Precisely Practicing Medicine from 700 Trillion Points of University of California Health Data

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Conflicts of Interest

• Scientific founder and advisory board membership
  – Genstruct
  – NuMedii
  – Personalis
  – Carmenta

• Honoraria for talks
  – Lilly
  – Pfizer
  – Siemens
  – Bristol Myers Squibb
  – AstraZeneca
  – Roche
  – Genentech
  – Warburg Pincus
  – CRG
  – AbbVie
  – Westat

• Past or present consultancy
  – Lilly
  – Johnson and Johnson
  – Roche

• Corporate relationships
  – NuMedii
  – Genstruct
  – Tercica
  – Ecoeos
  – Helix
  – Ansh Labs
  – uBiome
  – Prevenida
  – Samsung
  – Assay Depot
  – Regeneron
  – Verinata
  – Pathway Diagnostics
  – Geisinger Health
  – Covance
  – Wilson Sonsini Goodrich & Rosati
  – Orrick
  – 10X Genomics
  – GNS Healthcare
  – Gerson Lehman Group
  – Coatue Management

• Shares (Major)
  – NuMedii
  – Personalis

• Shares (Minor)
  – Apple
  – Facebook
  – Alphabet (Google)
  – Microsoft
  – Amazon
  – Snap
  – 10x Genomics
  – Illumina
  – Nuna Health
  – Assay Depot (Scientist.com)
  – Vet24seven
  – Regeneron
  – Sanofi
  – Royalty Pharma
  – AstraZeneca
  – Moderna
  – Biogen

• Shares (Major)
  – Optum
  – Progenity

• Companies started by students
  – Carmenta
  – Serendipity
  – Stimulomics
  – NunaHealth
  – Praedicit
  – MyTime
  – Flipora
  – Tumbl.in
  – Polyglot
  – Iota Health
  – Ongevity Health

• Speakers’ bureau
  – None

• Corporate relationships
  – Northrop Grumman
  – Genentech

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  – Carmenta
  – Serendipity
  – Stimulomics
  – NunaHealth
  – Praedicit
  – MyTime
  – Flipora
  – Tumbl.in
  – Polyglot
  – Iota Health
  – Ongevity Health
University of California
• 10 campuses and 3 national labs
• ~200,000 employees, ~250,000 students/yr

UC Health
• 20 health professional schools (6 med schools)
• Train half the medical students and residents in California
• ~$2 billion NIH funding
• $13+ billion clinical operating revenue
• 5000 faculty physicians, 12000 nurses
• UCSF and UCLA are in US News top 10
• 5 NCI Comprehensive Cancer Centers, 5 NIH CTSA
• IRB reliance, centralized contracting
The University of California and UnitedHealth Group are teaming up to form a new accountable care organization (ACO) and clinically integrated network. As part of the 10-year strategic relationship, UC Health’s five academic medical centers will expand use of Optum’s clinically integrated network services and advanced data analytics services.
The United States is spending billions on electronic health records, and it will be a tragedy if this data isn't used to improve health care.
Combining healthcare data from across the six University of California medical schools and systems

UC Health Data Analytics Platform
The University of California has an incredible view of the medical system

- Combined EHR data from UCSF, UCLA, UC Irvine, UC Davis, UC San Diego, and UC Riverside
  - 15 million patients treated over the past 15 years
- Central database built using OMOP (not Epic) as a data backend
  - Structured data from 2012 to the present day
  - 5.7 million patients with “modern” data
  - 228M encounters, 96M procedures, 593M med orders, 640M diagnosis codes, 2.3B lab tests and vital signs
  - “From Tylenol to CAR-T cells…”
  - OSHPD data, pathology and radiology text elements, death index
  - Claims data from our self-funded plans now included
  - Continually harmonizing elements
- Quality and performance dashboards
- Safe, responsible, respectful use of data
All five University of California academic medical centers provide health data to patients through FHIR (and Apple Health)

bit.ly/ucappleh
Many operational teams within UC Health now using and benefitting from the UC Health Data Warehouse, saving $millions

Central tools to improve quality of care

Decreasing expenses in our self-funded health plans

Managing costs in our self-funded health plans

Central management of primary care patients
University of California Cancer Consortium Takes on California’s $14 Billion Killer

By Elizabeth Fernandez on September 11, 2017

University of California President Janet Napolitano announced the formation of a UC Cancer Consortium to include five of the nation’s leading academic cancer centers during a press conference in Genentech Hall at Mission Bay. Photo by Susan Merrelli
161,715 cancer patients seen in 2019 across UC Health

UC Cancer Demographics
(Data from January 2012 through August 2020)

161,715 Total UC patients with a cancer diagnosis

<table>
<thead>
<tr>
<th>Location</th>
<th>Patients</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>UCSF</td>
<td>37,739</td>
<td>(23%)</td>
</tr>
<tr>
<td>UCSD</td>
<td>31,264</td>
<td>(19%)</td>
</tr>
<tr>
<td>UCLA</td>
<td>53,612</td>
<td>(33%)</td>
</tr>
<tr>
<td>UCI</td>
<td>20,376</td>
<td>(13%)</td>
</tr>
<tr>
<td>UCD</td>
<td>18,663</td>
<td>(12%)</td>
</tr>
</tbody>
</table>

Race:
- White: 23,791
- Unknown: 20,724
- Asian: 33,346
- Other Race: 11,764
- Black or African Am.: 11,073
- Native Hawaiian or: 30,244
- American Indian or: 14,821

Age:
- <2: 16,645
- 2-17: 16,645
- 18-35: 14,045
- 36-50: 10,456
- 51-64: 18,826
- 65+: 16,065

Gender:
- Female: 29,407
- Male: 18,275
- Unknown: 16,476

Ethnicity:
- Not Hispanic or Latino: 29,407
- Hispanic or Latino: 24,246
- Unknown: 42,246

Legends/Filters

Locations: UCSF, UCSD, UCLA, UCI, UCD

2017 Per Capita Income:
- $42,000 to 20,000
- $20,000 to 25,700
- $25,700 to 31,700
- $31,700 to 41,700
- $41,700 to 227,000

Seen at System Cancer Care Site:
- [x] Yes

Cancer Patient Status:
- [x] Active

Disease Lookup:
- [x] Cancer Group

Cancer Group:
- [x] All
Social Determinants of Health: Area Deprivation Index (ADI)

- Estimate socioeconomic status based on income, education, employment, housing quality at the neighborhood level
- Use with race, ethnicity, gender, age to identify health disparities
- Central geocoding capability to link 9-digit zip code for addresses
- We have now geocoded our UC-wide primary care population
- ADI is significantly associated with adverse health outcomes in our patients, in addition to race, ethnicity, and age
Patients living with a challenging ADI have a higher A1c, independent of age, sex, race and ethnicity.

University of California Diabetes Area Deprivalion Index: 33103 patients
Preliminary analysis, subject to change: generated on August 28, 2020
26,822 Type 2 Diabetes Patients at UCSF since EHR Adoption in 2012
Can we predict who will do well with metformin?

A. Model Comparison for Predicting Medication Class Increase Within 90 Days (Metformin Only)

B. Decision Tree Used In Classification (AUC 0.607)

Largest HbA1c
Ever Measured < 8.8

Largest Fasting Glucose
Ever Measured < 206

Odds Ratio: 2.14
n=371 14%

Odds Ratio: 2.10
n=50 2%
Multi-center long-term comparative effectiveness studies, including type 2 diabetes
### Number of tests started on each date

Patients with tests on two days are counted on each date. Patients with two specimens on two different kinds of test on one day are counted twice on that date. This is showing test counts, and may not match local dashboards which are counting patients.

<table>
<thead>
<tr>
<th>Date</th>
<th>UCD</th>
<th>UCI</th>
<th>UCLA</th>
<th>UCSD</th>
<th>UCSF</th>
</tr>
</thead>
<tbody>
<tr>
<td>19/3/2020</td>
<td>481</td>
<td>442</td>
<td>593</td>
<td>969</td>
<td>593</td>
</tr>
<tr>
<td>19/4/2020</td>
<td>713</td>
<td>614</td>
<td>713</td>
<td>639</td>
<td>614</td>
</tr>
<tr>
<td>19/5/2020</td>
<td>494</td>
<td>494</td>
<td>494</td>
<td>494</td>
<td>494</td>
</tr>
<tr>
<td>19/6/2020</td>
<td>494</td>
<td>494</td>
<td>494</td>
<td>494</td>
<td>494</td>
</tr>
<tr>
<td>19/7/2020</td>
<td>494</td>
<td>494</td>
<td>494</td>
<td>494</td>
<td>494</td>
</tr>
<tr>
<td>19/8/2020</td>
<td>494</td>
<td>494</td>
<td>494</td>
<td>494</td>
<td>494</td>
</tr>
<tr>
<td>19/9/2020</td>
<td>494</td>
<td>494</td>
<td>494</td>
<td>494</td>
<td>494</td>
</tr>
<tr>
<td>19/10/2020</td>
<td>494</td>
<td>494</td>
<td>494</td>
<td>494</td>
<td>494</td>
</tr>
<tr>
<td>19/11/2020</td>
<td>494</td>
<td>494</td>
<td>494</td>
<td>494</td>
<td>494</td>
</tr>
<tr>
<td>19/12/2020</td>
<td>494</td>
<td>494</td>
<td>494</td>
<td>494</td>
<td>494</td>
</tr>
</tbody>
</table>

### Tests by site (Click a site or test to filter)

<table>
<thead>
<tr>
<th>Site</th>
<th>Test Description</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>UCD</td>
<td>1230000042 GUEST COVID-19</td>
<td>1,000</td>
</tr>
<tr>
<td>UCI</td>
<td>30444 COVID-19 CORONAVIRUS WITH COV.</td>
<td>2</td>
</tr>
<tr>
<td>UCLA</td>
<td>139900 SARS-COV-2 NAA - LABCOPR</td>
<td>62</td>
</tr>
<tr>
<td>UCSD</td>
<td>30444 COVID-19 CORONAVIRUS - EXTERNAL</td>
<td>1</td>
</tr>
<tr>
<td>UCSF</td>
<td>21030444 COVID-19 CORONAVIRUS - QUALITY</td>
<td>1</td>
</tr>
</tbody>
</table>

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**Source:** UC Health COVID-19 Testing (Data through 10/26/2020 11:59 PM)
31,9819 tested
10,725 positives (3.35% of tested, 1.96% in past 7 days)
2,746 admitted to date (25.6% of positives)
234 expired inpatients (8.52% of admitted, 2.18% of positives)
Demographics and Daily Orders of Remdesivir Across UC Health

Daily Order Trends of Remdesivir (n = 169 (8.11%)); Hospitalized (n = 2,085)

Race (n = 169)
Ethnicity (n = 169)
Sex (n = 169)

Race, Ethnicity and Sex of Hospitalized Individuals on Remdesivir

- American Indian or Alaska Native
- Asian
- Black or African American
- MultiRace
- Other Race
- Unknown
- White
- Native Hawaiian or Other Pacific Islander

- Hispanic or Latino
- Not Hispanic or Latino
- Unknown

- Female
- Male
Follow @UofCAHealth for these numbers every afternoon.
Enabling UC researchers and patients to go beyond... machine learning in a safe, respectful, fair, equitable way in medicine
The Team

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- Kirk Kurashige
- Calvin Fong

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- Ray Pablo
- Tim Hayes
- David Gonzalez
- Charles Wilson

UNIVERSITY OF CALIFORNIA
HEALTH

Center for Data-driven Insights & Innovation
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