Biostatistics Shared Resource

UCI Chao Family Comprehensive Cancer Center

Leadership

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Mission

The BSR provides a centralized resource of biostatistical expertise for the experimental design and analysis of basic, translational, clinical and population-based cancer research.

To fulfill this mission, BSR:

- Initiates active participation during grant preparation in the areas of cancer etiology, genetics, detection, and prevention
- Partners on research design, qualitative and quantitative protocol features
- Incorporates existing and develops new statistical methods
- Provides guidance on sample size requirements

Services

Basic Statistical Analysis
- Statistical analysis for manuscript/grant preparation

Omics Data Analysis
- Genomic (SNP, WGS, WES) including GWAS, PheWAS
- Transcriptomic (microarray data, bulk RNA-seq) including eQTL analysis
- Epigenetics (ChIP-seq; ATAC-seq)
- Single-cell omics
- Functional analysis (pathway, GO)
- Metabolomics
- Microbiome
- Radiomics and radiogenomics

Advanced Statistical Analysis
- Project-oriented special study design and data analysis

Research Computing
- Project planning with HIPAA-compliant computational needs, and best practices on cloud computing technologies
- Database design, creation and management (e.g., linking EHR and omics data for PheWAS)
- Programming assistance
- Setting up and running intensive jobs on Cloud

Training and Education
- Annual NCI "*Big Data Training for Cancer Research*"
- Offer regular need-based workshops

Consulting
- Bioinformatics | Biostatistics | Database | Machine learning | Research computing | Statistical/computational genetics and genomics

Research Highlights

1 | Hereditary Cancer Clinics Improve Adherence to NCCN Germline Testing Guidelines for Pancreatic Cancer

Claudia Rosso, Naomie Devico Marciano, Deepika Nathan, Wen-Pin Chen, Christine E McLaren (CC), Kathryn E Osann, Pamela L Flodman, May T Cho, Fa-Chyi Lee (BIDD), Farshid Dayyani (SPT), Jason A Zell (CC), Jennifer B Valerin(SPT)

Publication: *J Natl Compr Canc Netw. 2024 ; 22(5):299-305 PMID: 38889755.*

Background: Pancreatic ductal adenocarcinoma (PDAC) has a poor prognosis, with a 5-year overall survival rate of 10%. In November 2018, NCCN recommended that all patients with PDAC receive genetic counseling (GC) and germline testing regardless of family history. We hypothesized that patients with PDAC were more likely to be referred for testing after this change to the guidelines, regardless of presumed predictive factors, and that compliance would be further improved following the implementation of a hereditary cancer clinic (HCC).

Methods: We conducted a retrospective analysis of patients diagnosed with PDAC from June 2017 through December 2021 at University of California, Irvine. We compared rates of genetics referral among patients in different diagnostic eras: (a) pre-NCCN era: June 2017 through November 2018), (b) post-NCCN era: December 2018 through January 2020, and (c) HCC (HCC era: June 2020 through December 2021). Data were compared using chi-square, Fisher exact, and multivariate analyses.

Results:
- Prior to the guideline changes, 30% were referred to GC compared with 54.7% in the post-NCCN era. After the implementation of the HCC, 77.4% were referred to GC (Table 1, *P*<.0001).
- The odds ratio (OR) for referral to GC among patients with a positive family history of cancer progressively decreased following the change (pre-NCCN era: OR, 11.90 [95% CI, 3.00–80.14]; post-NCCN era: OR, 3.39 [95% CI, 1.13–10.76]; HCC era: OR, 3.11 [95% CI, 0.95–10.16]).

Conclusions: The 2018 changes to the NCCN Guidelines recommending germline testing for all patients with PDAC significantly increased GC referral rates at this academic medical center. The implementation of an HCC further boosted compliance.

Table 1. Genetic Counseling Referral Patterns

	All (n=368)	Pre- NCCN (N=125)	Post-NCCN (N=140)	HCC (N=103)	P-value
Referred to GC	124	24/80 (30.0%)	35/64 (54.7%)	65/84 (77.4%)	<0.0001*
Attended GC	84	15/24 (83.3%)	26/35 (96.3%)	43/65 (74.1%)	0.0362
Completed Testing	74	13/15 (100%)	22/26 (91.7%)	39 /42 (92.9%)	0.8411
Deleterious Mutation Positive	15	3/9 (33.3%)	6/22 (27.3%)	6/38 (15.8%)	0.3818

2 | Interventions to mitigate cancer-related medical financial hardship: A systematic review and meta-analysis

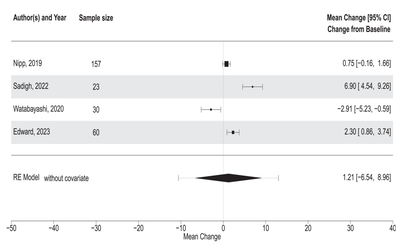
Ali Rashidi, Jinho Jung, Raymond Kao, Emily Lan Nguyen, Theresa Le, Brandon Ton, Wen-Pin Chen, Argyrios Ziogas (CC), Gelareh Sadigh (CC)

Publication: *Cancer.* 2024 Sep 15;130(18):3198-3209. PMC11347103
Funding: National Cancer Institute of the National Institutes of Health (P30CA062203)

Background: This study systematically reviewed interventions mitigating financial hardship in patients with cancer and assessed effectiveness using a meta-analytic method.

Methods: PubMed, Cochrane, Scopus, CINAHL, and Web of Science were searched for articles published in English during January 2000–April 2023. Two independent reviewers selected prospective clinical trials with an intervention targeting and an outcome measuring financial hardship. Quality appraisal and data extraction were performed independently by two reviewers using a quality assessment tool. A random-effects model meta-analysis was performed. Reporting followed the preferred reporting items for systematic review and meta-analyses guidelines.

Results:
- Eleven studies (2211 participants; 55% male; mean age, 59.29 years) testing interventions including financial navigation, financial education, and cost discussion were included.
- Financial worry improved in only 27.3% of 11 studies.
- Four studies (373 participants; 37% male, mean age, 55.88 years) assessed the impact of financial navigation on financial worry using the comprehensive score of financial toxicity (COST) measure (score range, 0–44; higher score = lower financial worry). Adjusting for pre-intervention COST, mean change of COST significantly decreased by 0.88 with every 1-unit increase in pre-intervention COST (p = .02). The intervention significantly changed COST score when pre-intervention COST was ≤14.5.



Conclusion
A variety of interventions have been tested to mitigate financial hardship. Financial navigation can mitigate financial worry among high-risk patients.

Key Equipment & Technologies

- SAS® software Version of 9.4
- R package
- StataCorp. 2017. Stata Statistical Software: Release 15. College Station, TX: StataCorp LLC.
- PASS 2023 Power Analysis and Sample Size Software. NCSS, LLC. Kaysville, Utah, USA, ncss.com/software/pass.
- nQuery 8. Sample Size and Power Calculation. "Statsols" (Statistical Solutions Ltd), Cork, Ireland.
- QIAGEN Ingenuity Pathway Analysis (IPA)

Future Plans

Community Engagement / Catchment Area
- Continue to support the development of grant applications / manuscripts that focus on the catchment area and result from partnerships developed through CE efforts;
- Continue to provide consulting services on bioinformatics, biostatistics, database access, data integration;
- Expand new services on machine learning, statistical genetics and genomics, research computing to facilitate interdisciplinary collaborations in catchment area.

Enhancing Diversity, Equity and Inclusion
- Offer scholarships for underrepresented trainees to attend the NCI-funded big data workshop;
- Develop new machine learning methods to improve the analysis of data from minority populations.

Education and Training
- Organize the annual NCI-funded summer workshop on "*Big Data Training for Cancer Research*";
- Offer regular need-based workshops on basic statistical analysis, workflow for sequencing data analysis, FAIR computational workflows on the cloud;
- Organize regular seminar series to provide education opportunities for trainees.

Publications

CFCCC Investigator	Program	Published Journal	Year
Christine McLaren, PhD Fa-Chyi Lee, MD Farshid Dayyani, MD, PhD Jason Zell, DO, MPH Jennifer B Valerin, MD, PhD	CC BIDD SPT CC SPT	J Natl Compr Canc Netw	2024
Daniela Bota, MD, PhD	BIDD	Neuro-oncology	2024
Christine McLaren, PhD Xiaolin Zi, PhD	CC CC	Clin Transl Med.	2024
Argyrios Ziogas, PhD Gelareh Sadigh, MD	CC CC	Cancer	2024
Farshid Dayyani, MD, PhD Fa-Chyi Lee, MD	SPT BIDD	Oncologist	2024
Helen Ma, PhD Pankaj Gupta, MD Wendy Cozen, PhD	CC SPT CC	Blood Adv.	2024