Tasks for the Datathon – Choose only one out of the four options:

Domain experts will be on site during the datathon and you can ask them any questions to help clarity your research question.

Task 1: Data Visualisation

Task 1 | Option 1 Design and develop the code for a front facing consumer/public dashboard for the ANZHFR to be displayed on the ANZHFR website.

Consider:
what key information would you like to know if you or your loved one (partner, parent, grandparent) has had a hip fracture?

Core Requirements:

- Visualisation: attractive easily understood presentation of key information/graphics including:
- Basic demographics (e.g. median age, sex, cognitive impairment)
- Main steps in the hip fracture care journey (See slides 6 ,7)
- Key outcome measures (e.g. length of stay, % rehabilitation, % requiring new placement in residential care)

User Experience:
The interface must be intuitive for use by the general public. Most likely accessed by older adults.

Examples:

- See slides 9 & 10 from the presentation slides
- See https://yourivfsuccess.com.au/ for an example of a front facing consumer website
- See https://app.powerbi.com/view?r=eyJrIjoiMjI1MTRhYWMtMTdkZS00Y2RmLWIzMzQtMDIyMjEyMGQ1MTMxIiwidCI6ImRkOGY5OTMxLWNiNzgtNDQwNi04YTAxLTAxYWM2MWMxMGQ0YSJ9

Task 1 | Option 2 Design and develop the code for an update of the clinician-facing dashboard (near to real-time data) to be accessed by clinical teams within the participating hospitals, that benchmarks hospital performance against the ACSQHC clinical quality indicators.

Consider:
What key clinically relevant information should be reported?

Core Requirements:
Visualization:

- Real-time visualisation
- Include metrics to allow benchmarking (Hospital, state and national levels)
- 2023 ACSQHC performance indicators
- Select acute care outcome measures (e.g. length of stay, median time to surgery, time in ED)

User Experience:

- The interface must be intuitive for use by clinicians working in the participating hospitals and hospital administrators.
- Include: Summary statistics - counts and proportion of patients, medians IQR
- Longitudinal data (Temporal trends)

Examples:

- See slides 12 & 13 from presentation slides

Task 2: The ANZHFR Cohort Builder

Background

The Australian and New Zealand Hip Fracture Registry (ANZHFR) collects data on over 19,000 hip fracture outcomes annually to improve care for older adults. Currently, researchers and clinicians often rely on static annual reports to understand patient populations. To accelerate quality improvement, stakeholders need a way to interactively explore the data and identify specific patient groups (cohorts) in real-time.

The Task

You are asked to build a **Cohort Builder Prototype**—an interactive, web-based tool that allows users (clinician researchers and hospital administrators) to filter, visualize, and define specific subsets of hip fracture patients based on the ANZHFR dataset.

If you have not heard of the concept of cohort builder before, you are encouraged to visit some of these existing cohort builders below for inspiration:

- **GDC (Genomic Data Commons) Cohort Builder:** https://docs.gdc.cancer.gov/Data_Portal/Users_Guide/cohort_builder/
- **All of Us Researcher Program Cohort Builder:** https://support.researchallofus.org/hc/en-us/articles/360039585591-Selecting-Participants-Using-the-Cohort-Builder.
- **UK BioBank Cohort Browser (on DNAnexus):** https://documentation.dnanexus.com/user/cohort-browser

Core Requirements

1. **Dynamic Filtering (Inclusion/Exclusion):**
    - Users can select participants based on key ANZHFR variables (e.g., *Age, Gender, Fracture Type, Surgery Type, Hospital Code, etc*).
    - Support for complex Boolean logic (e.g., "Patients aged 80+ **AND** who had a Total Hip Replacement Surgery **BUT NOT** Geriatric Assessment").
2. **Real-Time Visualization:**
    - As filters are applied, the dashboard should instantly update key metrics:
        - **Total Count:** Number of patients in the current cohort.
        - **Demographics:** Visual breakdown (e.g., Gender pie chart, Age distribution histogram).
        - **Clinical Outcomes:** Simple stats on time-to-surgery or length of stay for the selected group.

3. **User Experience:**
    - The interface must be intuitive for users with no coding experience. Avoid SQL queries; use dropdowns, sliders, or drag-and-drop facets similar to the examples above.
4. **Cohort Profiling and Comparison:**
    - Users can define and save the cohort profile to allow direct comparison between cohorts (e.g., “Comparison on time-to-surgery between patients in remote areas vs patients in metropolitan regions”).

Success Criteria

- **Functionality:** Can the tool correctly isolate a complex cohort (e.g., "Men under 75 with cognitive impairment") and allow comparison between cohorts?
- **Speed:** Does the count update immediately upon changing a filter?
- **Design:** Is the layout clean, accessible, and responsive?

Data Provided You will be provided with a **synthetic dataset** that mirrors the structure of the ANZHFR Data Dictionary.

Task 3: Development of causal models for patient outcomes

Example research questions:

- Does the use of a nerve block for the management of acute pain decrease the risk of post-operative delirium?
- Does early mobilization reduce the risk of new residential aged care placement? Other 'hot' research topics in hip fracture care:
- What is the impact of early mobilization on other outcomes (LOS, pressure injuries or mortality)
- What is the impact of malnutrition on outcomes (new residential aged care placement or mortality)
- What is the impact of private health insurance on provision of rehabilitation
- What is the impact of hospital volume on outcomes (LOS, provision of rehabilitation, mortality)

Consider:

- How can the exposure be defined from the available data?
- What is the estimand of interest
- What clinical or other background factors influence who received the treatment/exposure of interest?
- What observed variables can help to measure and correct for any imbalance?

Examples:

- Kawakami, Hirotaka, et al. **Timely surgical intervention for hip fractures is essential to reinstate ambulatory function on discharge: propensity score matching.** *JBJS Open Access* 10.1 (2025): e24. https://journals.lww.com/jbjsoa/fulltext/2025/03000/timely_surgical_intervention_for_hip_fractures_is.24.aspx
- Tanios, Anna-Marie G., et al. **The effect of type of anaesthetic on delirium after surgery for acute hip fracture: An instrumental variable analysis to assess causation.** Anaesthesia and Intensive Care 53.2 (2025): 116-124. http://dx.doi.org/10.1177/0310057X241275116

Task 4: Development of predictive models for patient outcomes

Example research questions:

- Can we predict if a patient will experience post-operative delirium, based on person and pre-operative characteristics?
- Can we predict if a patient will access rehabilitation post acute care, based on person and acute-care characteristics?
- Can we predict if a patient will require a new residential aged care placement, based on person and care characteristics?
- Can we predict if a patient will return to their pre-fracture walking status at 120 days post discharge, based on personal-level and acute care characteristics?

Consider:

- What is time zero? Time zero is the time for prediction. Variables recorded after time zero cannot be used even if they are available in the dataset.
- What variables are available to the person making the prediction at the time of prediction?
- How to handle missing data?

Examples:

- Oosterhoff, Jacobien HF, et al. **Prediction of postoperative delirium in geriatric hip fracture patients: a clinical prediction model using machine learning algorithms.** Geriatric Orthopaedic Surgery & Rehabilitation 12 (2021): 21514593211062277. https://doi.org/10.1177/21514593211062277
- Cary Jr, Michael P., et al. **Machine learning algorithms to predict mortality and allocate palliative care for older patients with hip fracture.** *Journal of the American Medical Directors Association* 22.2 (2021): 291-296. https://doi.org/10.1016/j.jamda.2020.09.025