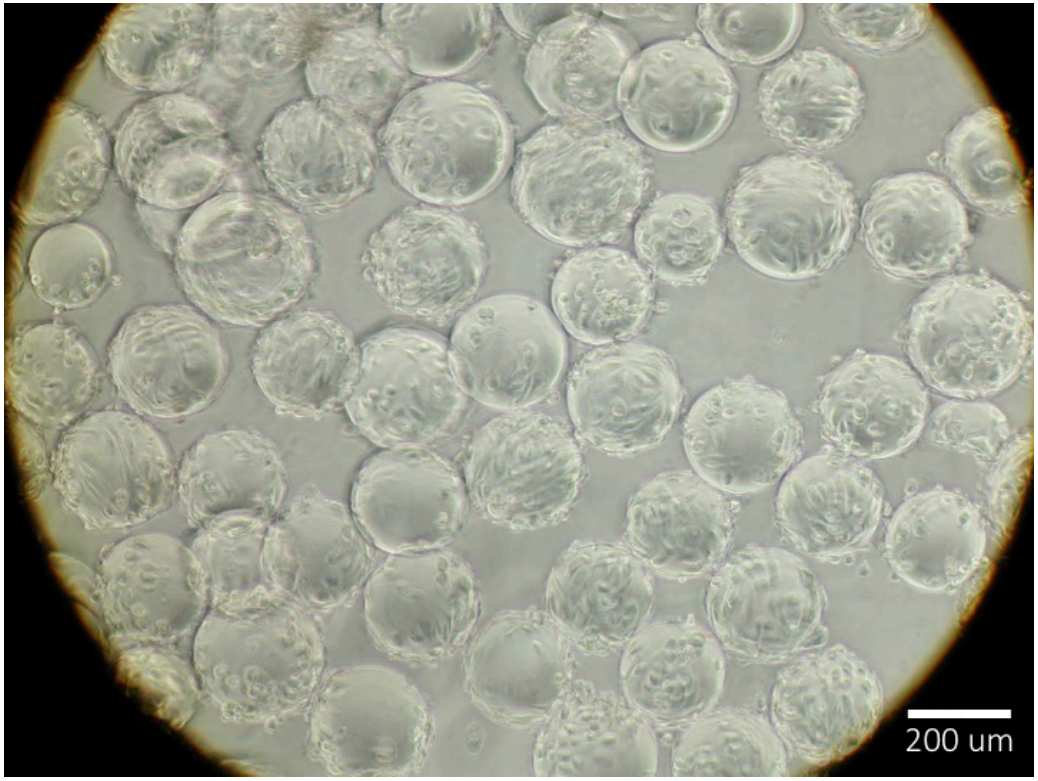
Demographic Inclusiveness in Human Cell Studies



Motivation

The discovery of new medical therapies begins with human cell models, progresses to animal models, and finally human test subjects. During the initial cell model stage, researchers purchase cells from an existing archive, populated by human donors since 1951. The demographic representation in the cell archive available to researchers may bias the generalizability of the research findings. The proposed work to characterize demographic bias in cell models aligns with current efforts within the pharmaceutical industry for personalized medicine based on an individual genetic make-up. The broader impact of the proposed research is in its potential to enhance knowledge of inefficiencies within the drug discovery process.

Objective

The objective is to assess demographic inclusiveness during the cell model phase of medical research by characterizing the assets available to researchers, how researchers use those assets and the existing gaps in treatment efficacy.

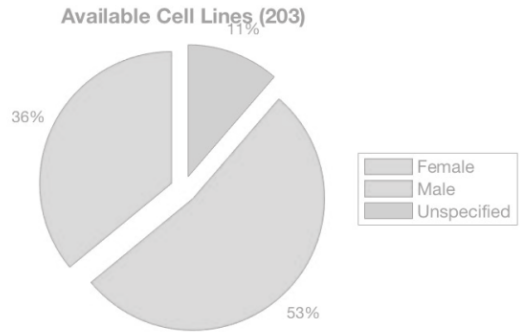
Research Tasks

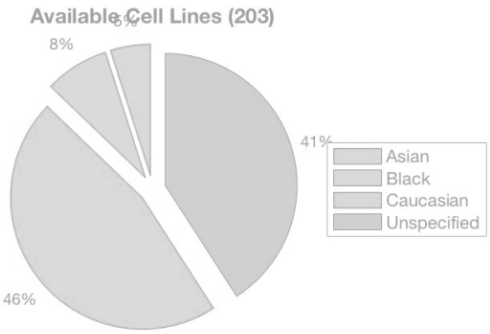
1. How are demographics represented in the tools available to medical researchers?
   - Characterize available cell lines
2. How do researcher use these tools?
   - Characterize frequency of each cell lines cited in publications.
3. How do such tools impact therapeutic options?
   - Characterize the frequency of cell lines cited in patent applications.
4. Does the efficacy of treatment decrease for demographics not represented in the tools available to medical researchers?
   - Compare a timeline on CDC statistics for disease morbidity to occurrences of cell lines cited in publications and patents.

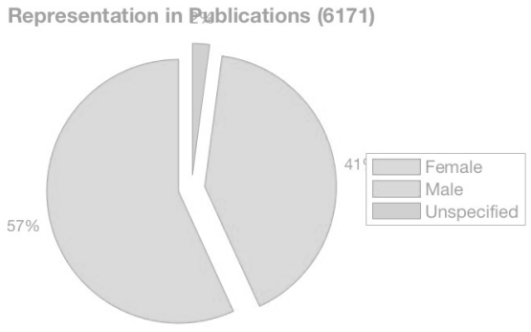
Results

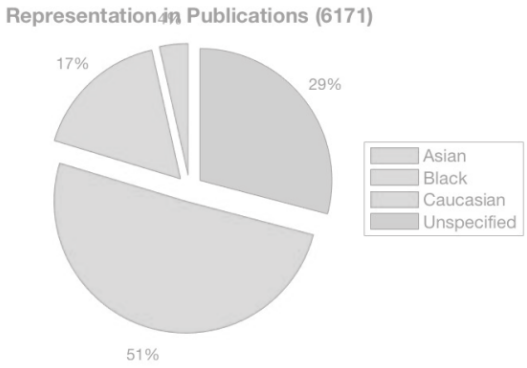
1. Characterize the demographics of the cell lines available to researchers.
2. Characterize how researchers use the available cell lines in published research.
3. Compare demographic representation of cell lines in publications to morbidity rates (CDC data).

What cell lines are available?

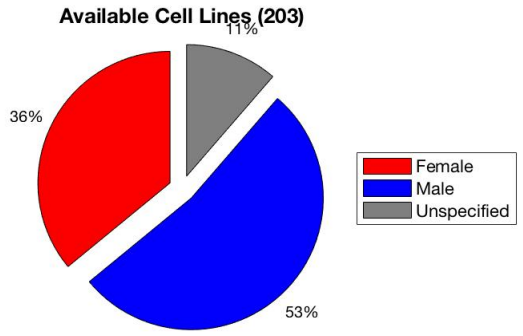


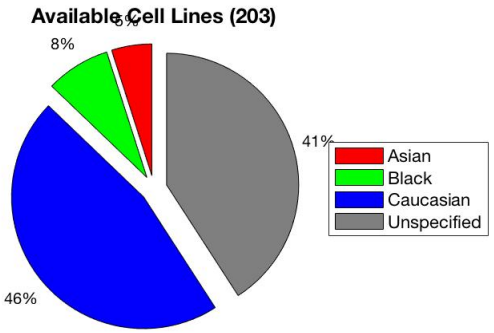


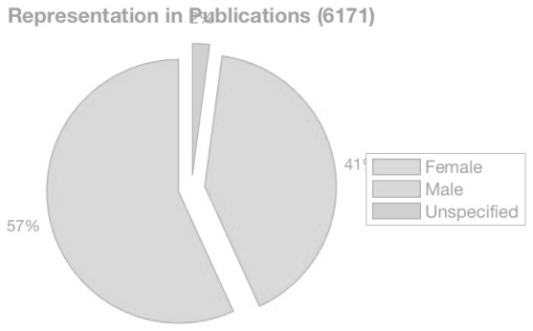


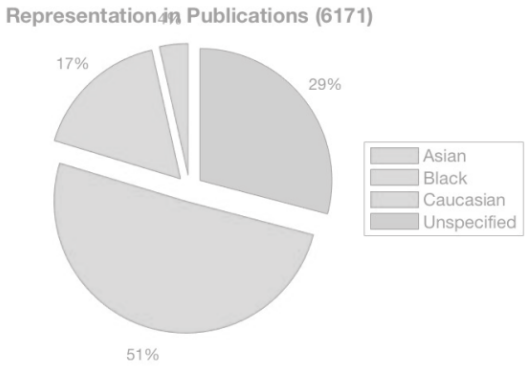


Demographics defined from cell line specification sheets.

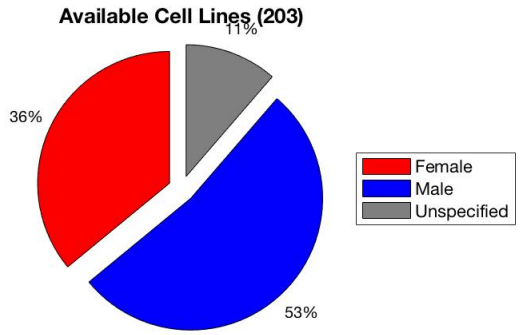


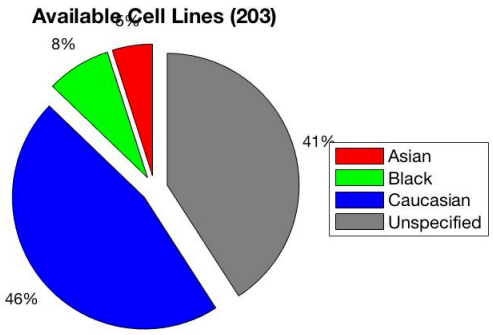


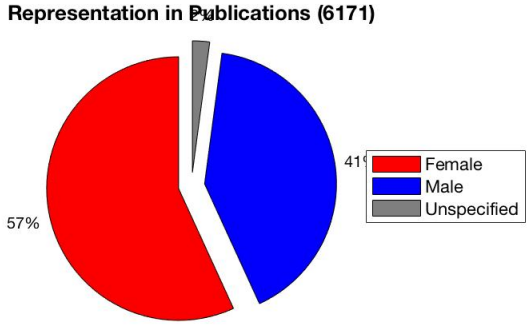


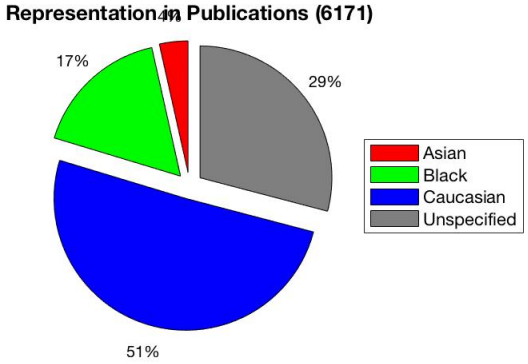


Representation in publications from mentions of cell lines.

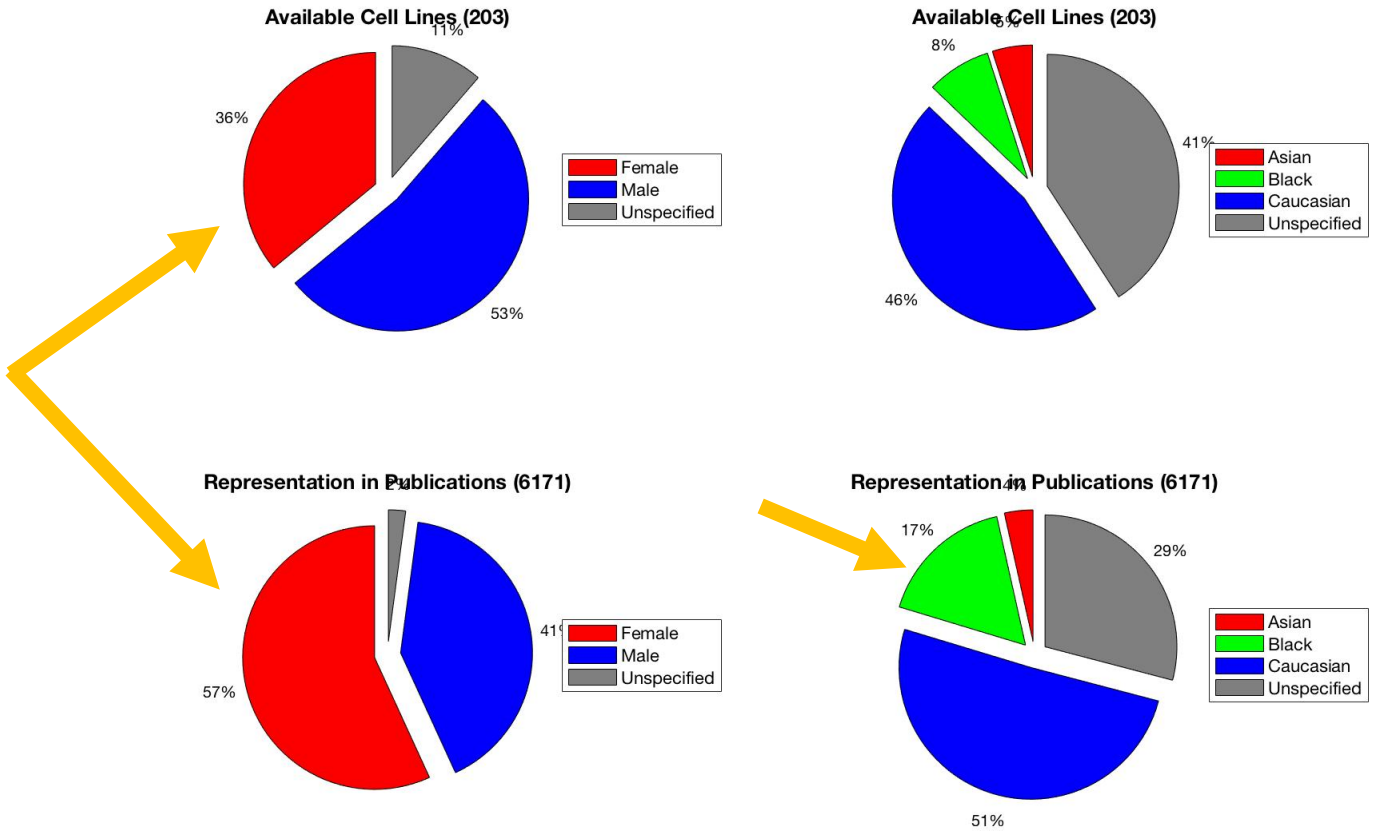




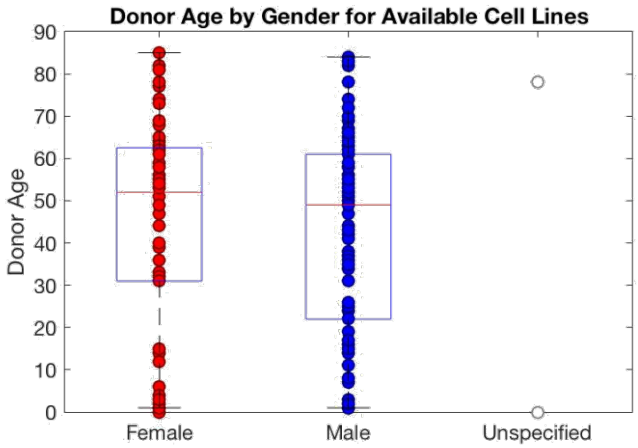


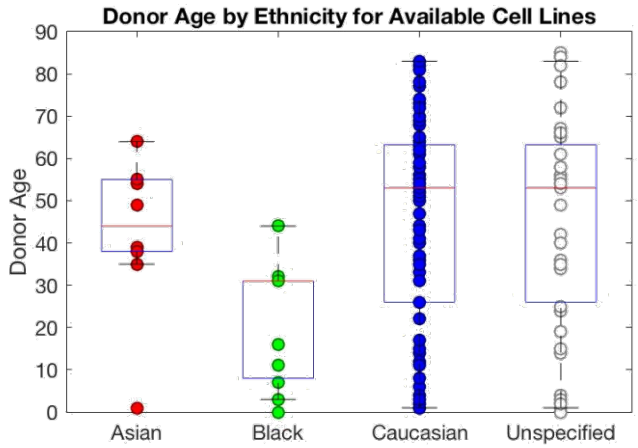


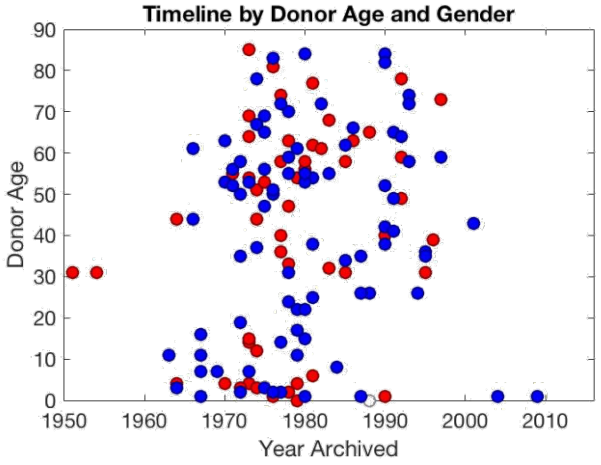
The original cell line was donated by a Black female. This may explain the representation in publications.

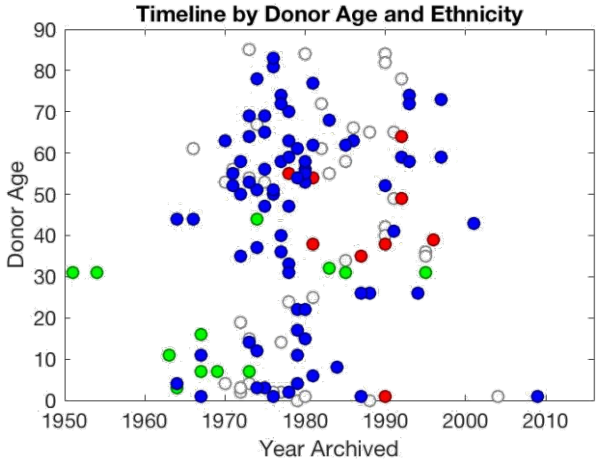


Timeline of the cell line catalog.
Donor demographics by age, gender and ethnicity

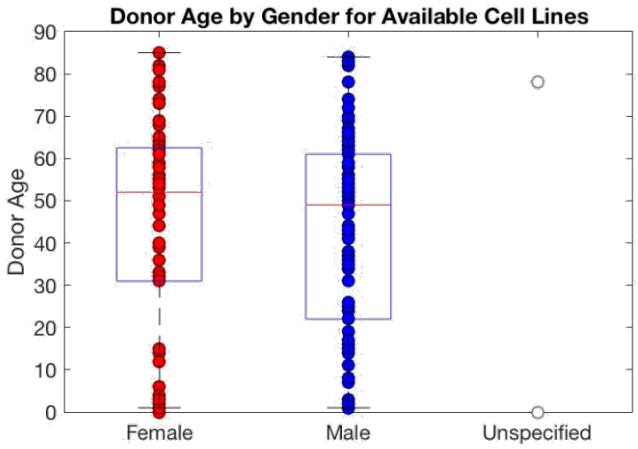


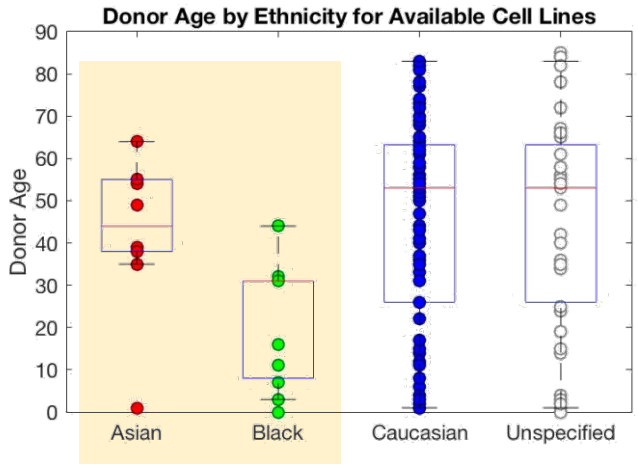


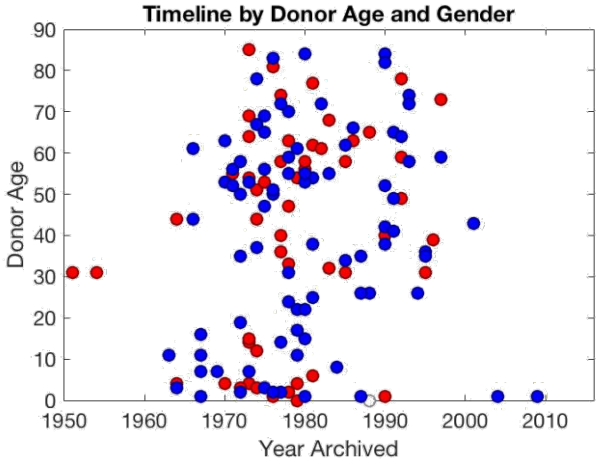


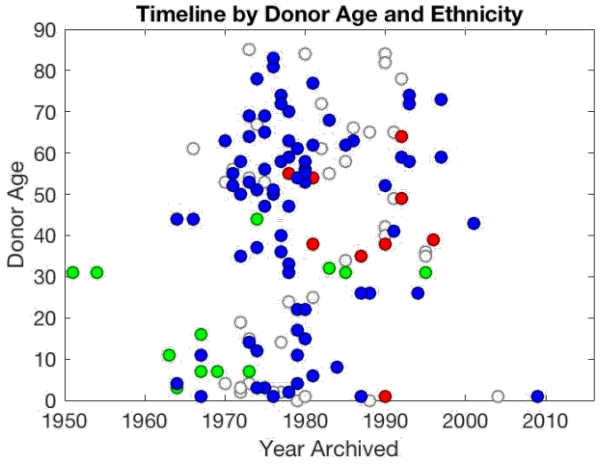


Asian donors younger than 30 are not represented,
neither are Black donors older than 40.
The more numerous Caucasian donors best represent the expected life span.

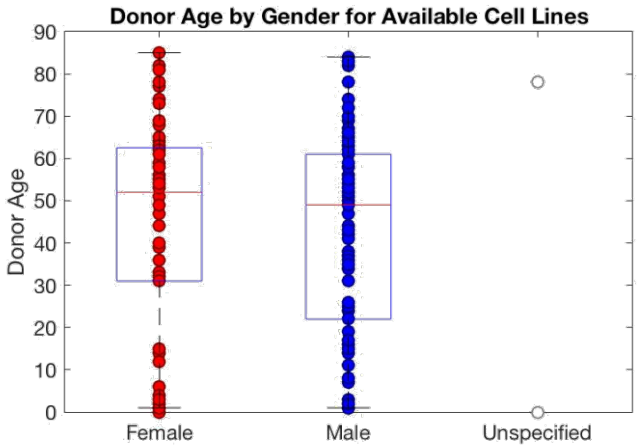


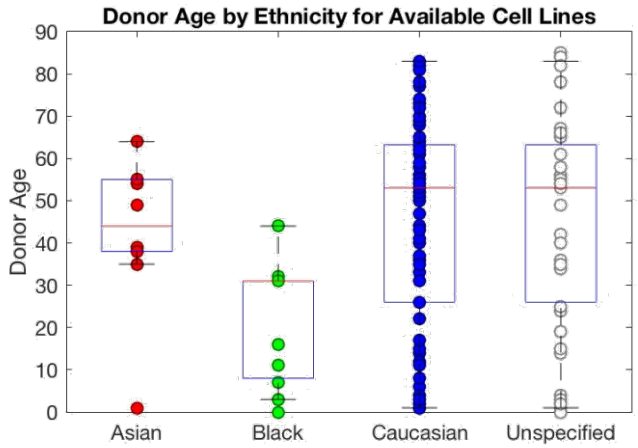


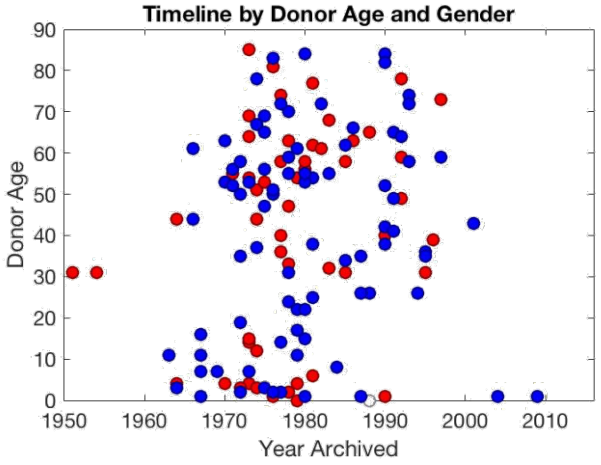


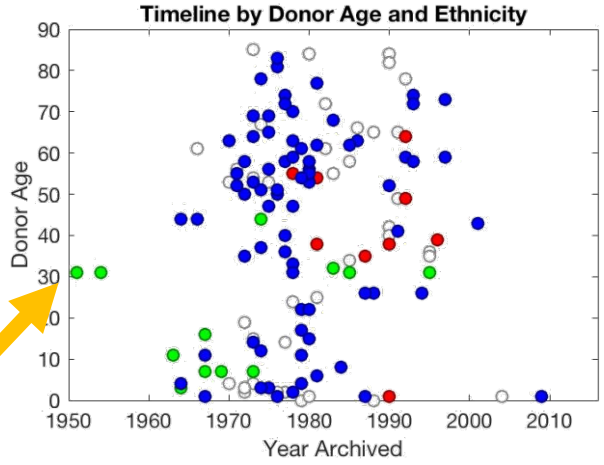


The first cell line was donated by a Black female.

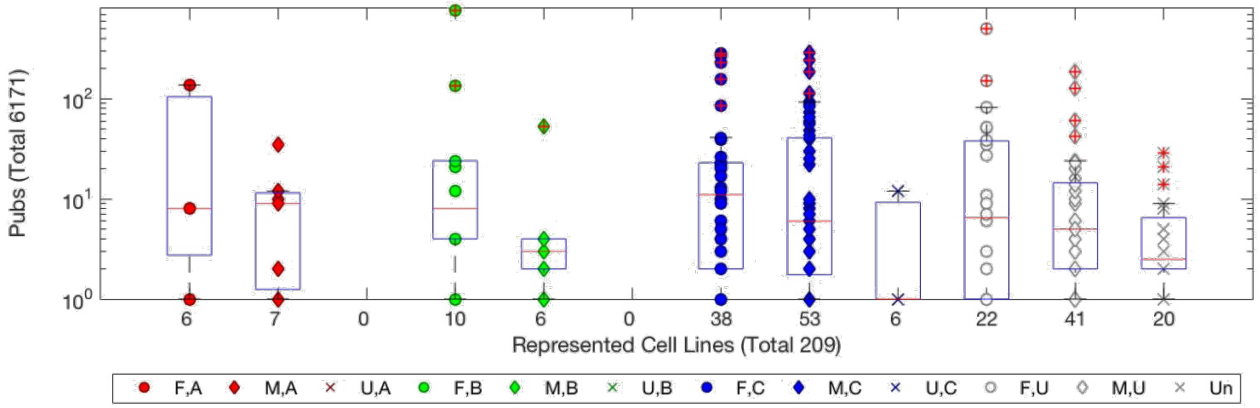


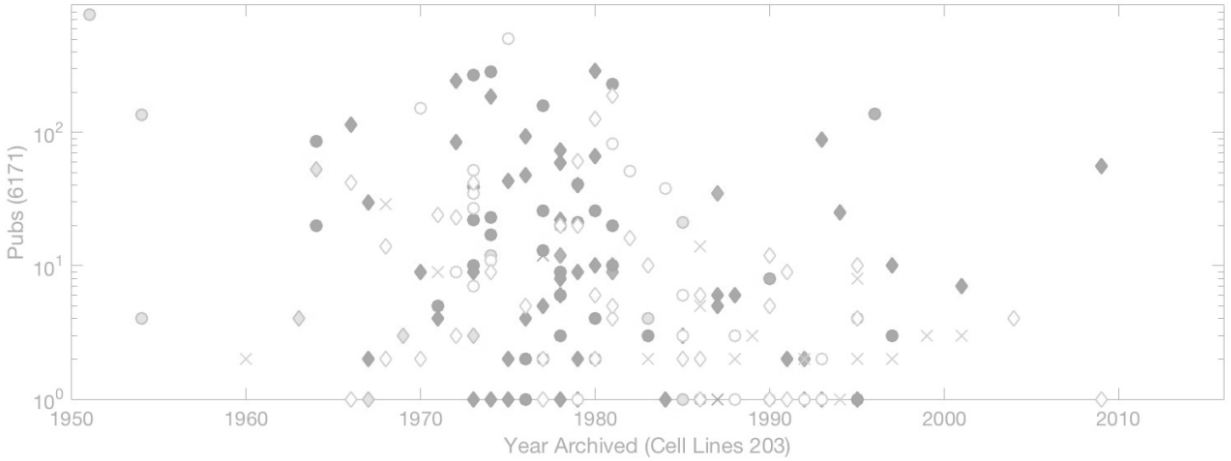




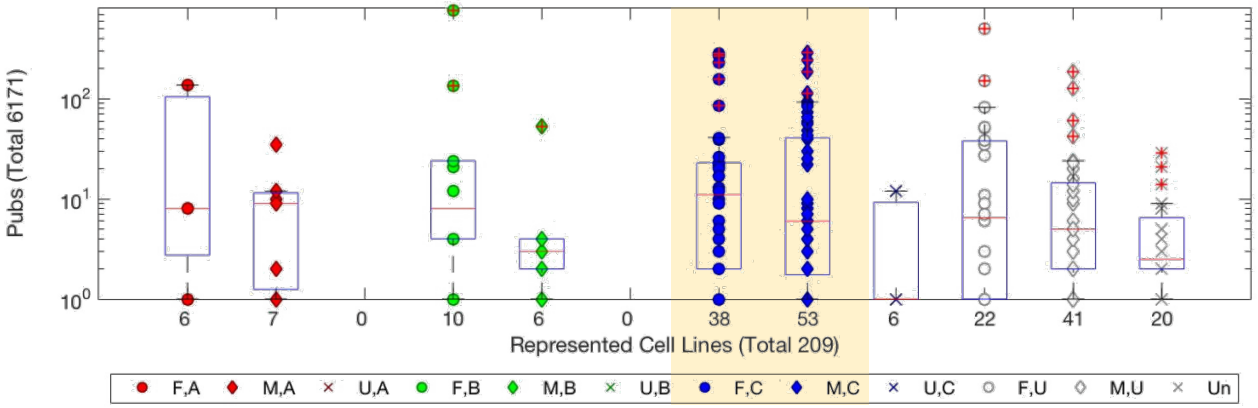


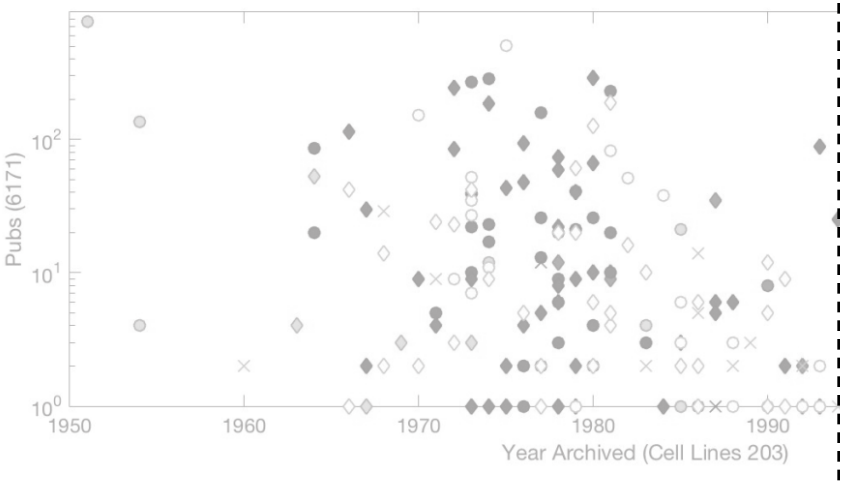
Demographic representation of the available cell lines in publications.

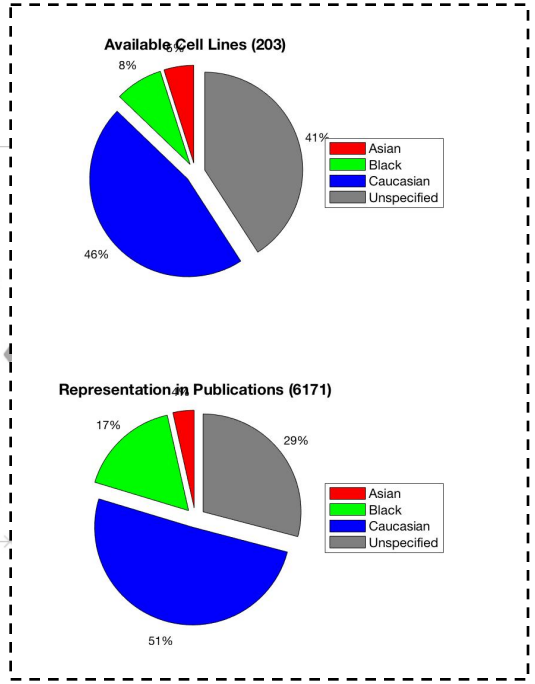




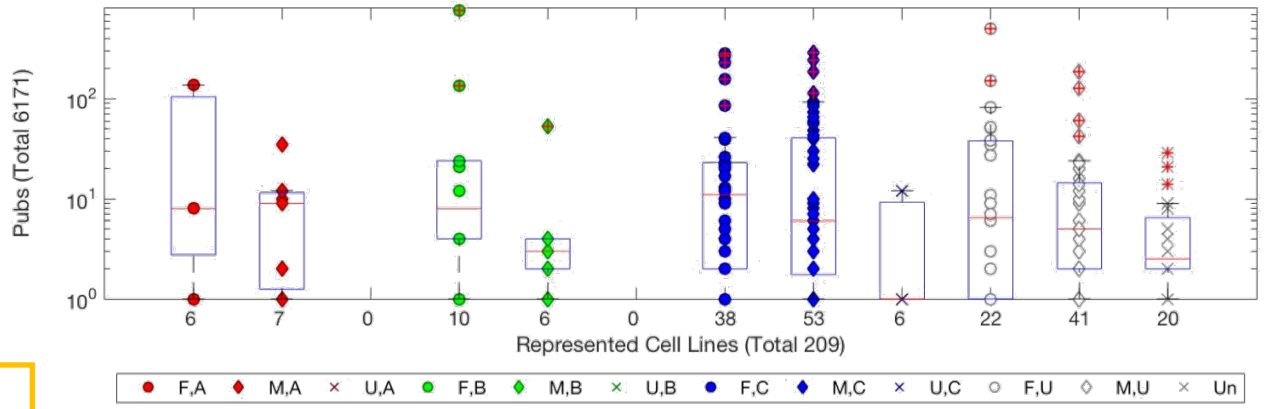
Caucasian is the best represented ethnicity among the available cell lines.

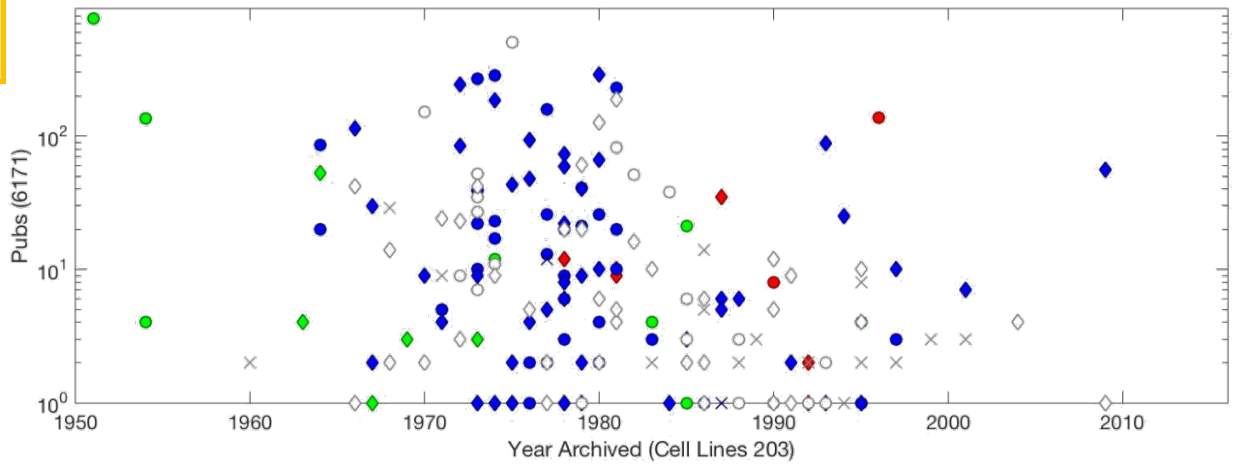




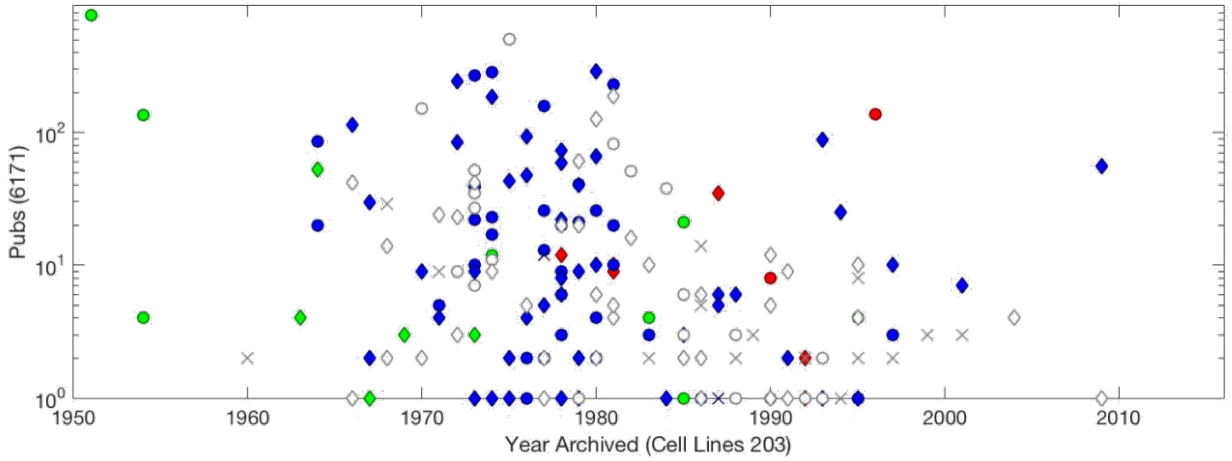


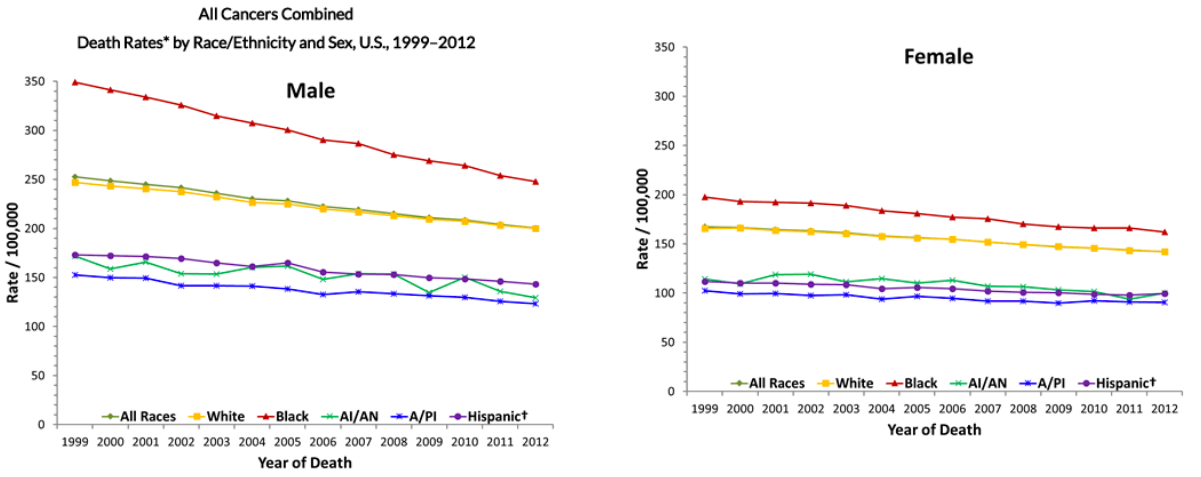
The most frequently cited is also the first established cell line.





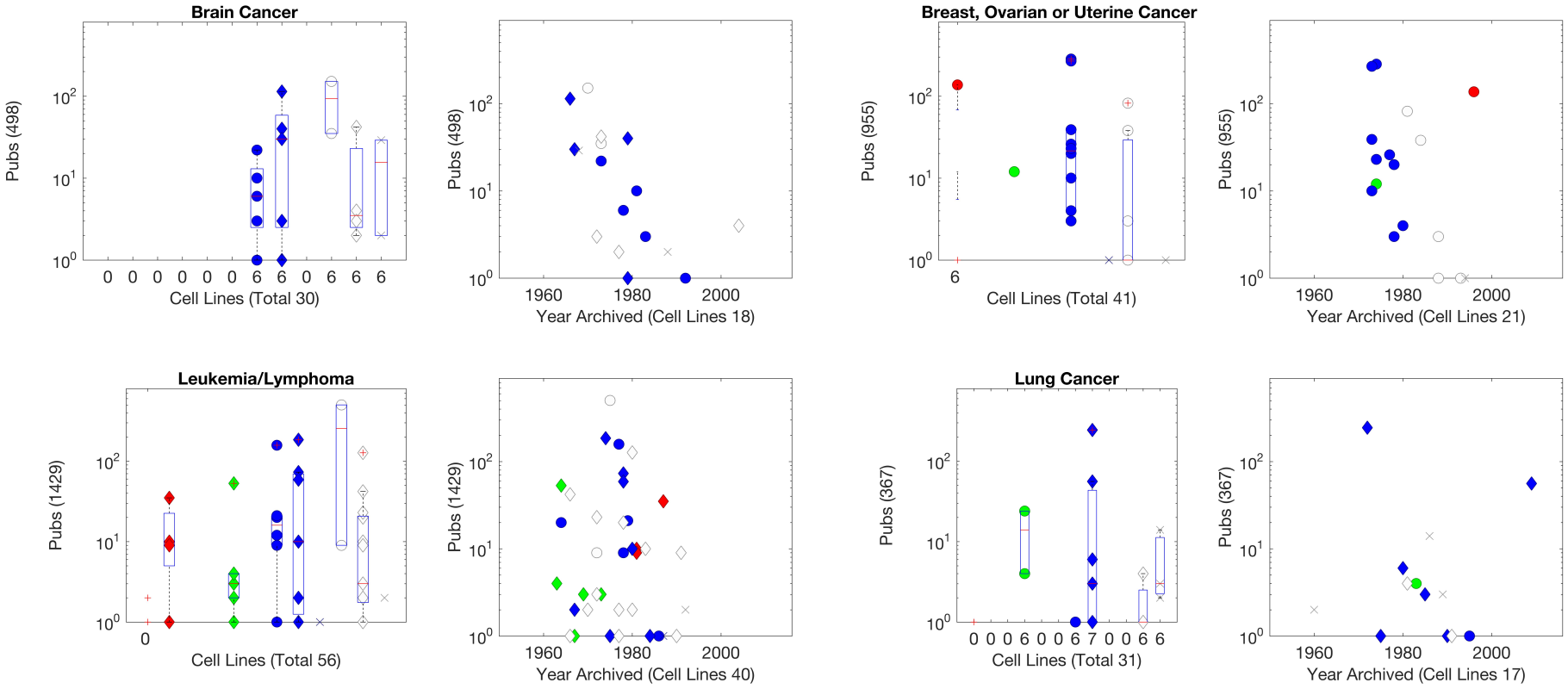
CDC statistics on demographics of cancer morbidity



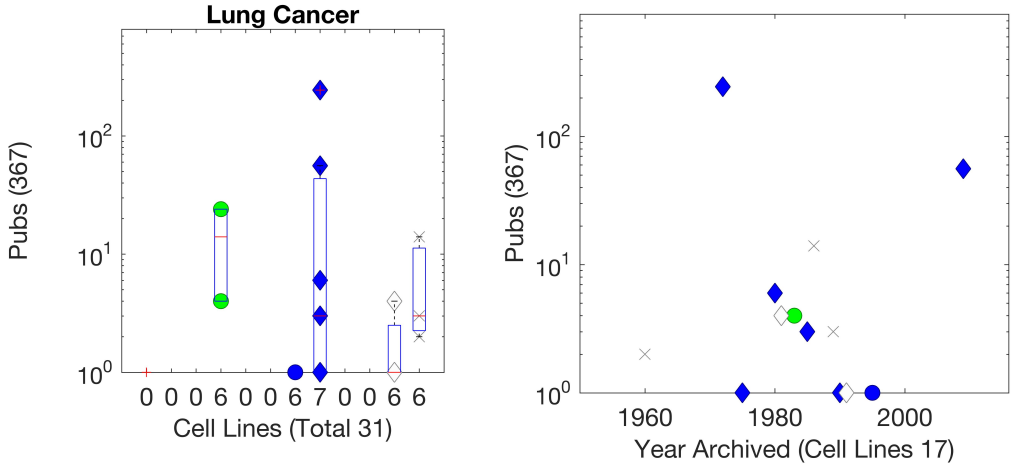


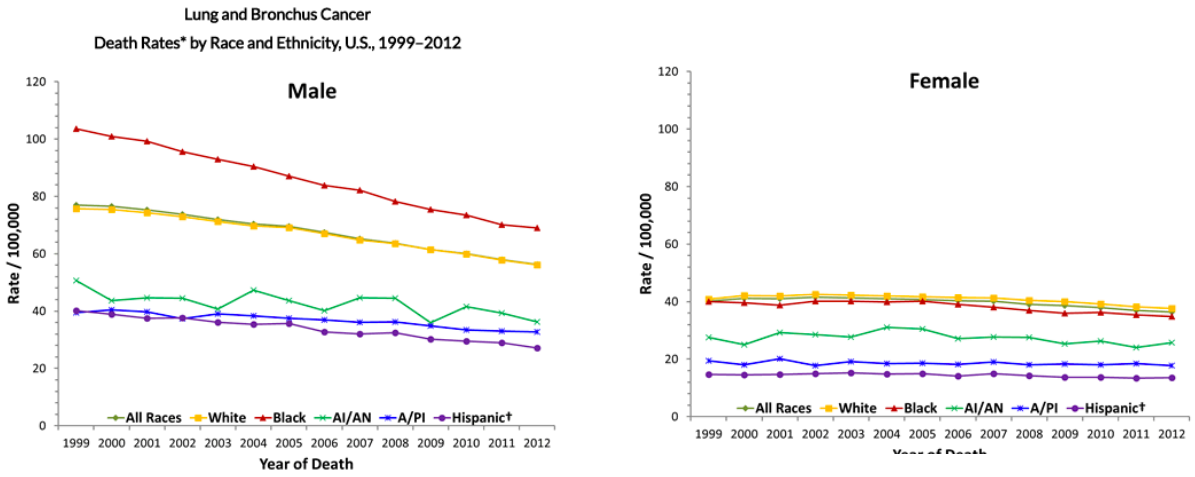
http://www.cdc.gov/cancer/dcpc/data/race.htm

Cell line use in publications by disease



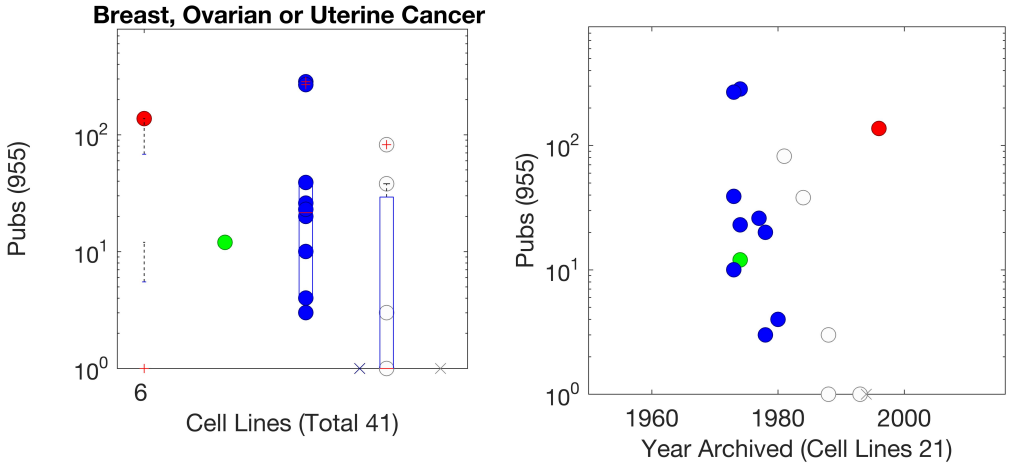
CDC statistics on demographics of lung cancer morbidity

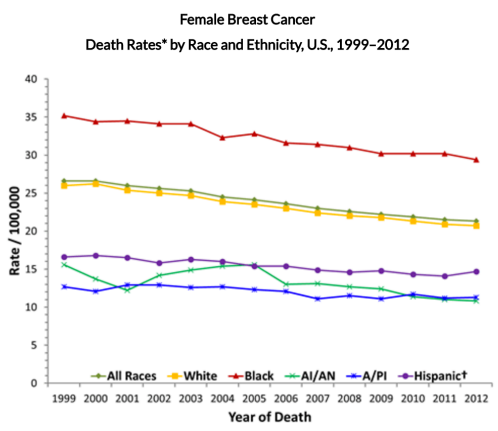


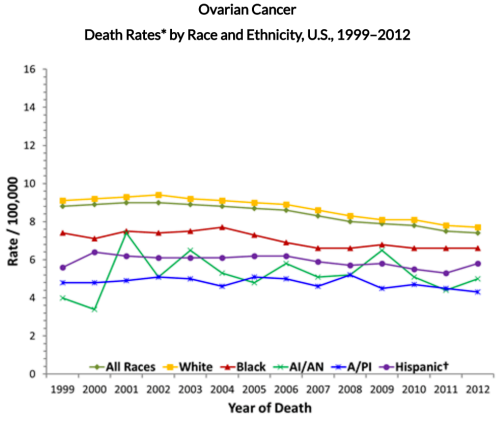


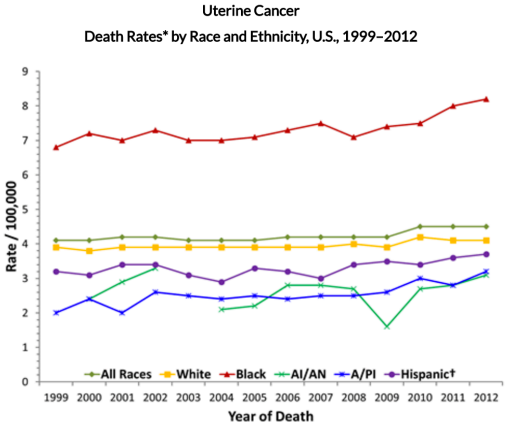
http://www.cdc.gov/cancer/lung/statistics/race.htm

CDC statistics on demographics of breast, uterine and ovarian cancer morbidity









http://www.cdc.gov/cancer/breast/statistics/race.htm . http://www.cdc.gov/cancer/uterine/statistics/race.htm . http://www.cdc.gov/cancer/ovarian/statistics/race.htm

Discussion

1. How are demographics represented in the tools available to medical researchers?
   - Characterize available cell lines
2. How do researcher use these tools?
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3. How do such tools impact therapeutic options?
   - Characterize the frequency of cell lines cited in patent applications.
4. Does the efficacy of treatment decrease for demographics not represented in the tools available to medical researchers?
   - Compare a timeline on CDC statistics for disease morbidity to occurrences of cell lines cited in publications and patents.

Conclusion

This retrospective characterizes the existing tool kit for medical researchers to study human cells in vitro, exposing gaps in the demographic representation of the existing tools, comparing those gaps with deficiencies in treatment efficacy.