InFOCUS

Data Visualization and Infographics

> "If you can't explain it simply, you don't understand it well enough."
>
> Albert Einstein

Data visualization translates complex ideas and concepts into a simple visual context. Patterns, trends, and relationships that might go undetected in text are conveyed at a glance in effective data visualization.
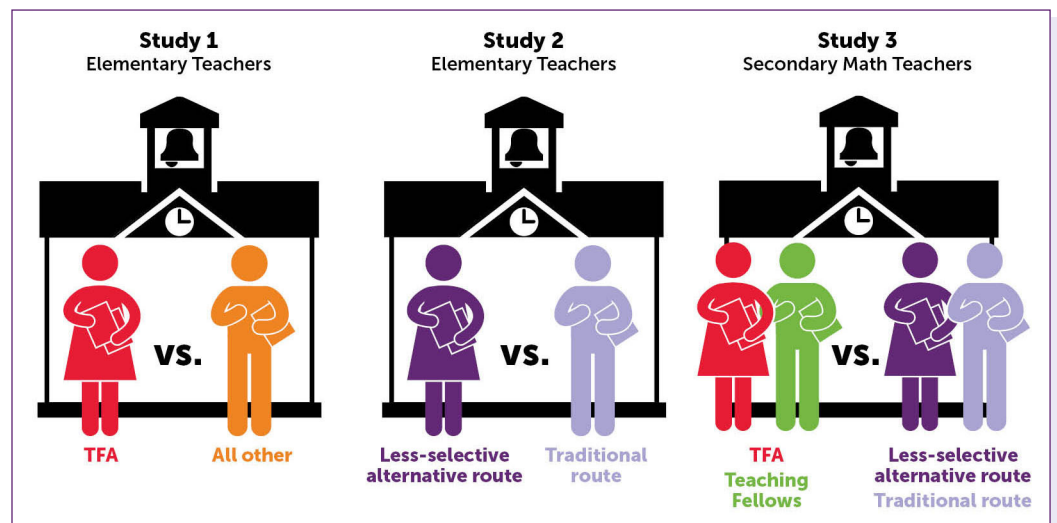
Mathematica is a leader in using effective data visualization and infographics to communicate research and policy findings. Our expanded and varied visual presentation of information is providing new insights and changing the way researchers, media outlets, and policymakers interact with data. Data visualization can be used at every stage of the research process: defining the context of a study, helping to collect and provide quality review, conducting data analysis, and communicating findings.
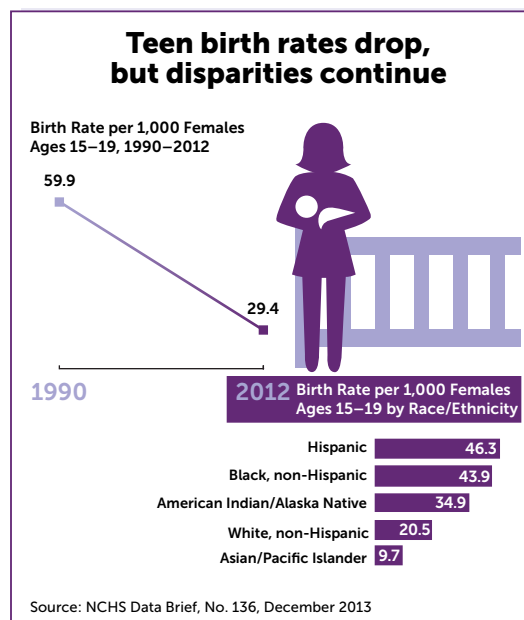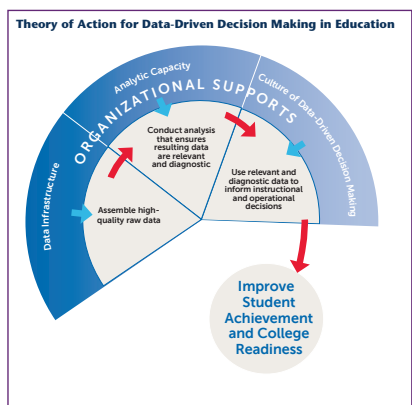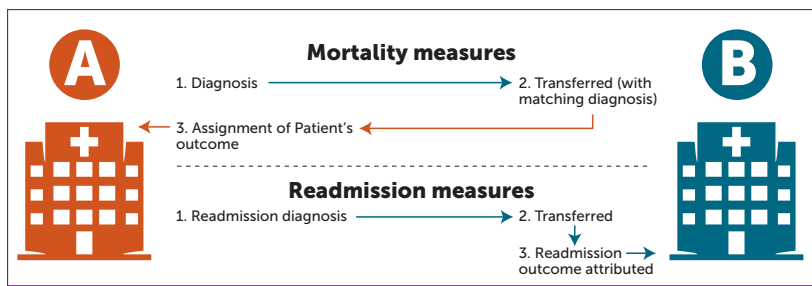
The following examples show the breadth and depth of our recent work.

INFOGRAPHICS

Infographics make a large amount of data more consumable, especially if the audience is new to the presented subject. Conceptually, they can describe relationships, make comparisons, or illustrate concepts related to time and lend themselves to telling a story through data and images.

Study 1
Elementary Teachers

TFA **vs.** All other

Study 2
Elementary Teachers

Less-selective alternative route **vs.** Traditional route

Study 3
Secondary Math Teachers

TFA
Teaching Fellows **vs.** Less-selective alternative route
Traditional route

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1

Mortality measures

A

1. Diagnosis → 2. Transferred (with matching diagnosis)

3. Assignment of Patient's outcome ←

B

Readmission measures

1. Readmission diagnosis → 2. Transferred

3. Readmission outcome attributed →

Theory of Action for Data-Driven Decision Making in Education

ORGANIZATIONAL SUPPORTS

Analytic Capacity · Culture of Data-Driven Decision Making

Data Infrastructure

Assemble high-quality raw data

Conduct analysis that ensures resulting data are relevant and diagnostic

Use relevant and diagnostic data to inform instructional and operational decisions

Improve Student Achievement and College Readiness

Teen birth rates drop, but disparities continue

Birth Rate per 1,000 Females Ages 15–19, 1990–2012

59.9

29.4

1990

2012

Birth Rate per 1,000 Females Ages 15–19 by Race/Ethnicity

Hispanic	46.3
Black, non-Hispanic	43.9
American Indian/Alaska Native	34.9
White, non-Hispanic	20.5
Asian/Pacific Islander	9.7

Source: NCHS Data Brief, No. 136, December 2013

What Works for Disadvantaged Adults

Reverse the decline in funding for the WIA Adult Program and other similar programs

Invest more per person

Invest in sectoral programs for in-demand occupations

What Works for Disadvantaged Youth

Intensive and **comprehensive** programs

Residential programs

Focusing on more mature youth

What to Try for Dislocated Workers

Programs with open entry

On-line programs that allow work while training

Sectoral programs

Targeting those with a positive return on the investment in training

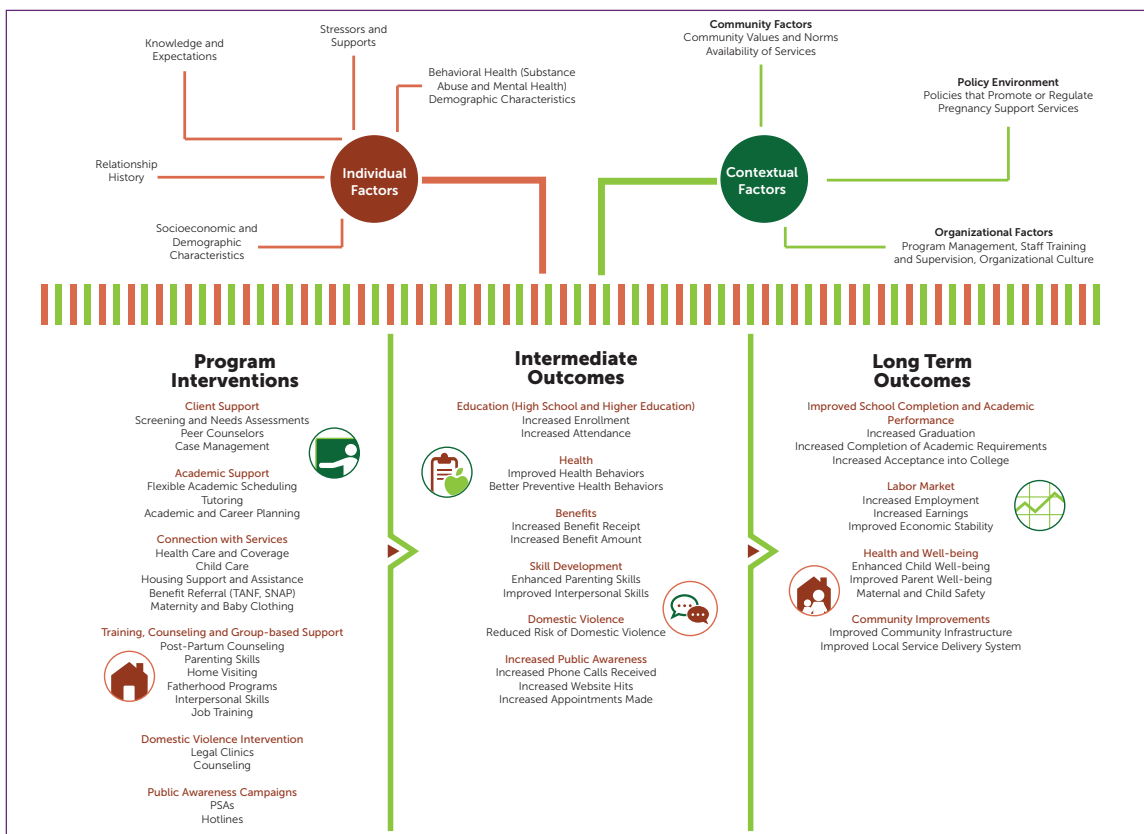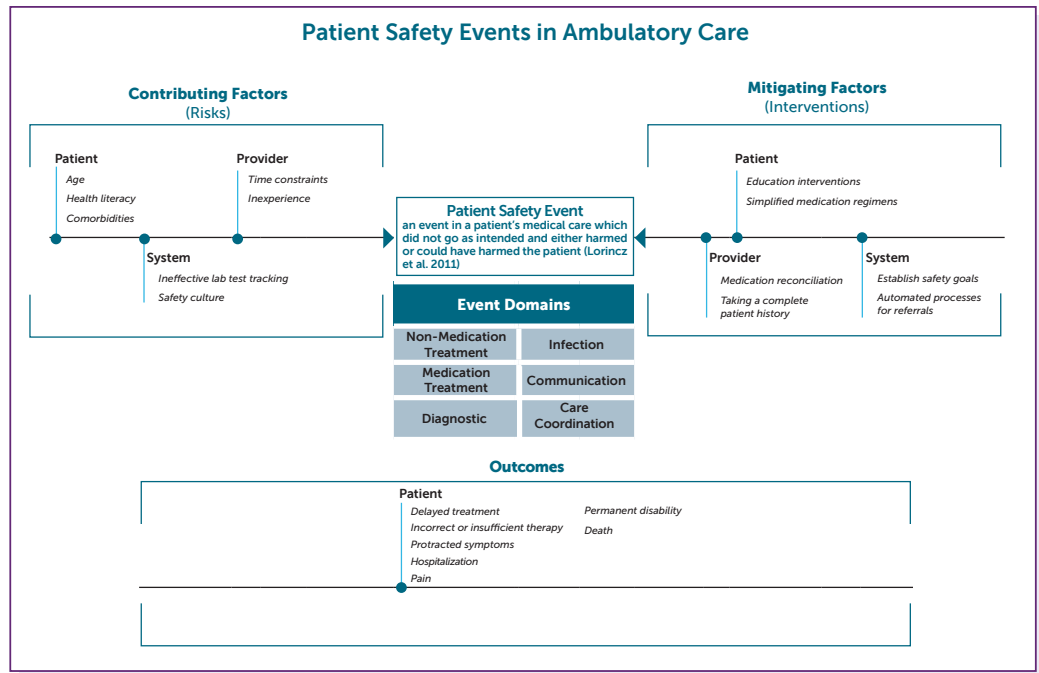**Modular programs that allow workers to customize training**

LOGIC MODELS AND FLOWCHARTS

Like a road map, a logic model shows the route traveled (or steps taken) to reach a destination, i.e., it presents a picture of how an effort or initiative is supposed to work. However, it does not need to be linear. A good model shows at a glance how each activity will lead to desired changes, or sketches out the chosen routes and how far you will go.

Patient Safety Events in Ambulatory Care

Contributing Factors (Risks)

Patient
- Age
- Health literacy
- Comorbidities

Provider
- Time constraints
- Inexperience

System
- Ineffective lab test tracking
- Safety culture

Patient Safety Event
an event in a patient's medical care which did not go as intended and either harmed or could have harmed the patient (Lorincz et al. 2011)

Mitigating Factors (Interventions)

Patient
- Education interventions
- Simplified medication regimens

Provider
- Medication reconciliation
- Taking a complete patient history

System
- Establish safety goals
- Automated processes for referrals

Event Domains

Non-Medication Treatment	Infection
Medication Treatment	Communication
Diagnostic	Care Coordination

Outcomes

Patient
- Delayed treatment
- Incorrect or insufficient therapy
- Protracted symptoms
- Hospitalization
- Pain
- Permanent disability
- Death

Individual Factors
- Knowledge and Expectations
- Stressors and Supports
- Behavioral Health (Substance Abuse and Mental Health)
- Demographic Characteristics
- Relationship History
- Socioeconomic and Demographic Characteristics

Contextual Factors
- Community Factors: Community Values and Norms, Availability of Services
- Policy Environment: Policies that Promote or Regulate Pregnancy Support Services
- Organizational Factors: Program Management, Staff Training and Supervision, Organizational Culture

Program Interventions

Client Support
Screening and Needs Assessments
Peer Counselors
Case Management

Academic Support
Flexible Academic Scheduling
Tutoring
Academic and Career Planning

Connection with Services
Health Care and Coverage
Child Care
Housing Support and Assistance
Benefit Referral (TANF, SNAP)
Maternity and Baby Clothing

Training, Counseling and Group-based Support
Post-Partum Counseling
Parenting Skills
Home Visiting
Fatherhood Programs
Interpersonal Skills
Job Training

Domestic Violence Intervention
Legal Clinics
Counseling

Public Awareness Campaigns
PSAs
Hotlines

Intermediate Outcomes

Education (High School and Higher Education)
Increased Enrollment
Increased Attendance

Health
Improved Health Behaviors
Better Preventive Health Behaviors

Benefits
Increased Benefit Receipt
Increased Benefit Amount

Skill Development
Enhanced Parenting Skills
Improved Interpersonal Skills

Domestic Violence
Reduced Risk of Domestic Violence

Increased Public Awareness
Increased Phone Calls Received
Increased Website Hits
Increased Appointments Made

Long Term Outcomes

Improved School Completion and Academic Performance
Increased Graduation
Increased Completion of Academic Requirements
Increased Acceptance into College

Labor Market
Increased Employment
Increased Earnings
Improved Economic Stability

Health and Well-being
Enhanced Child Well-being
Improved Parent Well-being
Maternal and Child Safety

Community Improvements
Improved Community Infrastructure
Improved Local Service Delivery System

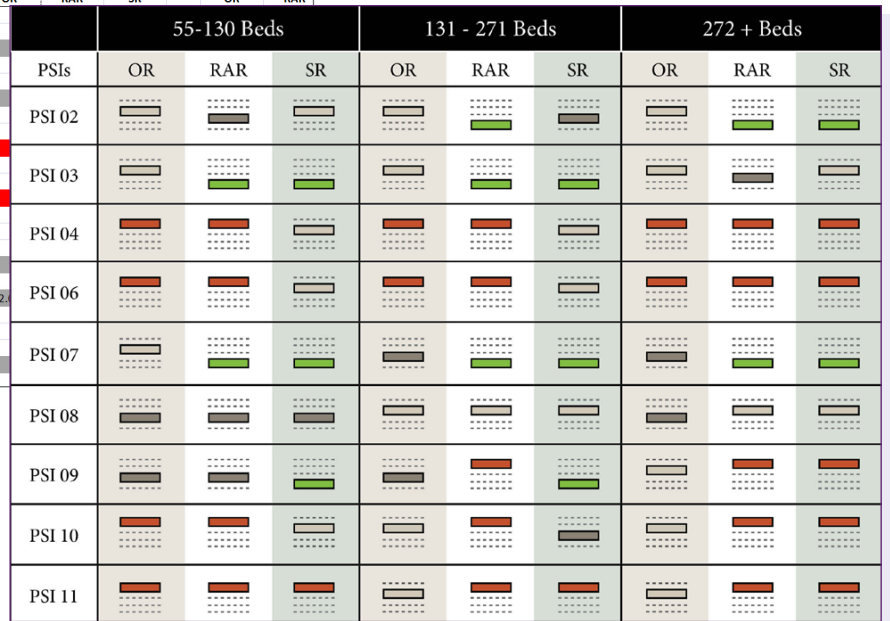## DATA VISUALIZATION: BEFORE AND AFTERS

Data visualizations are conducive to exploration and help the viewer create a story on their own. The narrative may provide context, but the visualization (whether static or interactive) does not. It is a more objective presentation than an infographic and used when the audience is familiar with the data to place the data in context and provide clarity. Here are some before and after examples of our work.

BEFORE

AFTER

The example above provides an easy visual snapshot of over 45 measures to show whether rates are significantly higher or lower by hospital size.

BEFORE

AFTER

The example above translates Excel data into a national picture.

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