

2013

The value of library and information services in patient care: Results of a multivariate analysis

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The value of library and information services in patient care: Results of a multivariate analysis

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The evolution of value studies

- Standards
- Inputs
- Outputs
- Outcomes
- Impacts
- Value-

Two types of value studies

- **Value in exchange (return on investment, monetary value)**
- **Value in use (a more holistic approach based on perceptions of value by the users. Includes both tangibles and intangibles. May include monetary value but goes beyond it)**

Value of Library and Information Services in Patient Care Study

- The purpose of the study was to understand the value and impact of information resources and services provided by the library and the librarian on patient care.
- Focus groups of librarians who had interviewed their administrators about their perceptions of the value of library services informed the study design.
- The research builds on the original Rochester study:
Marshall, JG. The impact of the hospital library on clinical decision making: the Rochester study. *Bulletin of the Medical Library Association*. 1992 Apr;80(2):169-78.

Acknowledgments

- The Value Study was a partnership of the National Network of Libraries of Medicine, Middle Atlantic Region (NNLM/MAR) and the University of North Carolina at Chapel Hill (UNC).
- This project has been funded in part with federal funds from the National Library of Medicine, National Institutes of Health, Department of Health and Human Services, under Contract #N01-LM-6-3501 from New York University, NNLM/MAR.
- Additional support was provided by the Hospital Library Section of the Medical Library Association (MLA), the NY/NJ Chapter of MLA; the Philadelphia Chapter of MLA; the Upstate New York and Ontario Chapter of MLA; the New York State Reference and Research Library Resources Councils and the Donald Lindberg Research Fellowship from MLA.
- Analysis for this paper was conducted by Joanne Gard Marshall, Jennifer Craft Morgan, Cheryl Thompson and Amber Wells.

Study team

NN/LM MAR Planning Team

- Julia Sollenberger, University of Rochester Medical Center
- Susan K. Cavanaugh, UMDNJ Camden
- Sharon Easterby-Gannett, Christiana Care Medical Libraries
- Sue Hunter, NN/LM MAR
- Mary Lou Klem, Health Sciences Library System, University of Pittsburgh
- Joanne Gard Marshall, UNC
- Lynn Kasner Morgan, Mount Sinai Medical Center
- Kate Oliver, NN/LM MAR
- Neil Romanosky, NN/LM MAR

UNC Research Team

- Joanne Gard Marshall, UNC Principal Investigator
- Cheryl A. Thompson, Project Manager
- Jennifer Craft Morgan
- Marshica Stanley
- Amber Wells

Participating sites by region

| Region | Sites (n=56) |
|-----------------------|--------------|
| Middle Atlantic* | 23 |
| Greater Midwest | 12 |
| Southeastern Atlantic | 7 |
| Pacific Southwest | 4 |
| Pacific Northwest | 3 |
| South Central | 2 |
| Mid-Continental | 1 |
| Canada | 4 |

Participating site characteristics

| | Sites (n=56) |
|--------------------------------------|--------------|
| Council of Teaching Hospitals member | 77% |
| Located in an urban area | 86% |
| Bed size: | |
| Less than 500 | 45% |
| 500 or more | 54% |

Methodology

Study design

- **Total study: 56 health libraries serving 118 hospitals.**
- Pilot phase: 7 health libraries serving 19 hospitals in Middle Atlantic Region
 - Survey of physicians, residents and nurses (Sept – Nov 2010)
 - Follow-up interviews with survey respondents (Jan – June 2011)
- Full launch phase: 49 health libraries serving 99 hospitals in across the United States and Canada
 - Survey of physicians, residents and nurses (March – May 2011)

Study methods

- Focus groups of librarians who interviewed their administrators about the value of the library in patient care were used to guide the study design.
- The Value Study Planning Group from NN/LM MAR worked in collaboration with the researchers at UNC Chapel Hill to design the study.
- Invitations and reminders to participate in the online survey were sent via listserv or portal announcement. Additional interviews were conducted by UNC.
- For further information see: Dunn K, Brewer K, Marshall JG, Sollenberger J. Measuring the value and impact of health sciences libraries: planning an update and replication of the Rochester Study. *J Med Libr Assoc.* 2009 Oct;97(4):308-12.

Participant benefits

- Each site received its own dataset in Excel format, a copy of the survey, a set of presentation-ready PowerPoint slides for use in their own institution, and a summary report of the aggregate findings.
- A list of the participating libraries is available on the study website. <http://nmlm.gov/mar/about/valueparticipate.html>
- No identifying information about survey respondents or individual sites will be included in published results of the full study.

Critical incident technique

In the Value Study, respondents were asked to think about an occasion in the last six months when they looked for information resources for patient care (beyond what is available in the patient record, EMR system or lab results) and to answer questions regarding that occasion.

Community Based Collaborative Research (CBCR)

The Value Study used an approach to research design that is based on active collaboration between researchers and members of the community who will benefit from the research. The approach has been used extensively in public health research (Israel, 2005).

Response rates

- Overall response rate 10% (n=16,122)*
- Physicians 10% (n=5,379)
- Residents 12% (n=2,123)
- Nurses 7% (n=6,788)

Note: Response rates are conservative estimates using as a denominator the number of physicians, residents and nurses reported by each site (N= 172,463). The N's reported by position do not add up to 16,122 because 1,158 respondents reported "Other" for their position and 674 did not report a position.

Response rates for individual sites (n=56)

- 10% or less 38%
- 11% to 20% 45%
- 21% to 30% 9%
- 31% or more 9%

Respondent demographics

Gender (n=12,826)

- Female 63%
- Male 37%

Age (n=12,834)

- Under 25 1%
- 25-44 47%
- 45-64 47%
- Over 64 4%

Interest in follow-up interview

- Yes – 1,123 respondents

Education

Attending & resident physicians (n=7,526)

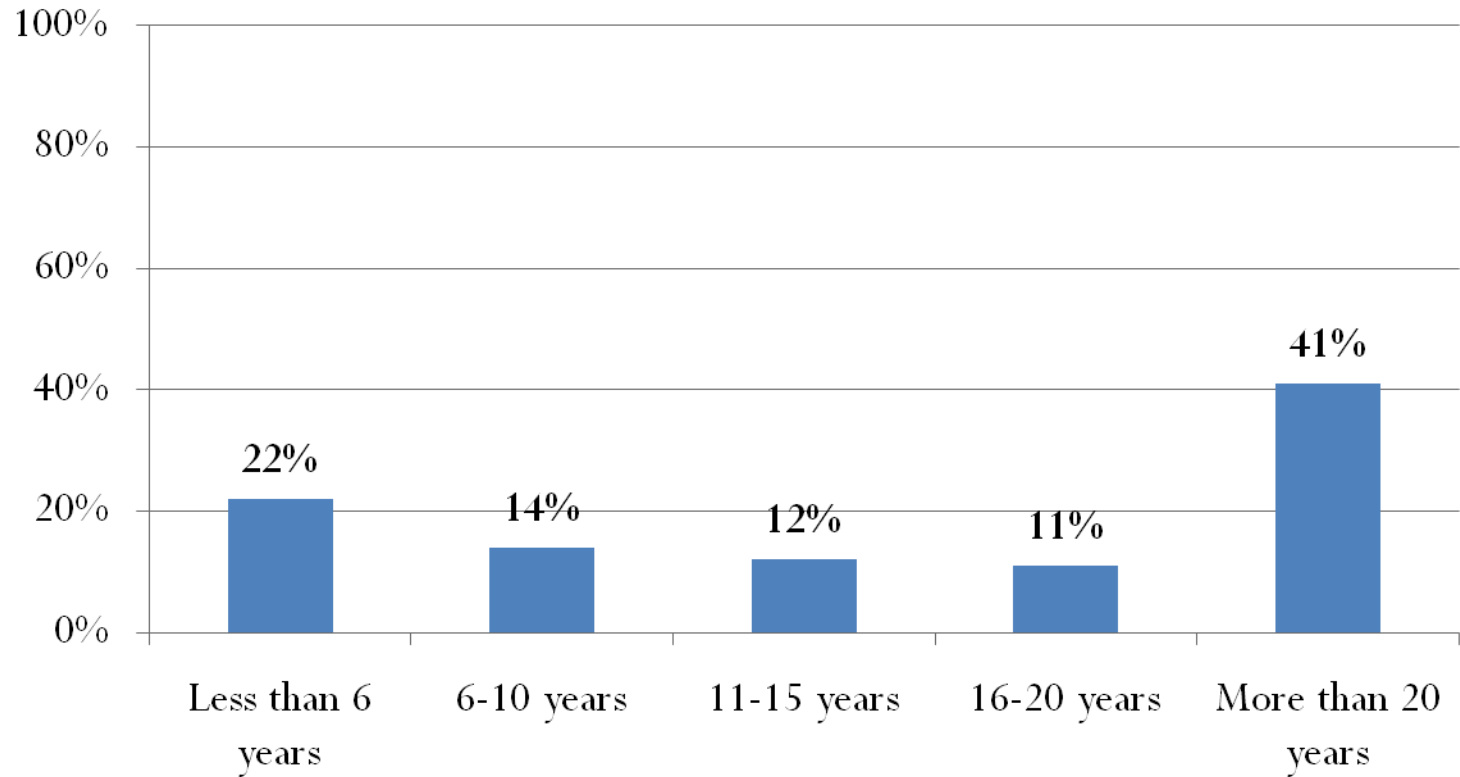
- MD 92%
- Master 9%
- PhD 6%
- DO 6%
- Other 3%

Nurses (n=5,326)

- Bachelor 47%
- Associate 22%
- Master 20%
- Diploma 13%
- Certified Nurse Practitioner 8%
- PhD 1%
- Other 6%

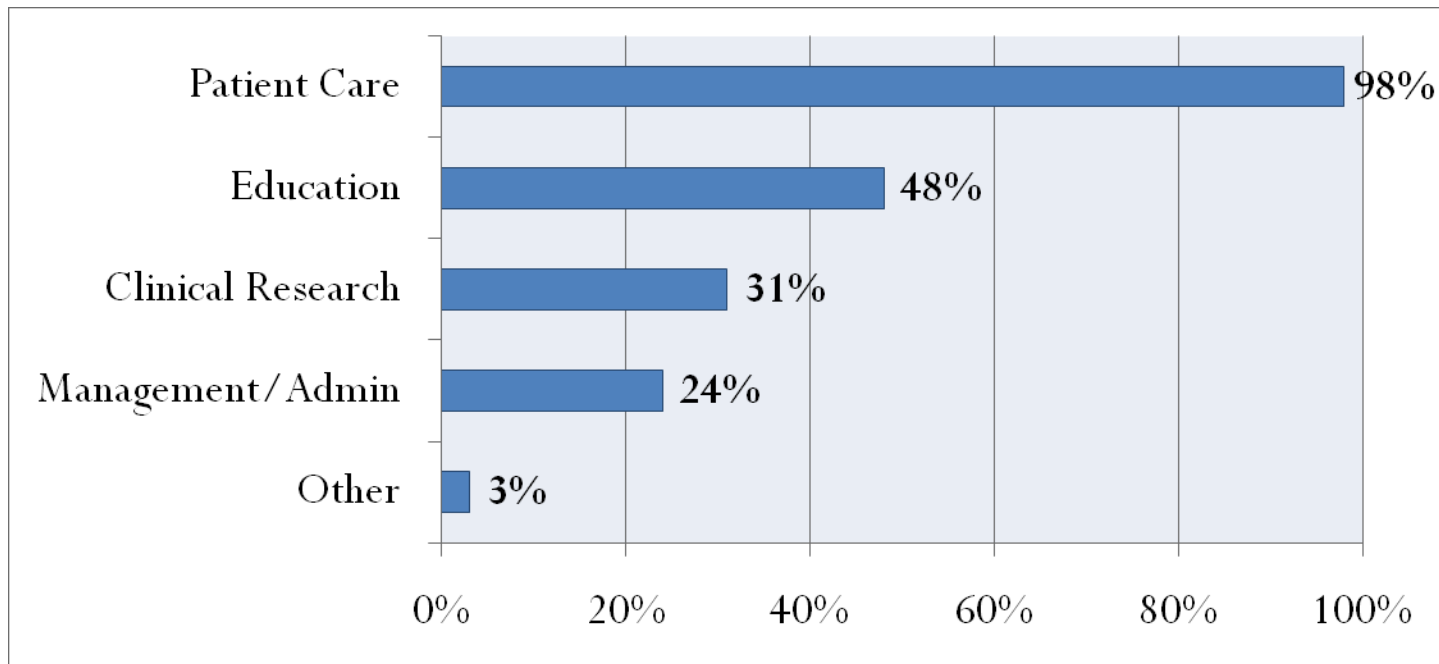
Note: For this question, respondents were able to check all that apply. The percents will not equal 100.

Years as a health care professional (n=12,843)



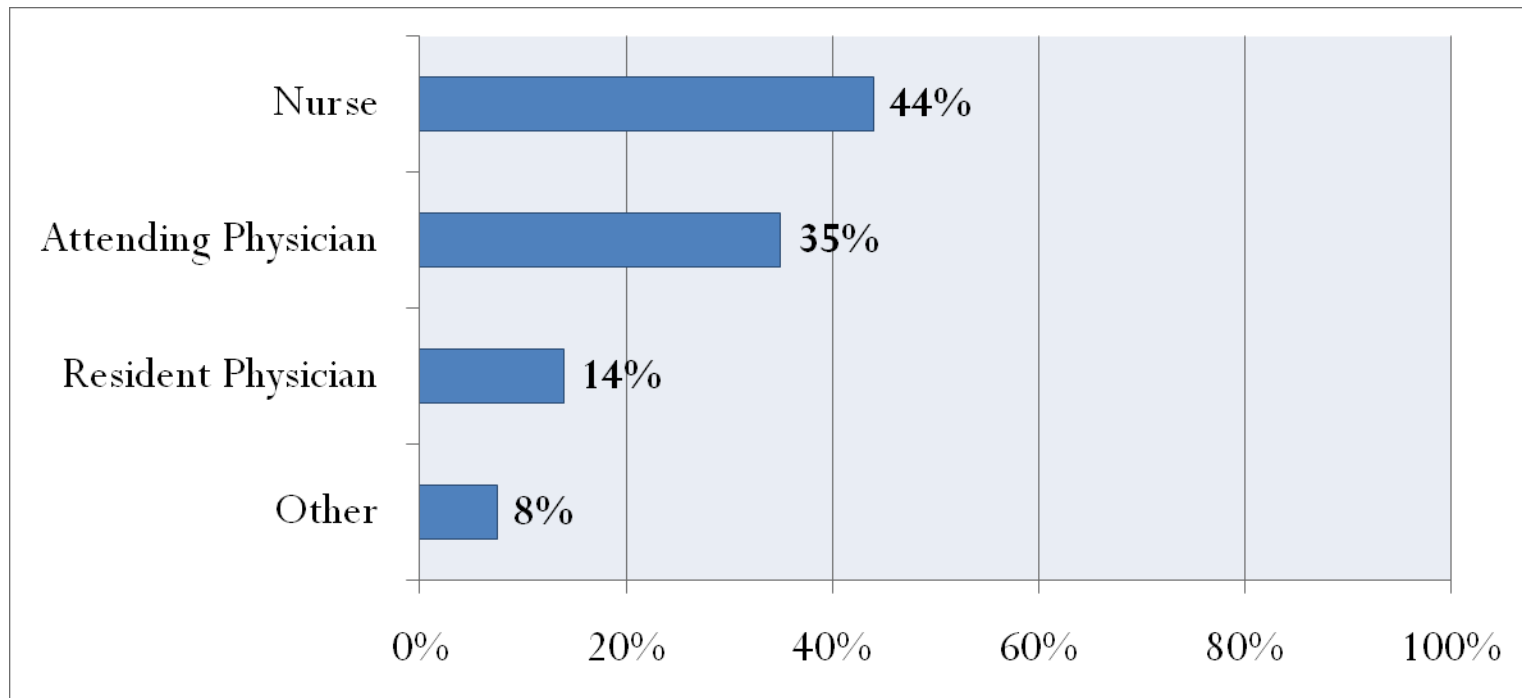
Job duties

Which of the following does your job involve?* (n=15,403)



***Respondents had to perform patient care or clinical research to be included in the study.**

Positions held by respondents (n=15,448)



Results: Value of library and information sources

Did you handle any aspect of the clinical situation differently as a result of having the information?

| | Overall (n=13,737) | Attending physicians (n=5,034) | Residents (n=1,979) | Nurses (n=5,785) |
|----------------|-----------------------|--------------------------------------|------------------------|---------------------|
| Definitely Yes | 31% | 38% | 38% | 22% |
| Probably Yes | 44% | 47% | 47% | 41% |
| Probably No | 21% | 13% | 13% | 31% |
| Definitely No | 4% | 2% | 1% | 7% |

Changes in patient care as a result of the information

| Changes Reported | Overall (n=13,159) | Attending physicians (n=4,906) | Residents (n=1,890) | Nurses (n=5,467) |
|-----------------------------------|-----------------------|--------------------------------------|------------------------|---------------------|
| Advice given to patient or family | 48% | 47% | 45% | 48% |
| Choice of drugs | 33% | 46% | 52% | 15% |
| Choice of other treatments | 31% | 42% | 43% | 17% |
| Diagnosis | 25% | 36% | 42% | 9% |
| Choice of test | 23% | 35% | 40% | 7% |
| Post hospital care or treatment | 12% | 12% | 15% | 12% |
| Length of stay | 7% | 7% | 11% | 6% |
| Not applicable | 16% | 7% | 8% | 26% |

Note: For this question, respondents were able to check all that apply unless they selected Not applicable. The percents will not equal 100. Changes included here must have had at least 10% or more of respondents in at least one of the 4 categories.

Value of the information

| Percent who agree that the information was... | Overall (n) | Attending physicians (n) | Residents (n) | Nurses (n) |
|---|---------------------|--------------------------|---------------|-------------|
| Relevant | 99% (13,259) | 100% (4,943) | 100% (1,906) | 99% (5,508) |
| Accurate | 99% (13,092) | 100% (4,893) | 100% (1,889) | 99% (5,427) |
| Will be of use in the future | 99% (13,050) | 99% (4,882) | 100% (1,897) | 98% (5,384) |
| Was of clinical value | 98% (13,098) | 99% (4,915) | 100% (1,896) | 97% (5,414) |
| Current | 97% (13,141) | 98% (4,918) | 98% (1,897) | 96% (5,431) |
| Refreshed my memory of details or facts | 96% (12,522) | 97% (4,727) | 98% (1,855) | 95% (5,100) |

Value of the information (continued)

| Percent who agree that the information... | Overall (n) | Attending physicians (n) | Residents (n) | Nurses (n) |
|---|---------------------|--------------------------|---------------|-------------|
| Resulted in a better informed clinical decision | 95% (12,329) | 98% (4,817) | 98% (1,859) | 92% (4,856) |
| Contributed to higher quality of care | 95% (12,529) | 97% (4,796) | 98% (1,848) | 93% (5,059) |
| Substantiated my prior knowledge or belief | 95% (12,332) | 95% (4,671) | 97% (1,818) | 94% (5,029) |
| Provided new knowledge | 92% (12,083) | 92% (4,831) | 97% (1,895) | 91% (5,357) |
| Having the information saved me time | 85% (11,887) | 85% (4,523) | 90% (1,768) | 83% (4,819) |

If the information saved time, how many hours?

| | Overall (n=9,295) | Attending physicians (n=3,607) | Residents (n=1,482) | Nurses (n=3,604) |
|--------------------|------------------------------|---|--------------------------------|-----------------------------|
| Mean | 2.5 | 2.6 | 2.8 | 2.0 |
| Median | 1.0 | 1.0 | 1.0 | 1.0 |
| Standard deviation | 7.8 | 8.4 | 8.3 | 5.9 |

Key adverse events avoided as a result of the information

| Adverse Event Avoided | Overall (n=12,910) | Attending physicians (n=4,801) | Residents (n=1,847) | Nurses (n=5,381) |
|--------------------------------------|--------------------|--------------------------------|---------------------|------------------|
| Patient misunderstanding of disease | 23% | 19% | 23% | 26% |
| Additional tests or procedures | 19% | 29% | 32% | 7% |
| Misdiagnosis | 13% | 22% | 23% | 3% |
| Adverse drug reaction or interaction | 13% | 15% | 16% | 10% |
| Medication error | 12% | 13% | 17% | 9% |
| Patient mortality | 6% | 7% | 10% | 3% |
| Not applicable | 44% | 38% | 35% | 51% |

Note: For this question, respondents were able to check all that apply unless they selected Not applicable. The percents will not equal 100. The most frequent events were included along with patient mortality.

Importance of library and non-library sources I

| Source | Overall (n) | Attending physicians (n) | Residents (n) | Nurses (n) |
|------------------------------|---------------------|--------------------------|---------------|-------------|
| Library/Information resource | 97% (12,027) | 98% (4,599) | 98% (1,773) | 96% (4,854) |
| Discussion with colleagues | 92% (11,038) | 87% (4,105) | 97% (1,730) | 94% (4,456) |
| Lab tests | 87% (9,810) | 86% (3,983) | 90% (1,623) | 87% (3,614) |
| Diagnostic imaging | 80% (8,708) | 80% (3,642) | 86% (1,490) | 76% (3,061) |

Note: For this question, respondents were able to check all that apply so the percents will not equal 100. The importance rating is based on the percentage of respondents who indicated a source was “important” or “very important”.

Importance of library and non-library sources II

| Source | Overall Mean (S.D.) | Attending physicians Mean (S.D.) | Residents Mean (S.D.) | Nurse Mean (S.D.) |
|------------------------------|---------------------|----------------------------------|-----------------------|-------------------|
| Library/Information resource | 3.9 (0.4) | 3.9 (0.4) | 3.9 (0.4) | 3.9 (0.4) |
| Discussion with colleagues | 3.8 (0.6) | 3.7 (0.7) | 3.9 (0.4) | 3.9 (0.5) |
| Lab tests | 3.7 (0.8) | 3.7 (0.8) | 3.8 (0.7) | 3.7(0.8) |
| Diagnostic imaging | 3.5 (1.0) | 3.5 (1.0) | 3.7 (0.8) | 3.4 (1.0) |

Note: For this question, mean scores were calculated based on 1=not at all important; 2=not very important; 3= important; and 4=very important. "Not used" was removed from this analysis.

Results: Library resources used

Number of library resources used

| | Mean number of resources used (S. D.) |
|--------------------------------|---------------------------------------|
| Overall (n=14,544) | 3.5 (2.4) |
| Attending physicians (n=5,230) | 3.8 (2.4) |
| Residents (n=2,047) | 4.5 (2.6) |
| Nurses (n=6,249) | 2.8 (2.2) |

Top five library resources used

| | Overall (n=14,591) | Attending physicians (n=5,233) | Residents (n= 2,050) | Nurses (n=6,280) |
|-------------------|-----------------------|--------------------------------------|-------------------------|---------------------|
| Journals (online) | 46% | 59% | 56% | 30% |
| PubMed/ MEDLINE | 42% | 54% | 59% | 25% |
| UpToDate | 40% | 53% | 77% | 18% |
| Books (online) | 30% | 32% | 46% | 22% |
| Micromedex | 24% | 14% | 18% | 35% |

Note: For this question, respondents were able to check all that apply so the percents will not equal 100.

Other library resources used

| | Overall (n=14,591) | Attending physicians (n=5,233) | Residents (n= 2,050) | Nurses (n=6,280) |
|------------------|-----------------------|--------------------------------------|-------------------------|---------------------|
| Books (print) | 21% | 24% | 25% | 16% |
| eMedicine | 20% | 20% | 38% | 15% |
| Ovid Medline | 16% | 22% | 18% | 11% |
| Journals (print) | 16% | 22% | 12% | 11% |
| MD Consult | 16% | 19% | 25% | 10% |
| ePocrates | 13% | 18% | 28% | 6% |

Note: For this question, respondents were able to check all that apply so the percents will not equal 100. Library resources included here must have had at least 10% or more of respondents in at least one of the 4 categories.

Other library resources used (continued)

| | Overall (n=14,591) | Attending physicians (n=5,233) | Residents (n= 2,050) | Nurses (n=6,280) |
|--------------------------------|-----------------------|--------------------------------------|-------------------------|---------------------|
| Professional assoc. website | 12% | 12% | 8% | 13% |
| Clinical Evidence (BMJ) | 10% | 10% | 15% | 7% |
| CINAHL | 9% | 1% | 1% | 18% |
| Nursing Reference Ctr. | 6% | 0% | 0% | 14% |
| Other | 12% | 9% | 6% | 15% |

Note: For this question, respondents were able to check all that apply so the percents will not equal 100. Library resources included here must have had at least 10% or more of respondents in at least one of the 4 categories.

Did you find the information you needed?

| | Overall (n=13,986) | Attending Physicians (n=5,069) | Residents (n=1,997) | Nurses (n=5,951) |
|---------------------------------------|-----------------------|--------------------------------------|------------------------|---------------------|
| Completely | 59% | 64% | 63% | 52% |
| Partially- time constraints | 21% | 15% | 19% | 27% |
| Partially – information incomplete | 16% | 16% | 14% | 16% |
| Partially- other reason | 4% | 4% | 3% | 4% |
| Not at all | 1% | 0% | 0% | 2% |

Access points used for all resources

| | Overall (n=14,544) | Attending physicians (n=5,230) | Residents (n=2,047) | Nurses (n=6,249) |
|--|-----------------------|--------------------------------------|------------------------|---------------------|
| On your institution's intranet | 52% | 48% | 61% | 53% |
| On your institution's library web site | 50% | 60% | 72% | 34% |
| Search engine such as Google | 37% | 38% | 39% | 35% |
| Personal/departmental subscription | 25% | 36% | 27% | 15% |
| In your institution's library | 19% | 21% | 26% | 14% |

Note: For this question, respondents were able to check all that apply so the percents will not equal 100. Access points included here must have had at least 10% or more of respondents in at least one of the 4 categories. Since institutions make online library resources available in different ways, options for both the library web site and the intranet were included in the survey.

Access points used for all resources (continued)

| | Overall (n=14,544) | Attending physicians (n=5,230) | Residents (n=2,047) | Nurses (n=6,249) |
|---|-----------------------|---------------------------------------|------------------------|---------------------|
| Via patient's electronic medical record | 18% | 18% | 16% | 17% |
| Mobile device | 16% | 20% | 31% | 8% |
| Asked librarian or library staff | 14% | 15% | 12% | 12% |
| Bookmarked website | 12% | 17% | 12% | 7% |
| Asked colleague | 9% | 7% | 7% | 12% |

Note: For this question, respondents were able to check all that apply so the percents will not equal 100. Access points included here must have had at least 10% or more of respondents in at least one of the 4 categories. Since institutions make online library resources available in different ways, options for both the library web site and the intranet were included in the survey.

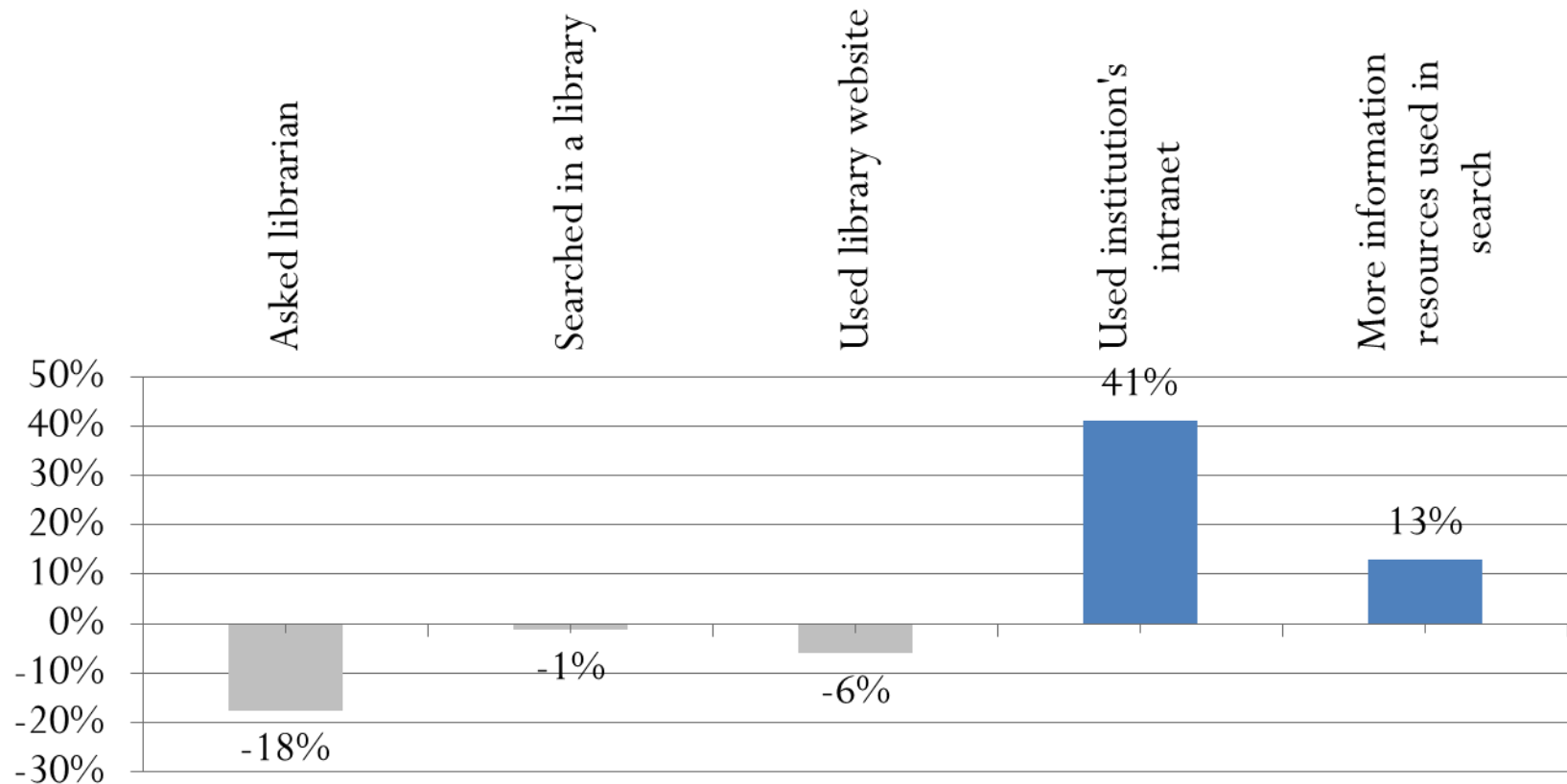
Multivariate Results

- We used multiple regression models to measure and test the effects of various independent variables on four outcome variables
 - Logistic Regression (categorical variables)
 - Whether one handled the situation differently.
 - Whether one changed the advice given to their patient.
 - *We present the results of logistic regression models in a bar chart format that shows relative magnitudes of the **odds** ratios (in the form of percents) for each of the variables in the models.
 - Ordinary Least Squares (OLS) Regression (continuous variables)
 - Time saved as a result of having the information obtained during the search.
 - Number of adverse events avoided.
 - Number of changes made in patient care.
 - *We also present the results of OLS regression models in a bar chart format that shows the relative magnitudes of **coefficients** for each of the variables in the models.

Outcome variables for nurses

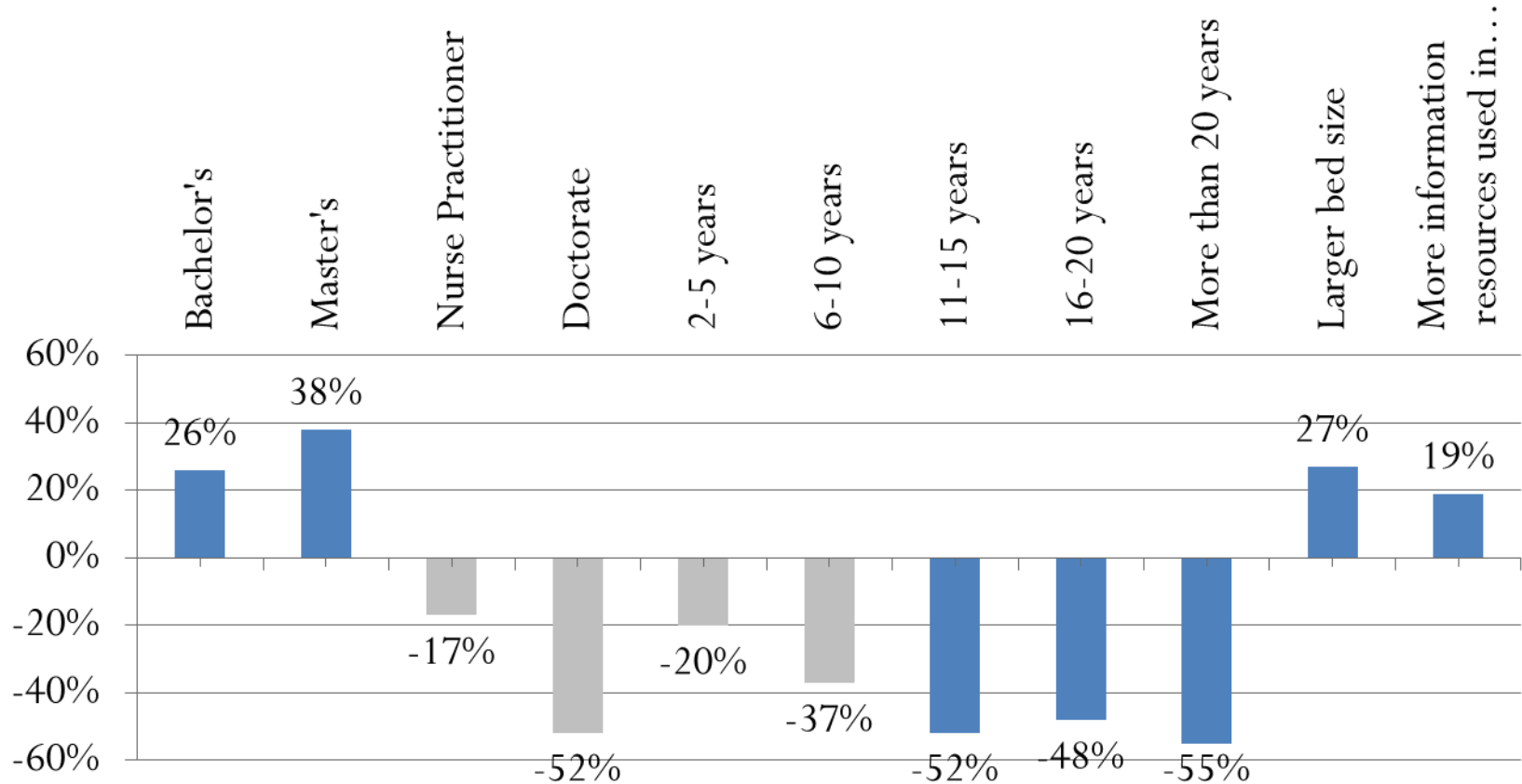
- Changed advice given to the patient
- Handled the patient care situation differently
- Time saved
- Number of adverse events avoided

Multivariate results: Nurses (Changed advice given to patient)



*Blue bars indicate statistically significant odds ratios. Gray bars are NOT statistically significant.

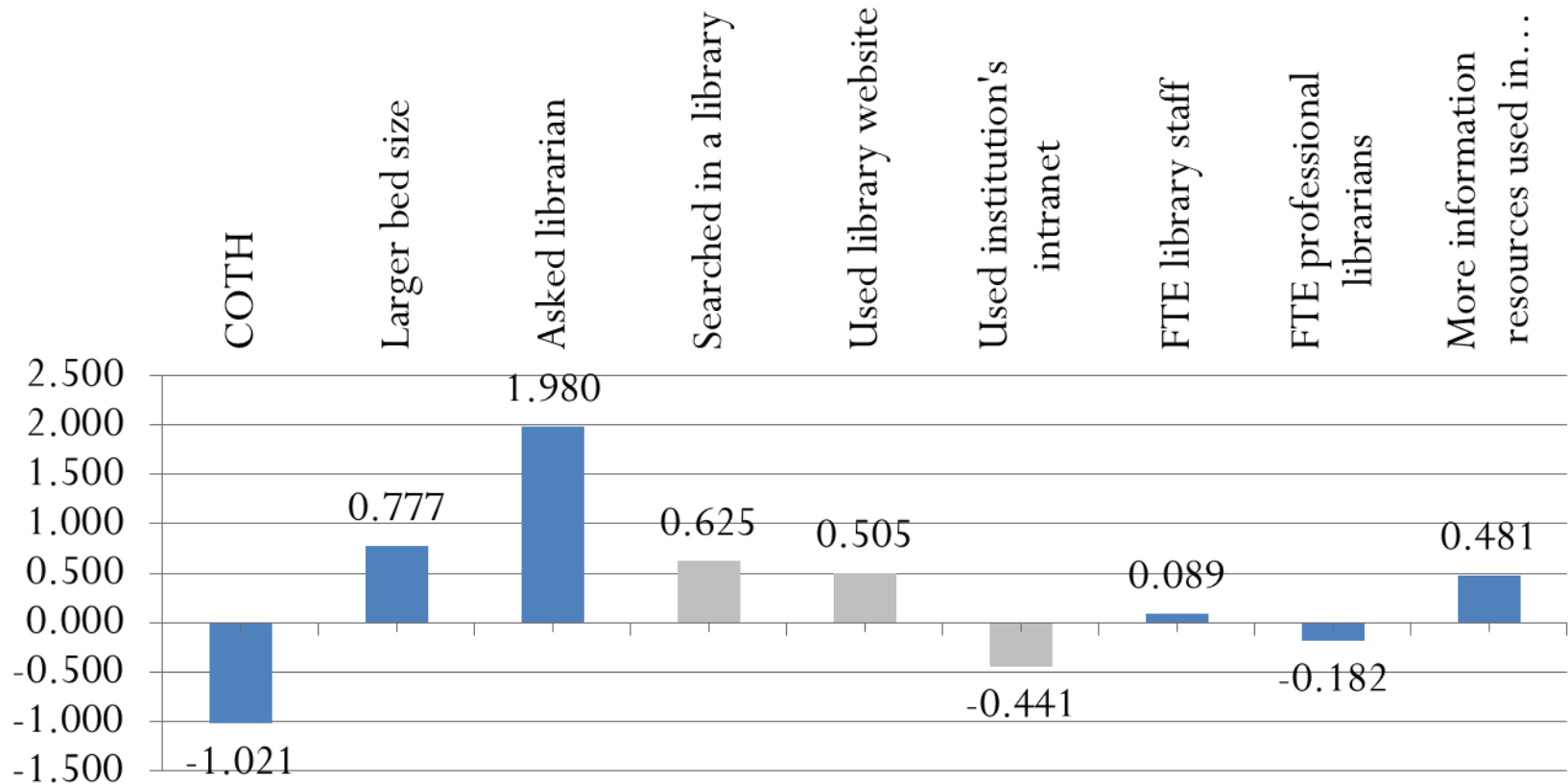
Multivariate results: Nurses (Handled situation differently model)



*Blue bars indicate statistically significant odds ratios. Gray bars are NOT statistically significant.

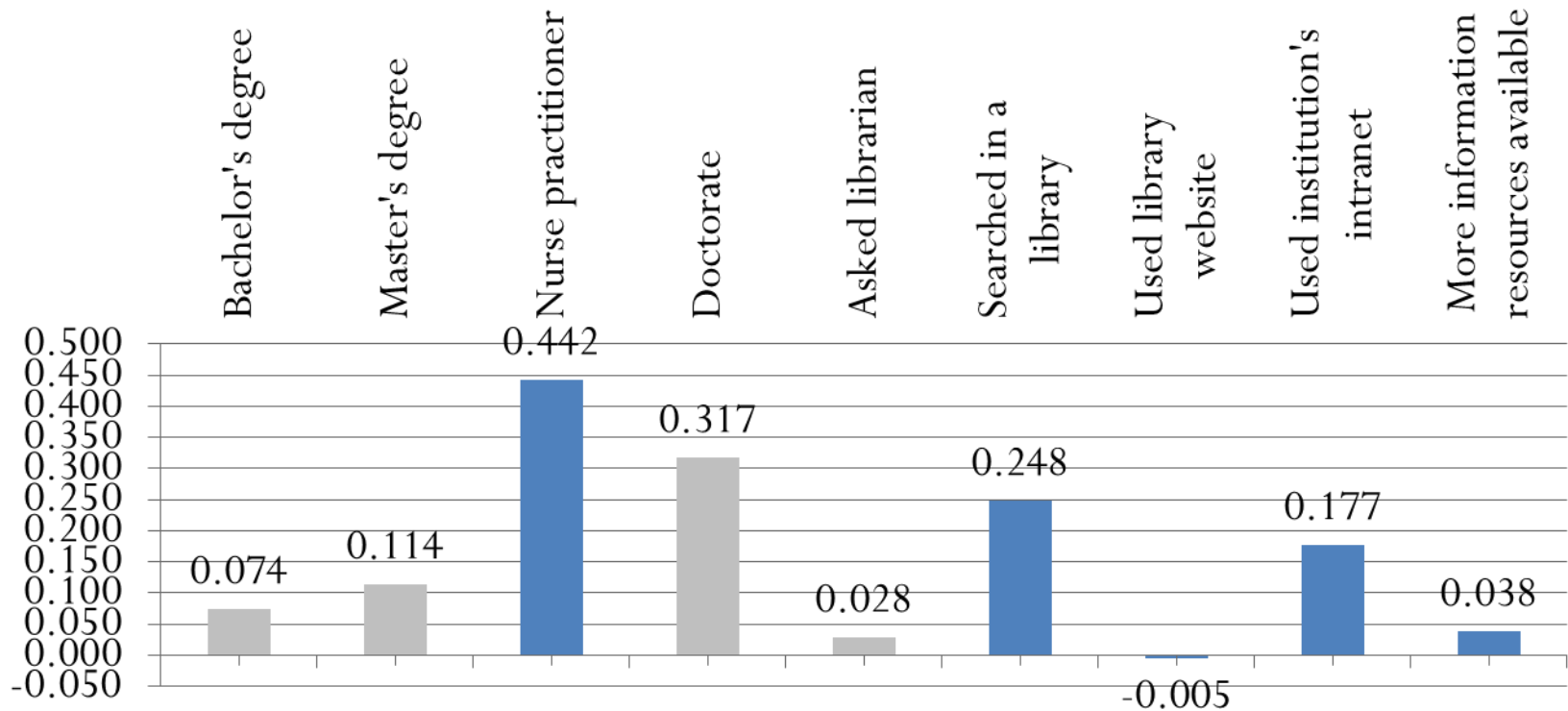
*Reference categories: Diploma or Associate's degree (Education), Less than 2 years (years as a healthcare professional)

Multivariate results: Nurses (Time saved model)



*Blue bars indicate statistically significant coefficients. Gray bars are NOT statistically significant.

Multivariate results: Nurses (Number of adverse events avoided model)



*Blue bars indicate statistically significant coefficients. Gray bars are NOT statistically significant.

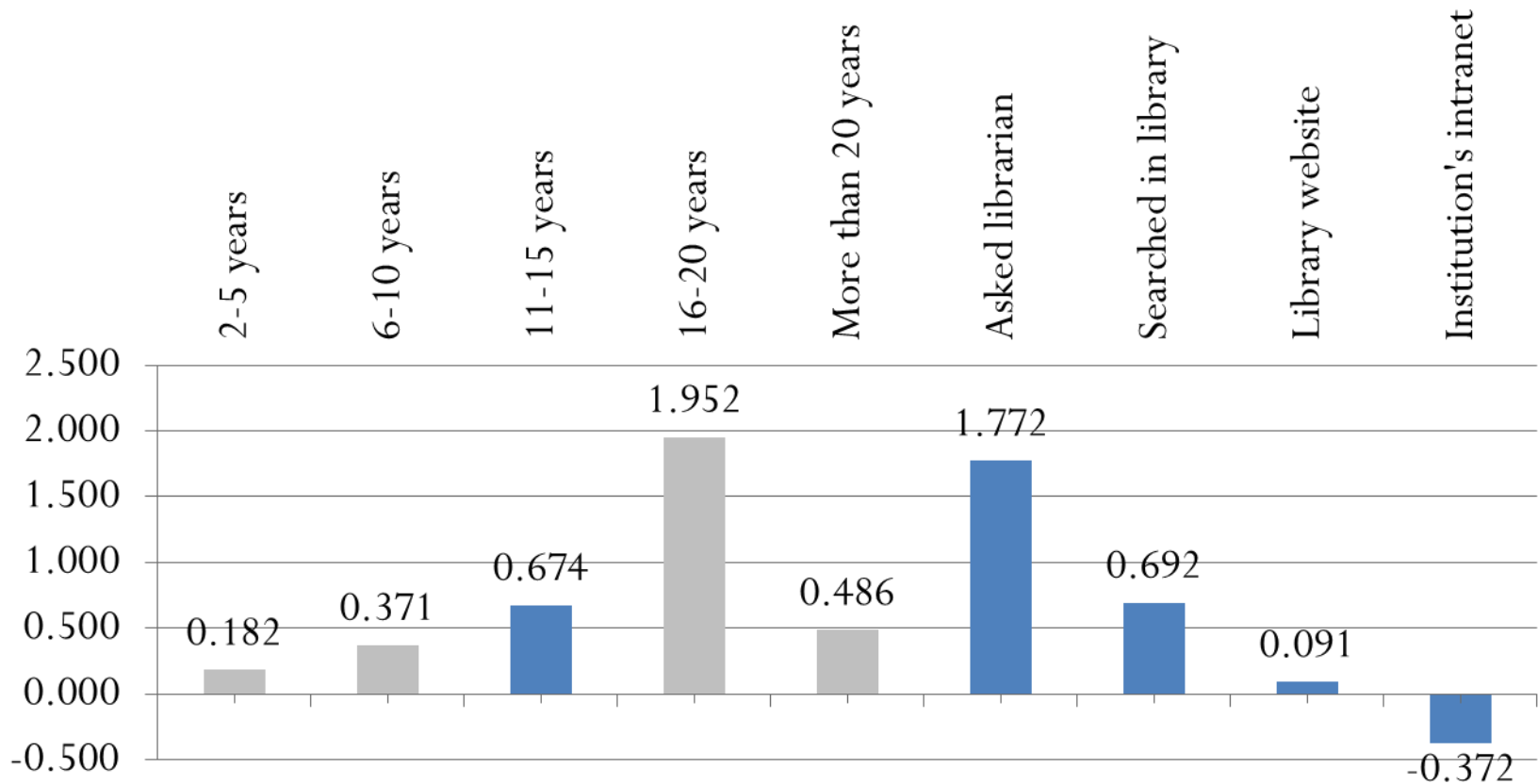
*Reference categorie(s): Diploma or Associate's degree (Education)

Outcome variables for physicians and residents

- Time saved
- Number of changes made to patient care
- Number of adverse events avoided

Multivariate Results: Physicians & Residents

(Time saved model)

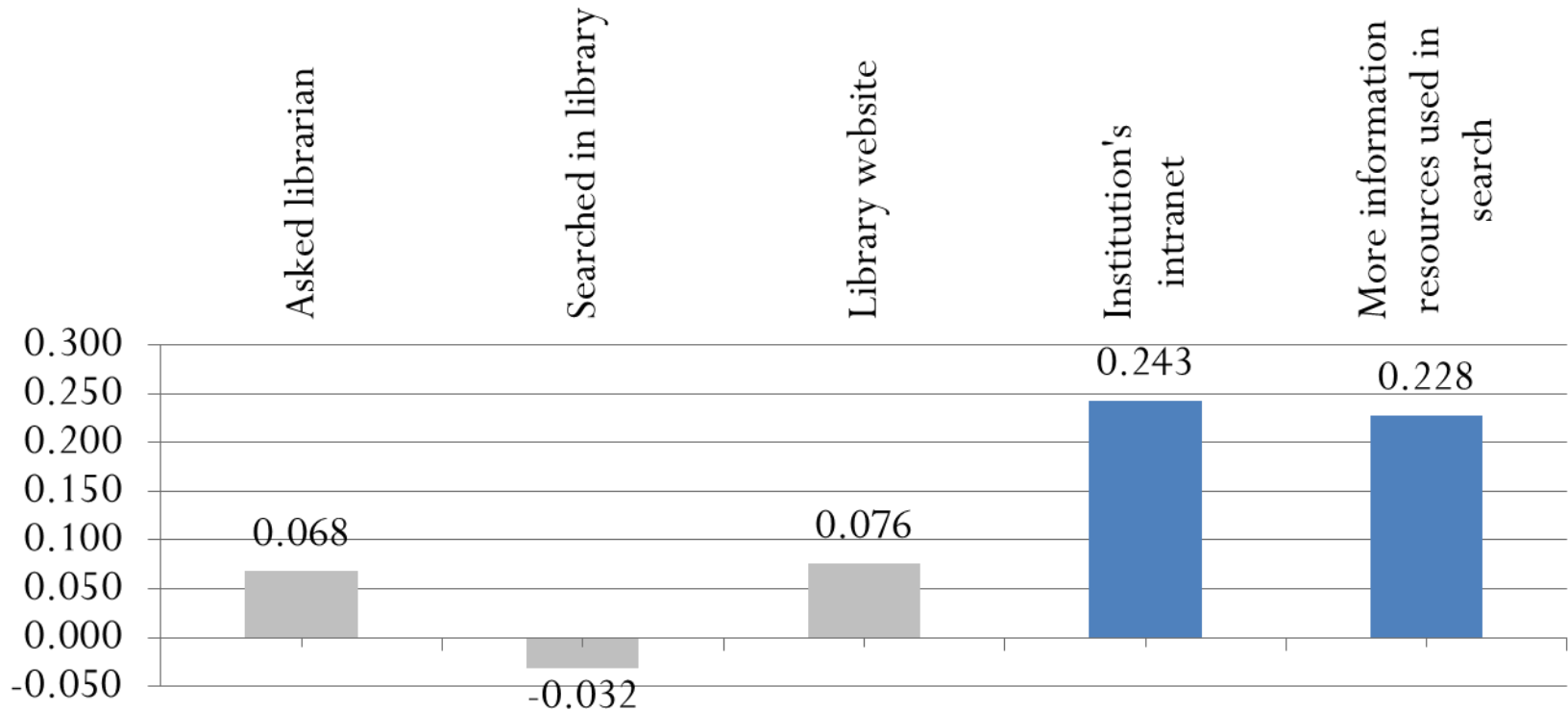


*Blue bars indicate statistically significant coefficients. Gray bars are NOT statistically significant.

*Reference categorie(s): Less than 2 years (years as a healthcare professional)

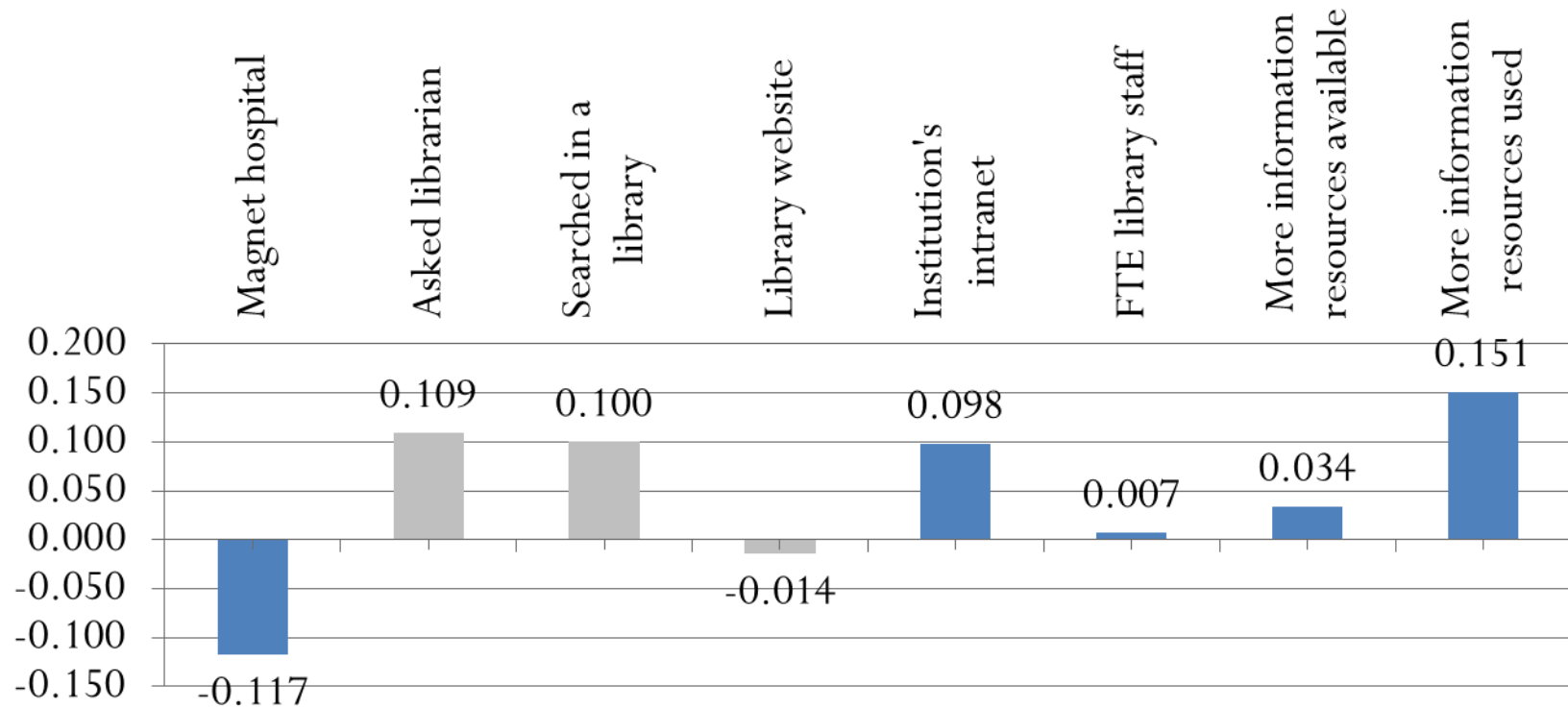
Multivariate Results: Physicians and Residents

(Number of changes made to patient care model)



*Blue bars indicate statistically significant coefficients. Gray bars are NOT statistically significant.

Multivariate Results: Physicians and Residents (Number of adverse events avoided model)



*Blue bars indicate statistically significant coefficients. Gray bars are NOT statistically significant.

Study contact and website

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- Study website: <http://nnlm.gov/mar/about/value.html>