Disclosures

- Karl Storz / GCQ: Consultant (informatics)
- VisionTree: Equity holder
- Surgical Theater, Equity
What we do

Geisinger Health System: Integrated health system, $6.5B

We care for patients
- 12 hospital campuses
- 216 clinic sites
- 2,500 providers

We provide quality, affordable healthcare coverage
- 581,000 members
- 60,000 contracted providers/facilities

We teach, research and innovate
- 504 students at GCSoM
- 475 residents/fellows
- 900+ active research projects
Where we do it

- Geisinger sites
- Contracted sites
Our strategy

Patients & members
Provide the best care to our patients and members

Geisinger family
Engage and fulfill all members of the Geisinger family

Markets
Lead in our markets so our friends and neighbors get the best care

Financial health
Achieve and maintain the financial health to fulfill our purpose
Who wants average healthcare?

We want the best, not just average.

In fact, we want perfection.
We are going to relentlessly chase perfection, knowing full well that we will not catch it, because nothing is perfect.

But we are going to chase it, because in the process, we will catch excellence.

We are not remotely interested in just being good.

VINCE LOMBARDI
Hall of Fame Coach
Excellence is the gradual result of always striving to do better.

Pat Riley
NBA Champion as player, coach, and team president
What if surgeons could rehearse every operation on *patient-specific* virtual simulations?
First

Proficiency → Virtuosity
What if surgical residents could learn and practice every operation until they were proficient, even flawless — before ever touching a patient?
Suction Point #1
2/3 of the distance to the distal margin of the hematoma

Right Supraorbital Burrhole; Eyebrow incision

Documentation of suction point #1 by screenshot
Stereotactic image guidance: insertion of Frazee scope sheath into hematoma
Aspiration of hematoma and measurement of hematoma volume
THE BIG OPPORTUNITIES FOR US:
Clinical and Academic Competitive Advantages

**TARGETS:** Stroke, Alzheimer's Disease/Dementia, Addiction, Depression, Stress

**Integration:** Psychiatry/Behavioral Health, Neurology, Neurosurgery

**Value-based Care Redesign:** ProvenCare (ERAS), Ambulatory Intervention

**Clinical Neurogenomics:** MyCode, Precision Medicine, Pharmacogenomics

**Big Data Analytics:** Predictive, Proactive Medicine

**Population Risk and Prevention:** Alzheimer's, Stroke
INTEGRATION
STROKE

Primary Prevention
- Phenomics
- Genomics
- Big data analytics, risk
- Behavioral modification
- Pharmacology

Stroke Dx and Rx
- Neuroimaging
- Medical Rx
- Endovascular, Surgical Rx
- Neuro Critical Care

Recovery
- Neuro rehab
- Stem cells
- Depression Rx

Secondary Prevention
- Pharmacology
- Behavioral modification
Opioid Overdoses in the Geisinger Service Area Over Past 10 Years

Why has Opioid Misuse Proliferated?

1. Overprescribing

2. Diversion of opiates to family and friends

3. Limited access to addiction treatment
Opioid Addiction

- Chronic Pain
  - Primary Care
  - Pharmacy
  - Neurology
  - Psychiatry
  - Neurosurgery

- Post Surgical Pain
  - Anesthesia
  - Pharmacy
  - Surgery

- Addiction
  - Psychiatry
  - Addiction Medicine
  - Pharmacy

- Neuroscience
  - Neuroscience
  - Genomics
  - Pharmacology
Quality

The degree to which the clinical process and the patient outcome approaches perfection, every time.
Is it possible to improve, to approach perfection in healthcare, in a systematic and reproducible way?

Do we know how to do it?
An Intervention to Decrease Catheter-Related Bloodstream Infections in the ICU

Peter Pronovost, M.D., Ph.D., Dale Needham, M.D., Ph.D., Sean Berenholtz, M.D., David Sinopoli, M.P.H., M.B.A., Haitao Chu, M.D., Ph.D., Sara Cosgrove, M.D., Bryan Sexton, Ph.D., Robert Hyzy, M.D., Robert Welsh, M.D., Gary Roth, M.D., Joseph Bander, M.D., John Kepros, M.D., and Christine Goeschel, R.N., M.P.A.

Peter Pronovost, MD, Intensivist, Johns Hopkins
THE PROBLEM
Central Line Associated Blood Stream Infection (CLABSI)

Each year in the United States

80,000 catheter-related infections

28,000 deaths

Average cost of care is $45,000 each = $2.3 billion annually
**THE INTERVENTION**
Central Line Bundle (Checklist, Protocol)

1. Hand hygiene
2. Maximal barrier precautions
3. Chlorhexidine skin antisepsis
4. Optimal catheter site selection, avoidance of the femoral vein
5. Daily review, prompt removal of unnecessary lines
THE RESULT
After Central Line Bundle Applied

Mean rate per 1000 catheter-days decreased from 7.7 to 1.4.

80% reduction in infection

(P<0.002)
Value-based Neurosurgery

Care redesign protocol for microvascular decompression surgery

Nancy McLaughlin, MD, PhD, Farzad Buxey, Karen Chaw, Neil A. Martin, MD
VALUE STREAM MAP
Summary of Interventions

**PRE-OPERATIVE**

- Discussion of the expected LOS 2 Days

**INTRA-OPERATIVE**

- Introduction of a comprehensive time-out
- Technical improvements – dural closure
- Marcaine injection, incision, pin sites

**POST-OPERATIVE**

- Early mobilization
  Standardization of discharge criteria
- Modifying PM rounds: Identification and prep of patients for AM discharge
- Standardization of discharge instructions, steroid taper, suture removal, and FU appointment
Value based neurosurgery: Microvascular decompression surgery

- Total 49 pts: Mean age 56 yrs; 31 TN; 18 HFS
  - Group 1 2008 – 18 months: 20 patients
  - Group 2 2011 – 18 months: 29 patients

- Rate of complete symptom resolution or improvement: 97% TN and 100% HFS
- No mortality
DC
POSTOP
DAY 2

Group 1: 3 readmissions, 3 reoperations for CSF leak

Group 2: 1 readmission, 0 reoperations
Defining: “Perfect Surgery”

1. No mortality
2. No post-operative complication
3. Resolution of symptoms
4. Discharged home
5. Post-operative LOS 2 days or less
6. Discharge by noon
7. No readmissions related to surgery
8. No need for repeat surgery

Pre-Redesign: 5% perfect surgery

Post-Redesign: 31% perfect surgery
From Quality to Value

Value = Quality/Cost
Value-based neurosurgery: measuring and reducing the cost of microvascular decompression surgery.


The average cost of a surgical care episode (index hospitalization + readmission/reoperation) decreased 25% after redesign.
Metabolic Disease Mgmt - Basic Elements

• 2 PCP visits per year
• Measures
  – Blood Pressure – every visit
    • Intervention if not at goal*
  – A1C Intervention if not at goal*
  – LDL Intervention if not at goal*
    • Goal <100 for DM, <70 for DM with CAD
  – Max Dose Statin* - every visit
  – Eye Exam* - annual
  – Foot Exam - annual
  – Flu Vaccine - annual
  – Pneumovax - once
  – Smoking Hx - every visit
  – Creatinine (Serum) - annual
  – Potassium (Serum) - annual
  – Microalbumin - annual
  – Urine Protein – baseline (once)
  – A1C – every 6 months
  – LDL - annual
  – EKG – baseline (once)
  – NYHA Class – every visit
  – ACE/ARB* - every visit
    • EF <40
  – Beta Blocker/EBB* - every visit
  – BMI – every visit
  – Advance Directives/POLST?

* PCP, Specialist, CM/HM, MTDM intervention needed
**Metformin**: (GFR 60+ - 2000mg) (GFR 30 - 60-1000mg)

**Exceptions:** GFR <30

- No history of severe hypoglycemia
- No advanced micro/macrovacular complications
- No advanced comorbidities

**HgA1c Goal <7%**

**Empagliflozin** (not for use as monotherapy)

- Exceptions: GFR <60, hx recurrent GU infections

**Linagliptin**

- If HgA1c is >1% above goal

**Symptom Management**

- Terminal illness
- Severe cognitive impairment
- End-stage complications
- Life expectancy <5 years

**Key**

- †: consider ER formulation to decrease risk of GI intolerance
- ♥: CV risk reduction
- ‡: HF admission reduction; consider as 1st add-on if HF and HgA1c ≤0.5% above goal; add Linagliptin if HgA1c remains above goal
- ±: If symptomatic: metformin + basal insulin +/- additional non-insulin therapy; if asymptomatic: dual or triple non-insulin therapy appropriate

**Liraglutide**

- Exceptions: hx of med. thyroid ca/MEN2

**HgA1c Goal <8%**

- Age >65 and/or:
  - Mld/mod. cognitive impairment
  - History severe hypoglycemia
  - Cerebro/cardiovascular disease
  - Advanced microvascular complications

**Linagliptin**

- Exceptions: HgA1c >0.5% above goal

**Note:** 1st add-on only if Linagliptin and Empagliflozin C/I

**Glipizide** (Consider Repaglinide if CKD 3B or post-prandial glucose elevated)

- Exceptions: elderly, frail, risk of hypoglycemia

**Glipizide**

- Exceptions: GFR <60, hx recurrent GU infections

**Liraglutide**

- Exceptions: hx of med. thyroid ca/MEN2

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**Basal Insulin**

(consider discontinuing sulfonylurea)

**Bolus Insulin**

(consider discontinuing DPP4/SGLT2; continue GLP-1 only if BMI 30+)
How Do Build and Enhance Quality in Your Program?

THREE Things
- Structure
- Measurement
- Protocols
QUALITY STRUCTURE

People
Quality Director, (analyst)

Regular Meetings
M&M, Monthly Service Line Review, Weekly Serious Event review

Dashboard
QUALITY MEASURES

SAFETY
- Infection, DVT

OUTCOMES
- Mortality, Discharge to Home

EFFICIENCY
- Length of Stay, Readmission

EXPERIENCE
- HCAPS, Press Gainey, Recommend
CLINICAL PROTOCOLS

SURGICAL EPISODE
ProvenCare CABG, ERAS

CHRONIC DISEASE
Diabetes Care Pathway

URGENT
Sepsis

PROCESS
Central Line Bundle
INFORMATICS
Geisinger’s Toolset for Digital Patient Engagement

“Only 1% of a person’s life is spent with healthcare professionals”

(Chase, 2013)
Big Data Analytics
Big data for provider experience and care quality

- Abdominal Aortic Aneurysm
- Frequently asymptomatic
- >90% mortality if ruptures
- Rupture risk increases with aneurysm size
- Found incidentally on diagnostic studies
- Some patients are lost to follow-up
AAA Close the Loop Program

- Retrospectively identify AAA patients not receiving follow-up for surgical repair (>4.0cm)
- 2 million reports reviewed through Natural Language Understanding
- Categorized patients by vascular risk
- 3,400 patients were contacted via PCP for follow-up
- 134 patients were identified for on-going monitoring
- 27 patients received life-saving AAA repair surgery

Population Genomics
MyCode® began in 2007
High consent rate (90%)
Goal >250,000 sequenced
154,000+ consented
152,000+ Participants
92,000+ Exomes sequenced
3.5% Expected to get results
## Top Three Most Prevalent Conditions in the G76 Expected to Compose Half of those Returned

<table>
<thead>
<tr>
<th>GENOMIC CONDITION</th>
<th>POPULATION PREVALENCE</th>
<th>CLINICAL RISK</th>
<th>DISEASE-ALTERING INTERVENTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Familial Hypercholesterolemia</td>
<td>1 in 250</td>
<td>Early-onset Coronary Artery Disease and Stroke</td>
<td>Targeted screening and aggressive medical management</td>
</tr>
<tr>
<td>Hereditary Breast and Ovarian Cancer Syndrome</td>
<td>1 in 400</td>
<td>Early-onset Breast, Ovarian, and Prostate Cancers</td>
<td>Targeted screening with prophylactic medical and surgical intervention</td>
</tr>
<tr>
<td>Lynch Syndrome</td>
<td>1 in 440</td>
<td>Early-onset Colon and Uterine Cancers</td>
<td>Targeted screening and management of pre-cancerous changes</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>&gt; 1 in 100</td>
<td><strong>Multiple Cancers and Cardiovascular Diseases</strong></td>
<td>Life-saving screening and intervention before development of disease</td>
</tr>
</tbody>
</table>

Responsible genes to be screened: *BRCA1, BRCA2, MLH1, MSH2, MSH6, PMS2, LDLR, APOB, PCSK9*
### CDC tier 1 conditions

<table>
<thead>
<tr>
<th>Condition</th>
<th>Patients per risk condition</th>
<th>Gene</th>
<th>Patients per gene</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hereditary breast and ovarian cancer (early breast, ovarian, prostate and other cancers)</td>
<td>183</td>
<td>BRCA1</td>
<td>64</td>
</tr>
<tr>
<td></td>
<td></td>
<td>BRCA2</td>
<td>119</td>
</tr>
<tr>
<td>Familial hypercholesterolemia (early heart attacks and strokes)</td>
<td>30</td>
<td>APOB</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LDLR</td>
<td>18</td>
</tr>
<tr>
<td>Lynch syndrome (early colon, uterine and other cancers)</td>
<td>18</td>
<td>PMS2</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MSH6</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MSH2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MLH1</td>
<td>2</td>
</tr>
</tbody>
</table>

### Cardiovascular risk

<table>
<thead>
<tr>
<th>Condition</th>
<th>Patients per risk condition</th>
<th>Gene</th>
<th>Patients per gene</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardiomyopathy (diseases of the heart muscle with dangerous complications)</td>
<td>25</td>
<td>MYH7</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MYBPC3</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TPM1</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TNNI3</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TNNI2</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MYL3</td>
<td>3</td>
</tr>
<tr>
<td>Arrhythmia (irregular heartbeat with risk for cardiac arrest)</td>
<td>18</td>
<td>SCN5A</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td></td>
<td>KCNQ1</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>KCNE1</td>
<td>2</td>
</tr>
<tr>
<td>Arrhythmogenic right ventricular cardiomyopathy (disease of the heart muscle with risk for cardiac arrest)</td>
<td>9</td>
<td>DSP</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PKP2</td>
<td>7</td>
</tr>
<tr>
<td>Marfan syndrome (connective tissue disease that can cause heart, eye, and skeletal problems)</td>
<td>2</td>
<td>FBN1</td>
<td>2</td>
</tr>
<tr>
<td>Heritable thoracic aortic disease (generic predisposition to weakening of the wall of the aorta, leading to swelling and sometimes rupture)</td>
<td>1</td>
<td>ACTA2</td>
<td>1</td>
</tr>
</tbody>
</table>

### Cancer risk

<table>
<thead>
<tr>
<th>Condition</th>
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<th>Gene</th>
<th>Patients per gene</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hereditary pheochromocytomas and paragangliomas (specific tumors that can release extra hormones)</td>
<td>7</td>
<td>SDHB</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SDHC</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SDHD</td>
<td>2</td>
</tr>
<tr>
<td>Multiple endocrine neoplasia type 1 (early thyroid cancer)</td>
<td>3</td>
<td>MEN1</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>RET</td>
<td>3</td>
</tr>
<tr>
<td>PTEN hamartoma tumor syndrome (characterized by noncancerous, tumor-like growths called hamartomas and an increased risk of developing certain cancers as well as intellectual disability in some cases)</td>
<td>2</td>
<td>PTEN</td>
<td>2</td>
</tr>
<tr>
<td>Tuberous sclerosis (multiple types of benign [non-cancer] tumors)</td>
<td>1</td>
<td>TSC2</td>
<td>1</td>
</tr>
<tr>
<td>Li-Fraumeni syndrome (early breast, soft tissue, brain, adrenal and other cancers)</td>
<td>1</td>
<td>TP53</td>
<td>1</td>
</tr>
<tr>
<td>Familial adenomatous polyposis (early colon cancer)</td>
<td>1</td>
<td>APC</td>
<td>1</td>
</tr>
</tbody>
</table>

### Other

<table>
<thead>
<tr>
<th>Condition</th>
<th>Patients per risk condition</th>
<th>Gene</th>
<th>Patients per gene</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malignant hyperthermia (life-threatening condition usually triggered by exposure to certain drugs used for general anesthesia)</td>
<td>15</td>
<td>RYR1</td>
<td>15</td>
</tr>
<tr>
<td>Fabry disease (enzyme defect leading to damage of blood vessels in the skin and cells in the kidneys, heart, and nervous system)</td>
<td>1</td>
<td>GLA</td>
<td>1</td>
</tr>
</tbody>
</table>

### Totals

<table>
<thead>
<tr>
<th></th>
<th>Patients per risk condition</th>
<th>Genes</th>
<th>Patients per gene</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>320</strong></td>
<td>320</td>
<td><strong>320</strong></td>
<td></td>
</tr>
</tbody>
</table>
Clinical–omics
Systems
Neuromedicine
P4 Clinical Neuroscience

- Predictive
- Preventive
- Personalized
- Participatory