

Development of a digital decision support tool for shoulder assessment and management (MAP SHOULDER)

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- Research Team
 - Dr. Jared Fletcher
 - Nate Peñas
 - Cheyenne Schamerhorn
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- Mount Royal University Internal Research Development Grant

A significant proportion of the global population will experience shoulder pain daily, yearly, and throughout their lifetime.

Lucas et al., 2022



Shoulder is the leading reason for accessing health services in Alberta. In 2022/2023, 470,755 patients visited a physician for a shoulder condition.

Thanh et al., 2024



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Thanh et al., 2024



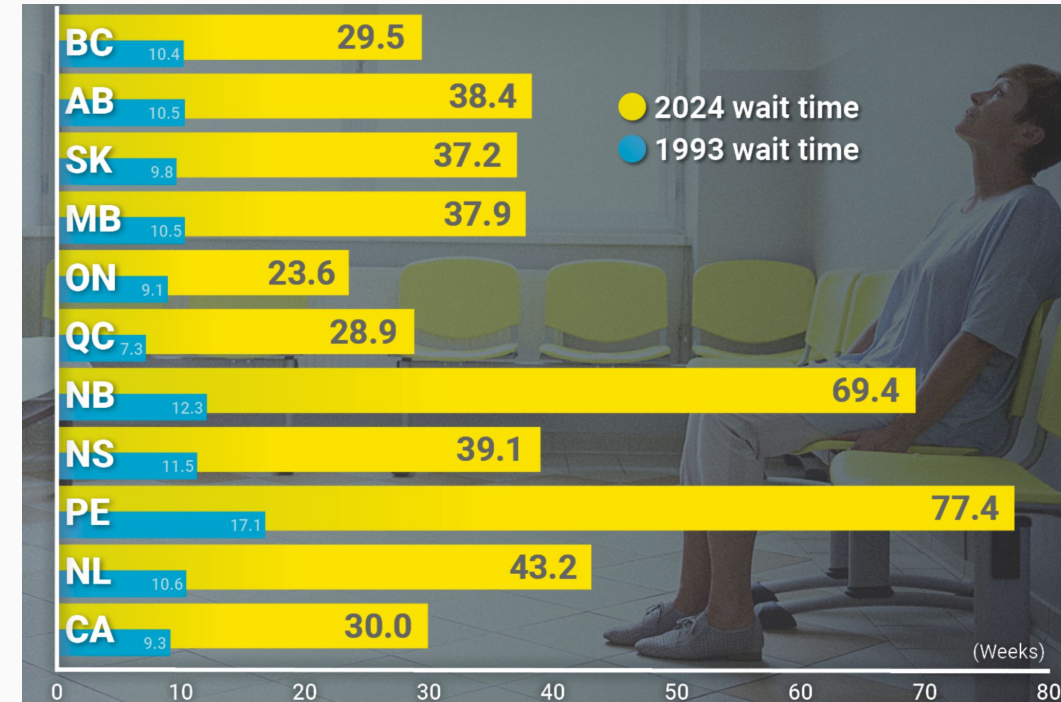
THE CURRENT STATE

- Health workforce shortages
- 1 family physician per 500 Canadians
- 2% of physicians are orthopaedic specialists
- 3% Canada's undergraduate curricula dedicated to MSK education



THE OBSTACLES

- Over-reliance on diagnostic imaging
- Excess referrals to orthopaedic specialists for surgical screening
- Lack of standardization in assessment and management
- Lack of coordination of health resources
- Lengthy wait times

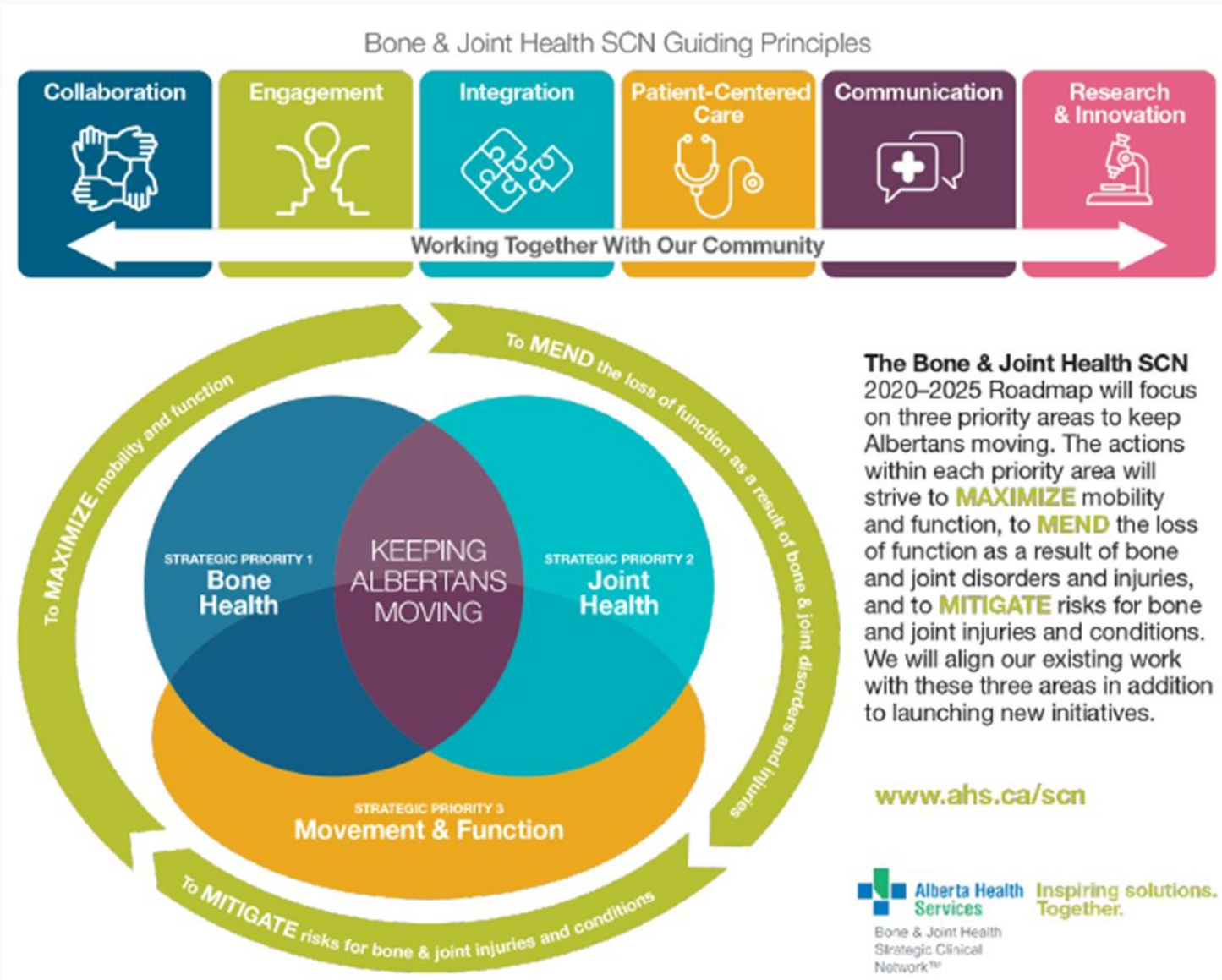


(Fraser Institute, 2024)

THE ULTIMATE GOAL

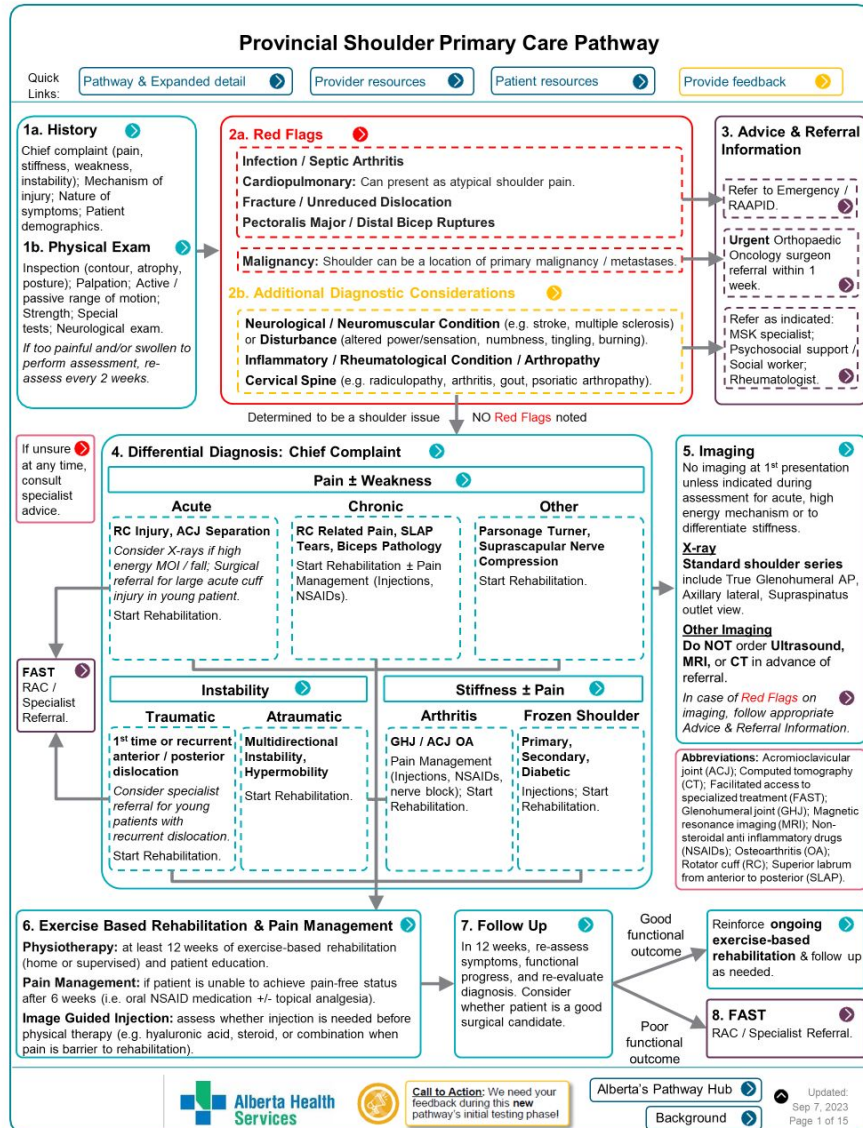


MSK-TRANSFORMATION PROGRAM



PROVINCIAL SHOULDER PATHWAY

- 16 pages
- History-taking guide
- Physical examination guide
- Patient flow processes for:
 - Pain
 - Instability
 - Adhesive capsulitis/arthritis
 - Rotator cuff disease, biceps pathology, & superior labral tear



STEP 1: STAKEHOLDER ENGAGEMENT

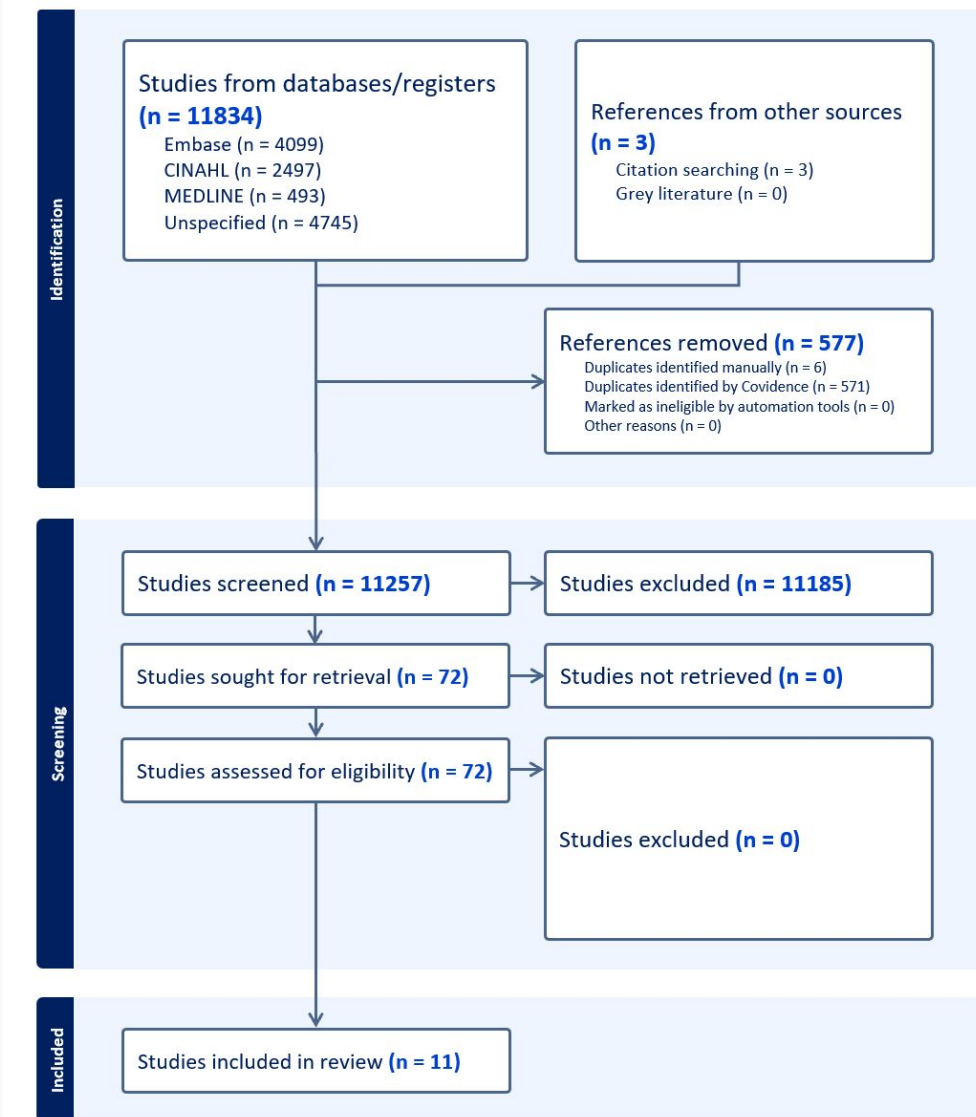
- Research Team

- Dr. Breda Eubank
- Dr. Jared Fletcher
- Nate Peñas (4th year Computer Information Systems)
- Cheyenne Schamerhorn (4th year Athletic Therapy)

- Stakeholder Group Representation

- Bone and Joint Strategic Clinical Network
- Institute for Improved Outcomes
- End-users (athletic therapists, physiotherapists)

STEP 2: SCOPING REVIEW

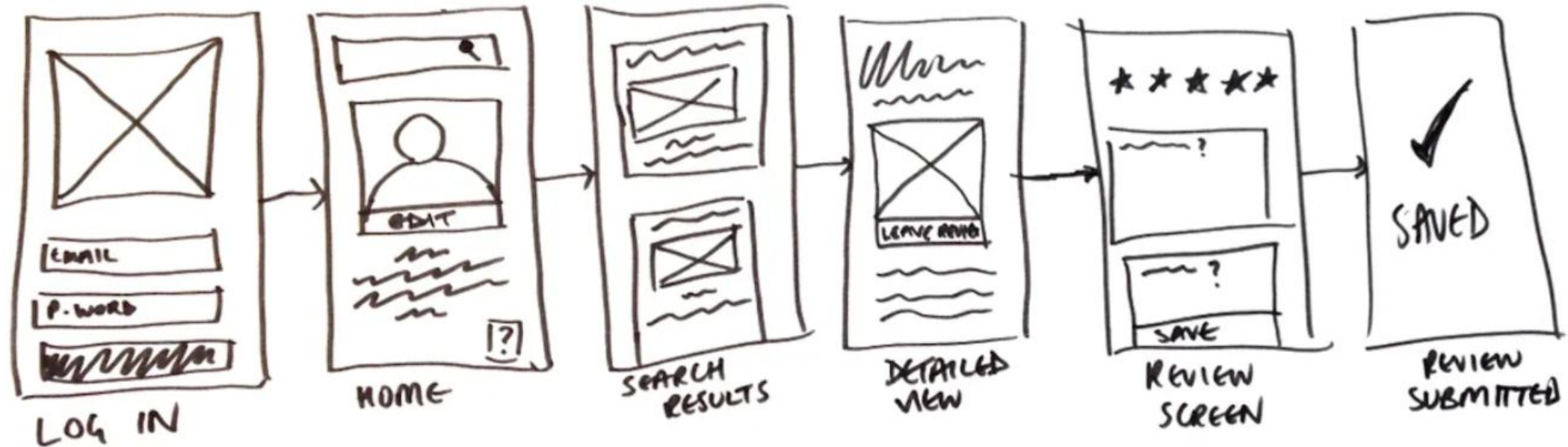


- O'Malley's 6-step framework
- Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) extension for Scoping Reviews (PRISMA-ScR)
- 4 databases
 - MEDLINE (Ovid)
 - EMBASE (Ovid)
 - CINAHL (Ebsco)
 - Scopus (Elsevier)

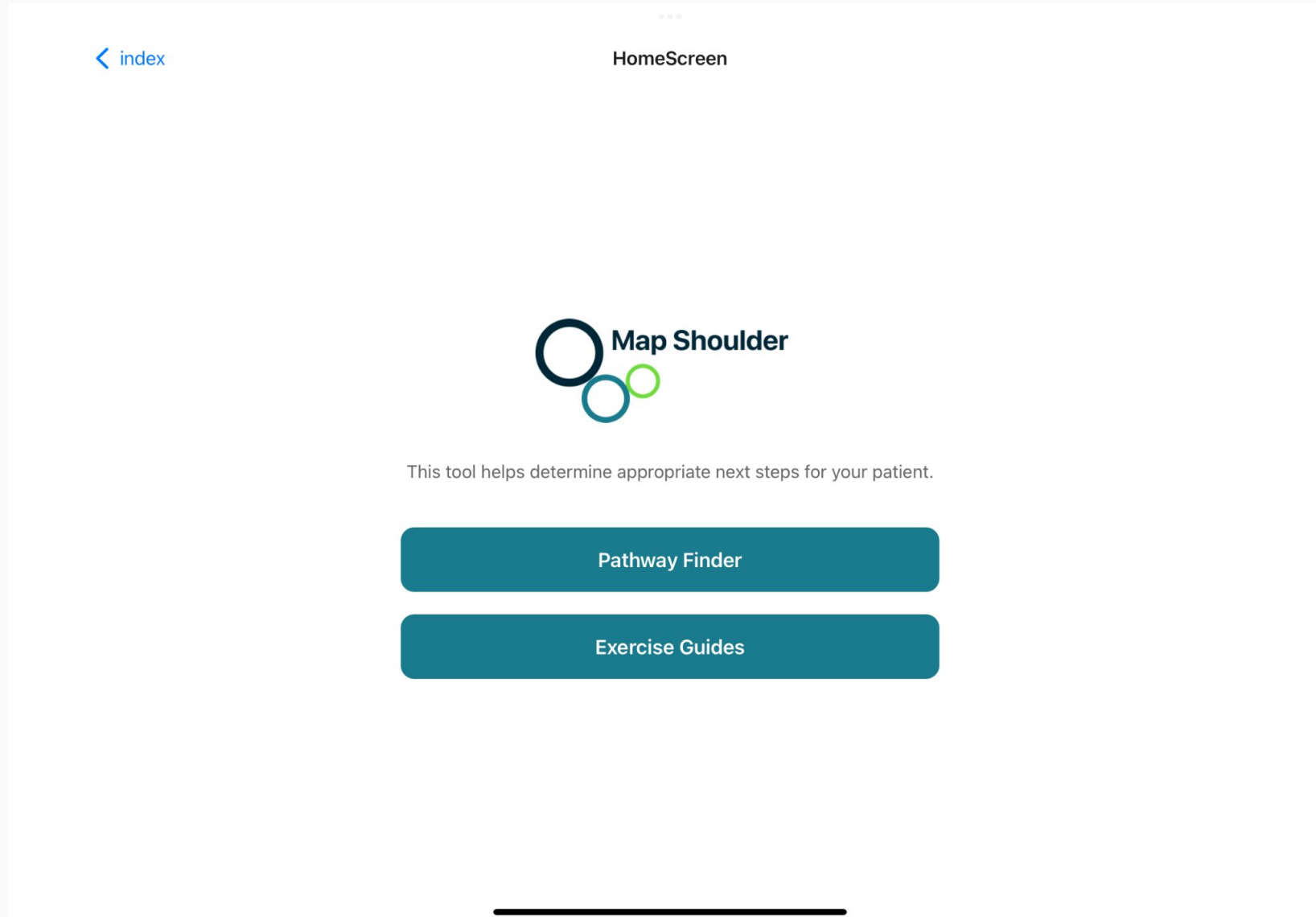


STEP 3: WIREFRAME DEVELOPMENT

- Development of blueprints to storyboard a design



STEP 4: HIGH-FIDELITY PROTOTYPE



[← HomeScreen](#)

PathwayFinderScreen

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Pathway Finder

Choose a starting point:

Patient Medical History

Physical Examination



Patient Demographics

Gather patient information and fill out the form

Age:

Gender:

Occupation:

Dominant Hand:

Left

Right

Back

Next



Red-Flag Screening

Please select any symptoms that the patient is experiencing.

- | | |
|---|--|
| <input type="radio"/> An obvious deformity | <input type="radio"/> Shoulder pain is not relieved after rest |
| <input type="radio"/> Unexplained mass or deformity | <input type="radio"/> Pain unrelated to activity |
| <input type="radio"/> Unexplained and/or significant edema | <input type="radio"/> Unremitting night pain |
| <input type="radio"/> Fever or is feeling unwell | <input type="radio"/> History of cancer |
| <input type="radio"/> Chest pain | <input type="radio"/> Night sweats |
| <input type="radio"/> Constant or progressive shoulder pain | <input type="radio"/> Sudden weight loss |

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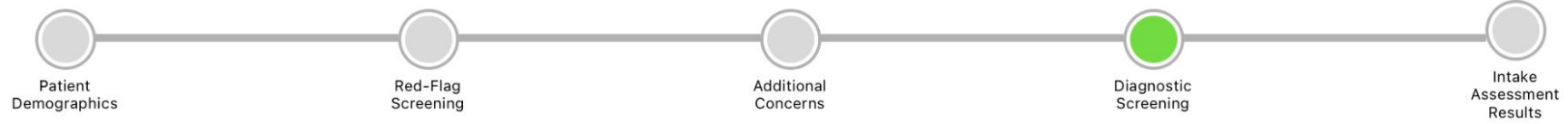
Additional Concerns

Please indicate any additional concerns related to the patient's condition.

- ☐ Active treatment for neurological/muscular condition
- ☐ Unexplained sensory/motor disturbance
- ☐ History/signs of inflammatory arthritis
- ☐ Work-related injury
- ☐ History of absenteeism at work
- ☐ Ongoing litigation with employer/insurer
- ☐ Delayed compensation claims related to date of injury
- ☐ Psychological distress, anxiety, catastrophizing, kinesiophobia

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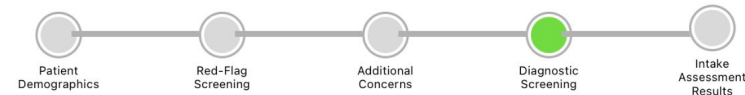
Diagnostic Screening

Proceed with the diagnostic screening to assess the patient's condition.

1. Mechanism ☐
2. Chief Complaint ☐
3. Sounds/Sensation ☐
4. Treatment History ☐
5. Neurological ☐
6. Medical History ☐

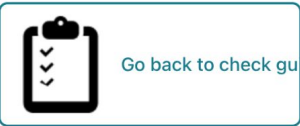
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Mechanism

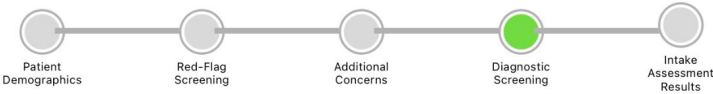
The following guiding questions for MECHANISM:



- 1. When did you first notice your shoulder problem?
- 2. Is your shoulder problem the result of a specific injury? If yes, how did you injure your shoulder?



Once you've done with this section, tap the mark box to complete it.



Sounds/Sensation

The following guiding questions for SOUNDS/SENSATION:



- 1. Do you hear or feel unusual sensations such as catching, locking, or grinding in your shoulder?

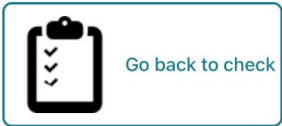


Once you've done with this section, tap the mark box to complete it.



Treatment History

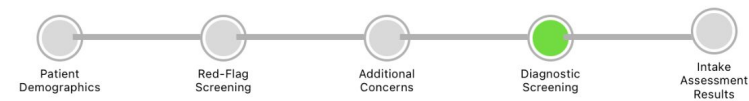
Ask the following questions about prior treatment.



- 1. Have you had any treatment(s) for your shoulder problem? (e.g. injections, physiotherapy)
- 2. If so, what treatments have you had to relieve or manage the pain?



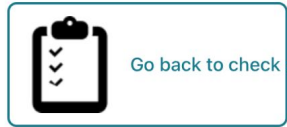
Once you've done with this section, tap the mark box to complete it.



Neurological

The following are guiding questions for NEUROLOGICAL.

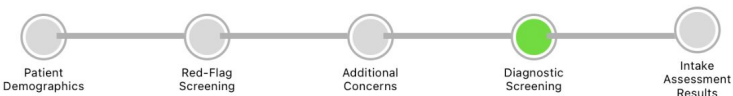
1. Do you have numbness, tingling, or burning in their shoulder or down their arm?



☐ Mark this section as complete

Back

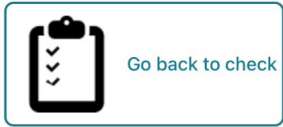
Next



Medical History

The following are guiding questions for MEDICAL HISTORY.

1. Did you have past and current medical conditions?
2. Are you currently taking any medications?
3. Did you have past surgical history?
4. Do you partake in recreational substances?



☒ Mark this section as complete

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CHIEF COMPLAINT: PAIN

DiagnosticScreeningScreen

ChiefComplaintScreen

Patient Demographics

Red-Flag Screening

Additional Concerns

Intake Assessment Results

Chief Complaint

Please select the patient's main concern:

Go back to check guide

Pain

Instability

Weakness

Stiffness

Back

Next

ChiefComplaintScreen

ChiefComplaintPart2Screen

Patient Demographics

Red-Flag Screening

Additional Concerns

Intake Assessment Results

Chief Complaint

Use the following questions to guide your assessment.

Go back to check guide

Pain

1. Describe the activity that provokes pain in the shoulder.

2. Describe the pain the patient is experiencing.

a. Character - Dull, sharp, ache

b. Duration - How long have they been symptomatic?

c. Location - Where in the shoulder is the pain?

d. Radiation - Does it radiate elsewhere?

3. What aggravates the pain? (e.g., arm position, time of day)

4. What alleviates the pain? (e.g., medication, position, ice)

Mark this section as complete

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CHIEF COMPLAINT: INSTABILITY

<

DiagnosticScreeningScreen

ChiefComplaintScreen

Patient Demographics

Red-Flag Screening

Additional Concerns

Diagnostic Screening

Intake Assessment Results

Chief Complaint

Please select the patient's main concern:

Go back to check guideline

Pain

Instability

Weakness

Stiffness

Back

Next

<

ChiefComplaintScreen

ChiefComplaintPart2Screen

Patient Demographics

Red-Flag Screening

Additional Concerns

Diagnostic Screening

Intake Assessment Results

Chief Complaint

Use the following questions to guide your assessment.

Go back to check guideline

Instability

1. Does your shoulder feel unstable?
2. Does your shoulder dislocate or come out of place?
3. Has your shoulder been dislocated in the past?
4. Have you required the shoulder to be relocated by a physician or someone else? If so, did you require sedation?

Mark this section as complete

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CHIEF COMPLAINT: WEAKNESS

ChiefComplaintPart2Screen ChiefComplaintScreen

Patient Demographics Red-Flag Screening Additional Concerns Diagnostic Screening Intake Assessment Results

Chief Complaint
Please select the patient's main concern:

 Go back to check guide

Pain

Instability

Weakness

Stiffness

Back Next


ChiefComplaintScreen ChiefComplaintPart2Screen

Patient Demographics Red-Flag Screening Additional Concerns Diagnostic Screening Intake Assessment Results

Chief Complaint
Use the following questions to guide your assessment.

Weakness

1. Does your shoulder feel weak?
2. What movements do you feel weakness in?
3. Is your weakness associated with pain?

 Go back to check guide

✓ Mark this section as complete


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CHIEF COMPLAINT: STIFFNESS

ChiefComplaintPart2Screen ChiefComplaintScreen

Patient Demographics Red-Flag Screening Additional Concerns Diagnostic Screening Intake Assessment Results

Chief Complaint
Please select the patient's main concern:

 Go back to check guide

Pain

Instability

Weakness


Stiffness

Back Next

ChiefComplaintScreen ChiefComplaintPart2Screen


Patient Demographics Red-Flag Screening Additional Concerns Diagnostic Screening Intake Assessment Results

Chief Complaint
Use the following questions to guide your assessment.

 Go back to check guide

Stiffness

1. Does your shoulder feel stiff?
2. What movements feel stiff?
3. When did the stiffness begin?

 Mark this section as complete

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Shoulder Physical Examination

This guide will help you perform a comprehensive shoulder physical examination. Start by going through the **Red Flag Screening** to identify critical conditions.

This examination includes the following key assessments:

Red Flag Screening

Screen for critical conditions that require immediate attention.

Ruling Out Cervical Neck Pathology

Assess if the shoulder pain is related to cervical spine issues.

Assess ROM & Strength Testing

Measure the Range of Motion and assess shoulder strength.

Special Tests

Perform specific tests to diagnose shoulder-related conditions.

[Start Red Flag Screening](#)

[Back](#)

Red-Flag Screening for Physical Examination

Please select any conditions that the patient is experiencing.

Abnormalities

Yes

No

Defects

Yes

No

Atrophy

Yes

No

Abnormal Posture

Yes

No

Next

[← Back](#)

RedFlagPEResultScreen

Red-Flag Results

Red Flag Condition(s) Detected:
Abnormalities, Atrophy

[Back to Pathway Finder](#)

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Shoulder Physical Examination

This stage will help you rule out cervical neck pathology resulting in shoulder pain, perform dermatomes, myotomes, reflexes, AND active range-of-motion (**ROM**) of the cervical neck.

| Movement | Range of Motion | Patient's Symptoms |
|--------------------|---|--|
| Flexion | <input type="text" value="Choose ROM"/> | <input type="text" value="Choose Symptoms"/> |
| Extension | <input type="text" value="Choose ROM"/> | <input type="text" value="Choose Symptoms"/> |
| Left Side-Flexion | <input type="text" value="Choose ROM"/> | <input type="text" value="Choose Symptoms"/> |
| Right Side-Flexion | <input type="text" value="Choose ROM"/> | <input type="text" value="Choose Symptoms"/> |
| Left Rotation | <input type="text" value="Choose ROM"/> | <input type="text" value="Choose Symptoms"/> |
| Right Rotation | <input type="text" value="Choose ROM"/> | <input type="text" value="Choose Symptoms"/> |

Shoulder Physical Examination

This stage will help you rule out cervical neck pathology resulting in shoulder pain, perform dermatomes, myotomes, reflexes, AND active range-of-motion (**ROM**) of the cervical neck.

| Movement | Range of Motion | Patient's Symptoms |
|--------------------|-----------------|--------------------|
| Flexion | LIMITED | PAIN |
| Extension | LIMITED | WEAKNESS |
| Left Side-Flexion | FULL | Choose Symptoms |
| Right Side-Flexion | FULL | Choose Symptoms |
| Left Rotation | LIMITED | PAIN |
| Right Rotation | Choose ROM | Choose Symptoms |

[Move to Stage 3](#)

Shoulder Physical Examination

Watch the videos below for Active Range of Motion, Passive Range of Motion, and Strength Testing.

Active Range of Motion



Passive Range of Motion



Strength Testing



Complete Physical Examination

DEMO

