Connecting The Dots From Data To Value

Building Your Business Case in a Value-Based Market

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Deloitte Consulting
Your World Is At Risk

The Urgent Need to Embrace Innovation
Industry Transformation In Progress

<table>
<thead>
<tr>
<th>Stage</th>
<th>Time</th>
<th>Providers</th>
<th>Revenue ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fragmentation</td>
<td>7-10 years</td>
<td>15,000</td>
<td>260B</td>
</tr>
<tr>
<td>Shakeout</td>
<td></td>
<td>6,000+</td>
<td>370B</td>
</tr>
<tr>
<td>Maturity</td>
<td></td>
<td>6,000+</td>
<td>370B</td>
</tr>
<tr>
<td>Decline</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Your Business Is At Risk For Digital Disruption

FIGURE 1

MOST FACE DIGITAL MARKET DISRUPTIONS
Percentage rating how susceptible their organization is to market disruption in the next three years from a new competitor based on their use of insight, data, or analytics.

(Scale of 1-10)

29%
EXTREMELY SUSCEPTIBLE (8–10)

43%
MODERATELY SUSCEPTIBLE (5–7)

27%
NOT AT ALL SUSCEPTIBLE (1–4)

1%
DON’T KNOW

SOURCE: HARVARD BUSINESS REVIEW ANALYTIC SERVICES SURVEY, JUNE 2016

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60%+ of Healthcare Organizations Expect Their Business To Be Disrupted By Digital Technology

Base: 412 global executives in companies with 250 or more employees (Respondents may be counted in multiple industry groups)
Source: Forrester/Odgers Berndtson Q3 2015 Global Digital Business Online Survey
Digital Innovation Can Better Prepare You For Change

FIGURE 3
DIGITAL INNOVATORS DETECT AND RESPOND MORE QUICKLY TO MARKET CHANGE
Percentage indicating how much they agree/disagree with the following statement:
“We are able to detect and respond quickly to changing conditions in our markets.”

<table>
<thead>
<tr>
<th></th>
<th>Digital Innovators</th>
<th>Analogous</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly agree</td>
<td>41</td>
<td>5</td>
</tr>
<tr>
<td>Slightly agree</td>
<td>44</td>
<td>18</td>
</tr>
<tr>
<td>Neither agree nor disagree</td>
<td>9</td>
<td>19</td>
</tr>
<tr>
<td>Slightly disagree</td>
<td>45</td>
<td>5</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>0</td>
<td>13</td>
</tr>
<tr>
<td>Don’t know</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

SOURCE: HARVARD BUSINESS REVIEW ANALYTIC SERVICES SURVEY, JUNE 2016

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Digital Transformation

*Digital transformation is the profound and accelerating transformation of business activities, processes, competencies and models to fully leverage the changes and opportunities of digital technologies and their impact across society in a strategic and prioritized way, with present and future shifts in mind.*
Digital Transformation Framework

VISION
Create a compelling vision that will allow everyone to reimagine your organization as a technology focused, data driven startup.

TACTICS
- Cloud Infrastructure
- Data Systems
- Mobility
- Tele Health
- Data Analytics
- IoT

Customer Experience
- Help customers to get to their desired outcomes
- Digitize end to end customer experience
- Provide better, faster, cost effective customer experience
Meet today’s health care consumer

Trends in consumer engagement from the Deloitte Center for Health Solutions 2015 Survey of US Health Care Consumers

Consumer engagement is increasing in three important areas
Partnering with providers: More consumers report wanting to partner with doctors

More consumers today (48% of consumers surveyed) prefer to partner with doctors instead of relying passively on them to make treatment decisions.

48% in 2012

40% in 2008
Tapping online resources: Consumer use and trust in the reliability of information sources is trending upward

52% of survey respondents report searching online for health- or care-related information.

Online research is highest among Millennials, higher-income groups, and those who have coverage through public health insurance exchanges.

Consumers trust physicians the most for reliable information about treatment options, but their trust in pharmacies, health plans, and life sciences companies is increasing.

Chart shows growth from 2012 to 2015:
- Physicians: 49% (up from 44%)
- Pharmacies: 32% (up from 27%)
- Health plans: 21% (up from 14%)
- Life sciences companies: 18% (up from 12%)

Among Millennials who received care, scorecard use grew from 31% in 2013 to 49% in 2015.

25% of consumers surveyed say they have looked at a scorecard to compare the performance of doctors, hospitals, or health plans—up from 19% in 2013.

37% of Millennials surveyed report using social media for health purposes—up from 28% in 2013.

22% of consumers surveyed report using technology to access, store, or transmit personal data or medical records—up from 13% in 2013.
Relying on technology: Consumer use of technology to measure fitness, monitor health problems, and stick to treatment is on the rise

63% of technology users surveyed (70% of users with major chronic conditions) say that utilizing health technologies has had a significant impact on their behavior.

Only 40% of technology users surveyed (62% of users with major chronic conditions) have shared their fitness or monitoring data with their doctor.

Consumer use of technology to measure fitness and health improvement goals has grown to 28% — up from 17% in 2013.

With Millennial use at 45%.

Tech-based monitoring among consumers with major chronic conditions has nearly doubled in the last two years — from 22% to 39%.

Use of electronic treatment alerts or reminders is increasing quickly among Millennial prescription medication users (14% in 2013 to 29% in 2015), more gradually among users overall (9% in 2013 to 13% in 2015).

21% of consumers surveyed say they have communicated with a provider using secure messaging, texting, or email.

72% are interested in doing so.

What Behavioral Health Customers Want…
Consumer Driven, Recovery Oriented MH System

Key Components of Recovery
- Resilience
- Respect
- Self-determination
- Choices
- Perseverance
- Access
- Peer Support
- Hope and Encouragement
- Acceptance
- Socialization
- Service
- Goal Orientation

Recovery is Not
- Stabilization of symptoms
- Temporary absence of symptoms
- Staying out of the hospital
- Absence of symptoms
- That serious symptoms will not return
- Watching TV all day
- Sitting on the porch smoking cigarettes all day
- Seclusion in your own home

What Consumers Want
- A job
- A home of their own
- A social life
- To contribute to society
End To End Transformation Of Consumer Experience

Traditional Model

Inquiry

Phone Call

Service Delivery

Face to Face
Tele Health

Outcomes

Subjective feedback loop

Discharge

Digital Model

Phone Call

Better Website
Online Chat
FAQs
Online admission

Face to Face
Tele Health

Online scheduling
On demand services
Increased tele health
Self help videos

Subjective feedback loop

Constant feedback loop
through evidence based,
measurable outcome tools

Discharge

Robust online alumni
community.
IoT

Gain an understanding of the “Internet of Things” (IoT) and its role in collecting and deciphering automated data.
What is the Internet of Things (IoT)?

- A) A way to describe the proliferation of the Internet
- B) FitBits and iPhones and Alexas and Nests and Garmins and Roombas and...
- C) What those Terminator movies were about
- D) Something else (or all of the above?)
What is the Internet of Things (IoT)?
Internet Ecosystem

Consumer
- Consume Information

IoT
- Create Data

Internet
- Translate & Distribute Data

Estimated 2020 Proliferation
- 26B Units
- 30x Increase from 2009
- 7.3B Units

Source: http://www.gartner.com/newsroom/id/2636073
Internet of Things refers to a world of intelligent, connected devices generating data for use in new services, where the intelligent devices generate actionable insights or triggers based on input stimuli.

Internet of Things (IoT) combines things, processes and people with relevant data.

- **THINGS**: Physical devices and objects intelligently connected.
- **PROCESS**: Delivery of the right information to the right place at the right time.
- **PEOPLE**: Connection of people in more relevant and valuable ways.
- **ANALYTICS**: Individual data streams are processed and analyzed with algorithms.
The IoT and Data Collection

Active
- Manual
- Sporadic

Passive
- Automatic
- Continuous

Wearables
- Blood Sampling
- External
- Epidermal
- Ingestible
- Tissue-Embedded

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How does this actually work?
# Sample IoT Use Cases

<table>
<thead>
<tr>
<th>Scenario nickname</th>
<th>Scenario full description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall detection (self)</td>
<td>You are an older adult who is at risk for falls because of a medical condition. You could wear a sensor that can detect if you have fallen and can notify a caregiver or your health care provider.</td>
</tr>
<tr>
<td>Location-tracking (caregiver)</td>
<td>You are a caregiver for a family member or loved one who has a risk of wandering off and getting lost. That person could wear a sensor to track their GPS location and notify you of their location if the individual is lost.</td>
</tr>
<tr>
<td>Heart attack prevention (self)</td>
<td>You are a healthy, active adult but have a family history of heart disease. You could wear a sensor the size of a paper clip in one of your arteries that would warn you when you are at risk of a heart attack or a stroke.</td>
</tr>
<tr>
<td>Fall detection (caregiver)</td>
<td>You are a caregiver for a family member or loved one who has dementia, and is at risk for falls. That individual could wear a sensor that could notify you if the individual has fallen.</td>
</tr>
<tr>
<td>Device/knee replacement (self)</td>
<td>You have had knee replacement surgery and the doctor gave you the option to place a sensor in the artificial knee. This sensor could notify your doctor if your device (knee replacement) is not working properly.</td>
</tr>
<tr>
<td>Chronic disease monitoring (self)</td>
<td>You have a chronic disease such as diabetes, and have equipment in your home that can report your vital signs back to your health care provider for monitoring. Your doctor can use your vital signs, such as blood pressure or blood glucose to monitor your health and medicines.</td>
</tr>
</tbody>
</table>
Beyond the Episode

• Using large volumes of behavioral data to better understand the workings of groups and networks is the domain of an emerging, interdisciplinary field known as computational social science (CSS).

• Computational social scientist Nicholas Christakis summarizes the perspective that motivates much CSS research: “If you had asked social scientists even 20 years ago what powers they dreamed of having, they would have said, ‘It would be unbelievable if we could have this little tiny Black Hawk helicopter that could be microscopic, fly on top of you, and monitor where you are and who you’re talking to, what you’re buying, what you’re thinking, and if it could do this in real time, all the time, for millions of people, all at the same time. If we could collect all these data, that would be amazing.’”
"What if something happens?" vs. "What if something is going to happen?"

• Smart sensor networks can provide remote caregivers real-time insight into the health and well-being of seniors aging in place.

• Sensor-enabled homes can use machine learning to recognize behavior patterns such as eating, sleeping, and movement, and identify and report any signs of illness or cognitive degeneration to caretakers and physicians.

• By some estimates, states can save an average of $9 million per day in health care costs by making it possible for just 10 percent of the elderly population to remain in their homes for an additional one to two years.\(^6\)

Internet of (Some) Things

• A leading health system launched a pilot for >40,000 diabetic patients’ glucose readings, streaming from a monitoring device to a mobile app on their phone or tablet, and then to an integrated big data repository.

• Care coordinators were alerted to unusual changes in the patient’s glucose levels so they could take appropriate action, such as bringing the patient into the hospital for closer examination or adjusting their medications.

• Start small

• Show viability

• Prove value
Evidence Based Clinical Tools

Review several clinical tools that can be used to build and demonstrate data value.
A National Call for Measurement-Based Care in the Delivery of Behavioral Health Services

All primary care and behavioral health providers treating mental health and substance use disorders should implement a system of measurement-based care whereby validated symptom rating scales are completed by patients and reviewed by clinicians during encounters. Measurement-based care will help providers determine whether the treatment is working and facilitate treatment adjustments, consultations, or referrals for higher intensity services.

- Kennedy Forum

BH Outcome Measures

Table 1: Adult Symptom Rating Scales for Core Outcome Measures

<table>
<thead>
<tr>
<th>MEASURE</th>
<th>DOMAIN</th>
<th># OF ITEMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHQ-9</td>
<td>Depression</td>
<td>9</td>
</tr>
<tr>
<td>Altman Scale</td>
<td>Mania</td>
<td>5</td>
</tr>
<tr>
<td>GAD-7</td>
<td>Anxiety</td>
<td>7</td>
</tr>
<tr>
<td>PCL</td>
<td>PTSD</td>
<td>20</td>
</tr>
<tr>
<td>PDSS_SR</td>
<td>Panic attacks</td>
<td>7</td>
</tr>
<tr>
<td>Audit-C</td>
<td>Alcohol</td>
<td>3</td>
</tr>
<tr>
<td>DAST-10</td>
<td>Drug abuse</td>
<td>10</td>
</tr>
<tr>
<td>PHQ-15</td>
<td>Somatization</td>
<td>15</td>
</tr>
</tbody>
</table>

BH Outcome Measures

Table 2: Adult Multi-Diagnostic Substance Abuse Outcomes Measurement

<table>
<thead>
<tr>
<th>MEASURE</th>
<th>DOMAIN</th>
<th># OF ITEMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Substance Abuse Outcomes Module</td>
<td>Substance abuse</td>
<td>22</td>
</tr>
<tr>
<td>Brief Addiction Monitor (BAM)</td>
<td>Substance abuse</td>
<td>17</td>
</tr>
</tbody>
</table>
## BH Outcome Measures

### Table 3: Additional Adult Functional Status Rating Scales for Core Outcome Measures*

<table>
<thead>
<tr>
<th>MEASURE</th>
<th>DOMAIN</th>
<th># OF ITEMS</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Functional Outcomes Survey 20-Item Short Form</td>
<td>General medical and mental functional status</td>
<td>20</td>
<td>Scoring is relatively complex. Similar to the SF-36 and SF-12™</td>
</tr>
<tr>
<td>Daily Living Activities (DLA-20)</td>
<td>Functional outcomes</td>
<td>20</td>
<td>National Council for Behavioral Health</td>
</tr>
<tr>
<td>WHO Disability Assessment Schedule 2.0</td>
<td>Covars (6) domains of functioning (cognition, mobility, self-care, getting along, life activities, participation)</td>
<td>12- and 36-item version</td>
<td></td>
</tr>
</tbody>
</table>

*Note: These measures need to be administered on a frequent basis to assure their usefulness as a clinical support tool.

BH Outcome Measures

### Table 4: Child & Adolescent Rating Scales for Core Outcome Measures

<table>
<thead>
<tr>
<th>MEASURE</th>
<th>DOMAIN</th>
<th>AGE VALIDATED AND # OF ITEMS</th>
<th>COMPLETED BY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pediatric Symptom Checklist (PSC)</td>
<td>Psychosocial dysfunction</td>
<td>35</td>
<td>Clinician</td>
</tr>
<tr>
<td>Modified Checklist for Autism in Toddlers (MCHAT)</td>
<td>Autism spectrum disorders</td>
<td>23</td>
<td>Clinician</td>
</tr>
<tr>
<td>CRAFFT</td>
<td>Substance abuse</td>
<td>9</td>
<td>Clinician</td>
</tr>
<tr>
<td>Mood and Feelings Questionnaire (MFQ)</td>
<td>Depression, dysthymia</td>
<td>7-17 yrs, long form (50 items) and short form (13 items)</td>
<td>Parent and youth</td>
</tr>
<tr>
<td>Patient Health Questionnaire Adolescent (PHQ-A)</td>
<td>Depression, dysthymia</td>
<td>12 - 19 yrs (9 items)</td>
<td>Youth</td>
</tr>
<tr>
<td>Vanderbilt ADHD Rating Scale-Parent</td>
<td>ADHD, scored for ADHD subscales, ODD, and conduct disorder, performance</td>
<td>9-17 yrs (50 items)</td>
<td>Parent</td>
</tr>
<tr>
<td>Vanderbilt ADHD Rating Scale-Teacher</td>
<td>As above</td>
<td>6-17 yrs (43 items)</td>
<td>Teacher</td>
</tr>
</tbody>
</table>
How Our Eyes Think

Thinking like a designer
How Our Eyes Think
Improving Design Through Understanding

Sensory Memory 1-3 Sec
Short Term Memory 15-30 Sec
Long Term Memory 1 sec - Lifetime
Preattentive Attributes Of Visual Perception

Form
- Length
- Width
- Orientation
- Size
- Shape
- Curvature
- Enclosure
- Blur

Color
- Hue
- Intensity

Position
- 2-D position
- Spatial Grouping

Motion
- Direction of Motion
Count The Number of “8”

<table>
<thead>
<tr>
<th>5 9 7 3 6 2 1 3 6 8 1 2 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 7 9 3 6 2 6 5 3 0 7 1 1</td>
</tr>
<tr>
<td>8 7 3 0 8 3 8 4 8 0 7 4 0</td>
</tr>
<tr>
<td>3 7 9 0 9 4 8 4 9 3 0 4 9</td>
</tr>
</tbody>
</table>

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Count The Number of “8”

5 9 7 3 6 2 1 3 6 8 1 2 5
1 7 9 3 6 2 6 5 3 0 7 1 1
8 7 3 0 8 3 8 4 8 0 7 4 0
3 7 9 0 9 4 8 4 9 3 0 4 9

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Where Are Your Eyes Drawn?
Where Are Your Eyes Drawn?
Applying Lessons From Visual Perception

Table 2: Percentage of Consumers With Co-Morbid Conditions

<table>
<thead>
<tr>
<th>Condition</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diabetes</td>
<td>46%</td>
</tr>
<tr>
<td>Tobacco Use</td>
<td>39%</td>
</tr>
<tr>
<td>Heart Disease</td>
<td>37%</td>
</tr>
<tr>
<td>COPD</td>
<td>24%</td>
</tr>
<tr>
<td>Heart Disease</td>
<td>16%</td>
</tr>
<tr>
<td>Cancer</td>
<td>11%</td>
</tr>
</tbody>
</table>

Co-Occurring Conditions For Clients With Psychiatric Diagnosis:

- Diabetes: 26.6%
- Tobacco Use: 22.5%
- Heart Disease: 21.4%
- COPD: 9.2%
- Cancer: 13.9%
Applying Lessons From Visual Perception

Percentage of Consumers With Co-Morbid Conditions

- Cancer: 11%
- Heart Disease: 16%
- COPD: 24%
- Heart Disease: 37%
- Tobacco Use: 39%
- Diabetes: 46%

- Easier to read and see a logical order
- Natural focus on the last row
- Reader loses interest in other rows
Applying Lessons From Visual Perception

Percentage of Consumers With Co-Morbid Conditions

- Diabetes: 46%
- Tobacco Use: 39%
- Heart Disease: 37%
- COPD: 24%
- Heart Disease: 16%
- Cancer: 11%
Design Principles

The Fundamental Principles of Analytical Design – Edward Tufte
Fundamental Principles of Analytical Design – Edward Tufte

1. Comparisons
2. Causality, Mechanism, Structure, Explanation
3. Multivariate Analysis
4. Integration of Evidence
5. Documentation
6. Content, counts most of all

Paris, 20 November 1869

The number of men present at any given time is represented by the width of the grey line; one mm. indicates ten thousand men. Figures are also written beside the lines. Grey designates men moving into Russia; black, those leaving. Sources for the data are the works of messrs. Thierry, Segur, Fenezide, Chambrey and the unpublished diary of Jacobi, who became an Army Pharmacist on 28 October. In order to visualize the army's losses more clearly, I have drawn this as if the units under prince Jerome and Marshal Duroc (temporarily separated from the main body to go to Minsk and Miklow, which then joined up with the main army again), had stayed with the army throughout.

Figure 58. Minard's map of Napoleon's Russian campaign.
This graphic has been translated from French to English and modified to most effectively display the temperature data.
Principle 1: Comparisons

“Visual display, if they are to assist thinking, should show comparisons.”
Principle 1: Comparisons

Illustrates size of the grand army along the army’s path

Illustrates size of the grand army returning from Moscow
Applying Principle 1

Values represent a comparison of ER visits after pilot program.
Principle 2: Causality, Mechanism, Structure, Explanation

Principles of design should attend to the fundamental intellectual tasks in the analysis of evidence; thus we have the Second Principle for the analysis and presentation of data:
Principle 2: Causality, Mechanism, Structure, Explanation

1 Graph of temperatures suggesting relationship between the size of the returning army and frigid temperatures
Applying Principle 2

Impact of Integrated Care Program

- # Primary Care Physicians
- # ER Visits

Period:
- Q1-2014
- Q2-2014
- Q3-2014
- Q4-2014
- Q1-2015
- Q2-2015
- Q3-2015
- Q4-2015
- Q1-2016
- Q2-2016
- Q3-2016
- Q4-2016
Principle 3: Multivariate Analysis

Multiple dimensions/variables displayed in the illustration
Applying Principle 3
Principle 4: Integration of Evidence
Applying Principle 4

Impact of Integrated Care Program

- $260K in savings

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Paris, 20 November 1869

The number of men present at any given time is represented by the width of the grey line; one mm. indicates ten thousand men. Figures are also written besides the lines. Grey designates men moving into Russia; black, for those leaving. Sources for the data are the works of messrs. Thiers, Segur, Fezensac, Chambray and the unpublished diary of Jacob, who became an Army Pharmacist on 28 October. In order to visualize the army’s losses more clearly, I have drawn this as if the units under prince Jerome and Marshall Davoust (temporarily separated from the main body to go to Minsk and Miklou, which then joined up with the main army again) had stayed with the army throughout.
Principle 6: Content, counts most of all

• “Induce the viewer to think about the substance rather than about methodology, graphic design, the tech of graphic production, or something else”
Principle 6: Content, counts most of all
Request For $1M Investment In Integrated Care Program

Opportunity to save $4.2M over 5 Years

Data Source: xxxxxxx
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Open Discussions
Thank You