infect Dis 2014;59: 96-105.

Objectives of the study

- Do QI interventions decrease the rate of CLABSI?
- Which QI interventions lead to larger infection rate reductions?

Methods – Systematic Review & Meta-analysis

Search strategy

- Medline search (1995 – June 2012)
- English papers
- Combination of search terms:
  - catheter-related infections/prevention and control;
  - catheterization, central venous/adverse effects;
  - catheters, indwelling/adverse effects;
  - infection control/methods;
  - infection control/standards;
  - intensive care units;
  - quality control;
  - quality of healthcare;
  - bundle

Methods – Systematic Review & Meta-analysis

Study selection

- **Participants**: adult ICU patients with CVCs
- **Intervention**: QI intervention
- **Comparator**: baseline standard of care
- **Outcomes**: CLABSI rate per CVC-days
- **Study designs**:
  - before–after
  - interrupted time series (ITS, at least 3 data points before/after implementation of the intervention)
  - controlled before–after
  - nonrandomized controlled trial
  - randomized controlled trial

Methods – Systematic Review & Meta-analysis

Data extraction

Quality Improvement Intervention (No. of Studies)	Definition and Examples
Education (n = 33)	Teaching lectures transmitting theoretical knowledge concerning CLABSI • Monthly sessions or a single lecture concerning CLABSI epidemiology or preventive interventions • Educational modules with pre- and posttest
Training (n = 4)	Training sessions for practical skills associated with CVC care and maintenance • Personnel training for aseptic CVC insertion on patient simulators
Feedback (n = 20)	Reporting of CLABSI or care item compliance rates to ICU personnel • Monthly reporting of infection rates at staff meetings • Posters of improving prevention measure compliance or CLABSI rates

Methods – Systematic Review & Meta-analysis

Data extraction

Clinical reminders (n = 15)	Reminders of optimal clinical practice strategically placed to improve awareness or application of prevention measures • Posters advertising proper hand hygiene or monthly CLABSI rates • A daily reminder per patient asking whether a CVC can be discontinued • Stickers placed on CVCs or wearable lapel buttons reminding personnel of the importance of care processes • Procedure fact sheets, flowcharts, algorithms, or daily goals sheet
Bundle (n = 11)	A short list of at least 2 IHI prevention measures to be used during CVC insertion and/or maintenance • A bundle consists of 2–5 IHI care items • A bundle does not contain quality improvement interventions aiming at improving compliance with prevention measures
Checklist (n = 18)	Checklist of bundled care item prevention measures to increase adherence to evidence-based infection prevention practices • A checklist of 2–5 IHI care items is used during CVC insertion to improve adherence to a bundle of care items

Methods – Systematic Review & Meta-analysis

Data extraction

Empowerment to stop procedure (n = 10)	Nurses are empowered to halt and restart CVC insertion care or maintenance when a prevention measure is not implemented correctly to ensure optimal catheter care
Surveillance: compliance monitoring (n = 12)	Nurses intermittently or continually supervise CVC insertion or maintenance prevention measures, with/without use of a bundle/checklist
Leader designation (n = 11)	A leader is designated to facilitate implementation of quality intervention processes by planning activities to improve awareness or introduction of bundled care items
Prepackaging of CVC materials (n = 16)	Use of a CVC cart or kit stocked with all necessary supplies to insert or maintain a central line
Infrastructure changes (n = 2)	Changes to hospital infrastructure to facilitate adherence to prevention measures • Installation of hand-rub dispensers to lower the threshold for personnel to apply antiseptic hand hygiene
Organizational changes (n = 4)	Organizational changes in personnel staffing or duties to improve adherence to prevention measures • Staffing of extra personnel to decrease the patient-to-nurse ratio • Only trained personnel may insert CVCs • Assistance in central line insertion or trainee supervision

Methods – Systematic Review & Meta-analysis
Quality assessment

- **Down & Black checklist**
  - Identifies study methodological risk of bias.
  - 27 questions to evaluate
    - ❑ Reporting
    - ❑ External validity
    - ❑ Internal validity
    - ❑ Power of non-randomized studies

Methods – Systematic Review & Meta-analysis

Statistics

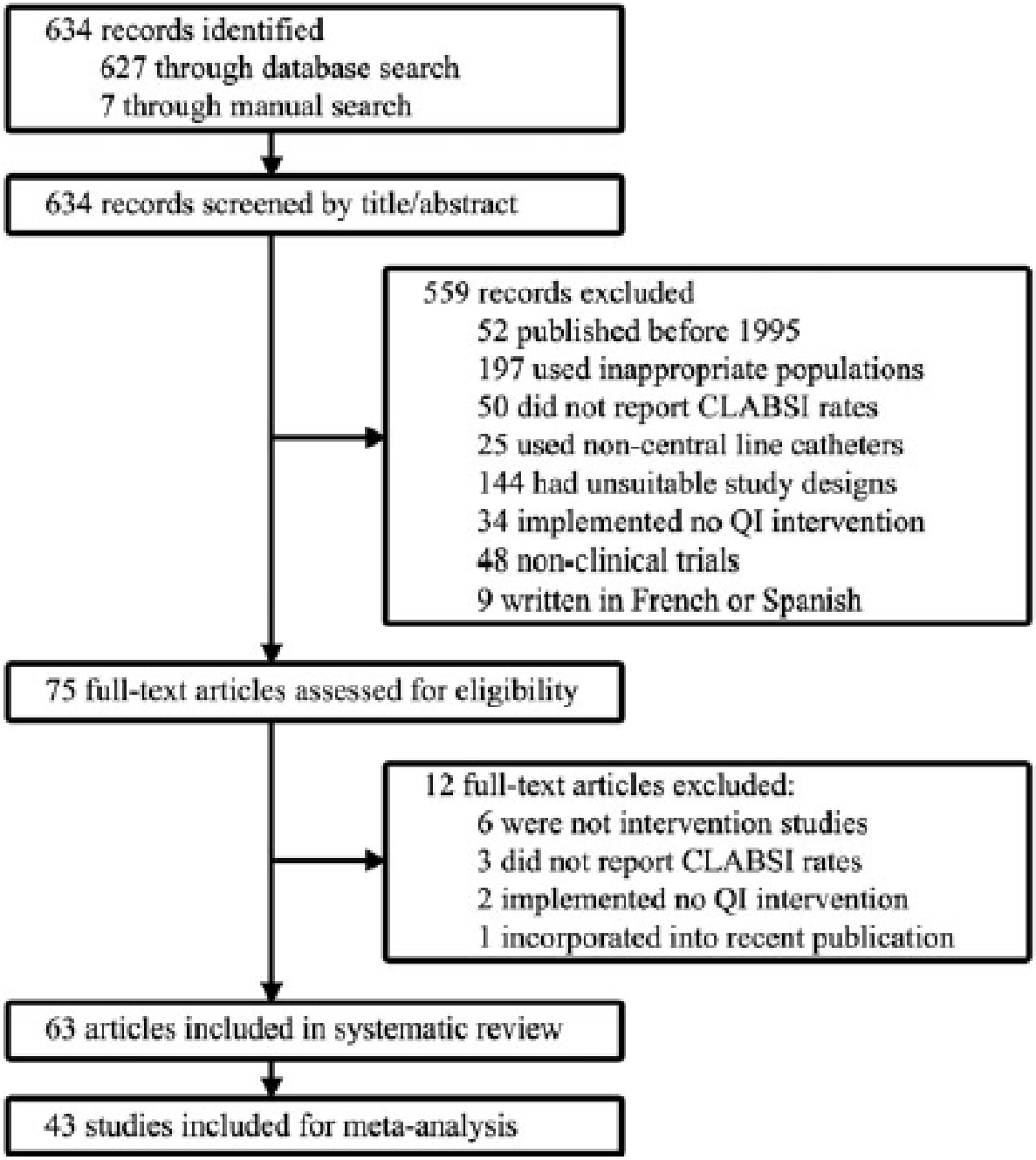
- Random-effects meta-analysis using the DerSimonian-Laird estimator obtained ORs and 95% CIs for CLABSI rate reductions.

- The Higgins I^2 test was predefined to quantify heterogeneity
  - $I^2 \leq 25\%$ = low
  - $25\% < I^2 < 50\%$ = moderate
  - $I^2 \geq 50\%$ = high

- Funnel plots assessed publication bias

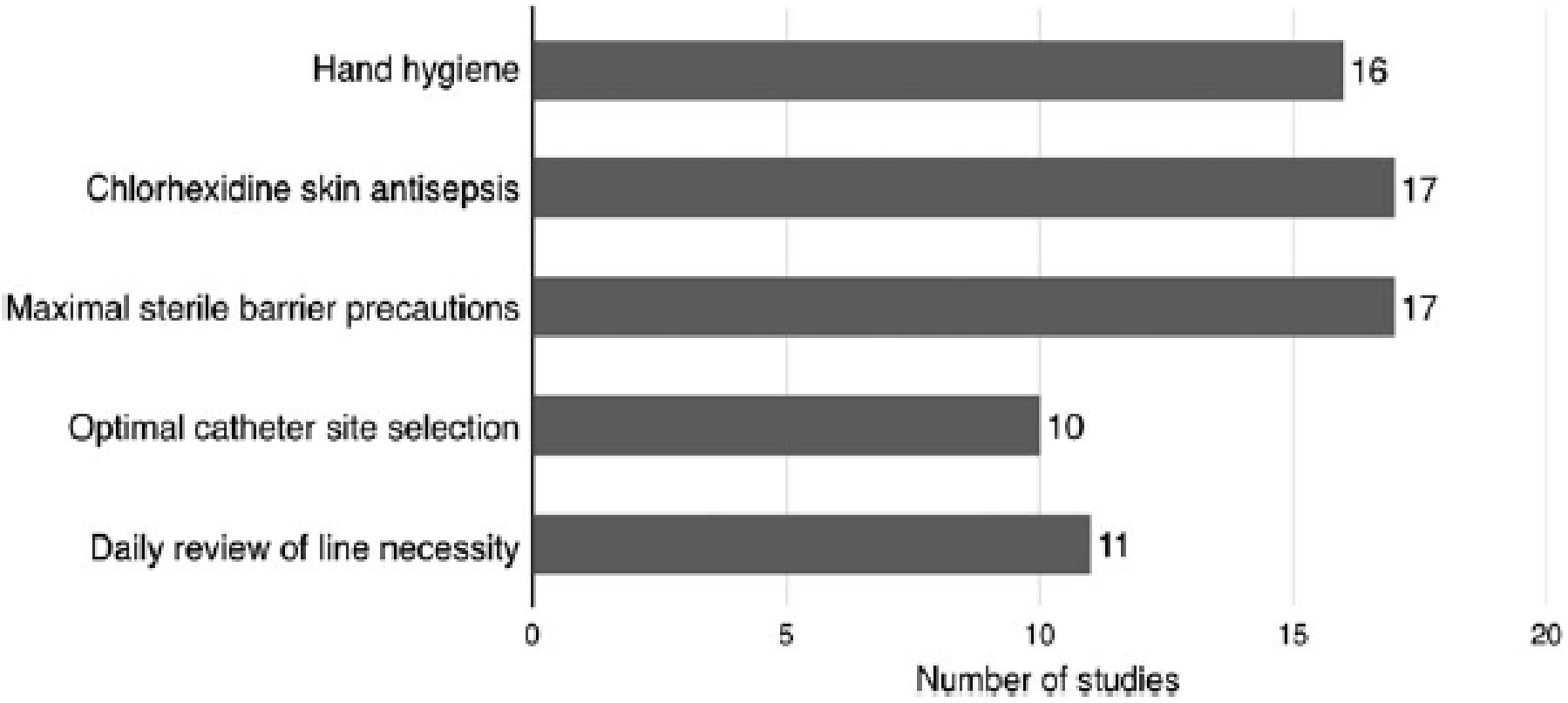
- Subgroup analysis through meta-regression for before–after study designs compared:
  - studies with or without bundle / checklist interventions,
  - baseline rates > or < 4.0 CLABSIs /1000 CVC-days,
  - power scores > or < 0.75

Results


634 records identified
627 through database search
7 through manual search
634 records screened by title/abstract
559 records excluded
52 published before 1995
197 used inappropriate populations
50 did not report CLABSI rates
25 used non-central line catheters
144 had unsuitable study designs
34 implemented no QI intervention
48 non-clinical trials
9 written in French or Spanish
75 full-text articles assessed for eligibility
12 full-text articles excluded:
6 were not intervention studies
3 did not report CLABSI rates
2 implemented no QI intervention
1 incorporated into recent publication
63 articles included in systematic review
43 studies included for meta-analysis

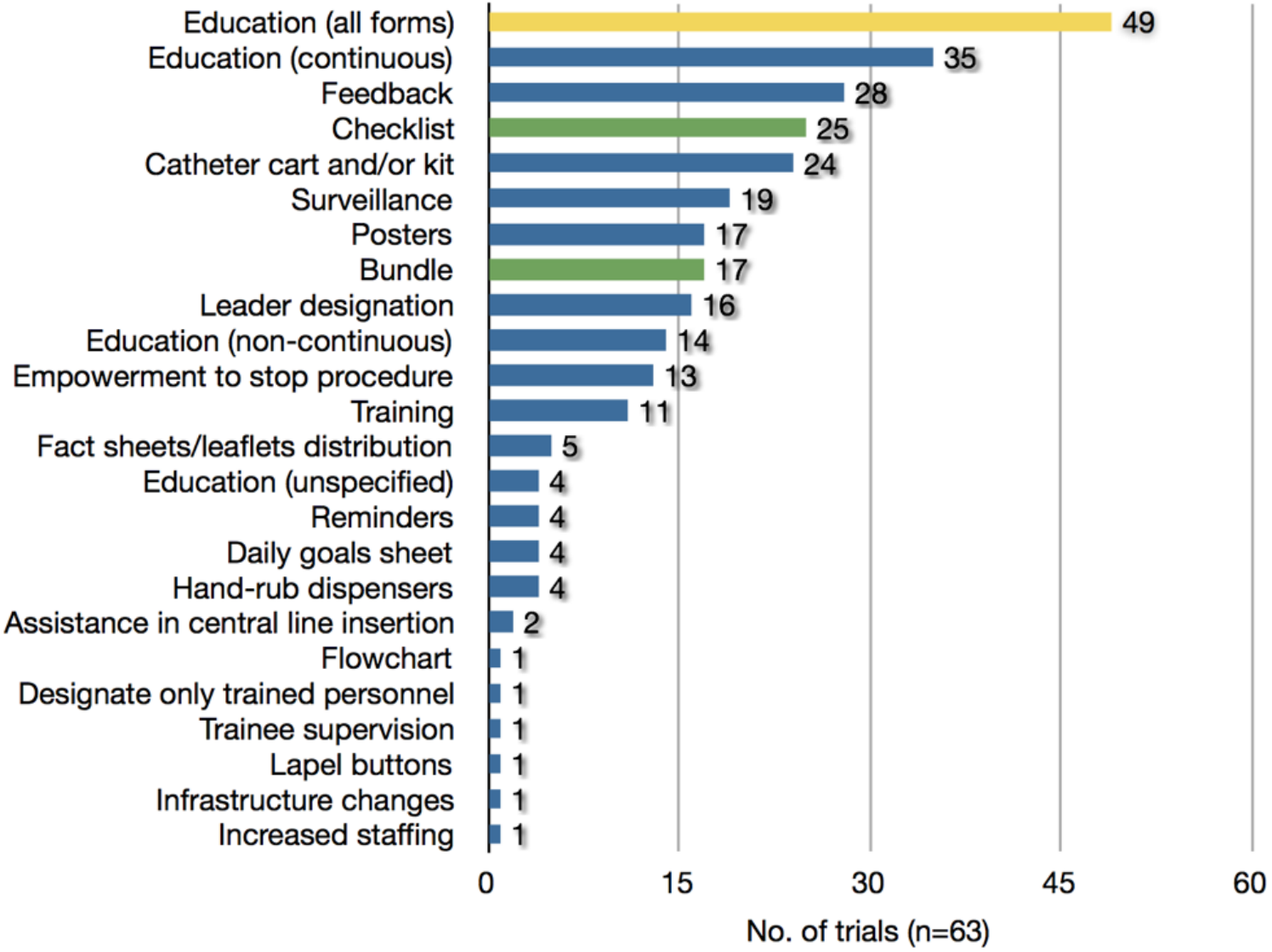
Results

Frequency of included care items



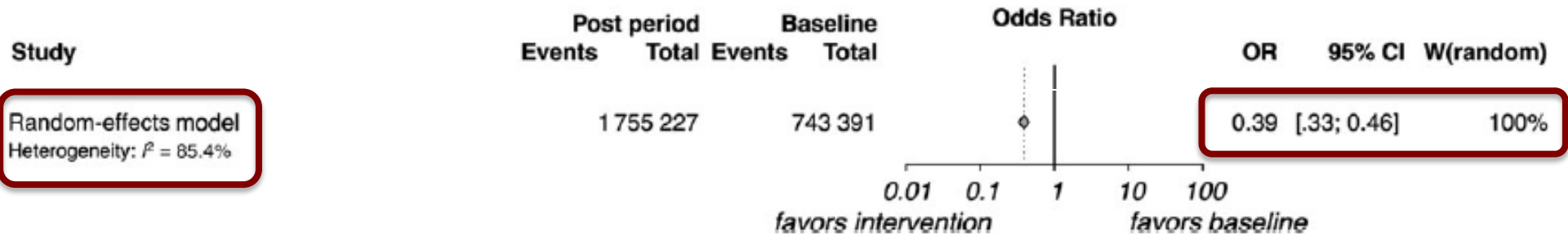
Results

Frequency of implemented interventions



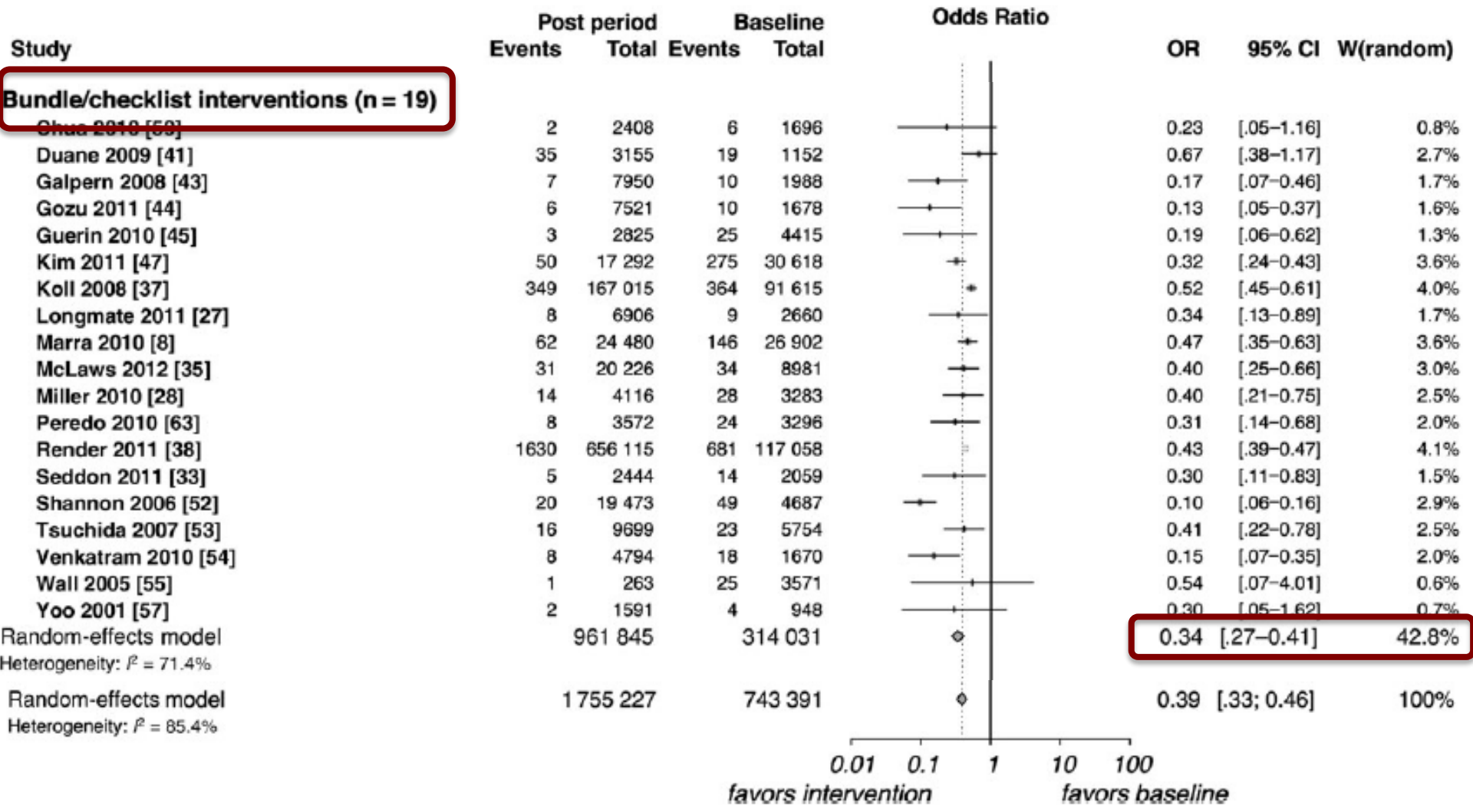
Results

Meta-analyses – overall result



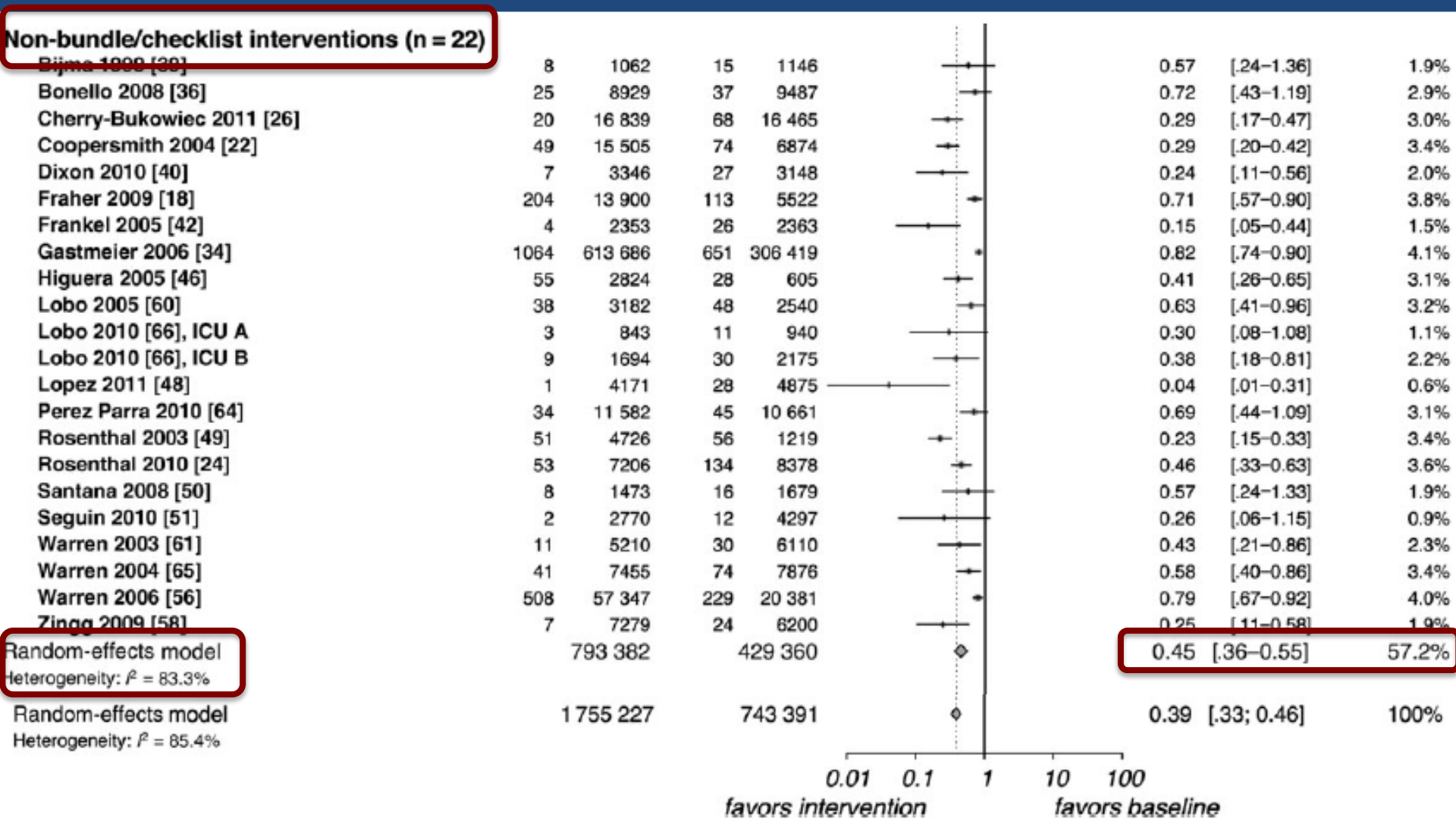
Results

Meta-analyses – studies with bundles/checklists



Results

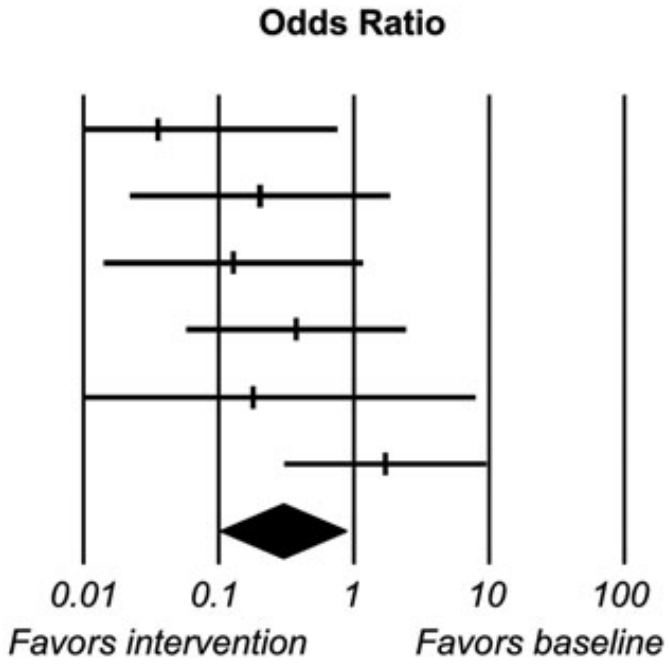
Meta-analyses – studies without bundles/checklists



Results

Meta-analyses – interrupted time series studies

Study	OR (95% CI)	Weight
Berriel-Cass 2006 [62]	0.04 [.002–.75]	10.4%
Coopersmith 2002 [20]	0.20 [.02–1.84]	17.5%
Dixon 2010 [40]	0.13 [.01–1.15]	17.7%
Peredo 2010 [63]	0.38 [.06–2.41]	22.3%
Perez Parra 2010 [64]	0.18 [.004–7.80]	7.2%
Warren 2004 [65]	1.71 [.31–9.44]	24.9%
Random-effects model	0.30 [.10–.88]	
Heterogeneity: I-sq=24.5%, tau-sq=0.44, *P* = .25		



Results

Meta-regression analyses

- **Bundles/checklist vs. Non-bundle/checklist interventions**
  - OR 0.34 (0.27-0.41) *vs.* OR 0.45 (0.36-0.55): P=0.026
- **Baseline CLABSI rate > or < 4.0 / 1000 CVC days**
  - OR 0.37 (0.33-0.46) *vs.* OR 0.49 (0.37-0.66): P=0.18
- **Low-power vs. High-power studies**
  - OR 0.33 (0.26-0.42) vs. OR 0.44 (0.36-0.54): P=0.06

Prevention of hospital infections by intervention and training (PROHIBIT): results of a pan-European cluster-randomized multicentre study to reduce central venous catheter-related bloodstream infections

- Multicenter RCT
- Intervention, 3 groups (switched over the ICUs / 3 months):
  - CVC insertion strategy
  - Hand hygiene promotion
  - Combination
- Oucomes
  - Process indicators (CVC insertion score)
  - Outcome indicators (CRBSI density)

van der Kooi T, et al. Intensive Care Med 2018

Prevention of hospital infections by intervention and training (PROHIBIT): results of a pan-European cluster-randomized multicentre study to reduce central venous catheter-related bloodstream infections

- **Results**
  - N=25 348 (35 831 CVCs)
  - CVC insertion scores & hand hyg. compliance↑
  - CRBSI incidence density: 2.4 ➔ 0.9/1000 CVC days
  - When adjusted for CVC and patient characteristics all 3 interventions were effective

van der Kooi T, et al. Intensive Care Med 2018

Conclusion

- QI interventions lead to decreased rate of CLABSI
- All defined subgroups achieved a significant reduction in CLABSI
- Strongest effects with use of bundles/checklist
- Further research should consider:
  - use of interrupted time-series analysis
  - thoroughly describe the interventions
  - report compliance with prevention measures

Thank you

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