Health Level 7 Web Service Search Success Rates in New York City's Citywide Immunization Registry

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Citywide Immunization Registry (CIR)

- Began citywide in 1997
- 1,700 active pediatric provider sites
- ~76m immunizations for 5.6m patients
- Reporting mandated for children (<19 years of age) and additionally incentivized by:
  - Meaningful Use
  - Vaccines for Children

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Immunization reporting

- CIR receives birth certificate data on a biweekly basis and creates a patient record
  - ~122,000 annual birth cohort
- Facilities can submit reports via electronic file, the Online Registry web application, or a real-time Health Level 7 (HL7) web service
  - 50% of reporting comes in via HL7

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HL7 Web Service

- In 2009, CIR started supporting HL7 reporting and querying
  - Immunization history and clinical decision support can be imported into the EHR
  - Facilities may automate batch submission of queries, which can be submitted in parallel
- Currently, 652 provider sites send HL7 2.3.1 or 2.5.1 data through the web service
  - 252 of these sites are bidirectional

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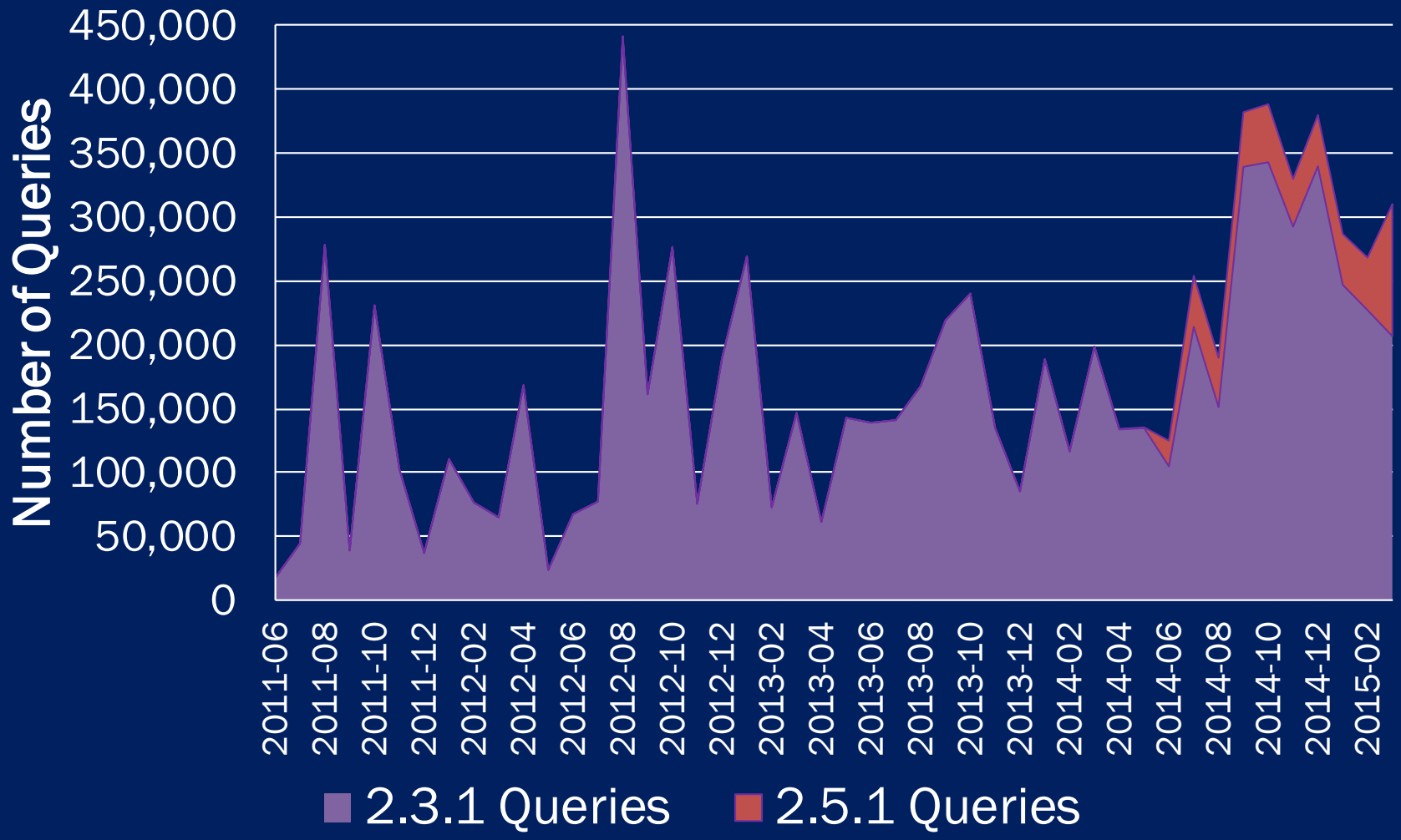
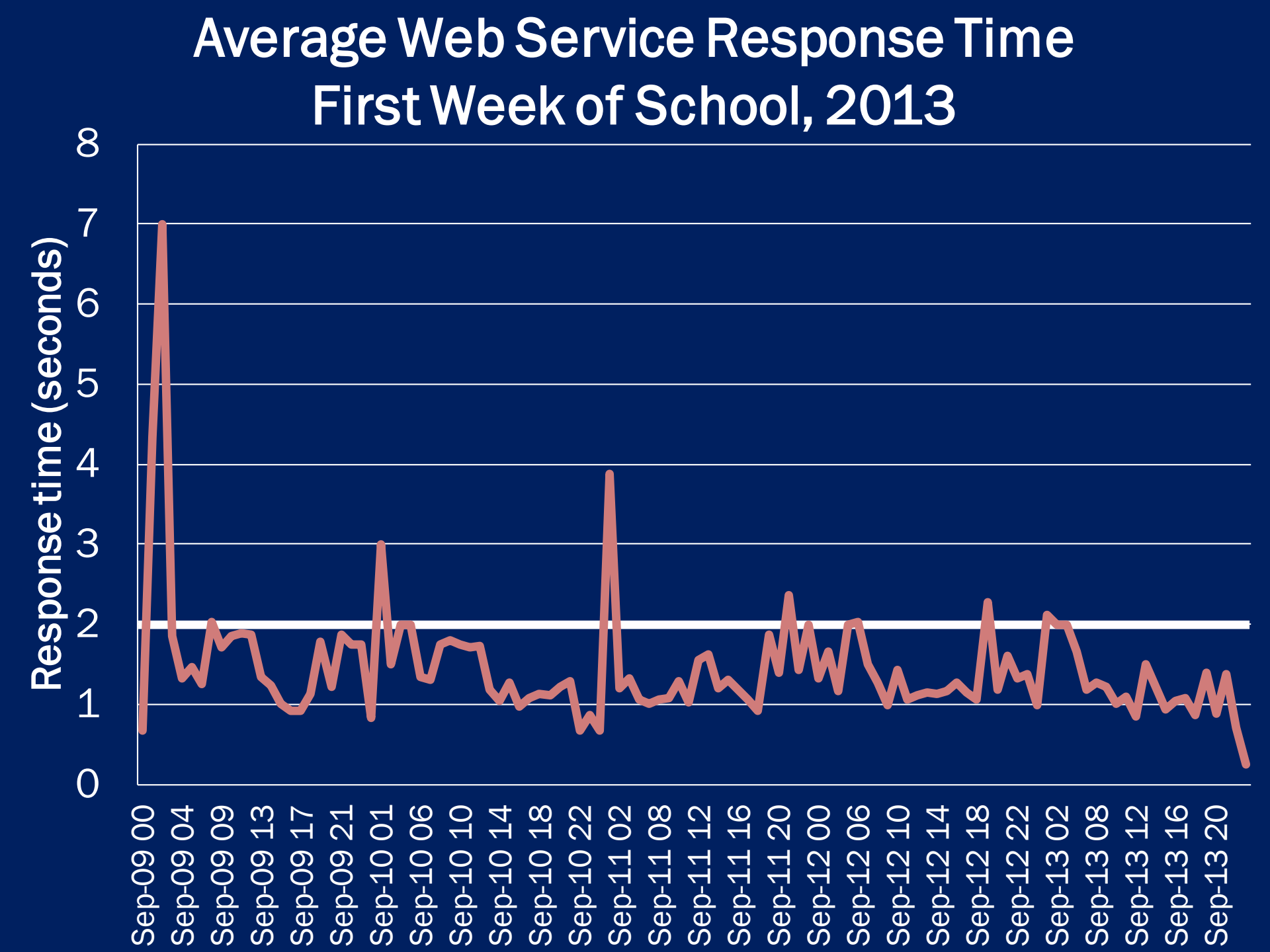
Real-time HL7 Queries



Average Web Service Response Time
First Week of School, 2013



Search process

- Electronic health record (EHR) systems send a variable number of data elements to the CIR
- 2-step matching process:
  - 40 search field combinations are used to determine an exact match
  - If no match is found, probabilistic matching occurs using all data elements sent by the EHR

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Search fields

Search fields include, but are not limited to:

- First name
- Last name
- Date of birth
- Gender
- CIR ID
- Medical record number (MRN)
- Medicaid number
- Mother's DOB
- Mother's maiden name
- Mother's first name
- Father's first name
- Father's last name
- Phone number
- House number

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Objectives

- Compare success rates for searches using different data elements in the CIR's HL7 web service
  - Determine search success rate, how it varies, how it can be improved
- Inform other IISs looking to implement bidirectional data exchange
  - Now proposed for inclusion in Meaningful Use Stage 3

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Methods

- Calculated search success rate for HL7 2.3.1 and 2.5.1 queries performed between August 1, 2013 and July 31, 2014
- Stratified by:
  - Patient age group
  - Search field combinations
  - EHR vendor/partner system
  - Number of data elements provided in the query

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Results

- 1,938,867 HL7 2.3.1 searches and 61,088 HL7 2.5.1 searches were performed
- Overall success rate in children and adults was 78.6%
- 78.7% of all queries were for children
- 2.1% of failed searches were due to duplicate matches found

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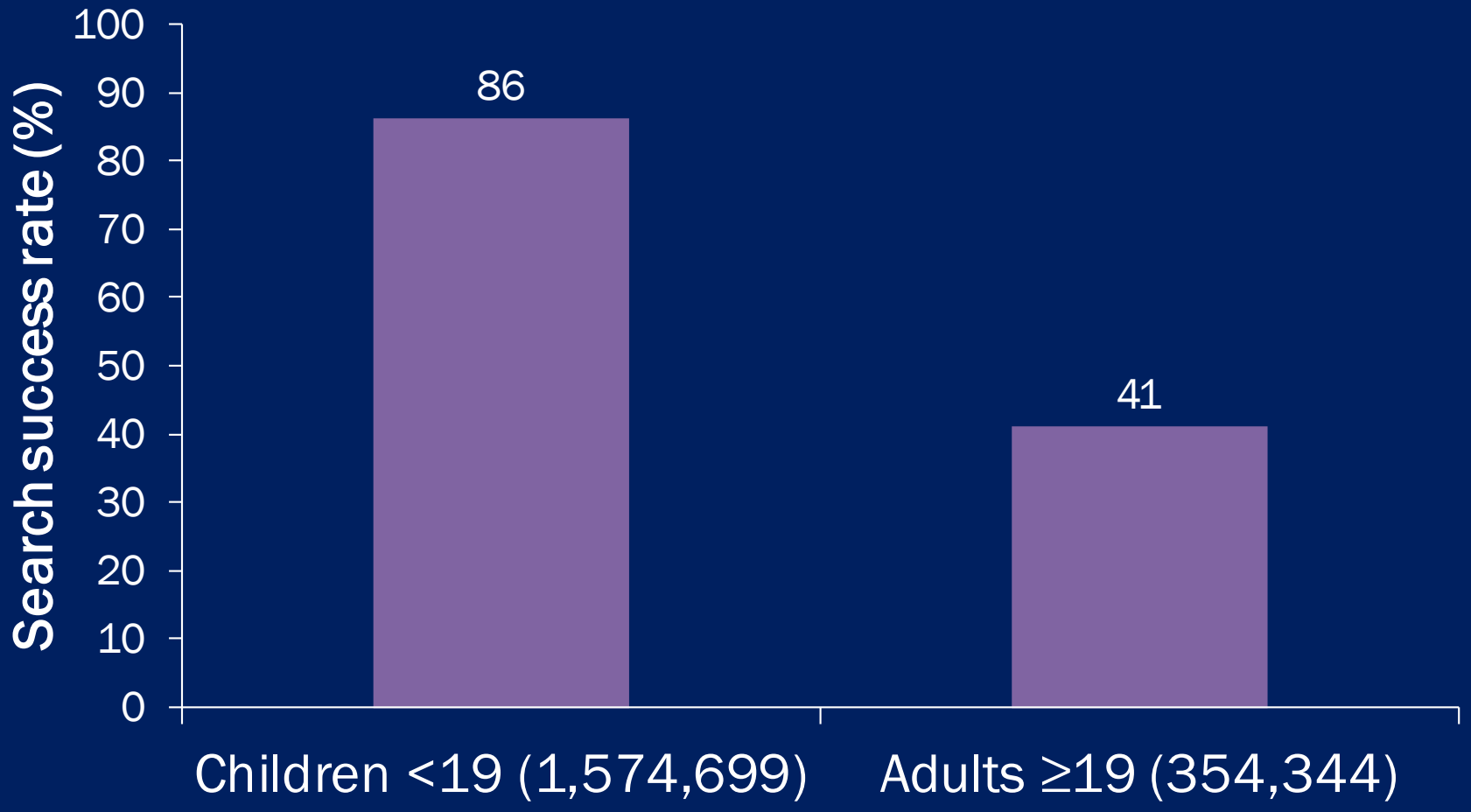
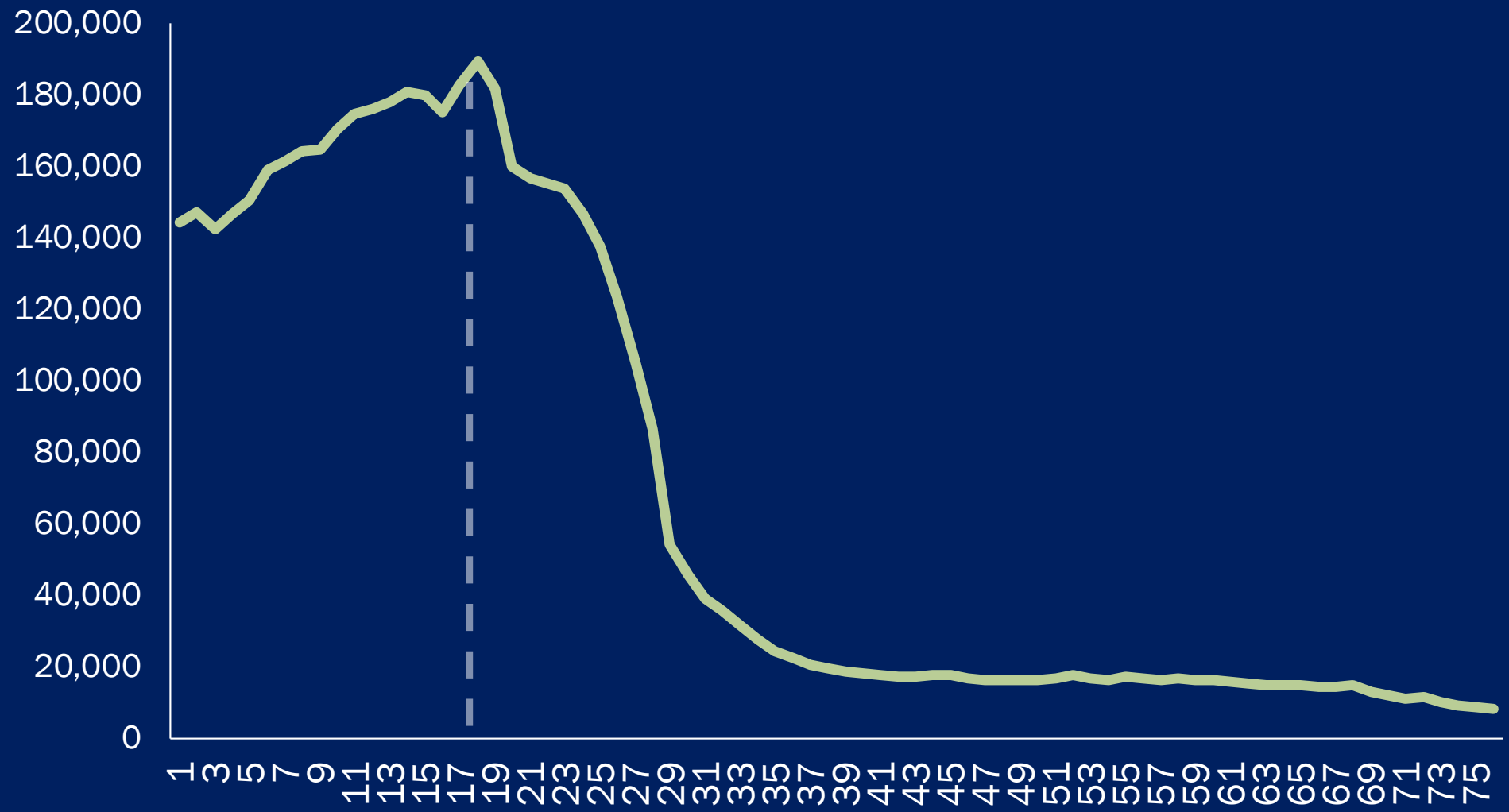
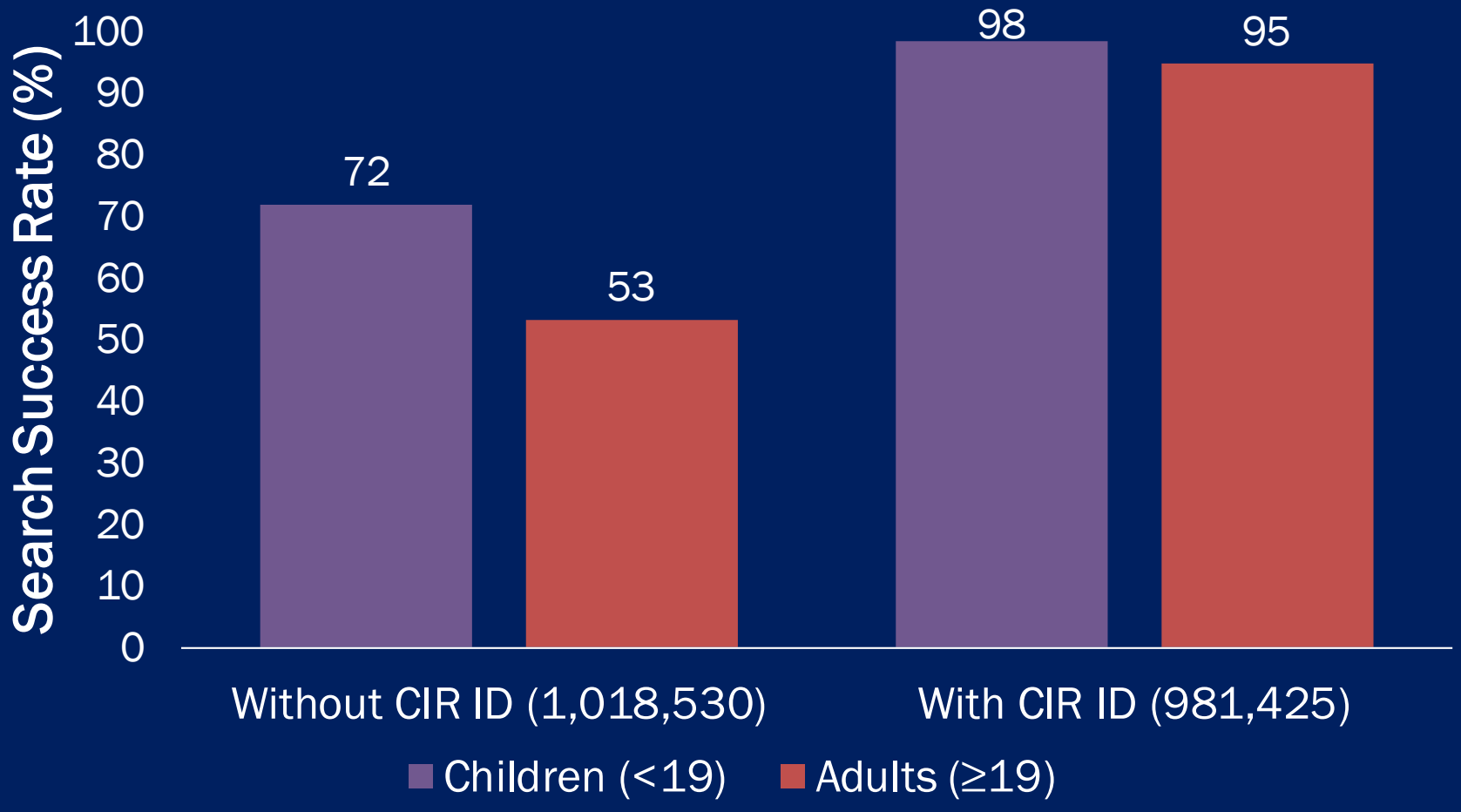
Search success rate by age group



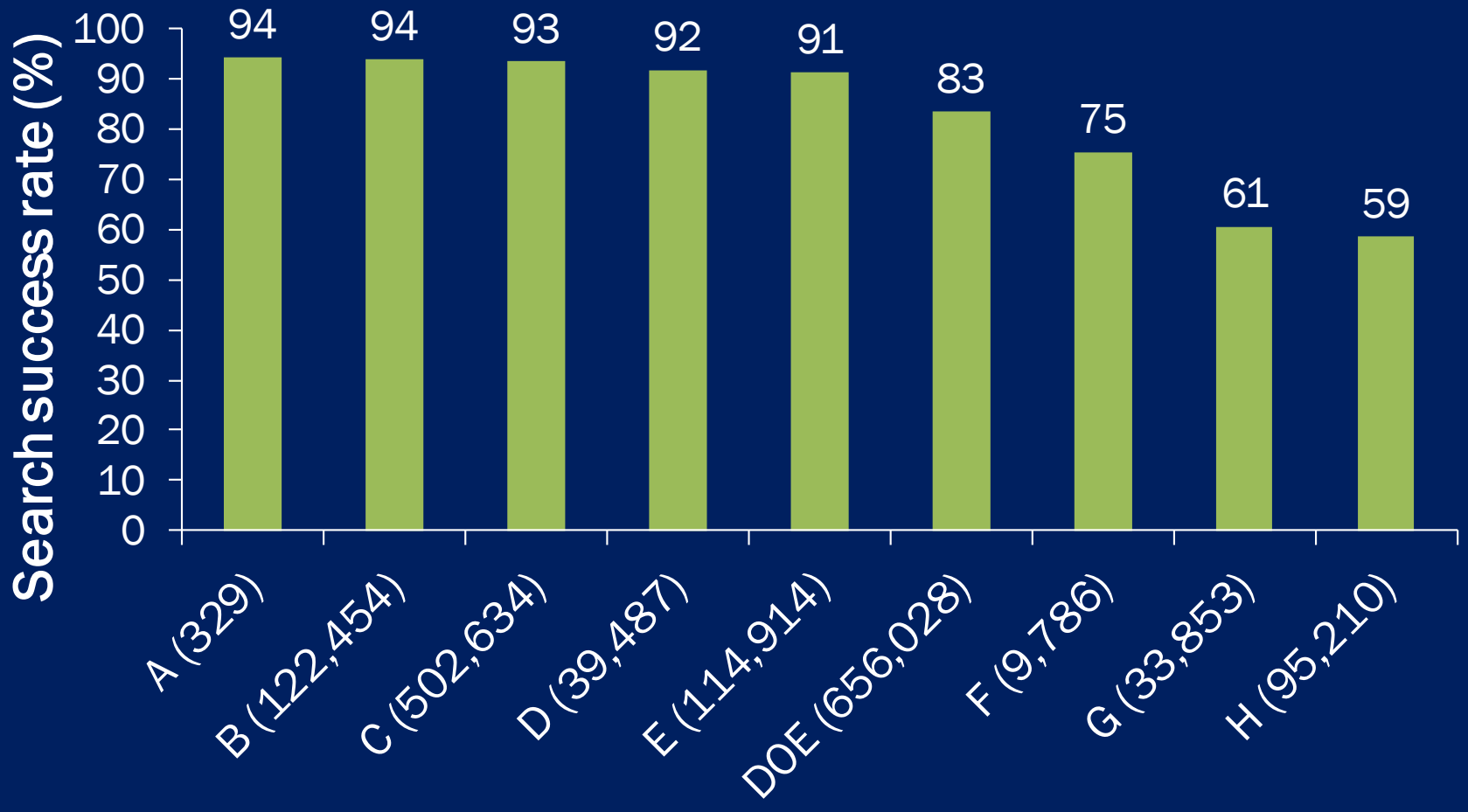
Age distribution in the CIR



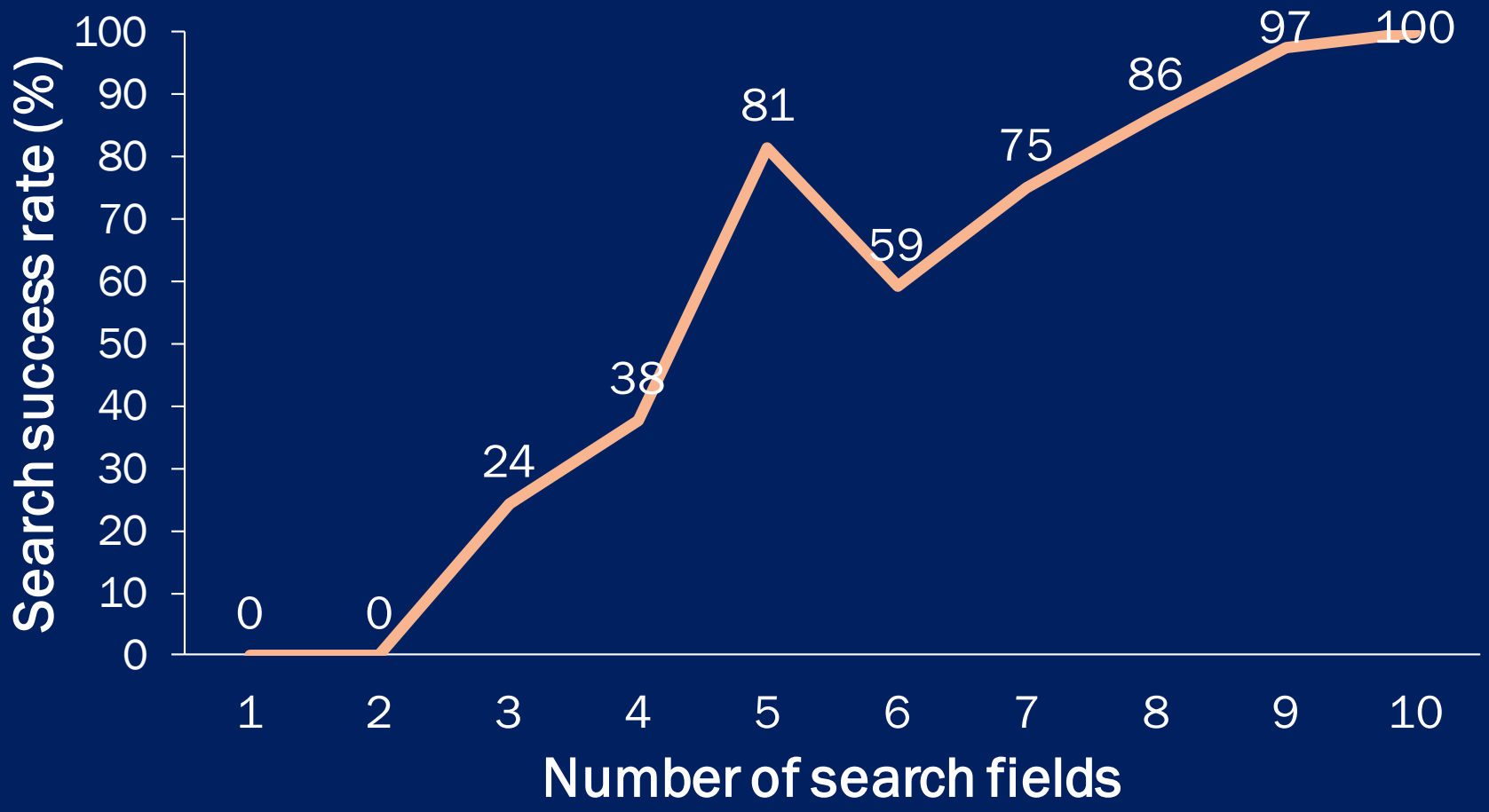
Success rate for queries with CIR ID



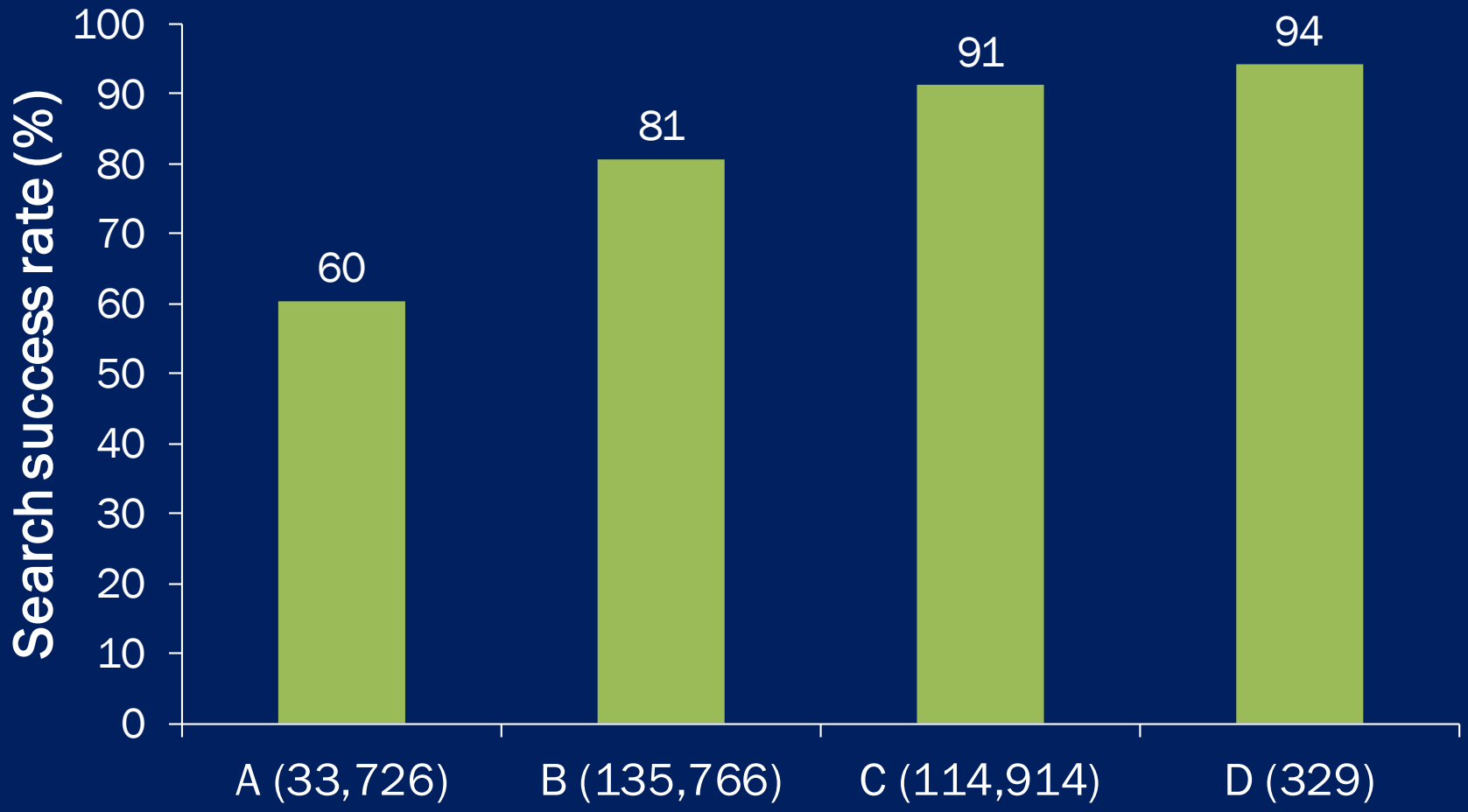
Success rate by partner



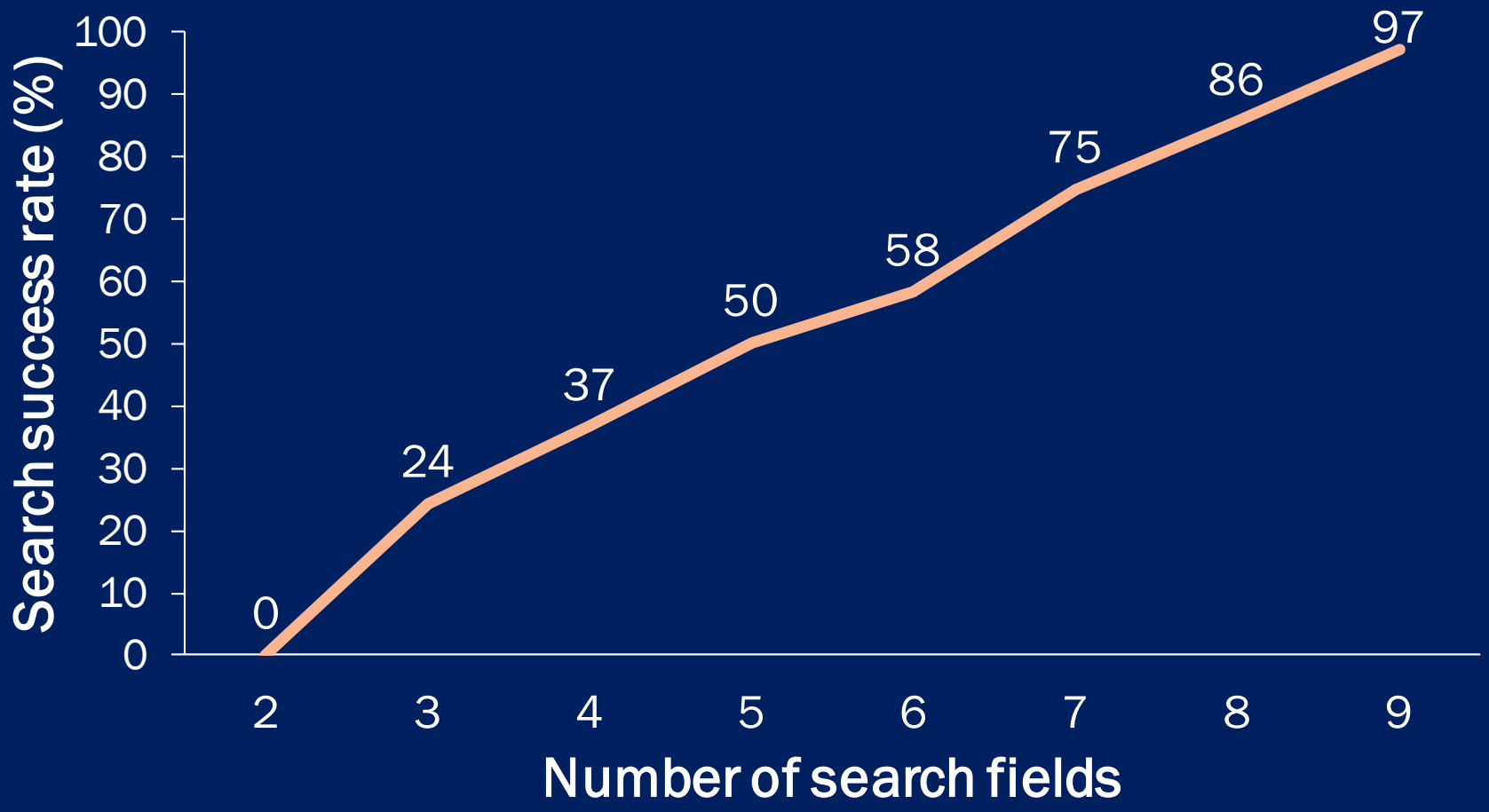
Success rate by number of search fields, without CIR ID



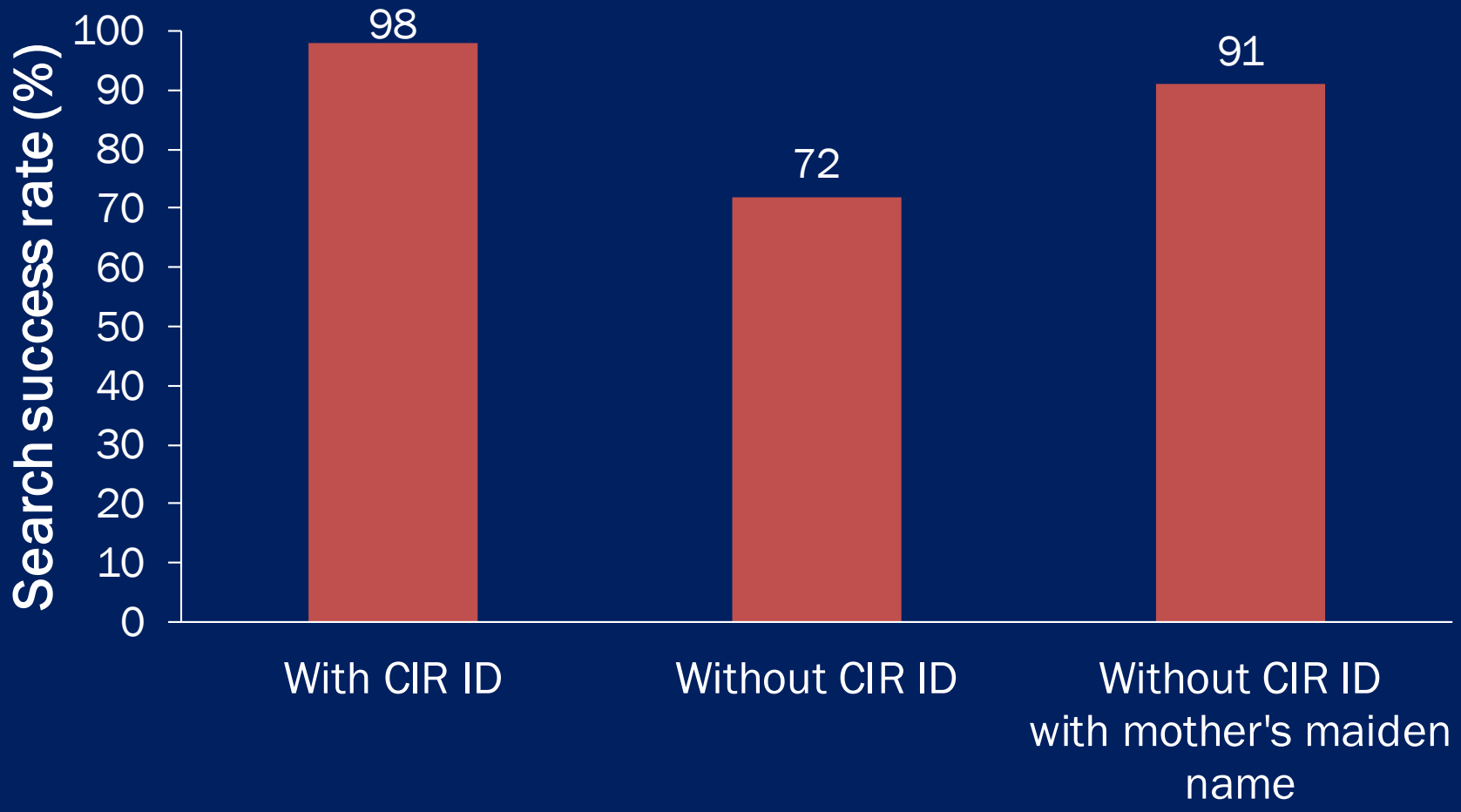
Success rate for queries without CIR ID and with MRN, by partner



Success rate by number of search fields, without CIR ID or MRN



Success rate with mother’s maiden name



Limitations

- Need to control for confounding in results
  - Many data elements contribute to success
- Need controlled studies to determine most useful search fields
- Initial studies showed smaller impact of CIR ID and mother's maiden name
  - Data quality may be a factor
  - EHRs receive CIR ID after successful search (bias)

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Challenges

- Difficult to tease apart factors affecting search success
- Difficult to know reasons for failure
  - If patient isn't located, is that because they weren't in the CIR or because discordant data was provided?
- Well de-duplicated database is necessary for successful patient matching and analysis
- CIR database grows and changes over time

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Conclusion

- Search success is higher when more search fields are sent
  - Systems would ideally send all available search fields
- Search success is highly complex; more controlled studies are needed to investigate this problem, as analyses are prone to confounding

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Simplified architecture diagram