# Spin #2 Retrospective Document

**Refined Project Scope:**

Our project scope is identifying factors that contribute to low bone mineral density as a method of predicting bone fractures. Low bone mineral density is a component, but no longer considered the only component of osteoporosis. These factors include lifestyle factors; such as exercise, diet, and alcohol intake; current diseases such as diabetes, chronic obstructive pulmonary disease and hyperthyroidism; biomarkers; and health history including history of previous fractures and stroke. We will limit our assessment of health issues to only those that contribute to fractures and not to those that may result from or be associated with fractures. Depending on the size of the results we find, we may further limit our assessment to an age range.

**Refined Domain Questions**

What is the impact of lifestyle factors such as exercise, diet, and alcohol intake on bone mineral density and the risk of fractures?

What specific biomarkers can be indicative of low bone mineral density or increased fracture risk?

**Refined Statement of Project Goals, Measurables, And Constraints**

As people age, they are often unwillingly forced to reduce fun activities due to an increased risk of unpredictable injury. Having a clearer idea of fracture risk based on individual health factors would allow people more freedom to choose which activities they are able to participate in. Our goal is to create a model that would accurately predict risk of bone fractures. Initially, we would utilize dataset analysis to determine the hyperparameters that would drive our feature reduction method to create the model.

*Project Goals:*

Identify lifestyle factors, prevalent diseases, biomarkers, and aspects of health history that significantly contribute to low bone mineral density and the subsequent risk of fractures.

Establish a model that predicts fracture risk based on these identified factors.

Develop guidelines for preventive strategies based on these identified risk factors.

*Measurables:*

A comprehensive list of lifestyle factors, diseases, biomarkers, and health history aspects that contribute to low bone mineral density and fracture risk.

A predictive model with quantifiable accuracy and reliability metrics for assessing fracture risk based on these factors.

A set of guidelines or recommendations that can be implemented to prevent or reduce the risk of fractures.

*Constraints:*

**Relevant KPIs**

* Determine which columns in the datasets are most relevant
* Reduce datasets to relevant columns
* Determine what factors to use to compare different datasets (this may include multiple comparisons)
* Combine reduced datasets to improve ease of visualization
* Create visualizations

**Refined Vision for data story**

* **Audience:** Our target audience is people at higher risk of fractures, their doctors, caretakers, and any other members of society who may benefit from this knowledge.
  + Healthcare Professionals: We aim to provide them with a tool that can help them identify patients at high risk and guide them in implementing appropriate preventative measures.
  + Policy Makers: Our insights can help inform healthcare policies and resource allocation decisions aimed at reducing the prevalence of fractures and improving patient care.
  + At-risk Individuals: By making our findings accessible to the general public, we can raise awareness about the risks and prevention strategies associated with fractures, empowering individuals to take charge of their own health.
* **Product:** Tentatively the data story will be in a powerpoint presentation. This may change if we determine a different medium will get the point across better.

**Summary of Project Literature Review**

While fracture risk and prediction has been extensively studied, rarely has such a large dataset been open for public use. The team has reviewed the MrOS list of publications and while they cover a wide breadth of topics the dataset is updated regularly which allows for the potential of newly discovered results or to confirm previously performed research using the MrOS dataset but updated for the year 2023 endpoints. Based on conversations with subject level expert at the Missouri Orthopedic Institute, some topics were considered “established” and avoided for less studied domains. For instance, the original version of our project was to research the effects of changes in bone mineral density on fracture instance. Due to the large amount of literature on this subject, we pivoted elsewhere. The list of MrOS publications can be accessed here: <https://mrosonline.ucsf.edu/PublicFiles/MrOSPublicationsListing.pdf>

[KB]There is a significant amount of literature regarding health and fractures. Factors such as lifestyle factors (i.e. exercise, diet, and alcohol intake), current diseases (i.e.diabetes, chronic obstructive pulmonary disease, and hyperthyroidism), and health history (i.e.history of previous fractures and stroke) have been studied as risk factors causing reduced bone mineral density which is a leading factor in general fracture risk, and we will attempt to address factors in our analysis. Contribution of hypothyroidism to fractures is still under debate and won’t be addressed in this analysis. Angina is a complication but not cause of fractures so it won’t be addressed in this analysis. Hypertension and arthritis are commong results from fractures but do not cause them and therefore won’t be addressed in this analysis. Radiation treatment from cancer and smoking slow repair of fracture but do not cause them and therefore won’t be addressed in this analysis.

Literature was found online and the references are listed below:

Aasis Unnanuntana, MD,1 Brian P. Gladnick, BA,2 Eve Donnelly, PhD,3 and Joseph M. Lane, MD1

J Bone Joint Surg Am. 2010 Mar; 92(3): 743–753.

Osteoporotic fracture risk assessment

AUTHOR: E Michael Lewiecki, MD

SECTION EDITORS: Clifford J Rosen, MD, Kenneth E Schmader, MD

DEPUTY EDITOR: Katya Rubinow, MD

**Changes in data storage, curation, and management**

The raw data flat files is stored in Juypter Hub but will not be pushed. We’ll then be uploading the data to a Postgres database where it will then be accessed for carpentry, analysis, and our data story.

**Changes to data provenance and assessment**

The MrOS data was a research study conducted from 2000-2002 at six clinical sites across the United States. The data was collected over the course of several visits. Our group is focusing on the original baseline visit. The baseline examination included the assessment of risk factors for fractures and other conditions, including neuromuscular, visual and cognitive function tests; bone mineral density (BMD); x-rays of the spine; QCT scans of the hip and spine and the collection of biospecimens. Subjects are surveyed three times a year for follow-up.

**Address any potential or identified weakness or biases to the data**

The MROS data was collected specifically on men, thus any results cannot be extrapolated to women. Additionally, a portion of the data is Null, and must be handled appropriately.

**Describe Data Carpentry**

* Datasets exported into PostgreSQL
* Column headers changed
* Nan values removed

**Describe EDA and Visualization Performed**

This is currently limited to exploring column contents.

**Weekly individual team member accountability/contribution assessment/evaluation included**

In addition to the regular Wednesday team meeting and mentor meeting, we communicate frequently and extensively on our group site on our Slack channel - casestudy\_su23\_group03.

**Project work success status evaluated and future work/tasks discussed**

**Jupyter Notebook(s) fully internally documented**

**All paths to data files map to DSA team shared folders**

**Current project SpIn artifacts (notebooks) are located in the TeamArtifacts\SpIn\_2\_Artifacts folder (provide link (within Europa) to the first notebook in the pipeline)**

**Jupyter Notebook(s) execute without exceptions**

**Link to Mentor recorded mentor meeting and key meeting takeaways provided**

[6-14-23\_Mentor\_Meeting\_Team03.mp4](https://mailmissouri-my.sharepoint.com/:v:/r/personal/jwj8c8_umsystem_edu1/Documents/SU23_DSA8080%20Casestudy/Zoom%20Meetings/6-14-23_Mentor_Meeting_Team03.mp4?csf=1&web=1&e=5RAV9H)