Stayin' Alive:
Tools for patients treating untreatable cancers

This presentation is at

https://rarekidneycancer.org/blog

W.G. Paseman

bill@RareKidneyCancer.org

20250305_1400 Festival of Biologics

Agenda

- **Patient's Journey
- Old Tools
  - Second Opinions
  - Tumor Boards (Wisdom of Crowds)
  - Patient Data
  - Weekend Hackathons
  - Game Theory (+ Case Study)
  - Drug Repurposing
  - Supplements (+ Case Study)
- Current Tools
  - LLMs
  - Continual Hackathons
- Future Tools
  - Digital Twin, Patient Caregiver, Agent Social Network
- Acknowledgements and Final Word

Patient's Journey

• Stage	Standard of Care →	Clinical Trials →	<You are here>
• Treatment Success	30-80%	3.4%	?? (<3.4%)

- <You are Here>
  - Papillary kidney cancer OS (curing it) <> PFS (keeping it at bay)
    - 2017 – PFS - 4.1 to 8.3 months**
    - 2026 - PFS - Cabozantinib – 9 months
  - TP53-mutated Acute Myeloid Leukemia (AML) OS is 6-8 months
    - Chemo Reduces life expectancy and QoL (Quality of life)
    - Treatments do not incorporate latest Diagnostic research.
    - e.g. effectiveness of chemo on TP53 AML

- What to do if <You are here>?

* doi:10.1093/biostatistics/kxx069

**2017 "Recommendations for the Management of Rare Kidney Cancers" https://www.europeanurology.com/article/S0302-2838(17)30542-0/abstract

Patient's Journey

- "My pet peeves are pancreatic cancer and glioblastoma, both of which have very poor outcomes. I'm going to get killed by my colleagues for saying this, but I'm still going to say it. **I think that these patients should get anything but standard of care, because the outcomes are so poor with pancreatic cancer.** There was a major study just published, and only 24% of patients are alive at one year, which is based on the standard of care. So it's my belief that they should not get the standard of care. A lot of people don't agree with me, but I'm going to say **in glioblastoma, the treatment we use was from a publication 20 years ago in the New England Journal of Medicine that showed a six-week improvement in survival, but everybody is dead at three years.** I think these patients should get anything but the standard of care." Razelle Kurzrock, MD

- "From a patient's perspective I find the medical professional restrictions annoying to say the least. We tend to be steering patients away from some of the best evidence sources. By doing this we are encouraging them to fail." - Prostate Cancer Patient

Agenda

- Patient's Journey
- **Old Tools
  - Second Opinions
  - Tumor Boards (Wisdom of Crowds)
  - Patient Data
  - Weekend Hackathons
  - Game Theory (+ Case Study)
  - Drug Repurposing
  - Supplements (+ Case Study)
- Current Tools
  - LLMs
  - Continual Hackathons
- Future Tools
  - Digital Twin, Patient Caregiver, Agent Social Network
- Acknowledgements and Final Word

Old Tool: Second Opinions

But what's a virtual second opinion? A second opinion is a way to get more information about a condition, treatment option or procedure from an expert — and when it's virtual, you can do it all without leaving home. No travel time, record-collecting, or hunting down the best specialists needed. With virtual second opinions, you'll be more informed and equipped to move forward.

> 67% of virtual second opinions recommend a change in diagnosis or treatment plan.

https://my.clevelandclinic.org/online-services/virtual-second-opinions

Old Tool: Tumor Boards

- **Question**: Should Bill enroll in the Everest (adjuvant Everolimus) Trial
- **Process**: “Second Opinions” (13) on Steroids (“Wisdom of Crowds”)
  - Yes - Gastro + Urologist
  - Yes - Stanford Oncologist - "If you are eligible always a good idea to partake on trials"
  - Yes - Sutter Primary Care Physician - "Minimal Downside"
  - Bill must decide - Parisian Oncologist, HK Internist, Radiation Oncologist, UCSF Primary Care Physician, MD Anderson Pharmacist
  - No - Los Gatos Hematologist, Waco Oncologist, Danish Researcher, German General Practitioner
  - No* - M.D. Anderson Oncologist (ran ESPN trial) - "I do not recommend any adjuvant trial w/ mTOR inhibitors or VEGF targeted agents for papillary RCC. There will be trials w/ immune checkpoint agents in the near future but not soon enough to enroll on." – subtext “Everolimus did not work for your type of cancer in the ESPN trial”
- **Answer**: The first 3 said “Yes”. Only one of 5 “Nos” understood the trial well

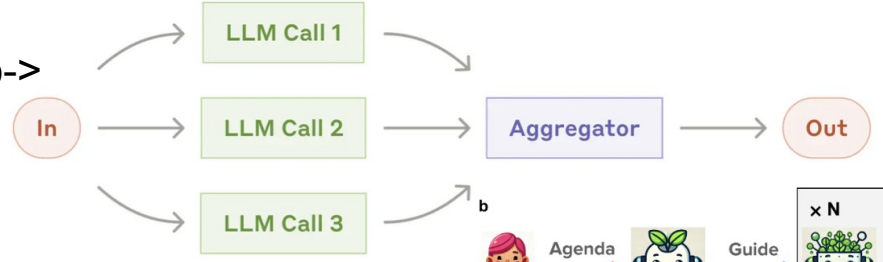
“The best way to have a good idea is to have lots of ideas.” - Linus Pauling

What makes a good Tumor Board?

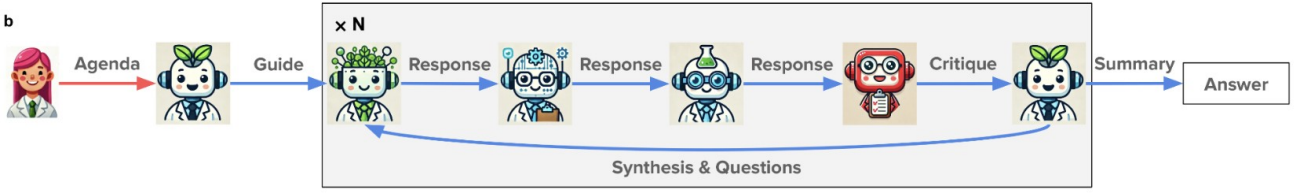
Wisdom of Crowds - https://en.wikipedia.org/wiki/The_Wisdom_of_Crowds

- Diversity of opinion
  - Each person should have private information even if it is just an eccentric interpretation of the known facts. (Chapter 2)
- Independence
  - People's opinions are not determined by the opinions of those around them. (Chapter 3)
- Decentralization
  - People are able to specialize and draw on local knowledge. (Chapter 4)
- Aggregation
  - Some mechanism exists for turning private judgements into a collective decision. (Chapter 5)

Need new info->



Not consensus->
(Information Cascade)

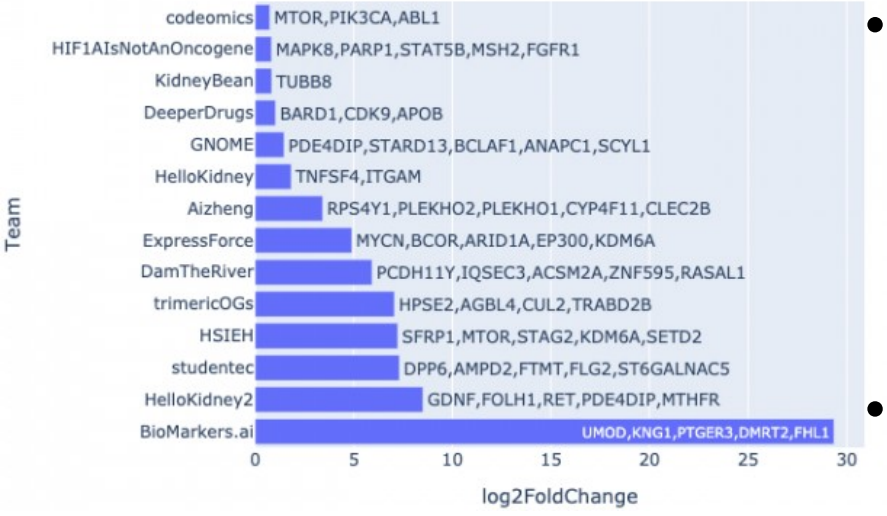


Old Tool: Patient Data

- 2014: Just aggregate all hospital patient data together!
  - Hospitals and Research organizations hold it, they might sell it, but they won't give it away.
  - EHRs are billing records, not patient histories
- 2018: Use Federated Data!
  - Pushes model to the data vs. pulling data to the model
  - KCA (2021) - https://www.kidneycancer.org/fast-track-cancer-research-with-ai-labs/
- 2018-2020: Used my own Patient Data
  - EHR, Imaging, Genomic (WGS, WES, RNA-seq, single cell …)
  - Once you gather it, what can you do with it?

Old Tool: Weekend Hackathons

- **Question**: What “Genes of Interest” should Bill look at if he progresses?
- **Process**: 80 People, forming 17 “Tumor Boards”, each given my WES Blood Normal 150X, WES Kidney Tumor 300X
- **Answer**: Teams’ methods were scored using my RNA-seq data
  - The winner, Saed Sayad, suggested looking at Bacelein and Valproic Acid

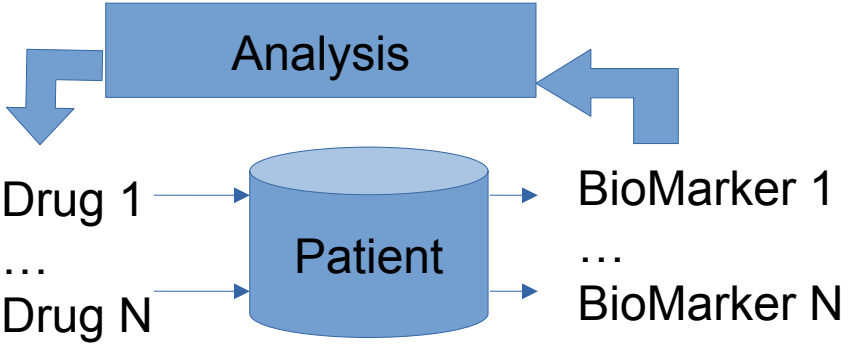


- Like Financial Portfolios, the values of “Tumor Board” and “Hackathon” Opinions have long tail (power law) distributions. This means that there is no average or standard deviation. **This, in turn, means that you never know if you have sampled enough, or in the right places.**
- Run by http://Researchtothepeople.com

https://rarekidneycancer.org/blog/alternatives-after-patients-are-past-standard-care-and-have-run-out-clinical-trials-p1rcc

Old Tool: Game Theory

- **Question**: If Cancer Treatment is a “war”, what strategy can one can take?
  - “Nuke em till they glow” using systemic therapy, “Strategic Bombing” using radiation, etc.
- **Game Theory Guy Process**: Treat Cancer as a Game*
- **Feedback Control Guy Process**: Treat Cancer as an experiment.
- **Answer**: Key Points
  - **Lab research** showing Treatment efficacy
  - **Therapeutics** with Known Safety Dosage Profile (Supplements or Phase 1 Drugs)
  - **Fast** Biomarker Turnaround
    - Otherwise loop is unstable
  - A sympathetic **Primary Care Physician** helps



*Optimizing Cancer Treatment Using Game Theory: A Review – Staňková
https://jamanetwork.com/journals/jamaoncology/article-abstract/2696342

Game Theory Case Study: Treating Prostate Cancer using Adaptive Therapy

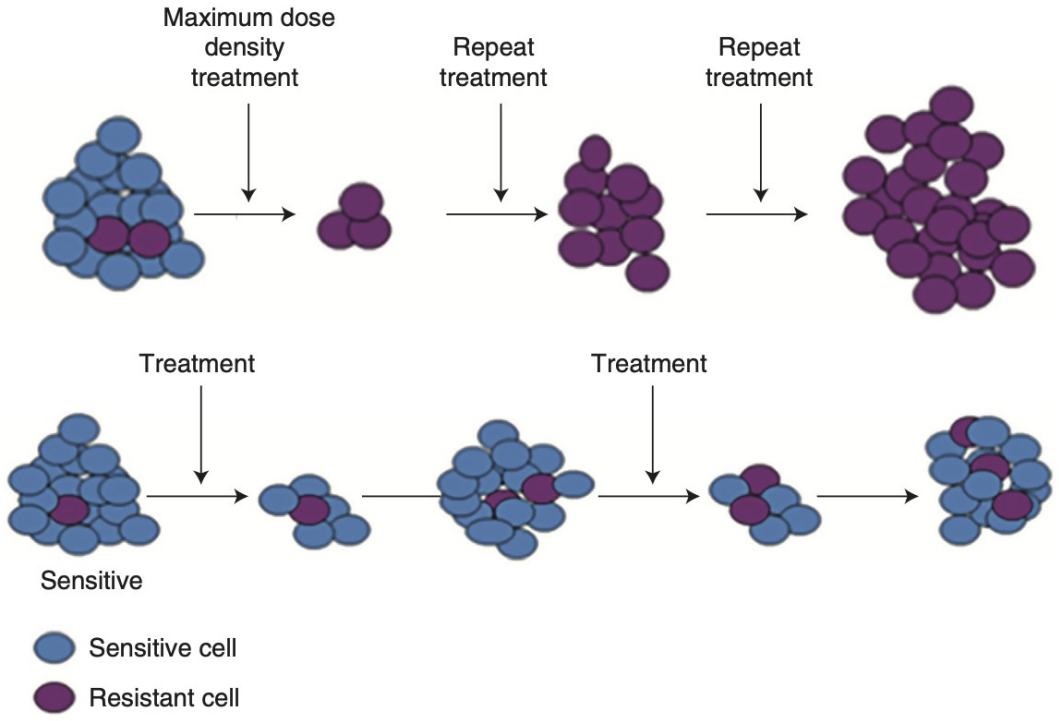
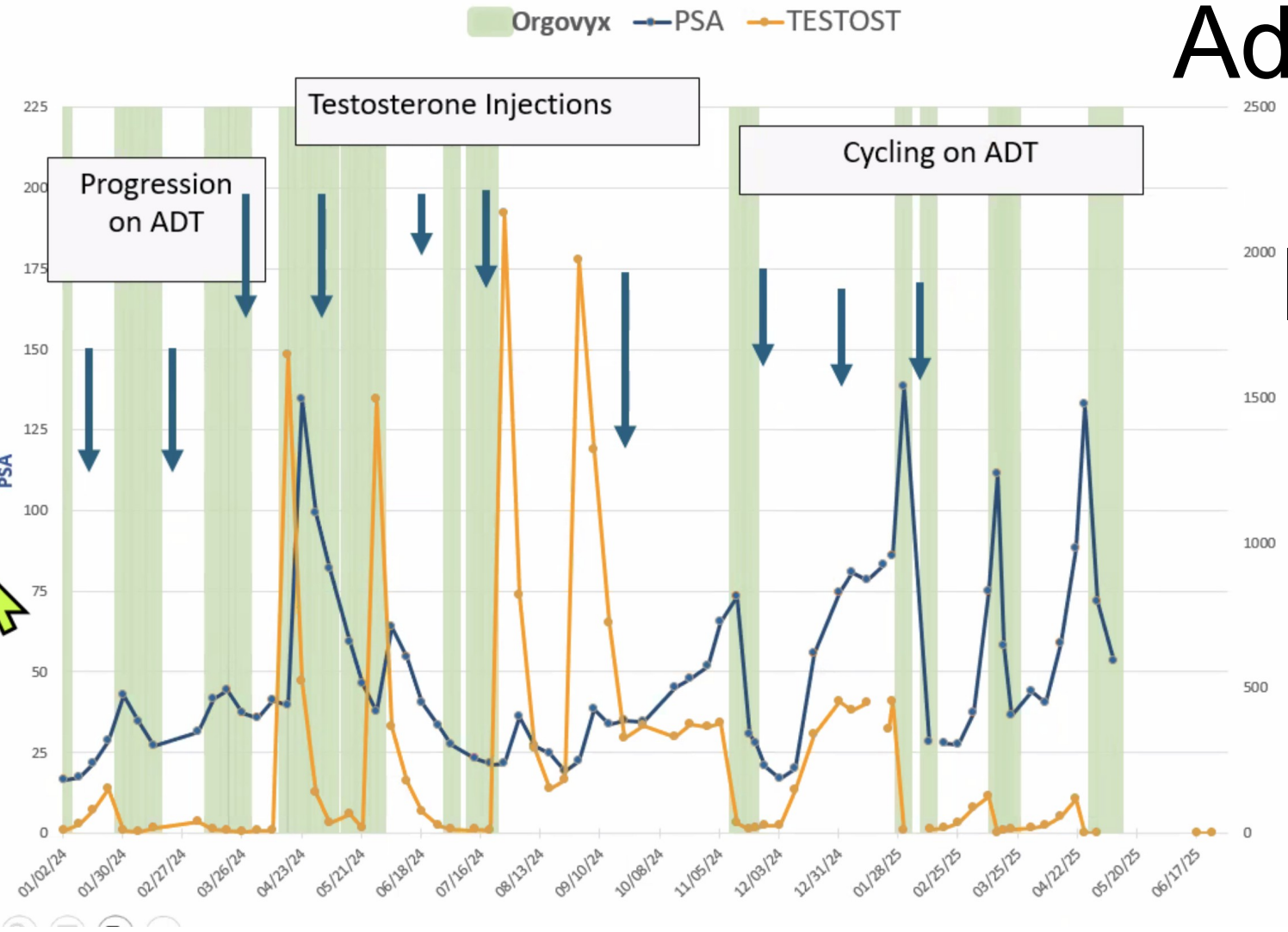


Figure 2. (*Top* row) Conventional high-dose density therapy explicitly aims to eliminate all cancer cells that are sensitive to therapy. However, this maximally selects for resistant phenotypes and eliminates competitors permitting rapid progression—an evolutionary dynamic termed "competitive release." (*Bottom* row) Adaptive therapy explicitly aims to maintain a small population of cells that are sensitive to treatment. While the resistant cells survive, the metabolic cost of the molecular machinery of resistance (Fig. 1) renders them less fit in the absence of therapy. Thus, when therapy is withdrawn, the tumor will regrow, but the fitness advantage of the sensitive cells allows them to proliferate at the expense of the resistant population. At the end of each cycle, the tumor remains sensitive to therapy.

The Evolution and Ecology of Resistance in Cancer Therapy
Robert A. Gatenby

https://perspectivesinmedicine.cshlp.org/content/10/11/a040972.full.pdf

Adaptive ADT using Biomarkers



- PSA – Prostate Cancer Biomarker
- ADT – Androgen Deprivation Therapy
- Orgovyx - suppresses Testosterone

Old Tool: Drug Repurposing

- Example: Sildenafil was was originally developed to treat cardiovascular issues.
  - Now, under the name Viagra, it is used to treat erectile dysfunction.
- David Fajgenbaum
  - Castleman's Disease
  - Conventional Chemotherapy
  - Rapamycin
  - https://davidfajgenbaum.com/
  - "Chasing my cure" - https://davidfajgenbaum.com/books/
- Sandra Bedrosian Sermone's Son
  - ADNP
  - Ketamine
  - https://www.researchgate.net/publication/363043411_An_Open-Label_Study_Evaluating_the_Safety_Behavioral_and_Electrophysiological_Outcomes_of_Low-Dose_Ketamine_in_Children_with_ADNP_Syndrome

Old Tool: Supplements

- Supplements are regulated as foods, not medications.
- This means they lacks rigid FDA approval for purity and therapeutic efficacy.
- That said, supplements have biological effect.
- And like repurposed drugs, have a variety of uses.
- We will show a dramatic example of this in our “Treating TP53-mutated AML” section.

Case Study: Treating TP53-mutated AML

- AML(Acute Myeloid Leukemia) acts by hijacking the bone marrow, causing a rapid, clonal expansion of immature myeloid cells (myeloblasts) that fail to mature. These dysfunctional blasts accumulate, disrupting and crowding out healthy blood-producing cells, leading to severe bone marrow failure (anemia, infection, bleeding).

- TP53-mutated Acute Myeloid Leukemia (AML) is a highly treatment-resistant, high-risk subtype with a very poor prognosis. **Median overall survival is approximately 6 to 8 months.** The 2-year survival rate is generally low, estimated at less than 10-12% for most patients, and relapse is nearly universal.

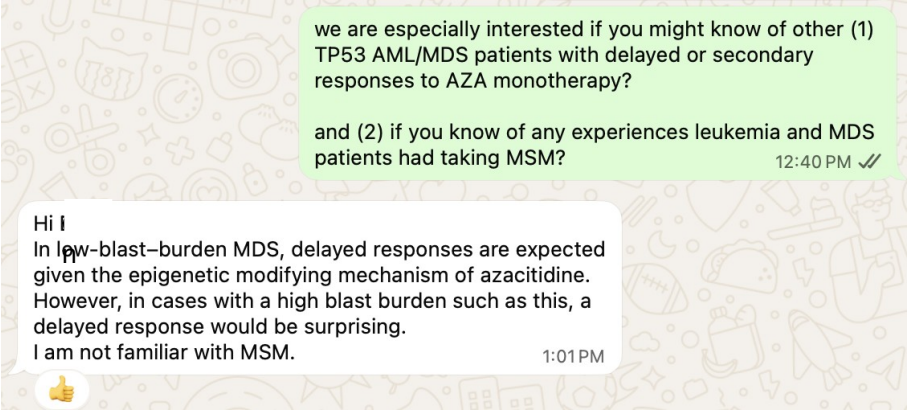
- Current SOC is Chemo (Azacitadine+Venetoclax, or 7+3 in younger patients). 7+3 treatment reduces life expectancy 10%, has severe QoL (Quality of Life) impact and does not address TP53 mutation issue.

- So. Now what? This patient (a control guy) read about old *in vitro* drug trials that worked in the lab but had not yet been used in a clinical trial, guessed initial drug dosage, determined the biomarkers needed to monitor progress and figured out how to measure them.

Case Study: Treating TP53-mutated AML

- "MSM induces apoptosis in cancer cells, including studies that show this occurs independently of the p53 status. This means MSM can potentially be effective even in cases where TP53 is mutated or deficient."*

- Name: MSM (Methylsulfonylmethane)
- Rationale: promote differentiation of blasts
- Note: MSM is dietary supplement and is
- regulated as a food, not a medication. This means it lacks rigid FDA approval for purity and therapeutic efficacy.



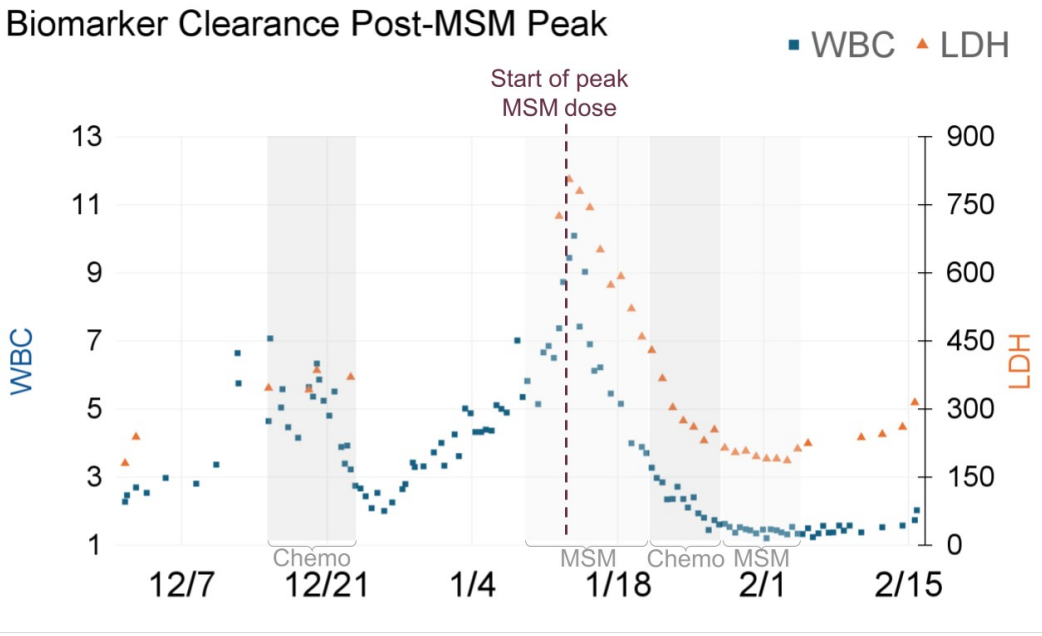
Recent Chemo History:

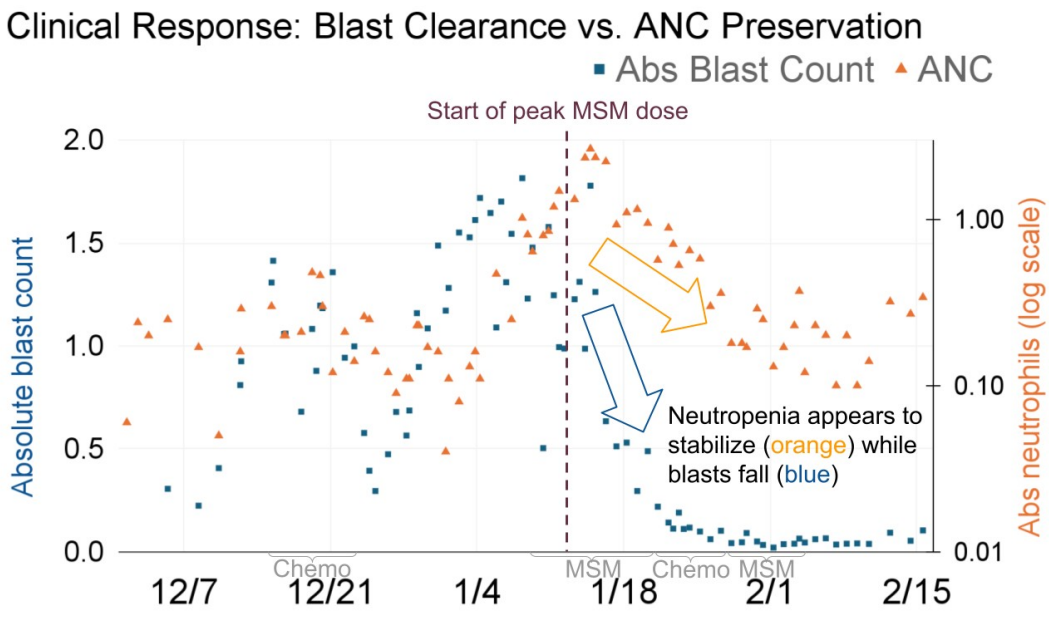
- Cycle 2 (7d azacitidine): ineffective - peripheral blasts rebounded to new highs within 1 week
- Cycle 3 (7d azacitidine with complements): partial response - **peripheral blasts fell from 1.82 to 0.02 (-99%) and sustained low levels for 4 weeks and counting**

* "Methylsulfonylmethane (MSM) induces caspase-dependent apoptosis in acute myeloid leukemia cell lines" https://pubmed.ncbi.nlm.nih.gov/39114894/

This is not advice. It is a data point suggesting that timing and metabolic context may matter as much as drug selection in TP53 disease. We feel it is critical to share observations so that patients can work with their own healthcare professionals to develop alternative strategies given the dismal prognoses inherent to TP53.

Case Study: Treating TP53-mutated AML





- Orange line (LDH, representing tumor burden) falls to upper-normal range. Largest decline is off-treatment (before chemo phase).
- **Peripheral blasts fall -99%.** Diverging blue and orange lines (blasts and neutrophils) may be hint of differentiation and recovery.

This in-vivo result has never been reported before. It may represent the first progress for TP53-mutated AML in several years. Email nicosiak62@gmail.com for details / discussion

Current Tool: LLMs

- GenAI is evolving fast.
- Example: Education
  - Initially, the focus was on detecting unauthorized AI use in student assignments.
  - Next, educators tried to teach responsible and effective AI use.
  - Now, students are encountering a job market where AI has automated roles they were preparing for.
- Math Research
  - An acquaintance recently had to give a talk to worried pure mathematicians
  - They wondered if they would be out of a job since genAI was discovering more and more.
  - My suggestion? Treat the genAIs as graduate students. Smart, but needing guidance.
  - Talk title?

We're all Principle Investigators Now

Current Tool: LLMs Example

- **Question**: What adjuvant clinical trial is more promising for papillary RCC and why?
- **Process**:
  - chatGPT
    - KEYNOTE-564 Trial: This trial focused on pembrolizumab in high-risk RCC after surgery. The trial demonstrated a significant improvement in disease-free survival compared to placebo. While this trial predominantly involved clear cell RCC, the success of immune checkpoint inhibitors in RCC provides a strong rationale for their use in other subtypes like pRCC.
  - claude.io
    - 1. Immunotherapy approach: KEYNOTE-564 uses pembrolizumab, an immune checkpoint inhibitor. Immunotherapy has shown promise in various RCC subtypes, including papillary RCC.
  - Toni Choueiri: "patients with nonclear cell RCC were not included" (in KEYNOTE-564).
- **Answer**: Papillary RCC is a nonclear cell RCC. Now, the machines did not directly say that KEYNOTE included papillary patients, but it did infer that this trial provided evidence for including them. Does it? That is a matter for discussion with humans.

Current Tool: LLMs – Hollyer Guardrails

- Cancer Prompt Project
  - A structured, patient-led oncology framework built from first principles: biology, mechanisms, and verifiable data rather than forum consensus or generic AI summaries.
  - A modular system of prompts and a standardized patient profile designed to force rigor, traceability, and explicit assumptions in every analysis.
- What differentiates this from others
  - **State-aware, not label-driven**: Focuses on biological state (hormonal, molecular, clonal, immune) rather than static categories like “HSPC” or “CRPC.”
  - **Testing-first logic**: Therapy discussion is downstream of comprehensive testing (biomarkers, molecular, functional, MRD, imaging), not the other way around.
  - **Mechanism over folklore**: Explicitly ties recommendations to mechanisms (AR signaling modes, DNA damage/repair, senescence, immune effects), with evidence grading.
  - **Transparency and auditability**: Every prompt forces disclosure of evidence quality, uncertainty, and what is known vs speculative.
  - **Patient-controlled and reusable**: The patient profile is portable across clinicians, AI systems, and tumor boards, reducing narrative drift and lost context.
  - **Designed for iteration**: Built to evolve as new data arrives (labs, scans, ctDNA), rather than producing one-off opinions.

Courtesy rhollyer@gmail.com

Current Tool: LLMs (Partial List 1/3)

System	Primary LLM / AI type	Can suggest diagnoses	Uses GenAI	Regulated	Synthesizes evidence	Provides references	Free (basic)	Open to non-medical users	Core role	Accuracy (typical use)
Ada Health	Proprietary probabilistic model (LLM-adjacent)	Yes	Yes	Sometimes	Limited	Rare	Yes	Yes	Patient triage and symptom-to-condition reasoning	**Moderate**
Buoy Health	Proprietary conversational model	Yes	Yes	Sometimes	Limited	Rare	Yes	Yes	Consumer symptom intake and care navigation	**Low–Moderate**
ChatGPT Health	General-purpose LLM	Indirectly	Yes	No	Sometimes	Sometimes	Yes	Yes	General clinical reasoning with safety guardrails	**Variable**
Symptoma	NLP + probabilistic engine	Yes	Yes	Sometimes	Limited	Rare	Yes	Yes	High-recall symptom matching across large disease ontology	**Moderate–High (recall-focused)**
ChatGPT (general)	General-purpose LLM	Indirectly	Yes	No	Sometimes	Sometimes	Yes	Yes	Broad reasoning, non-medical-device	**Variable**
Perplexity	LLM + search retrieval	Indirectly	Yes	No	Moderate	Yes	Yes	Yes	Evidence-linked exploratory reasoning	**Moderate**

Courtesy rhollyer@gmail.com

Current Tool: LLMs (Partial List 2/3)

System	Primary LLM / AI type	Can suggest diagnoses	Uses GenAI	Regulated	Synthesizes evidence	Provides references	Free (basic)	Open to non-medical users	Core role	Accuracy (typical use)
Google Gemini	General-purpose LLM	Indirectly	Yes	No	Sometimes	Sometimes	Yes	Yes	Broad reasoning, not healthcare-validated	**Variable**
OpenEvidence	Domain-tuned LLM	Indirectly	Yes	No	Yes	Yes (core)	Limited	Sometimes	Literature-grounded diagnostic and therapeutic reasoning	**Moderate–High**
Glass Health	LLM with structured reasoning layer	Indirectly	Yes	No	Moderate	Sometimes	Limited	Sometimes	Differential diagnosis and workup reasoning	**Moderate**
Elsevier ClinicalKey AI	LLM over curated corpus	Indirectly	Yes	No	Yes	Yes	No	No	Evidence-based diagnostic exploration	**High (within corpus)**
Aidoc	Deep learning (vision)	Yes (task-specific)	Sometimes	Yes	No	No	No	No	Acute imaging diagnosis (stroke, PE, ICH)	**Very High (task-specific)**
Viz.ai	Deep learning (vision)	Yes (stroke only)	Sometimes	Yes	No	No	No	No	Time-critical stroke detection and triage	**Very High (stroke)**

Courtesy rhollyer@gmail.com

Current Tool: LLMs (Partial List 3/3)

System	Primary LLM / AI type	Can suggest diagnoses	Uses GenAI	Regulated	Synthesizes evidence	Provides references	Free (basic)	Open to non-medical users	Core role	Accuracy (typical use)
PathAI	Deep learning (pathology)	Yes (domain-specific)	Sometimes	Yes	No	No	No	No	Cancer pathology diagnosis and classification	**High–Very High**
Fabric Genomics	AI variant-interpretation engine	Yes	Sometimes	Sometimes	Moderate	Sometimes	No	No	Genomic diagnosis and variant prioritization	**High (variant-level)**
Mendelian	Phenotype-genotype AI	Yes	Sometimes	Sometimes	Moderate	Sometimes	No	No	Rare disease diagnostic matching	**Moderate–High**
Epic Systems GenAI	Embedded LLM	No	Yes	No	Minimal	No	No	No	Workflow support and chart summarization	**Not Applicable (non-**
Nuance Copilot	LLM with ambient capture	No	Yes	No	Minimal	No	No	No	Clinical documentation and contextual surfacing	**Not Applicable (non-diagnostic)**

Courtesy rhollyer@gmail.com

Current Tool: Continual Hackathons

- The "hackathon" is (ideally) an ongoing support infrastructure for the target patient and caregivers, not an event. The tests and treatments continuously evolve and the patient's condition goes through ups and downs. There are meetings, and there is a discussion hub for 24/7 online discussion.
- The benefits to the target patients and caregivers are confidence and clarity. You may get better outcomes from the hackathon, but we can't control much of what happens. However, we can control leaving no stone unturned to give the patient their best shot and multiple "second opinions" that converge on an aligned strategy and tactics.
- Personalization is a driver in all aspects. For example, patients and caregivers are in the driver's seat, making tradeoffs like length of life vs. quality of life, tuning the discussion to their level of sophistication, and pursuing home runs vs. singles (risk vs. evidence).
- The diversity of the crowd yields serendipitous, unexpected insights.
- How is this hackathon different from previous hackathons? What has evolved?
- **Software infrastructure**: We provide software and human infrastructure for the patient. For the patient, it replaces some of his homegrown tools with more robust tools and services; for example, tools for communicating with his friends, family, and medical team. For us it's an opportunity to test and improve our services.
- **The role of AI**: Members often use AI to generate a very detailed report that, at a minimum, raises several hypotheses and, at most, provides the answer. Please see the report in the comments section below the link, as well as critiques (endorsements). Russ will run a report using the patient data and his prompts.

https://www.cancerpatientlab.org/ - Marlo Kwong Hackathon

Marlo Kwong Hackathon: AI Reports

Contents

Edwin Alphonse
http://Precision-ai.com

Ian Maurer - https://genomoncology.com

Marlo Kwong Hackathon: Therapy Recommendations

- The following is the list of suggested drugs from my analysis of the public dataset (GSE21122).
- As I mentioned, the ideal omics data would be single-cell RNA-seq from the patient.
  - 1- Ivermectin: Downregulates 50 of the top 100 upregulated genes without upregulating any other genes.
  - 2- Sunitinib: Downregulates 69 of the top 100 upregulated genes while upregulating 6 other genes.
  - 3- Dexamethasone: Upregulates 53 of the top 100 downregulated genes while downregulating 2 other genes.

- Moreover, I analyzed the low/high grade spindle cell sarcoma RNA-Seq data. Considering the small sample size (2 vs. 2), the most significant finding is the involvement of the following receptors in high-grade spindle cell sarcoma:
  - 1- TGF-β 1/2 receptors
  - 2- GPCRs class A rhodopsin like receptors

Saed Sayad
https://bioada.com/

CMU x NVIDIA Federated Learning Hackathon for Biomedical Applications

- Data (Note: No individual patient data)
  - Genetic: UK BioBank, ClinVar (Tera), gnomAD (LynnKim), Expression: GTEx
  - Clinical: Biobanks, Orphanet, OMIM, Protein: Stringdb
- Federated Learning - Pushes model to the data vs. pulling data to the model
- Collaboration: Zoom and Discord; MC: Ben Busby
- Winning Teams
  - FedGen: Federated Learning Infrastructure & Synthetic Genomic Data
  - Omnigenome: Federated Pangenomes & Genomic Background Modeling
  - MuFFLe: (Multimodal Framework for Federated Learning)
- **RAIDers: Devise precise therapeutic strategies for ALS patients by understanding different subtypes of ALS using multiomics data**
  - https://github.com/collaborativebioinformatics/RAIDers/tree/main

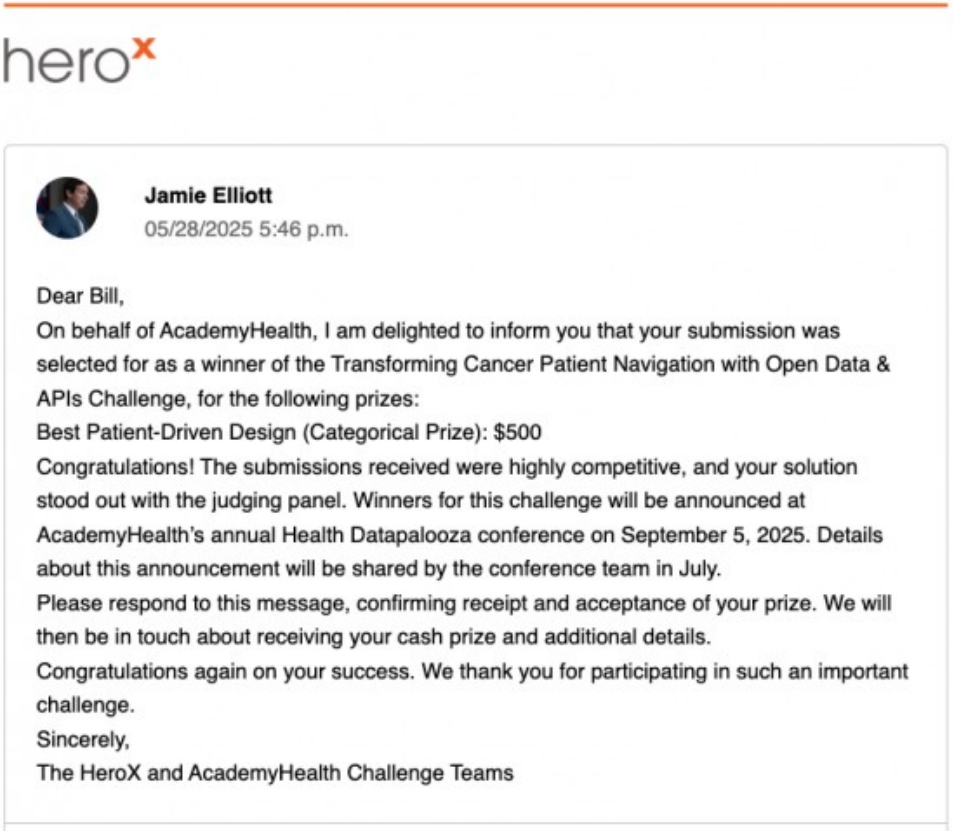
20260107-9 https://guides.library.cmu.edu/hackathon

Agenda

- Patient's Journey
- Old Tools
  - Second Opinions
  - Tumor Boards (Wisdom of Crowds)
  - Patient Data
  - Weekend Hackathons
  - Game Theory (+ Case Study)
  - Drug Repurposing
  - Supplements (+ Case Study)
- Current Tools
  - LLMs
  - Continual Hackathons
- >>>Future Tools
  - Digital Twin, Patient Caregiver, Agent Social Network
- Acknowledgements and Final Word

CareGiver Agent

“Crowd Wisdom” Caregiver Agent empowers patients facing complex or rare cancer decisions by aggregating expert opinions through a crowdsourced approach modeled on the "wisdom of crowds." The tool allows patients to submit questions, collect and analyze multiple clinical opinions, and generate aggregated insights to inform difficult treatment choices. Inspired by the founder’s own lived experience, it offers a novel, patient-led decision support alternative to traditional tumor boards.



hero^x

Jamie Elliott
05/28/2025 5:46 p.m.

Dear Bill,
On behalf of AcademyHealth, I am delighted to inform you that your submission was selected for as a winner of the Transforming Cancer Patient Navigation with Open Data & APIs Challenge, for the following prizes:
Best Patient-Driven Design (Categorical Prize): $500
Congratulations! The submissions received were highly competitive, and your solution stood out with the judging panel. Winners for this challenge will be announced at AcademyHealth’s annual Health Datapalooza conference on September 5, 2025. Details about this announcement will be shared by the conference team in July.
Please respond to this message, confirming receipt and acceptance of your prize. We will then be in touch about receiving your cash prize and additional details.
Congratulations again on your success. We thank you for participating in such an important challenge.
Sincerely,
The HeroX and AcademyHealth Challenge Teams

Delsee's Caregiver Tips

1) Create a spreadsheet of analyses, including tissue (or blood) source, date, summary of findings.
2) Keep analyses and reports in Google Drive in a "Medical Folder" for easy access and sharing with clinicians, researchers and advocates like you. If she finds it difficult to find or download reports from the various institution portals, contact the clinician to email directly to her (sometimes they will, HIPAA be damned), try copy/paste from the portal, or even a screenshot then place in Folder. It's key to be able to forward the information with ease and with speed.
3) When finding any article, clinical trial or research paper that is compelling, find the leading researcher (often has their email or contact info) and email them with a brief clinical summary, asking if willing to share a 10 minutes to chat. I've also just called directly toward end of day (their time) and I don't hesitate to leave a message, always very mindful, respectful and appreciative of her/his time.
4) What not to do: Be passive, apologetic or hesitant to ever advocate for oneself.

See also: https://andrewjrod.substack.com/p/so-you-want-to-cure-your-own-disease

Future Tools: Digital Twin, Patient Caregiver, Agent Social Network

- Digital Twin – So I started by putting my EHR in an LLM. Now I can ask it questions.
- Agent - systems where LLMs dynamically direct their own processes and tool usage, maintaining control over how they accomplish tasks.
- Patient Caregiver – This is the role that Delsee described, which the agent assumes.
- Social Network - Moltbook for hackathon collaboration. i.e. a networked community where automated patient caregivers, automated Digital Twins and automated doctors and share information, opinions and plans. Each agent is beholding to its owner wrt what it can share and with whom.

Happy to discuss further
bill@rarekidneycancer.org

Acknowledgements

- Tissue: UCSF's Dr. Max Meng and Tasha Lea
- Sequencing: Yale's Dr. Kaya Bilguvar and Christopher Castaldi and UCLA's Dr. Brian Shuch
- Sequencing Experiment Specification and Validation: Mike D'Amour for specifying the sequencing experiment parameters and fastq Validation Process
- 2018 Venue Donation: Salesforce's Steve Tamm and Lisa Ferrier
- 2018 Hackathon Teams
- 2018 Biomarker.ai Lead: Dr. Saed Sayad
- 2018 and 2020 Hackathon Master of Ceremonies: Ben Busby
- 2020 Hackathon: The TRI-con organizer: Kaitlyn Barago of healthtech
- 2020 Hackathon: Research to the People Organizer: Pete Kane
- 2020 Hackathon: "Clemson's 2020 normalized cohort" creators: Reed Bender, Ben Shealy and Benafsh Hussain from Dr. Alex Feltus' group
- 2020 Hackathon: Therapeutic Recommendations: GeneXplain's Dr. Jeannette Koschmann
- 2018 and 2020 Target Identification: QuantumInsights.io's Bernard Chen and Marvin Weinstein
- 2018 Hackathon: sv.ai volunteers: Ryan Leung, Clayton Melina, Lily Vittayarukskul, Hunter Dunbar, Pete Kane, Bill, Dom Jones, Marguerite, David Schachter, Anabelle Tang. Nina Sardesh, Sean Davis

2018 p1RCC HackathonTeams

Team	Members	Summary
Alzheng	Alex Feltus, Ben Shealy, Colin Targonski, Courtney Shearer, Eddie Weill, Ken Matusow, Sufeng Niu, William Poehlman	Model TCGA-RCC tumors as a “time series” across stage
BioMarkers.ai	Peyman Mirtaheri, Saed Sayad, Usman Qazi	Candidate p1RCC Biomarkers and environmental factors influencing expression
cancer-genome-workbench	Betty, rene lopez, Rui, Sarah	Predict/classify a sample cancer type using genetic data with: Unsupervised clustering, Dimensionality reduction, Somatic SNPs, Data exploration
causalnucleotidenetwork	Arkarachai Fungtammasan, Naina Thangaraj, Ola Zalcman, Steve Osazuwa	Variational Autoencoder and tSNE clustering
codeOmics	Daniel Hornburg, Milena Duerrbaum	Biomarkers to precision drugs
DamTheRiver	Andrew Wallace, Christian Clough, Felix Frayman, Matt Callahan, Nandita Damaraju, Pak Yu, Sebastian Nguyen, William Wright	Identification of neo-antigens present within patient P1RCC sequence data

2018 p1RCC HackathonTeams

DeeperDrugs	Andrew Mills, Biter Bilen, Jeff Lam, Lei Tian, Michael D'Amour, Monika Maleszewska, Prasun Mishra, Tahera Zabuawala, XIAOWEI ZHU	Rigorous variant filtering and target pruning
ExpressForce	Amrit Virdee, Maricris Macabeo, Nikhil Balaji, Sofia Medina Ruiz, Yuri Bendana	Netflix for Genes
geviz	Maytas Monsereenusorn, Natnicha Vanitchanant, Navi Tansaraviput, Thanapat Worasaran	Gene Expression Visualization
GNOME	In-Hee Lee, Sek Won Kong	Prioritizing germline and somatic variants potentially associated with p1RCC
HelloKidney	Terje Norderhaug	Autoimmune Clues to Kidney Cancer
HelloKidney2	Clinton Mielke, Robert Van Spyk	Genetic Markers
HIF1AIsNotAnOncogene	Eric Danziger, Joshua Bloomstein, Stephanie Kinnunen, Wanlin Zheng	A preliminary case study in EGFR

2018 p1RCC HackathonTeams

KidneyBean	Bea Nguy, Eric Kalosa-Kenyon, James (3), Jay (3), Kallen Schwark, Kandy Nachimuthu, Mabel Furutsuki, Maninder Singh, Marcus Strauss, Rahim Hashim, Sam Rapp, Wessam Sonbol	Drug candidates towards personal medicine
RecausalNucleotideNetworks	Andrew Carroll, Jason Chin, Pi-Chuan Chang, Samantha Zarate	How Effective Are Illumina Methods for BGI-SEQ? 20180531 BLOG POST
studentec	Brian Hanley, Rush Tehrani	USING BIGQUERY FOR GENOMIC DATA ANALYSIS
trimericOGs	Christine Kim, Lily Vittayarukskul, Phoebe So, Rohith Krishna, Samson Mataraso, senay yakut	Classifying Tumor Stages based on Structural Variants in Patient Data

Final Word

“If you work on frequent cancers, do randomized trials! If you work on rare cancers—find friends!”

Olson, TA, Schneider, DT, Brecht, IB, et al.

If you want to help improve rare disease treatment options, contact

Bill (bill@rarekidneycancer.org)

Probability of Success[2] by Clinical Trial Phase and Therapeutic Area

	P1 to P2	P2 to P3	P3 to Approval	Overall
Oncology	57.6	32.7	35.5	3.4
Metabolic/Endocrinology	76.2	59.7	51.6	19.6
Cardiovascular	73.3	65.7	62.2	25.5
Central Nervous System	73.2	51.9	51.1	15.0
Autoimmune/Inflammation	69.8	45.7	63.7	15.1
Genitourinary	68.7	57.1	66.5	21.6
Infectious Disease	70.1	58.3	75.3	25.2
Ophthalmology	87.1	60.7	74.9	32.6
Vaccines (Infectious Disease)	76.8	58.2	85.4	33.4
Overall	66.4	48.6	59.0	13.8
Overall (Excluding Oncology)	73.0	55.7	63.6	20.9

Source: Chi Heem Wong, Kien Wei Siah, Andrew W Lo. "Estimation of clinical trial success rates and related parameters." *Biostatistics* 20(2): April 2019, Pages 273-286. Published online: 31 January 2018. DOI: 10.1093/biostatistics/kxx069

Second Opinion Alternative

Suppose a second opinion gives no new info? What to do then?
Gary Oldman has some advice….