WHAT IS THE RETURN ON INVESTMENT OF AN INFECTION PREVENTION AND CONTROL PROGRAM?

APIC's Multi-Phase Approach to Quantifying the Value of IPC

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DISCLOSURES

- I have no conflicts of interest to disclose.
- AI tools were utilized to assist with the design of this presentation, but all content has been verified by an actual human (me)!

THE RATIONALE FOR CREATING AN ROI FOR IPC

1. Healthcare organizations continue to struggle with funding – and this won't be resolved anytime soon

2. IPs are routinely asked to justify staffing, technology, and program expansion, and often IP and other quality roles are a target when a reduction in force occurs.

3. Published estimates are rarely framed from the perspective of the health system that actually absorbs the expense, making them less trustworthy in the eyes of the C-suite.

4. Result: IPC leaders argue for resources on principle, not on defensible evidence.

APIC'S STRATEGIC PRIORITY

Develop a calculator members can use to quantify the value of infection prevention within their own institutions using a return-on-investment framework.

WORKING DEFINITIONS

Return on Investment

A financial metric evaluating the profitability of an investment by comparing its gain or loss relative to its cost.

Value

The importance, worth, or usefulness of something.

Effectiveness

The degree to which something is successful in producing a desired result.

THREE INPUTS DETERMINE ROI

1. **Cost of HAIs**
   Cost of each healthcare-associated infection

2. **Cost of IPC Programs**
   Direct and indirect cost of running the program

3. **IPC Program Effectiveness**
   How many infections the program prevents



WHY THE OLD ESTIMATES DON'T HOLD UP

- IP is a rapidly changing profession
  - Surveillance changes
  - New care settings
  - Expansion beyond traditional healthcare
  - Pesky global pandemics
- Attributing a cost to an infection isn’t simple
  - Many methodologies have been tried over time, but a lot of what we currently use as estimates can be tracked back to methodology that is inherently flawed
- The evidence base remains thin
  - Most HAI cost figures in circulation today are dated, inconsistently defined, and impossible to compare across studies. Very little exists that demonstrates the actual impact/ effectiveness of an IP Program

“Most published cost analyses are either more than a decade old, or did not adjust for timing of infection.”

— Sentiff, Yenugadhati, Spitz et al., 2023

A THREE-PART PLAN

1

Cost of HAIs

Scoping review replacing outdated estimates with accurate, transparently derived figures where they exist. A call for proposals to follow where gaps remain.

2

Cost of IPC Programs

Scoping review and leadership surveys capturing direct and indirect program costs.

3

The Calculator

Combines review data with user inputs to estimate program-specific ROI. This is the step that integrates “effectiveness” measures.

Today's focus: Part 1 — currently underway in the APIC Research Network

The Next Question

“What are the true costs of healthcare-associated infections?”

THE COST OF HAIS: WHAT WE'VE LEARNED OVER TIME

Peer-reviewed cost estimates and the methodological shifts behind them

1981

Baseline

Haley et al. estimate the lower-bound cost of infection at $641 per case in 1976 dollars.

Limitation: Data are 40+ years old and predate modern regression and matching methods.

Haley RW et al. Am J Med. 1981

1985

Inflation-adjustment

Update to the SENIC study (first national US estimate of HAI incidence, drawn from 1970s SENIC surveillance data; not broken down by infection type).

Haley et al. apply 15% inflation bringing the estimate to $1,800 per infection in 1985, along with 4 extra days of hospitalization.

Haley RW et al. Am J Epidemiol. 1985.

2002

Evidence audit

Stone et al. conduct a systematic audit of the economic evidence linking nosocomial infections and infection-control interventions from 1990–2000 (55 studies): mean attributable cost of BSI $38,703 and MRSA $35,367.

Limitation: A descriptive audit, not a new cost estimate; inherits the heterogeneity and quality problems of the underlying studies.

Stone PW, Larson E, Kawar LN. Am J Infect Control. 2002.

2005

Quality audit

Stone, Braccia & Larson quality-score 70 studies from 2001–2004 and find wide variation — studies estimating the cost attributable to infection are ~7x more likely to be judged of higher quality than studies of the cost of interventions.

Limitation: Quality scale is subjective; wide, unresolved variation in reported costs.

Stone PW, Braccia D, Larson E. Am J Infect Control. 2005.

THE COST OF HAIS: WHAT WE'VE LEARNED OVER TIME

Peer-reviewed cost estimates and the methodological shifts behind them

2009

Direct Medical Costs of HAI

CDC (Scott) uses published literature to provide a range of estimates for HAIs in US hospitals.

- SSI $10,443–25,546
- CLABSI $5,734–22,939
- VAP $11,897–25,072
- CAUTI $589–758
- CDI $5,042–7,179

Limitation: Although it uses 3 standard criteria for evaluation, it is a secondary synthesis not primary evidence

Scott RD. CDC report. 2009.

2010

Method check

Roberts et al. run multiple costing methods on the same data and show the method itself changes the answer.

Estimates range from $9,310 to $21,013 per infection from the same dataset, depending on the method used.

Limitation: Single-institution data; shows the method changes the answer, not which answer is right.

Roberts RR et al. Med Care. 2010.

2013

Perspective changes the number

Zimlichman et al. conduct a meta-analysis that puts 5 major HAIs at $9.8B (hospital-only). Marchetti & Rossiter, adding patient and societal costs, land at $96–$147B.

Zimlichman per-case cost: CLABSI $45,814 · VAP $40,144 · SSI $20,785 · C. diff $11,285 · CAUTI $896.

Limitation: Zimlichman is hospital-only and pools varied studies; Marchetti & Rossiter build on the same disputed primary estimates, with a wider range of costs.

Zimlichman E et al. JAMA Intern Med. 2013.
Marchetti A, Rossiter R. J Med Econ. 2013.

THE COST OF HAIS: WHAT WE'VE LEARNED OVER TIME

Peer-reviewed cost estimates and the methodological shifts behind them

2011–2015

Time-dependent bias exposed

Barnett et al. show that ignoring the timing of infection inflates excess length-of-stay estimates. Multistate models become the recommended fix.

Nelson et al. (2015) find conventional time-fixed methods overstate excess length of stay by ~139–238% on average.

Limitation: A methods review, not a new cost figure.

Barnett AG et al. Value Health. 2011.
Nelson RE et al. Infect Control Hosp Epidemiol. 2015.

2017

Pooled per-case costs

AHRQ/NORC pool 69 studies on 10 hospital-acquired conditions. Per-case HAI costs (2015 $):

- CLABSI $48,108
- VAP $47,238
- SSI $28,219
- C. diff $17,260
- CAUTI $13,793

Limitation: Hospital costs only; 5–9 studies per HAI, wide CIs.

AHRQ/NORC. HAC Cost and Mortality Report, Exhibit 7. 2017.

2024

Expanded scope

CDC (Scott et al.) costs 16 device and non-device hospital-onset infections in 2017 dollars: $14.6B (2011) and $12.1B (2016) nationally. Per case, 2011→2016:

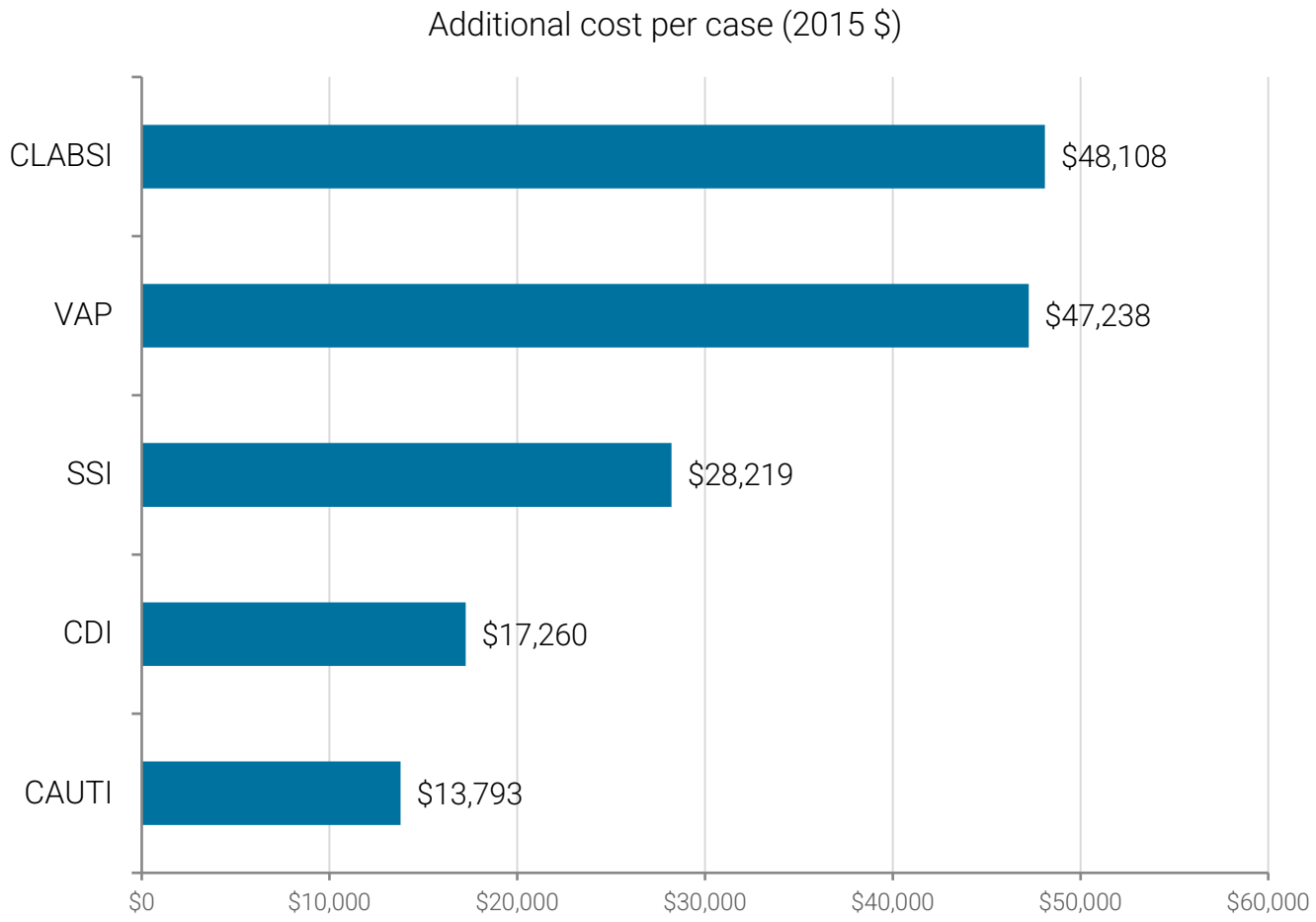
- BSI $25,452→$21,073
- CAUTI $12,804→$12,333
- VAP $48,543→$40,009
- C. diff $16,191→$12,618
- SSI $24,519→$23,698

Limitation: Analogy costing, not direct attribution (simulation models)

Scott RD et al. PharmacoEconomics. 2024.

THE AHRQ REPORT'S PER-CASE COST, BY INFECTION TYPE

2015 dollars, pooled meta-analysis estimates for the 5 infectious hospital-acquired conditions in the AHRQ/NORC 2017 report



How confident is each estimate?

HAC	Studies	95% CI
CAUTI	6	$5,019–$22,568
CDI	9	$9,341–$25,180
SSI	5	$18,237–$38,202
VAP	5	$21,890–$72,587
CLABSI	7	$27,232–$68,983

"We define additional cost as the incremental costs to the hospital for the inpatient stay attributable with the HAC of interest. The costs are limited to the hospital costs that would not have occurred had the HAC not occurred. These estimates do not include related costs (e.g., days of lost work) or costs of a readmission resulting from the HAC. Study results that report hospital charges have been transformed to costs using cost-to-charge ratios, a well-established method in the literature.[28] All costs are reported in 2015 dollar amounts and on a per-HAC-case basis."

Source: AHRQ/NORC, "Estimating the Additional Hospital Inpatient Cost and Mortality Associated With Selected Hospital-Acquired Conditions," Exhibit 7 (2017)

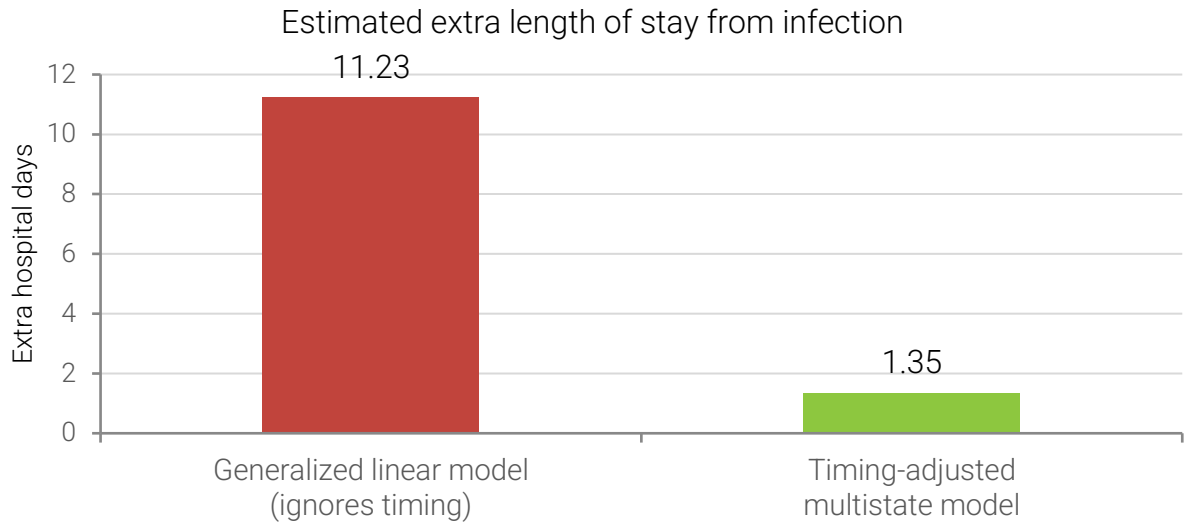
WHY “EXTRA DAYS FROM INFECTION” ESTIMATES ARE OFTEN TOO HIGH

You can only get infected after you're already in the hospital — ignoring that timing inflates the blame placed on infection

The mix-up in plain terms

1. Sicker patients naturally stay longer — and the longer you stay, the more chances you have to catch an infection.
2. Naive studies compare total stay for “ever infected” vs. “never infected” patients — as if the infection was there from day one.
3. That wrongly credits the infection with days the patient was always going to spend in the hospital, for other reasons.
4. Better studies count only the days after the infection actually started — giving a smaller, more honest number.

Same data, two ways of measuring



Source: Barnett et al., 2011 (multistate vs. time-fixed model)

WHICH STUDY DESIGNS GET CLOSER TO THE TRUE COST?

From easiest-but-least-accurate to most rigorous — each step reduces the overestimate

1 **Simple "infected vs. not" comparison**

Compares total hospital stay/cost for infected and non-infected patients. Simplest to do, most common in older studies, most likely to overstate cost — commonly by 1.5–3x.

2 **Matched on timing of infection**

Matches infected and non-infected patients so they've been in the hospital the same amount of time before the infection occurred. Cuts a lot of the inflated estimate.

3 **Multistate model**

Treats infection as something that can happen partway through a stay, not from day one. This is the approach most methods experts now recommend.

4 **Multistate model, severity-adjusted**

Also corrects for infected patients tending to be sicker to begin with, not just diagnosed later. Newest, most defensible approach; still an active research area.

Overestimates cost/LOS more

Closer to the true attributable cost

FROM THE COST QUESTION TO NEW EVIDENCE IN FOUR STEPS

How APIC's Research Network plans to

1

Focus the scope

Determine which HAIs to focus on first.

2

Scoping review

Screen and extract every article reporting cost results within those specific HAI categories.

3

State of the science report

Map which multistate-model, severity-adjusted studies exist in each category, and publish a revised estimate using the most recent literature.

4

Call for proposals

Through the APIC Research Network, encourage new studies in the categories where the report shows a gap. Provide standardized methodology to ensure rigor and consistency.

Each step narrows the question; the call for proposals closes the gaps the report identifies.

FALL FORUM 2025

APIC's Research Advisory Panel and Corporate Director's Council Weigh In

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A NEW PERSPECTIVE ON IPC PROGRAMS

Subprogram: a structured part of the IPC program with a desired result and effectiveness measures.
Activity: a task that supports several subprograms at once. Measure the time it takes, not the outcome.

Subprogram

- Device-associated infections
- Procedure-associated infections
- BBP and safe injection practices
- Standard and transmission-based precautions
- Environment of care (EOC)
- Emergency preparedness
- Diagnostic stewardship
- Antimicrobial stewardship

Activity

- Conducting surveillance
- Rounding
- Educating
- Developing policies, protocols, and processes
- Consulting
- Reporting
- Leading and attending meetings
- Managing subprograms
- Conducting performance improvement activities

A NEW PERSPECTIVE ON IPC PROGRAMS

The same activity shows up in every subprogram, making it difficult to attribute

Activities (what IPs do)	Device-associated infections	Procedure-associated infections	Standard and transmission-based precautions
Conducting surveillance	●	●	●
Educating staff	●	●	●
Developing policies	●	●	●
Reporting outcomes	●	●	●

Subprogram: a structured part of the IPC program with a desired result and effectiveness measures.
Activity: a task that supports several subprograms at once. Measure the time it takes, not the outcome.

The Research Agenda Question

“What are the costs from a health system perspective associated with healthcare-associated infections—specifically catheter-associated bloodstream infections, catheter-associated urinary tract infections, ventilator-associated events, surgical site infections, MDRO infections (including C. difficile), and respiratory infections—during an inpatient hospital stay?”

SEARCH STRATEGY OVERVIEW

A structured MEDLINE / PubMed search · English language · 2005–2025

Search stats

2,831

results returned

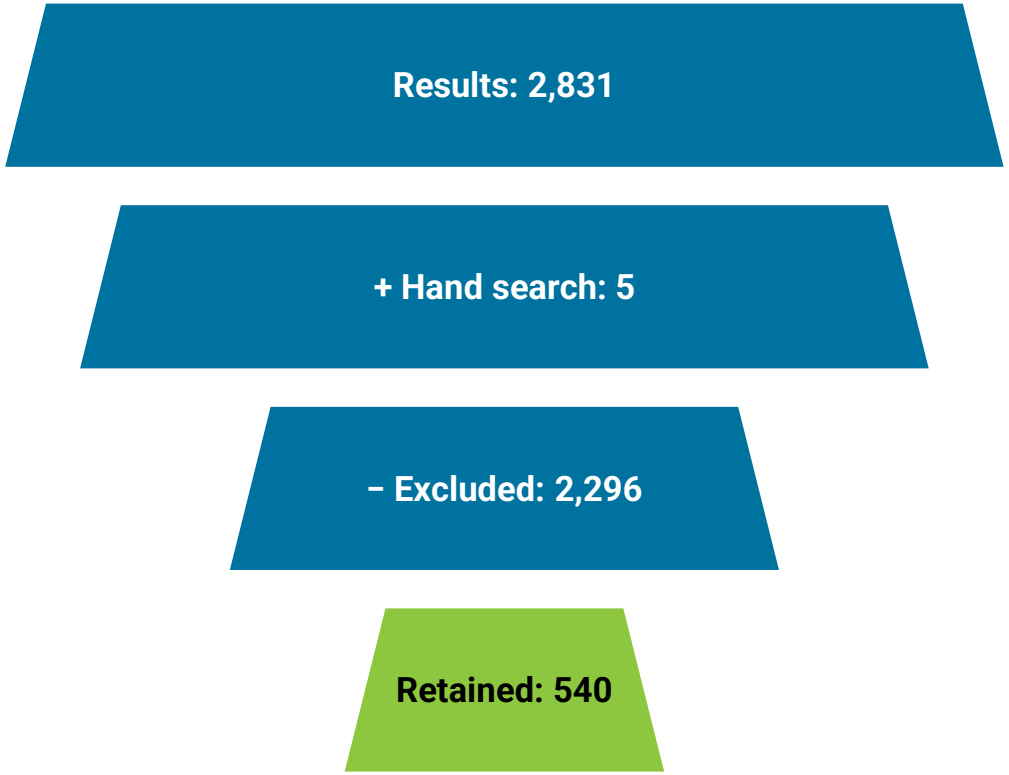
Value / cost metrics & methodologies

Inclusion Criteria Overview

- Inpatient, acute care hospitals of all sizes and acuity
- World Bank Classification high and middle income countries
- Patients of all ages, sex, races, and ethnicities
- Inpatient admission required
- HAI must be reported using NHSN criteria, ICD 9/10 codes, or other standardized definition
- Outcome data must be included in the form of cost or length of stay

SCREENING FUNNEL

Librarian Search

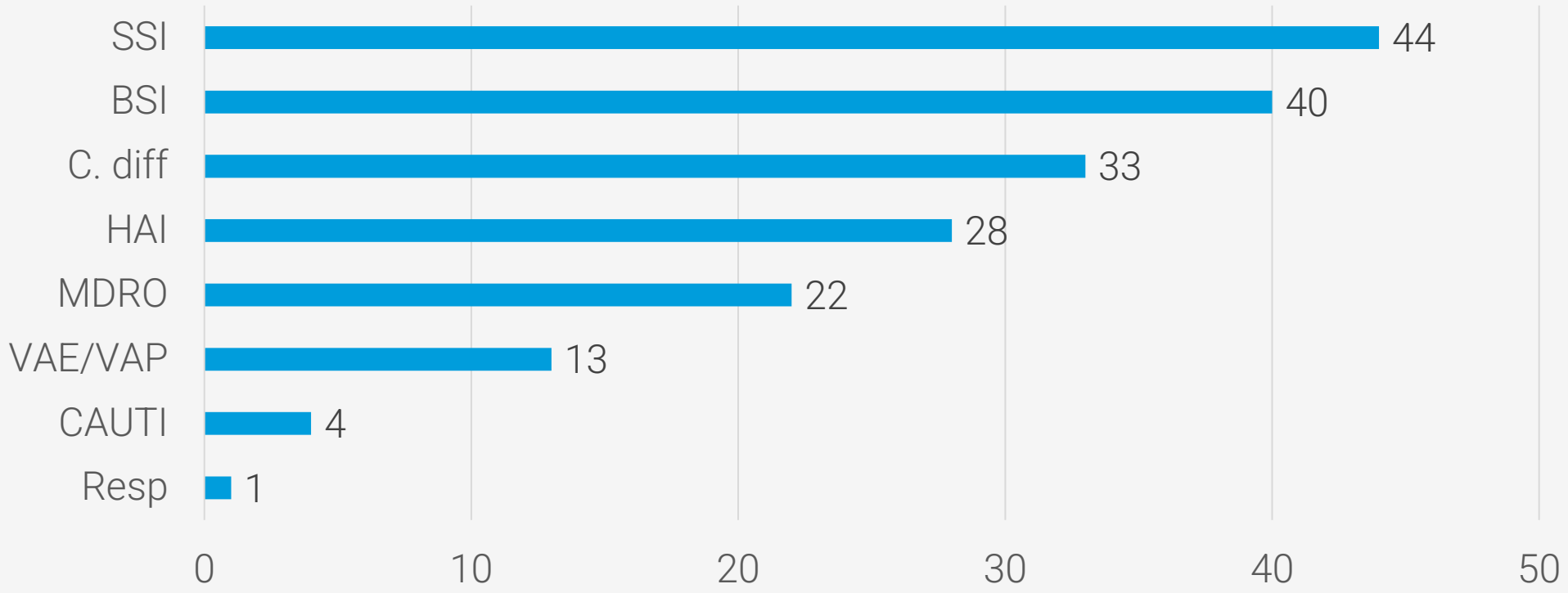


RAP Scoping Review



WHAT'S IN THE COST EVIDENCE BASE SO FAR

178 cost-focused citations catalogued to date, by HAI category



THREE-CHECKLIST QUALITY ASSESSMENT PROCESS

A structured pathway from study rigor to evidence usability

1 DESIGN-SPECIFIC CRITICAL APPRAISAL

Was the study conducted rigorously?

- Determine study design first
- Apply the appropriate JBI checklist
- Use Phillips/CHEERS for economic models

Selection • measurement • confounding • analysis

2 COST-OF-ILLNESS ASSESSMENT

Were the economic methods appropriate?

- Complete the full 20-item COI checklist
- Assess perspective, resources and valuation
- Check price year, inflation and uncertainty

Costs vs. charges • observed vs. modeled

3 APIC HAI COST EVIDENCE CLASSIFICATION

Can the study support an infection-specific estimate?

- Classify scope and attributable evidence
- Assess timing, matching and bias control
- Assign synthesis usability

Directly Usable • Qualified • Context Only

FINAL EVIDENCE DECISION

Separate study rigor, economic rigor and fitness for synthesis

Advance to Extraction

Strong attributable-cost evidence

Advance with Qualification

Relevant evidence with limitations

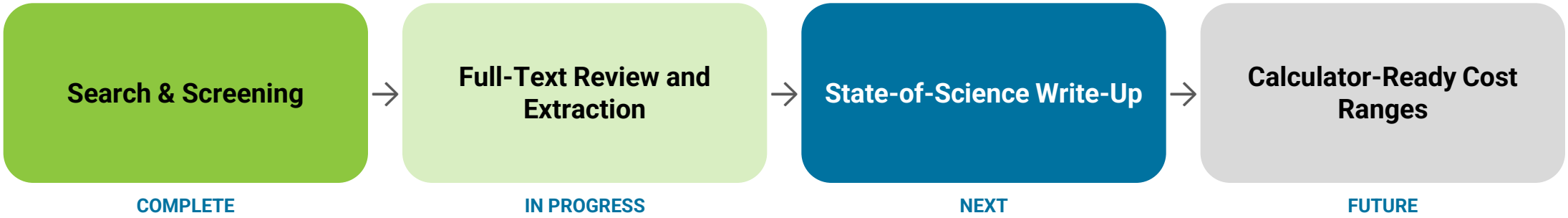
Context Only

Background, prevention or modeled evidence

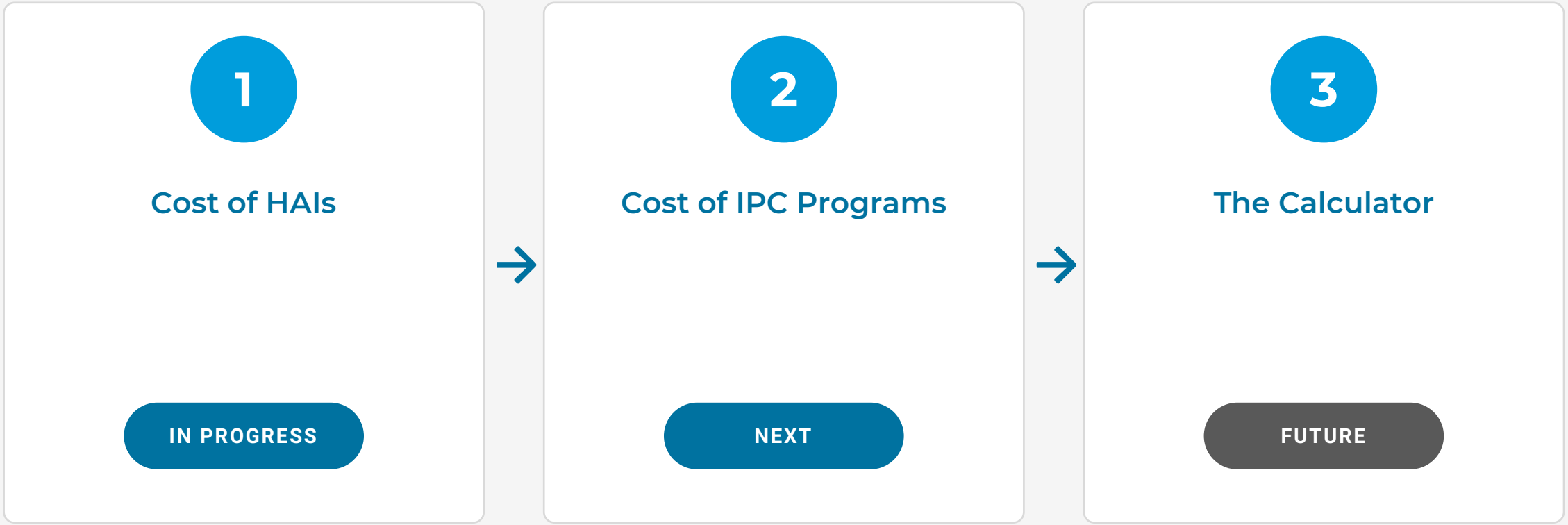
Transparent • Reproducible • Consistent across HAI types

WHERE THE REVIEW STANDS TODAY

Extraction is underway. The manuscript is being drafted section by section.



THE LONG-TERM DELIVERABLE



Cost evidence (Part 1) + program cost evidence (Part 2) + user inputs → institution-specific ROI estimate (Part 3). A multi-year, multi-organization effort — not a quick fix.

THE STATE OF THE SCIENCE PRODUCES SIX DELIVERABLES

Outputs for infection prevention programs and health-system leaders, not just a journal article.

Full report

The complete synthesis of HAI cost evidence and the methods behind it.

Executive summary

The short version, written for executives and finance partners.

Standardized definitions

Agreed cost definitions and recommended costing methods.

Evidence tables

Study-level tables that can be cited directly.

Prioritized research agenda

The gaps ARN will pursue and sponsor next.

Dissemination materials

Materials to carry the findings into everyday practice.

WHAT'S NEXT?

1

Watch for the publication

Submission is targeted before December 2026. The executive summary and evidence tables are written to be cited, so use them the moment they land.

2

Answer the ARN call for proposals

The review ends with a prioritized research agenda and call for proposals. Join us in adding to the evidence base.

3

Tell us which figures get challenged

Bring the cost questions your CFO actually asks, so the calculator is built around them rather than around what is easy to publish.

THANK YOU

Questions? Want to get involved with ACDC / RAP?

APIC Research Network · crpi@apic.org · apic.org/research

APPENDIX

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